

The Future of Climate Tech

A look at the technologies driving a
sustainable future

June 2023



Executive summary

A bright future for climate tech

The scientific consensus is clear. The world must achieve net-zero greenhouse gas emissions by 2050 to mitigate the worst human impacts of climate change. While this is a daunting task, it is possible. Achieving net zero doesn't hinge on a single moonshot scientific breakthrough, but rather on incremental technological improvements and the mass scaling of technologies that already exist in the lab. To do that, climate tech innovators must lead the way.

We understand the important role tech companies play in helping to solve the climate crisis and are optimistic about the future. This report leverages SVB's propriety data and sector expertise for an updated look at the state of climate technology. Much has changed since our last report. Market challenges in tech and financial services have created short-term headwinds for founders and investors. But the long-term outlook for climate tech companies is bright.

Climate tech has remained resilient despite a global slowdown in the venture capital (VC) ecosystem. Investors recognize the growing demand for climate tech solutions. No data point illustrates this optimism better than the resiliency of climate tech valuations. While the VC ecosystem has seen the most significant valuation correction in over a decade, climate tech valuations have remained at or above their 2021 levels.

Government policies such as the Inflation Reduction Act (IRA) have boosted tax credits and incentives, while demand for sustainable solutions among consumers is pushing businesses and money managers to consider climate costs in their decision-making. At the same time, tech advancements have given rise to a burgeoning new cohort of companies — and new sectors — built on foundational clean tech such as solar, wind and batteries.

The challenge to achieving net zero is to do so within the budget constraints, policies and market mechanisms of the real world. The role of climate tech is to develop cost-effective solutions to reduce climate change that are deployable at scale and depend on market demand for growth. With so many forces pushing climate solutions forward, we are mindful of the challenges ahead but steadfast in our belief that with dedication and commitment, the worst impacts of the climate crisis can be avoided.

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Outlook: Four themes influencing the future of climate tech



Government support

Massive federal spending creates momentum for scaling green infrastructure and energy deployments while providing a backstop to project finance. Stronger incentives for a wide range of carbon-reducing technologies **improve the economics for climate tech investors**. New funding from the Department of Energy offers a **lifeline for capital-intensive energy projects**.



Climate tech diversification

The next generation of climate tech is here, built on the foundational technologies developed during the cleantech 1.0 boom.¹ **Opportunities to optimize, decrease costs and develop new markets** arise when continued deep tech innovations are coupled with artificial intelligence (AI), machine learning (ML) and software. Climate tech 2.0 is thus not just a deep tech phenomenon but reflects a **more diverse cohort of companies with a wider range of solutions**.



Measurement and data

Deep tech innovations can capture and process **limitless streams of data**, from carbon emissions tracked by satellites to traffic data generated by cars. This data is being used to create **new climate tech software solutions**, such as more efficient carbon markets and AI-powered virtual power plants, but is also being used to generate **new revenue streams for hardware companies** and to open the door for new software companies.



Decarbonization

Electrification of the energy sector with **carbon-free electricity** will continue, augmented by the application of climate technologies such as **virtual power plants, improved weather forecasting and long-term storage** on the supply side. On the demand side, electrification of vehicles, buildings and industry **will require advances in climate technologies** such as smart grids and storage.



Navigating to net zero:

Key themes and policies



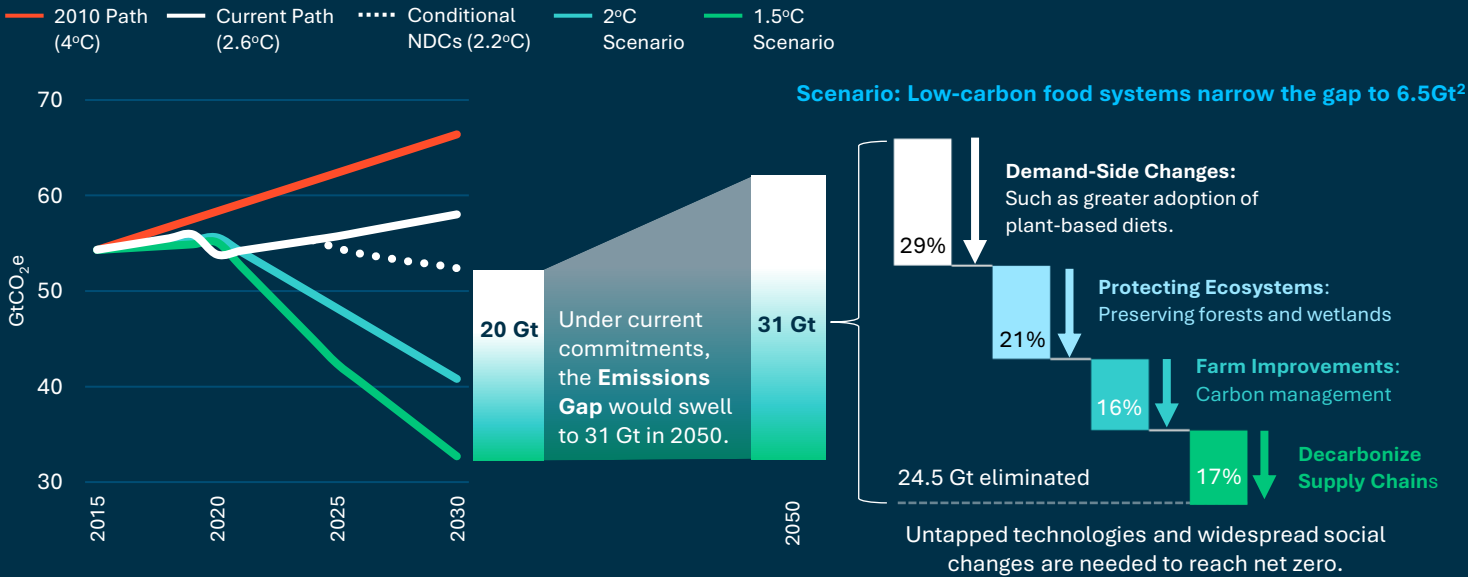
Bridging the global emissions gap

The impacts of climate change are becoming more apparent every year. Yet despite global progress curbing the growth of greenhouse gas (GHG) emissions over the last decade, the gap between current policy commitments and what is needed to avoid climate disaster continues to grow. A massive overhaul of the world's energy systems is well underway, but existing commitments won't be enough. Countries that signed the Paris Agreement are falling behind on their pledges, with announced policy commitments expected to reduce global emissions by 10% as of 2030, well short of the 45% reduction that is needed. Overcoming that gap is the challenge of our time.

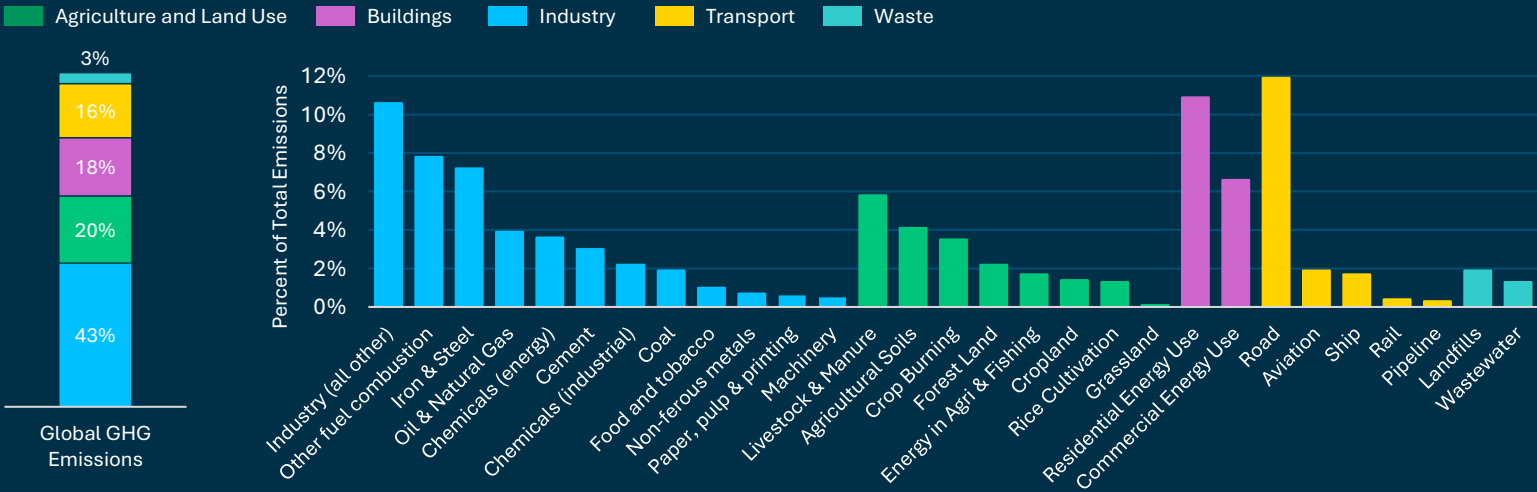
Tech companies will play an important role in addressing the climate crisis by enabling the global rollout of green energy and creating new solutions for challenges, such as decarbonizing industrial processes. However, tech is not a silver bullet. Solving the climate crisis doesn't hinge on a single major scientific breakthrough so much as the mass scaling and incremental improvement of existing technologies. By fostering economies of scale, reducing costs of clean technologies and creating demand for greener products and practices, tech companies are critical to accelerating our path toward a net-zero future.

Societal changes are needed in electricity supply, industrial processes, transport, buildings and, perhaps most urgently, food systems. Inputs required to feed humanity account for roughly one-third of GHG emissions. Unlike power production, which is trending more renewable, emissions from food systems are heading in the wrong direction. Reversing this trend through demand-side changes (such as shifting to plant-based diets) along with soil conservation and decarbonized supply chains (cleaner grocery store refrigerants, for example) are areas ripe for tech disruption.

Global Emissions Scenarios and the Widening Emissions Gap¹



Greenhouse Gas Emissions by Source



Notes: 1) Based on UN estimates of annual GHG emissions for various policy scenarios. Nationally Determined Contributions (NDCs) are the current cumulative emissions targets of countries that signed the Paris Agreement's long-term temperature goal. 2) Food systems include cross-sector activities such as land use and transportation. These estimates are based on a UN analysis of cuts needed to reach 1.5°C path by 2050.

