

# Traversing the Climate Technology Scale Gap

**Lead Authors:** Parham Peiroo and Melissa Uhl

**Contributing Authors:** Michael Bernstein, Veronica Chau, Danya Hakeem, Katie Hill, Dawn Lippert, Saritha Peruri, Raju Sarma, Vinay Shandal, and Avra van der Zee

June 2024

**BCG** + **BCGX** +  **Elemental  
Excelserator**

## **BCG**

BCG works with clients to accelerate their climate and sustainability journey. BCG helps them identify and harness climate innovation, embed sustainability at scale into their business, and capture the value they create. BCG's work is as far-reaching as the challenge.

## **BCG X**

BCG X is the technology and design unit of BCG. Turbocharging BCG's deep industry and functional expertise, BCG X brings together advanced technology knowledge and ambitious entrepreneurship to help organizations enable innovation at scale.

## **Elemental Excelerator**

Elemental Excelerator is a nonprofit investor focused on scaling climate solutions for deep local impact. Elemental has invested in this space consistently since 2009 scaling essential climate solutions that make neighborhoods and homes cleaner, healthier, safer, and more affordable. Elemental de-risks technologies for additional investment and centers social equity and community impact in products and technology deployments. Elemental's portfolio is active nationwide as well as more than 100 countries and has raised over \$10B in follow-on funding.

For more on our insights, please contact our lead authors, **Melissa Uhl** at [melissa@elementalexcelerator.com](mailto:melissa@elementalexcelerator.com) and **Parham Peiroo** at [peiroo.parham@bcg.com](mailto:peiroo.parham@bcg.com)

# Letter from the Authors

Broad adoption of climate technology is critical to reducing and mitigating the worsening effects of a warming planet. Yet, innovators often struggle to secure the funding needed to support early-stage commercial deployments.

The result is a sizeable “Scale Gap.” Within Elemental Excelerator's portfolio alone, the gap is greater than \$500 million. That gap is exacerbated by economic and geopolitical turbulence. Rising interest rates, inflation, capital markets volatility, (especially across the technology sector), and a spike in global hostilities all contributed to a near 40% drop in climate-related funding in 2023.

Despite these headwinds, there are many reasons for optimism. Over the last several months, Elemental Excelerator and Boston Consulting Group met with over 100 investors from across the capital stack, as well as corporates, engineering, procurement, and construction firms (EPCs), insurance providers, and foundations. We came away inspired. Everyone we've engaged with is eager to collaborate on potential solutions, be it through financing deals, capacity building, or devising solutions to de-risk deal making.

This report presents the key insights from these discussions. Our hope is that it will be a collective catalyst for action. We see an urgent need to bring capital and knowledge into the Scale Gap and ensure that the technologies most needed to make our planet and our communities cleaner, safer, and healthier are widely available.

With every investment and every conversation, we learn. The highlights from this work show that traversing the Scale Gap creates opportunities for everyone.



A handwritten signature in black ink that reads "Melissa Uhl".

**Melissa Uhl**  
Chief Growth Officer,  
Elemental Excelerator



A handwritten signature in black ink that reads "Parham Peiroo".

**Parham Peiroo**  
Partner,  
Boston Consulting Group



# Contents

- 1** Executive summary
- 2** Climate technology has a Scale Gap
  - Introducing the Commercial Inflection Point Scale
  - Understanding the root causes of the Scale Gap
  - Charting the impact of economic headwinds
- 3** Ways to traverse the Scale Gap exist
  - Taking advantage of “old tools”
  - Collaborating with “new friends”
  - Examining emerging deal structures that put these ideas in action
- 4** Everyone has a role to play
  - Taking the climate finance ecosystem to the next level
  - Getting started: A collective call to action
- 5** Conclusion
- 6** About the authors

# Executive Summary

To address climate change risk, the world needs advanced climate technologies. But many critical solutions are stuck in a logjam. They make it through the incubation stages only to flounder for years trying to progress through early deployment. Some succeed in securing needed funding and expertise. Many more don't. We need to remove these constraints. The Scale Gap doesn't need to exist. And the tools and insights to close it are lying in plain sight. Moreover, doing so benefits everyone. Analysis from the Rhodium Group shows that for every ton of carbon dioxide reduced within the US, two to three tons of emissions are cut globally, thanks to cost reductions in the green premium that come from bringing critical innovations to scale.

## What is the Scale Gap?

To achieve commercial adoption, climate technologies must go through successive early-stage deployments. And because these solutions often involve hardware, software and infrastructure, these deployments are complex. In addition to capital, they need project development know-how, community acceptance, and proven commercial demand. Projects are receiving some of these inputs, but not nearly enough. The shortfall creates what we call the Scale Gap.

## Why there's a Scale Gap.

Traversing the Scale Gap is a capital-intensive exercise and comes with a broader set of risks. These factors don't fit neatly into current investment archetypes. Deploying capital in first, second, up to nth-of-a-kind projects before they have been de-risked tends to be "too big for venture, not commercial enough for growth equity, and too risky for infrastructure investors," as one investor we spoke to put it. Most innovators are not project developers. And many investors are still figuring out how to evaluate and underwrite deals in the early deployment stages. These constraints create a Scale Gap of more than \$150 billion globally, according to our estimates.<sup>1</sup>

## Where the Scale Gap is most acute.

Few capital providers issue debt and other financing options for climate projects under \$100 million. As a result, in many instances, developers must finance their first through nth deployments using prohibitively expensive venture funding. It's only when these initiatives reach a sufficient size—whether individually or as part of a bundle—to meet a \$100 million scale that other, more affordable financing options become available.

1. This estimate represents the median funding need based on corporate equity alone. (The actual need is likely to be much larger when project finance and bank lending are factored in.) Source: Kate Larsen, Hannah Pitt, Mahmoud Mobir, Shweta Movalia, Alfredo Rivera, Emma Rutkowski and Trevor Houser, "Global Emerging Climate Technology Diffusion and the Inflation Reduction Act", July 6, 2023

### **"Old tools" and "new friends" can help.**

It's common to think that breakthrough innovations require complex and often bespoke financial instruments to support them. And while both BCG and Elemental actively engage in creating new tools where none exist, in this case, our market research suggests that existing financial and partnership structures can help traverse the Scale Gap. Banks, private equity, institutional investors, and infrastructure investors represent a growing share of climate technology funding. In addition, new tax incentives and funding programs from the Inflation Reduction Act (IRA) are entering the market. One example is the \$27 billion Greenhouse Gas Reduction Fund (GGRF). GGRF will result in a seismic infusion of funding to states, tribal nations, and nonprofit funding institutions in the US that could flow more capital into climate technology. Corporates also fill distinct needs—both as willing offtakers (one of the most critical unlocks) as well as project and “TopCo” investors. Insurers can play a vital role as well, creating products that would allow banks and other lenders to issue debt. These stakeholders create an increasingly diverse climate finance ecosystem.

