



WHITE
STAR
CAPITAL

Sustainable Global Economy

Through the eyes of an
international investor

H2 2023



Executive Summary

\$18tn

Investment gap to deliver the net-zero energy transition

\$97.3bn

Amount invested globally in Climate tech in 2022

\$370bn

In funding allocated by the Inflation Reduction Act (IRA) to mitigate climate change

\$9tn - \$12tn

Estimation of the climate tech market size by 2030

Source: Bloomberg (2023), Allianz Research Data (2023), McKinsey (2023), WSC Analysis (2023)

Looking at the Sustainable Global Economy from a VC perspective

The global climate crisis and the urgent need for a green transition are fueling what is being described as the new industrial revolution and the growth of what we call the Sustainable Global Economy. As venture capitalists, we get to sit at the forefront of this revolution. We believe we should be involved in this revolution not only because it is necessary for the good of our planet, but also because from a purely financial perspective it will undoubtedly see the rise of the unicorns of the future.

The green transition has been gaining significant momentum in the last few years, driven by several key factors. Macroeconomic forces, including Europe’s energy crisis, ambitious government green initiatives (such as the US IRA, the EU Green Deal or Japan’s GX Basic Plan), substantial technological improvements in renewables, biomaterials, and carbon removal, and finally growing alignment in capital markets toward green investments are coinciding to drive major change across industries while creating new ones.

There are many ways for venture capitalists to be involved, and we hope this report sheds a light as to where and how as generalists we can also participate, without having to completely rethink our investment criteria. There are amazing new technologies and business models and it is up to us to discover them. Software will play a pivotal role in this Sustainable Global Economy, the way it has elsewhere, disrupting industries and powering the green transition.

There will continue to be setbacks, hopefully not as harsh as during the last climate winter, but we believe this new industrial revolution is underway no matter what. It is up to us to seize this opportunity.

Sector Lead



Matthieu Lattes
General Partner

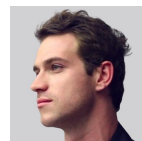


Cristina Ventura
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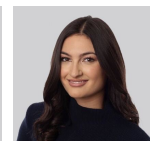
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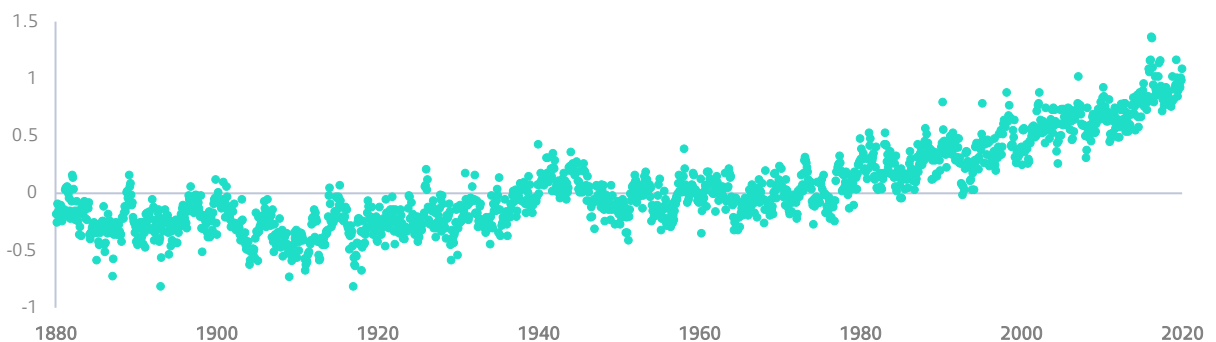
The Sustainable Global Economy: a new avenue of growth for venture capital

Despite the previous boom and bust, the conditions are now right for traditional VCs to fund the innovations needed to get us to Net Zero

It is now hopefully commonly accepted that a green transition is urgently needed. Indeed, small shifts in the earth's temperature have already unleashed dramatic storms, droughts, and floods to various parts of the globe, displacing millions, deregulating ecosystems, and driving biodiversity loss. A chilling proof: the last Ice Age, tens of millions of years ago, represented only a 5°C shift in temperature. **The risks of going above 2°C are just too high.**

The good news is that after stalled efforts, **there appears to be a global concerted initiative to address climate change and fund the technologies and businesses that will help us get to Net Zero quickly.**

Monthly Mean Global Surface Temperature – Land & Ocean



Why now?

Regulatory pressure, combined with consumer demand for sustainable and clean alternatives, are pushing stakeholders to rethink the way they do business while encouraging entrepreneurs to build the innovative solutions required.

Governments around the world are pushing for major change, with the US allocating more than \$370bn to climate as part of their Inflation Reduction Act while the EU passed a 'Green Deal' which could see them dedicate more than €1tn in public and private funds to mitigating climate change. Similar pieces of legislation are being passed around the world, from Brazil's National Plan to Japan's GX Basic Plan or the Chinese Five Year Plan. These measures may open up many more opportunities, which McKinsey estimates could reach \$9tn to \$12tn in annual investment by 2023.

What does this mean for WSC?

We are at the very beginning of a new industrial revolution, driven by macro and micro tailwinds, which should see the development of entirely new industries, jobs, and businesses dedicated to solving a single problem.

Sustainability tech is becoming mainstream. That said, there is a big gap between the types of businesses that can be funded by traditional VCs and those that will require longer-term, more infrastructure and moonshot-based approaches. At White Star, we believe we can play here, without having to redesign our investment strategy, by identifying the sectors and businesses that match our investment criteria.

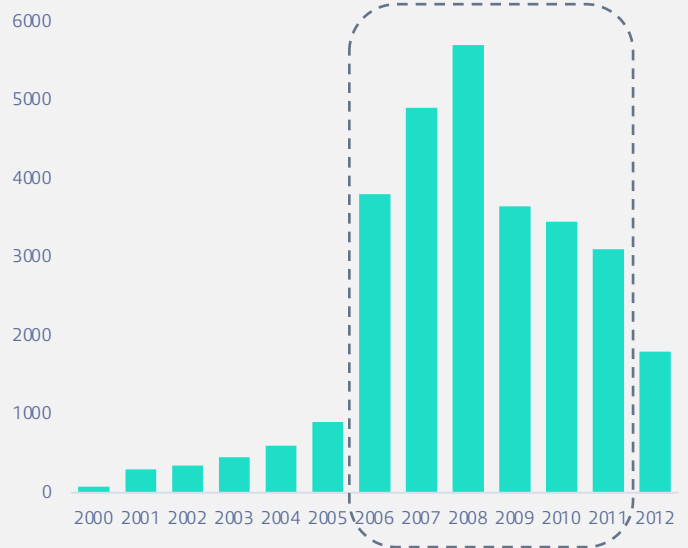
Source: NASA (2022)

Climate Tech VC has had a chequered past due to the nature of cleantech companies

Of the \$25bn that VC investors poured into Climate Tech from 2006-2011, more than 50% was lost by 2015

- Starting in 2006, growing consumer awareness, rising fossil fuel prices, and new legislation led to Silicon Valley VC firms going all in on climate tech, with a heavy focus on energy and renewables
- By 2011, almost all of the renewable start-ups founded in the previous decade were shut down or about to be, driven to bankruptcy by a combination of falling natural gas prices, inconsistent government policies, and the credit crunch of the 2008 financial crisis

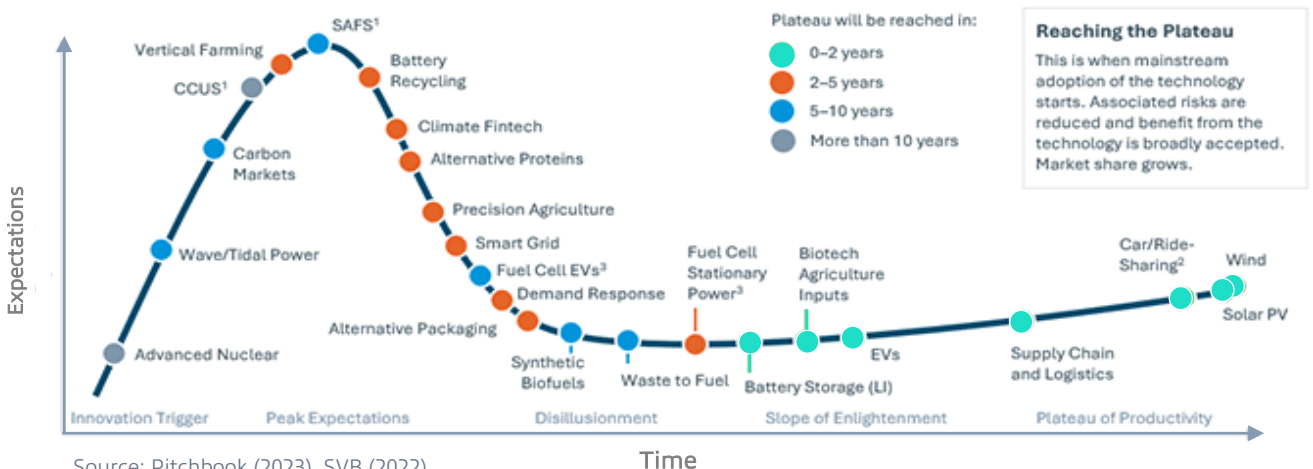
Total Capital Invested across Seed, Series A and Series B Climate Tech startups globally (\$m)¹



