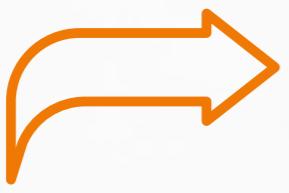




REPORT

CLIMATE FINTECH

Mapping an Emerging Ecosystem
of Climate Capital Catalysts



FORWARD THINKING

Put simply, solving climate change requires creating a new inertia. Since the industrial revolution, large economies have been driven by carbon-emitting energy, agriculture, and industrial systems. The invisible engine underlying it all has been finance; and at last, finance is facing disruption. This report lays the foundation for why it's so important to leverage this disruption for the benefit of people and planet.

– Marilyn Waite
Climate & Clean Energy Finance Program Officer
William and Flora Hewlett Foundation

Christine Lagarde, President of the European Central Bank said that we need forward-looking, dynamic data to address the gap in pricing risk due to climate change and nature loss. We can fix this with a planetary computer that connects satellites and sensors, by sharing information securely using Blockchain technologies, and by leveraging Artificial Intelligence for presentation in a standardized format. When combined, these tools allow for more stakeholders to consider climate risk in their decision-making. Climate Fintech actors will be the first movers to connect the needs with solutions and build a financial ecosystem to save the planet.

– Richard Peers
Founder | Responsible Risk Solutions

Asset managers are key contributors to the ecosystem of low-carbon investment. In the evolving pursuit of sustainable investing, Climate Fintech offers solutions to help leverage alternative data, ESG analysis, climate-risk modeling, and ultimately influence investment decision-making. This report shows how these cutting-edge technologies give investors tools to help decarbonize their investment activities, while further assisting countries towards sustainable development.

– Scott Yang
CEO | China Southern Asset Management

WRITTEN BY

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EXECUTIVE SUMMARY

ABOUT US

New Energy Nexus is a non-profit international organization that strives towards an abundant world with a 100% clean energy economy for 100% of the population in the shortest time possible. To achieve this goal, we support diverse clean energy entrepreneurs with funds, accelerators, and networks. We started in California and now operate programs in New York, China, India, Southeast Asia and East Africa.

Digital financial technology (known today as Fintech) has already disrupted the global financial system, but can it be used directly to improve our planet's well-being?

Recent improvements to banking, customer experiences, and investment decision-making do not always consider the health of our planet, so how can Fintech be channeled and applied to address climate change? Within this report, we set out to explore how Fintech can help mobilize more capital in the pursuit of reducing greenhouse gas emissions (GHG). The inaugural Climate Fintech Report explores crucial intersections of digital financial technology and climate as a fresh perspective by which to pursue decarbonization – through nurturing an emerging digital ecosystem of climate capital catalysts.

This report is a distillation of over 100 interviews from 2020

with financial institutions, Open Banking experts, climate scientists, blockchain advocates, cleantech VCs, and climate fintech startups, among others. This is the first of what we hope to be many endeavors to better understand where areas of opportunities exist, and how to best bring them to scale. Initial findings have yielded a growing database of more than 250 "Climate Fintech" companies from around the world. We have also touched upon the geopolitical nuances of three major carbon-emitting regions – Europe, the United States and China (who combined contribute to 52% of the world's carbon emissions) to best understand what business models and technologies thrive in each market.^{1,2,3}

Our research was guided by four key questions:

- 1 What is Climate Fintech and how is it defined?**
- 2 Where do areas of opportunity exist – what business models and digital technologies are successful in practice?**
- 3 How do these companies grow – what financial stakeholders and innovation frameworks must engage for these companies to have maximum impact?**
- 4 How do the regions of China, Europe, and the United States differ in their deployment of Climate Fintech?**

The **Climate Fintech Report** attempts to answer these questions by simplifying complex business models. Along the way, we unravel the financial system into 8 categories, each with their own chapter. We also explore how applied digital technologies, such as Big Data, Artificial Intelligence (AI), and Blockchain, can overcome incumbent challenges of climate finance, in areas like limited access to capital, opaque carbon accounting, and the cost-burden of debt issuance. Lastly, we analyze how big picture frameworks such as Crowdfunding, Platform Marketplaces, and Open Banking can create additional incentives and accessibility for climate-conscious stakeholder participation.

MAIN FINDINGS

- 1** Climate Fintech is simply digital financial technology which catalyzes decarbonization.
- 2** Climate Fintech has both downstream and upstream benefits – improving the daily lives of citizens and the behaviors of the largest financial institutions.
- 3** Globally, Climate Fintech innovations are most prolific in the categories of Consumer Behavior, Investing, and Risk Analysis. Artificial Intelligence is the most abundant applied technology used across Climate Fintech applications, unparalleled in its ability to synthesize data quickly and improve decision-making.
- 4** The Climate Fintech ecosystem is heavily populated with early-stage startups, attractive investment opportunities for climate-conscious and fintech-friendly asset owners.
- 5** Europe currently leads the US and China in its level of Climate Fintech innovation, though these other two markets have the potential to catch up through dynamic government policies and increasing sustainable capital flows. As governments and institutions begin to make good on their climate commitments, digital financial tools will become increasingly important.
- 6** A historic groundswell of decarbonization investment is apparent – indicating that now is a key moment. It is in our mutual benefit to deliberately foster innovation in this niche space.

Each financial category below has a designated chapter in this report containing case studies that highlight examples of Climate Fintech in practice. For innovators and investors, these cases warn of pitfalls to avoid, while showcasing successful pathways to financial system integration and capital mobilization, with the end-goal of demonstrating how digital financial technologies are applied to reduce GHG emissions.

FINANCIAL CATEGORIES



1

INTRODUCTION

01 | Introduction 02 03 04 05 06 07 08 09 10 11



We have reached a historic inflection point.

2020 will be a year seared in the memory of modern humanity – testing our resilience against numerous existential threats. While the COVID-19 pandemic looms as a shared experience, we have also set devastating records for heat waves, massive wildfires, and hurricanes around the globe. The resulting turmoil has caused significant damage to communities, and exposed broken social and political structures. However, these challenges have also revitalized a push for public good over private benefit, highlighted the importance of science and technology, and encouraged an unprecedented collective effort

to prevent the climate crisis.

2020 is also a historic year both for the energy transition and for the flow of capital which finances decarbonization.

In 2019, for the first time ever, renewables made up the majority of the world's new power generation, representing a momentous shift in how nations access their electricity.⁴ It is widely understood that mitigating a climate crisis requires roughly a USD 3 trillion annual energy system investment between now and 2050,⁵ a massive figure which is now motivating real action. **Spending on renewable power is set to overtake oil and gas drilling for the first time in 2021**, as clean energy affords a USD 16 trillion investment opportunity between 2020 and 2030, according to Goldman Sachs.⁶ In June 2020, European governments approved the most ambitious climate change plan to date, the European Green Deal, which plans to invest more than EUR 500 billion into decarbonization, ranging from electric cars to agriculture. Despite an extremely tumultuous year, the US saw record-breaking investments in renewables and Environmental, Social, and Governance (ESG) themed funds, while states like California acted to mandate that new vehicle sales be electric or fuel cell by 2035. With a newly elected president, the US is now likely to rejoin the Paris Agreement and reposition its approach to environmental stewardship.



And China, simultaneously the largest greenhouse gas emitter and biggest investor in renewables, has recently made momentous announcement at the UN General Assembly:

“COVID-19 reminds us that humankind should launch a green revolution ... we can no longer afford to ignore the repeated warnings of nature ... China will aim to achieve carbon neutrality before 2060. We call on all countries to pursue innovative ... green development and achieve a green recovery of the world economy in the post-COVID era.”⁷

— President Xi Jinping, China

While these gestures from investors and governments are encouraging, there is no vaccine for climate change.

Incumbent financial systems remain too entrenched in antiquated practices and fossil fuel interests to move resources in the volume and within the compressed timeline required to fully mitigate a global warming catastrophe. Deep structural changes must be implemented to address the inefficiencies inherent to global capital flows, giving more access and more equity to citizen participants. There are many pieces to this puzzle, including policy action, financial product innovation, improving economics of clean energy, and **the focus for this report – the integration of digital financial technology, known widely today as Fintech.**

Fintech has already demonstrated its ability as a highly-scalable disruptor to the financial industry. Digital technologies, such as big data, artificial intelligence [AI], and the Internet of things (IoT) significantly increase data availability and transparency while encouraging greater financial inclusion and innovation.⁸ These innovations improve existing business processes, but can also serve as the intermediary for new business models that radically change the financial sector, enabling services and markets to be automated, commoditized and customized.⁹ Mobile platforms and data analytics are bringing sophisticated financial services to wider demographics.¹⁰ For example, the shift from cash to digital payments in emerging economies can unlock USD 4.2 trillion of new deposits into the financial

system.¹¹ Artificial Intelligence is projected to lift global GDP by an estimated USD 15–20 trillion by 2030.¹²

Most importantly, USD 68 trillion in wealth will move between generations over the next 25 years,¹³ which is enough capital movement in the time frame necessary to achieve the ideal 1.5°C warming scenario – but only if these dollars are directed towards battery technology, carbon sequestration, reforestation, renewable energy, resource efficiency, and electrification. The capital is there, but where these resources end up are heavily influenced by how this capital moves.

In this report, we explore how Climate Fintech is accelerating the “greening” of capital flows, with the potential to make every citizen a climate-conscious asset owner. We also analyze three distinctly different but equally important markets of China, Europe and the US, their respective financial decision-makers, and how Climate Fintech opportunities are emerging in these places. **The tides of decarbonization have reached our shores – now we must build the best surfboards we can, and paddle out to ride these waves.**

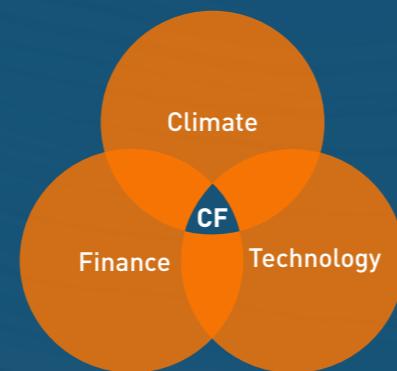


WHAT IS CLIMATE FINTECH?

Climate Fintech

digital financial technology that catalyzes decarbonization

Climate Fintech is simply the intersection of climate, finance, and digital technology. These digital innovations, applications, and platforms serve as crucial financial intermediaries and mediums between all stakeholders pursuing decarbonization.



2.1

History

Before focusing on Climate Fintech, it is important to acknowledge previous work and exploration around "Sustainable Digital Finance" which is directly related to this ecosystem. In 2017 the United Nations created the Task Force on Digital Financing of the 17 Sustainable Development Goals (SDGs), which address overarching humanitarian issues such as reducing poverty, gender equality, quality education, among many others. **Findings by the UN Task Force are centered around the concept that digitalization helps to channel citizen capital.** This is further bolstered by the Sustainable Digital Finance Alliance (SDFA), founded by UNEP and Ant Group (formerly known as Ant Financial), which explores how fintech-powered innovations can reshape the financial system in ways that better align it with the needs of sustainable development. Additionally, Fintech was identified as one of the three major research topics under the G20 Sustainable Finance Study Group for its potential to scale up climate finance.¹⁴

For the purposes of this report, we are focused specifically on decarbonization, which relates most directly to:

- **SDG13: Climate Action**
- **SDG7: Clean & Affordable Energy**

Fintech, when applied in these contexts, has the maximum potential to reduce greenhouse gas emissions such as carbon dioxide (CO₂) and methane (CH₄), though ultimately this pursuit also has knock-on effects which benefit many of the other Sustainable Development Goals.



2.2 Downstream and Upstream Benefits

Hindsight is 2020.

While Fintech was about disruption and improvement of financial processes, Climate Fintech is about the application of Fintech with the primary goal of decarbonizing the planet. By looking through a **'climate' lens** – the tools we focus on reduce an array of GHG emissions through the ways citizens decide, spend, and save as well as by how institutions transact, invest, and trade.

Applied technologies such as big data, AI, blockchain, and crowdfunding are not new; rather it's the application of these technologies in this "decarbonization" context that warrants investigation. These innovations make data processing, analysis, and availability much faster, transparent, and cost effective.¹⁵

These technologies now help to make customers more conscious when shopping for clothing and travel, assist asset managers in building more climate-aligned portfolios for their clients, allow insurance firms to better analyze weather perils, and give regulators better tools to monitor and measure carbon emission data from the largest corporations – holding them accountable to new policies and shareholder resolutions.



Benefits of Climate Fintech are wide-ranging – with both downstream benefits to the average citizen and developing economies, as well as upstream benefits to C-Suite decision makers and asset owners.

Downstream Benefits

of Climate Fintech **empower citizens, giving them access to energy and banking infrastructure which can improve quality of life.** "Until we see voices on climate that reflect the global community, we're not going to have the right folks in the conversation. We need the voices of women, youth and people from the Global South to challenge conventional thinking and bring justice into the conversation," explains Katharine Wilkinson of **Project Drawdown**. In the Global South, this often means enabling people to live with a lower carbon footprint, by providing given small-dollar access to energy for cooking, electric transport, and mechanized agriculture without overbearing externalities.

For other citizens, climate fintech enables and educates consumer choices, so one can purchase clothes from ethical sources or offset travel activities. **Project Wren** allows consumers such an opportunity to calculate their emissions based on their lifestyle choices, and then take definitive action to mitigate their impacts, such as supporting clean cooking initiatives for refugees in Uganda. Many emerging markets lack basic infrastructure when it comes to electricity, so microgrids, decentralized sources of power, and favorable credit structures are all paramount. Pay-As-You-Go platforms allow for these systems to be financed on an as-needed basis at affordable costs. Digital payments support compromised central banking infrastructures, allowing citizens without a traditional bank account to store credit on mobile phones and make transactions. Crowdfunding provides new sources of capital to local projects and small-dollar methods for communities to invest in themselves.

Upstream Benefits

of Climate Fintech are vast and diverse, products which impact large-scale financing decisions, investing behavior, and risk analysis modeling. The number of financial institutions incorporating the Science Based Targets initiative (SBTi) is growing rapidly, and with enforceable obligations around net-zero commitments, these institutions need powerful technologies to help them sift and sort the investable universe based on carbon and climate risks. This need is compounded by increasingly attractive economics for renewables and electrification, and the simultaneous collapse of coal.¹⁶

Asset Management firm **Ninety One**, together with the **World Wildlife Fund** now explore how geospatial satellite data can help analyze country-level natural resource use and commitment to conservation, drawing implications on sovereign debt performance. Tools such as **OpenInvest** and **WISE** provide unique portfolio insights, justification and logic as to why specific decarbonizing investment decisions are made – valuable talking-points between wealth advisors and their end-clients as capital shifts to a more socially-conscious generation.¹⁷ **Sustainalytics** leverages big data and AI to help incorporate environmental, social and governance (ESG) considerations into investment decision-making. This data allows for easy integration into internal or third-party systems (such as **Bloomberg**), and automated delivery allows for the creation of databases, reports and dashboards to facilitate further analysis based on thematic fund theses or regulatory requirements.

When comparing both downstream and upstream benefits of Climate Fintech, there are **elements of overlap** – benefits which are experienced by all stakeholders and market participants. These include:

- **Access**
greater accessibility to make climate-friendly decisions
- **Efficiency**
faster processing power, and thus more informed decision-making
- **Transparency**
increased visibility on source data and money flows of a transaction
- **Accountability**
verification and enforcement on carbon commitments
- **Education**
all stakeholders to learn about climate challenges, how to finance solutions, and how to participate with their financial assets

Unlocking Climate Fintech innovation can be instrumental in accelerating the clean energy transition when governments and corporates have the foresight to adopt these technologies, and when supportive ecosystems enable these startup companies to succeed. The following pages illustrate in graphic representation the Climate Fintech ecosystem as we see it, including relevant stakeholders, Climate Fintech business models and the underlying technologies that power these innovations. Lastly, we map the valuations trends of the 250 companies we have compiled so far in our ever-growing database.

3

ECOSYSTEM MAPPING

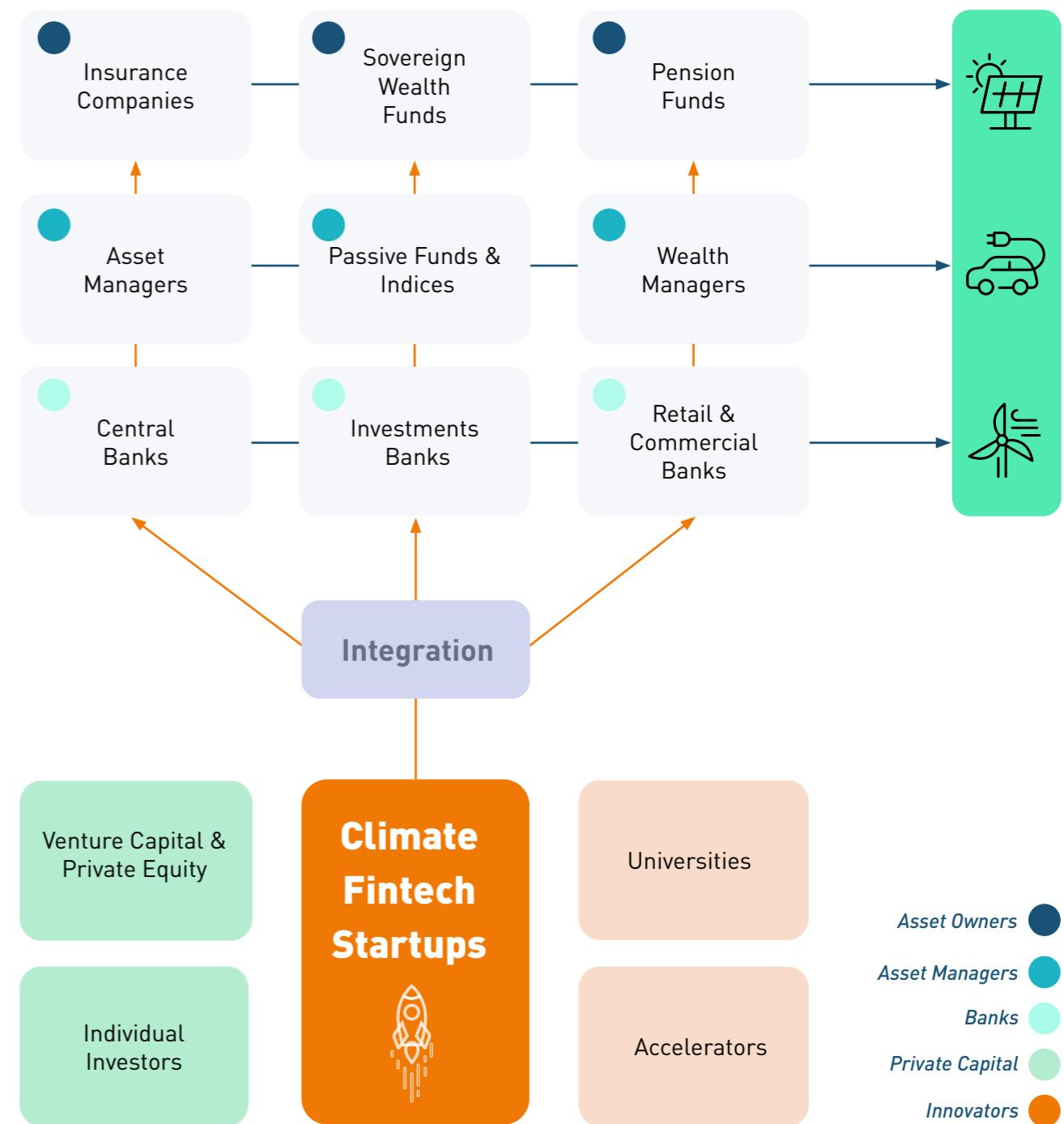
"A sustainable future can only be predicated on a financial system that enables the rapid transition of key industries to green practices whilst accelerating the innovation of new market makers defining breakthrough business models. Climate change is unprecedented in its challenge for humankind and calls for action across all stakeholders – traditional finance, policymakers, big business and of course the innovators breaking barriers. The role of Fintech will undoubtedly be a defining factor in the future of climate finance."

— Nicole Anderson
Managing Partner, Redsand Ventures

3.1

Key Stakeholders

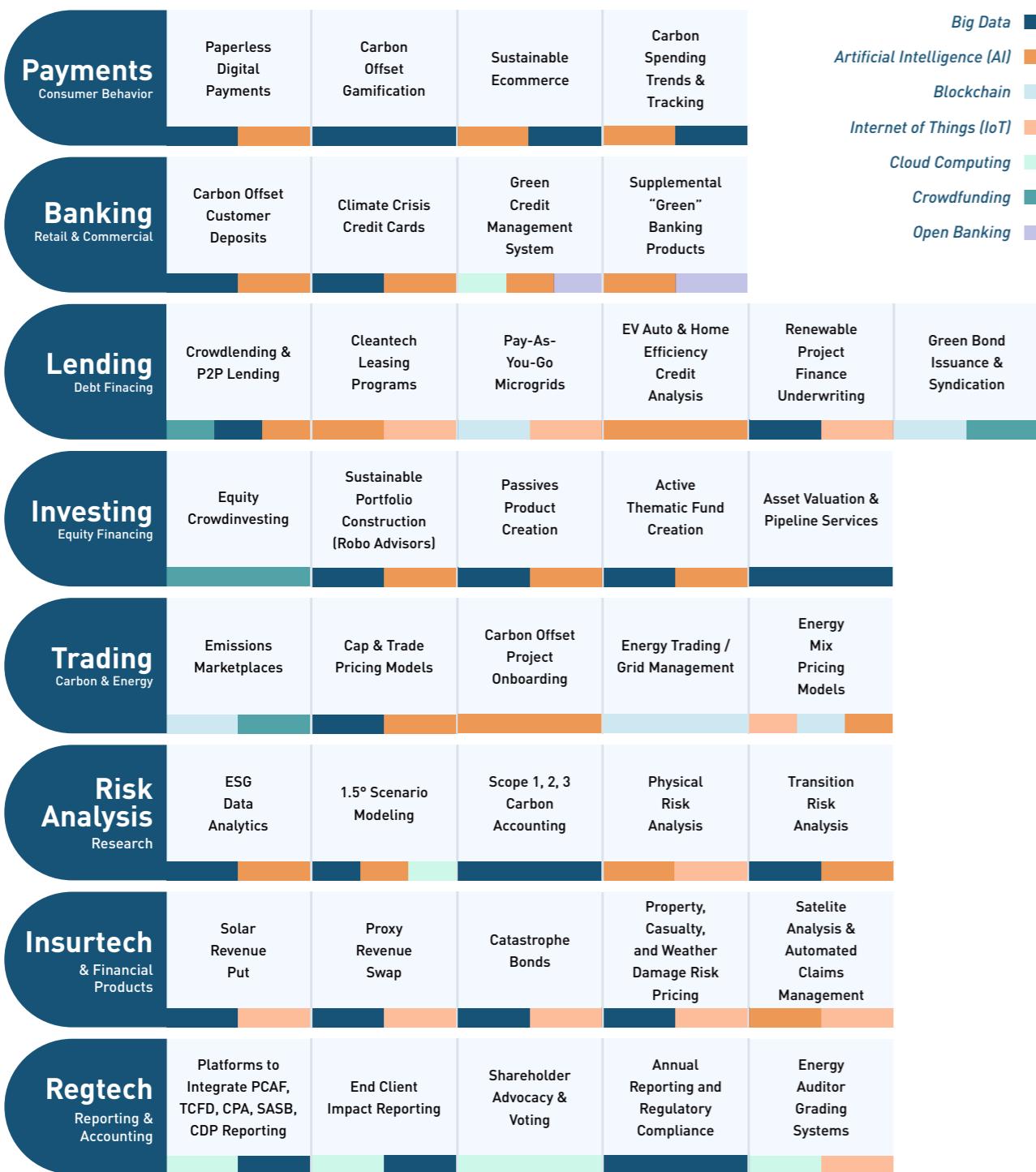
The graphic below represents a capital hierarchy of key stakeholders, and the pathway for Climate Fintech startups to integrate into the financial system, impacting the decarbonization of capital flows.



3.2

Business Models and Applied Technologies

Below are Climate Fintech business models which have been sorted based on their application within the financial system. Additionally, we have color coded these business models per the key on the right side, based on the applied technology or framework which is most commonly used by the business model.



Please note that we have not conducted a comprehensive survey, and the mapping makes no claim for completeness. It is rather a first step for a monitoring and exploration of the Climate Fintech landscape.

Applied Technologies

Big Data

The aggregation of large amounts of increasingly complex data from many different internal and external sources, unlocking opportunities for real-time business insights.

Artificial Intelligence (AI)

Advanced computer science and algorithms to analyze vast datasets, derive patterns to predict behavior and prices, automate decisions or provide recommendations, dramatically increasing decision-making capabilities. Machine learning is a type of artificial intelligence that provides systems the ability to automatically improve from experience without being explicitly programmed.

Blockchain and Distributed Ledger Technology

('DLT') or blockchain is a shared database of trusted transactions distributed across large peer-to-peer networks. The encrypted, distributed nature of data on the blockchain and system of consensus makes it inherently secure, immutable, verifiable and transparent to store transactions.