Source: United Nations Environment Program (UNEP), Our World In Data and SVB analysis.

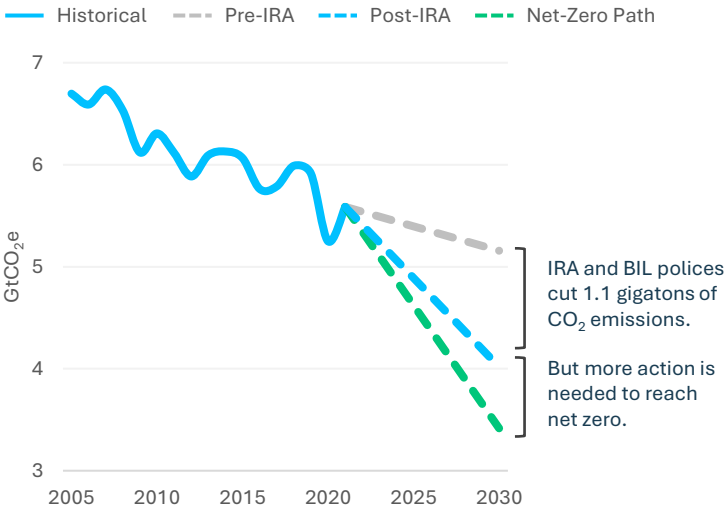
Federal incentives move the needle

US government action on energy innovation has taken a giant leap forward in the last three years. Together, the Bipartisan Infrastructure Law (BIL), the CHIPS Act and the Inflation Reduction Act (IRA) will fund nearly half a trillion dollars toward climate technologies and energy infrastructure over the next decade. The grants, loans and incentives within these spending bills will strengthen the economics of emerging business models, reducing risk and boosting investor confidence in the climate tech space.

The IRA alone represents the largest single climate spending bill ever passed in the US. It extends and creates new incentives to spur growth in renewable energy and promote clean technologies. Expanded tax credits improve the unit economics for carbon-reducing technologies such as direct air capture and home heat pumps. The legislation introduces new tax credits such as credits to individuals purchasing used electric vehicles and corporations purchasing clean fleet vehicles. It also jumpstarts the DOE loan program that was critical in funding wind, solar and early electric vehicle manufacturing a decade ago but has been less active for the last five years. These loans will accelerate large-scale renewable infrastructure projects that could be difficult to fund in the private market.

The actions within the IRA and other recent spending bills are expected to reduce annual US carbon emissions by about 1.1 gigatons by 2030. But even with these significant overhauls, more action is needed to meet net-zero commitments. Tech companies will play an important role in creating the efficiency gains needed to overcome the remaining gap.

US GHG Emissions Scenarios¹

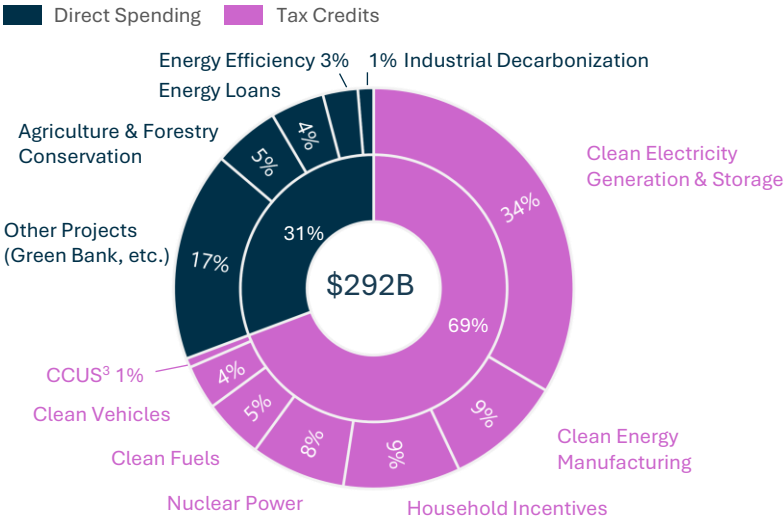


Notable Climate Tech Incentives in the Inflation Reduction Act (IRA)

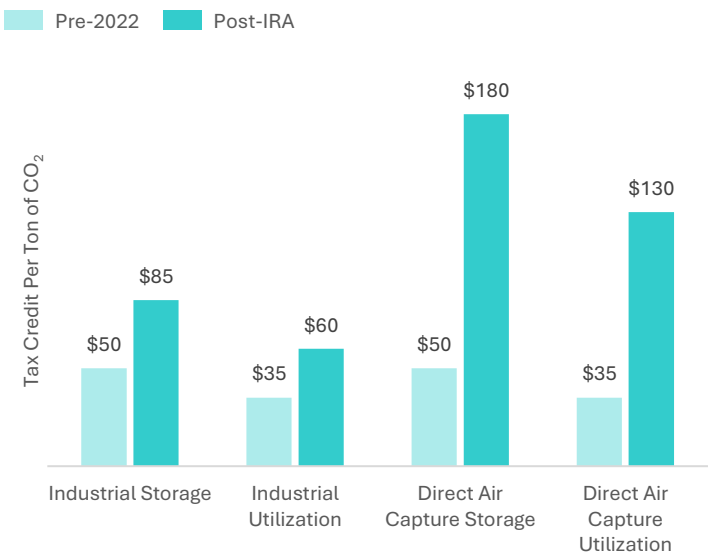
Sector	Incentive	Amount	Key Startups
Transport	Tax credit for clean fleet vehicles.	30% of the price dif. for a gas equivalent.	Spring Free EV
Transport	Tax credit for used electric vehicles.	30% of the EV price (up to \$4k)	evconnect+
Industry	Fee on methane emissions.	\$900/ton in '24 (up to \$1500/ton by '26)	OSK
Buildings	Tax credit for home heat pumps.	30% of the install cost (up to \$2k)	GRIDTENTIAL
Industry	Tax credits for CCUS projects.	\$180/ton captured	Heirloom
Industry	Tax credit for green hydrogen.	\$3/kg produced	SYZYG PLASMONICS

Notes: 1) Scenarios reflect the median path of outcomes based on current policy commitments. Carbon reductions estimated by the DOE. 2) Based on analysis by Brookings. 3) Carbon capture, use and sequestration. Source: United Nations Environment Program (UNEP), Brookings Institute and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.

Inflation Reduction Act (IRA) Spending²



US Carbon Capture Tax Credits



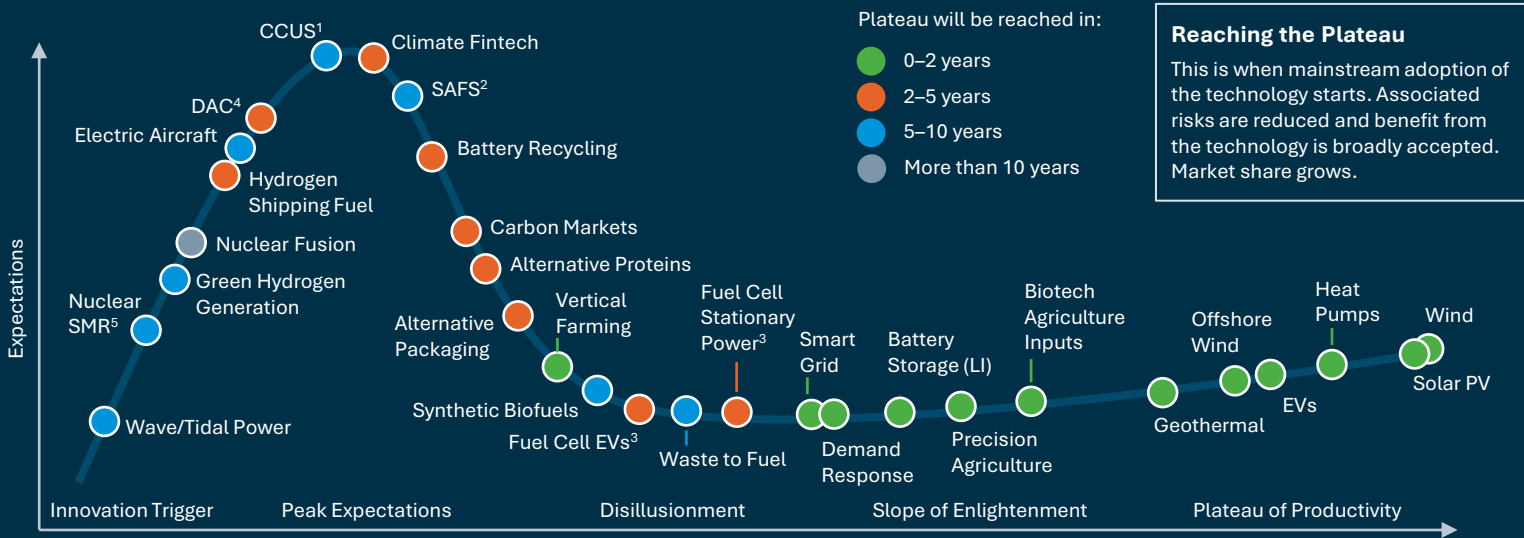
Ahead of the curve: Climate tech matures

Climate technologies are rapidly maturing. The science and systems enabling renewable energy sources like wind and solar have reached stable, high productivity levels. The cost of solar has fallen 80% in the last decade, while the efficiency of wind turbines has doubled. Renewable power is often cheaper than conventional sources. The challenge is scaling these technologies and addressing intermittency.