Cleantech companies developing new materials, hardware, chemicals, or processes tend to be poorly suited to VC investment due to the significant capital requirements, long development timelines, and unclear exit opportunities

Technologies take a significant amount of time to reach maturity, beyond typical VC funds' return requirements

SVB Climate Tech Innovation Hype Curve



Source: Pitchbook (2023), SVB (2022)
Notes: 1) Includes NA, Europe and SEA

Yet we believe that the conditions are right for a new sustainable global economy, funded by VC

The market and macro conditions today are ripe for outsized climate investing returns and impact



1 - Policies and regulations: Governments and regulatory bodies worldwide are increasingly prioritising climate action and implementing policies and incentives to accelerate the transition to a low-carbon economy



2 - Corporate or consumer demand: Businesses and consumers are increasingly seeking to be “greener”. Sustainable solutions have become central to consumers and thus to corporates. This creates a substantially more positive market environment



3 - Capital alignment: The rise of impact investing and Environmental, Social, and Governance (ESG) considerations in investment decision-making is a massive boost to the sustainable global economy. In addition, governments around the world are pledging trillions of dollars to reach net zero by 2050



4 - Tech maturity: The previous climate tech boom and bust resulted in economies of scale, particularly in solar where prices decreased by 89% in the last 10 years. Many climate tech companies are building on established technologies and have demonstrated commercial viability



5 - Talent interest: The climate issue and the desire to have a career with impact is top of mind for younger generations. These aspirations in new generations will create a formidable pool of talent ready to innovate



6 - Urgency of the crisis: If some on the conservative side of the political spectrum are still reluctant to recognise the issue, there is a consensus over the urgency of the matter. Only a 5°C change in temperature was necessary to move from the glaciation age to our current climate. With a projected 3°C change in the next 30 years the issue will become more pressing as time passes

In keeping with WSC’s investment guidelines, it is still possible to invest in Climate Tech if companies are able to:

Deliver solutions at price parity with existing ones

Innovate on business models to reduce sales cycle

Leverage regulatory environments

Hedge against macro events

Leverage established technologies

Ramp up revenues with capital raises

We've created a WSC VC Investability Index to assess sectors and subsectors of interest

The purpose of this report will be to help shed light on this burgeoning ecosystem, looking at every single industry and identifying opportunities for investment as a generalist venture capital fund

Scoring: Yes = 1 / No = 0



Business Model

Is this a recurring business model?



Technology Readiness

Is the existing technology ready to scale?



Margins

Are there software-like margins?



Stage

Are there revenue-generating businesses raising at Series A?



Market Size

Does the potential market size at scale correspond to our criteria (\$5bn+)?



Exit Environment

Have we seen large exits in this sector (\$1bn+)?



Capital Efficiency

Can these businesses achieve scale without overly diluting early shareholders?



Market Readiness

Are we seeing pull from the market and supportive regulatory regimes?



Barriers to Entry

Are there barriers to entry?



Internationalisation

Is this an internationally scalable model?

Legend

Out of Scope

Score 0-3

Work to be done

Score 4-6

Within WSC Scope

Score 7-9

And broken down the Sustainable Global Economy into 8 sectors and 34 subsectors

Green FinTech



- Payments
- Lending
- Insurance / Risk Management
- Crypto

Circular Economy



- Sharing Economy
- Product Lifecycle Management
- Sustainable Materials
- Waste Management

Carbon Management, Trading & Capture



- Carbon Trading & Carbon Markets
- Carbon Accounting & ESG Reporting
- Carbon Utilisation
- Direct Air Capture (DAC)
- Carbon Capture from Industrial Processes (CCI)

Electric Infrastructure



- Smart Grid Technology
- Energy Storage
- EV Charging Infrastructure

Construction



- Smart Buildings & Automation
- Sustainable Materials
- Prefabricated Buildings

AgriTech & FoodTech



- Picks & Shovels
- Precision Agriculture
- Alternative Proteins
- Food Waste Reduction
- Vertical Farming

Packaging & New Materials



- Packaging Software & Infrastructure
- Biodegradable & Compostable
- Waste to Value
- Bio-Materials

Clean Energy



- Solar Power
- Wind Power
- Nuclear
- Hydropower
- Waste-to-energy
- Hydrogen

Our thematic approach to investing leads us to focus on specific subsectors

WSC focuses on these key sectors undergoing rapid structural change



Climate SaaS

Industrial processes are increasingly reliant on software to report, capture, or reduce emissions and become more sustainable



Climate Finance

Financial innovation will be needed to fund society's climate adaptation and mitigation, while improved data, hardware, and models will pioneer broad-based spectrum insurance



Circular Economy

Reengineering of value changes will play a key role in the transition to net-zero emissions, leading to structural changes to markets that accompany the technological transition



RegTech

Increasingly heavy regulatory burdens globally can only be addressed through software

Based on our scoring, we have identified the following subsectors as the most investable for generalist VCs and thus WSC

	Climate SaaS	Climate Finance	Circular Economy	Regtech
Green Fintech				
Payments	✓	✓		
Lending		✓		
Insurance / Risk management	✓	✓		✓
Circular Economy				
Sharing Economy	✓		✓	
Product Lifecycle Management	✓			✓
Carbon Management, Trading & Capture				
Carbon Trading & Carbon Markets	✓	✓		
Carbon Accounting & ESG Reporting	✓	✓		
Electric Infrastructure				
Smart Grid Technology	✓	✓		
Construction				
Smart Buildings & Automation	✓			✓
AgriTech & Foodtech				
Picks & Shovels	✓			✓
Precision Agriculture	✓			
Packaging & New Materials				
Packaging Software & Infrastructure	✓			✓

Source: WSC Analysis (2023)

Our 10-year horizon predictions for the Sustainable Global Economy

As we look to invest in the top startups from across the globe, we believe the following key trends will result in a growing number of opportunities within the Sustainable Global Economy

Racing to reach Net Zero

There is a significant amount of work to be done to reach net zero by both reducing and removing carbon from the atmosphere.

As a result, we will see the proliferation of technologies surrounding carbon emissions and carbon measurements, from deep tech to software, across both B2B and B2C.

Certain technologies may finally reach enough scale to make substantial impacts on carbon emissions, although this remains far away for now.

1.5°C

Limit to temperature rises

45%

Reduction in emissions by 2030

98%

Of electricity will need to be carbon-free by 2050

Consumer pressure on corporates

Companies can no longer afford to ignore consumer demands when it comes to where goods come from, how they are made, packaged, and distributed and where they end up.

The circular economy will no longer be on the fringes but will make its way into business models across food and agriculture, manufacturing, packaging, logistics, and energy.

We will see both deep tech and SaaS companies that recycle and repurpose materials, reduce waste, and recirculate goods.

Changing climate and ecosystems

Nature is not the only loser in a changing climate – our built environment is not ready to sustain harsher storms, colder winters, and hotter summers.

We will see plenty of new infrastructures and technologies to improve cities' resilience to these changes as well as financial and insurance companies that help people who have been directly affected.

Decreasing reliance on fossil fuels

Renewable energy and EVs are increasingly overtaking oil and petrol cars, coal plants are being shut down, biodegradable and biomaterials are slowly overtaking plastics.

Yet there is so much work to be done to fully replace fossil fuels, in terms of price parity, infrastructure, and distribution.

We will see more and more businesses that tackle grid and EV management, address methane gas emissions, or reduce reliance on non-recyclables.

The sustainable global economy is picking up speed thanks to new policies and regulations

Governments around the world have taken significant legislative and regulatory action to support their climate and energy priorities including mandates, subsidies and market design

The EU

The Green Deal (2019), Fit for 55 (2021) and RePowerEU (2022) programs have progressively raised the target for emission reductions by member states.

