

DCVC Climate

Impact Report

DCVC
2023

DCVC believes in the power of deep tech to tackle climate change faster, smarter, and cheaper than ever before, while delivering venture scale returns.

DCVC is **deep tech venture capital.**



Over the past decade and a half, DCVC has pioneered venture investment in deep tech. Our portfolio companies have ranged across human health, industrial transformation, defense – and, of course, climate. The promise of our investments in this last category, spanning clean energy innovation, carbon transformation, water resilience, chemical fertilizer replacement, and beyond, encouraged us to establish a dedicated climate tech fund in 2023. Now, we felt, was truly climate tech’s time.

DCVC Climate seeks to back breakthrough technological advances that address the world’s toughest climate challenges. The fund focuses on commercializing emerging climate tech solutions to catalyze meaningful improvements to established value chains, transform high emitting industries, and contribute to mitigation and adaptation efforts.

This is the first impact report for our inaugural climate fund. In the years to come, we will publish annual installments dedicated to showcasing the power of deep tech to fight the climate crisis. Our goal is to transparently share the ways we invest for climate impact, while telling the stories of how the incredible entrepreneurs and teams in our ecosystem are working to restore health to our environments. In this vital work, we drive toward venture-scale returns for our investors.

We are encouraged by the possibilities of what we can collectively achieve in addressing the greatest challenge of our time, and we look forward to bringing you along on our journey.



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Executive Summary



DCVC Climate backs companies solving trillion-dollar climate problems in innovation-resistant industries.

There is widespread consensus that we need to achieve net zero greenhouse gas (GHG) emissions globally by 2050 to limit atmospheric warming to 1.5°C and avoid the worst effects of climate change. Each year, more countries, companies, and organizations commit to doing their part to achieve this vision, yet we are still moving in the wrong direction. Global emissions rose to a record 53.8 Gt CO₂e in 2022 and capital dedicated to scaling emerging climate technologies is still short of what is needed.¹

Physical industries such as power generation, industrial manufacturing, and transportation are particularly challenging to transition and represent over 75% of GHG emissions.² The challenge of transitioning physical industries is twofold:

1. High **capital expenditures** – Physical assets tend to be capital intensive and long-lived, meaning high-emitting facilities are locked into business models and lower-emitting solutions have significant up-front costs.
2. High **operating expenditures** – Profit margins are often tight making it difficult from a cost perspective to transition to sustainable technologies.

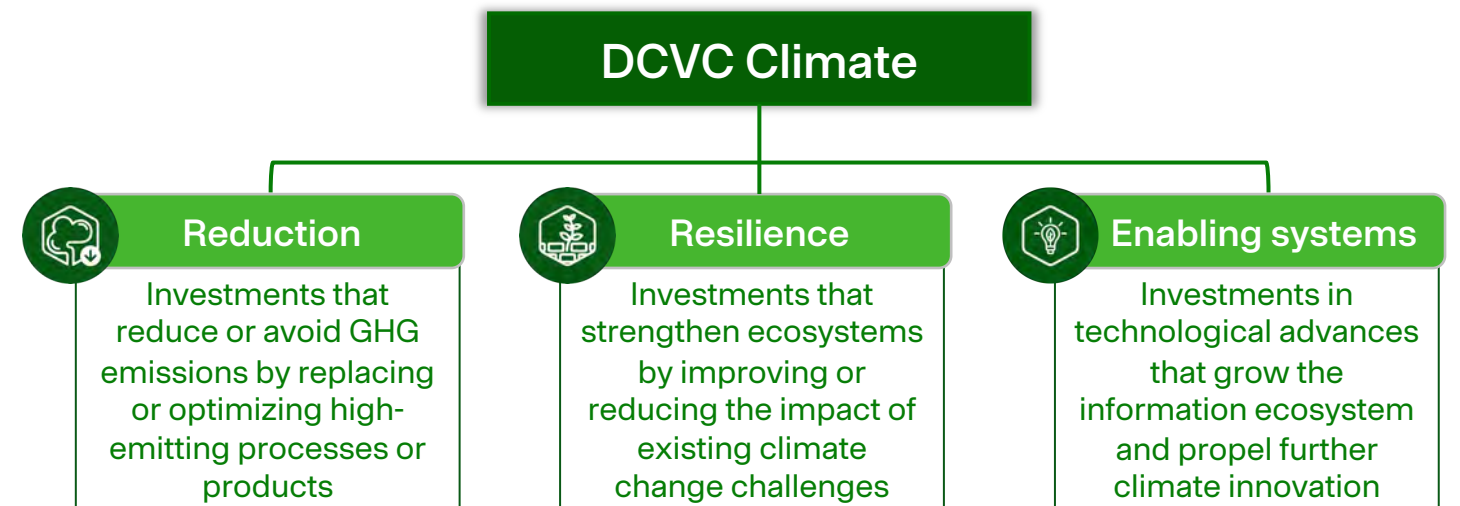
DCVC Climate is purpose-built to find, support, and grow the technologies necessary to transform hard-to-abate industries in a CapEx- and OpEx-efficient way, bringing the world closer to a 1.5-degree path.



At scale, DCVC-backed Fulfil can materially cut food waste, a major driver of methane emissions.