Philanthropy has the potential to play a catalytic role within this expanded ecosystem. Philanthropic capital that is seeking impact or impact plus small returns (such as program related investments, “PRIs”)

can help make early deployment projects attractive to other funders. Avenues can include taking a first-loss position or an equity investment to serve as a guarantee.

### **Traversing the Scale Gap is particularly important at this moment.**

There is significantly more capital available now than ever before—not just commercial and private capital, but also public capital as a result of the IRA, such as GGRF, and similar programs. Only when early climate technology solutions have crossed the Scale Gap can they access much of these dollars. We have a unique opportunity right now to make sure we don't leave anything on the table.

### **About our research**

We engaged with more than 100 investors and industry leaders to understand what it takes to close the Scale Gap and tested our content with over 50 organizations at New York Climate Week in 2023. Our perspective is also based on:

- Elemental Excelsior's experience in funding more than 160 portfolio companies since 2009
- BCG expertise provided from BCG Green Ventures, BCG's Climate and Sustainability practice, and industry practice experts and
- Data from analyzing climate technology transactions worth \$130 billion across 3,200 companies



## Climate Technology Has a Scale Gap

During the critical early deployment stages, technology risks are mostly retired. However, new risks around project development, project economics, and scaling solutions emerge. Building first, second, up to nth-of-a-kind projects require significant capital matched with an appetite for some risk. But very little financing is targeted at these stages. Most funds focus on early-stage investments or late-stage infrastructure opportunities, leaving mid-growth investments for climate technology largely unattended. Confusion around specific commercialization milestones adds to the challenge, with different parties using different terminology to refer to different stages of growth.

The lack of clarity has obscured the specific requirements projects need to reach broad-scale adoption.

Commercial Inflection Point scale Elemental Excelsior developed the Commercial Inflection Point (CIP) scale in 2019 to provide a standardized framework for investors, aligning them on key milestones across the climate technology commercialization journey—from ideation to mass market adoption. Inspired by the Technology Readiness Levels (TRLs) and ARENA's Commercial Readiness Index (CRI), the CIP scale ranges from 1 to 8, with 8 marking peak commercial maturity. See Exhibit 1.



## Exhibit 1

## Snapshot: Elemental's Commercial Inflection Point Scale

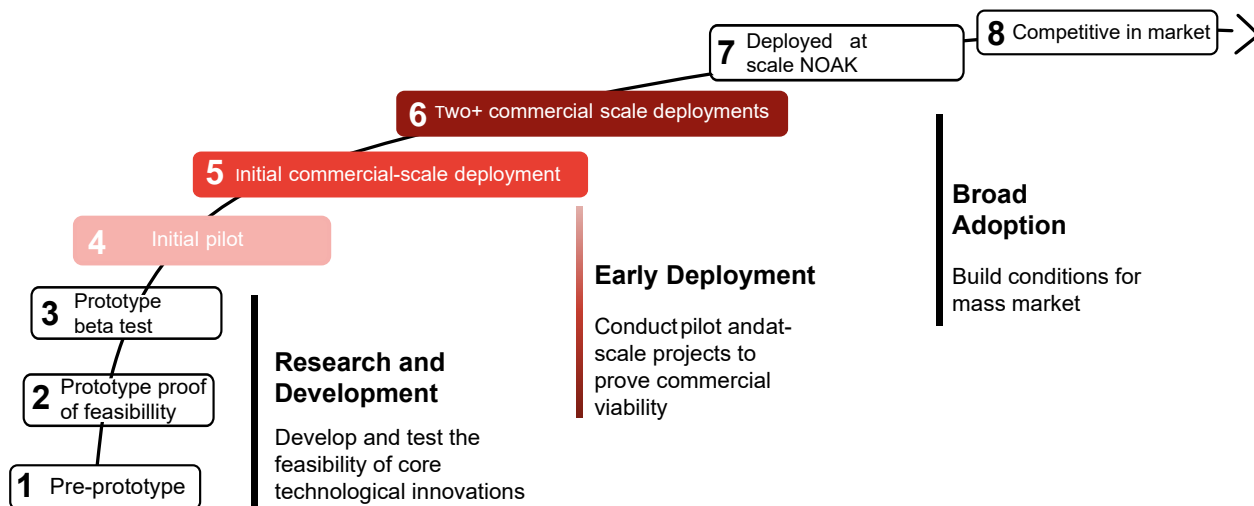
	Inflection Points	Description
Path to broad adoption	<b>1</b> Pre-prototype/ research	Solution is in the early stages of ideation and development. Commercial applications have been identified and technology solutions are being explored. Founders are developing ideas for social impact benefits.
	<b>2</b> Prototype proof of feasibility	Solution components and processes are being designed and tested in a lab setting. Company is confirming the technology viability of the prototype. Founders have a clear sightline to equity outcomes and social impact if their company scales but may be at different stages of setting values and culture.
	<b>3</b> Prototype beta test	Solution prototype is being tested with a small potential customer base before being released to real world settings. Company is ready to deploy solutions for demonstration in an operational environment, but commercial and operational drivers have yet to be tested in the field. Company is engaging with local communities to better understand the needs and opportunities in the places they want to deploy.
	<b>4</b> Initial pilot	Solution is deployed in small-scale pilots in a real-world setting. Company is using early technical and commercial results to drive interest for first commercial deployment and inform further product and market development. Company is strengthening equitable hiring and pay, engaging community partners and exploring workforce development, education, or other community engagement strategies, including creating community engagement plans.
	<b>5</b> Initial commercial scale deployment	Solution is deployed in a commercial-scale project with a customer or partner for the first time. Company is using results to prove viability in real world settings and generate additional commercial traction. Company is continuing to strengthen team culture, develop community partnerships, implement community engagement, and evaluate outcomes.
	<b>6</b> Two+ commercial- scale deployments	Solution is deployed at the commercial scale with at least two paying customers. Company is using technical and financial results to further inform growth plans in terms of team/board composition, community impact, equity outcomes, product, market, and sales strategy.
	<b>7</b> Deployed at scale	Solution is deployed at commercial scale with repeatable business and community benefits models in a significant number of markets or with a significant number of customers. The business is continuing to expand, grow sales and revenue, and is likely gaining market share – while continuing to deliver measurable climate and community impact.
	<b>8</b> Market leader	Solution is delivering significant value to customers. The sales process is repeatable with predictable revenue in multiple customer segments and/or multiple markets. The solution is gaining market share and the company is broadening its product offerings and support services. An engine to generate new jobs and measurable climate and community benefits has been created.



Using this mapping, we see that the Scale Gap affects CIP 4 through 6 most acutely. See Exhibit 2. The data in Elemental’s portfolio alone shows a \$4.6 billion pipeline of projects in these three stages, all seeking funding.