The EU has also broadened its Emission Trading System (ETS) to include new sectors such as the maritime and aviation sectors. In 2023, the European Commission introduced the Green Deal Industrial Plan, offering incentives for domestic production and CleanTech.

The EU Taxonomy Regulation symbolises governments' commitment to promoting sustainable finance and achieving environmental and climate goals by directing private capital toward sustainable investments. Under the SFDR, all EU financial market participants are required to disclose their ESG activities, with funds and banks classified under articles 6, 8 or 9 based on their investments. Since its adoption in 2000 the financial industry has seen a considerable increase in "green" practices.

The US

The Inflation Reduction Act stands as the most extensive piece of federal legislation ever addressing climate change, with an investment of \$783bn in provisions centered on energy security and climate change.

Some of the levers include tax credits like the Investment Tax Credit (ITC) and Production Tax Credit (PTC), allowing taxpayers to deduct a portion of renewable energy systems costs from their federal taxes.

The largest allocation areas are \$128bn for renewable energy and grid energy storage, \$30bn for nuclear power, \$13bn for electric vehicle incentives, \$14bn for home energy efficiency upgrades, \$22bn for home energy supply improvements and \$37bn for advanced manufacturing.

Canada

Canada has announced \$60bn in clean energy tax credits and \$20bn in sustainable infrastructure investments as part of its 2023 budget.

The largest portion of the Canadian budget's energy transition-focused investments, representing more than \$25bn through 2035, is made through the Clean Energy Investment Tax Credit.

The budget proposes a 15% refundable tax credit for investments including non-emitting electricity generation systems.

Japan

On December 22, 2022 the Japanese government unveiled the Green Transformation (GX) Basic Policy. It outlines regulatory, financing, and technology development priorities for the green transformation of various industrial sectors. A key pillar of the GX Basic Policy is the support for energy transition.

I

Sustainable Global Economy: An Overview



Ecosystem Highlights

\$181bn

Raised by climate tech startups in the last 3 years

\$35bn

Raised by climate tech startups in 2023 YTD (Jan-Aug)

685

Mega rounds¹

14.8%

Share of VC funding over the last 3 years

\$7.4bn

Share of seed funding in the last 3 years

43

VC-backed climate tech unicorns²

140

Climate tech exits in 2022

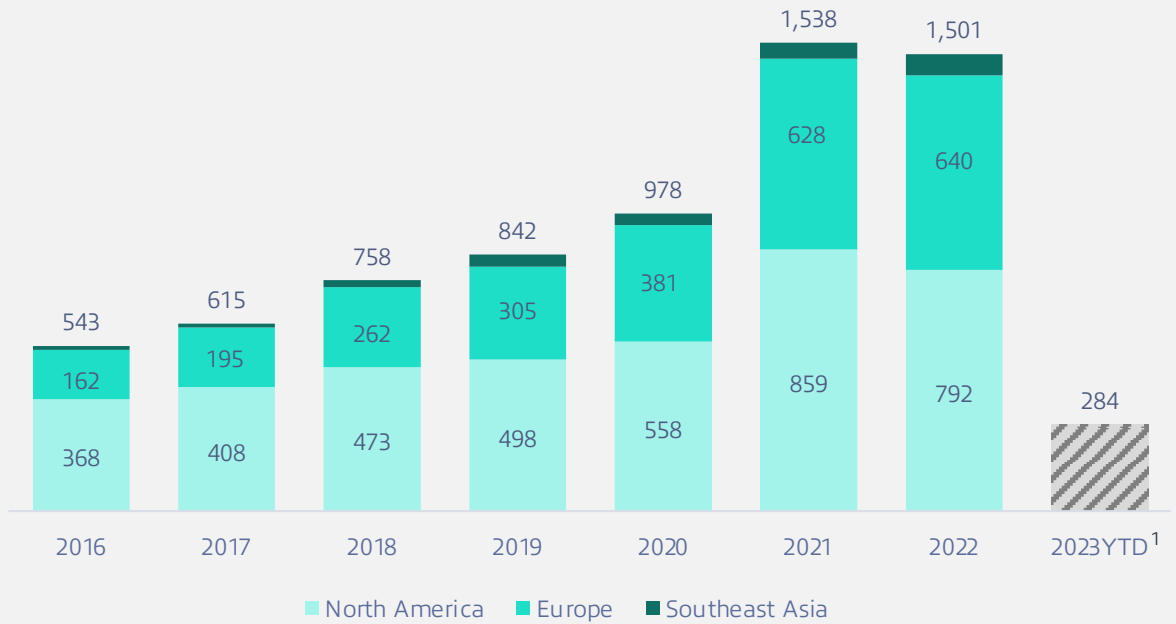
+163%

Share price performance of the top 30 public climate tech companies since 2017³

Deal activity has increased significantly over the last couple years

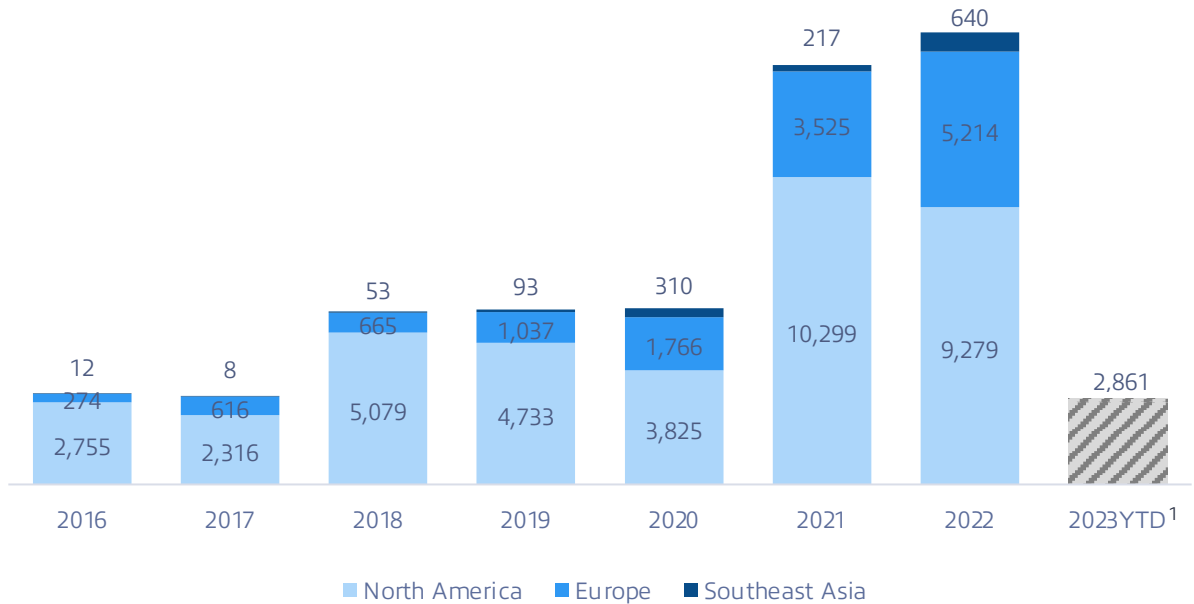
Deal volumes have almost doubled in Europe and North America

Climate Tech Deal Count across Seed, Series A and Series B by Region



While deal values are almost 3x vs. 3 years ago

Total Capital Invested in Climate Tech across Seed, Series A and Series B by Region (\$m)

