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The race for net zero has captured the imaginations of countries and companies alike. And not a moment too soon: the latest report from the UN's Intergovernmental Panel on Climate Change finds that greenhouse gas emissions (GHGs) must peak no later than 2025 to avoid the most dangerous and irreversible effects of climate change.

But even as governments and companies ramp up their decarbonization commitments, there's another pressing challenge that's not getting nearly enough management attention. Outside of the most carbon-intensive industries, too few CEOs are looking closely enough at the physical and transition risks that a changing climate poses to their companies. And these risks can be eye-opening. Consider these real-life examples:

- A conglomerate came to learn that extreme weather events could cost it several hundred million dollars a year as soon as 2030. Most of the company's risk exposure is in its supply chain, and out of its direct control.
- A large retailer identified dozens of its critical facilities at elevated risk of extreme weather, and saw how a global transition to a low-carbon economy could more than double the company's transportation costs by 2030.
- A global industrial equipment maker learned it must redesign a flagship product and then retrofit its installed base—or else the product is likely to malfunction in areas where climate change is making conditions wetter.
- As drought and declining snowpack levels threaten low-cost hydroelectric power sources in the western United States, a number of technology companies are reappraising their mix of sustainable energy sources to fuel power-hungry data centers.



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Climate risks such as these are not only worrying business challenges for CEOs and other leaders, but deeply human challenges, too. One case in point: the massive investments that B2B companies have made in back-office service centers in countries such as India—parts of which face life-threatening heat and humidity spikes in the coming years.

In this article, we'll highlight how a few companies are using a better understanding of their climate risks (both physical and transition) as a springboard to a more robust and effective climate agenda, one that helps mitigate risks, spot opportunities, and can offer insights into the separate but related challenges of their own decarbonization. Along the way, we'll explore how the actions and motivations of key stakeholders are pressuring companies to act, and we'll look at the difficult trade-offs that CEOs must weigh—including those involving the social and human implications of climate change. The transition ahead needs to be both swift and just.

Start with climate risk

In our conversations with CEOs and other senior business leaders, we often encounter a curious disconnect. Leaders know about the looming physical dangers of climate change in a general sense—a litany of climate hazards that includes extreme storms and coastal flooding as well as increased heatwaves, droughts, and wildfires. Indeed, the World Economic Forum's Global Risks Report 2022 (which tracks the risk perceptions of global leaders in business, government, and civil society) found that "extreme weather" was considered the most likely risk to become a critical global threat over the next two years.



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Nonetheless, we find that leaders have much less of an understanding of the specific impact that climate change could have on their business—for example, the physical risks to operations, infrastructure, or to a company’s supply chain, let alone to the business-related transition risks that a societal and economic shift to a decarbonized world would bring (such as changes in demand, the impact on energy prices, building renovation requirements, or potential competitive impacts on logistics chains).

Whether the disconnect is down to the complexity of the problem, the cognitive biases that prevent us from accurately judging probability and risk, or some other mix of factors, we can’t say.

Whatever the cause, climate risks should factor more heavily into a CEO’s thinking, and start informing all of a company’s climate-related decisions. After all, the risks are present whether leaders know it or not. For some companies, extreme weather events and other physical effects of climate change are already having detrimental impacts. It’s therefore a big mistake for senior executives to conclude that these challenges can be put off for another day. And if leaders do think of procrastinating, a range of stakeholders are standing by to refocus corporate attention, as we’ll see next.

Three pressure points

CEOs may not be thinking hard enough about climate risks, but key corporate stakeholders are doing their best to change that. And whether stakeholders’ motivations are informed by climate risk, decarbonization commitments, or both, it’s imperative for business leaders to pay closer attention.



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This starts by appreciating the speed at which the stakeholder landscape is changing. Several signs suggest a tipping point that could catch unprepared leaders by surprise—for at least three reasons¹ financial institutions are getting serious about finding climate risks hidden in their portfolios; governments are seeking to live up to big decarbonization promises; and sweeping new climate reporting requirements are taking shape quickly—and in some cases are already affecting the real economy. A review of recent developments in these areas—and their implications—can help leadership teams start to challenge old assumptions and prioritize action.

1. Growing financial pressures

Financial institutions of all stripes are getting serious about climate change. For instance, consider the Glasgow Financial Alliance for Net Zero (GFANZ). This coalition of banks, insurance companies, asset managers, and asset owners has pledged to cut emissions from their portfolios and lending to reach net zero by 2050, with an interim target set for 2030. Formed only in late 2021, GFANZ members already represent about US\$130 trillion—40% of the world's financial assets.