Internet of Things (IoT)

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet.

Cloud Computing

Cloud computing is the on-demand and remote availability of computer system resources, especially data storage and computing power.

Big Picture Frameworks

Platform Marketplaces and Crowdfunding

E-commerce that connects potential buyers and sellers all within one digital medium to help buy, negotiate, or invest. This includes online platforms which syndicate both equity and debt for projects, giving access to new sources of project finance, and new participation with smaller investment increments.

Open Banking

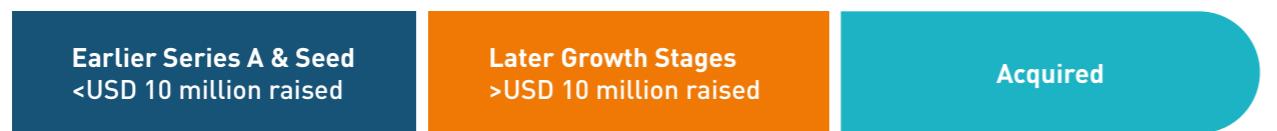
Granting third party access to banking data through application programming interfaces (APIs), which will drive competition and innovation in retail banking by providing consumers with more visibility, analysis and control over their finances.



3.3

Valuation Trends

Valuations and Ecosystem Trends



PAYMENTS

Consumer Behavior



BANKING

Retail & Commercial



LENDING

Debt Financing



INVESTING

Equity Financing



TRADING

Carbon & Energy



RISK ANALYSIS

Research



INSURTECH

& Financial Products

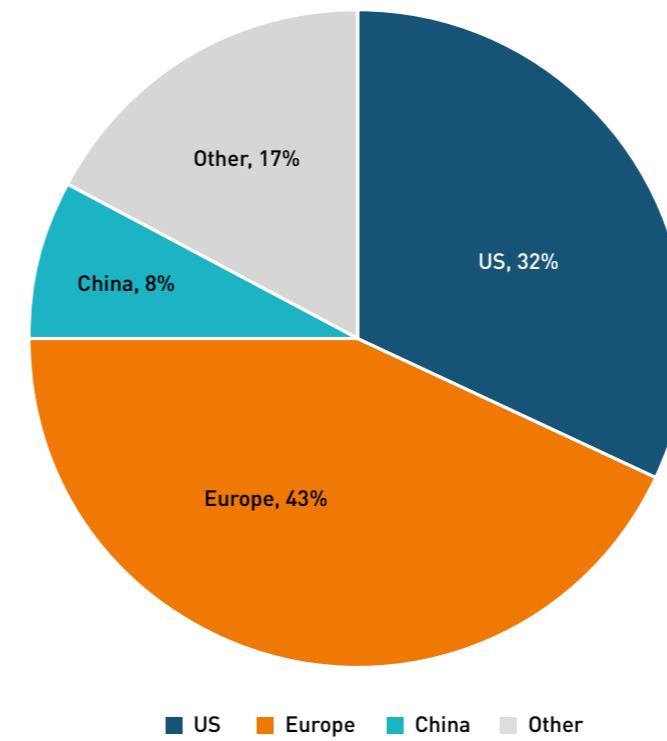


REGTECH

Reporting & Accounting



Geographic Trends of Climate Fintech Startups



Geographic breakdown of our Climate Fintech database as of November 1, 2020. The 250 companies in this database are not exhaustive, and we expect these ratios to change slightly as more information is collected in the coming years.

Valuation and Geographic Observations

- 75% of Climate Fintech companies are early stage – having received USD 10 million in corporate capital or less. This indicates this ecosystem is ripe for investment and de-risking initiatives which facilitate customer acquisition.
- The financial categories with the most activity are Investing, Payments (Consumer Behavior), Trading, and Risk Analysis.
- Risk Analysis is the category with the highest rate of exits, mergers, and acquisitions.
- Overall, there is commercial viability in a wide array of financial categories.
- Europe leads in Climate Fintech innovation, followed closely by the United States.
- China's 8% Climate Fintech representation has arguably tapped into more citizen usage than the other countries combined (See Ant Forest Case).
- "Other" Geographies of Climate Fintech activity primarily include Asia-Pacific, Africa, and Canada.

4.1

Payments

Consumers wield tremendous power. A united movement of citizen fiscal action can catalyze change faster than the actions of the largest investors. Spending habits are directly tied to carbon emissions – the way citizens allocate their hard-earned money does not go unnoticed, and purchasing trends drive product development. For this reason, the increasingly conscious-consumer must be given the tools to make intelligent decisions, and share their discoveries with friends and family.

Today, almost all of the top US Airline carriers now offer carbon-offsetting options for commercial flights, with JetBlue actually achieving carbon neutrality on all domestic flying in early 2020.¹⁸ **TripIt** calculates carbon footprint using the Greenhouse Gas Protocol, while taking into account factors like distance, flight class, and environmental elements. Within eCommerce, Amazon now offers eco-friendly shipping, eco-friendly packaging, or both. While air travel is currently tampered due to the COVID-19 pandemic, online shopping has skyrocketed, highlighting the increasing need for the most sustainable model possible. As public attitudes shift towards climate consideration, there is a tremendous opportunity, and subsequent innovation efforts to help citizens transact in the most ecologically-minded ways, with brands who are offsetting the GHG impacts of their manufacturing, supply chains, products, and services.

In 2019, mobile payment transaction volumes reached USD 51 trillion, an increase of more than 28 times from six years ago.²⁰ Digital payments are inherently less carbon-intensive than traditional banking. Paperless statements help limit deforestation and online banking saves a drive down to the local branch just to deposit a paycheck. Zimbabwe's **EcoCash** is already leading this trend, with 90% of the country's banking customers registered on its mobile payment platform. CEO Natalie Jabangwe explained that when the COVID-19 cases began to spike, "we were able to repurpose and retool very quickly, removing transaction fees for all companies paying employee salaries". This limited the amount of physical banking activities necessary, while helping to mitigate the virus and normalizing online banking as a cultural norm.

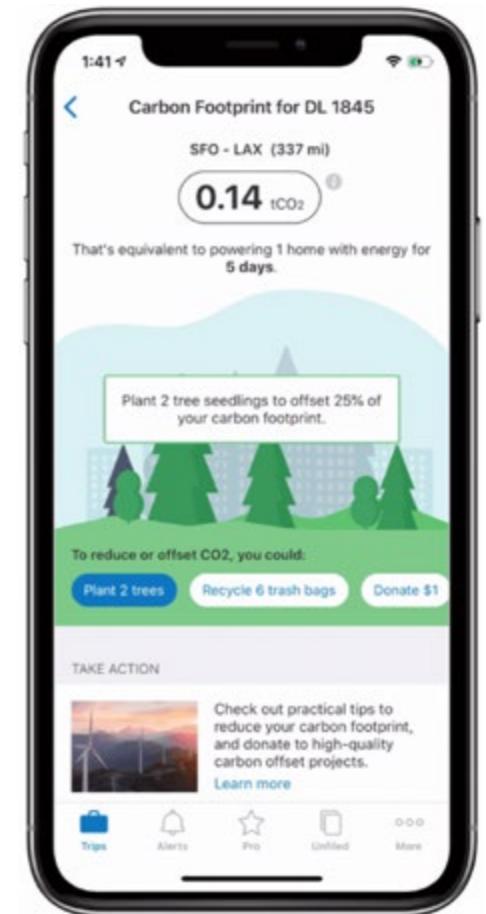


Image source: TripIt.com¹⁹

Leveraging the convenience and speed of mobile payments has been hugely impactful in reducing emissions tied to traditional banking activities, but now banking customers are becoming motivated, and in some cases incentivized to actively pursue decarbonization through gamification. Digital retail consumer finance channels such as **Alipay** and **WeBank** are innovating new ways to encourage consumers, retail investors, and enterprises to adopt green practices through their mobile payment platforms. In many cases, additional financial incentivization or healthy competition help to attract more users to carbon accountability.

FOCUS AREAS AND CASE STUDIES

4



Case:
ecountabl

Ecountabl offers a tool that helps consumers see environmental and ethical standing of the brands they spend money on. The platform enables users to rank the personal values they care most about, from gender equality to climate protection; see which companies are living up to their values, and browse hundreds of alternatives. It also securely connects credit card spending activity so that customers can see the real impact they are making through their shopping patterns and via the brands they support. The app also ties in with social media, so users can share and start conversations about value-aligned brands. Ecountabl is also developing business tools to enable banks and retailers to provide values-driven customer experiences and rewards. Ecountabl's team gathers some of best climate and social data from a vast array of data-providers, amalgamating as many as 48 indicators into a rolled up "eccountabl Score." Some of their data sources are JUST Capital, Gender Fair, Official Black Wall Street, CSR hub, and We Are Still In. As scalable tools like eccountabl are normalized in the consumption process, brands will be forced to improve their environmental and social stewardship.

“The goal is to use it as an everyday tool, translating accessibility of information into leverage for the average citizen, and motivate corporate accountability through customer attention, not just investor attention.”

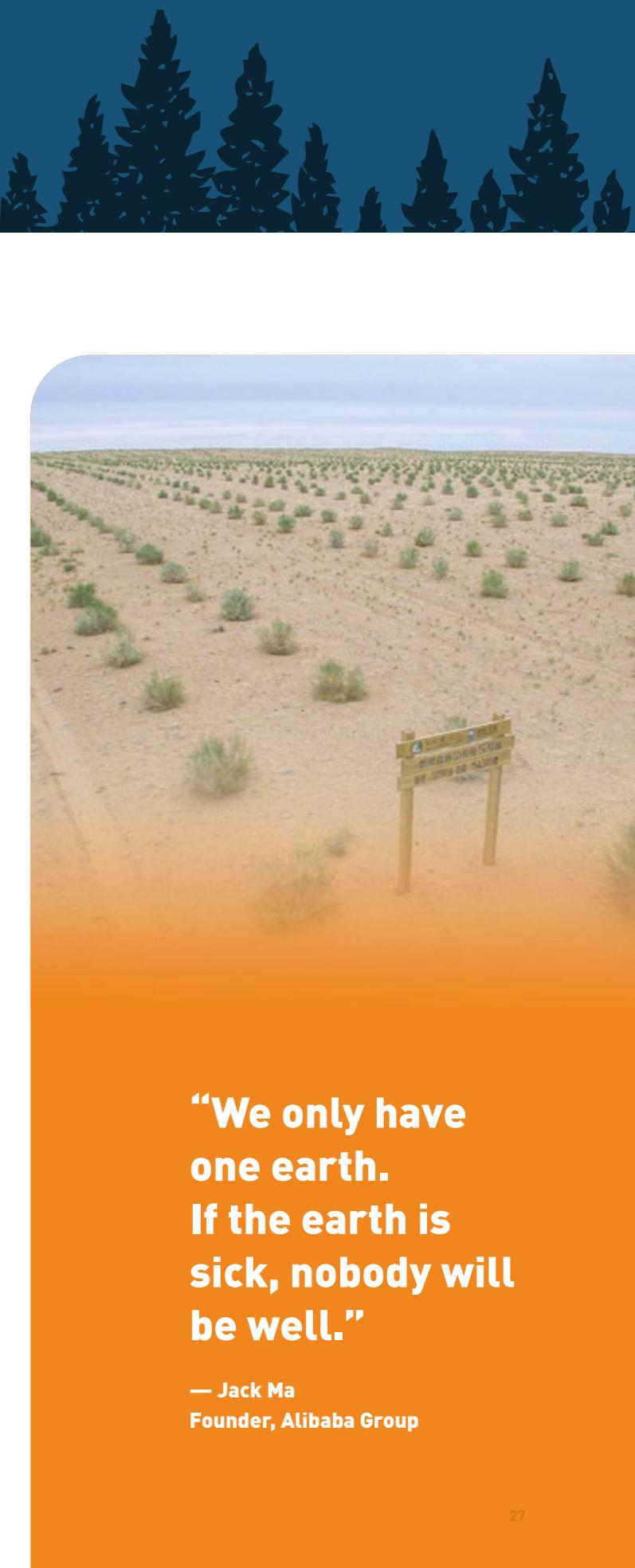
— Andy Burr
CEO, eccountabl

Case:
Ant Forest

Ant Forest is a green initiative launched on Alipay mobile client by Ant Group which combines mobile transactions and gamification to encourage a low-carbon lifestyle. Since its inception in 2016, the platform has experienced unparalleled traction in China, having onboarded more than 7% of the world's population, resulting in the planting of over 120 million trees in just three years.

Ant Forest reduces carbon emissions and protects the environment by incentivizing consumers to change their behaviors for greener lifestyles. Users are encouraged to take low-carbon actions such as taking public transport, paying utility bills online and booking tickets online. **These carbon emission reductions are recorded and users are rewarded 'green energy' points, which they accumulate to eventually plant an actual tree.** Users can view real-time planting of trees in their chosen conservation areas via satellite on the platform. In addition, users can help their friends virtually-water the trees as a way to maintain their social connections. Users' achievements are also ranked to encourage them to outdo their peers in living greener lifestyles.

As of March 2020, more than 550 million people have joined the Alipay Ant Forest, reducing carbon emissions by 11 million tons, greening a total area of 112,000 hectares in northwest China. The project has become China's largest private sector tree-planting initiative. Besides the meaningful environmental benefit it provides, Ant Forest also serves as an important tool to improve Ant Financial's user-stickiness and customer loyalty. The gamification of daily low-carbon actions shows how technology can transform our world by harnessing the ecological motivations of citizens at scale.²¹



4.2

Banking

When it comes to decarbonization of financial flows, banks are uniquely positioned as intermediaries, as both retail and commercial banks have the capacity to finance entrepreneurs and institutions which are committed to tackling major social and ecological issues. To stay within ecological limits, tools that enable and educate retail customers must be integrated, while on the commercial side, fintech can be used to increase transparency, de-risk and scale up project finance.

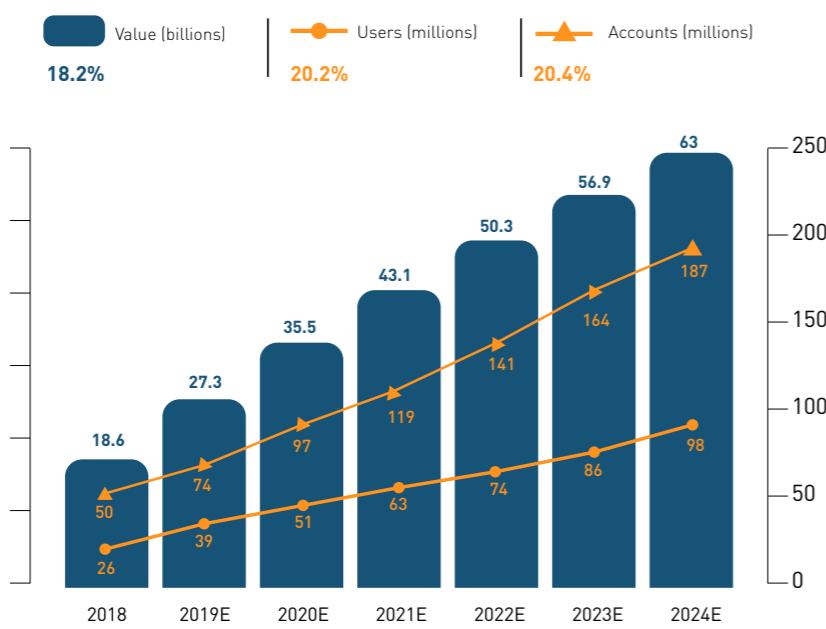
Retail Banking

The retail banking industry is in the midst of an identity crisis. Challenged by more tech-savvy Fintech alternatives, over 35% of all banking revenues could be at risk if incumbents fail to innovate and adjust.²² While commercial banks are also now using some fintech solutions, the effects of digital transformation are acutely felt in retail banking, which taps into citizens' needs for both convenience and accessibility. This trend has been visibly accelerated by COVID-19, as large swaths of the population were forced

to stay home while handling money matters, switching to 'neobanks', also known as 'challenger' banks.²³ **COVID-19 has accelerated trends that were already occurring, and one of those is the shift towards digital banking.**

Neobanks and their respective corporate valuations have skyrocketed recently on the back of attractive offerings such as personal finance management (PFM) features, low rates, and superior user experiences. This increased consumer interest is stimulating competition globally – between both incumbents and neobanks. As neobanks gain customers and market share, banking giants have first responded in the areas easiest for them to fix: mobile banking, lower fees, and higher interest rates on savings accounts. However, it is much harder for established institutions like JP Morgan and Bank of America to untangle their intertwined business with fossil fuel companies. **This is where neobanks have a substantial advantage – by offering ethical positioning, transparency, and simple financial product offerings which have a positive environmental impact.**

Global Neobank Value, User, And Accounts



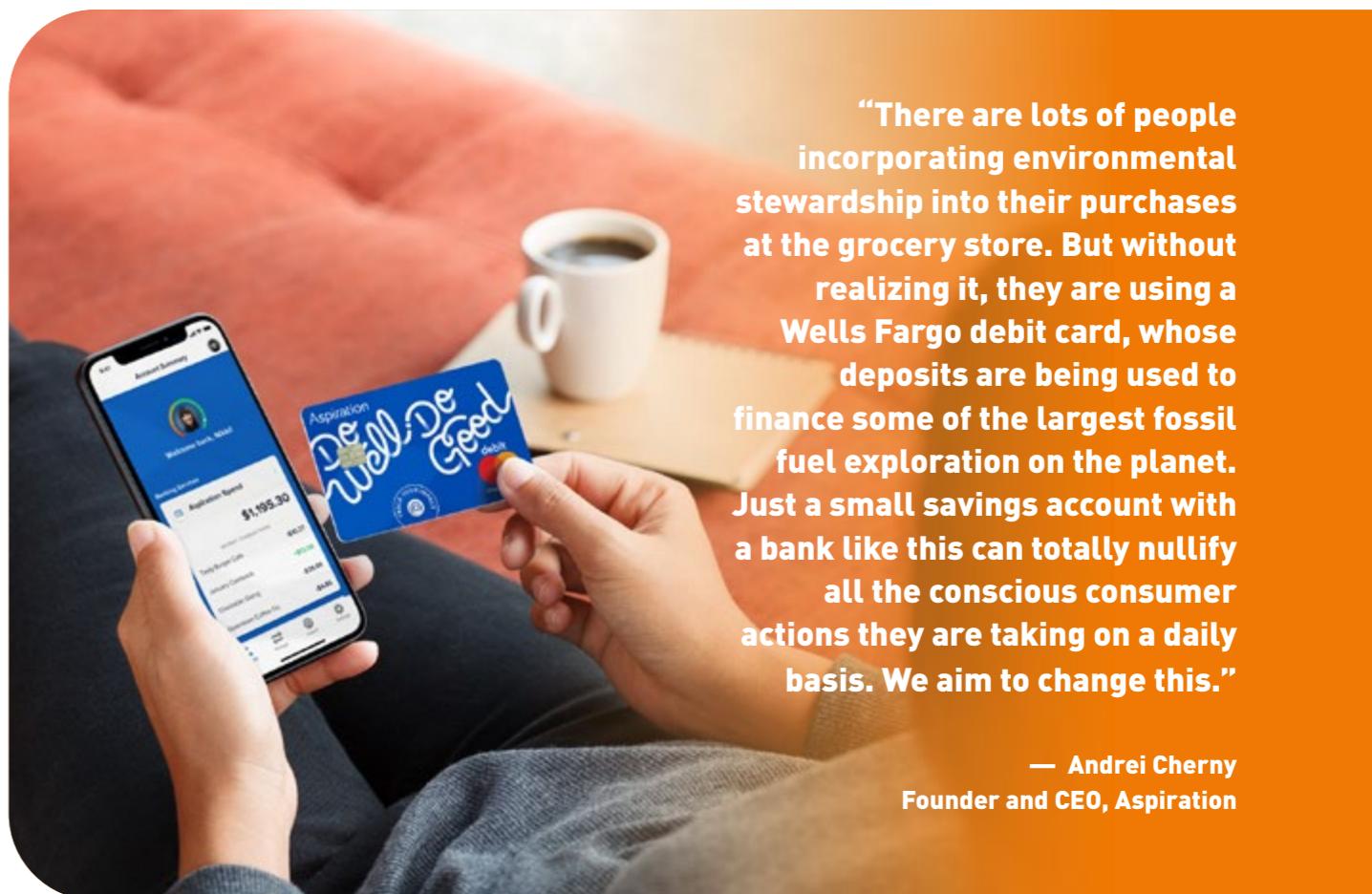
Global neobank customers are projected to grow to 98 million by 2024²⁴

Source: Business Insider Intelligence, Digital Banking Ecosystem, Insider Inc, 2019.

Banking With Values

The inherent misalignment of interests and values in the banking sector has provided an immense opportunity to create 'green neobanking' businesses. Consumers didn't have a core financial partner which was built around their ethical concerns, so these offerings are a strong product-market fit. There is now a clear acceleration of the understanding that people's financial life and the daily decisions they make are inextricably linked, as roughly 65% of digitally-active global consumers use fintech services²⁵.

Case: Aspiration



"There are lots of people incorporating environmental stewardship into their purchases at the grocery store. But without realizing it, they are using a Wells Fargo debit card, whose deposits are being used to finance some of the largest fossil fuel exploration on the planet. Just a small savings account with a bank like this can totally nullify all the conscious consumer actions they are taking on a daily basis. We aim to change this."

— Andrei Cherny
Founder and CEO, Aspiration

Since its inception in 2013, Aspiration has grown its customer base to over 1.7 million people. As a socially-conscious, sustainable alternative to the big banks, Aspiration found their stride by releasing a suite of banking products which focus on the reduction of GHG emissions. These include Aspiration Impact Measurement (AIM), which lets customers track personal impact as they shop, and shows businesses doing good for people and the planet. Aspiration's Planet Protection automatically offsets the climate-changing carbon dioxide from every gallon of gas that is purchased. This sustainable retail loop is completed by Plant Your Change™, which rounds up the cents of every dollar spent to go towards planting trees. Today, large banking incumbents are reaching out to Aspiration for strategic direction, in part to learn about the deployment of these products and strategies.

Commercial Banking

Commercial Banks are also key to decarbonization, though their adoption of, and integration of fintech are subject to a long vetting process and intense regulation. As a result, the most common applications in commercial banking are around credit analysis and project finance of renewable energy, electrification, and resource efficiency businesses. Dutch-based **Triodos Bank** has been financing and advocating decarbonization for many years, but has only recently explored how fintech can help with their business. The bank is looking to leverage artificial intelligence to parse alternative data, such as utility and bill payments, to ultimately help design lending models targeting underbanked markets, and to help underwrite and issue additional green bonds. Triodos is also evaluating how other subsectors, such as agricultural technology (AgTech) can help them meet both their impact and financial criteria. Another element of Climate Fintech in commercial banking is the issuance and verification of green bonds using blockchain and decentralized ledger technology, which we will explore later in our “Lending” chapter.²⁶

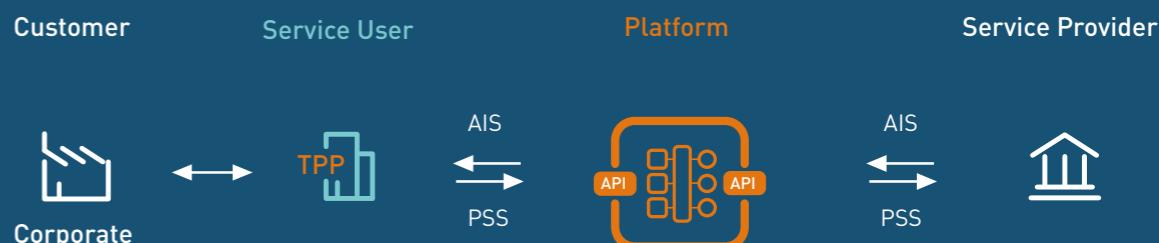
Big Picture Framework: Open Banking

“The bigger Open-Banking-enabled ecosystems get, the bigger the advantages become for banks, fintechs and consumers – both economically and ecologically.”

— Sven Siat
Head of Connectivity, SIX

Historically, banks have always maintained exclusive access to their customer data – privacy has been paramount to maintaining customer loyalty and trust. However, today's **banking is not just an industry, but an ecosystem** – an interconnected web of partners, providers and customers which requires more active participation. Open Banking is the idea that banks should open up their systems, actively develop this ecosystem, and allow third parties to access their data. This is a two-way street, as collaboration with Fintechs can provide enhanced insights, improved products, and customized services to their end-banking customers. Open Banking is becoming an increasingly important business-driver towards digital transformation, allowing banks to determine gaps in their technology, assemble open banking teams, and integrate new innovations while minimizing disruption to existing processes. Most importantly, banks can now make strides in their offerings to customers while ensuring the security of sensitive customer data.