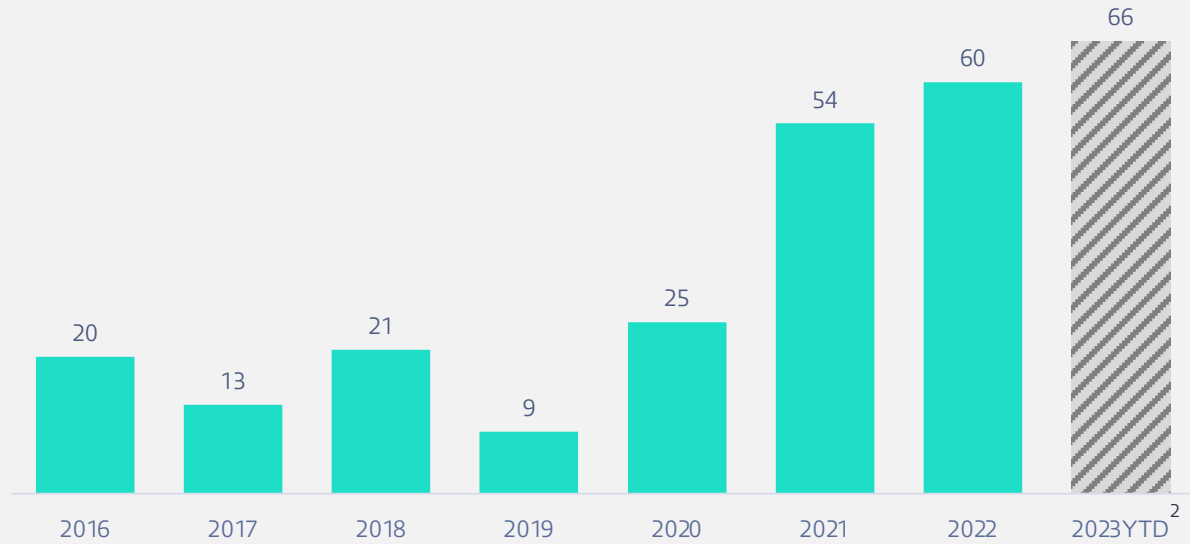


Source: Pitchbook (2023)
Notes: 1) As of August 2023

Despite worsening market conditions, climate tech VCs continue to raise funds

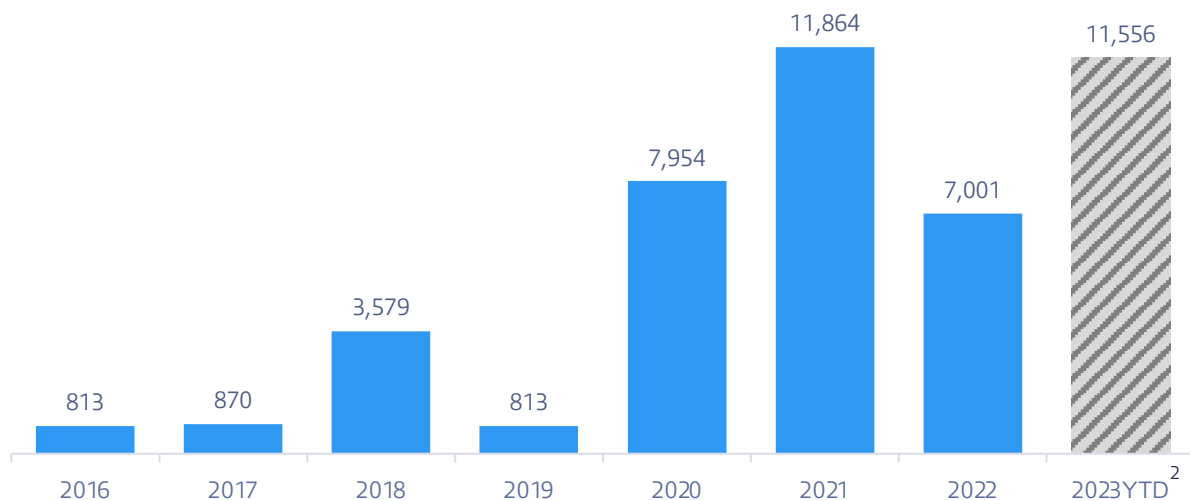
Climate Tech VCs are raising more funds than ever

Number of Climate Tech funds raised by Climate Tech VCs globally¹



LPs have increased appetite to invest into Climate Tech Funds

Value of funds raised by Climate Tech VCs globally (\$m)



Source: Pitchbook (2023)

Notes: 1) Includes NA, EU and SEA, 2) As of August 2023

VC funds fall within 4 broad categories when looking at Sustainability

Classification of VC Investors: here we will use Sustainability and Climate Tech interchangeably

Climate Specialists: climate general thesis across 7 climate verticals (e.g. energy, mobility, food & agriculture, construction, carbon)

Vertical Specialists: single vertical focus within climate (e.g. energy, mobility etc.)

Deeptech: frontier, hard science technologies to address climate


Generalist: predominantly enterprise or consumer software, with opportunistic climate investments



Source: CTVC (2023), WSC Analysis (2023)

Active early-stage Climate Tech funds have raised over \$13bn in AUM

Select Top Climate Specialist VC funds in order of AUM

Investor	Founded	HQ	AUM (\$)	Stage	Deal Count	Top Deals
 ENERGY IMPACT PARTNERS	2015		5.0bn	Seed / Series A	190	 Arcadia  BOSTON METAL  PROTERRA
 Breakthrough Energy Ventures	2015		2.0bn	Series A / B	180	 Commonwealth Fusion Systems  REDWOOD MATERIALS  Form energy  PIVOT BIO
 Prelude Ventures	2013		1.5bn	Seed / Series A	142	 BOSTON METAL  Form energy  PIVOT BIO  ELECTRIC HYDROGEN
 SUSV	1994		1.5bn	Seed	2,466	 getaround  TIER  green union  MCO
 ENERGIZE	2016		1.2bn	Seed / Series A	43	 aurora  Patch  Pvcase  volta
 bdc	2018 ¹		1.1bn	Seed – Growth	50+	 carbon upcycling  Li-Cycle  META  CoolIT systems
 C	2010		500m	Seed / Series A	389	 LyA  DANDELION  Commonwealth Fusion Systems
 WORLD FUND	2021		€350m	Seed	13	 treecard  SUNROOF
 SEAYA ANDROMEDA	2013		€300m	Series A / B / C	4	 Pachama  RECYCLEYE  Seabery  011h
 2150	2020		312m	Series A	16	 Hometree  CARBON CURE  BIOMASON
 <norrskan> >C	2017		€130m	Seed / Series A	61	 northvolt  alight  einride
 planet VENTURES	2020		€110.8m	Seed / Series A	22	 Makersite  INERATEC  HIVED

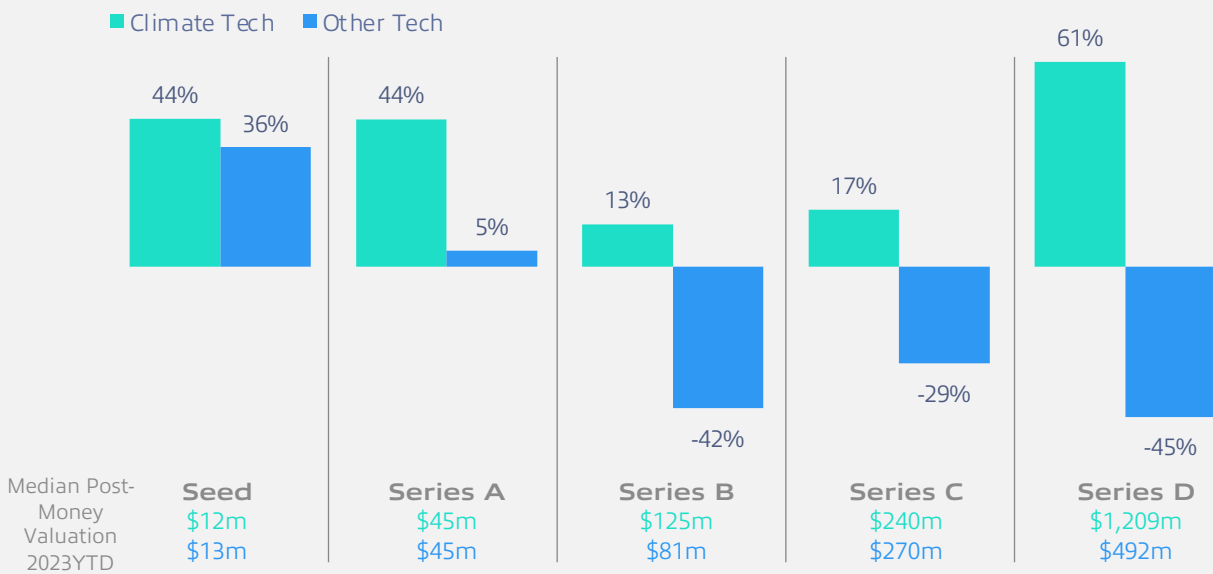
Source: WSC Analysis (2023)

Notes: 1) Includes the CleanTech Fund I, ClimateTech Fund II and the Sustainability Venture Fund