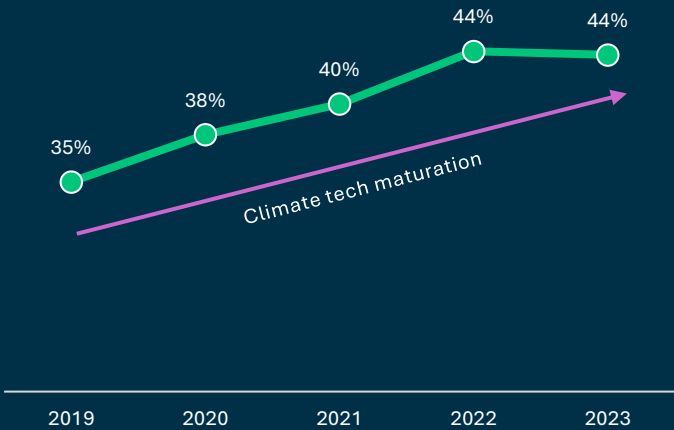
Along with the technologies, climate tech startups are also maturing. Late-stage companies account for over 44% of VC deals in the climate tech space, up from 35% in 2019. The shift toward later-stage investment signals climate tech companies are reaching the revenue milestones needed to support higher valuations. It is also a sign that investors are becoming more confident in the long-term prospects of climate tech. This maturation has led to a boom of unicorns with 80 climate tech unicorns worldwide, including 14 US companies that became unicorns since 2022. These companies are in a variety of sectors, including energy, transportation, agriculture and waste management.

Unicorns’ success is a testament to the growing demand for climate-friendly solutions and a sign that the market is moving toward a plateau of productivity. Climate technologies are becoming increasingly affordable, efficient and scalable. While climate change is well understood, the challenge is financing, scaling and adopting solutions and technologies. Moving technologies like battery storage, smart grids and carbon capture to a plateau of productivity will require a concerted effort from governments, businesses and individuals. The good news is that the climate tech industry is growing rapidly, and many promising solutions are available.

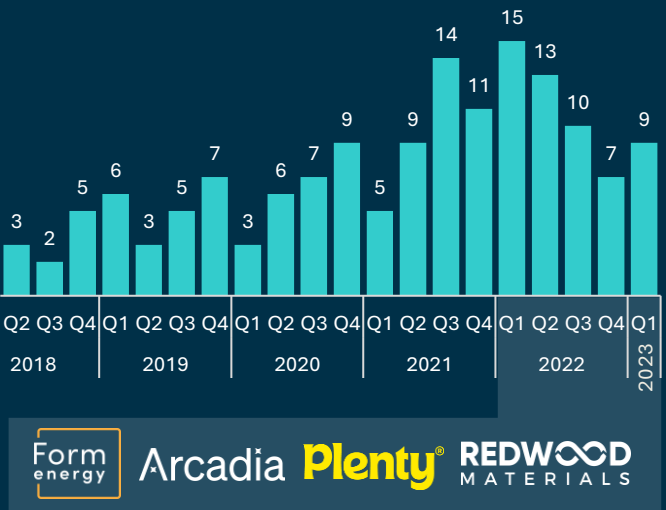
Select Climate Tech Innovation Hype Curve



Percentage of US VC Deals in Climate Tech Going to Late-Stage Companies⁶



US Climate Tech Unicorn Deals⁷



Notes: 1) Carbon capture utilization and storage. 2) Sustainable aviation fuels. 3) Hydrogen fuel cell. 4) Direct air capture. 5) Small modular reactor. 6) Late-stage defined by PitchBook. 7) Notable company logos. Source: PitchBook, Holon IQ, Cleantech Group i3 Connect, SVB proprietary taxonomy, International Energy Agency and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.



Resilient investing

The financing dynamics of a green future



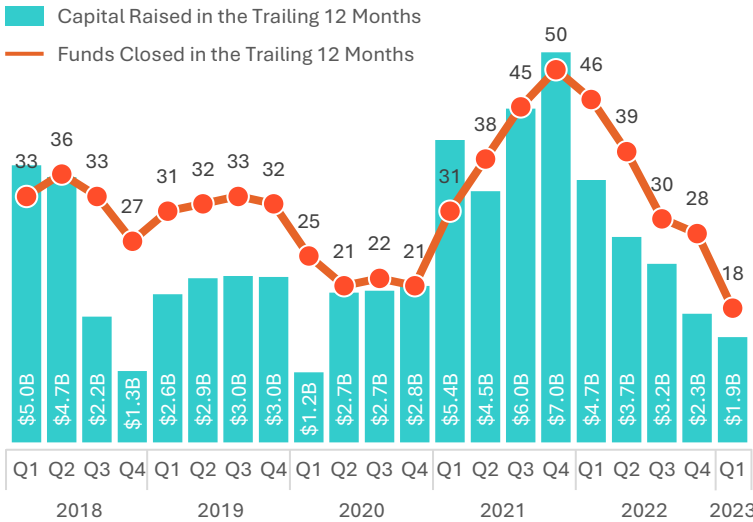
Fundraising down, investment not out

Climate tech fundraising is down 60% YoY mirroring the decline experienced by the overall US VC fundraising market. The reality is that Fed tightening, public market uncertainty and what has been reported as the worst performing vintage in over a decade¹ means that limited partners are slowing down investments into funds.

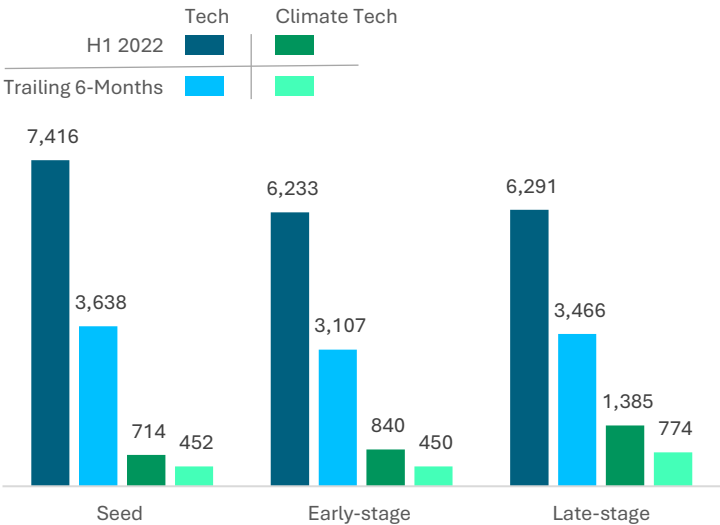
These trends mean that general partners are also pulling back. The number of investors making investments in seed-stage US climate tech companies has decreased by 37% since H1 2022. However, at the seed-stage, the decline of active tech investors fell by 51% across the broader tech sector, suggesting climate tech is more promising than tech overall, reflecting an optimistic view of the sector's future. Furthermore, the decline in active investors is less significant than deal activity. This is partly due to the concentration of deals among relatively few investors. The top 5% of investors account for 32% of all climate tech deal activity since 2021.

Climate tech companies have benefited from the many generalists in the space. For example, BlackRock, Fidelity and Insight Partners are among the top investors in late-stage climate tech companies. Generalist investors account for 59% of deals made by climate tech's top 100 most active investors. This results from the fact that generalists are typically larger than climate tech funds. Among the top 100 climate tech investors, generalists had a median fund size of \$1.9B, while specialist investors had a median fund size of \$450M. The breadth of capital available to climate tech companies, and interest in the sector may shield them from the worst of the declines in VC fundraising and investment.

US Climate Tech Fundraising²



Active US Investors by Stage and Sector³

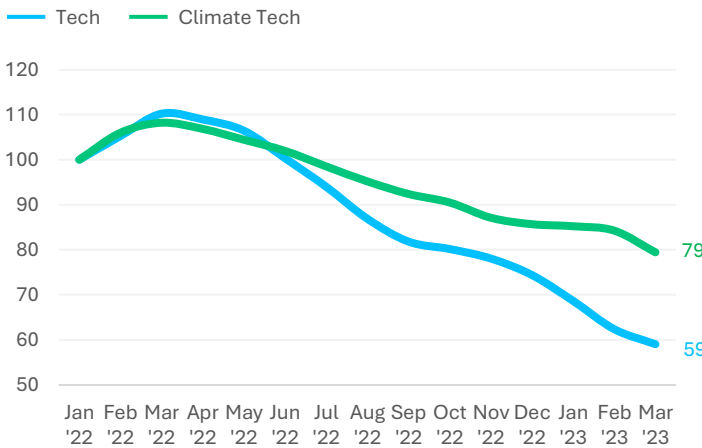


Notes: 1) PitchBook and The Wall Street Journal. 2) Funds with a stated emphasis in: Electric and hybrid vehicles, clean technology, agtech, energy storage and batteries and renewable energy. 3) Active defined as investors of any fund type that have made an investment in the last 6 months. 4) Total VC deals for the trailing three months indexed to 100 1/1/2022.
Source: PitchBook, Cleantech Group i3 Connect, SVB proprietary taxonomy, The Wall Street Journal, Prequin and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.

Total US VC Climate Tech Fundraising Since 2021 by Fund Strategy



US VC Deal Activity Index: Trailing Three Months⁴



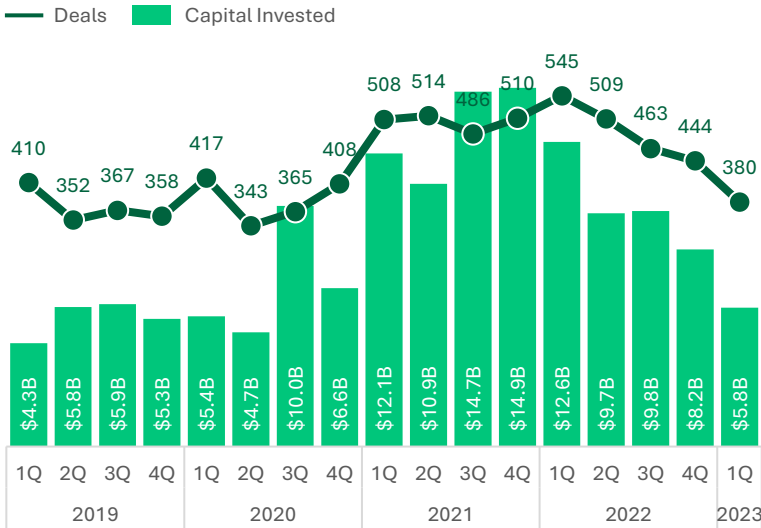
Slow down: A yellow light for green VC

VC deal activity in climate technology has slowed by 21% since the beginning of 2022. Still, it has fallen slower than VC investment in other technology sectors, which fell 41% in the same period. Despite climate tech’s outperformance, nearly all verticals within climate tech have seen a YoY decline, with the steepest declines in food tech, fintech and supply chain technology.