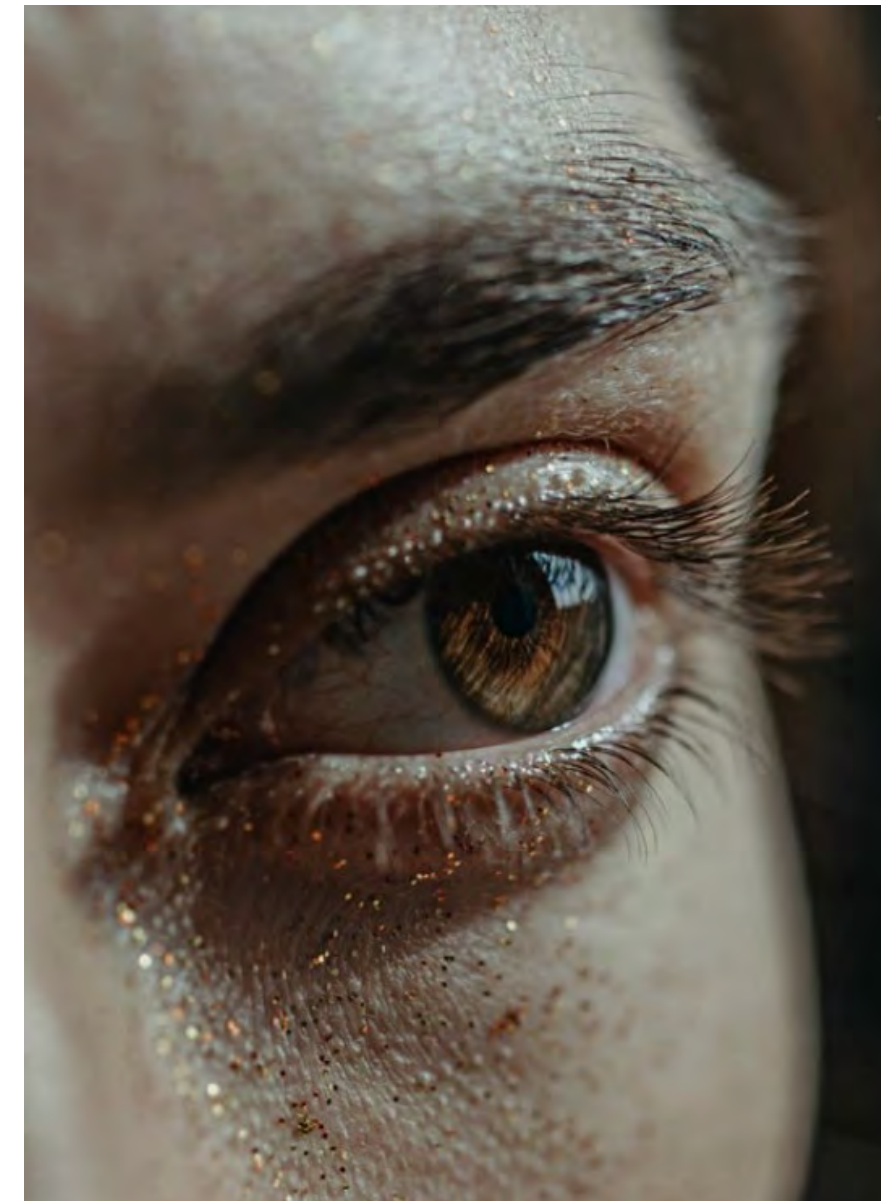
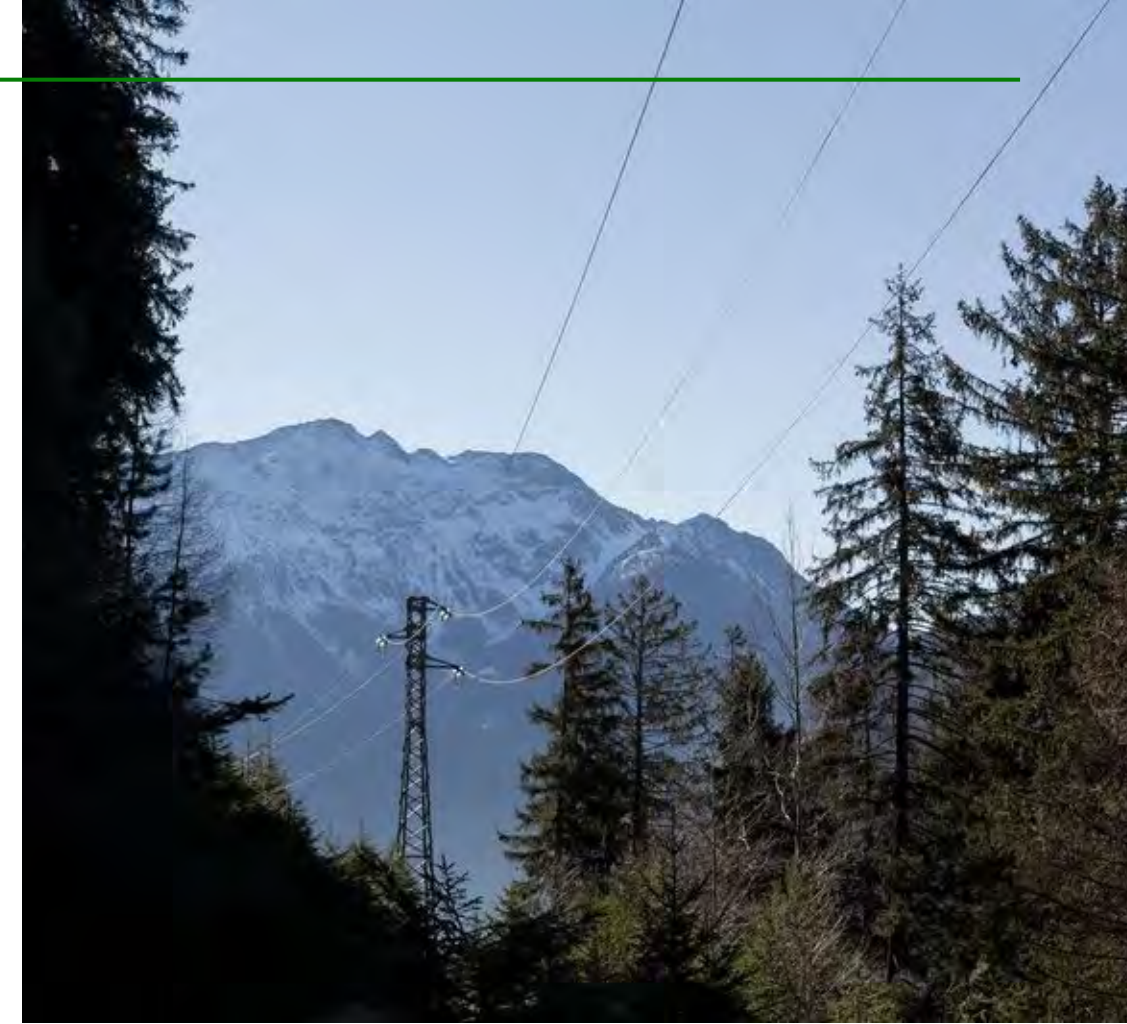
DCVC is uniquely positioned to scale innovation in deep tech to help solve the climate crisis.

Differentiated capital Filling the missing middle of climate funding	Climate tech knowledge Expertise to retire industrialization risk early	Climate and deep tech network Professional connections that matter	Strategic support Operational guidance for efficient scaling
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2023 portfolio overview

Company	Primary pathway	2023 milestones
Equilibrium Energy	Enabling systems	Equilibrium signed the largest energy storage tolling agreement in Texas to operate a 100MW battery project.
FERVO ENERGY	Reduction	Fervo inaugurated a 400MWe enhanced geothermal project in Utah, the largest of its kind.
twelve	Reduction	Twelve broke ground on its first commercial “AirPlant” to produce sustainable aviation fuel from recycled CO ₂ .
VERDIGRIS	Reduction	Verdigris closed an \$11 million round co-led by DCVC to expand operations and Scope 2 measurement capabilities.



History of Impact

Founded in 2010, DCVC backs brilliant entrepreneurs using computational approaches to solve trillion-dollar problems.

Whether in the fields of space innovation, biotechnology, or cybersecurity, we finance companies that drive game-changing innovation by delivering operationally elegant and economically attractive solutions to industries traditionally resistant to change.

After witnessing the operational difficulties in capital intensity faced by CleanTech 1.0 in the early 2010s, Zack and Matt – DCVC’s co-founders – came together to re-envision how VC approaches climate investments. The combination of deep technical understanding and a desire to approach climate problems through a computational lens is the backbone of how DCVC invests.