So far ClimateTech has proven resilient to the downturn

Early-stage valuations remain resilient amid market downturns

% Change in Median Post-Money Valuation by Series Globally 2021 – 2023YTD¹



Most sub-sectors saw boosted valuations from 2022 to H1-2023

Median Post-Money Valuation per Sub-Sector

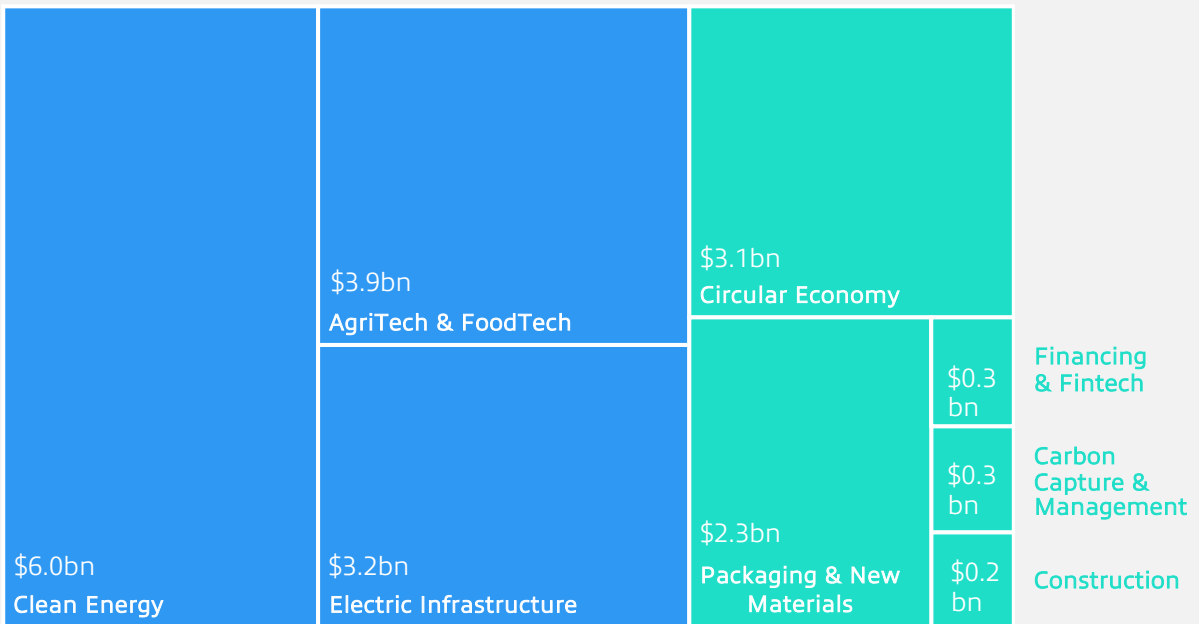
Sub-sector	2022	H1-2023	% Change
Carbon Capture & Management	23.4	22.3	-4.5%
Electric Infrastructure	21.0	24.1	+44.0%
AgriTech & FoodTech	20.8	24.1	+15.9%
Packaging & New Materials	22	32.0	-10.9%
Clean Energy	30.8	44.3	+17.1%
Construction	18.3	19.8	+8.3%
Circular Economy	14.2	22.0	+45.2%
Financing & Fintech	14.5	18.0	+27.4%

Source: Pitchbook (2023), SVB (2023)
Notes: 1) As of August 2023

Most of the funding is going to Clean Energy, where there are the most exit opportunities

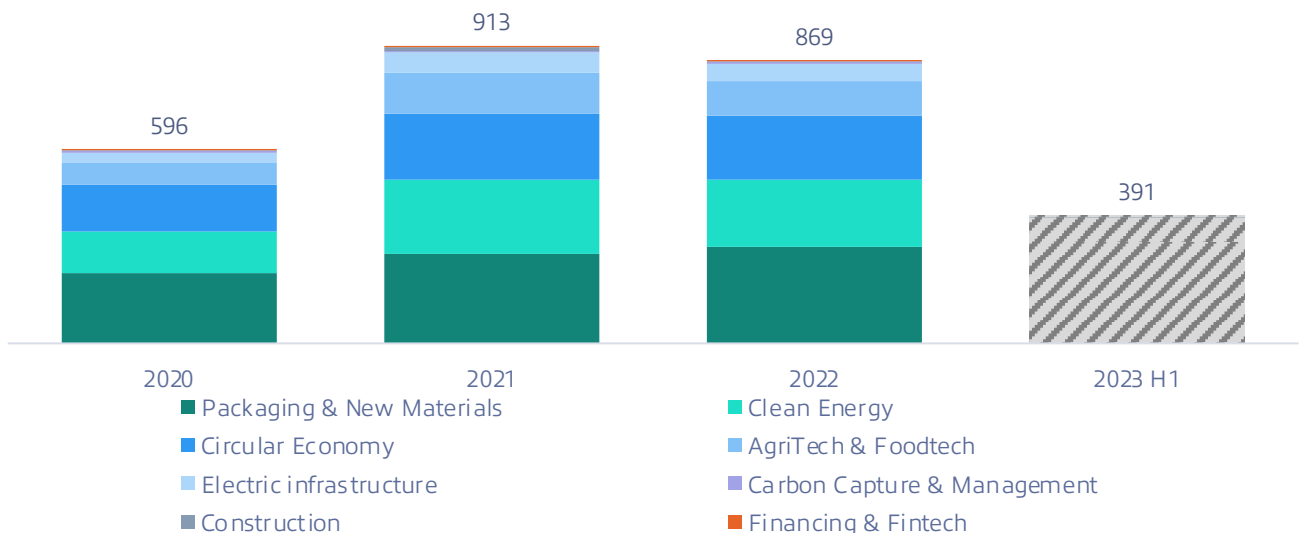
Clean Energy, AgriTech & FoodTech, and Electric Infrastructure led overall funding

H1-23 Funding per Subsector



Packaging & New Materials and Clean Energy led count of exits

Count of climate exits across M&A and IPO since 2020 by sub-sector



Source: Pitchbook (2023)

The exit environment is picking up, which is key to the long-term viability of the ecosystem

Climate tech exit activity has increased 70% YoY in the last two years, led by large energy companies and private equity firms

57%

Of exits from 2020 to February 2023 were M&A transactions

63%

Of climate tech acquisitions since 2020 were driven by corporate buyers


289


Climate tech companies have exited via M&A, SPAC, and IPO since 2020

\$400bn


In total EV from the last three years' disclosed exits


Large climate tech exits across key climate verticals since 2020

IPO 2023 

 nexttracker.

[NASDAQ: NXT]
\$638m raised at \$4.9bn

M&A 2022 

 ARCHAEA ENERGY

Acquired by BP (LON: BP) for \$4.1bn

M&A 2020 

 Advanced Disposal

Acquired by Waste Management for \$4bn

M&A 2023 


 PARK WIND
JERA GROUP


Acquired by Jera for €1.6bn

M&A 2022 

 SUNSEAP

Acquired by EDP Renováveis for €600m

M&A 2022 

 CRODA

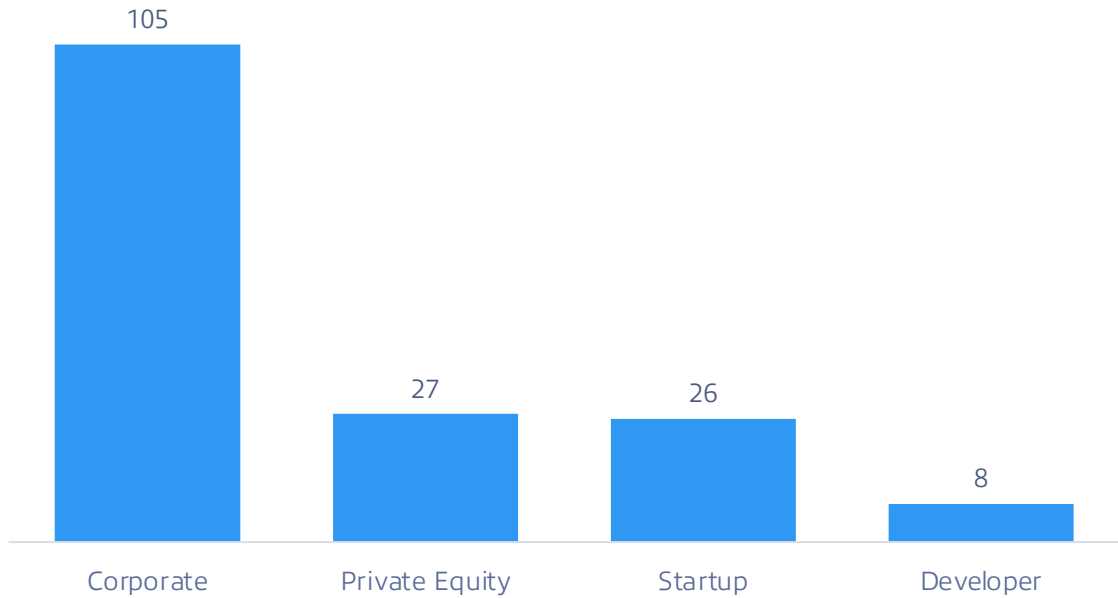
Acquired by Cargill for £775m

Source: Climate Tech VC (2023), Pitchbook (2023)