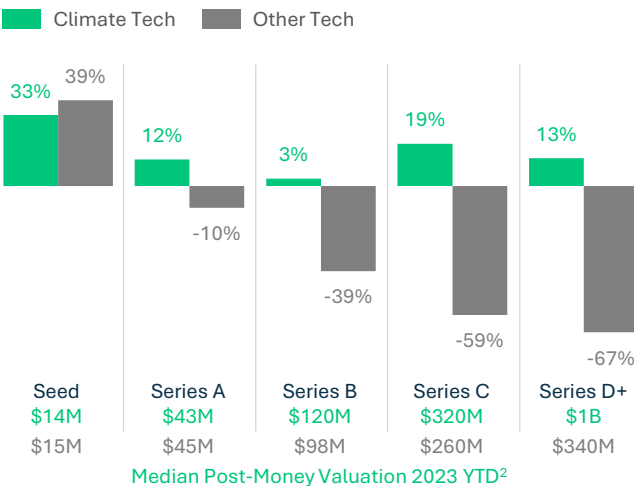
Alternative protein companies have seen lackluster performance in public markets, which may help explain the below-average investment levels of food tech companies. However, we may see a resurgence in the space with a few cultivated meat companies getting FDA approval. Climate fintech has also seen significant declines, but this is driven by factors exogenous to climate tech, such as increased regulator uncertainty and large fraud cases in the crypto/fintech space with FTX, among others.

Despite the slowdown, valuations in climate tech have remained flat or up, compared to general tech, which has seen valuations fall across all stages apart from seed. This is likely due to the large market opportunity for climate tech deals and the fact that some climate tech investors are less valuation sensitive due to their mission-driven investment thesis balancing climate impact and financial returns. As a result, they are willing to pay higher valuations for companies developing innovative solutions to climate change.

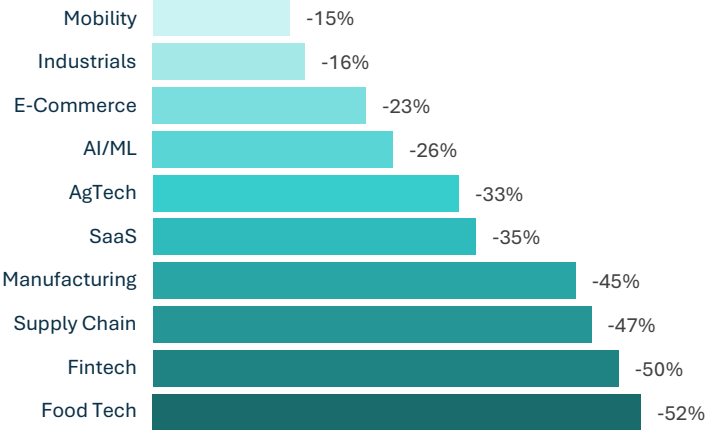
US Climate Tech VC Investment



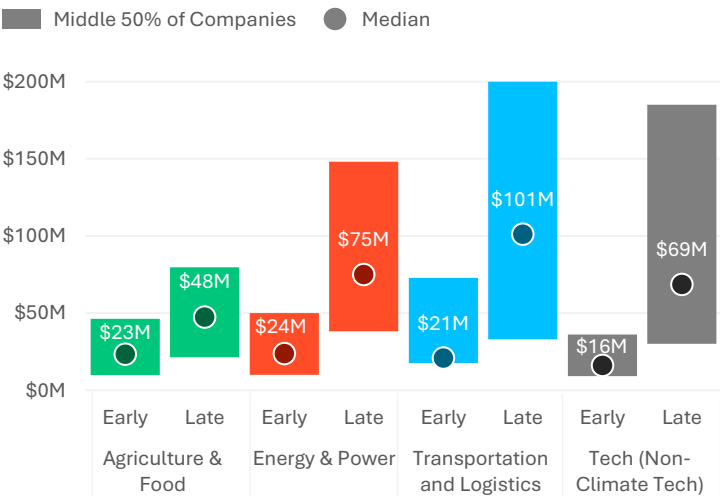
Change in Median US Post-money Valuation by Series 2021 – 2023 YTD²



YoY Decline in US VC Deal Activity by Notable Climate Tech Verticals¹



US VC Pre-Money Valuations by Stage and Sub Sector: Trailing 12 Months³



Notes: 1) Trailing three months as of 5/31/2023 compared to trailing three months as of 4/30/2022. 2) YTD as of 4/30/2023. 3) Late-stage defined using PitchBook: Post series B or 5+ years after founding date, trailing 12 months as of May 31. Source: PitchBook, Cleantech Group i3 Connect, SVB proprietary taxonomy and SVB analysis.

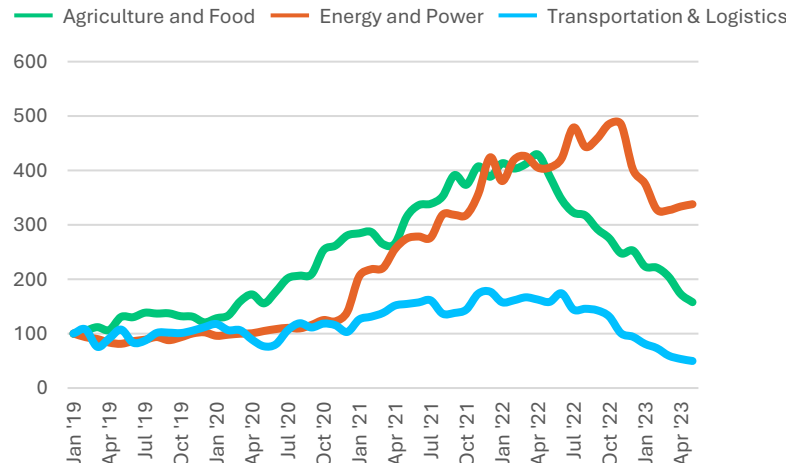
Energy powering ahead

As VC investment has slowed, cash runway for climate tech companies has begun to fall. Most companies do not have the 18-24 months of runway that some investors recommend. However, in past market cycles, VC investment tends to rebound after 12-18 months. We are 18 months into the decline, and monthly VC investment numbers leveled off, suggesting that we are reaching a floor. Thus, companies with 12 months of runway may have enough to weather a continued slowdown in VC — especially climate tech companies sheltered from the worst of the VC slowdown.

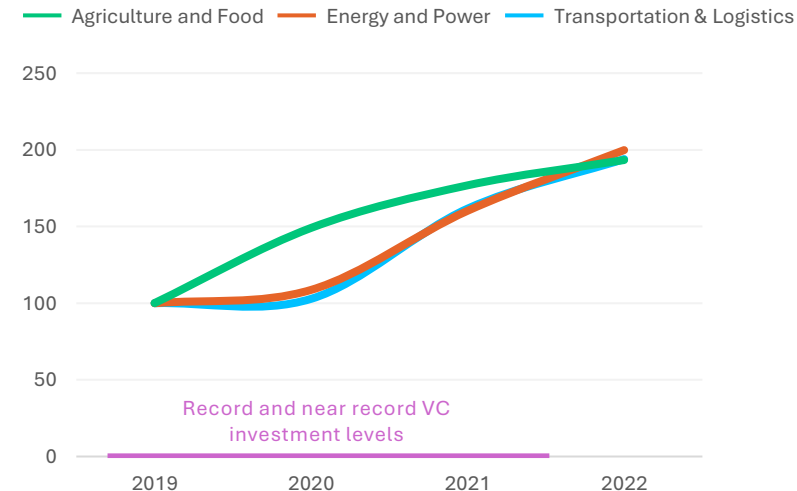
In 2022 investment slowed for climate tech, with the exception of energy and power. Energy and power saw continued revenue growth as the median growth rate was nine percentage points higher than in 2021 compared to transportation and agriculture, which both saw revenue growth slide 17 percentage points.

Energy and power has fared well due to several market factors, including high energy prices and increased subsidies. These factors have led to increased demand for climate tech solutions, which has helped offset the VC investment slowdown. However, other sectors are mixed, such as agriculture and food. While some agriculture and food tech companies like Pivot Bio may feel tailwinds from nitrogen supply chain challenges, others may feel squeezed by falling consumer confidence shifting consumer preferences away from higher-priced food such as alternative meats to lower-cost options.

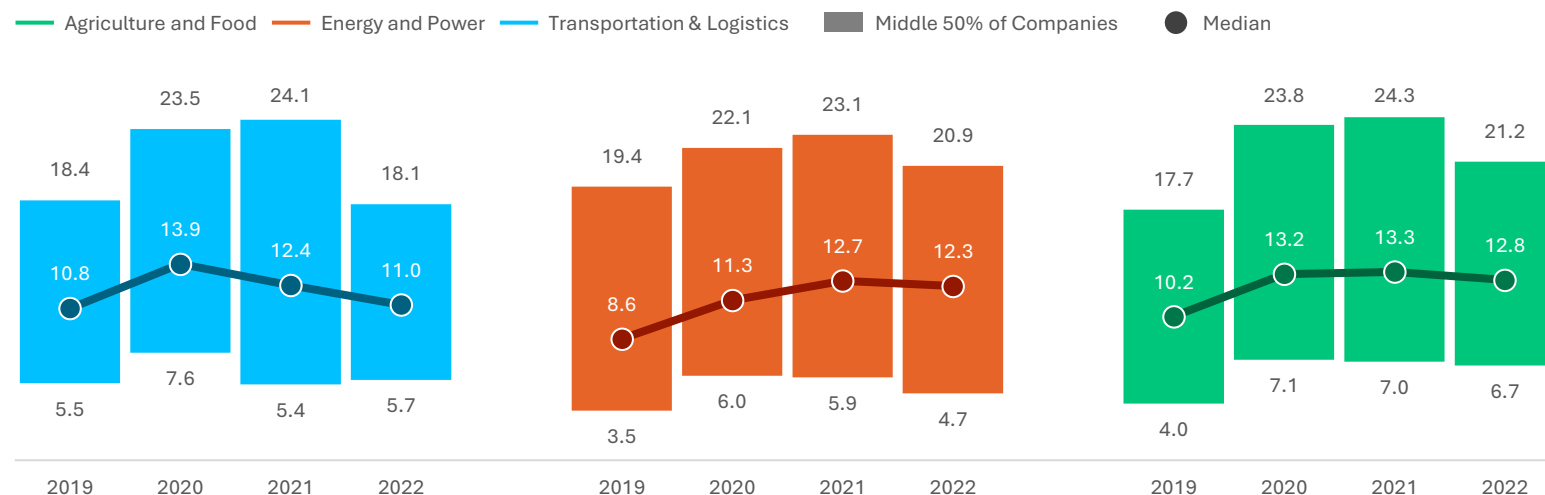
Index of US VC Investment By Climate Tech Sub Sector¹