By seeking out commercially viable deep tech, we make planet-saving technologies scalable and affordable, while delivering venture-scale outcomes. The key, we believe, is to treat climate enterprises like any other field. By investing in category-defining businesses and examining potential transformational outcomes, we’re able to overcome the fundamental issues of CleanTech 1.0.

On the DCVC investing team, bench skills, industry experience, and published papers count for more than MBAs. Our team has an exceptional sense of which technological opportunities will be the most transformative, which are the closest to market, the most economically viable, and which entrepreneurs are best qualified to get them there.

“There are a lot of these trillion-dollar problems out there in the climate space. And if you can solve them, you can create a huge positive impact for the world while building a large, successful capitalist company.”

– Zachary Bogue, DCVC co-founder and managing partner.

Historical Climate Investments

DCVC has been financing climate resiliency for over a dozen years, backing our first climate-focused start-up in 2012. To date, we’ve leveraged our team’s exceptional technological backgrounds to fund companies revolutionizing the fields of green agriculture, electrification, carbon capture & storage, nuclear and renewable energy, and water. The more we financed environment-improving technologies, the more we realized the need to establish a fund specifically focused on innovative climate investments.

\$419M
Invested in Climate
Companies

29
Deep-tech Climate
Companies

PIVOT BIO

Nitrogen fertilizer is one of agriculture’s largest climate challenges. While we rely on high-yield synthetic fertilizer to feed an ever-growing global population, its production and use accounts for more than 5% of global GHG emissions.³

Pivot Bio replaces synthetic fertilizer with the use of computationally tailored microbes. This delivers essential nitrogen to plants without the negative impacts of synthetic chemicals, while maintaining or improving yield. In 2022 alone, use of Pivot Bio’s fertilizer avoided the equivalent of 226.4k metric tons of CO₂e—a breakthrough in fertilizer-induced GHG emissions reduction.

DCVC is proud to have led Pivot Bio’s Seed and Series A, and co-led the Series D funding rounds, helping the company’s revenue to grow almost tenfold since. We’ll continue to grow with Pivot Bio as it expands its reach to over 10% of US corn in the near future.

All figures in this report are as of December 31, 2023 unless otherwise indicated.

DCVC Climate

Deep tech is the solution to the climate crisis.

Building on a decade and a half of climate tech investing, DCVC is committed to intensifying efforts to solve the existential problems facing our planet.

Impact thesis: Harnessing deep tech to deliver climate impact



Half of the emissions reductions required to meet net zero GHG emissions by 2050 will be provided by technologies that are currently at the demo or prototype phase, yet these critical technologies are often overlooked by traditional climate investors due to perceived risk and lack of expertise.⁴ While funding for climate is on the rise, capital is disproportionately allocated to early- and growth-stage companies, leaving a “missing middle” of funding for mid-stage climate technologies.⁵

Now is the time to invest in climate tech. Emerging breakthroughs in AI and advanced computation are creating the operational and cost efficiencies needed to integrate climate solutions into physical industries, which account for 75% of global emissions.⁶ Deep tech presents the greatest opportunity to tackle climate change faster, smarter, and cheaper than ever before, while delivering venture returns.

DCVC Climate backs companies using advanced computation to solve the toughest challenges in climate, helping them get from demonstration to commercialization. Harnessing breakthrough AI technology, our entrepreneurs develop CapEx- and OpEx-efficient solutions to disrupt innovation-resistant industries and deliver climate impact at scale.

Native expertise in AI, heavy computation, and materials science allows us to underwrite complex scientific breakthroughs and retire technical risk earlier than most. Combined with our extensive track record investing in climate deep tech, DCVC is uniquely positioned to find and scale critical climate solutions while delivering venture scale returns.

Climate investments propel the commercialization of emergent climate solutions, resulting in deep improvements to established value chains, industry transformation, and lasting climate impact. Our impact is shown through reduced emissions, increased climate resilience, and improved networks and infrastructure for enabling the climate transition.



At DCVC, we are biased towards action. With our technical expertise, network, and capital, we back entrepreneurs delivering transformational climate solutions.

DIFFERENTIATED CAPITAL

DCVC Climate helps fill the “missing middle” of climate capital by investing in and leading mid-stage rounds for deep tech climate companies to bring transformational solutions to commercial scale. Funding pilot or first-of-a-kind technologies, DCVC underwrites complex scientific breakthroughs only after conducting robust techno-economic analysis. We seek to retire technical risk as a key first step in catalyzing further investment.

CLIMATE TECH KNOWLEDGE

DCVC’s team has a native understanding of computational advantage, AI/ML, quantum/novel supercomputing, materials science, hyperscale data analytics and sensor networks, environmental science, synthetic biology, and the natural sciences. The team is uniquely positioned to provide technical and sector expertise to address tech challenges, scale solutions, and strategically position solutions to drive industry transformation.

CLIMATE AND DEEP TECH NETWORK

With over 200 investments and a decade and a half of experience, DCVC draws on a wide network of people with exceedingly rare combinations of operational and technical depth. DCVC supports ambitious founders by expanding their access to the right resources and making key introductions.

“The continued confidence of such an important and respected investor is so meaningful in conversations with other investors and enables us to be taken seriously in every room.”
(Nicholas Flanders, Twelve)

STRATEGIC SUPPORT

Working with founders and investors, DCVC has created tens of billions of dollars of value while driving transformational impact. DCVC provides strategic and operational expertise to facilitate efficient growth and commercialization at a venture scale, while addressing the climate crisis head-on.

“DCVC is very unique in that they’re able to understand our business and see the value in it. As time goes on, I expect they will be our closest strategic partner and sounding board.”
(Ryan Hanley, Equilibrium Energy)

Companies in the DCVC Climate fund create climate impact through three distinct pathways: Emissions Reduction, Climate Resiliency, and Enabling Systems.

Pathway	Description	Impact
Reduction 	Investments that reduce or avoid GHG emissions—either directly or through enabling effects—by replacing or optimizing high-emitting processes or products	Emissions reduction or avoidance Illustrative outputs: <ul style="list-style-type: none"> • GHG emissions avoided or reduced • GHG intensity improvement
Resilience 	Investments that improve the strength and resilience of our ecosystem by improving or reducing the impact of existing climate change challenges	Enhanced (non-emissions) climate resilience and adaptive capacity Illustrative outputs: <ul style="list-style-type: none"> • Water conserved • Area of land sustainably managed
Enabling Systems 	Investments in technological advances that can grow the information ecosystem and propel further innovation to address and adapt to climate change	Improved networks and infrastructure for enabling the climate transition Illustrative outputs: <ul style="list-style-type: none"> • Number of customers or climate solutions enabled • Sector-specific KPIs that demonstrate enabled impact

*ZwitterCo was added to the DCVC Climate portfolio in 2024

Assessing potential impact: More science than art

The early- and middle-stage nature of our investments means that most of our portfolio companies' impact is yet to materialize. As such, it is critical for us to understand the *potential* of our investments to create climate impact in the future.