HOW IT WORKS: OPEN BANKING



Current applications on Platform

AIS Account information for accounting solutions and financial institutions

PSS Payment submission for accounting solutions and financial institutions

TPP Third-Party Provider

Source: b.Link, SIX Group

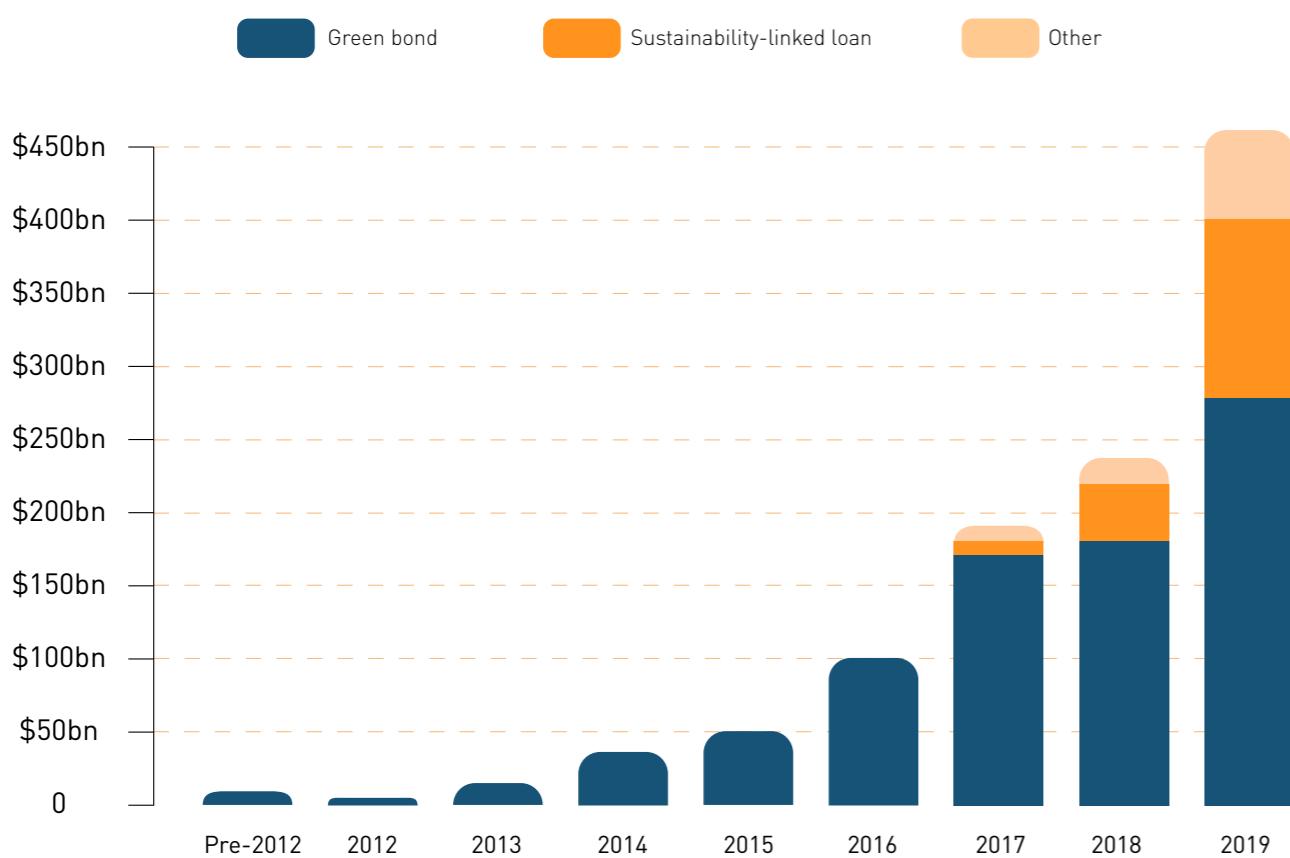
Open Banking works when banks, Fintechs and other verified third-parties exchange data, grant access to APIs (Application Programming Interfaces), and share mutually-beneficial learnings and insights as a result. These APIs give developers on both sides access to new data sets that can be used to create fresh products and services, such as account aggregation and budgeting tools. More advanced Open Banking participants are reaping the benefits, sharing multiple APIs and platforms to facilitate developer usability. These efforts drive multiple dimensions including new revenue, cost cutting, and customer loyalty. Oftentimes, third-party developers become banking customers themselves. This exchange of data is voluntary, so in order to maximize participation from stakeholders, it is important to structure Open Banking initiatives so that both sides have clear benefits.

“Current trends show that consumers are moving into ecosystems that combine different offers into one seamless buyer journey,” explains Sven Siat, Head of Connectivity at SIX. “In the retail segment for example, banks could introduce a new offering targeting customers who are increasingly conscious of the environment. Dedicated applications that link directly to a bank account and analyze transaction data in real-time could not only help save money, but can also translate data into how much carbon is consumed.”

Lending

Debt financing is an enormously important component of facilitating investment and initiating projects. A lender assesses a borrower, and then gives them capital based on how likely they believe repayment to be. This type of analysis and risk/reward exchange is thousands of years old, and it is the fundamental financial structure of swiping a credit card, leasing a car, or building a massive offshore wind farm. Most large infrastructure projects are financed with project finance, and most project finance is predominantly debt-financed rather than equity-financed. In the renewable energy sector, certain tax incentive structures tend to drive the debt-to-equity ratio and overall deal structuring. The digitalization of this core financial process has been both extremely disruptive, and beneficial. Now Fintech applications like P2P lending, Artificial Intelligence, and Blockchain are demonstrating their immense value by increasing accessibility to debt capital, while improving the processes of credit analysis, structuring, counter-party verification, loan issuance, and regulation among others.

Sustainable Debt Issued By Instrument Type, 2012-2019



Source: BNEF
<https://str2020.generationim.com/chapters/economy-and-finance#entry--5563>

Banks have already started to implement blockchain technology to help with bond issuance, including green bonds. To be considered "green bond" status, a bond issue has to undergo detailed disclosures around its environmental impacts and comply with the 'Green Bond Principles'.

There are several benefits of using blockchain for green bond issuance:

- 1** Reduction of intermediaries
- 2** Efficiency of distribution and settlement
- 3** Increased transparency and credibility allowing for more rapid verification

The foundation of a blockchain-enabled green bond is a smart contract with built-in encryption features, making a transfer of value virtually fraud-proof.²⁷ Blockchain presents significant cost-saving opportunities by reducing the need for intermediaries, which in turn creates an opportunity for smaller decarbonization projects to be included and financed. Blockchain also enables automated impact reporting, coupon payments, and "Know Your Customer" (KYC) verification. Some of the most valuable benefits are still to be realized by integrating IoT sensor capability to determine asset-level performance after a loan is issued.²⁸ In February 2019, BBVA issued the world's first Green Bond using blockchain of EUR 35 million utilizing proprietary DLT technology, demonstrating to the banking sector that this Climate Fintech has real-world applications.²⁹

Big Picture Framework: Crowdfunding and Platform Marketplaces

Crowdfunding is the business model of financing a project by raising small amounts of capital from large numbers of people, using a digital platform marketplace. Over the last decade this practice has seen tremendous success, resulting in the creation of thousands of platforms which finance projects in a vast variety of industries and structures. In 2019, the value of the crowdfunding market was USD 100.32 billion and is projected to reach USD 224.67 billion by 2024.³⁰ Examples include philanthropic crowdfunding for a neighborhood theater program, or equity participation by accredited investors in a coveted New York real estate project. In either case, the benefits include:

- 1** Increased visibility for the project sponsor
- 2** New non-traditional sources of capital

3 Newfound access to alternative investments by participants

4 The ability to participate in tangible projects for smaller increments

Although there are many structures, the Crowd lending segment accounts for the largest crowdfunding market share by raising debt capital, and has been applied to help finance renewable energy projects and decarbonization technologies. Two examples are **Ecologico Investments** and **Trine**, both Crowd lending platforms which offer the opportunity to finance decarbonization projects in developing economies.

**Case:
Powerhive**

Powerhive is the first privately licensed energy provider in Kenya, providing rural villages with solar powered mini-grids and electric motorcycles, and catalyzing local businesses through affordable loans and profit sharing. The Powerhive Micro Business program gives customers loans and guidance on how to use this electricity to power new businesses, and then receives payments from a portion of that business income. These successful businesses inspire others in the community to create their own enterprises, which stimulates further economic development. Electric stoves also eliminate the

need to chop down trees or use charcoal. Once hand-milled, grain can now be processed more efficiently by machines, and chicken eggs are incubated with heat lamps.

Now customers get convenient, affordable and reliable utility services, governments reach their electrification and renewable energy targets, and investors get access to bankable investments in new, high-growth markets. Powerhive believes this model is one which could serve Africa for generations.



**Case:
Mosaic**

Mosaic is a well-known US-based residential solar financier, which works with homeowners and contractors across the nation to provide financing options available for solar energy systems, batteries, and energy-efficient home improvements. Initially, Mosaic started by utilizing a crowdfunding model, where investors could issue loans to finance solar projects in exchange for a small amount of interest in addition to their original principal. Using this model, they were able to finance USD 20 million in rooftop solar from a community of 4,000 individual investors. Despite this success, the company had very little traction with VCs, only gaining major interest when Prince, the legendary musician invested in the startup. With newfound visibility, and the breakthrough of new loan structures allowing for the amortization of solar tax credits up front, Mosaic saw an opportunity to scale its impact and its business. BNP Paribas, one of the largest banks in Europe, offered a USD 200 million warehouse line of credit to Mosaic, allowing them to finance nearly 10 times the quantity of solar than during their crowdfunding days. While institutional capital has nullified the model of crowdfunding from a retail investor community, the number of solar projects that have been financed has grown exponentially. This tale reveals the inherent challenge which many crowdfunding platforms face – scaling crowdfunding platforms in small investments increments is often a delicate balance of managing compliance cost, investor relations, and onboarding viable projects. With the support of BNP Paribas, Mosaic has emerged as a top residential solar financier in the US. This platform marketplace continues to inspire other innovations, and is poised to finance billions in solar loans in the coming decade.³¹

“Fintech still offers a lot of opportunities to deliver better experiences, and to make it easier to adapt clean energy technologies.”

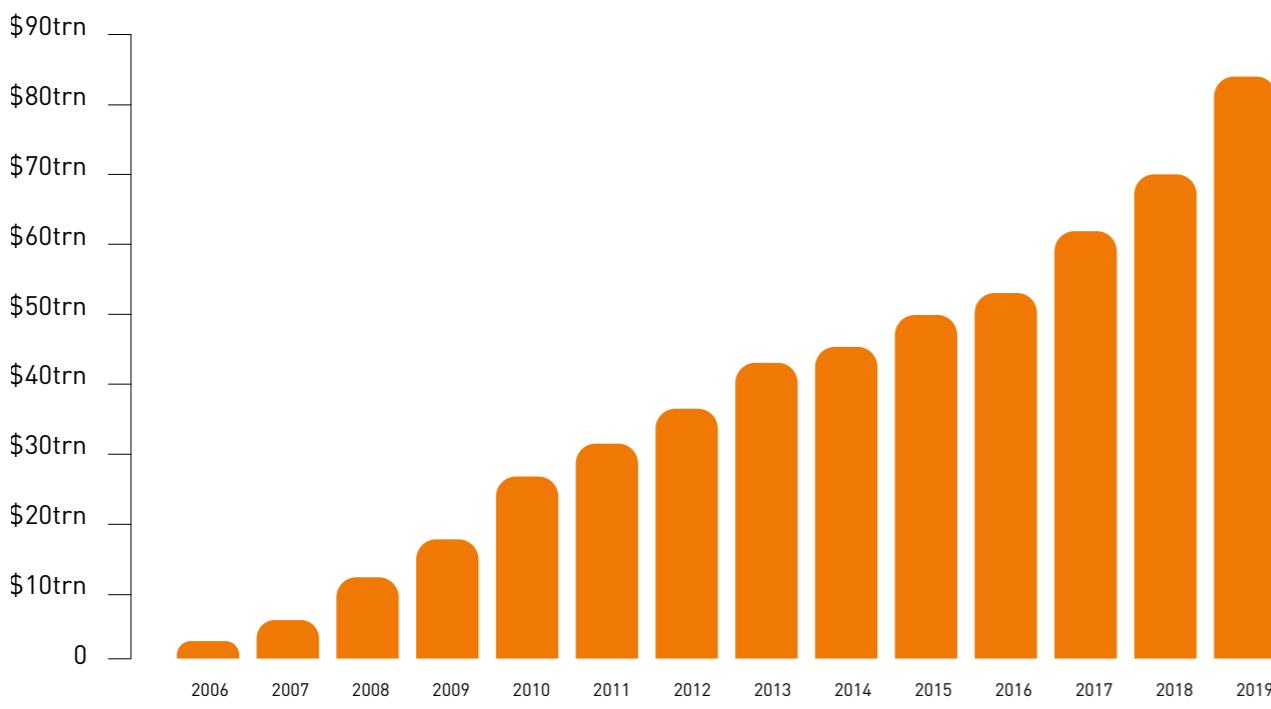
— **Billy Parish**
CEO, Mosaic



4.4 Investing

Investment activity in decarbonization has exploded, shattering all previous annual growth metrics and solidifying ESG considerations as a mainstream component of investing moving forward. This wave of ESG (Environmental, Social, Governance) investment is driven by several factors, including regulatory pressure, product proliferation, increasing climate change education of the masses, the shift of capital to younger generations, lower fees, and perhaps most importantly, superior investment performance. As Bill McKibben explained, "You better hope that you weren't long on oil going into the COVID-19 pandemic, because you not only helped to wreck the planet – you also lost your shirt." Indeed, **the majority of ESG funds outperformed the wider market over the last 10 years.³²** There is growing recognition that ESG analysis can identify investment risks and generate excess returns.

Responsible Investment Assets Under Management, Global, 2006-2019



Source: Generation investment management, Principles of Responsible Investing [PRI]

Asset Owners and Asset Managers are co-signing this movement, with nearly USD 100 trillion in AUM as members of the Principles of Responsible Investment (PRI). Many of these investors have also signed the Net-Zero Asset Owner Alliance, agreeing to transition their portfolios to "net-zero GHG emissions by 2050 consistent with a maximum temperature rise of 1.5°C above pre-industrial temperatures, taking into account scientific knowledge including findings of the IPCC, reporting regularly on progress, and establishing targets every five years in line with the Paris Agreement."³³ This incentivizes their portfolio holdings (large corporations) to embark on similar strategic journeys, changing business models to achieve net-zero operations. For example, BP just announced it will transform its entire business strategy, aiming to be net zero by 2050.³⁴

Four Ways to Lower Your Carbon Footprint

Take one less international flight per year

Take the train instead of the car

Eat maximum one piece of meat each week

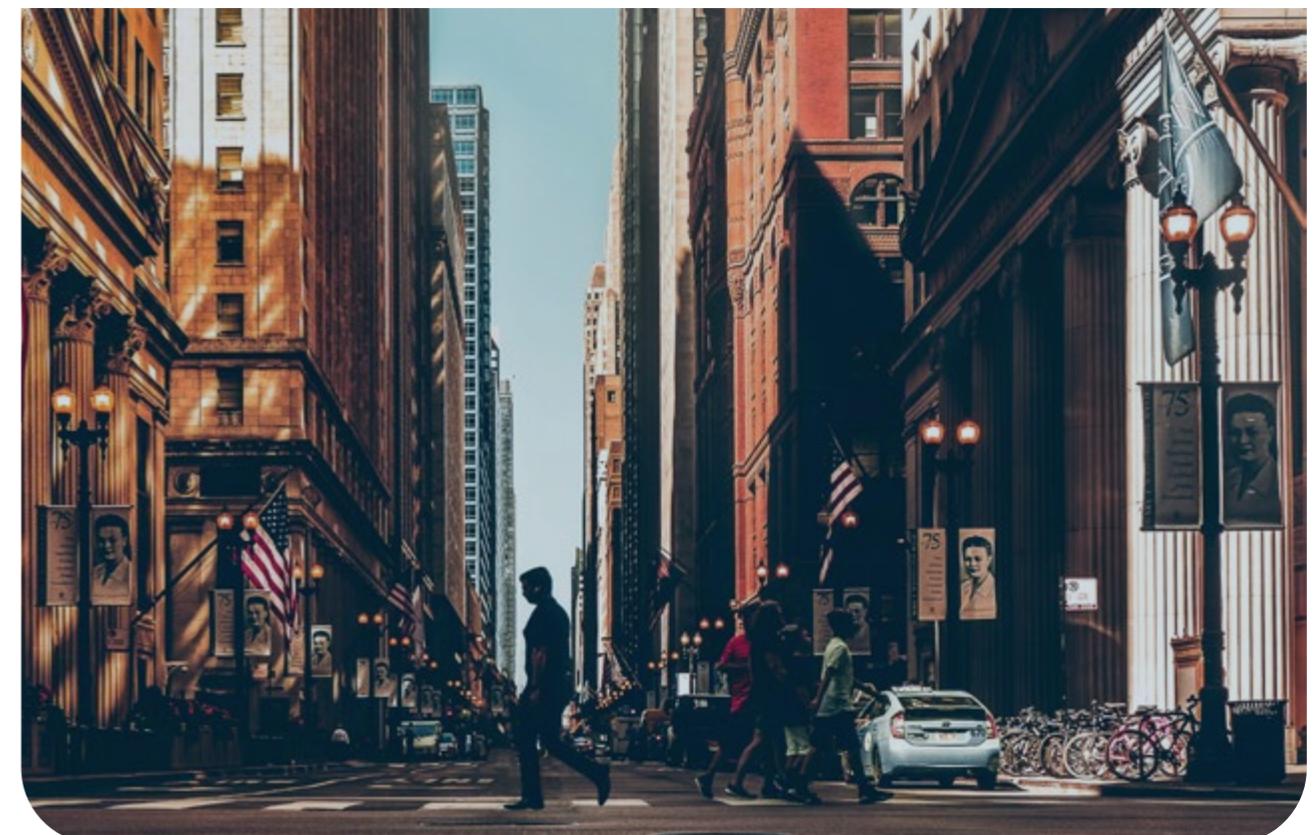
Move your pension saving to sustainable funds

0 500 1000 1500 2000

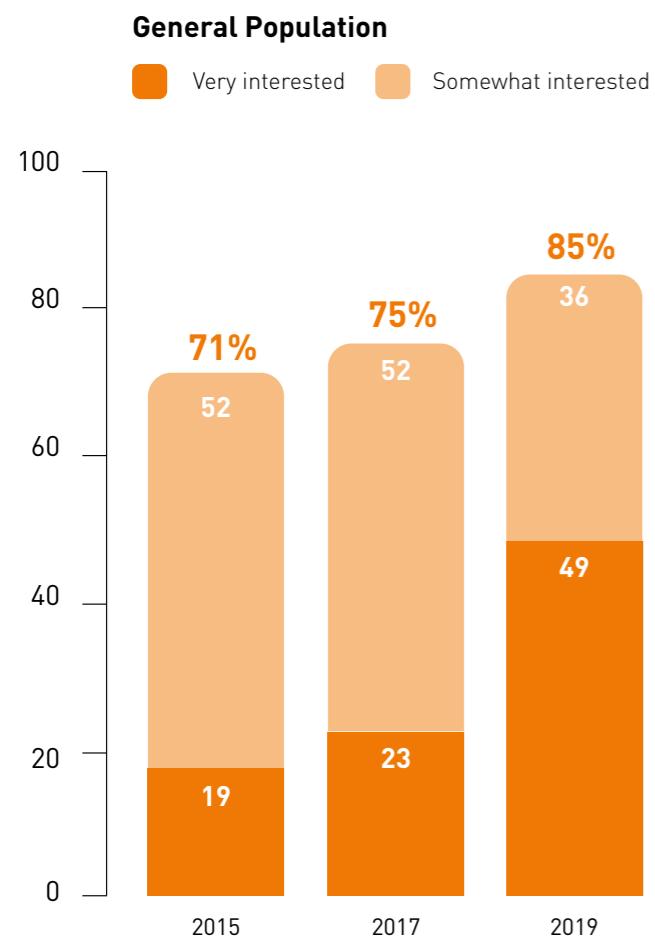
Can be
27x
more efficient
compared to the other activities combined

Source: <https://makemymoneymatter.co.uk>

Indeed, this shift in investment behavior is not just lip service or greenwashing. Moving a pension to a more sustainable fund is 27 times more effective in reducing your carbon footprint than not flying and becoming a vegan combined.³⁵ Millennials are cognizant of this reality, and starting to invest with values. According to Morgan Stanley, 95% of millennials are interested in sustainable investing.³⁶



Interest In Sustainable Investing Jumps In 2019



Source: Morgan Stanley. Data as of November 2019.

The encouraging movement of capital in this direction is facilitated by a number of Fintech applications, including platform marketplaces which give increased access to sustainable investments for average citizens, robo advisors, and other technologies which help wealth advisors build custom portfolios for their clients. Advanced AI and Big Data algorithms are now used by the largest institutional investors to make the most informed capital allocation decisions-based carbon accounting. **Climate fintech within the investing space is prolific, with plenty of emerging opportunities for entrepreneurs to participate.**

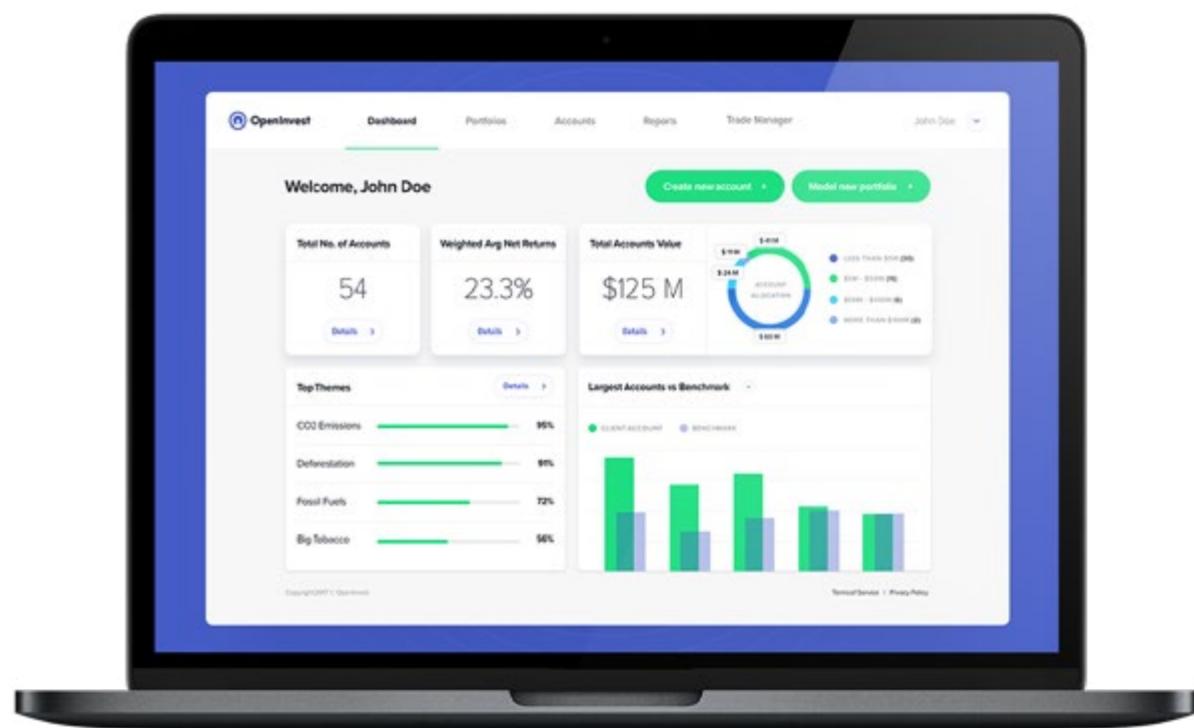
Case: OpenInvest

OpenInvest is a Turnkey Asset Management Program (TAMP) which uses Dynamic Custom Indexing technology to build passive, separately managed accounts for values-based investors. Their investment process allows investors to select issues of importance (for example climate change), and then builds a thematic portfolio of individual stocks designed to track the performance of the S&P 500 while maintaining this values-based lens. Individual stocks can also be added or screened according to investor preferences. The platform has seen considerable traction with retail investors who can invest as little as USD 3,000. However over 70% of the business is derived from wealth managers and financial advisor channels. OpenInvest also recently announced a platform partnership with Bank of the West, enabling their financial advisor community to execute robust, real-time customization of private wealth client portfolios through the proprietary Dynamic Custom Indexing (DCI) technology. Josh Levin, Co-Founder and Chief Strategy Officer explains his philosophy,

"ESG investing using technology is going to be the vanguard of capital allocation. Now financial advisors can hand a client an iPad and easily show, in addition to financial analysis, how many tons of carbon were avoided, how many trees were planted, and the gender composition of executive boards."

— **Josh Levin**
Co-Founder and Chief Strategy Officer, OpenInvest

Despite the company's enormous growth, the early days were not easy. After a stint in YCombinator, OpenInvest engaged with over 180 investors before raising their seed round. "Early-stage and Pre-seed impact investors are inherently some of the most risk-adverse, applying a triple-bottom line scorecard to a company with 4 months of revenues. This is the exact moment for that to be flipped, we need these early-stage impact investors to be more risk-loving and bring these climate-saving technologies to market as soon as possible."