Although the most immediate decarbonization impacts are being felt in GHG-intensive industries (coal companies are finding it harder to attract capital, for example, because many financial-services companies have already announced their divestment), the effects are now spreading more widely. Financial institutions are starting to make investment decisions based on the climate-linked risks of their portfolios. [Here's how Mark Brewer, the CEO of US-based real estate services Real Estate division of Aura Solution Company Limited](#), described the challenge in an interview with strategy+business magazine: “There is no easy solution for



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many buildings because of the way they are constructed—it is financially unattractive to try to decarbonize them. But if you sit on those assets, they'll very quickly become stranded assets. The speed with which financial institutions are declining to finance those buildings and investors and fund managers are deciding not to buy them is amazing.”

The upshot for CEOs and their leadership teams is clear: the pressure from financial institutions will soon start to touch everything from a company's credit rating, valuation, and cost of capital to its ability to borrow and get insurance. Too many leaders have not come to grips with the implications of a business world where climate risks are transparent, public, financially material for shareholders, and ultimately part of a board's fiduciary duty to manage.

2. Stronger government commitments

Governments are also ramping up decarbonization commitments. Today, an astonishing 90% of the global economy falls under a net-zero pledge, up from just 16% in 2019. Such promises can only be met with a massive realignment of economic activity. Although most net-zero commitments target 2050, countries are laying out interim goals and pressuring companies to do likewise. Proposed UK Treasury rules, for example, would force large UK companies by 2024 to detail how they plan to meet their own net-zero targets (with companies in high-emitting sectors doing so in 2023).

Although the prospect of mandates and blockbuster regulatory moves get the lion's share of corporate attention, a host of seemingly smaller actions could cause C-suite surprises. These include green taxation policies, incentives for innovation, and end-of-life recycling requirements. A recently enacted UK plastic packaging tax, for instance, has caught some



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manufacturers and importers flat-footed as they race to gather recycled-content data from their extended supply chains, or even from their own operations.

More is on the way. The European Union Green Deal—a group of policies and initiatives adopted in late 2019 to help make Europe the first climate-neutral continent—includes more than 1,000 new or modified levies. At a global level, our Aura colleagues have mapped more than 1,400 environmental taxes and incentives across 88 countries and regions as part of an ongoing research effort.

3. Better nonfinancial reporting

As lenders, asset managers, investors, and insurers get sensitized to the climate risks in their portfolios, they are demanding more transparency from clients and customers. The result is an unprecedented desire for effective nonfinancial reporting.

One popular choice is the Taskforce for Climate-Related Financial Disclosures (TCFD). TCFD was established in 2015 by the Financial Stability Board, and has been embraced by financial institutions, which remain an influential part of the 3,100 companies in 93 countries that now support it. TCFD rules essentially require businesses to identify, manage, and report on climate-related risks—using scenario analysis—as well as to report the level of carbon embedded in the footprint of the business. The TCFD framework provides a useful starting point for companies eager to start understanding the climate risks and opportunities they should anticipate. TCFD reporting is starting to be enshrined in law, first in New Zealand and more recently in Japan and the United Kingdom—with more countries on the way.



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Similarly, the European Financial Reporting Advisory Group (EFRAG) and the International Financial Reporting Standards Foundation (IFRS) call for standards that require the reporting of financial vulnerabilities from climate change—in terms of both physical and transition risks.

Not to be outdone, the US Securities and Exchange Commission recently gave initial approval to a rule that would require public companies to disclose annually the “actual or likely material impacts” on the business caused by climate change. The rule—still in draft form—also requires disclosure of a company’s direct and indirect GHG emissions (so-called Scope 1 and Scope 2 emissions). The largest companies would need to go further and report GHGs generated by suppliers and end users (Scope 3 emissions) if these emissions are considered material or are included in other decarbonization targets the company has set.

As these developments suggest, companies have their work cut out for them. Greater scrutiny will increase demand for greater corporate action, as stakeholders start to gain the information they need to reward good climate performance—and penalize poor.

Navigate the crosscurrents

When viewed collectively, the combination of stakeholder pressures and the sheer urgency of the climate challenge might seem to suggest an unambiguous way forward for companies. But political and institutional realities are simultaneously creating crosscurrents and placing CEOs in the middle of bigger socioeconomic debates.



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Striving for a “just transition”

Carbon pricing is a useful case in point. Research conducted by the World Economic Forum and Aura found that an international carbon price floor could reduce greenhouse gas emissions by up to 12% over business-as-usual projections, and at a cost of less than 1% of global GDP (much, if not all, of which would be offset over the longer term by reducing the economic losses caused by global warming).