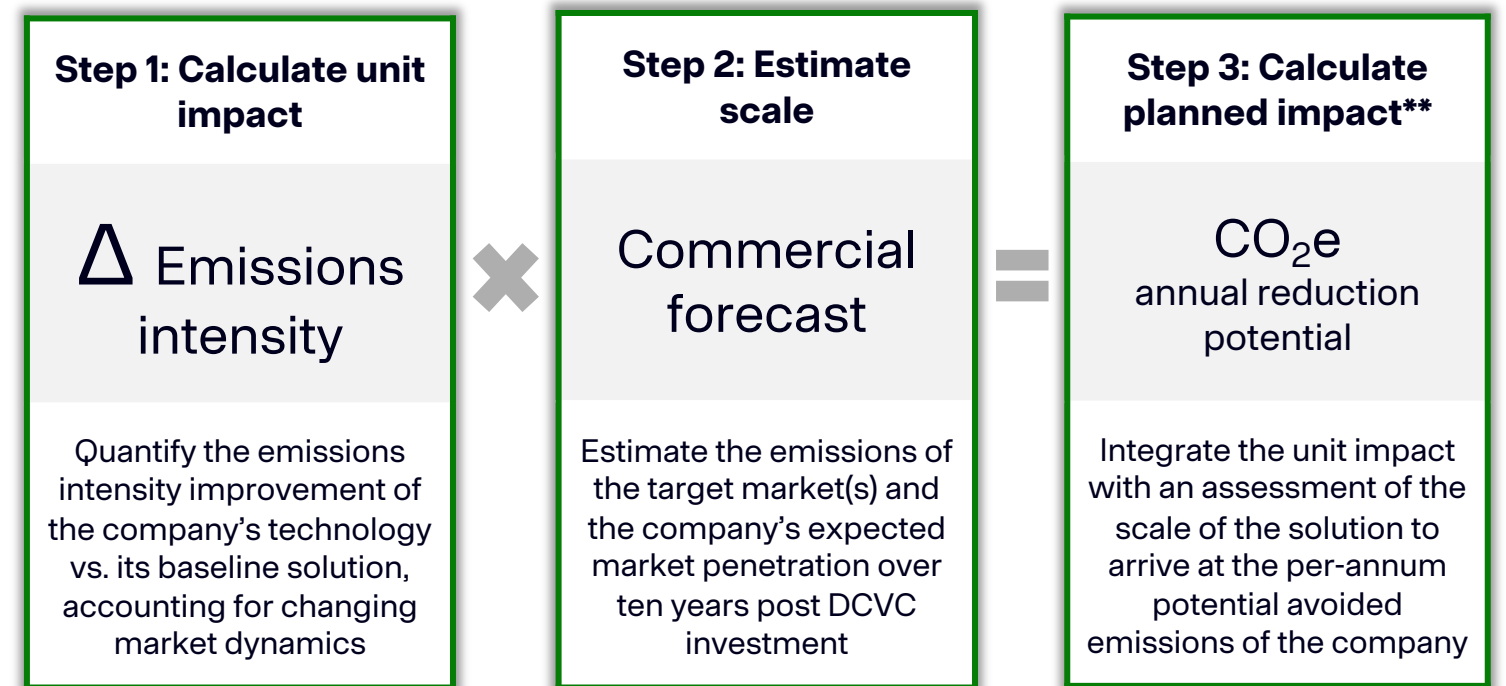
Measuring future emissions avoidance requires scientific rigor, deep technological understanding, and the use of industry-leading analytical frameworks such as the Emissions Reduction Potential (ERP) methodology.⁷

We work closely with our entrepreneurs during diligence to understand the underlying technology and its potential impacts, setting targets for avoided emissions over time. We then track progress through routine collection of impact KPIs throughout the holding period of our investments.

In 2023, we integrated ERP assessments into our impact management system, and in 2024 and beyond plan to conduct robust ERPs on all DCVC Climate portfolio companies.

DCVC is committed to assessing impact with scientific rigor and in alignment with market best practices.

DCVC's approach to ERP:



**Project Frame defines Planned Impact as the change in GHG emissions that a specific innovation both intends and expects to cause compared to an incumbent and based on a realistic analysis of its business model.

Example: Measuring potential impact of enhanced geothermal

Despite the increasing supply of renewable energy, fossil fuels continue to play a major role in supplying the baseload power needed to meet constant grid demand. Geothermal heat is an abundant, constant, renewable energy source that can provide clean, consistent baseload power. However, given past technological limitations, a substantial amount of geothermal energy has remained inaccessible, and thus accounts for only 0.4% of current electricity generation in the U.S.⁸ Fervo’s precision drilling technology and computationally driven reservoir design expand the viable resource base for geothermal power generation, filling the market demand for 24/7 clean power.

Step 1: Calculate Unit Impact

On average today, the U.S. electrical grid produces 0.39 kg CO₂e per kWh of electricity delivered.⁹ Over time as more clean energy capacity is added to the grid, the emissions intensity will decrease, which is factored into the baseline scenario. When looking at natural gas, the type of energy geothermal is most likely to replace, the emissions intensity jumps to 0.44 kg CO₂e per kWh.¹⁰

Geothermal energy nearly eliminates GHG emissions, with total lifecycle emissions of 0.04 kg CO₂e per kWh.¹¹ Compared to the grid, this represents a current improvement of 90.5%, decreasing year-over-year to 88.5% in 2033. When replacing natural gas, Fervo is delivering a 91.6% improvement.

Step 2: Estimate scale

Electricity generation in the U.S. from utility-scale power plants totaled 4.23 billion MWh in 2022, resulting in 1.65 gigatons of CO₂e. Natural gas in the U.S. was responsible for nearly half of those emissions at 743 million metric tons (Mmt) in 2022.¹²

Fervo started selling electricity to the grid for the first time in 2023 and expects to have 1 gigawatt electric (GWe) online or under development by 2030. Applying the 90% average capacity factor of geothermal plants, Fervo would deliver approximately 7.9 million MWh of renewable electricity in 2033. Fervo is currently concentrating on the U.S. market, although the technology has the potential to scale globally.

Step 3: Calculate Planned Impact

Using the unit impact of Fervo’s geothermal energy against natural gas energy of 0.4 kg CO₂e per kWh, the commercial forecast of 1 GWe of geothermal capacity by 2033, and the appropriate conversion factors, the following equation represents Fervo’s planned annual emissions reduction in 2033:

0.403 kg CO ₂ e per kWh improvement	×	7.9 million MWh renewable energy delivered	=	3.2 million mt CO ₂ e 2033 reduction potential
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91.6%

Emissions intensity improvement compared to natural gas

7.9M

MWh delivered annually by 2033

3.2M

mt CO₂e annual reduction potential in 2033





Featured Companies

DCVC Climate Impact Report, 2023

Equilibrium
Fervo
Twelve
Verdigris

DCVC

Climate
Investments

twelve

Twelve transforms CO₂, water, and electricity into essential products that are traditionally made from petrochemicals. Carbon transformation reduces emissions from supply chains, closes the carbon loop, and brings to market an enduring carbon management solution.