Source: OpenInvest

Case:

Swell Investing

Swell, perhaps the first-ever impact investment portal, first came onto the scene in 2017. The company was an intrapreneurial venture within Pacific Life, a large insurance firm based in California. The effort also received external guidance from IDEO, a creative design-thinking firm. Pacific Life and IDEO combined forces to conceptualize, develop, and launch Swell Investing. Over the course of 18-months they took Swell from prototype to a SEC-registered Registered Investment Advisory, onboarding customers and increasing revenues. The concept was to have a pure expression of impact investing, allowing small-dollar investment in 6 different thematic funds, ethically-oriented baskets of 30–40 stocks a piece.

The strategy was championed internally for three main reasons:

1

The platform was digital and would add technology to an antiquated insurance infrastructure.

2

Pacific Life's existing client base was an older generation – this was an opportunity to attract younger customers.

3

This business model was direct to consumer, with no third-party involvement.

Swell's initial momentum saw customers invest an average of USD 10,000 each and Swell's fund managers would allocate this capital into their thematic funds. At its apex in 2018, Swell had tens of millions in AUM and several thousand customers, but this was not enough to appease Swell's corporate parents, who wanted to see faster revenue growth. The startup began to run out of operational runway, and these problems were compounded by **Pacific Life**'s reluctance to tap into its older, wealthier client base – who was never presented with Swell as an attractive new impact investing tool. Further strapped by budget cycles, **Pacific Life**'s investment was not structured as patient capital, so they could not give Swell the time needed to reach a "critical mass" of its younger demographic. Unfortunately, Swell dissolved their operations in July, 2019.

"Scaling an inefficient strategy becomes really expensive, really quickly."

— Carl Fudge
Co-Founder, Swell Investing



4.5 Risk Analysis

In the context of investing, risk is exchanged for financial reward. **As the planet changes and technology evolves, the revenues (and rewards) derived from GHG intensive activities are increasingly undermined by outsized risks.** These risks include replacement by cleaner and cheaper alternatives, policy changes, penalties for environmental destruction, and physical destruction resulting from extreme climate events and weather patterns. **Managing the investment risk of climate change does not necessarily mean fighting climate change, it means ensuring that your investments earn the highest return possible despite climate change.** This may be an unpopular distinction, but the ramifications of climate risk analysis include billions in divestment from poor GHG performers, encouragement of more net-zero business practices, and deliberate investment into renewable energy, resource efficiency, electrification, and emissions reduction.

Big Data allows for superior analysis of ESG risks and impacts. The digitalization of information has catalyzed the creation of higher quality, more granular datasets (Big Data),³⁷ but also the ability to analyze this data in high-volume, high-variety and high-velocity formats (the “Three V’s” of Big Data). Satellite data, sensors, cloud computing and artificial intelligence provide information on everything from traffic patterns to food production. Risks associated with climate change such as rising sea levels, floods, wildfires, deforestation, as well as GHG emissions can be automatically factored into calculations and scenarios to ultimately influence capital-deployment decisions. Fintech is now playing an outsized role in climate risk analysis.

Big Data Value Chain



Source: Generation Investment Management

The EU Taxonomy has clearly laid out two kinds of Climate Risk Data which are analyzed at scale:

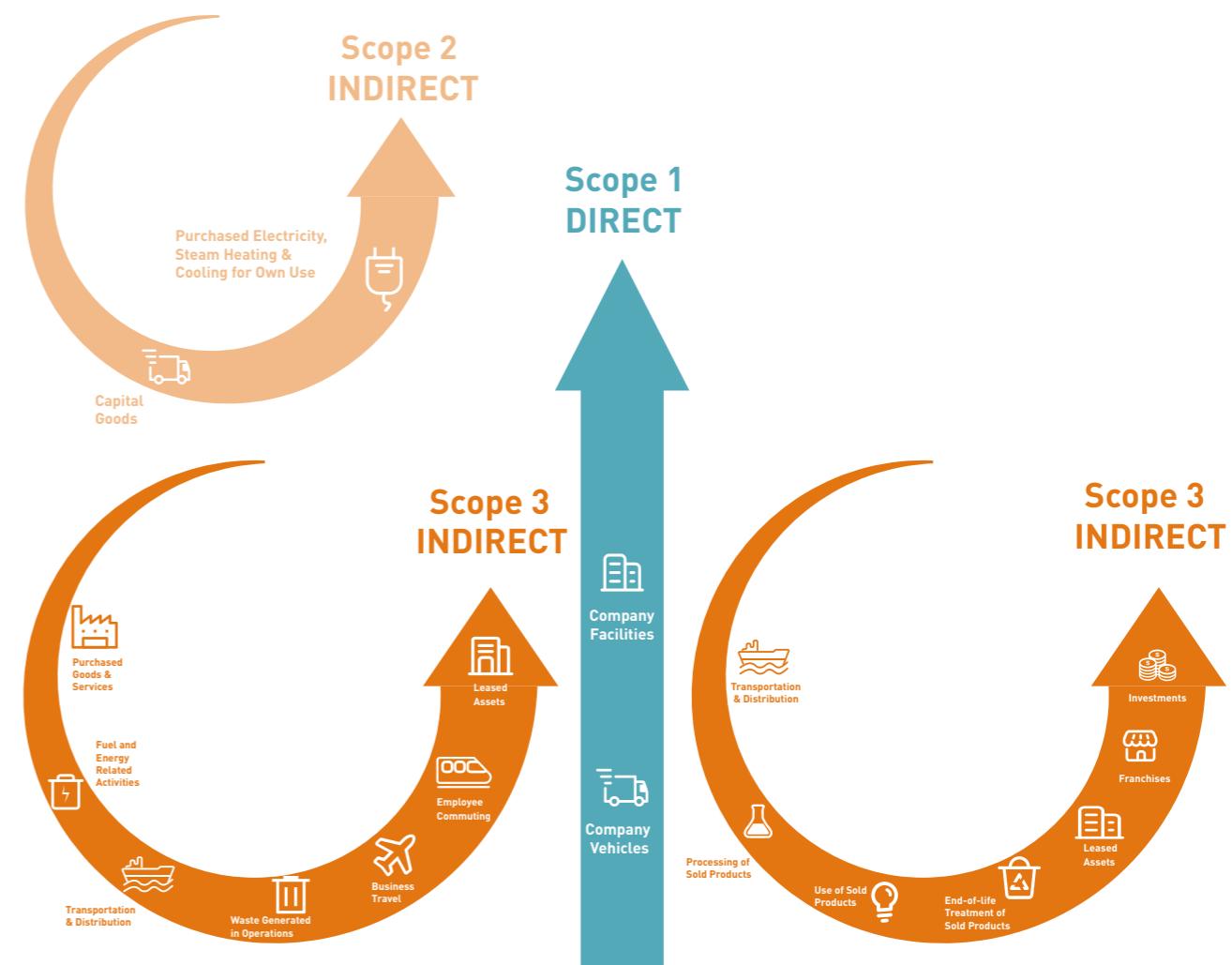
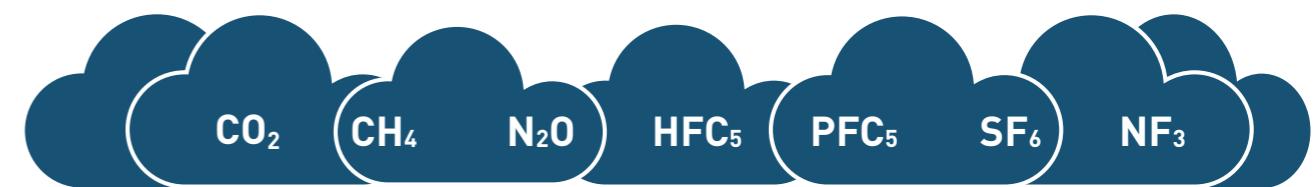
1 Transition Risk relates to the process of transitioning to a lower-carbon economy

2 Physical Climate Risk relates to the physical impacts of climate change

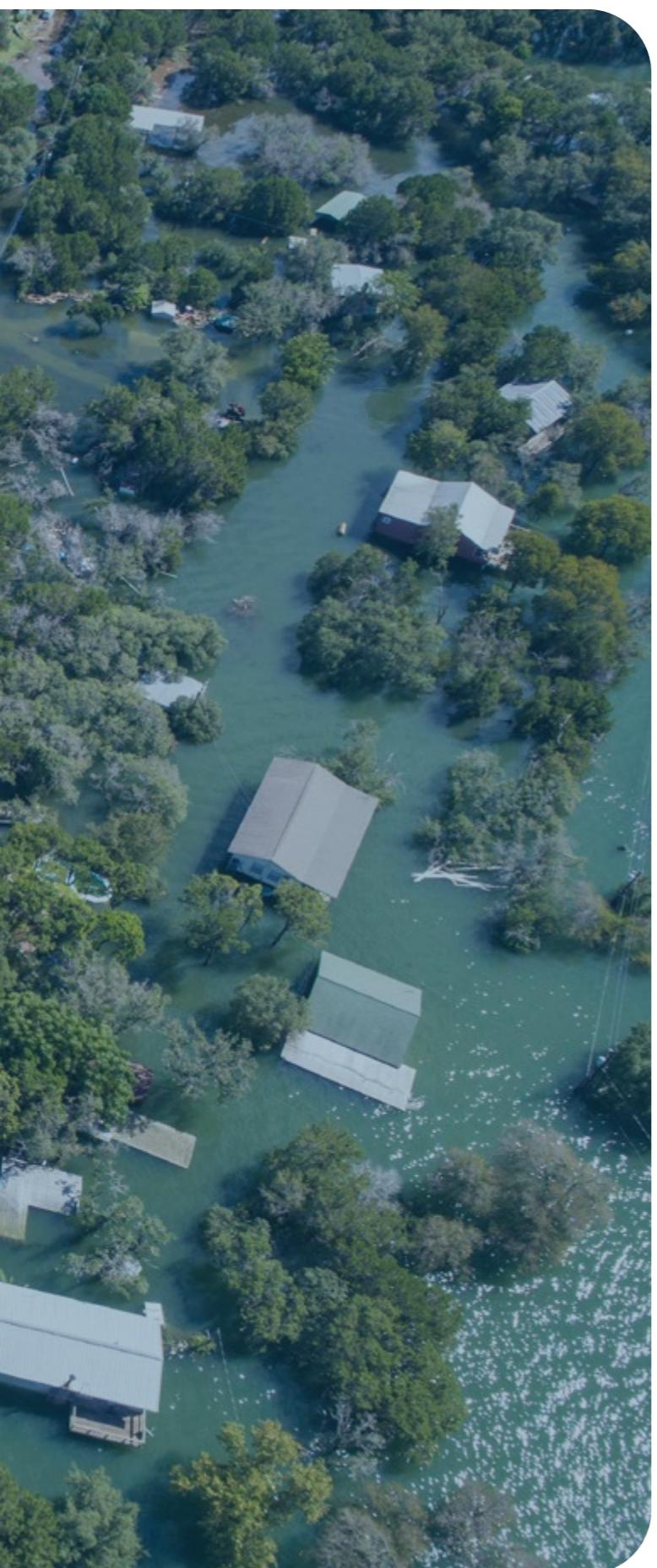
Transition Risk Analysis

There are a number of sub-categories within transition risk including Policy and Legal Risk, Technology Risk, Market Risk, and Reputation Risk. Depending on the nature, the size, and the speed that these variables change, organizations are subject to considerable exposure and need to take active mitigation measures. Transition Risk Scenario modeling can be challenging, as one regulation or calculation adjustment can spell the worst day for solar or the best day in history for the coal industry. Another important component is the compiling of Scopes 1, 2 and 3 GHG emissions into repositories for each large corporation. This emissions data serves as the foundation for ESG-related products, indices, and regulatory disclosure requirements.

Scope 1, 2, 3 GHG emissions



Source: Environmental Protection Agency (EPA)

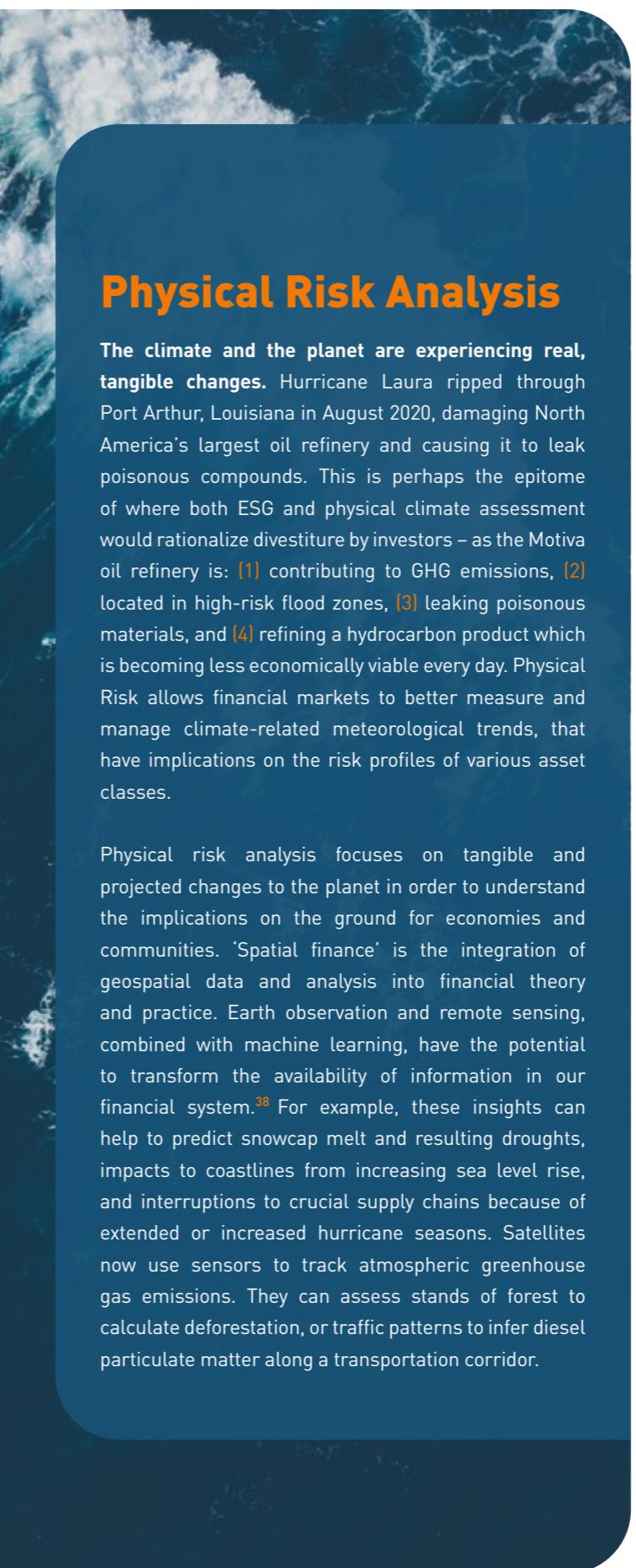


Case: Carbon Delta

Carbon Delta is a recent and important success story in the transition risk analysis space – it was acquired by index market-leader **MSCI** in 2019. Their solutions for investment managers provide actionable insights to evaluate climate change risks on publicly-traded companies and identify opportunities in low-carbon technology innovation. Climate Value-at-Risk (CVaR) is a product they deploy which provides forward-looking and return-based valuation assessments in an investment portfolio, “helping to close the gap between a portfolio manager managing climate risk and carbon intensity not being a metric that explains risk.” They also synthesize this data to assign warming scenarios both for individual companies and portfolios, scoring 1°C – 6°C representative of the climate scenario pathway.

Their road to acquisition was not easy, and initial traction was slow. “During the bitcoin bubble, we ended up pitching to 20 VCs without any bites”, explains CEO and Founder Oliver Marchand. Early support was instead found with the Climate KIC accelerator program, Swiss angel investors, and the eventual onboarding of Swiss RE and AXA as clients. As Carbon Delta permeated this space, the ESG sales team at MSCI would find themselves soliciting institutional investors for climate services, only to be told, “Sorry, but we are already taken care of by Carbon Delta”.

The eventual acquisition in late 2019 was a validation of this business model, emissions data, and its importance to the financial industry. Oliver is grateful for using the Blue Ocean strategy, creating a brand-new market and demand for his products and services. So far, the acquisition and resulting integration into MSCI has been seamless.



Physical Risk Analysis

The climate and the planet are experiencing real, tangible changes. Hurricane Laura ripped through Port Arthur, Louisiana in August 2020, damaging North America’s largest oil refinery and causing it to leak poisonous compounds. This is perhaps the epitome of where both ESG and physical climate assessment would rationalize divestiture by investors – as the Motiva oil refinery is: [1] contributing to GHG emissions, [2] located in high-risk flood zones, [3] leaking poisonous materials, and [4] refining a hydrocarbon product which is becoming less economically viable every day. Physical Risk allows financial markets to better measure and manage climate-related meteorological trends, that have implications on the risk profiles of various asset classes.

Physical risk analysis focuses on tangible and projected changes to the planet in order to understand the implications on the ground for economies and communities. ‘Spatial finance’ is the integration of geospatial data and analysis into financial theory and practice. Earth observation and remote sensing, combined with machine learning, have the potential to transform the availability of information in our financial system.³⁸ For example, these insights can help to predict snowcap melt and resulting droughts, impacts to coastlines from increasing sea level rise, and interruptions to crucial supply chains because of extended or increased hurricane seasons. Satellites now use sensors to track atmospheric greenhouse gas emissions. They can assess stands of forest to calculate deforestation, or traffic patterns to infer diesel particulate matter along a transportation corridor.



Case: Jupiter Intel

Jupiter Intel leverages satellite data, artificial intelligence, machine learning, and IoT to deliver probabilistic, asset-level physical risk predictions on a computing platform designed specifically for climate impact analysis. Jupiter’s ClimateScore™ Platform provides sophisticated, dynamic, hyper-local, current-hour-to-50-plus-year risk analysis for weather in a changing climate. ClimateScore Global’s scope and granularity enables users across numerous industries and the public sector to project how a portfolio of assets may be affected by climate change: the perils it will be exposed to, the driving segments and locations, and how that will change over time and across varying carbon emissions scenarios. ClimateScore Global incorporates dozens of scientists’ most comprehensive climate models, coupled with machine learning, land use data, and models for hydrology, wildfire, and many other variables. Strategic investors include three of the world’s largest property and casualty firms – Liberty Mutual, Mitsui MS&AD, and QBE, indicating the importance of these tools in the insurance industry.³⁹

As sustainable investment becomes mainstream and data-driven asset management technologies are adopted, big players are actively acquiring startups. For example, **Moody’s** recently acquired minor stake in **SynTao Green Finance** in China and **Four Twenty Seven** in the US. Major acquisitions were also observed in other regions in both 2019 and 2020; in addition to the previously mentioned **MSCI** acquisition of **Carbon Delta**, **Bain & Company** acquired **Ecovadis** in Europe, **Morningstar** acquired **Sustainalytics**, and **BlackRock** formed a strategic partnership with **Rhodium Group**. ESG data analytics, transition risk analysis, and physical risk analysis have become important arenas where Climate Fintech applications help to decarbonize the largest financial stakeholders.

4.6

Trading

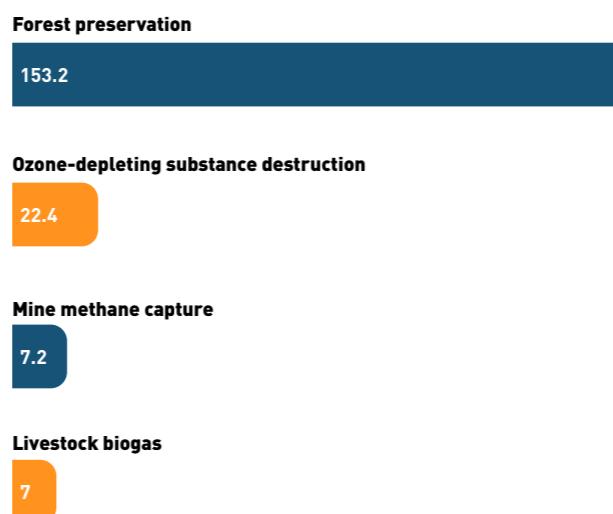
In this section we touch upon two main types of trading in the context of climate fintech: **carbon markets** and **energy trading**. The first explores the world of trading carbon, emissions exchanges, and voluntary schemes which are proliferating on platform marketplaces and using Distributed Ledger Technology (DLT). The second is energy trading; the exchange of distributed energy using smart grids, in some cases also using blockchain technology.



Trading Carbon

Emissions trading and carbon markets have grown to become an increasingly popular tool to regulate emissions. These frameworks control pollution by putting a price on carbon emissions and pollution, while also incentivizing projects which sequester or offset these same emissions. In a cap-and-trade emissions trading scheme, typically a government will allocate allowances to corporations, who can buy and sell these on the open market. Most allowances permit emissions of one metric ton of CO₂. Keeping the planet to 1.5°C would require limiting all future net emissions of carbon dioxide from 2018 onwards to 570 gigatons. At the current pace, the world would exceed the 570-Gt target in 2031, so carbon markets play an important role in regulating emission caps.⁴⁰ Studies show that the EU Emissions Trading System reduced 1.2 gigatons of CO₂ between 2008 and 2016 (3.8%), relative to a system without carbon markets.⁴¹ Clearly these systems play a role, but they must be applied and scaled-up on a global scale, while complimented by voluntary carbon offsetting. For now, California is currently the only US state with a cap-and-trade system. Recently, however, **large energy companies have started to acquire and preserve vast tracts of forest beyond what they need for California, betting that voluntary offsetting is a burgeoning trend.**⁴²

California Offset Credits Issued, By Project Type, In Millions



Note: Data as of August 12, 2020
Source: California Air Resources Board

Case: ClimateSeed

Voluntary carbon offsets have the potential to contribute significantly to carbon market development. As consumer demands apply pressure on corporate responsibility, companies are starting to proactively purchase offsets for their business activities. ClimateSeed is a result of this demand, an **intrapreneurial venture** coming out of French Bank BNP Paribas, as the bank's commitment to the Paris Agreement, coupled with client requests for a carbon-offsetting platform. **ClimateSeed is a platform marketplace which provides a range of internationally-certified projects including reforestation, energy efficiency, renewables, and waste management in more than 20 countries.** They conduct due diligence on the offset project carriers, and then present simple and transparent solutions on their site

as climate action that organizations can take to mitigate the unavoidable greenhouse gas emissions of their business activities, products and services, buildings, trips and events. "There is a disconnect between those looking for offsetting in northern hemisphere versus projects in southern hemisphere," explains Vincent Loubinoux of ClimateSeed. The company addresses the lack of transparency between intermediaries and educates corporate partners on various strategies for carbon offset. To date, the platform has helped offset 5 million tons of CO₂. It is the first business launched by BNP Paribas which reinvests 100% of its profits in environmental projects to contribute to the Sustainable Development Goals set by the UN.