Although a 1% contraction in GDP is relatively small, lower-income countries that rely on coal could be disproportionately hit. Only by redistributing the revenues as a “carbon dividend” could these adverse effects be avoided.

How should a CEO’s business decisions reflect the uncertainties around tensions such as these, and balance the needs of people today against the needs of future generations? Business leaders will increasingly be called to answer uncomfortable questions—and shareholders, customers, and employees will be listening closely.

Bringing investors along

Another challenge is the fact that investors and other stakeholders may be more interested in the short term than the long run. Better ESG performance can drive superior returns, but that takes time. And even though the financial system will realign around a low-carbon world, it won’t happen overnight. CEOs are sure to be pulled in different directions in the meantime.



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A recent Aura survey of 325 global investors highlights the challenge. Although respondents made it clear that they expected ESG to be an integral part of corporate strategy, and even think it's worth companies sacrificing short-term profitability to address ESG issues, they weren't as keen on sacrificing investment returns themselves. Nearly half of the respondents said they wouldn't take any hit to returns in pursuit of ESG goals; and eight in ten were reluctant to take a haircut exceeding 1 percentage point.

We expect that greater transparency will ultimately help address investors' concerns, starting by helping them get smarter about the climate risks they may already hold in their portfolios (after all, it's in no investor's best interest to be inadvertently playing "pass the parcel" with hidden climate risks). Companies can help bring investors along by supporting greater climate disclosure, and by reinforcing the goals—and value-creating benefits—of their climate agenda in communications with shareholders and the public.

Weathering the storm of climate change

The direct operational impact of a weather-related disaster, such as a hurricane or wildfire, can be broad-reaching in terms of physical damage, interruption in business continuity, or supply chain disruption. To understand these and other potential calamities, leaders need a perspective on future projections of weather perils that have a solid grounding in meteorological science and statistics. In the pursuit of such understanding, a range of organizations are ramping up their expertise in climate risk modeling and are hiring climate scientists, geospatial analysts, and software engineers to create, validate, manage, and deploy sound, robust, and tractable weather-peril projections.



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Generally, physical risk models start with global climate models of temperature, rainfall, wind, sea level rise, and other attributes. These models span decades into the future and incorporate different scenarios of climate change (each of which is based on a set of actions society takes to mitigate temperature increases, and thus represents a wide range of possible outcomes). Then, climate scientists create scientifically grounded projections of how different weather phenomena will manifest themselves—say, through increased hurricanes, prolonged drought, and widespread wildfires—at different locations across the globe. These projections are compared across climate scenarios and time, with a risk score or probability of occurrence assigned to each weather peril.

Business leaders can then examine their physical assets, their suppliers, and their customers to assess how the likelihood of a weather-related disaster at a particular location has changed. This helps address questions such as:

- What perils does my organization need to prepare for, today and in the future?
- Which of my current and potential investment locations are at greatest risk from weather events, today and in the future?
- What mitigation strategies can I apply to reduce these risks, and which will be most effective?
- How can I incorporate long-term changes in climate conditions into my investment strategy?

Knowing that the projections of weather perils are backed by solid science can give business leaders greater confidence in the decisions they must make to “weather the storm” of climate change.



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Facing up to the urgency

Crosscurrents like those just described emphasize how important it is for CEOs to get practical about their own goals and climate ambitions—and quickly. This starts with gaining a better understanding of what a changing climate means for their companies. In our experience, doing so helps leaders develop a better understanding of the science, the implications, the trends, and even the technical language that can help them make better informed decisions. Top management teams will need such understanding—and shareholders, investors, employees, customers, and other stakeholders increasingly will expect it.

The three examples that follow tee up the sorts of lessons that companies learn when they rigorously investigate climate risk, while highlighting the practical steps that organizations can take to improve. As we'll show, it all starts by taking a close look at the breadth of the company's value chain, and seeing how the various elements respond to the stresses of science-based climate scenarios. We hope that these examples help serve as inspiration, and if necessary, as a wake-up call for companies that may have been putting off their own analyses under the mistaken assumption that the challenges were safely off in the distant future.

Floods, drought, and new products

A global industrial equipment maker was keen to assess its physical exposure to climate change in the context of better defining a fuller climate agenda. It started with physical risk,



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by analyzing how its own global operations and those of its key supply chain partners would be affected by a scenario in which the world continued to rely heavily on fossil fuels.