Corporate M&A from energy companies is driving overall exit count

Corporates are the most active acquirers of climate tech companies

Count of acquisitions by acquirer type



The most active acquirers are energy companies, followed by financial institutions

Most active acquirers of Climate Tech companies by count since 2020



Source: CTVC (2023)

Select Top ClimateTech Unicorns

northvolt®

High-quality lithium-ion batteries for electric vehicles and energy storage systems

\$11.8bn Valuation



octopus energy

Renewable energy supplier, offering affordable and sustainable energy solutions to customers

\$5.0bn Valuation



FARMERS BUSINESS NETWORK

Farmer-to-farmer agronomic information network to help farmers in the management of their data and gain insights from each other

\$4.0bn Valuation



aurora

Simplify the solar design and sales process through the development of their cutting-edge cloud-based platform

\$3.8bn Valuation



inform

Developing modular, vertical farming systems that can be installed in supermarkets, restaurants, and warehouses

\$1.0bn Valuation



2

Sector Focus



Green FinTech

Green FinTechs can deliver the innovative power that financial institutions lack by leveraging big data and AI, and reducing costs and friction

\$1.7bn

Raised by Green FinTechs in H1-23

75%

Of banking CEOs believe their future growth is determined by their ability to shift to a low carbon economy

\$2.4tn

Raised for green bonds globally as of Jan-23 to support sustainable projects

\$53tn

In AUM for global ESG assets by 2025

ESG and sustainability have become increasingly important to financial institutions. From carbon offsetting through payments, lending and investing into sustainable projects, to trading carbon, to risk analysis management and insurance, we are seeing increasingly innovative financial engineering to address environmental and sustainability challenges.

This is an area of sustainable technology that lends itself well to VC investments, given the asset light nature of these businesses. That said, VCs should be aware of the growing regulatory burdens these businesses face, especially against greenwashing.

Technology	WSC Score	Notes
Payments	7	Easy to build
Lending & Green Investing	7	Consumer demand
Insurance / Risk Management	7	Software play
Crypto	5	

Technologies & Subsectors

Payments

Score: 7

Consumers and companies need tools and infrastructure that enable them to make sustainable spending decisions. The next wave of innovation for payments companies are tying transactions to carbon offsetting.

Tailwinds

- + Consumer demand
- + Ease of implementation

Challenges

- + Growing transaction costs
- + Lack of transparency from off-setting initiatives
- + Already competitive market

Lending & Green Investing

Score: 7

Debt plays a major role in the green economy. The majority of heavy sustainability projects, such as solar panels or wind turbine installations are financed with debt. Sustainability-linked lending skyrocketed from \$5bn in 2017 to \$120bn in 2020.

Tailwinds

- + Many new policies and incentives are put in place to encourage green investments, including the issuance of green bonds
- + Institutional investors, including pension funds and asset managers, are increasingly interested in sustainable and responsible investment options

Challenges

- + Green bonds may have lower yields
- + "Greenwashing" concerns

Insurance and Risk Management

Score: 7

Climate change affects insurance underwriting due to the prevalence of natural disasters in some regions. Innovations include climate projections; artificial intelligence and satellite monitoring; and insurance products, helping businesses assess climate-related risks and minimise losses.

Tailwinds

- + The rising frequency and severity of climate-related events, such as hurricanes, wildfires, and floods, are driving demand for insurance and risk mitigation solutions

Challenges

- + Difficulty of risk assessments
- + Lack predictability for pricing
- + Increasing loss ratios as prevalence of natural disasters grow

Technologies & Subsectors

Crypto and Blockchain

Score: 5

Most serious crypto companies in the climate space are centered around carbon credits, like Switzerland's Toucan, which tokenises credits on blockchain. Blockchain can be a useful technology to prevent fraud and provide more transparency in carbon trading.

Tailwinds

- + Transparency and traceability of transactions is facilitated by blockchain technology

Challenges

- + Some blockchain networks, particularly proof-of-work networks are criticised for their high energy consumption
- + Blockchain networks often face scalability issues

Circular Economy

Software can solve for the 3 Rs: reducing, reusing, recycling, which are key aspects of sustainability and reducing overall emissions

2.1bn

Tonnes of waste dumped in landfills every year

\$4.3tn

Additional economic output created by the circular economy by 2030

1 Truckload

Of textile waste is discarded each second

9.3bn

Tonnes of CO2 emission that can be avoided by 2050 by implementing circular economy strategies

Our economy operates under a 'take-make-waste' system. In a circular economy, a fundamental requirement is that the materials re-enter the economy at the end of their use. The shift from a linear to a circular system is at the heart of the circular economy concept.

The sharing economy and second-hand market represent the most advanced sectors of the circular economy, largely thanks to major platform shifts (e.g. mobile, e-commerce, logistics), with some focusing on the optimization of goods' usage and promoting the idea of access over ownership.

Technology	WSC Score	Notes
Sharing Economy	7	Proven success
Product Lifecycle Management	7	WSC experience ¹
Sustainable Materials	5	
Waste Management	2	

Source: Ellen MacArthur Foundation (2022), WSC Analysis (2023)

Notes: 1) WSC portfolio includes 900.care offering refillable hygiene products

Technologies & Subsectors

Sharing Economy

Score: 7

The sharing economy, exemplified by services like Uber and Airbnb, and the growth of secondhand market platforms such as eBay and Vinted, play a vital role by efficiently utilising resources and promoting product reuse.

Tailwinds

- + The sharing economy encourages the idea of access over ownership
- + Maturity and proven economic viability of these business models

Challenges

- + Market saturation
- + Low margins
- + Limited barriers to entry

Product Lifecycle Management

Score: 7

Technologies that improve product design and lifecycle management, or products that are easier to disassemble and recycle and using data analytics to optimise the use of resources.

Tailwinds

- + Commercial value of imbedding recyclability in product manufacturing
- + Can lead to cost optimization in manufacturing process

Challenges

- + Disrupts existing supply chain and infrastructure

Sustainable Materials

Score: 5

Startups are developing new materials that are more sustainable and have a lower environmental impact, such as bioplastics, biomaterials, and recycled materials.

Tailwinds

- + Increasing awareness of environmental issues and resource depletion is driving demand for materials that have a lower environmental footprint

Challenges

- + Disrupts existing supply chain and infrastructure

Technologies & Subsectors

Waste Management

Score: 2

Startups are working on advanced recycling technologies to reduce waste, recover valuable materials, and create a circular economy from waste streams.

Tailwinds

- + Regulations and standards are being implemented to promote responsible waste management, recycling, and waste reduction

Challenges

- + Supply chain and infrastructure complexity
- + Achieving profitability

Carbon Management, Trading & Capture

Carbon capture and management are intertwined, with a growing demand for direct carbon capture as companies seek to reduce emissions

14%

Potential reduction in greenhouse gas emissions from carbon capture by 2050

\$2.7tn

Global carbon credit market by 2028

\$250bn

Growth expected by the carbon-offset market by 2025

\$6.1bn

Raised by carbon capture & management startups in the last 3 years

Carbon capture and management technologies are crucial in combating climate change. To prevent a 5°C global temperature increase by 2050, we must reduce emissions and remove 220 gigatons of CO2 from the atmosphere.

While technologies within Direct Air Capture are still in their infancy and require significant investments to scale, carbon trading and offsetting technologies are mature and ready to scale.

Technology	WSC Score	Notes
Carbon Trading & Carbon Markets	8	Market that can be improved
Carbon Accounting & ESG Reporting	7	Attractive SaaS models
Carbon Utilisation	6	
Direct Air Capture	3	
Direct Capture from Industrial Processes	3	

Source: C2ES (2023), Globe News Wire (2023), WSC Analysis (2023)

Technologies & Subsectors

Carbon Trading & Carbon Markets

Score: 8

Carbon markets, established in the 90s following the Kyoto protocol have matured significantly. Polluters can purchase credits to offset their emissions, tradable on open markets. Each credit equals one ton of CO2 equivalent.