Challenge

Industries producing essential products—from detergent, to car parts, to jet fuel, used every day by millions of people—rely on emissions-intensive fossil fuels as their building blocks. As a result, the industrial sector was directly responsible for emitting 9.0 Gt of CO₂ in 2022, or a quarter of global energy system emissions.¹³

The aviation industry consumes almost 100 billion gallons of conventional, petroleum-based jet fuel annually, and demand is expected to increase to 150 billion gallons by 2050. In 2022, aviation accounted for 2% of global energy-related CO₂ emissions.¹⁴ As the climate crisis worsens and demand for air travel continues to grow, the need for sustainable alternatives to jet fuel is paramount.

While other solutions to industrial pollution—like carbon capture and storage—work to sequester these emissions, they fall short of creating large-scale industrial value that can reduce our dependence on fossil fuels.

Solution

Twelve’s proprietary Opus CO₂ electrolyzer converts CO₂ emissions into the building blocks for carbon-based products without sacrificing their quality or performance. Through CO₂ electrolysis, Twelve produces two key products: E-Jet®, a power-to-liquid sustainable aviation fuel, and E-Naphtha™, a core component of traditionally carbon-based products like laundry detergent and plastic auto parts.

E-Jet® has a 90% emissions intensity improvement relative to conventional jet fuel and can be blended with traditional jet fuel for commercial use. E-Naphtha™ produces true drop-in replacements for incumbent equivalents, making its low-emissions products exactly as useful as highly polluting alternatives. Not only does Twelve’s technology avoid carbon emissions, but it transforms CO₂ into high quality products, at a rate of 3kg CO₂ per 1kg product.

1:1

Replacement ratio of E-Naphtha™ vs. conventional

3:1

Ratio of CO₂ transformed to product produced

Market insights: Why is Twelve’s Sustainable Aviation Fuel unique?

Sustainable aviation fuel (SAF) is the new standard for decarbonizing the aviation industry. All pathways to make SAF take non-crude oil feedstocks and turn them into the hydrocarbon chains that make up kerosene—the main component of jet fuel. The four main SAF pathways are outlined below:

SAF PATHWAYS

1. HEFA Fuels are biofuels made with vegetable oils, waste oils, or animal waste fat. While HEFA is an inexpensive and mature technology, its manufacturing process requires high land and water use, and limited supply of waste fat limits how much fuel can be produced. HEFA fuel is projected to meet only 5% of estimated 2030 aviation fuel demand.¹⁵

CO₂e reduction potential vs. fossil jet¹⁹

32%

Minimum, up to 84%

2. Alcohol-to-Jet Fuels are biofuels made from agricultural crops (corn, sugarcane, etc.) to produce ethanol, which is then turned into jet fuel. These fuels require significant amounts of water, land, and feedstock for production. Currently, there is only enough feedstock to produce 50 billion gallons of SAF annually, about 50% of estimated 2030 demand. Alcohol to jet fuels also require high volumes of feedstock for relatively little output, with a conversion rate of 13%.¹⁶

26%

Minimum, up to 94%

3. Gasification is a process that converts carbon-based waste into synthesis gas and then fuel. Gasification requires significant water use, and scaling SAF production via gasification to meet estimated 2030 demand would require dedicated feedstocks, presenting additional logistical, financial, and sustainability challenges.¹⁷

85%

Minimum, up to 94%

4. Power-to-Liquids Fuel uses CO₂, renewable energy, and clean hydrogen and creates fuel using carbon transformation. Production requires minimal water and land and is highly scalable, with a potentially unlimited supply. **Power-to-liquid fuels, like Twelve’s E-Jet®, have an emission intensity improvement of >90% while using 3-30X less land and 1,000x less water than alternatives.**¹⁸

>90%

Up to 100% with a fully decarbonized supply chain

Carbon transformation for a climate-positive world

Impact

Twelve conducts lifecycle analyses (LCAs) to quantify emissions mitigation effects of products sold, which demonstrate:

- E-Jet® lifecycle emissions are 0.8 kg CO₂ per gallon of fuel, compared to 9.8 kg CO₂ per gallon of fuel from fossil jet fuel, a 90% reduction.
- E-Naphtha™ emissions are cradle-to-gate carbon negative at -2.6kg CO₂ per kg of naphtha, compared to 0.5kg CO₂ per kg of fossil naphtha, significantly reducing lifecycle emissions of products that use naphtha as an input (such as plastics, rubber, resins, and cleaning agents).

Carbon transformation closes the carbon loop by creating a source of revenue from carbon waste. Twelve’s technology enables the transition from an extractive carbon economy to a sustainable manufacturing model without sacrificing quantity or quality of indispensable commodities.

8,600

Targeted mtCO₂ transformed per day by 2030

3.1M

Projected mtCO₂ transformed annually by 2030

Key Milestones

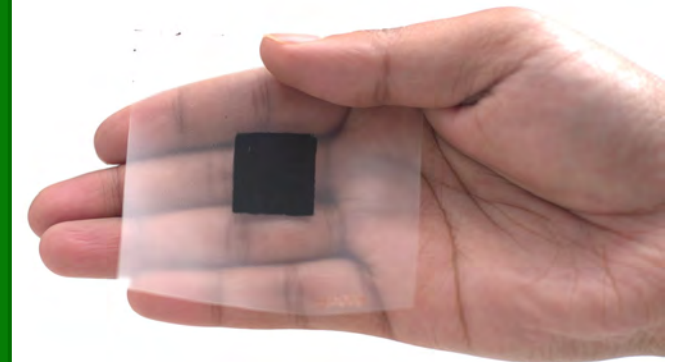
In 2023, Twelve broke ground on its first commercial AirPlant™ in Moses Lake, WA. As the company grows, additional AirPlants will enable Twelve to scale its core technology and produce E-Jet® and E-Naphtha™ at industrial scale.

In February 2024, Twelve announced a major E-Jet® offtake agreement with IAG. Twelve will supply IAG’s five European airlines, including British Airways and Iberia, with 785,000 metric tons of E-Jet® over 14 years, starting as early as 2025.

With zero emissions and zero fossil fuels, carbon transformation creates a source of revenue from what was once waste.

265M

Gallons of E-Jet sold by 2030 (projected)



90%

Fewer GHG emissions than traditional jet fuel

1st

Power-to-liquid jet fuel plant in North America



“A truly green jet fuel production facility with a company that uses CO₂ and water to make a truly clean climate change-defeating fuel.”

– Gov. Jay Inslee (WA, pictured) at the ground-breaking for Twelve’s first power-to-liquid jet fuel plant in Washington State.



Next-generation geothermal power

Fervo delivers 24/7 carbon-free energy through the development of next-generation geothermal projects, enabling continuous, cost-effective geothermal energy production in previously unviable locations.