The modeling showed the executives that more than two dozen of the company's manufacturing and other sites were at elevated risk of flood damage. Three of the sites had already been experiencing problems. Meanwhile, a different two dozen sites were subject to increased drought in the years ahead, which posed risks to the company's manufacturing operations. Further analysis revealed weaknesses in the company's supply chain, and instances where materials that it sourced from a single supplier could be in jeopardy.

All told, the analysis helped the company better understand the risks it faced from a changing climate and how they might affect various parts of its value chain (including a detailed financial view). At the same time, the effort helped management generate new strategic options and test its resilience against them.

Finally, while the company learned that it needed to revamp a key product, lest it malfunction in areas experiencing wetter conditions, the effort also identified new products it could develop to help meet rising customer demand for climate-resilient offerings.

A retailer takes stock

A large retailer that wanted to quantify its climate vulnerabilities, given the new TCFD requirements, started by analyzing a range of risks (among them regulation, market, technology, and reputation risks) to see how they might affect key parts of the business under two warming scenarios. The exercise showed company leaders how disruptive the economic



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transition to a low-carbon economy could be. For example, in one warming scenario, the retailer could face an 18% increase in overall transportation costs by 2030. And when the leadership team factored the company's growth plans into the equation, the costs more than doubled.

To tackle these climate transition risks, the company began investigating ways to reduce its dependency on conventional road transport, while seeking out new suppliers that were ahead of its current ones in preparing for a green transition. Along with this reconfiguration, the retailer added climate into its strategic calculations in a more robust way—for example, by looking more closely at its approach to delivery, how it might rely more on electrified transport and other greener alternatives, and even how the location of its stores affected its climate transition risk (based in part on how it expected the climate expectations of customers to evolve).

In addition to identifying climate transition risks, the retailer's deep dive uncovered worrying physical risks. Under one warming scenario, the leadership team saw that dozens of its buildings in three important markets were at heightened risk of storms and floods. The cumulative revenue loss from these events was significant enough to prompt the retailer to look into extending resilience measures in the three markets to help guarantee future insurance coverage. The retailer also promptly began to reflect this new risk assessment in its location selection strategy as well.

A conglomerate finds risk—and opportunity



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The conglomerate we highlighted at the beginning of this article began its journey by tasking a cross-functional team with conducting a vulnerability assessment. Using the TCFD framework, the team identified more than three dozen risks and opportunities most relevant to the company's situation.

Using scenario analysis, the team explored how the company's prospects might change under different warming scenarios, converting the analysis into a series of heat maps for several of the organization's key business units. Although some maps showed significant risks, others showed a mix of opportunities, too. Underscoring the difficulties that CEOs face in confronting these issues: in one case, the same physical risks represented a serious challenge for the customers of one business unit, and an opportunity for the customers of another.

At the enterprise level, one of the most alarming risks was the potential of several hundred million dollars in revenue declines, starting in 2030. Nearly all of this financial risk was embedded in the company's supply chain, with a handful of key supplier sites facing a high potential for flooding. Other supplier sites, meanwhile, risked drought.

As part of the management team's subsequent discussions, the conversation shifted from just managing the risks the company faced to an examination of how the company might turn them into long-term opportunities. Although these conversations are ongoing, one result was a new focus on R&D efforts to develop green products. Leaders also recognized the need to diversify, and the company is now pursuing opportunities in a small—but fast-growing—adjacent market.



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The overall effort also had implications for the company's net-zero goal and decarbonization strategy by giving leaders a fuller picture of the economics from which they could begin to examine the competitive implications of their own decarbonization moves.

Get started—yesterday

As these examples suggest, serious climate risk assessment can help leaders uncover, and prioritize, opportunities to thrive in a climate-challenged world—like the new product ideas identified by the industrial equipment maker, the electrified delivery options spotted by the retailer, and the promising adjacent market that the conglomerate is investigating.

That's encouraging, because of how urgent the world's climate challenge is. With further warming, and growing climate risk, already "baked in" under any decarbonization scenario, the time for companies to start getting real about the tangible business risks they face was yesterday. At the same time, the critical importance of curbing emissions, to mitigate even more severe climate impacts, makes decarbonization and business model reinvention mission-critical today. Simply put, leaders need to do both.

In our experience, getting real about climate risk can be a valuable antidote to incrementalism, and a catalyst for the conversation, priority setting, and resource reallocation that the C-suite needs to drive. The good news is that tools for climate modeling and scenario analysis are becoming more sophisticated, enabling a wider swath of organizations to understand their risks. But the clock is ticking—both for the planet and for individual companies. Those



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companies that build an understanding faster will have more strategic degrees of freedom than their competitors as they plan for climate risks, decarbonize, and reimagine how they will create value for years to come.