Tailwinds

- + Emissions and carbon trading has become an established practice
- + Governments are reducing caps and demanding more transparency on emission levels

Challenges

- + Oversaturated market

Carbon Accounting & ESG Reporting

Score: 7

Software enabling companies to generate carbon emissions and ESG compliance reports.

Tailwinds

- + Carbon reporting mandatory in the EU for specific companies
- + New regulations coming into place including the SECR policy where carbon emissions reporting is mandatory

Challenges

- + Oversaturated market

Carbon Utilisation

Score: 6

Exploring ways of utilising captured carbon such as converting it into useful products including fuels, chemicals, and building materials.

Tailwinds

- + Government support

Challenges

- + Capital intensive projects primarily financed by governments or oil and gas companies

Technologies & Subsectors

Direct Air Capture (DAC)

Score: 3

DAC technologies extract CO₂ directly from the atmosphere through various chemical approaches which include solid DAC and liquid DAC. Solid DAC captures CO₂ on the surface of a filter, while liquid DACs systems involve passing air through a chemical solution.

Tailwinds

- + Government support
- + Can be deployed around the world

Challenges

- + Must demonstrate efficiency at scale
- + Massive industrial projects requiring large investments (e.g., Climeworks have raised over \$700m but remains unprofitable)
- + Most expensive application of carbon capture

Carbon Capture from Industrial Processes (CCI)

Score: 3

Capturing carbon emissions from industrial processes, such as cement and steel manufacturing, power plants or oil and gas production.

Tailwinds

- + Strong interest from oil and gas companies to finance such projects

Challenges

- + Requires significant capital to deploy
- + Must demonstrate efficiency at scale
- + Criticised for providing a “free pass” for oil and gas companies to continue drilling

Electric Infrastructure

The pressing need for better grids, better storage, and better electricity management systems can be solved with software

50%

Of cars will be electric by 2035

70x

Will be needed in a net zero world than we currently have today

90%

Decrease in the price of Lithium-ion battery in the last 10 years

\$40bn

Went to investments in battery storage in 2023

The coming years will require a substantial increase in electricity supply, driven primarily by booming EV sales. As renewable energy and EVs gain momentum, the auto battery and energy storage markets are expected to grow at a 25%+ CAGR over the next decade. The widespread adoption of EV charging could lead to a 15% – 50% increase in peak electricity demand on local grids, requiring costly grid updates.

We believe software can address many of these issues. Energy creation and storage now goes hand in hand with software to help optimise loads at peak times, redistribute to the grid, and automatically rebalance how energy flows through our grids.

Technology	WSC Score	Notes
Smart Grid Technology	9	Interesting SaaS companies
Energy Storage	6	
EV Charging Infrastructure	6	

Technologies & Subsectors

Smart Grid Technology

Score: 9

As the energy system decentralizes and becomes more intermittent, startups are developing software platforms and services to optimize energy use, reduce costs and improve grid reliability. Emerging spaces are Virtual Power Plants (VPPs) and Distributed Energy Resources (DERs).

Tailwinds

- + Ageing grid infrastructure requires renovation
- + Reduction in cost of installation and increase in energy cost incentivizing individual homeowners to become energy producers

Challenges

- + Renovating grid infrastructure requires public authority intervention
- + Complexity around interconnection with the grid by energy systems "behind the meter"
- + Slow sales cycles

Energy Storage

Score: 6

Energy storage spans various sizes, from small vehicle batteries to large grid systems like the Tesla Megapack. While Lithium-ion batteries dominate, promising alternatives include the use of rust in new iron batteries, sodium-ion batteries and liquid metal batteries.

Tailwinds

- + Considerable reduction of cost (price per Kwt of energy stored with lithium ion battery has dropped by 97% since 1991)
- + US and EU legislation is cutting red tape, providing tax credits and public subsidies

Challenges

- + Highly competitive market
- + China's raw material dominance in lithium, graphite and battery anode materials

EV Charging Infrastructure

Score: 6

With the rising popularity of EVs, the need to improve EV batteries and charging infrastructure is growing. A promising new market is emerging, focusing on building charging networks and charging solutions.

Tailwinds

- + Many regulations are put in place to subsidize the sale of EV by consumers
- + In 2022 the Zero Emission Government Fleet Declaration, requires governments to reach 100% zero emission vehicles in public procurement

Challenges

- + EV battery space is dominated by incumbents
- + EV charging networks requires contracting with public authorities
- + Low margins

Construction

Despite the physical nature of the built environment, the sector leverages software to reduce emissions and improve energy efficiency

40%

Of annual world CO2 emissions

30bn

Tonnes of concrete made every year

\$300bn

Market size of the global green construction market

1 NYC

Built every month for the next 40 years

The sustainable construction sector has experienced rapid growth in response to the demand for eco-friendly construction materials. Among various construction materials, concrete is the most crucial due to its significant global consumption, second only to water. Concrete accounts for 8% of human-made CO2 emissions, highlighting the urgent need for more sustainable alternatives.

Other emerging technologies include enhancing building energy efficiency through software and connected devices, which can tap into consumer markets.

Technology	WSC Score	Notes
Smart Buildings & Automation	8	Software + Consumer play
Sustainable Materials	4	
Prefabricated Buildings	1	

Technologies & Subsectors

Smart Buildings & Automation

Score: 8

Building automation systems can help reduce energy consumption by controlling heating, cooling, and lighting systems.

Tailwinds

- + Consumer demand for IoT and smart homes
- + Growing energy costs
- + Government regulations and standards pushing for more efficient energy systems

Challenges

- + Competitive market
- + High upfront costs
- + Integrating various components and systems (e.g., HVAC, lighting, security)
- + Compatibility issues and the need for skilled technicians

Sustainable Materials

Score: 4

Companies are developing sustainable building materials that have a lower environmental impact than the highly CO2 emitting cement and concrete. These new materials could be new biomaterials or reused materials. Organic materials, like hemp, are now being used for isolation.

Tailwinds

- + Governments and municipalities are implementing regulations and standards that encourage or require the use of sustainable construction materials, such as energy efficiency requirements, green building certifications, and building codes

Challenges

- + Sustainable materials may have a higher upfront cost compared to traditional materials
- + Supply chain issues and raw material availability
- + Competition from traditional materials

Prefabricated Buildings

Score: 1

Prefabricated construction involves building sections of a building off-site and then assembling them on-site. This is an area where 3D printing is playing an interesting new role. This reduces construction waste and can speed up the building process.

Tailwinds

- + Speed and efficiency
- + Design flexibility

Challenges

- + High upfront costs (green premium)

AgriTech & FoodTech

Food production remains a key focus for VC funds given its close ties to climate issues and the need to feed a growing global population

70%

Increase in food production needed to feed the world population by 2050

26%

Of annual world CO2 emissions come from the food industry

\$260bn

Estimated global FoodTech market size in 2022

1/3

Of all food produced is lost or wasted, costing the global economy close to \$940bn each year

A transition toward greener practices in agriculture and food manufacturing is critical, given that the current food system contributes to a third of CO2 emissions worldwide, consumes 70% of freshwater usage, drives 80% of global deforestation, and results in approximately one third of global food production going to waste.

Technological advancements combined to consumer demand for sustainable, healthy, affordable, and safe food options have led to the emergence of large unicorns in this space. Some solutions are more capital intensive than others, especially within alternative proteins, which saw substantial investment but has not reached global scale.

Technology	WSC Score	Notes
Picks & Shovels	9	Many asset light businesses
Precision Agriculture	7	Interesting AI and software play
Alternative Proteins	5	
Food Waste Reduction	4	
Vertical Farming	4	

Source: Eurostat (2023), Agfunder (2023), Statista (2023), Our world in data (2019), WSC Analysis (2023)

Technologies & Subsectors

Picks & Shovels

Score: 9

The infrastructure and software supporting AgriTech companies as they expand throughout the value chain.

Tailwinds

- + Market maturity and readiness in adopting new software

Challenges

- + Competitive and saturated market
- + Slow sales cycles

Precision Agriculture

Score: 7

New technologies are being developed to improve the efficiency and sustainability of farming practices, such as using drones, sensors, and AI to monitor crops and optimize inputs.

Tailwinds

- + Reduces the need for excessive water, fertilizers, pesticides, and other resources
- + Optimise crop yields and productivity

Challenges

- + Significant initial investment in hardware, software, and equipment
- + Farmers may exhibit resistance to adopting new technologies

Alternative Proteins

Score: 5

There is a growing trend towards alternative proteins, such as plant-based and lab-grown meat, as consumers become more interested in sustainable and ethical food choices.