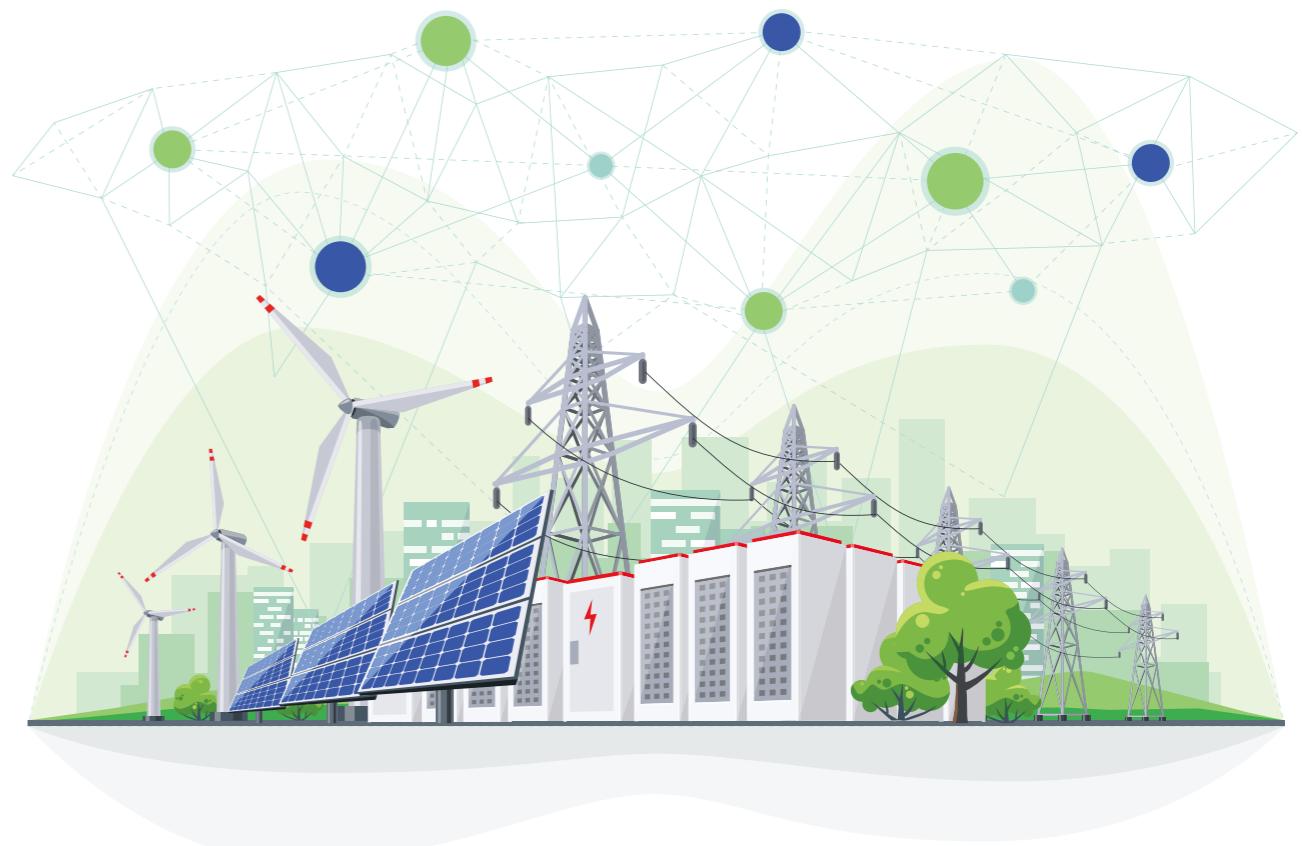
Blockchain is also being used to support emissions trading. One example is the **AirCarbon Exchange**, a blockchain-based distribution and trading network which securitizes carbon credits into fungible and tradable securities with transparent pricing and real-time settlement. Blockchain allows for an open, transparent, and liquid asset that reduces friction, and ultimately decentralizes the system to provide a borderless solution for commodities trading. AirCarbon uses a distributed ledger technology (DLT) to securitize carbon credits into digital tokens (digital receipts) representing a clear line of ownership. Every token is backed by a 1 tCO₂ carbon credit that sits in the Exchange's Trust. This simplifies and automates today's laborious and manual carbon trade processes, allowing for the ability to make settlements, synchronize document exchange, and manage collateral.⁴³

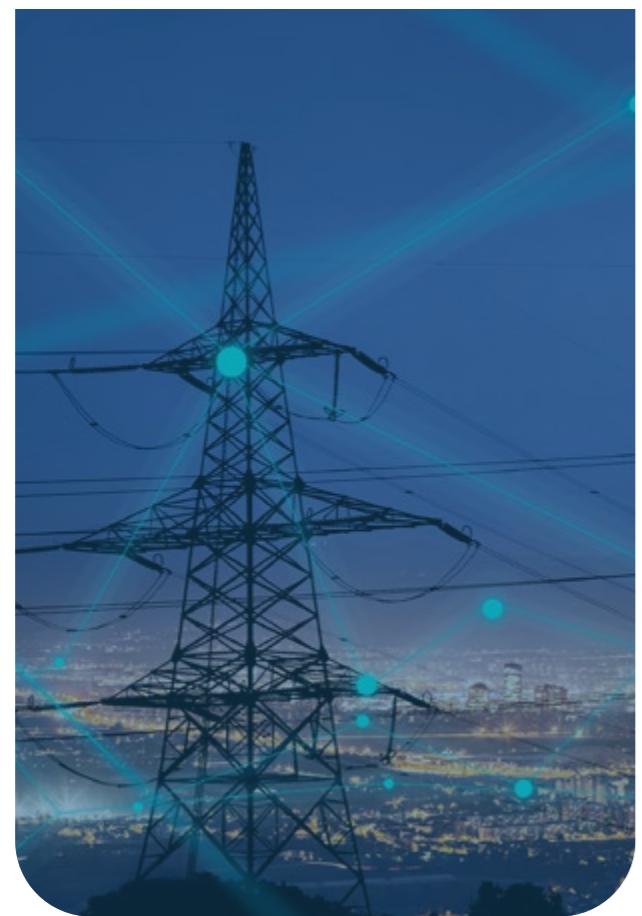
With blockchain application in energy trading, energy assets are listed on a distributed ledger; producers and consumers would be assigned a digital identity by a governing body. From here energy trading can occur, whereby each transaction is recorded in the ledger, a public log of all the transactions on behalf of all stakeholders involved. **Blockchain has the potential to remove intermediaries and avoid friction in the energy trading process, thus making energy management more efficient and secure.**

Smart Grids, Energy Trading, and Decentralization

Traditionally, power grids are centralized systems, whereby utilities control the flow of electricity based on demand by passive consumers. **Now, with the increasing prevalence of renewable energy sources like wind and solar, more flexible and efficient decentralized energy infrastructure is emerging.** This localized energy production can help to avoid the 'line loss' effect – i.e. wasted energy during distribution, a common issue with long-distance transmission lines. The consequence: conversion of the traditional grid into a series of interconnected networks known as microgrids, giving management responsibilities back to local communities. **Decentralized energy systems are projected to account for roughly 25% of the energy market by 2050.**⁴⁴

This interconnected web of decentralized microgrid systems is known as a smart grid, an electricity network which uses technological upgrades including smart meters, smart appliances, and renewable and efficient energy resources. **Innovation around smart grids holds a lot of promise; improving the efficiency of the US electricity grid by 5% alone would be the equivalent of eliminating the fuel use and carbon emissions of 53 million cars.**⁴⁵ These decentralized systems naturally lend themselves to the practical application of artificial intelligence, machine learning, internet of things, and blockchain technologies. As renewables grow in the energy mix, utilities can make use of AI-powered tools to remove uncertainty and predict demand more accurately regardless of climate fluctuations. Top-connected sensors on wind turbine blades use machine learning so that they can adjust themselves to the best angle of the wind in order to optimize power generation. And as these decentralized systems produce power and sell it into the grid alongside incumbent utilities, blockchain serves an important role to track and trade these kilowatts in a transparent and equitable framework.⁴⁶

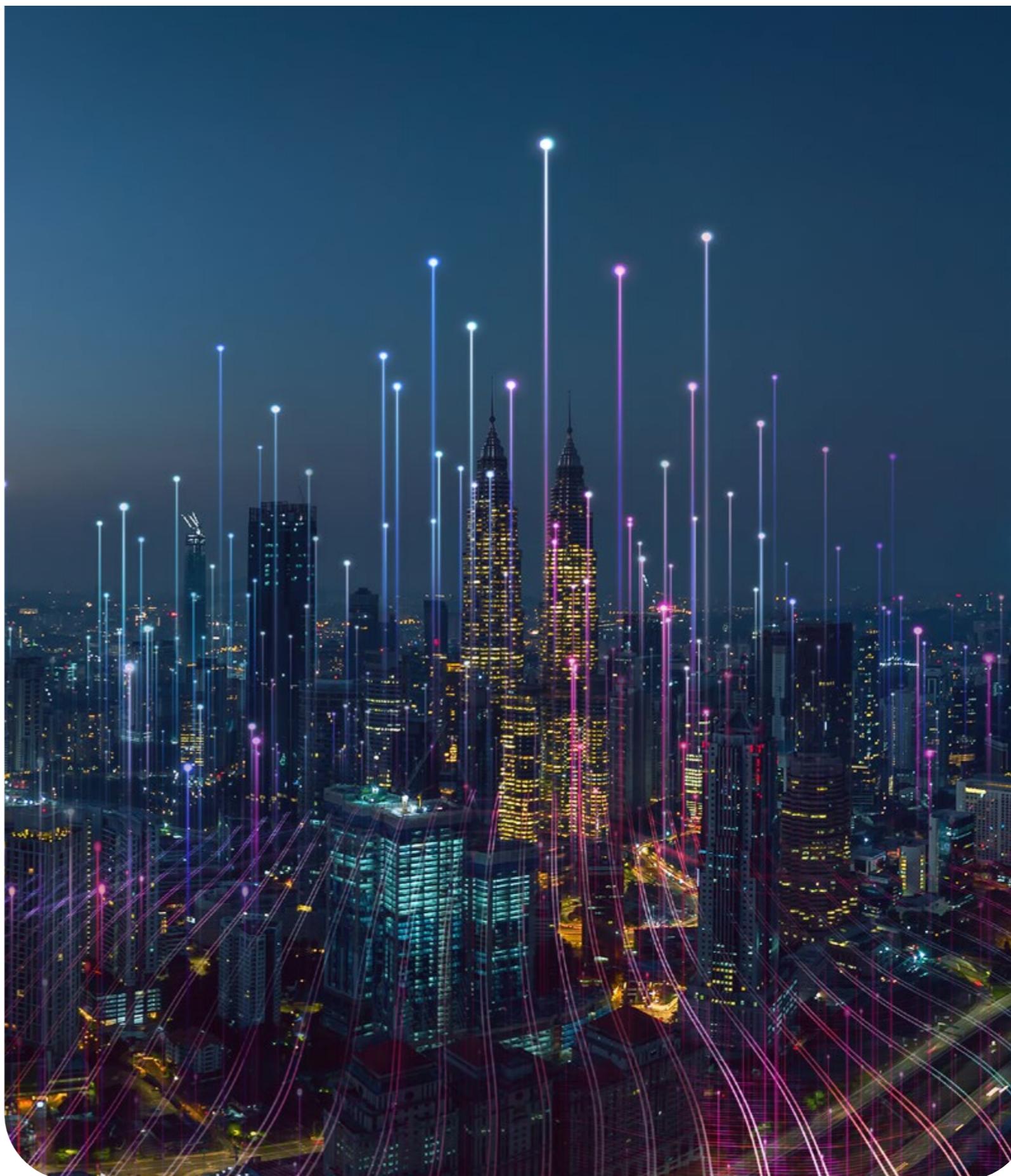




**Case:
Dipole Tech**

Dipole Tech is an energy trading platform based in China which combines blockchain, IoT, and AI technologies to build a trustworthy network for trading of both distributed energy and distributed renewable assets. It matches demand and supply of microgrid systems, while helping participants to increase energy efficiency and price optimization. Dipole's platform allows customers to develop, run, and manage their own energy network without the complexity of building and maintaining the physical infrastructure. Data is provided to the user on demand, regardless of geographic or organizational separation between provider and consumer. The network optimizes resource allocations by considering network and computing resources as a unified whole.

Dipole also provides, where users can implement disintermediation, low-cost electricity metering, billing, and trading. In terms of energy, every kilowatt is consumed at the optimal appropriate time for the use of household appliances. In addition, users are protected in terms of both energy and data security, as the energy network calculator ensures the safety of energy use, and their blockchain recording method protects sensitive user data. Customers don't have to worry about the leaking of sensitive data when their information is uploaded to a common blockchain node. Additionally, the Dipole platform is highly scalable because it can be adapted to grids of any size. Whether it is a regional network, a microgrid, a residential building, or several electric vehicle charging stations, everything can be organized into an open energy network through its platform as a service.⁴⁷



4.7

Financial Product Innovation and Insurtech

Financial product innovation and deployment is a vital component of the mobilization of capital towards decarbonization. These financial instruments inherently focus on de-risking various forms of investing or lending, reducing barriers to entry, and incentivizing participation in projects from a larger pool of stakeholders to help scale climate action. These financial products are proposed by enterprises, fund managers, fixed income specialists, market experts and local governments to help overcome market barriers to investment. Although these financial instruments are often created without fintech, many of them use fintech as delivery systems and methods of deployment to reach a larger population.

The Global Innovation Lab for Climate Finance (The Lab)

'The Lab' is an international organization composed of investors, market makers, and foundations whose mission

\$2.07+ bn
mobilized by
49 instruments for climate action in developing countries

\$370+ mn
invested by Lab Member institutions
\$1.7+ bn
catalyzed in additional investment

lab instruments have mobilized
200x
what funders have invested in the Lab Secretariat

Source: The Lab



'The Lab' Financial Products

Blockchain Climate Risk Crop Insurance

A standardized, digital index crop insurance platform for smallholder farmers that addresses the impacts of climate change on crop production by making insurance more transparent, efficient, and scalable.

Sustainable Energy Bonds

A class of bonds to drive impact investment to sustainable energy projects in India by offering debt exposure, sufficient returns, and standardized impact measures. Target projects include distributed renewable energy (small-scale and off-grid solutions), energy efficiency for buildings and industry, and projects for increasing energy access.

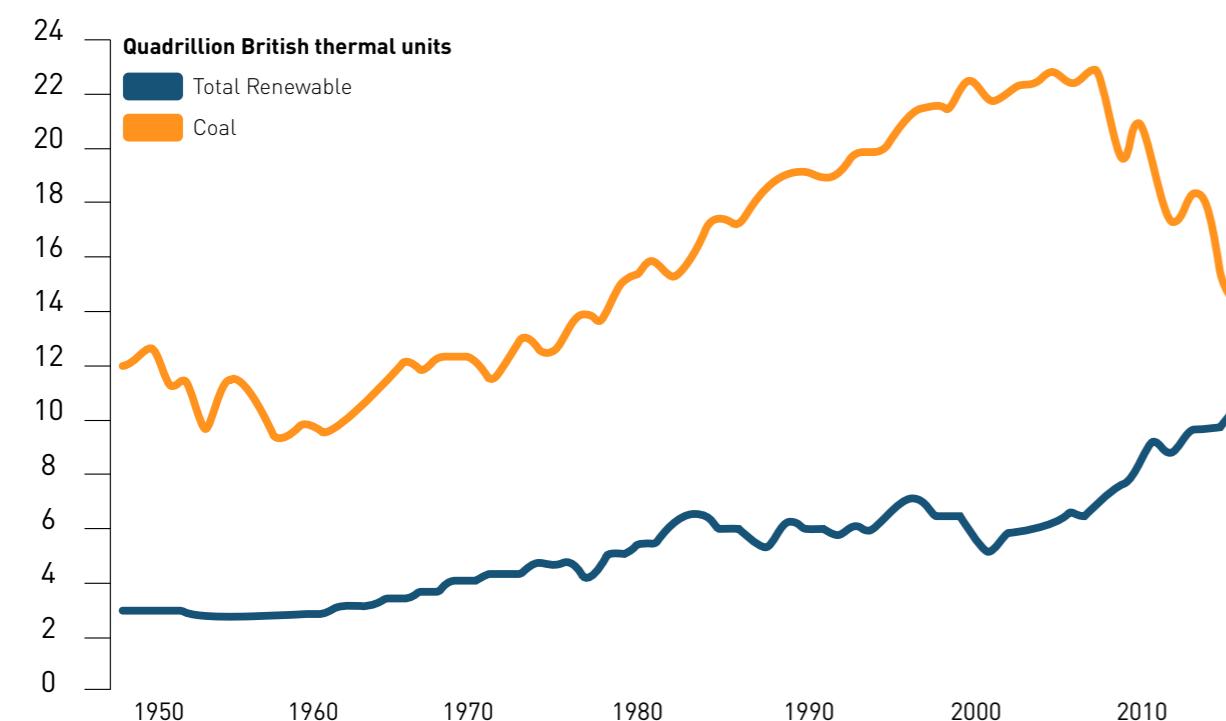
Solar Securitization for Rwanda

An initiative that pools loans from multiple solar developers into a tradable, asset-backed security, freeing up capital for expanding the solar home system market. This drives capital to accelerate Rwanda towards its goal of 100% energy access by 2024. Using a blended finance structure, it invests growth equity in companies delivering climate intelligence or physical products and services for resilience.⁴⁹

Insurtech and Climate Change

Insurance companies regularly pay the price of climate change. After pension funds, insurance firms are the largest group of asset owners on the planet, with over USD 30 trillion in AUM. These firms are uniquely positioned in the financial system; systemic in facilitating infrastructure projects; and play a crucial role as a risk manager, risk carrier and investor. Insurers protect homes and businesses by absorbing financial shocks due to cyclones, fires, and other acute weather events, as well as other longer-term “chronic” risks such as sea level rise and drought. There is robust attribution that climate change is a severe threat to the insurance industry, both via their financial investments which are susceptible to physical damage (e.g. real estate), and more importantly, through increased claims received following policy holders’ losses.⁵⁰

Coal And Renewable Energy Consumption, US, 1949-2019



Source: Generation Investment Management, US EIA

As risk managers, insurance companies have been aware of the risks of climate change for many decades, and they **mitigate environmental and climate risk using technology**. Insurance firms have access to the latest climate models, tracking climate change through geospatial analysis, which in turn affects their catastrophe risk modeling and loss-prevention systems. One of China’s largest insurance companies, **PICC P&C developed a Remote Damage Assessment and Claim Settlement Platform** to rapidly assess catastrophic damage by using big data, modern surveying techniques, and advanced mapping technology. By using the system, catastrophe claims are paid in as short as four days, and labor cost is reduced by one-third.⁵¹ Tech startups like **Gago** and **Rainbow Tech** use AI to aggregate satellite data for better evaluations of insured property, such as the condition of crops or flood damage. Such technology improves accuracy while reducing the cost of inspection.

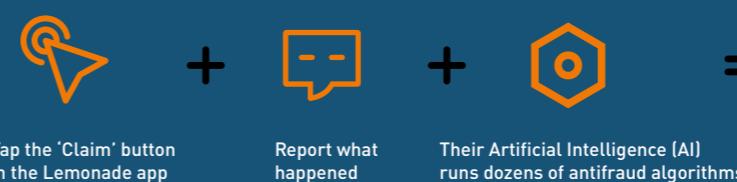
Since big insurance companies have the capability to build their own systems, startups are targeting small and medium-sized insurance companies to provide their technology services. It seems that climate insurance is useful in the aftermath of damage caused by climate change; however, the adoption of climate insurance quantifies and monetizes such damage, embedding it within the financial system. The data is now motivating action, helping to determine what projects and firms are appropriate to insure. One example is coal divestment and insurance. Peter Bosshard of the Sunrise Project has helped numerous insurance firms to divest from coal investments. “If you can expose hypocrisy in the system, you can apply pressure.” **As of Q2 2020, at least 19 major insurers with combined assets of more than USD 6 trillion have divested from the coal industry.**⁵²

Case: Lemonade

The more traditional nature of the insurance industry makes it a prime target for disruption and innovation. Lemonade is a homeowners and renters’ insurance platform making considerable waves in the industry for several reasons. Firstly, they use a combination of artificial intelligence and behavioral economics to measure the digital body language of each customer. By leveraging this technology, claims are paid out instantly without the need for in-person interaction, resulting in a world-class customer experience without sacrificing risk controls. Secondly, Lemonade is a for-profit Benefit Corporation, whereby a portion of leftover premiums

are donated during its annual Giveback to nonprofit causes chosen by its policyholders. This removes the conflict of interest inherent to the industry and clearly demonstrates that Lemonade is not incentivized, like other insurers, to reject claims.⁵³ Lastly, **Lemonade became the first US insurance company to not invest in coal.** “You wouldn’t think your insurance company would invest your premiums in businesses that increase the catastrophes you are paying them to protect you against”, says CEO Daniel Schreiber. “Lemonade has over USD 100 million in investments, none of them in fossil fuels, and we’re committed to keeping it that way.”⁵⁴

How Lemonade Claims Work



Source: <https://moneycheck.com/lemonade-insurance-review>

4.8

Accounting and RegTech

As stakeholders increase capital commitments towards decarbonization, the need for accurate carbon accounting and reporting becomes paramount. RegTech has the potential to organize increasing carbon reporting efforts by the largest corporates and investors, ensuring that this data undergoes systematic financial supervision while providing actionable insights for policy makers and regulators.

There is now a concerted international effort to align climate monitoring and taxonomies between corporates and states, with a number of global consortiums and frameworks are collaborating to improve carbon accounting, disclosure and risk assessment. G20 Finance Ministers and Central Bank Governors asked the Financial Stability Board (FSB) to review how the financial sector can take account of climate-related issues. The FSB then established the Task Force on Climate-related Financial Disclosures (TCFD). The TCFD includes high-level principles for effective disclosure of climate-related risks and opportunities, viewed as a foundation for many other carbon accounting efforts and initiatives.⁵⁵ The Partnership for Carbon Accounting Financials (PCAF) is an initiative which has taken the TCFD guidelines and developed an accounting tool to assess financed emissions. With nearly 70 banks and investors from five continents representing USD 9 trillion in assets, the goal of PCAF is to develop a global accounting standard to be utilized by the financial sector, providing more transparency to stakeholders. Rather than creating a new framework, PCAF developed their reporting guidelines to complement existing frameworks including those of the Climate Disclosure Standards Board (CDSB) and the Sustainability Accounting Standards Board (SASB).⁵⁶

Case: Normative.io

Normative.io is an accounting tool which helps simplify corporate sustainability reporting by automatically calculating of carbon usage and emissions data. Corporate clients simply upload their data, and Normative automatically generates analytics and sustainability reports. By transforming a typically time-consuming and expensive process into one that is easy and financially-palatable, more companies can participate in carbon accountability and disclosure. As a result, this SaaS startup is helping companies all over the world get better at measuring their

sustainability.⁵⁷ Founded in 2014, the Stockholm-based startup initially focused on the B2C market with a mobile app for customers, later shifting in 2017 to the B2B market in order to make a larger impact on society. In 2019, the company received USD 2.1 million in seed funding from several notable investors, including Eric Wahlforss (co-founder of SoundCloud), Luminar Ventures, and Wave Ventures. As carbon accounting becomes increasingly important for corporates, the market for these types of solutions will continue to grow.⁵⁸

The TCFD and Mainstreaming Climate-Related Disclosure

Spearheaded by Bank of England Governor and former Financial Stability Board Chair Mark Carney and chaired by Michael Bloomberg, the TCFD was the first private-sector-led initiative working to develop consistent climate-related financial disclosures to inform investing, lending, and underwriting decisions. The task force developed four widely adoptable recommendations on climate-related financial disclosures that are applicable to public companies and financial institutions across sectors and jurisdictions.

Governance

Disclose the organization's governance around climate-related risks and opportunities.

Strategy

Disclose the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material.

Risk Management

Disclose how the organization identifies, assesses, and manages climate-related risks.

Metrics and Targets

Disclose the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

Final Report

Recommendations of the Task Force on Climate-related Financial Disclosures

TCFD | TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES

June 2017

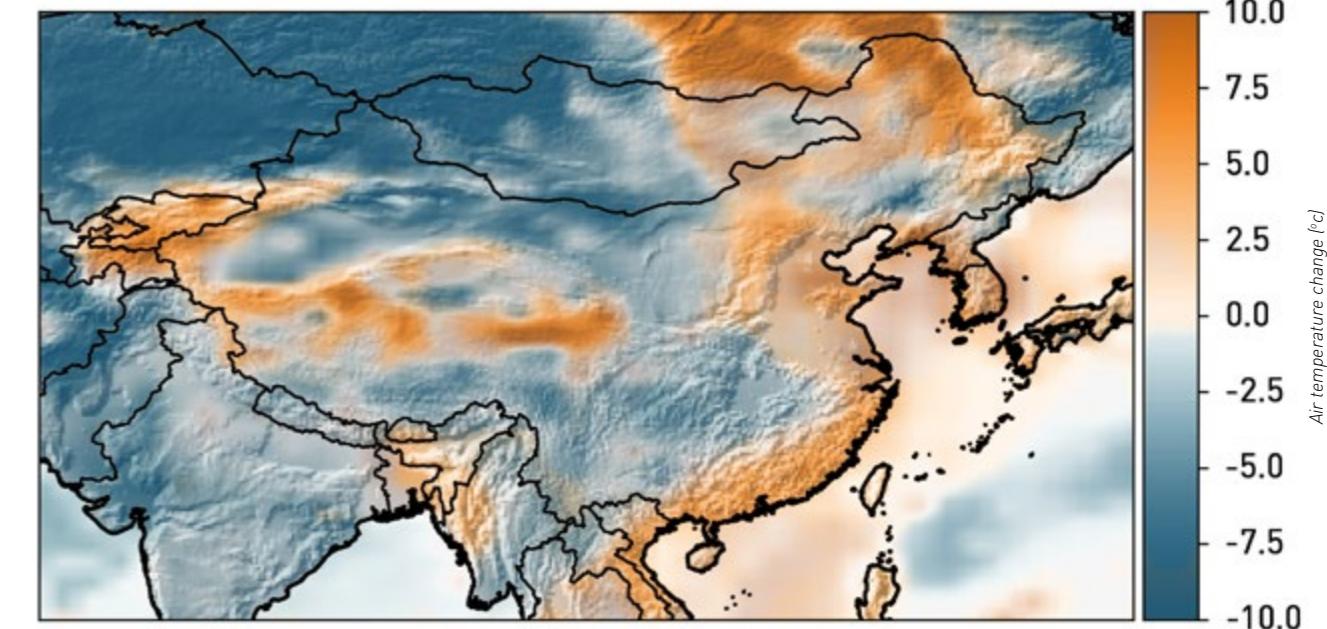


As of September 2019, more than 830 organizations have expressed their support for the TCFD including more than 370 financial firms responsible for assets of over USD 118 trillion. Other organizations include corporations, trade associations, stock exchanges, central banks, regulators, and national governments.