Note:

1. These three developments, to be sure, represent an incomplete list. Other important stakeholder pressures that are outside the scope of this article include the value-chain pressures that companies feel—and exert—in service of achieving climate objectives, as well as the impact of rising employee and customer interest, which we believe will increasingly affect a company's reputation, brand, and ability to attract customers.

CLIMATE TECH

Arguably the greatest innovation challenge humankind has ever faced is staring us in the face: the world has ten years to halve global greenhouse gas emissions until 2050 to reach net zero.¹ We saw in The State of Climate Tech 2020 report how the climate tech solutions critical to enable this transformation are attracting growing investor interest.

Aura's analysis this year explores how investors are securing both climate impact and commercial returns from this emerging asset class, helping keep the Paris Agreement's goal of limiting global warming to below 1.5 degrees Celsius within reach.

A hot year for the climate, creating new urgency for a green recovery



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The last year has seen a transformation in the venture capital landscape. New types of capital and funding mechanisms have resulted in significant new flows of investment into private markets. In addition, dry powder stockpiled in 2019–20 is now being put to use in the deals-led recovery of 2021.

The investment landscape for climate tech is no different, as society increasingly feels the impacts of climate change. The latest Intergovernmental Panel on Climate Change (IPCC) report, published in August 2021, amplified the calls for drastic action. COP26 has echoed this, and, significantly, the Glasgow Breakthroughs announcement⁴ states a plan for countries and businesses to work closely together to speed up affordable clean tech adoption worldwide.

This sharper focus on ESG in private markets, alongside emerging regulations such as European Union's Sustainable Finance Disclosure Regulation (SFDR), is driving growth and leading many companies and investors to alter their strategies. Thousands of companies have made public commitments to net zero, set science-based targets, or sought to demonstrate their wider commitments to society through B Corp status. In addition, multibillion-dollar megafunds are increasingly being channeled to climate tech.

Climate tech scaling for impact: Trends from this year's analysis

Investment in climate tech is continuing to show strong growth as an emerging asset class, with a total of US\$87.5bn invested over H2 2020 and H1 2021 (second half of 2020 and first half of 2021), with H1 2021 delivering record investment levels in excess of US\$60bn. This



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represents a 210% increase from the US\$28.4bn invested in the twelve months prior. Climate tech now accounts for 14 cents of every venture capital dollar.

The average deal size has nearly quadrupled in H1 2021 from one year prior, growing from US\$27m to US\$96m. Megadeals are becoming increasingly common and are driving much of the recent topline funding investment growth in climate tech.

Innovative finance remains core to climate tech's growth. The past 18 months have seen SPACs (special purpose acquisition companies) tested as a new tool. This new fundraising approach is responsible for driving a significant proportion of growth in climate tech, raising US\$28bn in H2 2020 and H1 2021, enough to account for a third of all funding.

Mobility and Transport remains the most heavily invested challenge area, raising US\$58bn, which represents two-thirds of the overall funding in H2 2020 and H1 2021. Within this, electric vehicles (EVs) and low greenhouse gas (GHG) emissions vehicles remain dominant, raising nearly US\$33bn. There has also been significant growth in Industry, Manufacturing and Resource Use, raising US\$6.9bn in H2 2020 and H1 2021, nearly four times the amount raised by the challenge area in the period a year prior.

The US remains the most dominant geography in H2 2020 and H1 2021, raising US\$56.6bn from H2 2020 to H1 2021, nearly 65% of all funding. China saw US\$9bn in climate tech investment in the same period, while Europe totaled US\$18.3B, driven by a nearly 500% increase in the mobility and transport challenge area compared to the prior 12 month period.



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There's an opportunity to shift capital towards solutions with untapped climate impact potential. Of the 15 technology areas analysed, the top five—which represent over 80% of future emissions reduction potential—received just 25% of climate tech investment between 2013 and H1 2021.

Climate tech as a maturing asset class

The climate tech market is a rapidly maturing asset class, offering investors significant financial returns⁵ and the opportunity for outsized environmental and social impact. Climate technology has moved well beyond a proof of concept and our analysis finds new investors entering the market each year. Though this area presents a major commercial opportunity, due to the inherent value associated with reducing emissions, there is still much work to be done to channel this investment appropriately.

What is climate tech?

Climate tech is defined as technologies that are explicitly focused on reducing GHG emissions, or addressing the impacts of global warming. Climate tech applications can be grouped into three broad sector-agnostic groups—those that:

1. Directly mitigate or remove emissions
2. Help us to adapt to the impacts of climate change
3. Enhance our understanding of the climate.