Index of Cash and Cash Equivalents: US Climate Tech Cash²



Months of Cash Runway: US Climate Tech Sub Sectors³



Fast burn amid slowing growth

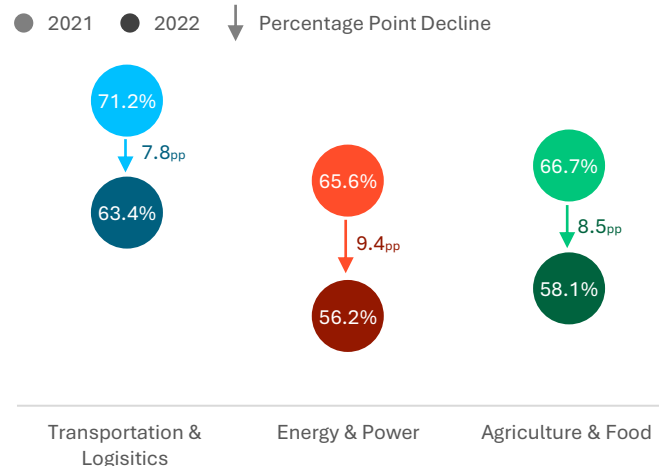
Not only has the innovation economy slowed, but the economy has also shown signs of cooling down as interest rates have risen at the fastest pace in modern history. As a result, fewer companies have seen revenue growth. Although median revenue growth increased for energy and power companies, just 56% had revenue growth in 2022.

Data suggests that companies are burning more cash to gain new revenue as growth becomes harder. Transportation and logistics companies, for example, are burning \$3.00 to gain one dollar of net-new revenue, up from \$2.10 in 2021. This trend is true across all climate tech sectors indicating the marginal dollar spent yields less new revenue than in 2021.

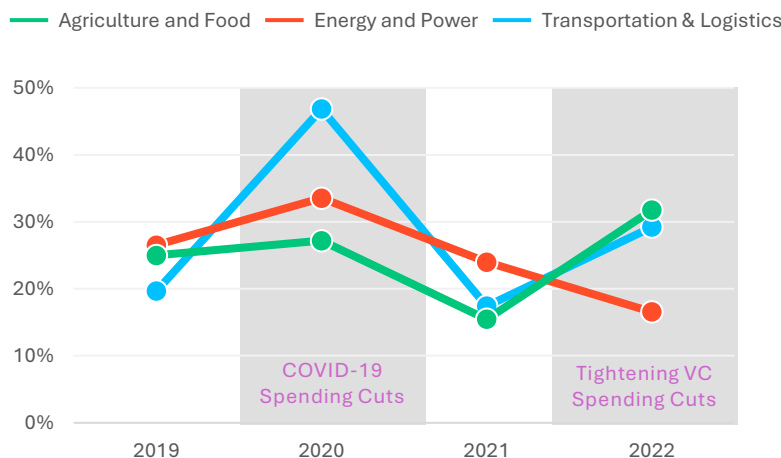
As a result of the slowing fundraising environment and tougher environment for growth, many companies are beginning to make cuts. About 30% of agriculture and transportation companies have reduced net burn in 2023 compared to 16% in 2022. We saw the same trend in 2020 when companies cut net burn in anticipation of a bumpy road ahead even though that rough road led to the largest years of VC investment in history.

Energy and power, however, saw very few companies reduce net burn in 2022, mainly due to the robust VC investment environment those companies faced. As investment has cooled in 2023, it's likely the energy and power companies will reduce net burn. This is especially true given the sector's low EBITDA margins. However, the low margins are unsurprising given the long timeframes for energy and power companies to reach revenue milestones and the difficulties of operating in a space where these utilities are often customers.

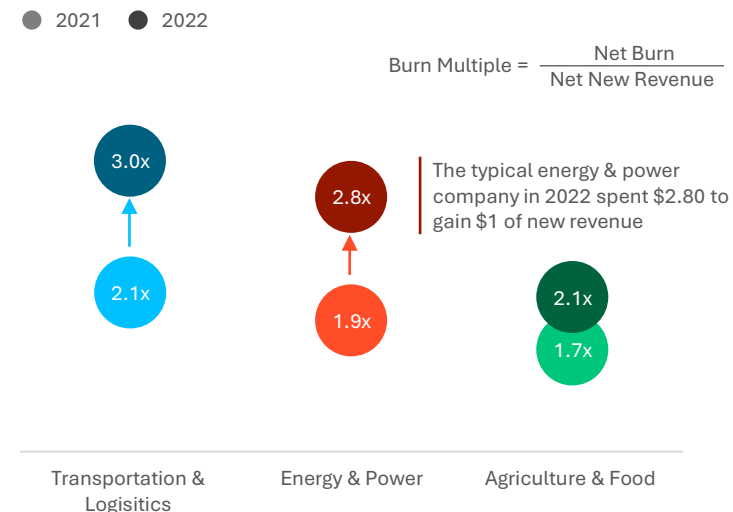
Percentage of US Climate Tech Companies with Increasing Revenue¹



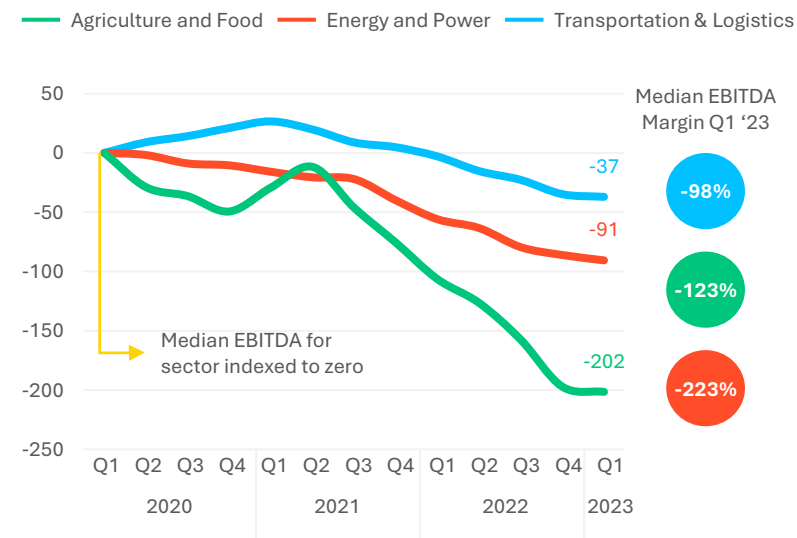
Percentage of Companies with Decreasing Net Burn: US Climate Tech²



US Climate Tech Median Burn Multiple



US Climate Tech EBITDA Margin Index³



Notes: 1) Calculated as the total number of financial statements with QoQ revenue growth over the total number of statements. 2) Percentage of companies with net burn that saw net burn decrease year over year. 3) Cohorts consist of US companies with negative EBITDA and at least \$1M in revenue; smoothed using four-quarter trailing average.
Source: Cleantech Group i3 Connect, SVB proprietary taxonomy, SVB proprietary data and SVB analysis.

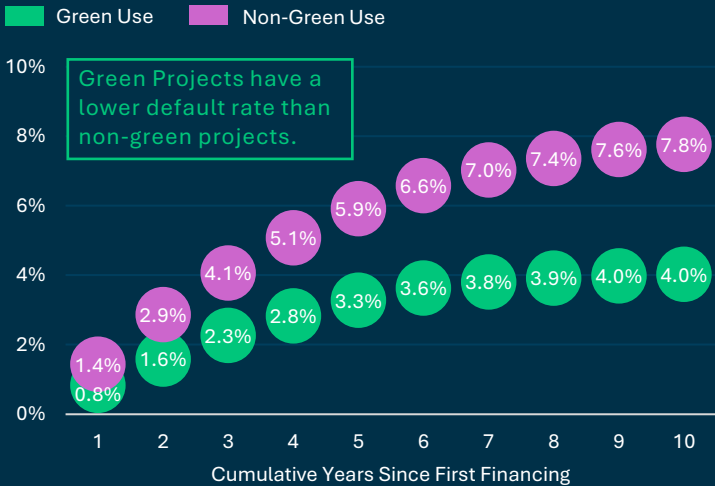
Saving the planet: A safer bet

One of the biggest challenges of bringing climate technologies to scale is the high capital requirement to fund the necessary infrastructure. A single renewable energy project may require billions of dollars to get started. These costs, combined with a higher risk profile of the newest technologies, can often deter traditional project finance investors.

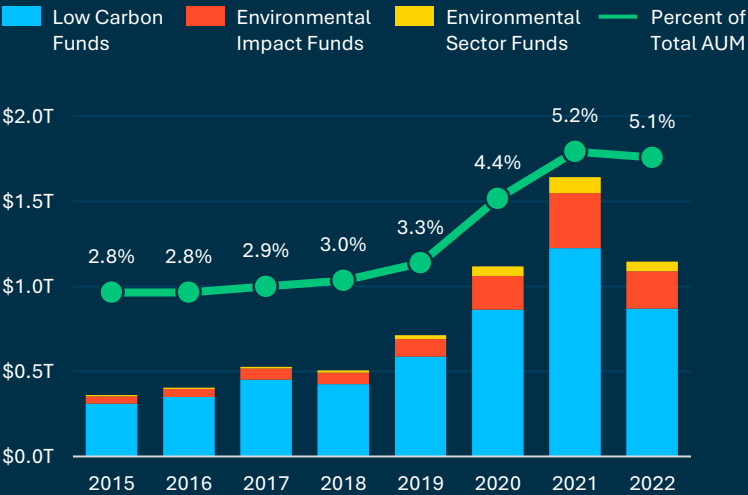
However, established green energy technologies such as solar and wind are proving to be fundamentally strong investments. Moody's data shows that global green infrastructure projects have a lower default rate than non-green projects. Green projects tend to carry high-quality contracts and are often backed by government mandates or subsidies, which can help to reduce the risk of financial losses. The capital needs of the energy transition are considerable. The UN estimates that \$125 trillion is required to hit climate goals by 2050, with as much as 70% sourced from the private sector. Global investment in climate projects has ticked up in the last five years, with green funds representing 5.1% of private assets under management in 2022, up from 3.0% in 2018.