5

GEOGRAPHIC CONSIDERATIONS

5.1 China



Climate model projections of the difference between annual minimum temperature in 2020 and 2050.⁵⁹

China High-Level Observations

- China has fewer climate fintech startups than Europe and the US, despite its substantial renewables and green finance markets
- Climate Risk and ESG risk analysis are the most promising verticals
- Regulation plays an important role in a policy-driven, centralized green economic system
- Climate fintech startups play the role of enablers rather than disruptors

China is both the largest emitter of greenhouse gases and the largest market for renewables and green financing. While its political system and regulatory framework are different from its western peers, China is leading fintech innovation in many ways. The current climate ecosystem in China is still in its infancy, but we believe that it is a unique market with enormous potential to create impact.

Regulatory Environment

There is a top level design with local pilot tests to build a green finance system in China. Because of its centralized system and a sustainable finance market dominated by state owned banks, sustainability policies can be implemented more effectively in China.

Top-level Design



- SC State Council
- NDRC National Development and Reform Commission
- PBOC People's Bank of China
- MOF Ministry of Finance
- CBRC China Banking Regulatory Commission
- CIRC China Insurance Regulatory Commission
- CSRC China Securities Regulatory Commission
- MIIT Ministry of Industry and Information Technology
- MEP Ministry of Environmental Protection
- MEE Ministry of Ecology and Environment
- MNR Ministry of Natural Resources
- NEA National Energy Administration
- MHURD Ministry of Housing and Urban-Rural Development

Since 2012, China has committed to tackling climate change, with a national strategy to build an "Ecological Civilization". In 2015, the central government issued the Integrated Reform Plan for Promoting Ecological Progress to establish "a systematic and complete institutional framework for promoting ecological progress".⁶⁰ In 2016, the Guidelines for Establishing the Green Financial System set out additional rules for the development of green bonds, insurance, lending, and other sustainable financial products and services.⁶¹ President Xi Jinping's "lucid waters and lush

mountains" philosophy has been promoted in recent years, pushing officials on all levels of government to enforce the concept. The 2017 Green Finance Reform Pilot Area, now covering nine cities in six provinces, created additional opportunities for sustainable and digital innovation within the financial industry. At the UN general assembly in September 2020, President Xi Jinping committed to peak GHG emissions before 2030 and achieve carbon neutrality by 2060. The 14th Five-Year Plan is in development, of which many anticipate heavy emphasis on sustainable finance and infrastructure.

With stricter ESG disclosure requirements from various stock exchanges, public companies must now comply with such changes, and investors are encouraged to upgrade their sustainable investment practices.

Timeline of Major ESG Guidelines in China⁶²



The rapid expansion of the fintech sector in China has outpaced the central government's capacity to establish a comprehensive legal and regulatory framework, resulting in consumer fraud and the quick rise – and fall of the peer-to-peer lending segment. To prevent data misuse, a new national standard on personal information protection was introduced in 2018. The People's Bank of China (PBOC)

released the "Fintech Development Plan (2019-2021)" paper in September 2019, which aimed to strengthen support and lessen risks for the fintech sector through increased regulation of the fintech industry, as well as encourage data-related investments.⁶³

Capital Flows and Financial Stakeholders

China is now the largest renewables market in the world. By the end of June 2020, renewables accounted for approximately 40% of total electricity generation capacity. In the first half of 2020, 10.15 GW of photovoltaic capacity was added, a 16.4% growth from the previous year. During the same period, major energy enterprises invested CNY 173.8 billion (USD 24.8 billion) in new power plants, 92.5% of which produce renewable energy.⁶⁴ However, most of these are SOE-funded projects associated with utilities, while renewable projects funded by private investors still face financing problems.⁷¹

Green loans are the largest source of climate finance in China. In fact, bank loans account for more than half of the domestic financial market. Green loan financing reached CNY 10 trillion (USD 1.4 trillion) by the end of 2019, however this accounts for only 10% of total bank loans.⁶⁵ Progress in regulation and innovation of financial products and technologies is still needed to mobilize the financing of low-carbon projects. Some banks are prioritizing green loans as their primary business, such as China Industrial Bank (CIB), the leading green bank in China with CNY 1.01 trillion (USD 144 billion) in green loans on record.⁶⁶

Green bonds are the second-largest and fastest-growing source of climate finance in China. The cumulative issuance of green bonds in China has reached USD 120 billion from 2016 to 2019, almost quadruple the amount in 2016.⁶⁷ Standards for green loans are also shifting to align with international standards, as more foreign investors are increasingly interested in China's green bond market.

Equity investment in low-carbon projects remains small, but state-owned funds are more progressive in sustainable investments. A national green development fund of CNY 88.5 billion (USD 12.6 billion) was established in July 2020 to support clean energy initiatives.⁶⁸ Overall, the adoption of sustainable investment principles among asset managers in China is lower compared to developed markets, where 16% of asset managers have already taken measures to adopt ESG principles, while 71% are still doing research.⁶⁹ The number of asset managers joining the UN PRI is also increasing rapidly, almost doubling from 2018 to 2019.

Foreign capital has become an active driver in recent years, both in equity and debt markets of sustainable investments. With increasing international investment in the sustainable market, international standards and practices are being introduced to domestic investors. In November 2019, MSCI raised the inclusion of China's large-cap A-shares in the MSCI index from 15% to 20%, adding China's mid-cap A-shares to the MSCI index with 20% inclusion.⁷⁰ In addition, the quota on qualified foreign institutional investors (QFII) was lifted in June 2020, allowing the largest ever flow of foreign capital into the domestic A-share market.⁷¹

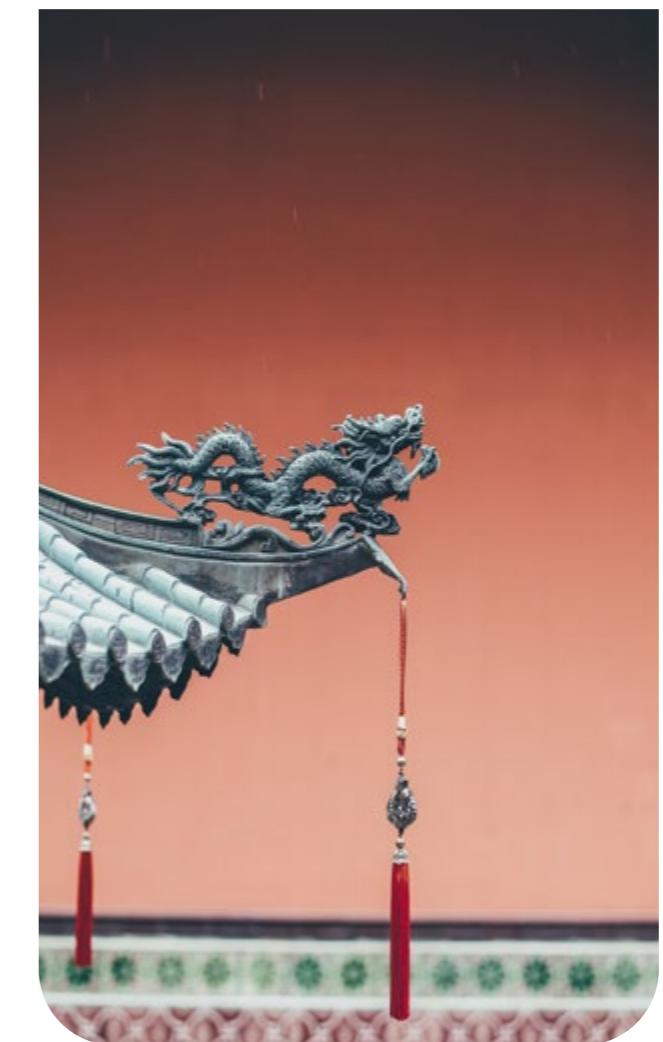
Open Innovation Culture and Startup Ecosystem

China's economy once relied on low labor cost and massive markets. Now, with improved industrialization and rising labor costs, the engine of the economy has shifted to innovation. China's share of global Research & Development (R&D) expenditure has increased dramatically between 2000 to 2018, from 4.9% to 26.3%.⁷² In 2019, China spent USD 321.3 billion on R&D,⁷³ making it the second-largest spender after the US. China also ranks 2nd after the US – in the number of patent applicants and unicorn startups (96 as of August 2019).⁷⁴ Top-level policies have been enacted to support the innovation ecosystem, such as the Mass Entrepreneurship and Innovation Program, which prioritizes innovation in the economic agenda.

China's innovation is concentrated in first-tier cities, including Beijing, Shanghai, and Shenzhen, which host numerous high-tech industrial parks and innovation demonstration zones that account for nearly 40% of R&D investment.⁷⁵ Huzhou, a third-tier city and pilot city of the Green Finance Reform, also uses green credit management systems to improve green project verification, due diligence, labor cost, and supervising transparency.

Entrepreneurship vs Intrapreneurship

Entrepreneurship became popular as a new digital market emerged, resulting in the creation of over 16,000 new internet startups in 2015. However, this number dropped to 2,900 in 2017 when the market consolidated as competition intensified and many front-runners evolved into multinational conglomerates.⁷⁶ This compression is partly attributed to the regulation of peer-to-peer lending platforms by the government to prevent systemic fraud. Top Fintech giants such as Alibaba and Tencent now dominate the market, leading the digital ecosystem and fintech innovation. Other tech giants including Baidu, JD and Meituan also set up their enterprise laboratories, investing huge social capital in R&D. Financial incumbents also established fintech departments or subsidiaries for digital transition and innovation. For example, China Industrial Bank has set up CIB Fintech to provide open-banking services and various intrapreneur programs to foster internal innovation.



China Climate Fintech Observations

China has fewer climate fintech startups than our other two focus regions, with a focus on investment risk analytics, financing, and regulation. Our initial analysis of the Climate Fintech ecosystem yielded roughly 250 companies which match our definition: *digital financial technology which catalyzes decarbonization*. These companies fall under our 8 financial categories (e.g. investing, lending, regtech) and all use some kind of applied technology or framework (e.g. artificial intelligence, platform marketplace). Of the 250 companies we mapped, **20 companies were based in China, representing 8% of the ecosystem.**

Investment risk analytics startups show the fastest growth among all business models.

This is due to the rapid increase in sustainable investment, driven by regulation, risk avoidance, value creation, and globalization. UN PRI's analysis of MSCI ESG Research data suggests that the MSCI China ESG Leaders Index outperformed the MSCI China Index by 4.7% from June 2013 to June 2019.⁷⁷ The sustainable investment value chain consists of asset managers creating ESG active and passive indexed funds, service providers and research institutes providing ESG framework advisory services, as well as ESG ratings and index creation.

ESG Thematic Investment Ecosystem

Market Player	Product & Service	Cases
Startup	<ul style="list-style-type: none"> Data Rating Index 	 
Big Tech	<ul style="list-style-type: none"> Data Rating Index 	
Service Provider	<ul style="list-style-type: none"> Data Rating Index 	
Research Institute	<ul style="list-style-type: none"> Data Rating Index 	 
Financial Institution	<ul style="list-style-type: none"> Index Fund 	   

Climate fintech startups position themselves as alternative data and technology providers, helping to address and solve for one, the major issues of data integrity.

ESG information (including climate related information) is usually voluntarily disclosed by companies in a Corporate Social Responsibility (CSR) report. As of June 2020, less than 27% of companies listed on local stock exchanges in China issued ESG reports (including CSR reports and sustainability reports). Additionally, although 49.2% of the largest CSI 300 companies have disclosed environment-related data, only 34% of those companies have disclosed GHG emissions data.⁷⁸ However, companies such as **Mio Tech** and **Sino-Securities** have expanded their data sources to include regulator websites and social media. Increasing data points are also used to evaluate environmental benefits and financial impacts, improving model accuracy. Most importantly, the analysis is powered by AI, significantly reducing the time and cost of evaluation.

Chinese ESG analytics startups are still relatively underdeveloped, as a focus on sustainable investment is a new trend. However, the growing popularity of sustainable investing will increase innovation in this field. Notably, Chinese tech giants such as Tencent (through its subsidiary, WeBank) is now participating in the market. Competition in this field is growing, and it is the combination of technology and ESG know-how that can build the core competitive advantages for climate fintech startups.

Climate fintech in the lending industry is likely to mobilize greater amounts of capital.

Two major business models are observed in the market:

- **building green credit management systems**
- **applying blockchain technology to help finance distributed renewable assets**

A green credit management system, powered by AI and big data, is able to identify, evaluate, classify and even monitor the environmental impacts of banks' green projects automatically, more accurately and more frequently.⁷⁹ Supported by climate fintech startup **Uni Inclusive**, Huzhou Bank upgraded its credit management system to a cloud-based smart green credit management system. This is just one example of the Overall Plan of Building Green Finance Reform Pilot Area. Reform is expected to expand to other cities in China, allowing the system to be scaled in more banks.

Blockchain technology startups are contributing to the green financing market.

These companies gather performance data through IoT chips in green assets and record it on the distributed blockchain in a secure, immutable, and transparent manner as cross-referenced data. This lowers inspection and financing costs of distributed assets for financial institutions.⁸⁰ Such applications, provided by companies like **NengLian** and **Mixis Link**, help climate-friendly companies receive better financing and also help them improve internal management efficiency by increasing transparency. Furthermore, this technology also helps monitor the issuance and performance of green asset-backed securities. China has already accumulated CNY 10 trillion in green assets (USD 1.47 trillion), issuing more than CNY 1 trillion in green loans and green bonds each year. Efficiency improvements in the green credit system could unlock hundreds of billions in new capital for climate-friendly projects.

Blockchain technology is also increasingly applied to transactions and trading of carbon, renewable energy and renewable assets.

Areas with numerous, complex processes involving multiple parties and large amounts of data, such as cross-border transactions, supply-chain finance and trading are also suitable for blockchain technology application.⁸¹ However, climate fintech startups may have difficulty in executing their business models in big cities, where energy giants dominate. While electricity trade reform is in progress, changes happen slowly.

Unfortunately, Crowdfunding and P2P lending are no longer viable business models in China.

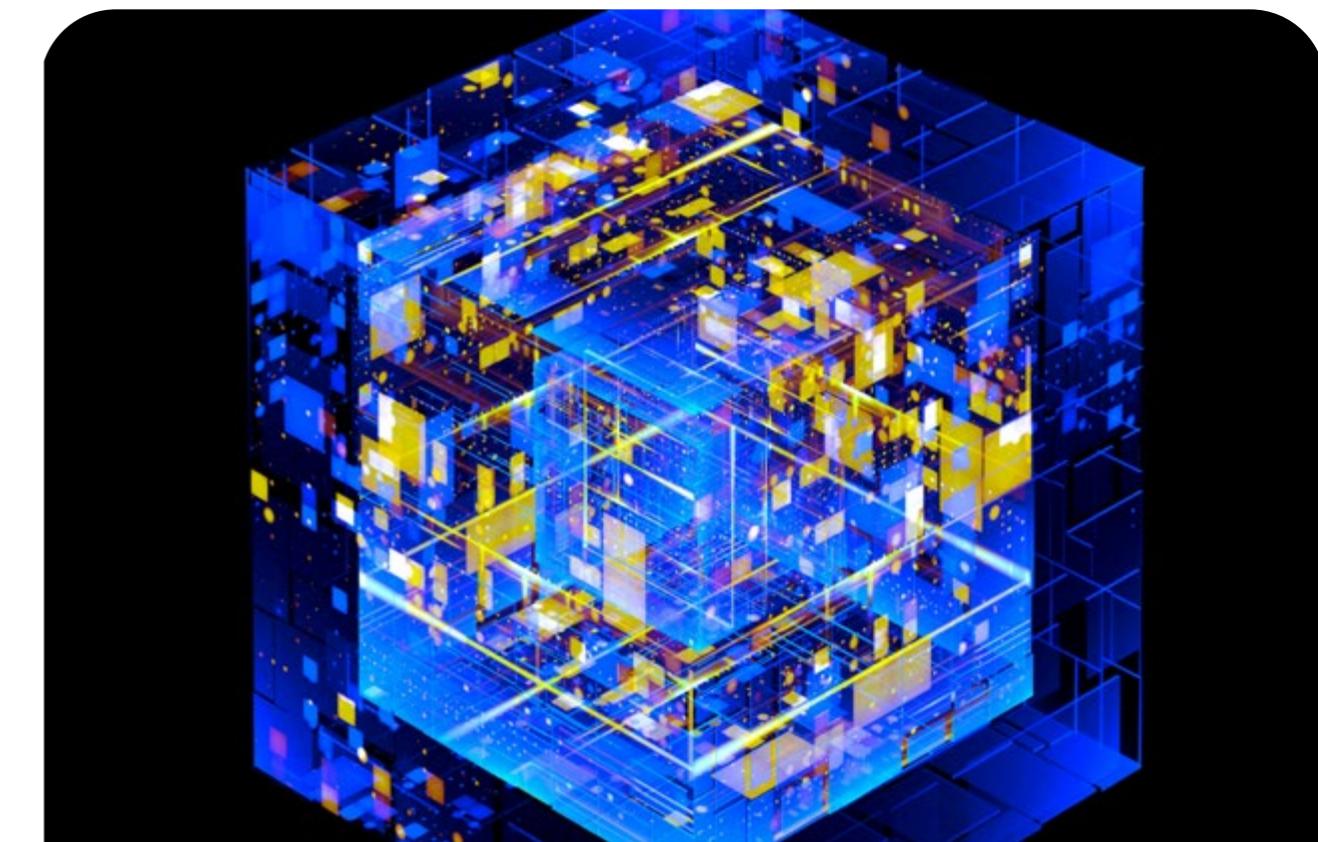
Waves of fraudulent activity prompted a government crackdown since 2017. However, some government-backed green project information-sharing platforms are still in operation, such as the Green Finance One-Stop Service Platform of Huzhou city.⁸²

Regtech could have a massive impact in China.

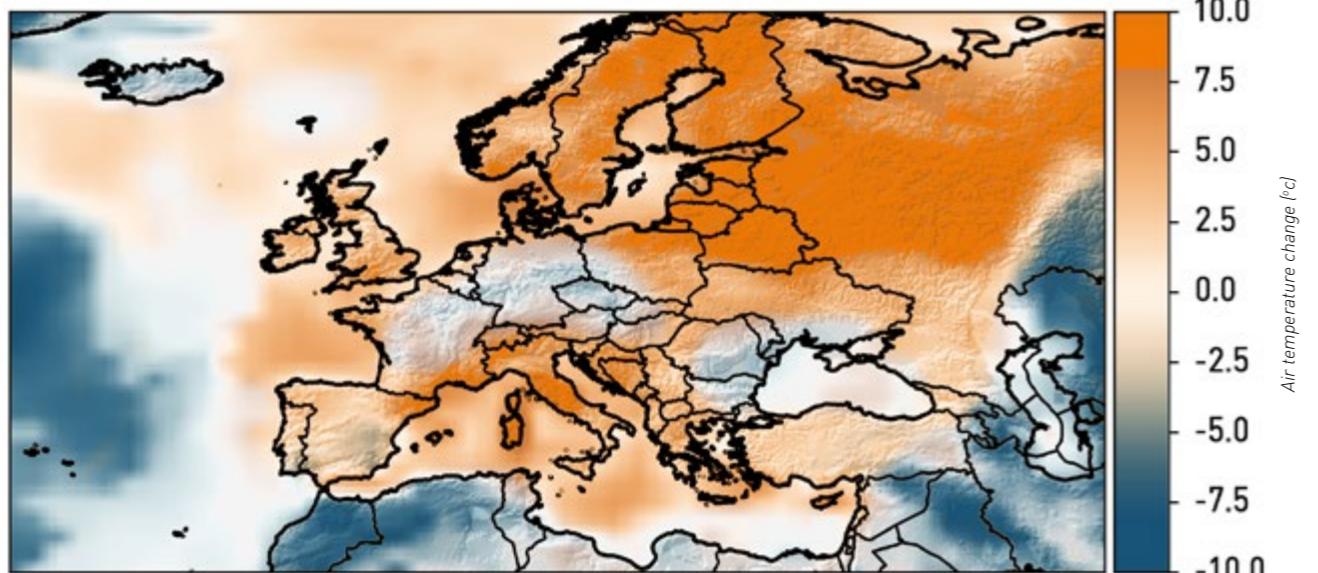
Because climate finance is a top-down driven system heavily influenced by regulation, regtech innovations could enable regulators to better monitor climate financing activities and allow policies to more effectively support decarbonization.

Consumer behavior changes have enormous impacts in China due to the scale and size of the population.

The key to increased adoption by larger citizen populations is incentivization beyond just "being green", often by the clear demonstration of savings, rewards, or financial benefits of decarbonization. Additional success factors include influence – those with a large retail customer base and tools within the ecosystem are more likely to succeed, such as online shopping giants. Startups that wish to participate will need to focus on a small ecosystem – some have found opportunities in the recycling business: tokenizing the credit generated by low-carbon behavior and transmitting that credit to purchase other low-carbon products is one such constructive experiment by some blockchain companies.



5.2 Europe



Climate model projections of the difference between annual minimum temperature in 2020 and 2050.⁸³

Europe High-Level Observations

- Europe is leading other regions in its collective policy action and investment in decarbonization. As a result, Europe is the most active ecosystem for Climate Fintech solutions, representing over 40% of the solutions we surveyed.
- Although there are overarching themes, each European country is nuanced – for example fintech intrapreneurship is more prevalent in the Netherlands, while entrepreneurship is more important in Germany and Spain.
- Many European financial incumbents now encourage in-house intrapreneurial fintech innovation through concerted open innovation teams, corporate venture capital (CVC) mandates, and through the use of Open Banking.
- Blockchain shows promise for loan issuance and smart grid management, while crowdfunding and robo advisory platforms empower decarbonization investment activity by an already climate-aware population.

Europe is leading climate action, sustainable finance, and climate fintech ecosystems. This maturity stems from a unique combination of economic strength, progressive regulatory policy, and climate-aware population which is actively seeking eco-solutions in their daily lives. Centralized regulatory frameworks, such as the EU taxonomy and initiatives like the European Green Deal have positioned the region for an energy mix transformation over the next decade. With support for innovation and decarbonization within the largest financial institutions, we believe Europe is uniquely positioned to integrate Climate Fintech within its sustainable finance efforts over the next few years.

Regulatory and Political Environment

In June 2020, European Parliament voted to adopt the EU taxonomy framework across all 27-member states, setting emissions standards, holding financial institutions accountable, and preventing greenwashing in both investment activity and reporting techniques.⁸⁴ Soon thereafter, in July 2020, heads of government reached the most ambitious climate change plan to date via the European Green Deal; committing more than USD 572 billion to develop clean energy resources, stimulate the market for emissions-free cars, invest in new technologies, and promote energy efficiency.⁸⁵ In September 2020, the European Commission, the EU's executive arm, also raised its 2030 emissions-reduction target to 55% from its current goal of 40%.⁸⁶ This move influences decarbonization in every sector of the economy – from energy, transportation, hospitality, to agriculture and trade. Despite its complex orientation with Europe, the United Kingdom has also championed carbon offsetting and accounting through initiatives by the Bank of England and **Carbon Tracker**, among others. UK Prime Minister Boris Johnson is expected to ban the sale of petrol and diesel cars by 2030 – 10 years ahead of previously established decarbonization schedules.⁸⁷

Country-level policy-making on both climate issues and fintech have influenced Climate Fintech innovation. For example, the Dutch Central Bank chairs the Network for Greening the Financial System (NGFS), showing its commitment to transitioning their banking sector and increasing sustainable digital finance innovation in country.⁸⁸ In Spain, their Climate Change and Energy Transition law dictates the direction of economic recovery from the coronavirus pandemic, which includes a requirement for financial institutions to publish specific decarbonization objectives of loan and investment portfolios, adhering with the Paris Agreement.⁸⁹ The Paris Climate Agreement serves as a beacon for climate policy measures which support an already enormous flow of regional capital towards environmental and sustainability initiatives.

Capital Flows and Financial Stakeholders

Much of the early momentum in ESG investing has come from Europe, and this groundwork is now paying dividends. According to a UBS 2020 Report, family offices in Europe expect to have higher sustainable investment allocations than those both in Asia and the US.⁹⁰ Retail investors are pouring their money into ESG ETFs and thematic funds; in the last year European funds devoted to sustainable investing attracted a record EUR 120 billion (USD 135 billion) from investors.⁹¹ Additionally, in 2019, the total volume of sustainable investments in Switzerland reached USD 1.2 trillion, representing an enormous annual growth of 62%.⁹² Institutional investors are now taking ecological investing a step further, shorting carbon-intensive energy companies to exploit transition risk. For example, the BNP Paribas Environmental Absolute Return Thematic fund “shorts companies that are either sitting with significant stranded assets, or have technologies that are either outdated or insufficient to address climate change.”