Challenge

The electricity sector is the source of an estimated 25% of national GHG emissions.²⁰ Renewable electricity sources like wind and solar struggle with intermittency issues, relying on fossil fuels as backup when the wind isn't blowing, or the sun isn't shining. Geothermal electricity is carbon-free, safe, and reliable, performing the same function as fossil fuels without the emissions. However, until now, geothermal energy has been limited to specific geologies and marked by infrastructural challenges that result in high cost and failed projects. These limitations have led to geothermal energy constituting less than 1% of global renewables—despite its potential for 24/7 clean power generation.²¹

Solution

Fervo leverages existing technology in the oil and gas sector, including horizontal drilling, distributed fiber optic sensing, and hydraulic fracturing, to expand the viable resource base for geothermal power and enhance system performance and well design. Using data gathered from fiber optic sensing, Fervo's advanced data modeling algorithms pinpoint resources and further optimize heat mining efficiency. Combined, these approaches ensure Fervo's geothermal plants are scalable and commercially attractive.

Innovation in geoscience increase the supply of clean, reliable energy

Impact

Fervo's distinctive approach to geothermal well design, reservoir engineering management, and advanced data analytics makes geothermal energy a more reliable and cost-effective renewable energy source.



Fervo is currently on track to have 1 GWe online or under development by 2030. By adding renewable energy capacity to the grid, Fervo will replace mostly natural gas, resulting in a planned 3.2 million metric tons of CO₂e avoided per year by 2033.

Key Milestones

In May of 2023, Fervo successfully produced steam in its first commercial plant, Project Red. Its 30-day flow test established the project as the most productive Enhanced Geothermal System (EGS) in the world, achieving a record flowrate of 63 liters per second that enables 3.5 MW of electric production.²² In partnership with Google, the plant is now online, powering Google's local data center in Nevada.²³

In June of 2023, the firm marked the start of its 400MWe drilling campaign in Southwest Utah: Cape Station—the largest next-generation geothermal plant. Early results from this project showcased a 70% year-on-year reduction in drilling times, significantly reducing costs.²⁴

In February of 2024, Fervo raised \$244 million to support the Cape Station project's aim of delivering clean electricity to the grid by 2026, accelerating the transition to carbon-free, geothermal energy generation in the US, and driving progress toward the emissions reduction potential metrics listed below.

Emissions reduction potential highlights

373

MWe contracted generation capacity

92%

GHG emissions intensity improvement

3.2M

mt CO₂e annual reduction potential in 2033

Market insights: What is enhanced geothermal?

“Our technology is fully de-risked, our pricing is already competitive, and our resource pipeline is vast. This investment enables Fervo to continue to position geothermal at the heart of 24/7 carbon-free energy production.” – Tim Latimer, Fervo CEO.

The road to 24/7 power amidst a green transition

Most renewable energy sources face issues with intermittency due to their reliance on the weather, but geothermal power can produce a steady output of energy on an uninterrupted basis.²⁵ To leverage this potential, developments in geothermal technologies need to be scaled and commercialized.

The challenges of traditional geothermal

Traditional geothermal power has historically faced two key roadblocks:

1. Geographic constraints due to limited availability of naturally occurring reservoirs with sufficient heat and permeability.
2. High costs and pervasive resource risk, leading to low success rates.

These roadblocks have limited the large-scale commercialization of geothermal. Because traditional developers are so constrained by resource quality and location, they cannot tap into learning curves that come with repeated operations across a basin.

Fervo’s enhanced geothermal solution

Fervo addresses these scalability challenges using the following techniques:

1. Horizontal drilling.
2. Hydraulic fracturing to create sufficient permeability for heat transfer.
3. Distributed fiber optic sensing to precisely monitor fluid flow across the geothermal reservoir and collect large swaths of data to improve simulations.

By engineering permeability in hot rock, Fervo eliminates resource risk, creating geothermal reservoirs in unconventional locations. These techniques allow Fervo to drill hundreds of wells in a single basin, reducing costs by creating economies of scale. Additionally, Fervo’s proprietary operational technology, FervoFlex, coupled with its data and advanced compute, allows for the flexible management of wells to meet variable demand, with the capability to deliver in-reservoir energy storage.²⁶ Fervo’s technology also ensures that nearly 100% of the water used is reinjected back into the ground, maximizing efficiencies in water use.

The future of the next-gen geothermal market

To deliver economy-wide decarbonization in the US, an estimated additional 700-900 GWe of 24/7 clean generation capacity must be added to the grid. Next-gen geothermal is estimated to be able to provide up to 300GWe—over 1/3 of the necessary clean energy.²⁷ DCVC firmly believes in Fervo’s potential to provide a large percentage of this needed energy by providing the technology improvements to unlock geothermal deployment, while delivering outsized financial returns.



The Climate Generation Power Company

Equilibrium Energy is building an end-to-end power company that significantly mitigates electricity grid emissions. To date, Equilibrium has introduced a novel battery tolling model which improves battery economics, a critical enabler of renewable energy adoption. With years of power industry expertise, and AI-powered solutions, Equilibrium is built to cost-effectively support the proliferation of energy storage technology while becoming a competitive supplier of clean energy.

Challenge

The transition to a renewable energy system with a stable supply of energy will require a quadrupling of energy system flexibility (the amount of dispatchable energy available to meet hour-to-hour power demand) by 2050, driven in large part by batteries and smarter electricity networks.²⁸ Increasing volatility in electricity supply, weather patterns, and electricity demand is further compounding the need for flexible energy systems. However, traditional power companies and battery operators are not built to handle mass volatility, resulting in sub-optimal battery operations, slow underwriting and deployment of grid flexibility projects like grid-scale batteries, and underutilization of intermittent renewable resources.

The availability of batteries to store renewable power and supply clean, consistent energy is severely limited by several factors including:

1. Uncertain revenue models limiting financing for battery projects
2. Challenges in trading energy in increasingly volatile power markets

“We believe that we need more companies dedicated solely to climate, and we hope to become a next generation power company that helps the entire industry move quicker in its fight against climate change.”

-Ryan Hanley, CEO, Equilibrium Energy.



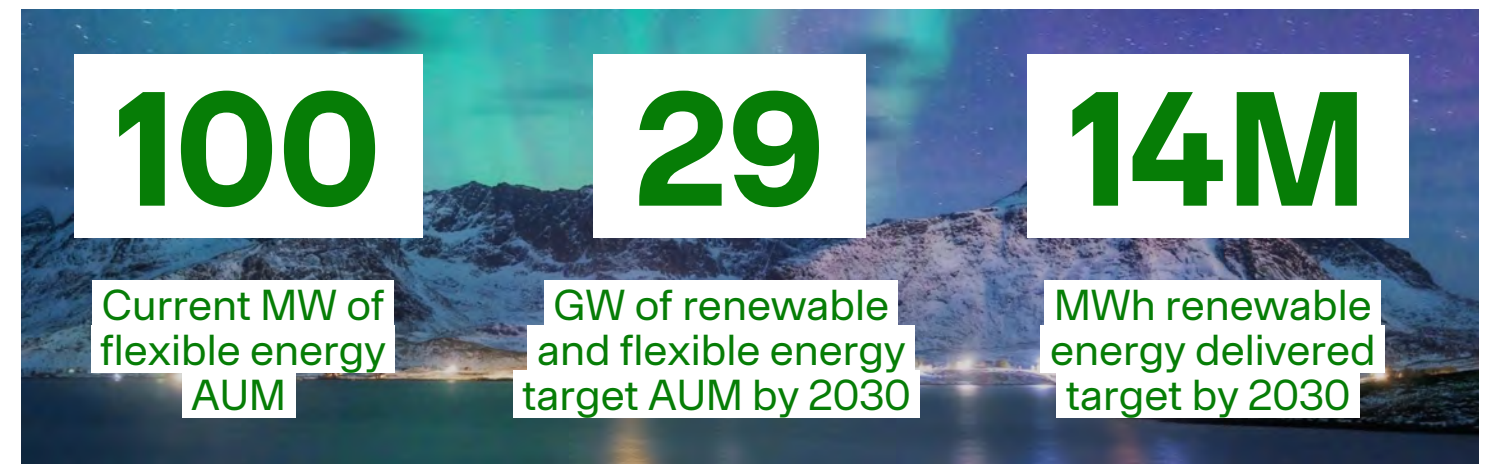
Jupiter Power’s Crossett battery project in Crane County, Texas (Jupiter Power)