In the US, the DOE is more active in financing the most capital-intensive climate tech projects. In 2022, the IRA expanded the DOE's loan authority from \$40B to more than \$400B over the next decade. As a result, loan requests have spiked by 74% since January 2022. The 141 active requests in April 2023 represent \$121B in financing requests for projects ranging from advanced vehicles to virtual power plants. Vetting can take years to complete. But for projects that get funded, the loans can be transformational. In 2010, Tesla used a \$465M DOE loan to mass produce the Model S.

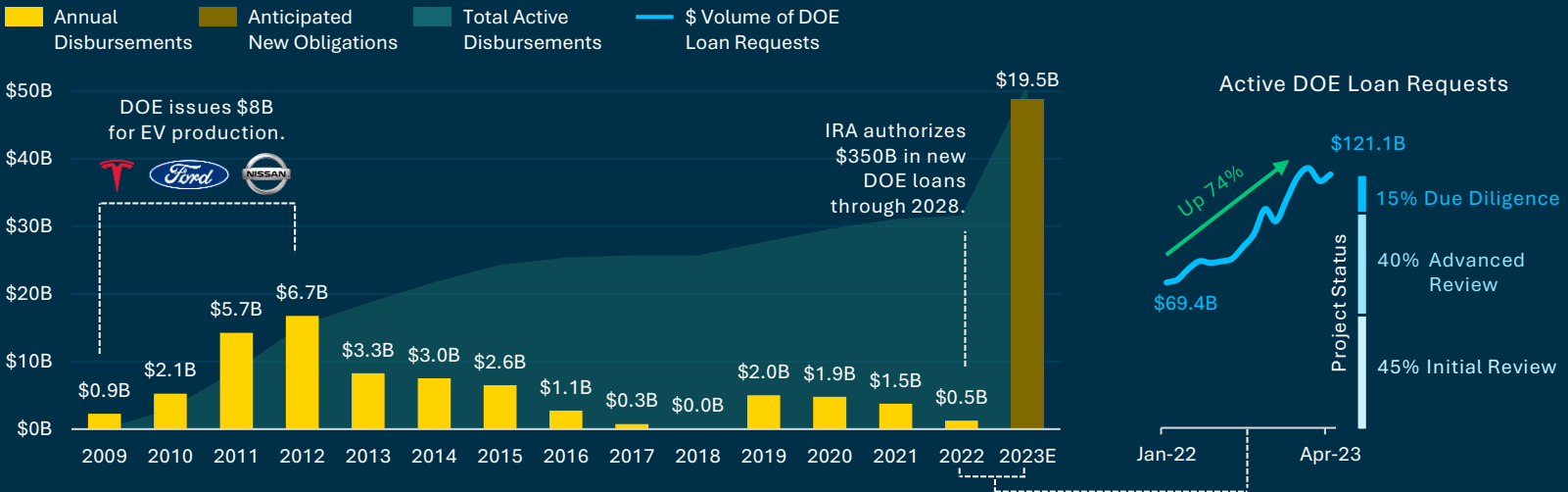
Global Default Rates on Infrastructure Finance Projects by End-Use¹



Global AUM in Climate Funds by Type²



US Department of Energy Loan Program Disbursements³ and Requests



Notes: 1) Based on Moody's analysis. 2) Based on IMF analysis of private equity and VC markets through H1 2022. Low carbon funds invest in companies with low carbon footprints. Impact funds invest in companies positively impacting the environment. Sector funds invest in green industries. 3) New obligations for 2023 are estimates based on the 2024 DOE budget request. Funds are disbursed over several years. Source: Department of Energy, International Monetary Fund (IMF), Moody's Investor Service and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.

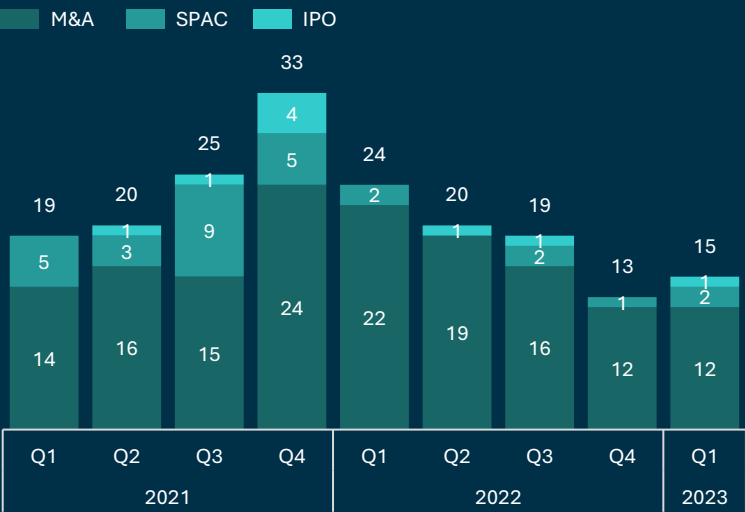
On ice: Exits wait for an open window

The exit market in climate tech is not dissimilar from the overall innovation economy. As volatility reintroduced itself in public markets, IPO and de-SPAC activity fell sharply thanks partly to rising rates and geopolitical unrest. While public markets are all but closed, M&A continues, albeit at a slower pace. But this isn't necessarily all positive. The percentage of M&A deals with unreported valuations has increased by eight percentage points since 2021. While a high percentage of M&A deals don't disclose valuations, this increase indicates that companies and acquirers are obscuring lackluster performance — M&A deals born out of necessity rather than an optimal exit for investors and founders.

With public markets down, enterprise value to next twelve months (EV/NTM) revenue multiples have fallen. These falling valuation metrics are a bellwether to investors and founders that terminal valuations are falling, and thus, many companies are waiting for better exit opportunities. However, some companies with strong fundamentals are testing the waters, Nextracker, for example, raised \$638M in an IPO in February 2023 and has seen strong performance since then.

This strong performance is not mirrored by many of the high-profile de-SPACs that occurred in 2021, which were concentrated in the transportation sector. Since 2021, 68% of climate tech exit value in public markets has been in transportation. Part of the decline in multiples has been driven by lackluster de-SPAC performance. De-SPACs in 2021, for example, have lost over 70% of their market capitalization since their de-SPAC date. But the SPAC fad is slowing, with just 5 VC-backed climate tech de-SPACs in all of 2022 and 23 in 2023.

US VC-Backed Climate Tech Exits



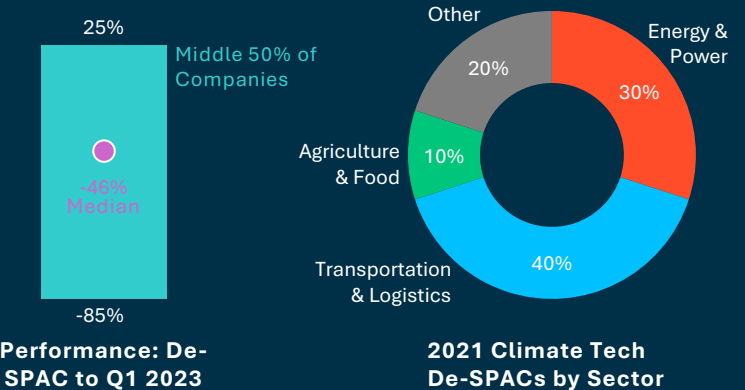
2021 Climate Tech De-SPACs Statistics

\$14.5B

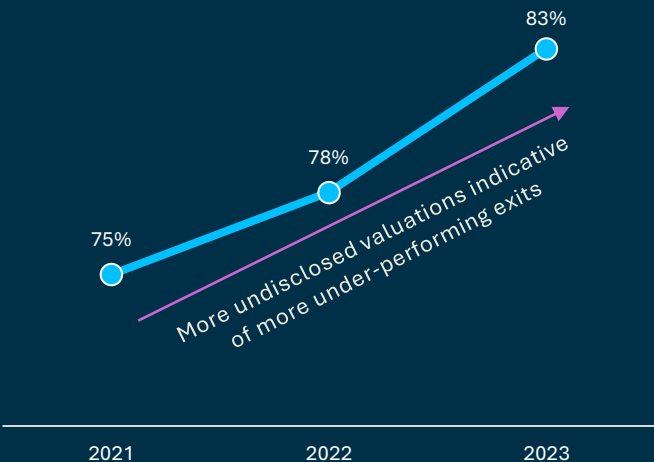
Total value of market caps at merger date

\$4.3B

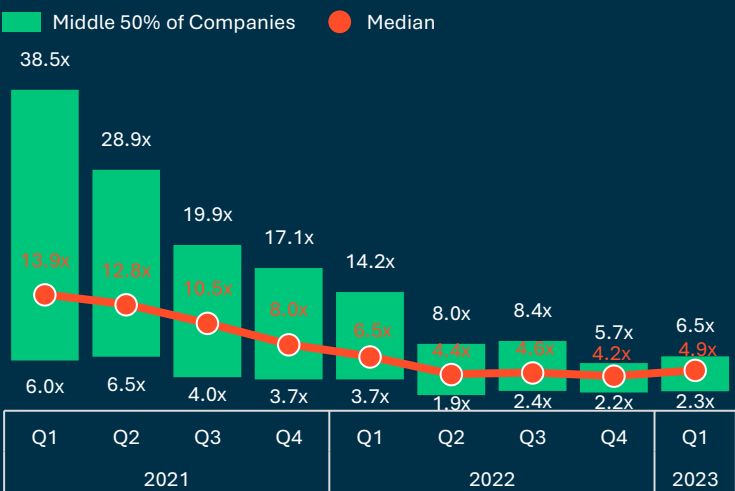
Total value of market caps Q1 2023



Percentage of M&A Deals without Valuations Disclosed



US EV/NTM Multiple: Public Climate Tech Companies¹



Notes: 1) Enterprise value to next twelve months revenue.
Source: PitchBook, Cleantech Group i3 Connect, SVB proprietary taxonomy, S&P CapitalIQ and SVB analysis.