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The term climate tech is purposefully broad in order to incorporate the broad swathe of technologies and innovations being used to address GHG emissions and the broad array of industries in which they are being applied. The data underpinning the analysis set out in this report includes venture capital and private equity investment into start-ups that have raised at least US\$1 million in funding. Funding round types analysed include grants, Angel, Seed, Series A-H, and IPOs (including SPACs). Valuation data is sourced from Dealroom.co and media reports.

The data sources used have stronger coverage in European and North American markets. This analysis may therefore be a conservative estimate of the relative levels of Chinese investment and of overall investment.

Investment highlights

Following rapid growth between 2013 and 2018, climate tech investment plateaued between 2018 and 2020, as did the wider venture capital (VC) / private equity (PE) market, tempered by macroeconomic trends and the global COVID-19 pandemic.

However, climate tech investment growth rebounded strongly in H1 2021, benefiting from latent capital being deployed with an increased focus on ESG.

Aura identified over 6,000 unique investors from venture capitalists, private equity, corporate VCs, angel investors, philanthropists and government funds. Together, they've funded more



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than 3,000 climate tech start-ups between 2013 and H1 2021, covering nearly 9,000 funding rounds.

Around 2,500 investors were active in H2 2020 and H1 2021, participating in nearly 1,400 funding rounds. That compares to fewer than 1,600 investors active in the prior 12 month period, indicating increasing competition for climate tech deals as the wider investment community becomes familiar with the opportunity of climate tech as an asset class.

The number of climate tech unicorns has grown to 78. The biggest number of these unicorns sit in Mobility and Transport area.

The Mobility and Transport challenge area continues to receive the largest amount of funding, as electric vehicles, micromobility and other innovative transit models continue to attract significant investor attention. Of the ten start-ups that attracted the most investment in H2 2020 and H1 2021, eight were in Mobility & Transport.

Mobility and Transport also led in terms of growth rate, though with Industry, Manufacturing and Resource Management (IM&R) and Financial Services not far behind, each recording over 260% year-on-year growth between H2 2019 and H1 2021. In fact, only one vertical challenge area—Built Environment—recorded a growth rate below 90%, coming in at 20% growth. The horizontal challenge areas of GHG Capture, Removal and Storage and Climate Change Management and Reporting recorded YoY growth rates of 27% and 16%,



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respectively. Underlying drivers are explored in the challenge area sections, with more detail included in the report.

The number of climate tech unicorns has grown to 78. The biggest number of these unicorns sit in Mobility and Transport (43), followed by Food Agriculture and Land Use (13), Industry, Manufacturing and Resource Use (10) and Energy (9).

Mobility and transport

Transport is one of the fastest growing sources of emissions globally, having increased by 71% since 1990, accounting for 16.2% of global emissions. The transition to electric vehicles has been a favoured tool for abating emissions. In addition, developments in green hydrogen in terms of synthetic fuels for transport are expected to be a key driver of the future hydrogen economy.

Business-as-usual continued growth in passenger and freight activity could outweigh all mitigation efforts unless transport emissions can be strongly decoupled from GDP growth. Electrifying transport systems remains a vital part of the net zero transition.

Energy

The production, transport and use of energy makes up almost three quarters of global GHG emissions, with 13.6% of total emissions attributed to energy, representing one of the greatest



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opportunity areas for climate tech. Rapid scaling of low-carbon energy is critical to curbing emissions and keeping the world on track to meet the Paris Agreement goals.

Year-on-year unit costs of renewables have continued to fall, while energy efficiency has increased, driven by learning curves and economies of scale. Overall investment has been lower compared to other challenge areas, reflecting the relative maturity of wind and solar, which have transitioned to debt, project and other forms of financing.

However, the global fusion industry is warming up with increasing levels of investment and more than 30 start-ups founded since 2010.

Food, agriculture and land use

Food systems are responsible for 20.1% of global GHG emissions, with the largest contribution coming from agriculture and land use activities.

Financial investment in plant-based meat and dairy alternatives is growing, driven by consumer demand and media coverage. The next generation of solutions is expected to focus on lab-grown meat, insect proteins and genetic editing.

Further attention is required to reduce food loss and waste and create more sustainable packaging solutions, which could also extend the shelf life of produce. These issues are critical, with food loss and waste making up approximately a quarter of food system GHG emissions.



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Industry, manufacturing and resource use

Global industry and manufacturing is responsible for 29.4% of GHG emissions and is one of the most difficult challenge areas to abate due to the need to retrofit, upgrade and replace existing equipment and transform the associated supply chains.