Tailwinds

- + As the global population continues to grow, alternative proteins offer a potential solution to food security
- + Increasing awareness of environmental and ethical concerns related to traditional livestock farming has led to a growing demand

Challenges

- + Tough to scale
- + Low margins
- + Distribution challenges

Technologies & Subsectors

Food Waste Reduction

Score: 4

Startups tackling food waste through new uses for products that would otherwise be discarded, such as turning 'ugly' produce into snacks or converting food waste into biofuels.

Tailwinds

- + Some governments and regions are implementing regulations and initiatives to encourage food waste reduction
- + Growing consumer demand

Challenges

- + Supply chain and infrastructure complexity
- + Low margins

Vertical Farming

Score: 4

With the rise of urbanization and the need to produce more food with less land and water, vertical farming is becoming increasingly popular. Most of these companies are using LED lighting and hydroponics to grow crops in stacked layers in urban environments.

Tailwinds

- + Resource efficient using significantly less land and water than traditional farming methods
- + Enables year-round production

Challenges

- + Reliance on artificial lighting and climate control systems that are energy-intensive and sensitive to energy price fluctuations
- + High upfront costs
- + Tough to scale

Packaging & New Materials

Sustainable packaging innovation is on the rise, with software firms playing a key role in advancing manufacturing and packaging design

380m

Tonnes of plastic produced annually, 50% of which are for single-use items

\$917bn

Global packaging market size in 2019, reaching \$1tn by 2024

9%

Of global plastic waste is currently recycled

\$57.9bn

Market size of the global e-commerce packaging industry

In 2019, global plastic packaging production exceeded 360m metric tons, making up a \$917bn industry. By 2050, plastic production is projected to triple and will account for one-fifth of global oil consumption. This poses significant environmental challenges and calls for a major shift in packaging practices, while the large market size also makes it an attractive sector for investors.

Emerging packaging startups are actively developing sustainable, efficient, and consumer-friendly solutions using advanced materials and technologies to foster a circular economy.

Technology	WSC Score	Notes
Packaging Software & Infrastructure	8	Pick and shovels play
Biodegradable & Compostable	5	
Waste to Value	5	
Bio-Materials	5	

Technologies & Subsectors

Packaging Software & Infrastructure

Score: 8

The manufacturing of new materials requires infrastructure to scale up research but also to help consumers navigate this new packaging market.

Tailwinds

- + Market maturity and readiness in adopting new software

Challenges

- + Already competitive and saturated market

Biodegradable & Compostable

Score: 5

Several startups are focused on developing packaging materials that are biodegradable and compostable. These bio-materials generally produces flexible packaging made from plant-based materials (for example mushroom or seaweed).

Tailwinds

- + Regulation are favoring sustainable materials vs. single-use plastics
- + Consumers are increasingly seeking products made from sustainable materials

Challenges

- + Technologies are in the early stages of scaling
- + Distribution remains an issue
- + Low margins

Waste to Value

Score: 5

Startups are also developing packaging materials made from waste materials, such as compostable plant-based materials, and biodegradable plastics from food waste.

Tailwinds

- + Commercial value of imbedding recyclability in product manufacturing
- + Can lead to cost optimisation in manufacturing process

Challenges

- + Technologies are just beginning to scale
- + Distribution remains an issue
- + Low margins

Technologies & Subsectors

Bio-Materials

Score: 5

Rapidly growing sector focused on developing and commercialising innovative materials as alternatives to traditional materials derived from fossil fuels. The main areas of research are Bioplastics, Bio-based Textiles, Biomimetic Materials, Bio-based Composites.

Tailwinds

- + Increasing awareness of environmental issues and resource depletion is driving demand for materials that have a lower environmental footprint

Challenges

- + Technologies are in the early stages of scaling
- + Distribution remains an issue
- + Low margins

Clean Energy

Clean energy is achievable but will require hefty investments in new technologies and infrastructure, beyond the traditional VC scope

73%

Of emissions are created by energy use

\$2tn

Investment required to get carbon free electricity for the US grid by 2035

89%

Decrease in the price of solar energy in the last 10 years

80%

Surge in capacity for solar and wind power by 2026

The renewable energy market is growing significantly thanks to cost competitiveness, supportive policies and rising demand. Renewables are finally more cost-effective to produce than fossil fuels. In 2022, wind and solar power generated 22% of the EU's electricity, overtaking gas for the first time. In the EU, renewables now account for nearly 40% of total electricity generation.

Direct energy production lends itself more to infrastructure-type investments due to the long-term nature and capital intensity of these projects. That said, investors are monitoring Software as a Service (SaaS) offerings in these sectors for designing solar field infrastructure and optimising engineer deployments.

Technology	WSC Score	Notes
Solar Power	5	Potential SaaS opportunities
Wind Power	5	
Nuclear	5	
Hydropower	5	
Waste-to-Energy	5	
Hydrogen	4	

Source: S&P Global (2021), Lightsourcebp (2023), McKinsey (2022), WSC Analysis (2023)

Technologies & Subsectors

Solar Power

Score: 5

The solar industry has considerably matured in the last decade, with innovative technologies making solar energy more affordable and accessible, while software is coming in to reduce inefficiencies, help design infrastructure, monitor plants, and support engineers.

Tailwinds

- + Price has decreased by 89% in the last decade
- + Capacity is growing steadily
- + US and EU legislation is cutting red tape, providing tax credits and public subsidies

Challenges

- + Market is dominated by large industrials

Wind Power

Score: 5

Wind turbines technologies have advanced significantly, primarily by increasing turbine size for greater energy generation. Innovations are also improving the efficiency and reliability of wind turbines, including vertical axis wind turbines, bladeless turbines, and offshore wind farm models.

Tailwinds

- + US and EU legislation is cutting red tape, providing tax credits and public subsidies
- + Governments are investing in offshore wind farms

Challenges

- + Criticised for their visual impact on land
- + Offshore wind farms that require shallow seabeds

Nuclear

Score: 4

Nuclear energy has progressed slowly, with most technologies relying on fission. Despite major investments like ITER, progress in fusion has been limited and attention is turning to Modular Reactors (SMRs), Molten Salt Reactors (MSRs) and new Fusion Energy approaches.

Tailwinds

- + Proven and reliable technology
- + US and EU legislation is cutting red tape, providing tax credits and public subsidies

Challenges

- + Lack of significant breakthrough in fusion
- + European governments have reduced research due to public pressure
- + Capital intensive projects

Technologies & Subsectors

Hydro Power

Score: 5

This category includes dams and tidal turbines. Hydro energy stands out as the most predictable source of energy, being the only renewable option capable of consistently providing reliable energy.

Tailwinds

- + Proven and reliable technology
- + Constant

Challenges

- + Capital intensive projects
- + Requires specific land available

Waste-to-Energy

Score: 5

Waste-to-Energy technologies cover various methods for converting waste materials into energy, including incineration, gasification, pyrolysis, and anaerobic digestion.

Tailwinds

- + Proven and reliable technology

Challenges

- + Not entirely clean
- + Limited profitability

Hydrogen

Score: 4

Hydrogen, abundant in the universe, is a superior clean energy alternative for energy generation and storage, used in a variety of applications including transportation, heating and power generation and serves as an energy storage medium.

Tailwinds

- + Ability to use existing fossil fuel infrastructure
- + Versatility in energy applications
- + Supported by new government regulations

Challenges

- + Limited natural hydrogen availability
- + Green hydrogen production is challenging and costly
- + Storage and production involve significant energy loss

Climate Tech – a Timeline

There is a large gap between awareness of climate change and action, and after a first attempt, we are entering a new era of climate tech VC

- 1938 – First proof that global temperatures are rising
- 1954 – The birth of the solar cell
- 1958 – First proof that CO2 levels are rising and fossil fuels are to blame
- 1967 – Earth’s changing climate modelled for the first time
- 1985 – Lithium-ion battery is invented
- 1988 – The intergovernmental Panel on Climate Change is established
- 1994 – First climate change legislation comes into force
- 1997 - Kyoto Protocol - First climate treaty to reduce carbon emissions
- 2000 - Clean Tech 1.0 as Silicon Valley VCs march into the sector
- 2008 - Great Financial Crisis and climate tech crash
- 2015 – Landmark international Paris agreement reached to cut carbon
- 2021 – Scientists predict world will reach 1.5°C of warming by 2040
- 2022 – Clean Tech 2.0