**Exhibit 2**

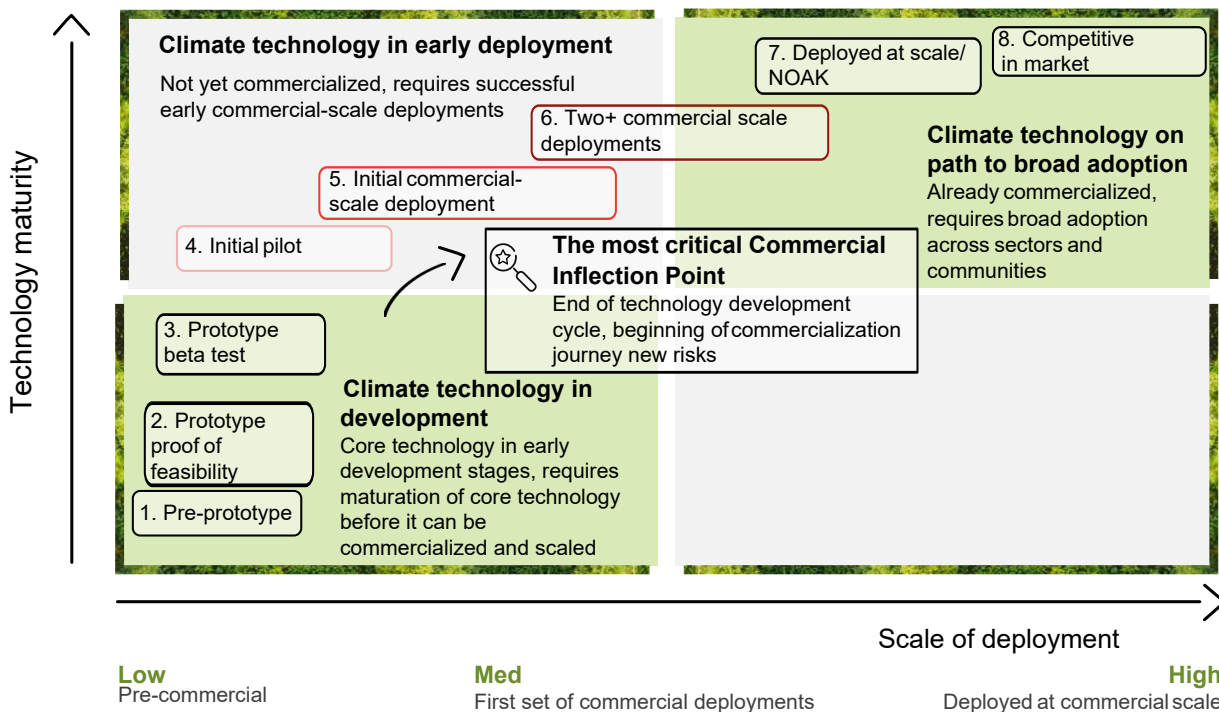
**Elemental Excelerator Commercial Inflection Point Scale**



Source: Elemental Excelerator Commercial Inflection Point Scale

**Exhibit 3**

**Several technology and commercial milestones must be met to achieve scale**



Note: Y-Axis: The technology maturity scale covers ranges from developing tech (when significant technology dev and step changes occur) to mature technology, at which point core technology goes through changes. X-Axis: The scale of deployment from prototypes and pilot (short time period) to first set of commercial deployments (longest time period) to deploy at commercial scale (continues on into future), in which a company goes from startup, new entrant to incumbent and competitive in the market.

Source: Elemental CIP Scale, Climentum Capital, Elemental Excelerator & BCG analysis



### **Understanding the root causes of the Scale Gap**

What makes the 4th, 5th and 6th inflection points so challenging? And why does investment ease at stage 6 and beyond?


Moving through each stage of early deployment requires big leaps. Advancing from CIP 3 to CIP 4, for instance, requires a massive increase in project development expertise. This is where initial plants or large-scale projects are built. Progressing from CIP 4 to CIP 5 brings with it other new demands. Chief among them is much deeper engagement with corporates and community partners. Those relationships are critical in gaining market acceptance, securing planning permission, and proving long-term viability. But building these relationships takes time and expertise. Corporates often act as a project's first customers and help assuage go-to-market concerns for market-rate investors. And community partners, regulatory and permitting agencies can make or break a project's success.

As we've seen, traversing the Scale Gap from start-up to commercial-scale business is a capital-intensive exercise. Companies between CIP 4 to 6 often need Series A and B funding to develop pilot or first-of-a-kind commercial facilities. **In the global climate technology sector, approximately 2,100 companies are at the Series A or Series B stages. These startups require an estimated \$100 billion to \$180 billion in additional "TopCo" funding over the next 2-3 years. And this amount could increase between 2 and 10 times when project-level financing held in special purpose or joint venture vehicles is considered.**




Because clean technology involves new solutions and business models, it carries more risk than funding commercialized technology. Ticket sizes often exceed the threshold for most venture investors and risk factors often extend beyond those that investors with the ability to write larger checks typically consider. Investors and industry leaders we spoke with acknowledge these challenges and cite several unresolved frictions.


- **Projects are hard to evaluate and underwrite.** Capital providers often perceive early deployment projects to present financing risk. That perception can result in limited syndication and a lack of incentives for investors to commit. The head of sustainability for one major fund said,

 *Today, we don't have a lot of the technical expertise to underwrite and price many of the technologies appropriately... It's tougher to develop sector specialization because every company and technology is so different"*


- **High green premiums create offtake risk.** A high green premium can hike prices, increasing feedstock and unit costs, and make it hard to meet customer willingness to pay and investors' risk-return thresholds. One airline executive told us,

 *As a publicly traded company in a margin-intensive business, we simply cannot afford to buy sustainable airline fuel at a 3 to 5x premium"*

- **Risk-return profiles can be unattractive.** Value propositions may vary across segments and even across a single business— making it challenging to amass resources and capabilities to evaluate and underwrite deals. Uncertain project economics and policy and regulatory environments can also hinder climate technology deployment. A senior asset manager said,

 *Other asset classes can have an easier time to get to 25% return with less risk"*

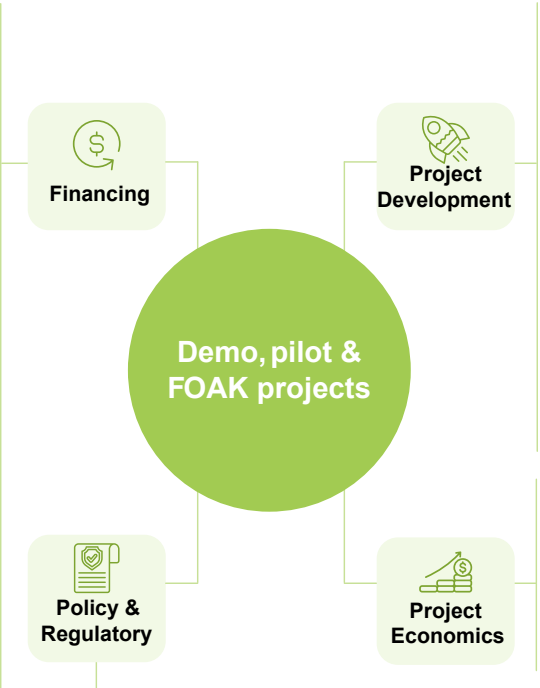
- **Innovators and industry leaders often face constraints.** As noted, advancing through CIP 4 through 6 requires new skills, especially in project development. And many innovators and operators have limited expertise in these areas. As one senior executive of an asset management firm put it, limited mandates are another challenge:

 *We asset managers can only do what our clients allow us to do. The risk budget that we're given is determined by the LP base"*

These multi-dimensional challenges to scaling climate technology are synthesized below in Exhibit 4.