Open Innovation Culture and Startup Ecosystem

Although Europe lacks a concentrated innovation hub like Silicon Valley, its member countries are home to many robust innovation centers known for fintech and climate solutions. For example, Level 39 in London serves as an innovation hub for the fintech, cybersecurity, and retail tech communities. Station F in Paris, located inside a massive retrofitted train station, is the largest physical startup facility in the world currently providing accommodation for up to 1000 early-stage business. In Switzerland, Zurich is home to Fintech Accelerator F10 and an enormous effort to explore sustainable finance by UBS and Credit Suisse; while nearby Zug serves as the blockchain and crypto capital of the world, pioneering decentralized ledger applications in everything from agriculture to sea transport. Environmental accelerator community Climate KIC is directly supported by the European Union, with offices in programming in more than 30 cities in Europe, nurturing startups in sustainable energy production, climate resiliency, and plant-based systems among others.

Open innovation teams are also prolific within the largest European financial incumbents, and actively pursuing fintech collaboration through various open banking initiatives. The Barclays Accelerator, powered by Techstars, is a Fintech-focused program designed to scale solutions which can both integrate into the larger Barclays operation, improve upon existing solutions, or serve new banking demographics. BNP Paribas currently runs a joint accelerator program with Plug and Play in Paris, resulting in the integration of more than 30% of graduating cohorts into various business units of the banking organization. ING hosts a Fintech village in Belgium, distilling over 100 applications to bring 7 innovative solutions to the market each year, allowing these participating startups to test their products in a banking environment. Each of these innovation ecosystems are coupled with Corporate Venture Capital (CVC) and senior executives who champion the most promising ideas on a path to investment, acquisition and integration. **All of these financial institutions have made major commitments to decarbonization, meaning their open innovation efforts are now specific searches for fintech companies that help to decarbonize assets or consumer behavior.**

Entrepreneurship vs Intrapreneurship

"Intrapreneurship is the entrepreneurship within an existing organization". Although Europe is home to many strong startup and entrepreneurial support systems, in many cases intrapreneurship remains the preferred method to nurture innovation. A recent study by the World Economic Forum explains that "due to the risk and opportunity profiles that European economies offer, entrepreneurial individuals in Europe frequently choose to start new ventures or projects while working for their employers rather than start their own business. Where this occurs, a shift into intrapreneurship is observed, also known as entrepreneurial employee activity (EEA)".⁹³ Indeed, **Europe doesn't lack entrepreneurs, but given the myriad of regulatory regimes and cultural attitudes, many innovations occur within larger organizations.** This is part of the reason countries like Denmark, Germany, and the United Kingdom maintain such robust, cutting-edge economies despite lower levels of independent startups launched than the United States. The importance of intrapreneurship is now recognized by the largest European financial players, who leverage open innovation, corporate venture capital (CVC), and champion these innovations from within the organization.

While there is an overarching European trend towards entrepreneurship, each country is different in this regard. While financial incumbents have designed the most notable fintech solutions in the Netherlands, this intrapreneurial/entrepreneurial split is more even in Spain, and more fintech-dominant in Germany.⁹⁴

Europe Climate Fintech Observations

Our initial analysis of the Climate Fintech ecosystem yielded 250 companies which match our definition: *digital financial technology which catalyzes decarbonization*. **Of the 250 companies we mapped, 108 companies were based in Europe, representing a substantial 43% of the ecosystem.** We found more Climate Fintech companies in Europe than any other geographic region, with a meaningful proliferation of solutions within investing, trading, and consumer behavior – business verticals which rely heavily on artificial intelligence, blockchain, and crowdfunding technologies.

Blockchain Climate Fintech solutions are currently in development throughout Europe, partly driven by common interest in transparency in financial transactions.

Spain was the first country to issue blockchain-powered green bonds and also the first country to use a mobile banking application powered by blockchain showing remittance customers. Germany is home to several fintechs developing solutions for tokenized energy and smart-grid management. And the Netherlands has huge potential to pair blockchain technologies with its focus on green bond issuance. Clear central regulatory policy allowing banks to hold cryptocurrency assets can pave the way for increased DLT application across Europe.⁹⁵

Crowdfunding platforms are perhaps the most numerous "climate fintech" business model in Europe, a popular venue for a climate-aware population to engage and invest in sustainable projects.

In some cases, the "Do it Yourself" model has gained traction, allowing neighborhoods to finance hyper-local smart grids. Piggy-backing on successful real estate crowdfunding models, platforms now build in energy efficiency or green infrastructure financing for citizens to become co-financiers of the energy transition.

Artificial Intelligence, Machine Learning, Big Data – Roughly 30 percent of the European Climate Fintech Landscape leverage increased data capabilities to inform retail investors, or active asset management for institutions using robo advisory services.

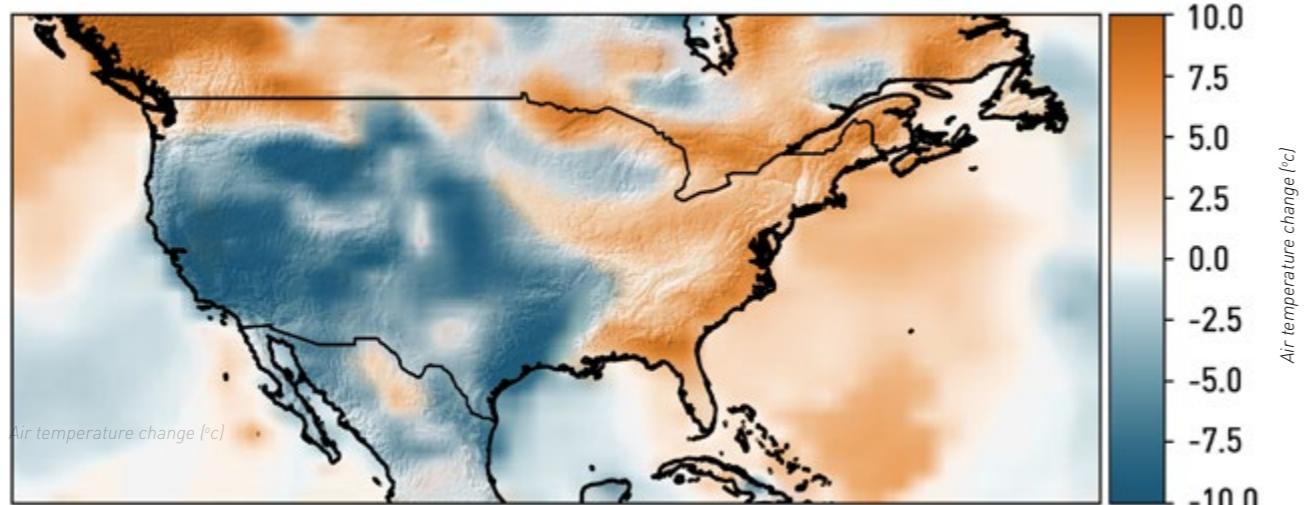
Only 5% of the fintechs in Germany are delivering on the UN SDGs, and only 2 of the 17 SDGs directly address decarbonization.

This is a sobering reminder that this area needs to be fostered more deliberately by policy-makers, financial incumbents, and entrepreneurs alike.⁹⁶

European citizens command more consensus around climate change and thus demand more from corporates and investors when it comes to decarbonization, especially when compared to the US or China.

As the continent continues its advocacy of climate finance, Climate Fintech innovations will increase in their potential for commercialization and scale.

5.3 United States



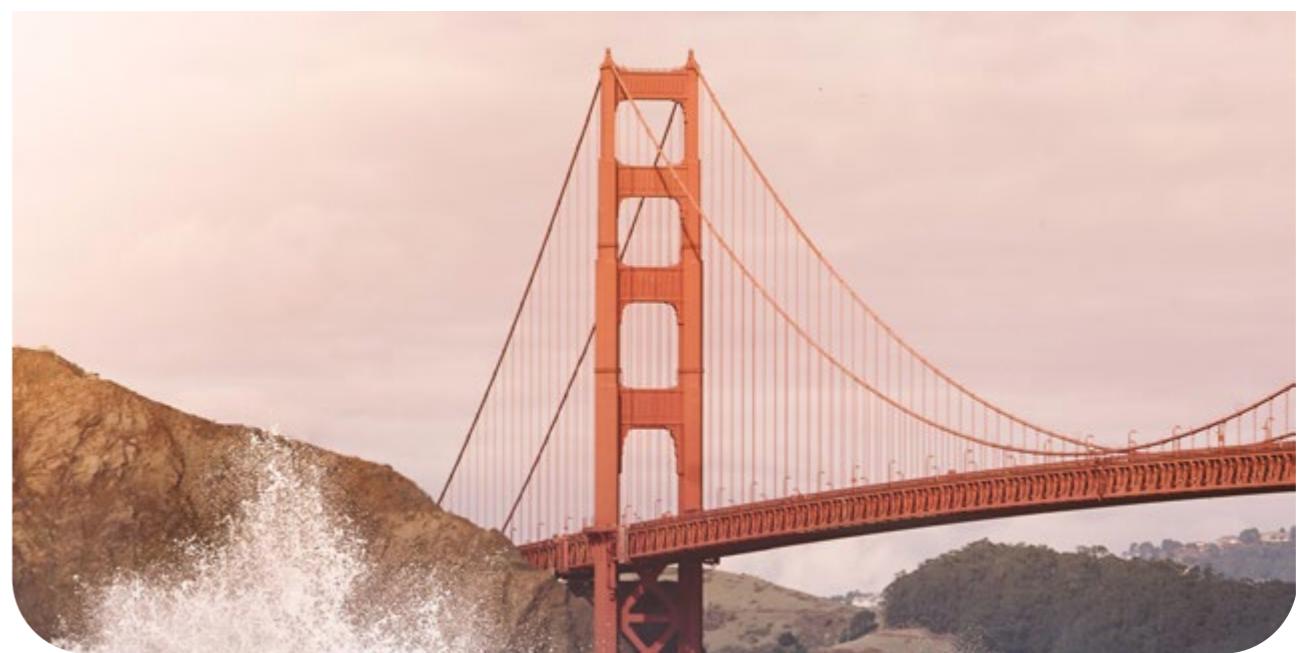
Climate model projections of the difference between annual minimum temperature in 2020 and 2050.⁹⁷

United States High-Level Observations

- The US is navigating a volatile moment of political transition and compromised economic strength, exacerbated by the COVID-19 pandemic.
- Despite federal resistance to climate action and a polarized electorate, capital flows have increased significantly for ESG and decarbonization.
- Entrepreneurial ecosystems are more robust than in Europe, especially for fintech startups on the two coasts.
- Roughly 31% of the startup fintech companies we found were based in the USA, the second largest geographic concentration.
- US citizen sentiment around climate action has changed significantly in recent years, as roughly 79% of Americans now support the prioritization of alternative energy sources – such wind and solar development.⁹⁸

The United States of America is currently in a tumultuous moment. Bungled management of the COVID-19 pandemic bundled with an economic crisis, racial tensions, and a deeply polarized electorate has culminated to an especially volatile 2020. Interestingly, these challenges have provided fertile grounds for important reflections, motivating deeper discussions around climate change, and catalyzing record-setting impact investment. As the second-largest GHG emitter, the United States still has the potential to

set a global example by transitioning its energy grid and advocating for more responsible investment practices. The country also maintains some of the most robust climate and fintech innovation communities in California and New York, which could be supercharged by additional resources and regulatory policy. While progress will likely be made on all of these fronts in the long-term, short-term efforts are heavily impacted by the tense political climate.



Regulatory and Political Environment

In June 2017, the United States withdrew its participation in the Paris Agreement, signaling a departure from international commitments of GHG reduction. In response, a bipartisan coalition of individual states formed the US Climate Alliance with the commitment of upholding the Paris Agreement, setting out clear targets intended to drive forward the energy transition within their borders. Over the last several years, this push-and-pull dynamic between the federal government and local actors has affected energy policy and investment throughout the country. For example, despite its higher cost to produce electricity, the US coal sector continues to secure substantial industry subsidies, which together with natural gas, still account for 60% of domestic electricity production.⁹⁹ Furthermore, in June 2020 the US Department of Labor proposed a rule which would curtail ESG considerations by Public Pension funds, mandating that funds "must make investment decisions based solely on the risk-adjusted value to beneficiaries and may not subordinate the interests of the plan to unrelated goals or objectives."¹⁰⁰ Despite these regulatory challenges, capital has continued to flow towards ESG and decarbonization at record rates.

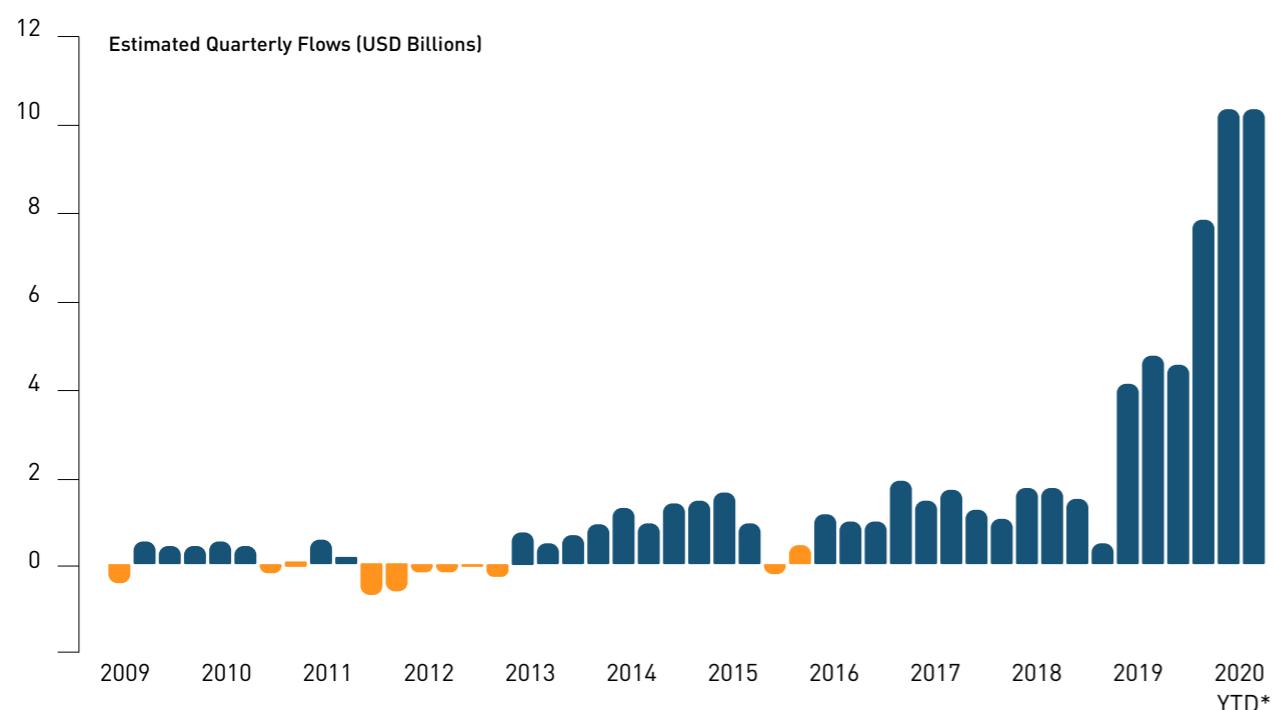
Major policy action and financial stimulus still remain somewhat uncertain as President-elect Joe Biden takes office. Although the incoming Biden Administration intends to rejoin the Paris Agreement, its proposed USD 2 trillion Climate Infrastructure plan requires Senate approval – a congressional body which is still in limbo. This proposal

includes the implementation of a carbon-free power sector by 2035, energy efficiency upgrades of four million buildings, and the construction of 500,000 electric vehicle charging stations, among other components. "We're going to make historic investments that will seize the opportunity," Biden explained in July 2020. If approved, this policy could reposition the United States as a leader on climate action.

Capital Flows and Financial Stakeholders

The United States is the world's largest and deepest market for investors, and ESG investing is finally becoming mainstream. This phenomenon is in part due to the now superior economics of renewables over coal. In the US, the average cost of electricity generation for solar plants built in 2020 is between USD 35 to USD 55 per megawatt-hour, down from USD 100 per megawatt-hour just four years ago. For coal, it's between USD 55 and USD 150 per megawatt-hour.¹⁰¹ Clearly superior economics, combined with increasing investor concern over social and environmental issues have propelled approximately USD 24 billion of capital flows into ESG-focused funds as of July 31, 2020. This figure already surpasses the calendar-year record of USD 21.4 billion set in 2019, a figure which suggests **more capital will flow into ESG funds in 2020 than the 3 previous years combined.**¹⁰² "Impact portfolios are significantly outperforming traditional ones," said Brad Harrison, a co-head of impact investing at Tiedemann Advisors. "It only escalated in the last year while we've been dealing with this pandemic."¹⁰³

U.S. Sustainable Funds Quarterly Flows



Source: Morningstar Direct. Data as of June 30th, 2020. *YTD 2020 as of June 30th, 2020.

Includes ESG Integration, Impact, and Sustainable Sector funds as defined in Sustainable Funds U.S. Landscape Report, 2018. Includes funds that have been liquidated; does not include funds of funds.

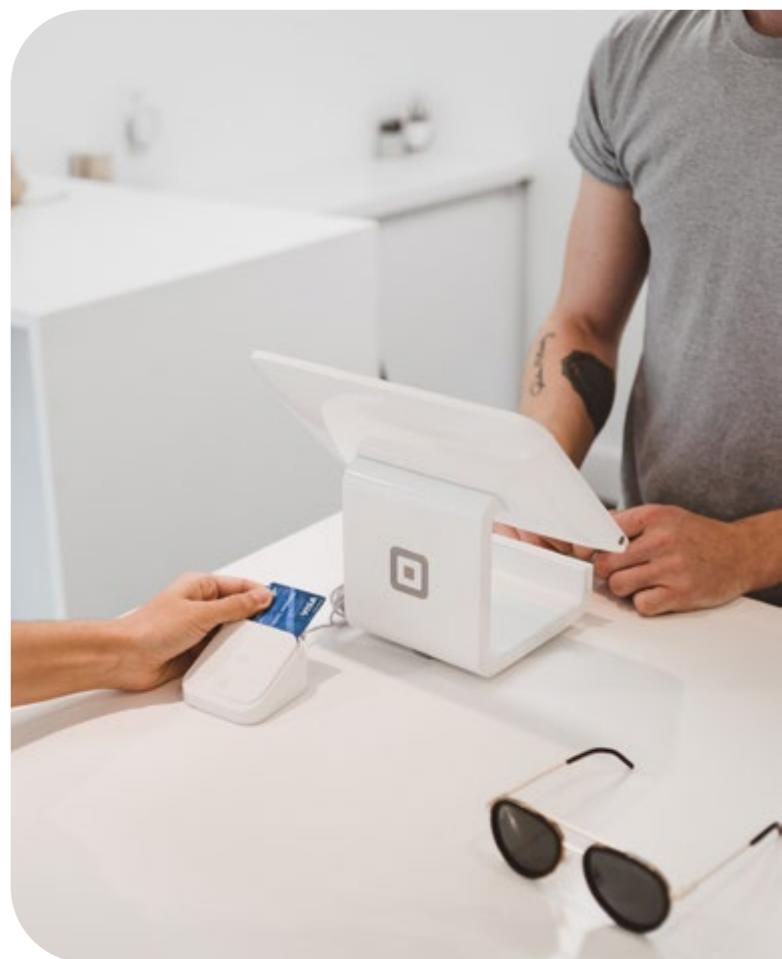
These capital flows are further supported by financing commitments and increased transparency by some of the largest US Banks. Citi recently announced a 5-year plan to finance USD 250 billion by 2025 in low-carbon solutions, following the USD 164 billion the bank has financed in the last 5 years. This new goal includes financing activities in renewable energy, water conservation, sustainable transportation, energy efficiency, and sustainable agriculture, among others.¹⁰⁴ Citi, Bank of America, and Morgan Stanley have all now joined the Partnership for Carbon Accounting Financials, an alliance of over 60 institutions working to

contribute to and uphold the goals of the Paris Agreement. Addressing systemic climate risk and pressing large corporates for increased transparency has also been visceral in shareholder resolutions – 77% of Fortune 100 companies highlighted their sustainability initiatives and commitments this year, more than double the figure of 2017.¹⁰⁵ “It reflects reality: a public and its policymakers fed up with fossil fuels, making a whole lot of it simply unprofitable to produce – same for the companies that produce it. This was true before COVID-19, which has only accelerated a process well underway.”

Open Innovation Culture and Startup Ecosystem

The United States has one of the most robust innovation cultures in the world. According to CB insights, there are 483 unicorns in the world; startup businesses which are valued at over USD 1 billion,¹⁰⁶ of which 49% are companies have emerged from within the US. American culture prides itself on its enterprising nature, a by-product of capitalism which encourages the creation of small businesses across the 50 states. However, fintech innovation is still largely dominated by the tech hubs of the San Francisco Bay Area and the financial epicenter of New York.

In 2019, Bay Area startups had attracted about USD 45.9 billion in new funding, representing 44 percent of all such funding in the country, topping the total from the next four biggest fundraising hubs combined.¹⁰⁷ YCombinator, Techstars, and Plug and Play are perhaps the most renowned accelerator programs in the States, who collectively have supported tens of thousands of startups now worth close to USD 200 billion. The combination of robust fintech culture, large capital pools, and an increasingly climate-aware population make the United States an attractive place to pursue the Climate Fintech innovation.

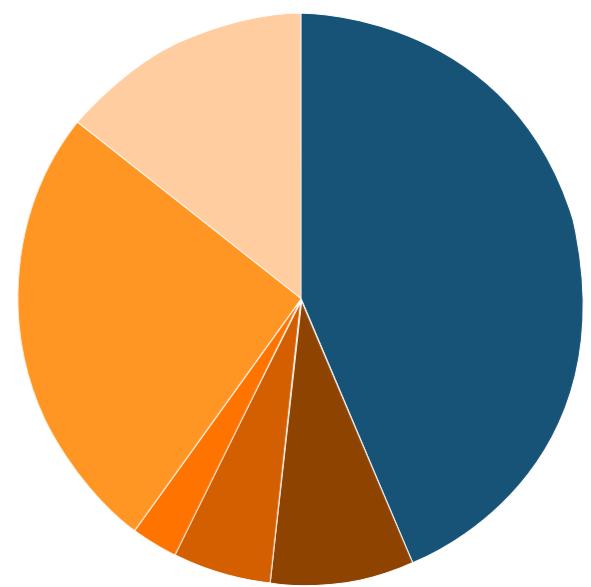


Proportion of Invested Dollars in 2019 in Leading Metro Areas

Includes Seed And Venture Financing

Greater New York Area	Greater Los Angeles Area
Rest of US	Greater Boston Area
Greater Seattle Area	San Francisco Bay Area

source: Crunchbase



Entrepreneurship vs Intrapreneurship

Both entrepreneurship and intrapreneurship play a role in scaling startups and ultimately connecting climate fintech startups to larger financial incumbents. Robust resources available to independent startups in the US lend itself to a more robust entrepreneurship culture. However, Intrapreneurship is also prolific in the states; for example, both Gmail and the Mac computer are examples of enormously successful intrapreneurship. But with so many accelerators, incubators, VC funds, meet-and-greets, hackathons, bootcamps, and tightly-knit investor communities, the brave US-based entrepreneur can often find support in their independent innovation efforts.

Within our US case studies, we find the comparison between Swell Investing and **OpenInvest** perhaps most illustrative of this dynamic. **Swell Investing**, created under the purview of Pacific Life insurance, was not allowed the strategic flexibility, access to existing customers, nor time frame it needed to reach economies of scale. Despite onboarding thousands of customers and tens of millions in assets, the platform was pressured with unrealistic economic expectations, without being provided enough time to mature, or the right resources to pivot customer demographics. This ultimately contributed to the unfortunate unraveling of an impact investment business that had tremendous potential. In contrast, **OpenInvest** went through accelerator community **YCombinator**, sourcing support from an enormous body of successful entrepreneurs and like-minded investors. Although they too started with a retail-investment platform with compressed margins, their strategic flexibility allowed for a pivot to a largely advisory-driven business model. Today, they are scaling all four verticals of their business (retail, advisory, platform, and institutional) which maximizes the utility they have for investors of different shapes, sizes, and diverse impact values – including a heavy focus on decarbonization.



United States Climate Fintech Observations

Our initial analysis of the Climate Fintech ecosystem yielded 250 companies which match our definition: *digital financial technology which catalyzes decarbonization*. **Of the 250 companies we mapped, 77 companies were based in the US, representing a sizable 31% of the overall ecosystem.** These companies had a meaningful proliferation of solutions focused on investing, risk analysis, and consumer behavior – many leveraging artificial intelligence and big data to enhance decision-making using large swaths of data.

Consumer spending applications which track carbon impacts continue to gain traction.

These solutions must strike a delicate balance between aggregating robust data and maintaining financial privacy, while still providing a useful and actionable output for the end-user.