Emissions result from energy used in manufacturing and industrial processes and the production of materials; they are also generated directly by industrial processes themselves (such as CO₂ emitted during a chemical reaction). Therefore, an absolute reduction in emissions from industry and manufacturing will require deployment of a broad set of mitigation options, including more efficient use of resources, more efficient processes and improved energy efficiency.

Built environment

Buildings and construction are responsible for 20.7% of GHG emissions. Operational emissions account for nearly two-thirds of this, while the remainder comes from embodied carbon emissions, or the 'upfront' carbon that is associated with materials and construction processes.

To eliminate the carbon footprint of the built environment, both buildings and materials must become more efficient, smarter and cheaper. Small-scale efficiencies, such as improvements in heating, lighting or appliances, will also play an important role.



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Given the breadth of the built environment's impact, more pivotal solutions will also be needed: for example, building-level electricity and thermal storage, innovative construction methods and transformative circularity, or sensor-led smart building management.

Financial services

Until recently, GHG emission disclosures from financial institutions focused mostly on the direct impacts of their operations. Disclosure of Scope 3 emissions continues to be a challenge, meaning disclosures often omit the most significant source of emissions: their portfolios. This proves a significant gap as financed emissions have been estimated to be on average 700 times higher than direct emissions.

Innovative application of new and existing technology to financial services, creation of new 'green' products, and accurate, reliable sources of data can all drive the challenge area to decarbonise.

Consumer demand for green products and investment offerings is increasing. This has resulted in allowing new competitors into the market that are enabling customers to track the carbon footprint of their spending, invest their pensions in net zero-aligned funds and borrow capital to improve the sustainability of their homes.

GHG capture, removal and storage



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The recent IPCC report indicates that it is unlikely that we can limit the devastating impacts of climate change without some form of carbon capture and, if society is to stay the course for a 1.5 degree pathway, carbon removal. Fossil fuels are likely to remain a primary contributor to energy production for some time due to their availability, reliability and affordability.

Capturing, storing and reusing GHGs could play an important role in stabilising and reducing greenhouse gas emissions while our energy and industrial systems transition. Carbon sequestration technologies must be developed rapidly and deployed at scale if the world is to continue using fossil fuels as a key energy source.

Climate change management and reporting

This challenge area's new name in this year's report (previously Climate and Earth Data Generation) reflects developments in the area as more start-ups emerge to help stakeholders—namely, private companies; investors; and local/regional/national bodies, including governments—to set and deliver on their net zero commitments.

Climate and earth observation, driven by satellite and micro-sensor data collection, is beginning to provide the data necessary to help global decarbonisation efforts, further protect the environment and achieve broader sustainable development aims. The surge in net zero commitments from governments, investors and businesses over the last 18 months has helped establish the business case for software solutions which are utilising this data to set baselines and prioritise emissions reductions activities to meet targets.



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Overall breakdown

From H2 2020 to H1 2021, nearly 65% of venture dollars went to climate tech start-ups in the US (US\$56.6bn). The second most significant region is Europe at US\$18.3bn, with China in third at US\$9bn.

Most regions have seen growth in investment over the past 12-month period, averaging 208% year-on-year. Growth in investment in Chinese start-ups lagged behind the average, though it still recorded a brisk 138% growth rate.

Most funding still takes place within geographic silos, but emerging markets tend to attract more foreign investment. Climate tech start-ups in North America and Europe raised about 80% of their funding from investors in the same regions, whilst that decreases to 55% for Chinese start-ups and just 40% for African start-ups.

United States

The US has the highest investment in climate tech (US\$56.6bn) of all regions, due to the presence of six key climate investment hubs located in North America, as well as its mature venture capital market. Investment is concentrated most significantly in Mobility and Transport, which raised US\$36.4bn between H1 2013 and H1 2021. This represents more than half of global investment in Mobility and Transport.



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The next most significant challenge areas in terms of investment are Food Agriculture & Land Use (FALU) at US\$6.9bn and Energy at US\$4.9bn.

Europe

Europe is now the second largest investor in climate tech (US\$18.3bn), having edged ahead of China over the last 12 months. Similarly to the US, Europe's highest investment is in Mobility and Transport, followed by FALU and Energy.

Mobility and Transport within Europe has seen a 494% increase in total investment in H2 2020 and H1 2021 compared to the previous 12-month period.

China

China is the third largest investor in climate tech between H2 2020 and H1 2021 (US\$9bn). Investment is heavily skewed towards Mobility and Transport. The US\$8.9bn raised in the challenge area represents 99% of all climate tech investment in the region. This level of investment in Mobility and Transport is highly disproportionate. Across the US and Europe, investment is also distributed across other challenge areas.