**Exhibit 4**

- 1 Capital providers need to build new expertise.**  
Limited expertise with pricing and underwriting climate risk. Lack understanding of which instruments to leverage to deploy capital outside of silo
- 2 Limited syndication across investors.** Limited collaboration due to lack of incentives to tear down silos and need for new structures
- 3 Limited capabilities and knowledge to underwrite.** Investors lack resources (e.g., engineering, technical, policy knowledge) to evaluate/underwrite the technology and engineering merits of investable climate technology opportunities
- 4 Misaligned incentives.** Investors and investment platforms not incentivized to target early climate technology deployment, but on (e.g., via carried interests, individual promotions) asset classes with predictable returns



- 5 Operators need to build up new capabilities.** Operators have limited expertise in project finance (e.g., to access funding), project development (e.g., get project shovel ready), government and community relationship management (e.g., permitting)
- 6 Engineering challenges.** Integration into complex, existing systems and structures without significant disruption to output (e.g., industrial processes, requisite technical or infrastructure)
- 7 Demand and supply side uncertainties.** Supply (e.g., feedstock) and demand (e.g., no offtakers, perceived credit risk, novel GTM) uncertainties impact forecasted project economics
- 8 Policy and regulatory uncertainties.** Ecosystem dependence on uncertain, unclear and often misaligned policy and regulations (fed vs local) and lack of public provision for infrastructure enablement impacts project economics, feasibility and delivery



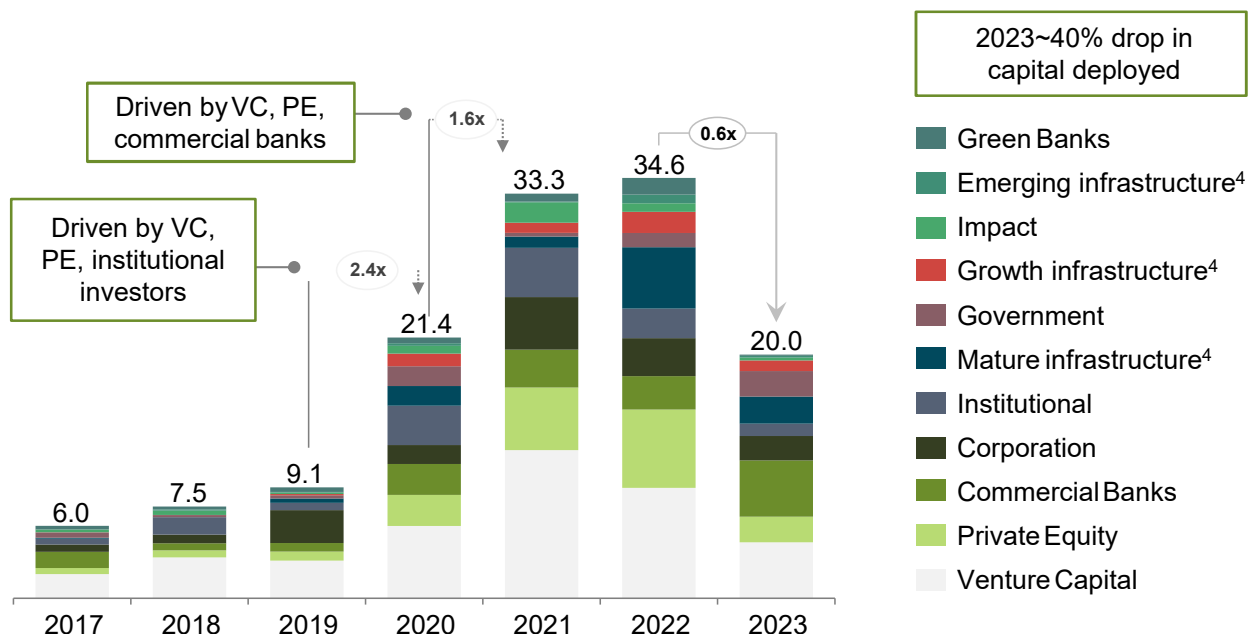


## Charting the impact of economic headwinds

Recent market factors have exacerbated funding challenges. A rising interest rate environment, inflation, recessionary concerns, volatile capital markets activity all contributed to a 40% decline in climate investments in 2023 over the year before. See Exhibit 5.

**Exhibit 5** 2023 saw a 40% pullback in climate investments

### Investment (\$B) by capital provider per year since 2017



1. Share of individual investor is not available in an investment round. Hence, we have equally distributed \$inv among participating investors. e.g. If 5 investors are participating in a round, we have equally distributed the round \$inv among them. Debt data is only included where investor info was available, and the type was available; 3. Green Bank data has been sourced from CC consortium report and is updated till 2022; 4 Infra Investors are tagged according to CTVC investor classification. Note: Analysis based on private investments across ~3.8K US cleantech companies invested by US/Canada based investors since 2017.; Source: BCG Greentech Portal, Pitchbook, Center for Growth & Innovation Analytics, EIA, BCG Analysis

This pull back occurred across all investment classes with the exception of governments and banks and underscores the need for the investor ecosystem to come together and deploy a broader set of tools to help companies traverse the Scale Gap.

However, recent declines notwithstanding, the amount of money flowing into climate technology has been growing exponentially. Bank investment increased by 3.5x between 2017 and 2023, making them the largest capital contributors to climate technology, marginally overtaking venture capital for the lead.

Private equity and emerging, growth and mature infrastructure platforms are also stepping up engagement in a big way. See Exhibit 6. These shifts signal both a maturing climate technology environment as well as the emergence of new funding platforms to service them.

**Exhibit 6** Funding from private equity, institutional and infrastructure investors has grown exponentially since 2017

**Investment (\$B) by capital provider per year since 2017**

Capital providers	Inv jump (17/23)	'23 invest (\$M)	Avg cheque (\$M)
Green Banks	~1.4x <sup>3</sup>	~1370 <sup>3</sup>	-
Emerging Infrastructure <sup>4</sup>	12.5x	~142	11.4
Impact	~1x	~225	6.7
Growth infrastructure <sup>4</sup>	~270x	~883	79.4
Government	4.7x	~2091	4.4
Mature infrastructure <sup>4</sup>	27x	~2232	140
Institutional	2.1x	~1013	26.8
Corporation	3.3x	~2000	8.8
Commercial Banks	~3.5x	~4629	30.5
Private Equity	~4.2x	~2110	20
Venture Capital	~2.3x	~4608	3.5

1. Share of individual investor is not available in an investment round. Hence, we have equally distributed \$inv among participating investors. e.g. If 5 investors are participating in a round, we have equally distributed the round \$inv among them. Debt data is only included where investor info was available, and the type was available; 3. Green Bank data has been sourced from CC consortium report and is updated till 2022; 4 Infra Investors are tagged according to CTVC investor classification. Note: Analysis based on private investments across ~3.8K US cleantech companies invested by US/Canada based investors since 2017.; Source: BCG Greentech Portal, Pitchbook, Center for Growth & Innovation Analytics, EIA, BCG Analysis

Emerging infrastructure and growth infrastructure investors have also shown strong interest in climate technology. Total funding is up 270 times 2017 levels and TopCo capital deployment now stands at more than \$1 billion. Corporate investment has grown as well, with over \$2 billion invested in 2023 alone.