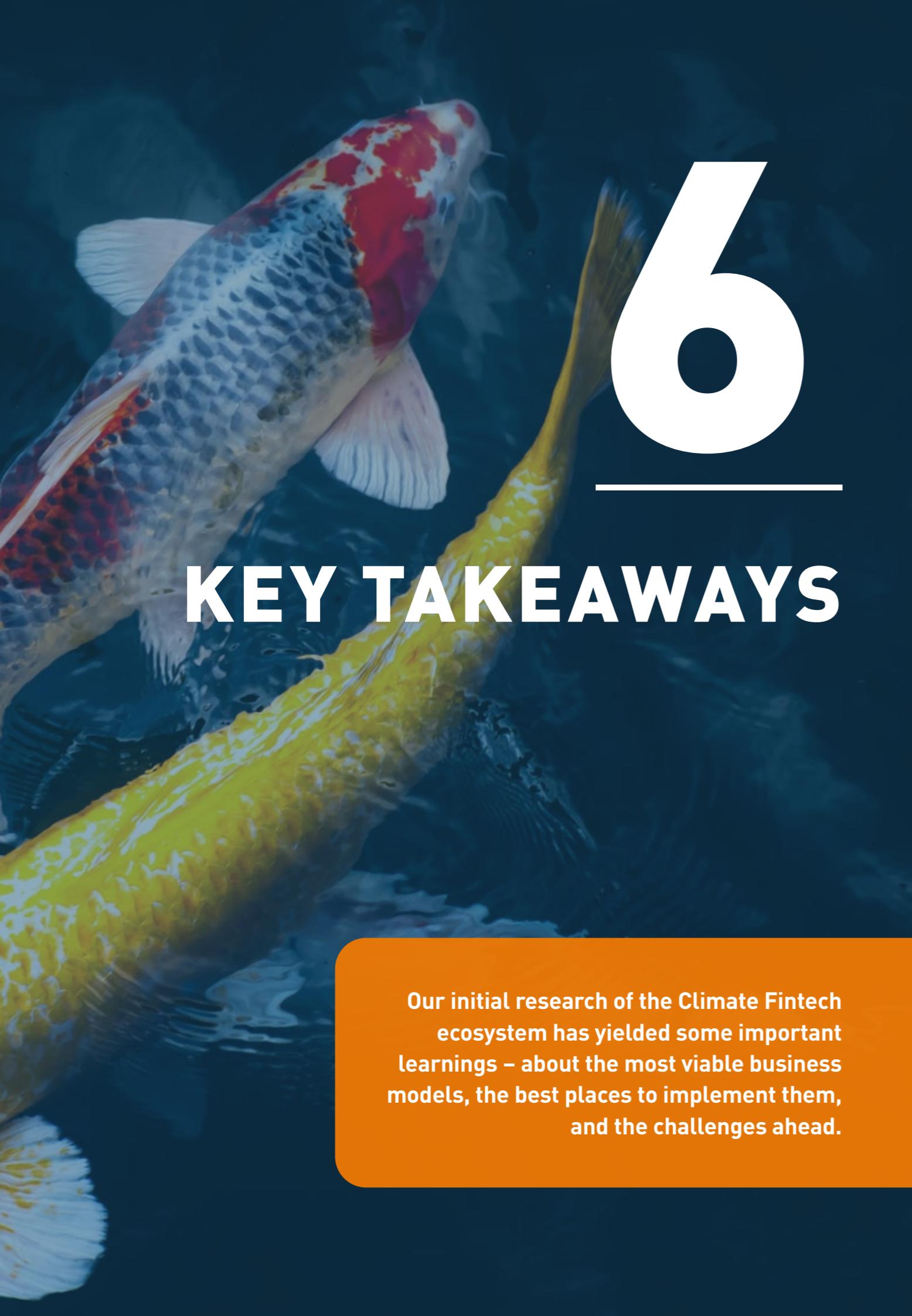
Risk Analysis companies who analyze ESG metrics, transition risk analysis, and climate risk have seen significant trends of adoption and acquisition by financial service companies such as Moody's, Morningstar, and Bloomberg.

Significant decarbonization uncertainty remains in the United States, though its potent combination of capital resources, pending policy action, and robust innovation hubs indicate the potential for a “decarbonization renaissance.”

Instead of “green” crowdfunding, US-based retail investors are increasingly tapping into robo advisory and Turnkey Asset Management programs to help them allocate small dollars more sustainably.

The election outcome paired with regional initiatives from the most populous states will spur continued investment in a cleaner energy mix, improved energy efficiency, and support a growing community of Climate Fintech entrepreneurs.





KEY TAKEAWAYS

Our initial research of the Climate Fintech ecosystem has yielded some important learnings – about the most viable business models, the best places to implement them, and the challenges ahead.

1

Climate Fintech has both downstream and upstream benefits – improving the daily lives of citizens and the behaviors of the largest financial institutions. In both directions, these benefits include increased accessibility, efficiency, transparency, accountability, and education for all participating stakeholders.

2

Globally, Climate Fintech innovations are most prolific in the categories of Investing, Consumer Behavior, and Risk Analysis. These verticals are the most common as they provide Climate Fintech startups the best chances for commercialization, integration, and scale.

3

Artificial Intelligence is the most prolific applied technology used across Climate Fintech applications, unparalleled in its ability to synthesize data, quickly discern patterns that humans cannot, and self-improve upon decision-making, predictions and recommendations which guide climate policy and investment.

4

Europe currently leads the US and China in its level of Climate Fintech innovation, though these other two markets have the potential to catch up through dynamic government policies currently in limbo. Intrapreneurship is a more common innovation strategy in Europe and China, while Entrepreneurship is a more common innovation strategy in the US.

5

75% of the Climate Fintech landscape is early stage – capitalized with less than USD 10 million – however these companies have real opportunity for scale especially when given access to legacy customer bases seeking climate-conscious products and services.

6

Only 5% of the fintechs in Germany are delivering on the UN SDGs, a sobering inference that other countries likely have much lower rates of decarbonization imbedded in their Fintech ecosystems. While Climate Fintech is a small subset of the overall ecosystem – these decarbonization intermediaries demonstrate commercial viability and warrant a more deliberate investment by VCs and larger financial incumbents.

7

Climate Fintech integration into financial incumbents is best facilitated by:

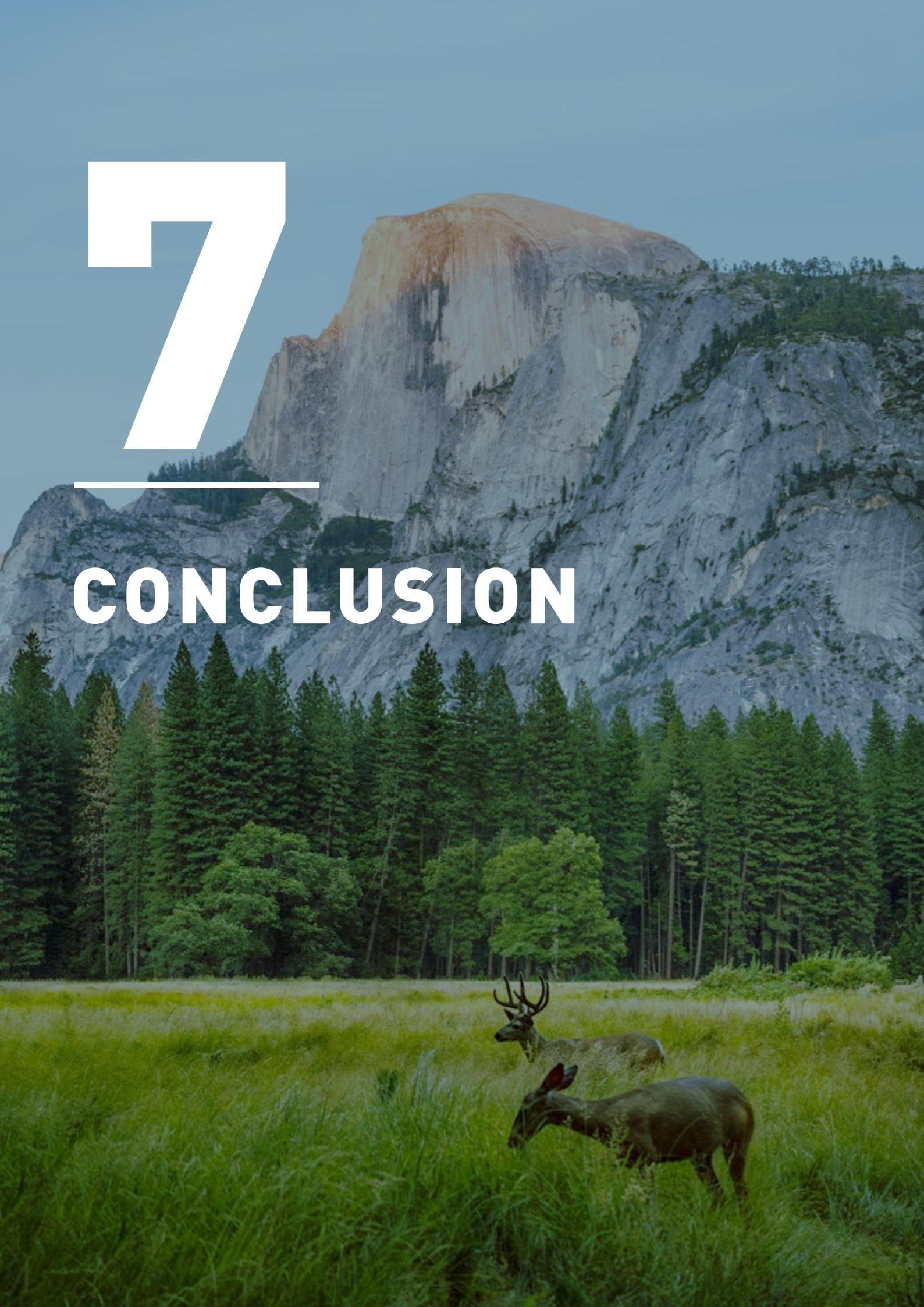
1. acute business unit relevance,
2. a dedicated culture or team of Open Innovation and use of Open Banking, and
3. securing an executive-level internal champion to advocate your value proposition.

8

Banks should advocate internally for more Open Innovation and interaction with Climate Fintech solutions, while Asset Management firms should mandate the use of ESG practices, transition risk analysis, and physical risk analysis in their investment process across all asset classes.

9

Meaningful knock-on effects exist for technologies which are intermediaries for capital movements. For example, a USD 5 million platform marketplace infrastructure can move USD 50 billion in sustainable project finance, especially when paired with a large crowdfunding population and institutional capital.



CONCLUSION

Climate Fintech may be in its early days, but it is an exciting subsector of digital financial technology which can be applied to catalyze decarbonization at enormous scale in the years to come. In many cases, these technologies are hybrids of existing applications and digital technologies, but with a newfound focus on GHG reduction and ecological preservation. **Citizens maintain tremendous and often underestimated influence over this digital decarbonization** – a climate-aware populous will inevitably hold governments and institutions accountable to decarbonization ambitions. As governments and institutions make good on their climate commitments, these digital tools and intermediaries will become increasingly important to both downstream and upstream participants.

For institutions, banks, asset managers

WE IMPOLE YOU TO ADVOCATE

for open innovation efforts directly exploring Climate Fintech; to champion promising innovations that can integrate into your respective business units, and use this as an opportunity improve the impact services you offer your clients.

For investors and private capital

YOU PLAY A PIVOTAL ROLE

in de-risking these innovations, opening your rolodex, and advising startups on the best path forward towards initial customer acquisition.

For citizens

YOU ARE THE MOST POWERFUL WHEN YOU ARE VOCAL AND UNITED

around the environment, your actions have already told corporates how to behave. Please explore solutions, both digital and analog, to decarbonize your spending and banking routines – and of course share, and educate friends and family on what technologies work best for you.

For climate fintech startups

YOU ARE IN THE RIGHT PLACE AT THE RIGHT TIME

We're thrilled by your work, and welcome you to share your questions, pain points, and motivations while we all strive to make a difference in decarbonizing the financial system.

APPENDIX

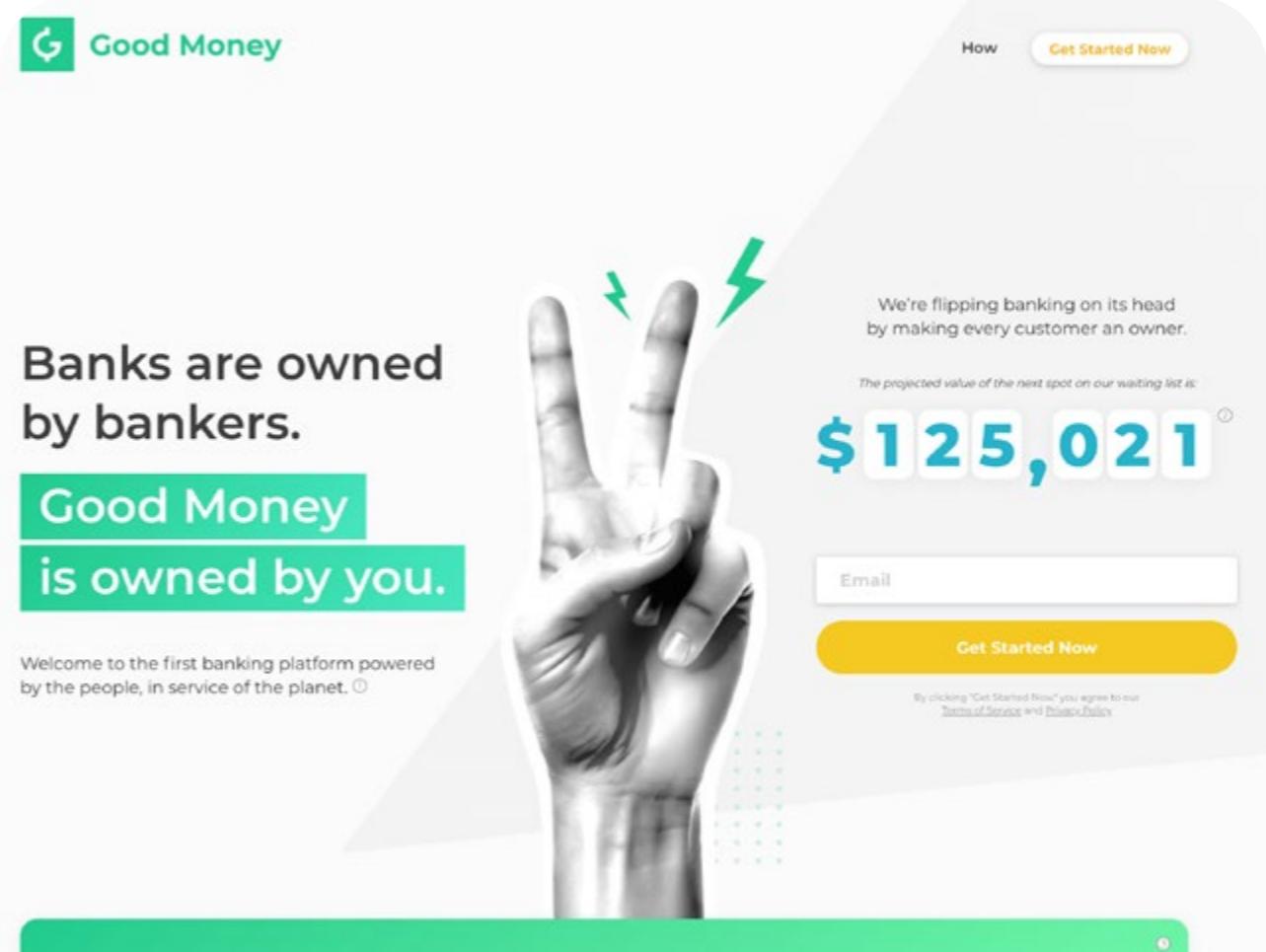
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Case - Banking

Good Money

Good Money is a conscious banking platform, and the first online bank to democratize bank ownership to its banking customers. Good Money believes that wealth inequality and climate change are the defining issues of our time, and the products they offer focus on tackling these two issues. In their equity program, instead of earning points or airline miles when a customer uses their card, they earn a minimum of 1% back in equities on all purchases via a basket of values-aligned public equities while protecting the rainforest. Gunnar Lovelace, co-CEO of Good Money is also the founder of Thrive Market, an online grocery store which democratizes access to healthy food. He explains, "Consumers are increasingly expressing their personal identities and values through the

brands and companies with whom they choose to do business, and banking is the core medium to empower consumers to vote with their money to reshape capitalism towards a thriving future for humanity and the planet. In many ways **Good Money shines more brightly in the Covid-19 down-market, as the conditions which cause feelings of intense economic populism are further intensified.**" Launched in 2020, Good Money has seen meaningful traction to date, having raised USD 30m from VCs while simultaneously creating a 'Good Deeds' initiative, whereby 50% of profits are donated to social and environmental causes. Their partnership with The Rainforest Initiative has protected nearly 1 million trees as of November, 2020.



Case - Investing

ETHO ETF**ETHO is the first broad-based, diversified, socially responsible and fossil-free exchange-traded fund (ETF) that does not have exposure to the traditional energy sector.**

The diversified index ETF selects equities based primarily on an assessment of an equity's carbon footprint. Etho's CEO Ian Monroe explains, "Etho is driven by Big Data sustainability using a quantitative focus on climate emissions, but we also look at an ever-growing set of overall ESG data. We're also integrating AI and machine learning into our portfolio construction process to find additional financial performance signals that will help us optimize climate and ESG impacts while continuing to improve financial returns." Etho calculates the "climate efficiency" of companies by calculating the total Scope 1-3 emissions per dollar invested. They analyze these inputs over 7,000 of the most commonly-

traded companies, and then select the climate leaders while also removing bad actors.

Etho also considers physical climate risk, which helped them to divest from PG&E ahead of the massive wildfires that caused the company's bankruptcy. While Etho is currently focused on decarbonizing and de-risking public equity investments, they believe there is an enormous need and opportunity for similar investment approaches in private equity investing. **"Many asset allocators are still investing based on an outdated understanding of 1950's-era Modern Portfolio Theory. It's time for us to work together to update Modern Portfolio Theory for 21st Century climate change realities."**

Case - Lending

Prime Energy

Commercial scale solar debt is attractive for its inherent recourse, stable and predictable returns, and measurable decarbonization impacts. For this reason, it is sought after by banks and institutional investors, leaving little of this debt product available for retail investors. **Prime Energy in Switzerland grants retail investors unique access to green bonds, allowing them to provide debt financing for solar projects all over Europe.** For a minimum of EUR 5,000 individuals can finance a solar project, subscribing

to a corporate loan issued by the solar developer. The loans provide investors stable and predictable annual fixed interest payments, with a balloon payment at maturity. The electricity produced by these solar facilities is integrated into the grid or directly consumed by end customers, and is bought at a fixed price over 20 or 25 years. Prime Energy has syndicated debt capital using a crowdfunding model from high net worth individuals, resulting in the financing 74 solar plants and producing over 35 MW of clean energy in 5 different countries.



Case - Risk Analysis

Mio Tech

Mio Tech is a China-based ESG analytics startup which is solving for issues around ESG data availability and accuracy. As of June 2019, less than 26% of companies that were listed on local stock exchanges in China issued CSR (corporate social responsibility) information and rely on self-reported data. Only 34% of CSI 300 component listed companies have disclosed emission data.¹⁰⁸

Mio Tech applies AI and big data technologies to solve the above problems. Alternative data are analyzed in addition to traditional data sources, including websites of regulators where information of environment related penalties and license status are disclosed. Media is another data source, where fraudulent activities and other malpractices are increasingly exposed and at a faster pace on social media and other online platforms, as news of targeted companies is extracted by machine. **While traditional data only contains**

roughly 20 inputs, alternative data sources can provide significantly more (up to 300). This allows for better prediction modelling to forecast the causal relationship between the ESG information and the performance of the company. Data is updated daily, making the information timelier for investors. Most importantly, all information is processed by AI (Natural Language Processing and Image Recognition), unstructured data in various forms such as PDF, Word or even image, can be transformed into structured data for analysis, or automatically analyzed by machine learning. This dramatically reduces processing time and allows for more advanced predictive modeling. Mio Tech now covers 800,000 private and public Chinese companies, and aggregate all ESG data points into one platform with exclusive access to both public resources and alternative datasets¹⁰⁹.

Case - Trading

SilviaTerra Natural Capital Exchange (NCAPX)

Another example of digital carbon trading is the **Natural Capital Exchange, known as NCAPX, which democratizes forest carbon markets by empowering every landowner to participate.** The program is supported from Microsoft AI for Earth and then built on top of SilviaTerra Basemap, the first high-resolution forest inventory of the continental United States. "We spent 10 years getting the data right, now we can

report accurately on every species of every acre in the United States," explains Product Manager Gordon Vermeer. This data is updated annually and for every parcel in the country, landowners gain insight into the composition of their forests, the value of their timber, the amount of carbon on their land, and the payments they could receive by reducing their timber harvests.

Case - Financial Product Innovation and Insurtech

kWh Analytics: The Solar Revenue Put

The Solar Revenue Put is a credit enhancement that guarantees the performance of solar assets. It was invented by **kWh Analytics**, a firm that conducts risk analysis and due diligence on solar project development. Over a 12-year period, kWh aggregated the performance of hundreds of solar projects around the country, resulting in enough data to create an actuarial model and price the risk of consistent solar revenues. With this vast amount of data in hand, they worked with Swiss Re, one of the largest reinsurance firms in the world, to create a product which would guarantee solar revenues regardless of the volatility of energy prices and varying production due to weather fluctuations. "These things take a long time, and the finance community hates new things. But if you can show that risk is mispriced, and offer a product that pencils for the end customer, there is tremendous potential to change how long these projects take

to be financed," explains Richard Matsui, CEO of kWh. "The product improves lender terms by de-risking the asset with an insurance-backed production guarantee for up to 95% of expected energy output. **This is the tip of the iceberg; there is still untapped opportunity for firms to look at insuring the floor of electricity prices as they drop, or wind resources hedging such as a proxy revenue swap. This space is ripe for additional product creation and innovation.**" Investors have long sought assurance that solar power plants will perform as promised. With kWh Analytics and Swiss Re now protecting their investments, stakeholders are better able to deploy the hundreds of billions of dollars that the solar industry requires in the coming years.



GLOSSARY

- **API:** Application Programming Interface; a computing interface which defines interactions between multiple software intermediaries
- **AUM:** Assets Under Management; the total market value of investments managed
- **Carbon Footprint:** The amount of measurable or assumed carbon dioxide and other GHGs emitted due to normal business operations or daily routines
- **CPI:** Climate Policy Initiative; an analysis and advisory organization with a mission to help governments, businesses, and financial institutions drive economic growth while addressing climate change
- **Decarbonization:** The process of removing or reducing carbon dioxide output
- **Digitalization:** The use of digital technologies and digitized data to impact how work gets done, transform how customers and companies engage and interact
- **Digitization:** the process of converting information or a business model using digital format, in which text, pictures, or sound are synthesized into a form that can be processed by a computer
- **DLT:** Distributed Ledger Technology; a digital system for recording the transaction of assets; a consensus of replicated, shared, and synchronized digital data geographically spread across multiple sites, countries, or institutions
- **ESG:** Environmental, Social, and Governance; typically associated with investing
- **ETF:** Exchange Traded Fund; a type of investment fund which is thematic in its composition, securitized, and sold on a stock exchange
- **GHG:** Greenhouse Gases
- **IPCC:** Intergovernmental Panel on Climate Change; the United Nations body for assessing the science related to climate change
- **Microgrids:** A local energy grid with control capability, which means it can disconnect from the traditional energy grid and operate autonomously
- **Neobank:** A type of direct bank that operates exclusively online without traditional physical branch networks.
- **Net Zero:** Also referred to as "carbon neutral"; when the amount of greenhouse gas emissions produced is completely offset by the amount of greenhouse gas emissions removed
- **P2P Lending:** Peer-to-Peer Lending; a type of crowdlending that connects people or entities willing to loan money to people or businesses that want to borrow money
- **Pay-As-You-Go:** A system in which a person or organization pays for the costs of something when they occur rather than before or afterwards
- **PBOC:** People's Bank of China; the central bank of the People's Republic of China
- **PCAF:** Partnership for Carbon Accounting Financials; an industry-led partnership to facilitate transparency and accountability of the financial sector to the Paris Agreement
- **TAMP:** Turnkey Asset Management Program; allowing financial advisors, typically fiduciaries, to outsource the management of their clients' assets
- **TCFD:** Task Force on Climate-related Financial Disclosures; an organization created by the Financial Stability Board (FSB) to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders
- **UN PRI:** United Nations Principles for Responsible Investment; an international network of investors working together to implement its six aspirational principles, often referenced as "the Principles"
- **UN SDGs:** United Nations Sustainable Development Goals
- **UNEP:** The United Nations Environment Program
- **WWF:** World Wildlife Fund; an international non-governmental organization that works in the field of wilderness preservation and the reduction of environmental impact

10

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METHODOLOGY

In our search for Climate Fintech companies around the world, there was no clear taxonomy to firmly determine what qualifies as "Climate Fintech." Our definition is broad and we cast a wide net, in part to uncover as many digital financial solutions facilitating decarbonization investment, clean energy finance, and sustainable consumer habits as we could. Third-party data varies significantly, so attributing "climate-conscious" company activities and valuations was a largely qualitative exercise. While deeper evaluation of our database might yield some adjustments, the database is ever-growing and will supplement these findings. While this is not a scientific method, we hope that our perspective stimulates deeper exploration by our readers as this ecosystem evolves.



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