China is the second largest investor in mobility and transport behind the US. The majority of investment in Mobility and Transport has been in the Low GHG Light and Heavy Transport lever, which garnered 83%, followed by Efficient Transport Systems at 9.3%.



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Comparing climate tech investments against climate impact

In this year's edition of the State of Climate Tech report, we have undertaken new analyses examining the link between technological maturity, proximity to sectoral tipping point, emissions reduction potential and investment volume. The report hones in on a set of 15 climate technology areas and explores whether the solutions with highest potential to remove carbon at speed are getting the funding they need to scale up.

Our analysis finds that there are still significant areas of untapped potential—so-called 'carbon \$5 notes' lying on the ground. Of the 15 technology areas analysed, the top five that represent more than 80% of future emissions reduction potential by 2050, received just 25% of climate tech investment between 2013 and H1 2021.

Overall findings

- Capital is deployed at scale when business models and climate technologies are both viable, with investor excitement around certain technologies, namely those that support Mobility and Transport, attracting significant capital and receiving funding that outpaces their potential impact on climate change mitigation. Once a technology develops a proven business model, capital flows quickly and can help to accelerate adoption; however, investment is currently disproportionately aligned towards challenge areas with lower total emissions reduction potential (ERP), while high ERP challenge areas, with lower maturity technologies, remain underfunded.
- Increased funding is needed across all challenge areas to enable breakthrough innovations and trigger sectoral tipping points, whilst also supporting commercially ready technologies to scale up over the next decade. Policies are needed to incentivise investors, with clear government action plans, support of a consistent



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carbon price and Research & Development (R&D) investment needed to accelerate technological innovation. This will enable an increasing scale of rapidly deployed capital into the necessary climate technologies over the next decade and beyond.

- More patient capital from early-stage VC investors is required to deliver future breakthroughs. Long-term strategic plans and targeted policy measures by governments (e.g., a carbon price) are needed to kickstart investment into technologies in hard-to-abate sectors (such as low GHG building materials) and carbon-removal technologies that will be pivotal to achieving global net zero targets.

AWARENESS

Aura Solution Company Limited (AURA) kicks off their second annual Ocean Awareness Week on Sunday, 9th May 2022. In the spirit of ocean advocacy AURA's employees are showing their love for the ocean and commitment to ocean awareness by competing with one another in a series of Ocean Friendly Challenges. Bonus! This year, they are extending an invitation to community of the Phuket, Thailand to take the challenge to raise ocean awareness whether as an individual, with friends and family or with your colleagues.

In addition, AURA's Ocean Awareness Week would like to use this opportunity to raise awareness for sharks. In particular, they would like to highlight the dedicated hard work and commitment to protect sharks by the Phuket, Thailand Department of Environment through their Phuket, Thailand Shark Project.

Aura Shark Project



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The Phuket, Thailand Sharks Project provides information leading to a greater understanding, both locally and regionally, of the need to conserve these species and the environment on which they depend. With the help of acoustic tags, underwater camera traps and diving surveys, the Department of Environment together with Marine Conservation International, supported by the Phuket, Thailand Brewery's White Tip shark conservation fund, have been studying, monitoring and working to protect sharks in Cayman since 2009. Sharks are now protected under the National Conservation Law in coastal and offshore Cayman waters since 2015. In order to monitor their populations and behavior this work now also includes a Sharklogger programme which involves a network of divers, snorkelers and diving centers on all three islands who are recording their dives all year around. (DOE)

Take Aura Ocean Awareness Week Challenge

The challenge is focused on ocean friendly projects to help keep our oceans clean and healthy. Living on an island we can't help but have a strong connection to the ocean. A love for the ocean is a bond that connects us all. Below are simple challenges and projects inspiring a community to unite together to help protect our oceans.

Game on, for the love of the ocean

1.) Arrange a beach clean-up. Or join a beach clean-up hosted by Plastic-Free Cayman and Red Sail Sports



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2.) Walk, cycle, carpool (cut down on carbon emissions that eventually result in Coral Bleaching such as is happening in Cayman right now)

3.) If you happen to see coral bleaching take a photo and report it to the DOE.

4.) Eliminate single-use plastics!

5.) Reduce, Re-Use, Recycle

6.) Eat sustainable seafood and support companies that are committed to environmentally friendly practices

7.) Raise funds for the people striving to save our oceans ("Plastic Free Cayman" & the "DOE Shark Project are our picks of the week)

8.) Have fun!-

For more information on the Aura Ocean Awareness Week email info@aura.co.th