Governments also play a key role. As a new white paper from BCG and the Bipartisan Policy Center describes, early-stage grants, loans and other supports provide a vital lifeline to help breakthrough innovations scale. For example, a federal loan from the US Loan Programs Office accounted for about 3% of Tesla’s total funding from founding to 2019, but the funding came at a pivotal time in Tesla’s growth journey in the aftermath of the 2008 financial crisis when private funders were less willing to invest.

All told, we now have a plurality of actors that can help advance projects through the critical early deployment stages. And, as we’ll detail in the next chapter, the mechanisms that can enable them to do so effectively are available.

## Ways to Traverse the Scale Gap Exist

Climate technology may be relatively new, but many of the mechanisms to fund it are already available. Investors and industry leaders can employ proven financial instruments and collaborative partnerships to manage early deployment risks. We call these “old tools” and “new friends.”

### Taking advantage of “old tools”

Old tools are existing financial structures that help investors align economic interests, mitigate risks and improve deal governance. They are tried, tested, and available for deployment today. More than a dozen such tools are already in market. See Exhibit 7.

Market rate tools encompass everything from corporate finance to venture equity and venture debt. It can also involve novel types of project finance, including some that flip the ratio of sponsor equity to project debt from 80/20 to 20/80 and allow a coverage ratio of more than 2x versus the more typical sub 1.5x.

Part of the fresh thinking is bringing a cross-section of these tools together to bridge new deal models. For example, concessionary capital works best as a lever to attract market rate capital rather than as a stand-alone solution, since by itself it can misprice risk. Likewise, loan products can help improve the risk-return profile for equity investors, but lenders need the right insurance products in order to issue debt.

Other old tools, such as warrants, can then help to “sweeten” the deal and help make early deployment projects feasible from a risk-return perspective. Commercial offtakes and non-market-rate capital, such as capped rate equity and debt, loan guarantees, contract-for-difference arrangements and grants also play a key role.

But while plenty of old tools exist, the challenge today is that investors traditionally deploy capital in siloes. Venture investors participate in venture rounds with other private or corporate venture funds. Commercial lending groups invest on their own or in syndicates with other banks. Infrastructure project financiers often write the entire check themselves without any other investor engagement. Some new investment funds such as Just Climate and Spring Lane Capital have begun to apply parts of the venture model (to help achieve high returns in corporate equity) and parts of the project finance model (to ring-fence risk and unlock capital for early deployments). But we need more such platforms and more diverse investment structures.



The complexity and challenging risk-return profiles of early deployments invite a unique deal-making opportunity that brings together a medley of tools from across these investment classes.

**Exhibit 7** There are an array of tools in the market today

**1 Grants**

Non-dilutive, concessionary funding typically provided by government agencies, foundations, family offices etc.

**2 Debts**

There are an array of different debt instruments to fund climate technology companies varying with stage of maturity. Such instruments may be secured against the company, against specific assets of the company, against certain receivables (e.g., such as a tax receivable) or not secured at all. Debt instruments may also include "warrant" sweeteners to provide an "upside kicker".

**3 Equity**

Investing capital (cash) in a company in exchange for shares or ownership stakes.

**4 Hybrid**

Hybrid instruments have debt and equity like features. An example of a commonly used one in the start-up ecosystem is SAFE Notes. A SAFE Note is a convertible instrument that allows investors to invest in a scale-up without determining an immediate valuation; rather, the investor can convert to equity a valuation determined by a subsequent round of investment by a group of arm's length investors. Typically, the holder of the SAFE Note will be able to convert to equity at discount to the valuation at the next equity financing in exchange for bearing the risk of deploying capital at an earlier stage.

**5 Project Finance**

Project finance enables investment in a specific project rather than a company itself. Project finance enables risk to be ring-fenced to a specific project vehicle (i.e., corporation). Project finance is conventionally used to fund long-term infrastructure, industrial projects and public services. However, it is increasingly being used to fund climate technologies albeit with adaptation given in many instances projected cash flows are less certain in climate than conventional infrastructure.

**6 Offtake Agreements**

Offtake agreements offer a long-term contract to purchase the output of a particular climate technology, typically with a pre-agreed volume and price (including a price elevator). Offtakes help assuage go-to-market risk by creating certainty in cash flows.



## Collaborating with “new friends”

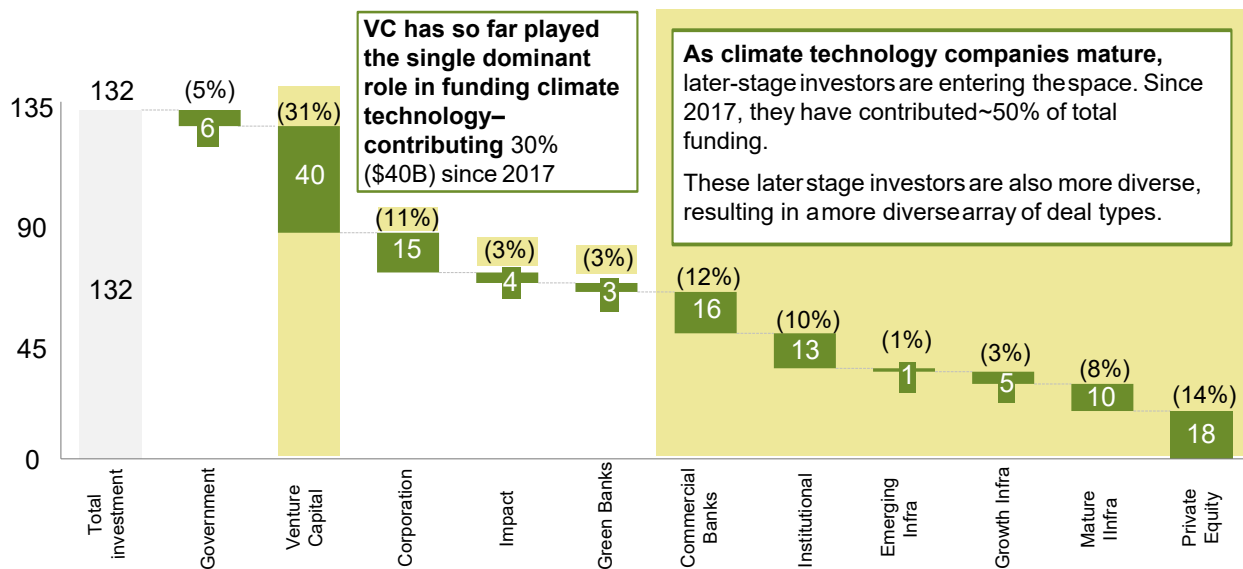
New friends are strategic relationships that provide critical funding and skills. Similar to the club-based approaches common in other investment settings, the "new friends" model pools project risk. It enables traditional and later-stage capital to come together, bringing the due diligence and underwriting expertise that early-stage climate technology deployments need.