Promising tech

Climate tech software, thermal tech
and green hydrogen

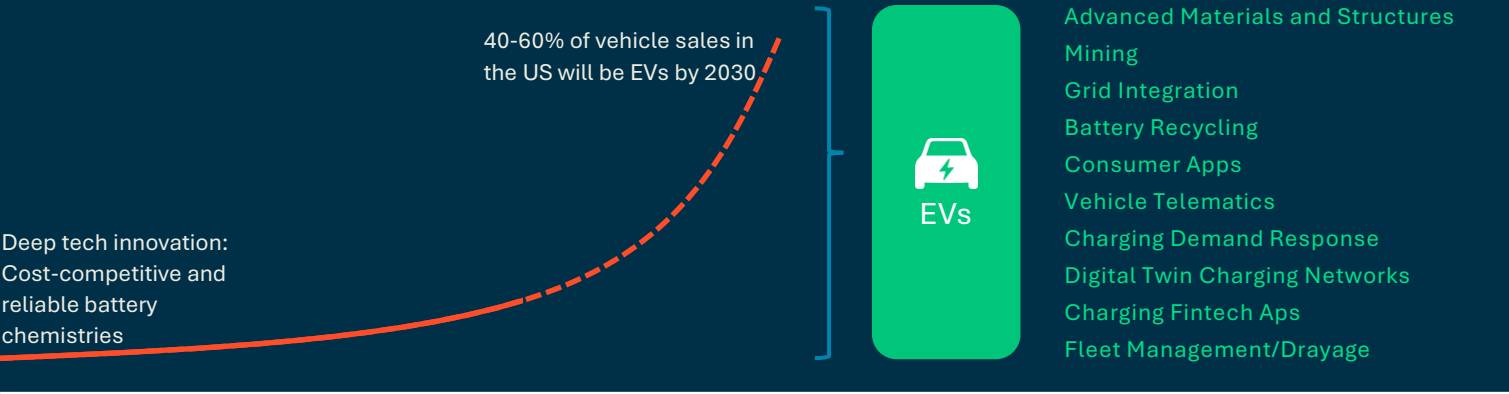


Data keeps the lights on

Just as Silicon Valley was built on the advent of hardware such as chips and computers, so too is climate tech. Batteries, solar panels, wind turbines and robots are the foundational technologies that have enabled many climate tech innovations to scale. From this crucible of deep tech has emerged a plethora of industries including many software companies built around optimization. AI, for example, plays a significant role in the US climate tech sector with nearly 500 US climate tech startup leveraging AI. Companies like Ensemble Energy (acquired in 2021) developed AI to do predictive maintenance on wind turbines thus decreasing downtime and increasing profit margins. Still other companies heavily rely on data such as Streetlight Data which uses big data to solve transportation issues from EV charging infrastructure to traffic. Tesla is looking to unlock additional functionality by applying existing technologies to new solutions such as using Tesla power walls to create a virtual power plant that can supply peak power in California. These examples reflect that the future of climate tech is not going to be built on just hardware (as much of the first clean tech boom), but that climate tech today reflects a far more diverse set of solutions.

An ongoing theme that continues to gain traction in the climate tech space is the adoption of recurring revenue models, or so-called hardware-as-a-service (HaaS). One benefit to the HaaS model is converting large capital expenditures, which typically require financial planning and senior management sign-off, to periodic “operating” expenses. This generally means a shorter sales period, lower selling expense and simpler account management. Many HaaS companies create additional value from the data they are collecting through their deployed hardware. In an SVB survey of HaaS companies, 41% of respondents said they own the data generated by their hardware. Another 16% indicated that they either have a data-sharing agreement or some other kind of understanding with their clients indicating the value companies see in this data as a future revenue stream.

Deep Tech Development Cycle: EV Case Study



Phase I

Initial innovation. Financed by government, specialty VCs and universities.

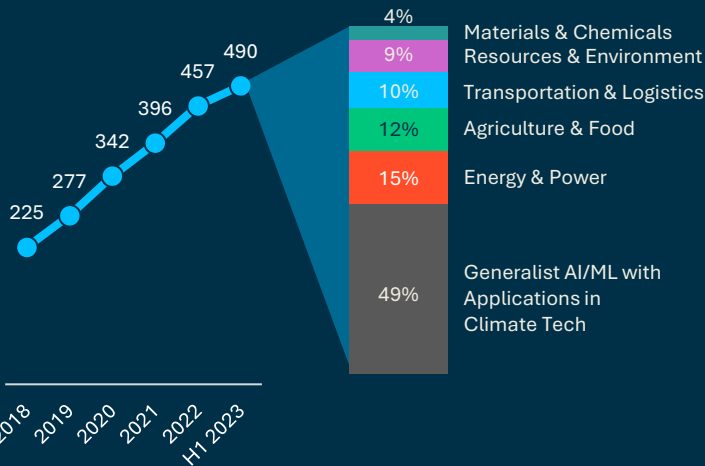
Phase II

Widespread adoption of technology. Financed by traditional funding sources: large corporates, generalist VC funds, public markets.

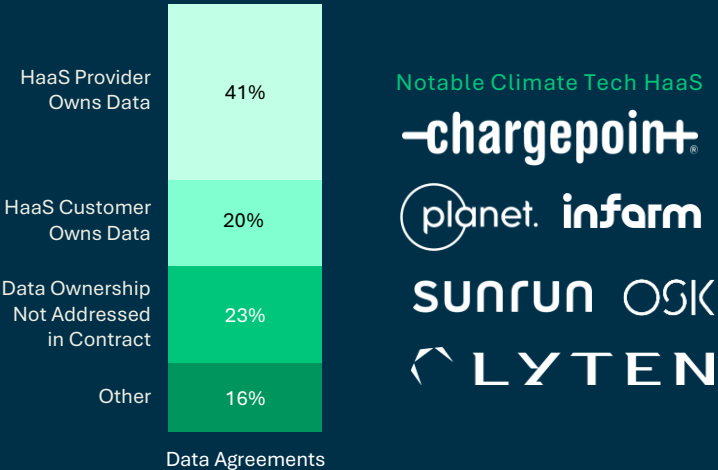
Phase III

New industries created on the back of Phase I Innovations. Software layer adds optimization, enablement and enhanced functionality. Data becomes a core part of value proposition.

Active US AI Climate Tech Startups¹



HaaS Data Agreements



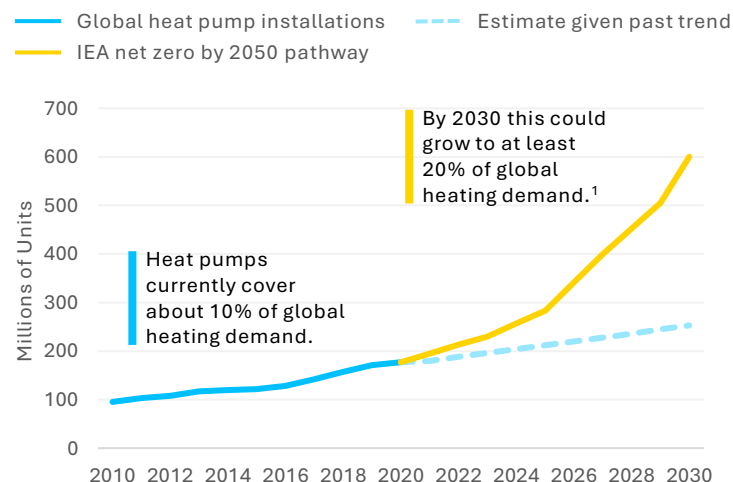
Notes: 1) Active US VC-backed climate tech startups that leverage AI and ML as part of their tech stack; active companies are those that have received VC funding in the last five years. Percentages add to 99% due to rounding. Source: PitchBook, SVB The State of Hardware-as-a-Service, US Bureau of Labor Statistics, International Energy Agency and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.

Get (heat) pumped

Total heat applications spanning commercial, residential and industrial account for approximately 21% of US annual GHG emissions. Heat pumps will help decarbonize all of these spaces, but adoption has been slow going. While heat pumps now cover about 10% of global heating demand (in 2022 surpassing gas furnaces in the US), their high cost and the longevity of the legacy HVAC systems they seek to replace have created barriers for would-be buyers. To accelerate the transition, new tax credits in the IRA offer up to \$2,000 in tax credits for homeowners looking to purchase and install heat pumps in homes. In September 2022 the DOE launched its Industrial Heat Shot program which seeks to develop cost-effective solutions for industrial heat, including low-emission heat sources such as heat pumps.

While heat pumps are commercially available through major manufacturers, venture-backed tech companies are disrupting the space with innovations that span new devices for heating and cooling to new business models. Collectively nine companies have raised \$915M in venture funding, with 47% of this funding raised since 2022. Companies working on new devices are upending existing heat pump technology by using novel conduits for heat and new mechanisms for installation. For example, Cellicus is piloting salt batteries to cool and heat homes without fossil inputs, while Gradient has developed window mounted heat pump aimed at retrofitting older buildings affordably. Other companies are pioneering business models that unify a fragmented market lessening the burden of upfront costs and project management for homeowners. BlocPower uses predictive modeling to conduct energy analysis on buildings and then provides financing and project management support.

Global Heat Pump Installations



Heat Pump Market Map and Select Firms

Startups

Heat pumps, components, and installation



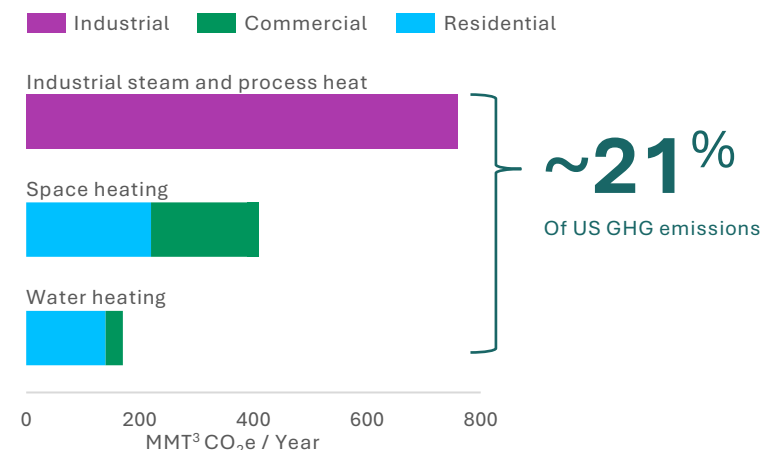
Sensors and temperature optimization paired with heat pumps.