Solution

Equilibrium is an AI-enabled clean power company built specifically to handle volatility and supply clean, steady electricity at the optimal price. Equilibrium plans to operate clean energy generation and storage resources, engage in virtual energy trading, and become a retail energy provider managing complex energy portfolios of the growing number of corporations trying to achieve their ambitious climate goals.

To start, Equilibrium is signing battery tolling agreements with grid storage developers to build a flexible energy asset portfolio. Equilibrium pays a fixed fee to the battery owner in exchange for the dispatch rights, then, leveraging AI, grid fundamentals, and advanced data, Equilibrium optimizes battery operations for use on the volatile grid. These tolling agreements provide steady revenue for battery project owners, allowing them to access incremental financing for additional projects.

In a future phase of growth, Equilibrium plans to sign agreements with corporations to manage their clean energy portfolios in support of meeting their sustainability goals.



Impact

Increasing the quantity and utilization of flexible and renewable energy assets is essential for decarbonizing the grid. Equilibrium simultaneously increases the utilization of flexible energy assets while providing the financing necessary to deploy battery projects, and, in the future, renewable projects. Both outcomes ultimately increase the share of renewable energy in the global energy mix for final consumption.

Key Milestones

In May of 2023, Equilibrium announced a partnership with Hatch Renewables (known as Hatch EQ) and subsequently signed the largest energy storage tolling agreement in Texas. Under this milestone agreement, Hatch EQ and Equilibrium will provide a fixed multi-year revenue stream to Jupiter Power for the rights to operate and collect revenues for Jupiter’s 100 MW battery project, Crossett I.²⁹

In decarbonization, all roads lead to the grid

The energy sector is the largest source of global emissions with a record 37.4 Gt of CO₂e in 2023, making it the key to reducing global carbon emissions.³⁰ Global electricity demand is expected to more than double by 2050, driven in large part by electrification across all sectors. To meet growing electricity demand and global sustainability goals, the share of clean electricity will need to increase from 29% in 2020 to 88% in 2050.³¹ Power grids are the backbone of the electricity system and will play an increasingly central role in decarbonization efforts.

With grid electrification comes volatility

Massive volatility in the supply and demand of energy will be driven by a combination of increased renewable generation, mass electrification, and increasingly extreme weather. Solar and wind are expected to make up approximately 70% of all electricity generation by 2050, rapidly increasing the share of intermittent renewables in the global energy mix.³² These assets provide intermittent generation dependent on physical conditions (i.e., the amount of sunlight and wind), and with weather patterns becoming more extreme and unpredictable, power grids are under serious threat of losing energy security and stability without the appropriate infrastructure and mechanisms to manage volatility.

Volatility requires flexibility

Grid flexibility is the capability of the power system to maintain balance between generation and load under uncertainty.³³ Traditionally, gas-fired power plants are used to fill the gap when energy demand exceeds supply. These “peaker plants” are one of the dirtiest forms of energy, accounting for 2-3x the carbon emissions of a typical power plant.³⁴ To reach net zero, unabated gas power plants need to be phased out by 2040, replaced by a combination of batteries, demand response technologies, and low-carbon flexible power plants, all supported by smarter electrical networks.

Equilibrium is a volatility-centric power company

Equilibrium is building an end-to-end power company built specifically to handle electric grid volatility. To do this, it plans to be an asset-light data-driven power company with the ability to aggregate flexible and clean energy resources, engage in virtual trading and physical asset management, and become a retail clean energy provider to corporations with ever growing sustainability goals. Pairing AI models with electric grid system models, Equilibrium is building an enterprise technology platform that will allow it to optimize energy flows across the grid for sustainability, reliability, and price.

Market insights: Why is grid flexibility so important?





Energy intelligence

Verdigris is on a mission to bring AI-powered intelligence to every building in the world. The company's AI-enabled dashboard, powered by smart sensors, empowers building owners to monitor and optimize their energy assets for cost and energy savings. Verdigris enables buildings to modulate energy demand, essentially becoming active grid participants, and playing an integral role in the transition to more flexible power grids. Eventually, the SaaS platform the company is developing will allow corporate clients to track their indirect, scope 2 emissions, supporting a company's ability to report and reduce accordingly.

Challenge

The rapid evolution of artificial intelligence, virtual currencies, and real-time transportation of physical goods is fueling the exponential growth of data centers, logistics facilities, and cellular networks. While these critical infrastructure components are increasingly vital to modern life, they are massive consumers of energy and their electricity consumption could double to 1,000 TWh annually in 2026, roughly the electricity consumption of Japan.³⁵

More broadly, operational energy use in commercial buildings is responsible for 3.7 Gt CO₂, but more than one third of the electricity these buildings consume is wasted.³⁶ The companies running these facilities do not have adequate sensors, tools, controls, or data necessary to understand their buildings' energy use, making it difficult to reduce energy consumption while maintaining reliable operations. As the world grapples with the challenges of climate change, these essential infrastructures stand out as a critical area for improvements in energy efficiency.

Solution

Verdigris' solution integrates advanced sensor hardware with cloud software, enabling companies to monitor their energy consumption and reduce electricity waste by leveraging reliable, real-time data. The easy-to-install advanced sensor technology collects high-resolution energy data down to the circuit level, which is analyzed by proprietary AI algorithms and analytics to provide actionable insights into energy efficiency and equipment reliability. In addition, this hardware-enabled SaaS solution enables real-time energy monitoring, identifying opportunities for efficiency and utilization improvements, as well as carbon reduction. By leveraging AI and IoT technology, Verdigris helps companies optimize energy use and minimize environmental impact.

"Energy and CO2 waste in the enterprise is a solvable problem. Our solution empowers the world's largest consumers of electricity to improve the reliability and performance of their most intensive electrical assets, while dramatically reducing their costs and carbon footprint, fueling business prosperity and a sustainable future."—Mark Chung, CEO, Verdigris.