As the climate finance ecosystem grows—more new friends are entering the space, looking for opportunities and seeking strong partnerships. Venture capital used to dominate climate technology—and it’s still a major pool of capital. But later stage investors are entering the climate finance ecosystem. See Exhibit 8. There are a much broader set of later stage investors as well as new investment platforms emerging including those that we refer to as "emerging" and "growth" infrastructure bringing niche expertise in deploying capital discrete climate technologies - often with sophistication (and check-writing abilities) across both corporate and project finance.

### Exhibit 8

New friends are reshaping the funding landscape...

#### Aggregate investment (\$B) and share (%) by capital provider, since 2017



## Examining emerging deal structures put these ideas into action

Already, we're seeing exciting examples of how the pairing of old tools and new friends can unlock funding for innovative climate technology and crowd in capital.

### Exhibit 9

Old tools and new friends can come together in a variety of ways

	Deal model	Overview	Strategic Value	Examples
1	<b>VC and strategic corporate partner</b>	VC funding paired with corporate pre-purchase agreement	<ul style="list-style-type: none"> <li>Retire go-to-market risks</li> <li>Right-size funding, achieve valuation expansion</li> <li>Crowd-in more VC capital</li> </ul>	Reverion secured consecutive seed (\$7.4M), \$60M in pre-orders (10% deposit), and series A (\$9M) all transacted within 1 year
2	<b>Emerging infrastructure and strategic corporate joint venture (JV)</b>	Equity collaborates with corporate partners to invest in TopCo; corporate partner to co-fund JV Growth	<ul style="list-style-type: none"> <li>Ring-fence risk via SPV</li> <li>Use corporate assets, expertise, operational capacity</li> <li>Reduce go-to-market &amp; implementation risk</li> </ul>	CBRE, strategic partners and VC investors' \$15M preferred share financing of Forum Mobility
3	<b>Growth equity combined with EPC partnership</b>	Growth equity in TopCo and SPV, with EPC firm serving as project sponsor	<ul style="list-style-type: none"> <li>Mitigate development and engineering risks via EPC wrapped contracts, potential insurer guarantees</li> </ul>	Centinela Solar Energy Facility financing led by Prudential Capital; Fluor dual role as both EPC and equity investor
4	<b>Growth infrastructure with infra/institutional for heavy assets</b>	Growth equity in TopCo, and syndicate of infra. Investors in SPV (warrant kicker)	<ul style="list-style-type: none"> <li>Align incentives across investors</li> <li>Improve project-level returns via warrants</li> </ul>	Spring Lane, Equitix Infra with PE catalytic cap invest \$20M in Andion; and \$250M project development equity financing
5	<b>Green bank short-term secured debt</b>	Short-term debt for small capex deployments secured against receivables, bundled to crowd in inst. Investors	<ul style="list-style-type: none"> <li>Unlock non-dilutive capital for smaller check sizes via aggregation</li> <li>Recycle capital</li> <li>Decrease concentration risk</li> </ul>	NYCEEC \$400K equipment loans for energy efficiency upgrades in multifamily buildings



## Case study 1: Dimensional Energy

Dimensional Energy is an emerging leader in carbon utilization technology and green fuels. When they were ready to get their first plant off the ground, Elemental stepped in to help, providing Dimensional with financial support as well as coaching. Investment came in the form of a simple agreement for future equity (SAFE). With a SAFE, an investor gains the right to convert the debt into equity later, typically at a discount of about 10% to 20%. That discount rewards the investor for bearing the upfront risk, but is not dilutive to the company's value. SAFEs can help companies get to an inflection point where they can attract funding from a wider cadre of investors. Elemental's support was critical in helping Dimensional identify a first commercial market and raise their Series A. Elemental's coaches also worked with Dimensional to help identify the best approach to engaging with a tribal community to ensure that the community would accrue benefits alongside the company. Further, through Elemental's Equity & Access community of practice, CEO Jason Salfi was able to engage deeply on what he describes as a continual learning journey. Dimensional will continue to use Elemental's growing community benefits resources as they continue to build out their strategy, which they see as an ongoing effort.

Since that original project and funding, Elemental has adapted the SAFE by creating a debt-based development SAFE (D-SAFE). Instead of the forced conversion, a recipient company can simply repay the debt, with interest capped at pre-market rates.

Elemental has recently invested in Dimensional again, this time using the D-SAFE to support the company as it develops a first-of-a-kind commercial-scale facility. This facility has been structured as 100% owned by Seneca Environmental, a wholly owned subsidiary of the Seneca Nation, with a developer fee and license fee to Dimensional for ongoing use of the technology, operations and maintenance, and royalties on carbon abated.

When complete, the project is expected to abate close to 60 thousand tons of carbon annually and provide workforce and other benefits to tribal members. The innovative D-SAFE funding approach can serve as an invitation for other foundations and non-market rate investors to explore similarly creative models.

The vital "new friend" partnership with the Seneca Nation reduces Dimensional's go-to-market risk and makes it easier for the company to secure production guarantees and commitments from EPC partners.



## Case study 2: Forum Mobility

Another “old tools and new friends” approach combines growth equity and a strategic corporate partnership. Forum Mobility, a zero emission trucking solutions provider, took this tack from their inception. The primary old tools comprise growth equity and traditional project finance, buttressed by corporate equity.

New friends include infrastructure investors (CBRE Investment Management), non-profit investors (Elemental Excelerator) and growth equity investors (Homecoming Capital), each contributing unique strengths to the effort. Similar to the approach often taken when financing largely de-risked renewable energy projects, Forum’s corporate structure includes not only a TopCo but also special purpose vehicles designed to isolate risk and enable use of different sources of funding. This approach safeguards the TopCo by ring-fencing the risks associated with SPVs, while mitigating go-to-market and project level risks. Additionally, Forum is able to efficiently recycle capital and generate cash flows from the projects as the asset level operator.

The company closed a \$15 million Series A funding round and announced a \$400 million

joint venture in January 2023—led by a fund sponsored by CBRE Investment Management. The arrangement gives Forum Mobility access to CBRE’s real estate network as a base to provide comprehensive, zero-emission charging and vehicle solutions to truck fleets and drivers, and it allows CBRE IM to build a meaningful investment in a high-growth market. Homecoming Capital also participated in the Series A funding round and provided \$100 million to the joint venture.