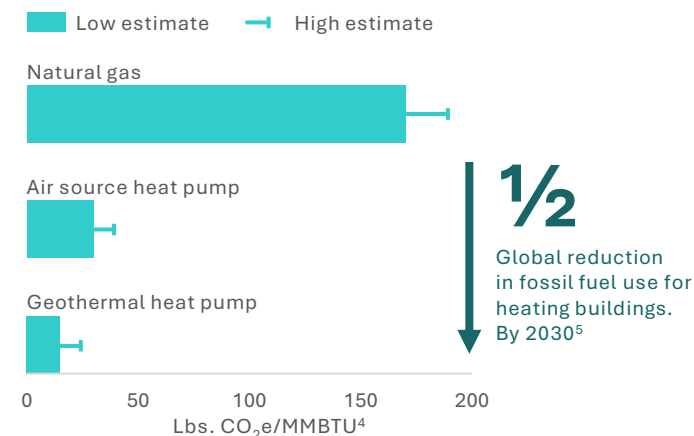
Established Firms



Estimated US Yearly Carbon Footprint for Heat (2010-2020)^{1,2}



Estimated GHG Emissions for Select Heating Options⁶



Notes: 1) Under announced Pledges Scenario and Stated Policies Scenario 2) Estimates based on a series of studies compiled by Alstone et al. 3) Million Metric Tons 4) Pounds of CO₂ per million British thermal units. 5) If governments meet announced climate commitments on time. 6) Assumes 70% renewable electricity. Source: Alstone et al. Toward Carbon-Free Hot Water and Industrial Heat with Efficient and Flexible Heat Pumps., McKinsey, Department of Energy, International Energy Agency, Carbon Brief and SVB analysis. All non-SVB named companies are independent third parties and are not affiliated with Silicon Valley Bank, a division of First-Citizens Bank & Trust Company.

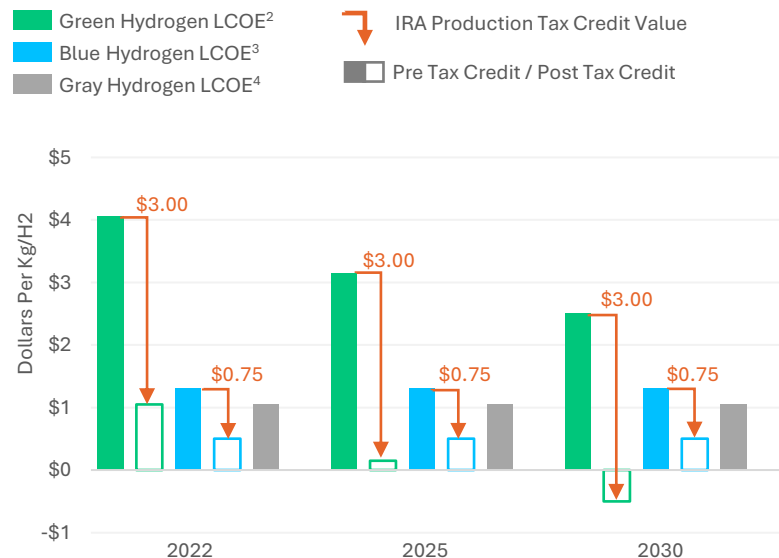
Green hydrogen levels up

Green hydrogen has been hailed as the Swiss army knife of decarbonization for the steelmaking, chemical manufacturing and trucking industries. However, the high costs compared to fossil-derived alternatives and the need for more infrastructure have held back green hydrogen. The IRA makes bold bets to unlock green hydrogen demand with production tax credits of up to \$3 per kilogram. These incentives set the US up to be the cheapest source of green hydrogen in the world. For companies to qualify for the maximum tax credit, the law requires hydrogen to be produced with processes where the GHG emissions rate is less than 0.45 kg of CO₂e per kg of hydrogen. For comparison, grey hydrogen produces about 24x more CO₂e. To further fast-track this transition, the DOE has allocated \$8B to develop six to ten regional hydrogen hubs across the US.

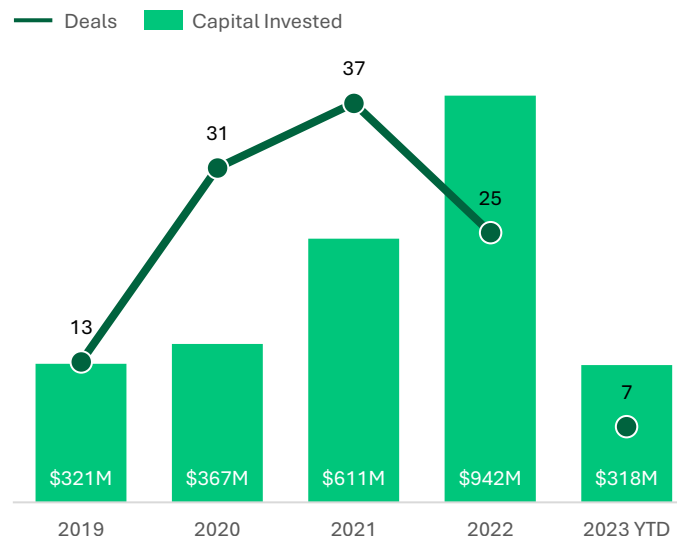
While fuel cell vehicles have captured the public's imagination for years, their scope remains limited. Some commercial viability has been demonstrated in trucking and aviation, but more than 90% of the world's hydrogen is currently used for just three industrial applications: diesel refining, methanol production for fuel blends and ammonia production for fertilizers and chemicals. In the US, the current demand is about 10 million metric tons and is supplied largely by fossil-derived hydrogen. The DOE's "10, 20, 50 Initiative" aims to drive this current demand toward green hydrogen and support the expansion of this demand.

Since 2021, 69% of green hydrogen venture funding in the US has been allocated to production. Companies such as Monolith use methane pyrolysis to produce hydrogen and solid carbon that can be sequestered and have benefitted from this investment.

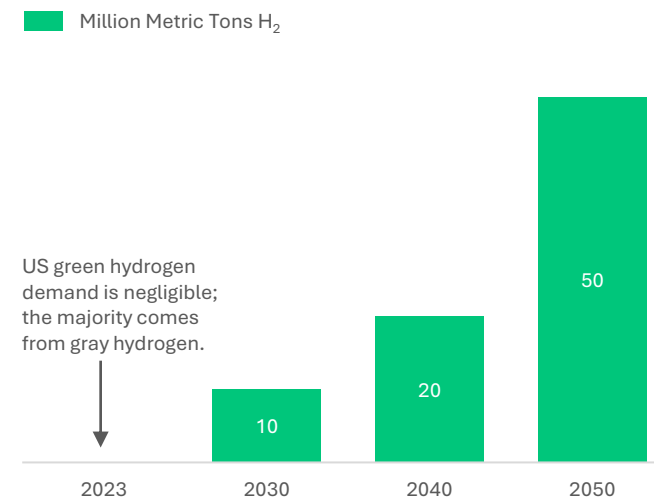
US Levelized Cost¹ of Hydrogen by Source



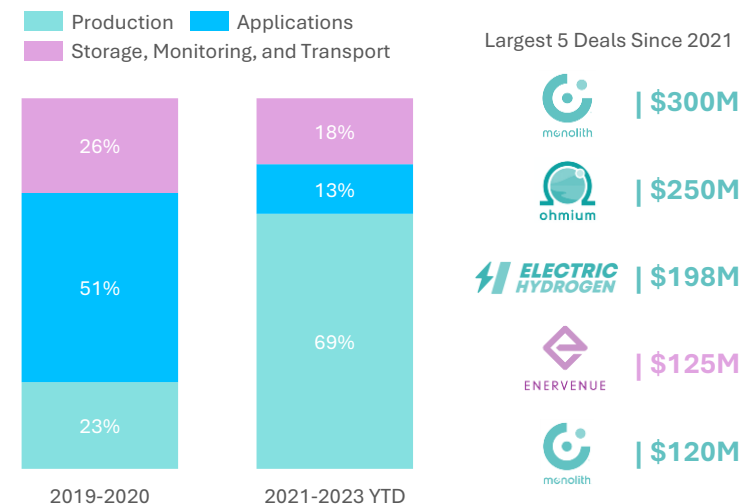
VC Investment in US Green Hydrogen⁵



US Green Hydrogen Demand by 2050



US Green Hydrogen VC Investment by Subsector⁶



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Dan is the head of the national Climate Technology and Sustainability practice. He and his team manage hundreds of client relationships in low carbon energy, food, agriculture and transportation technologies. He is experienced in many aspects of early stage, growth, middle market, corporate and project financing.

Prior to joining SVB in 2007, Dan was focused on corporate and asset finance at commercial banks and non-bank finance companies. He has experience in structured debt, large ticket leasing, partnering, syndications and public accounting.



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Jordan has dedicated his career to helping early-stage and established private and public companies with their financial needs. Prior to joining SVB in 2011, he held roles at Union Bank and Bank of America.



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Prior to SVB, Mona served as a trusted partner and capital provider for top private equity firms at GE Antares Capital. Previously she held corporate finance roles in GE Capital's energy financial services, private equity and real estate businesses.

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SVB's Climate Technology and Sustainability Practice



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Silicon Valley Bank (SVB), a division of First Citizens Bank, is the bank of some of the world's most innovative companies and investors. SVB provides commercial and private banking to individuals and companies in the technology, life science and healthcare, private equity, venture capital and premium wine industries. SVB operates in centers of innovation throughout the United States, serving the unique needs of its dynamic clients with deep sector expertise, insights and connections. SVB's parent company, First Citizens BancShares, Inc. (NASDAQ: FCNCA), is a top 20 U.S. financial institution with more than \$200 billion in assets. First Citizens Bank, Member FDIC. Learn more at [svb.com](https://www.svb.com).

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