Impact

Verdigris helps commercial building owners reduce building energy, saving, e.g., up to 30% in HVAC costs. With tens of millions of square feet monitored, Verdigris has helped commercial customers reduce energy consumption, cut down costs, and move towards sustainable building management.

Key Milestones

As of the end of 2023, Verdigris' technology is at work in large corporate warehouses and data centers belonging to clients such as T-Mobile, Amazon, and Verizon. With over 33 current customers, the company has deployed 1,634 active systems within the past decade. Since 2021, Verdigris has received numerous sustainability and innovation awards, including the prestigious Golden Bridge Business and Innovation Award, Network Sustainability Award, and Silver Stevie Award.

At the end of 2023, DCVC, along with Solea Energy, led Verdigris' most recent funding round of \$11 million to support the next stage of growth. The financing will power Verdigris' expansion of building portfolios, increasing its ability to reduce carbon and scope 2 emissions by tackling energy waste.³⁷

16.7

Million sq ft of building space monitored

12%

Average customer energy cost savings

108

GWh electricity saved annually



Market insights: How can we be better at understanding and reducing energy consumption?

Why we need energy intelligence

All industries are facing mounting pressure to take actionable steps towards combatting climate change. One significant bottleneck in companies' efforts to reduce their scope 2 emissions (those associated with the purchase of electricity, steam, heat, or cooling) is the necessity to operate their facilities 24/7 – often resulting in inefficiencies and energy waste.

While scope 2 emissions make up the majority of most firms' carbon footprint, they can be difficult to measure, and therefore reduce. Most existing electrical meters are technologically outdated and riddled with inaccuracies, making GHG accounting a tiresome process for firms looking to reduce their effects on the climate. This means there's a growing market for energy intelligence technologies that can track, report, and optimize energy usage to simplify the process.

Energy intelligence technologies

Emerging energy intelligence systems, typically in the form of IoT sensors and software, can be installed in pre-existing infrastructure to collect data and reduce costs associated with energy and water systems.³⁸ While they represent an improvement over current processes, many such technologies require people to check and read sensors that provide this enhanced data, leaving the process open to human error and increasingly complex when deployed across multiple sites or operational systems.

Verdigris' unique solution

Verdigris' innovative patent leverages AI algorithms to perform non-intrusive load monitoring, categorizing electrical signals into specific usage types, such as lighting, motors, and HVAC. This enables an automated, detailed, and granular mapping of energy consumption to end-use; eliminating human error and providing a comprehensive breakdown of energy usage for entire buildings with minimal sensor footprint. The Verdigris solution also detects and automatically corrects mislabeled or incorrectly installed sensors, while continuous AI monitoring guarantees market-leading data quality and reliability. This ensures effortless maintenance and continuous adaptation to the latest energy upgrades and facility changes. With real-time insights, firms can significantly reduce energy consumption and associated emissions. Verdigris is now expanding its offerings to include automated energy optimization and GHG emissions reductions tracking, simplifying scope 2 emissions measurement and reduction.

Impact potential

By identifying wasteful practices and reducing inefficient energy consumption, energy intelligence technologies have the capacity to reduce up to 30% of energy consumed in buildings, amounting to \$150 billion in annual savings in the U.S. alone.³⁹ Globally, smart building automation systems have the potential to reduce up to 14 Gt CO₂e between 2020 and 2050 while saving over \$3.4 trillion.⁴⁰

We're proud to be growing our climate portfolio and publishing our DCVC Climate report, signaling our commitment to financing the green transition. Here at DCVC, we believe that the only way to scale the technologies needed to combat the climate crisis is to focus on those that reduce both capital and operating expenses. The breakthroughs in AI we are seeing in our pipeline are reaffirming our excitement about the possibilities of deep tech to cut through the systemic barriers keeping our economy locked into fossil fuels and extractive practices.

We continue to focus on outcomes—not specific industries or climate problems—in pursuit of high financial and environmental returns on our climate investments. DCVC Climate is actively seeking mid-stage climate start-ups with clearly defined, and tested, transformational outcomes. We deploy our team and capital to ensure that the technical risks faced by our portfolio companies are retired efficiently, so the companies can begin to deliver their impact at scale.

Future Impact: Upcoming Climate Tech Investment Opportunities

An eye on future opportunities: Water tech.

As global populations continue to grow and the effects of climate change increase in intensity, water scarcity has fast become one of the largest climate-related issues affecting human life. Currently, approximately 1.1 billion people lack access to clean water, with an additional 2.7 billion finding it scarce at least one month a year.⁴¹ At current consumption rates, nearly two-thirds of the world's population will face water shortages by 2025.⁴² Business forecasts are also alarming – while water scarcity is poised to be the biggest climate-related threat to corporate assets in the next few decades, investors are still largely unaware of the extent of the risk.⁴³

Addressing this water crisis will require investment in advanced technologies using computational techniques to provide alternatives to a diminishing global supply of freshwater, including water filtration, purification, and desalination.

While investments in water technology start-ups from venture capital have historically been lacking, we have seen steady growth of exceptional new water-focused enterprises. At DCVC, we're committed to addressing water scarcity by focusing on some of the remarkable outcomes that these water tech firms have the potential to generate.

“Around 70% of the cost associated with adaptation to climate change will be in water adaptation.” - Alex Rappaport, ZwitterCo CEO.



Our most recent addition to the Climate fund, ZwitterCo, has developed a novel type of filtration membrane chemistry that can repel the fats, oils, and grease found in wastewater—improving the effectiveness of filtering organic matter. This is one of the first major innovations in membrane chemistry in nearly 50 years. Distinguishing it from other membranes on the market, ZwitterCo uses its namesake – Zwitterionic copolymers – to process 10,000 times higher organic loading than conventional filters, making it exceptional for agricultural applications. The company's patented membranes are anti-fouling and durable under intense chemical loading, allowing them to operate for years in streams that would destroy other membranes in days. Given that irrigation for agriculture accounts for 70% of freshwater consumption

worldwide, the implications of commercially viable, deep tech water filtration systems are staggering.

Currently, ZwitterCo is helping its customers save over 6 million gallons per day of treated water, providing filtration solutions for dairy and poultry wastewater, food waste and manure digestate, and bioprocessing.

Named the Breakthrough Technology Company of the Year 2023 at the Global Water Summit in Berlin, ZwitterCo is now operating a first-of-its-kind, 30,000 square-foot innovation center in Massachusetts. The company is presently developing a range of applications of its technologies, including for water desalination, water purification, and food grade separation.⁴⁴



“DCVC are amazing investors. They are as involved in my personal growth as my company's success, and I have grown tremendously under their guidance”. - Alex Rappaport, ZwitterCo CEO.

By providing both funding and operational expertise, DCVC will support ZwitterCo to address the critical issue of water scarcity through the development and scaling of its world-leading water filtration systems. With ZwitterCo's new innovation center fully operational as of February 2024, and a total addressable market of between \$50-\$70 billion, we're excited to delve further into the company's progress in next year's Climate Fund Impact Report.

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All figures in this report are as of December 31, 2023 unless otherwise indicated.