Elemental’s work with Forum has included funding their project in the Port of Long Beach, working with them to accomplish policy goals, and helping them build a diverse team. More recently, Elemental has provided Forum with a D-SAFE to help them bridge the time and funding gap between signing a lease on a property and doing all the project development work required to begin project deployment.

These are just two use cases that show how old tools and new friends can come together. And we’re still only at the cusp. As understanding of these mechanisms grows, we believe investors and innovators can use them to create an array of deal structures.



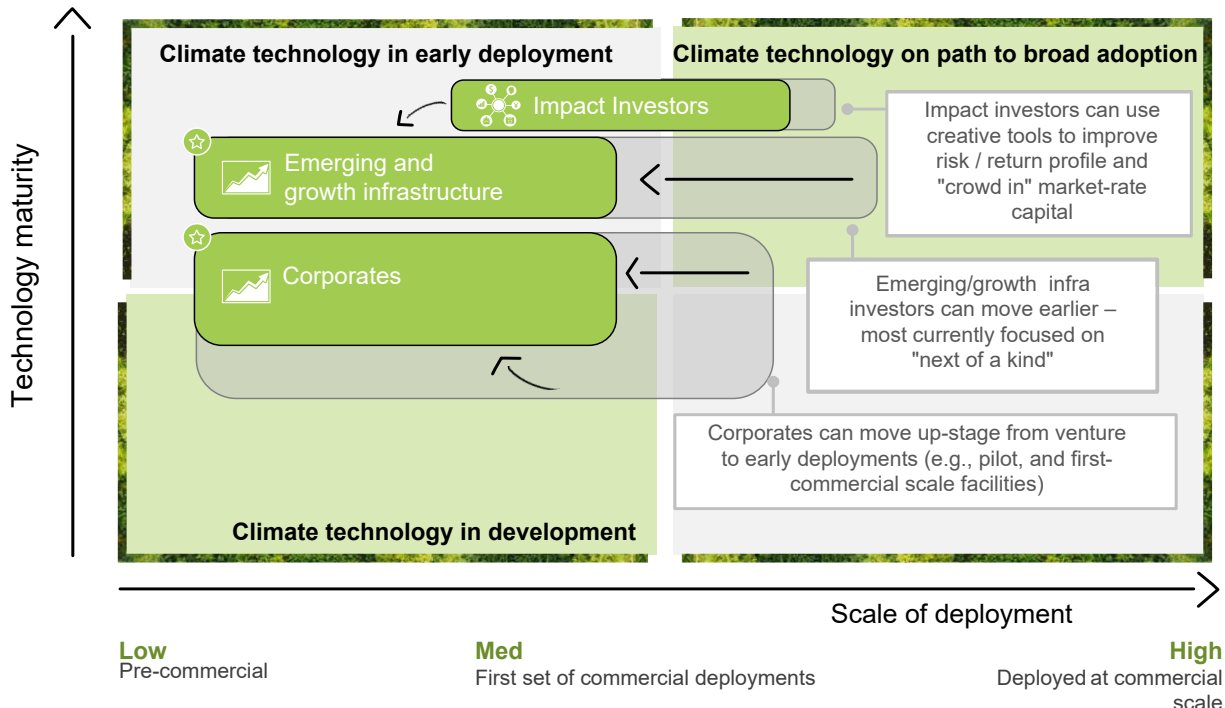
## Everyone Has a Role to Play

Our research shows that leaders across the capital stack are excited about the opportunities that climate technology can generate. They also know that availing of these opportunities will require engaging in new ways.

**Taking the climate finance ecosystem to the next level** The investors and industry leaders who make up the climate finance ecosystem each bring distinctive skills and resources. Although some are accustomed to working in the later stages of the commercialization journey, and others in the beginning stages, the availability of old tools and new friends allows ecosystem participants to transcend traditional roles. Together, they have what it takes to help promising solutions traverse the Scale Gap. See Exhibit 10.

**Exhibit 10**

The path forward requires certain investor classes to more intentionally invest in early deployments



Source: Stakeholder interviews, Elemental Excelerator and BCG analysis




### Getting started: A collective call to action

Traversing the Scale Gap will require open minds and a collaborative spirit. In that vein, here are some actions to consider today.

## 1. Corporates can move up from venture and play a strategic role in early deployments.

Corporates have a strategic interest in placing bets in new climate value pools to gain revenue generating opportunities and tap into decarbonization levers. Corporates also have an array of tools that can help mitigate their investment risk—including the capability to serve as a strategic partner or co-developer, offtaker, or future acquirer. As one senior emerging and growth infrastructure investor told us,

 *Corporates need to do more than provide finance at critical mid-growth stages—they also need to provide project development expertise and opportunities for offtakes"*


To take things forward, here's where corporate leaders could focus.

- Determine if your decarbonization levers meet your climate pledges and what levers require investment or exposure to emerging climate technologies.
- Assess the marginal abatement cost for each of these levers and if advancing climate technology would reduce your marginal abatement cost
- Find out if your energy procurement team is educating their non-energy procurement colleagues on the value of long-term offtakes for scaling emerging technologies. If they're not, start building that connective tissue across the organization

## 2

### **Venture capital can build on their trusted advisor status**

Venture investors are often startup founder's trusted advisors and have a big interest in ensuring that the company can traverse the Scale Gap to see a positive return on their investment. However, the incentive and time horizon for seeing a return is sometimes misaligned with the company's need to plan for longer term growth. As one venture and emerging infrastructure fund investor advised,

 *We need to take a longer-term on build out instead of focusing on near-term capital raise"*

Here are a few suggestions we heard:


- Prepare your portfolio companies for the next stage of development.
- Get to know later-stage growth and emerging infrastructure investors and ascertain what they need to invest in follow-on rounds. Then, find ways to support your founders in building this into their roadmaps. Examples include: fractional project finance CFOs; project developers in residence; and relationships with EPC firms.
- Help companies navigate and access government loans and new grant programs.
- Help portfolio companies document and build risk mitigants, keeping the needs of later-stage project finance investors in mind.

## 3

### **Infrastructure investors can increasingly partner or build emerging and growth infrastructure platforms that deploy in first-of-a-kind and next-of-a-kind opportunities**

Infrastructure investors are typically interested in funding large deals in commercially proven ventures (CIP 7 and 8). But, to get that high-quality deal flow, they need to ensure that climate technology innovations make it through CIP 4, 5 and 6. That bridge to bankability requires knowledge and shared risk taking. By financing early deployment projects, infrastructure investors are funding their own long-term pipeline. Early-stage projects provide a lens into the technologies that will transform our economy. Leaders can use that intelligence to cut smarter deals with general partner platforms in the following ways.

- Consider what structures could help channel offtakes and source non-dilutive capital and whether there are opportunities to tie returns to impact such as the amount of greenhouse gas emissions reduced or removed.
- Build portfolio value creation capabilities such as corporate partnerships team, capital markets team to help channel offtakes for your portfolio, source non-dilutive capital to improve the return profile of investments for equity investors.
- Increase confidence and limited partner mandates by growing the base of asset managers versed in project finance and infrastructure. As one senior investor said,

 *We need 10 times more skilled asset managers that can deploy capital in emerging infrastructure"*



## 4

### **Impact investors can de-risk early deployments and attract market-rate capital:**

Capital from catalytic and philanthropic sources such as green banks, foundations, high-net-worth individuals, and public sector entities is crucial in paving the way for follow-on financing from market-rate investors. These players can invest through an array of tools, including development loans for pre-construction activity, or non-market rate instruments (such as contracts for difference, guarantees, subordinated debt). Vehicles also include grants, guarantees, subordinated positions, and first-loss provisions. Impact investors can also offer necessary support such as capacity building, policy advocacy, and community engagement. To land impact, however, impact capital and engagement must be deployed in creative, well-structured ways—that focus on areas of high need and provide value that is additional to market-rate capital. An executive at one family office told us,



*I would like to see our impact capital deployed in ways that are catalytic and unlock public and private funding. Our funding should be concessional and targeted toward areas with the largest need where there are gaps in funding and potential for real climate and community benefits."*

Here's how this class of investors can land an even bigger impact.

- Determine if you have the capabilities to invest directly, or if you are looking for mission-aligned aggregators, partners, and general partners
- Test whether capital is being deployed in ways that are truly additive and unlock to public and private funding
- Invest in case studies about funding models that work and lessons learned
- Be open to experimentation
- Test new ways to reward positive actions and to share upside (including financial returns) with companies, community partners and others who help

## 5

### **Insurers can make early deployments bankable.**

Insurance acts as a risk-transfer mechanism to move risk away from the capital markets to the insurance market.



*It's a closing condition for projects"*

said one senior insurance leader. Insurance is especially important in the early deployment stages, where project development risk, counterparty risk, supply chain risk and other exposures can deter investors from providing financing. Insurers can provide the specialized types of insurance needed, be it credit enhancements to cover projects that are below-investment grade or that require particular types of property insurance to satisfy bank mandates or cover carbon market risk. The following steps can allow insurers to play a more transformative role.

- Look at which existing products could be repurposed to support climate technology projects and estimate the revenue potential for your business. And speak with innovators and investors to learn what insurance products would best serve them.
- Build capabilities to underwrite investments in climate technologies and infrastructure.





## 6

### **EPCs bring meaningful technical expertise and operational efficiencies.**

These specialists have extensive experience managing infrastructure projects and can bring that knowledge to bear, ensuring early-deployment projects are completed on time and within budget. Their industry connections can help operators and financiers facilitate better procurement deals, obtain regulatory approvals and gain market access. As one growth equity director said,



*EPCs have the most important and hardest job: executing the project. They can pull various levers to help de-risk projects—from wrapped contracts to deferred payment structures”*

To become more engaged, EPCs could consider these actions.

- Build business lines that focus on partnering with emerging and growth climate technology innovators.
- Consider innovative approaches that tie financial returns to performance and explore products that can assuage innovator and investor concerns. These can include such instruments as “wraps” that guarantee on time and on budget project performance on time.

## 7

### **Banks can invest or serve as a node across the capital stack.**

While others pulled-back in 2023, certain commercial and investment banks doubled down—investing 78% more in climate technology than in 2022. This growth made banks the biggest capital contributors to climate technology, marginally overtaking venture capital for the lead. Many have set up teams to support the decarbonization efforts of their corporate clients and generate longer-term opportunities for capital markets and infrastructure finance activity. Banks have the potential to participate in earlier stage opportunities including both venture capital and debt (directly or indirectly as an LOP), commercial lending, project finance, growth equity (where they have an asset management division) and infrastructure or capital markets investments. Beyond the breadth of principal investments banks can make, they play a central role in the financial ecosystem as a node, which can help facilitate capital from partners or clients to climate technologies – where more apt (based on risk-return profile and underwriting criteria). A senior leader at an emerging infrastructure fund said,



*Banks should support climate technology projects in a more systematic way from advisory through to financing and be open to non-traditional avenues to bring projects to scale effectively”*

Source: BCG Greentech Portal, Pitchbook, Center for Growth & Innovation Analytics, BCG Analysis



These are among the “must-do” next steps for the banks

- Articulate a holistic climate strategy with clear “focus areas” for investment as well as participation models (direct or indirect) to gain appropriate exposure – even if it means “experimenting” as a “cost of entry” to gain access to later stage opportunities
- Build an operating model that invites collaboration (including deal sourcing, evaluation and underwriting) across business units within the bank
- Develop an ecosystem engagement strategy that includes non-traditional players such as green banks as well as other participants across the capital stack.

## 8

### **Institutional investors can partner with asset managers to support early-stage deployments.**

Many institutional investors have developed direct investing platforms that traverse the capital stack including venture capital, growth equity, private equity, and infrastructure funds. They have a variety of tools at their disposal as well, and can deploy corporate equity, debt, and project finance to advance climate technology through CIP 4 through 6, where support is most needed. These development stages are earlier than is traditional for institutional investment, but that doesn’t need to be a barrier. Firms can take a limited partner position and join forces with asset managers on lighter-touch co-investments to start. They can then build direct investment platforms or use their existing platforms to support follow-on investments. They can also make new friends with other institutional investors to alleviate pressure on follow-up capital draws. As one institutional investor told us,



*We need to shift to an ecosystem collaboration mindset with capital providers to scale single solutions rather than taking bets against each other...”*

Here’s how institutional investors can engage.

- Explore “one fund” approaches that integrate venture, growth equity, private equity and infrastructure teams, and consider alternative mandates.
- Foster active engagement and co-investment with leading asset managers to help direct-investment teams build capabilities.
- Explore alternative mandates that bring focus on both climate impact as well as responsible stewardship of capital.





# Conclusion

Our research and interviews give us renewed optimism that the investment and advisory community has the means and opportunity to bring vital climate technologies to market. However, all those we spoke to acknowledge that much more work needs to be done.

Early deployment projects require fit-for-purpose capital to manage their inherent risks. As this report has detailed, tested financial instruments and innovative deal-making collaborations can help unlock funding and provide critical expertise.

Today, collaborative engagement among diverse investors is rare. To close the Scale Gap, we need to build bridges across the climate technology ecosystem.

Now is the time for us all to engage as thought partners and committed actors. We look forward to continuing this dialog with you—and helping to close the Scale Gap in a holistic and sustainable way.

# Lead Authors



## Parham Peiroo

Parham co-leads the climate tech and green business build topics in North America where he supports climate investors formulate their thesis, large corporates in developing or investing in climate technology, and climate tech founders build and scale their ventures. Prior to joining BCG, Parham was a corporate finance lawyer supporting venture capital and private debt funds across the technology sector.



## Melissa Uhl

Melissa leads Growth at Elemental. She has helped guide and build the organization since 2015 - launching Elemental's 5 Year Strategy, Equity & Access focus, Policy Lab, and Scale Gap work. Melissa is also a Climate Advisor with Emerson Collective and a founding board member of Earthshot Ventures, an early stage venture capital fund that she helped develop and spin out of Elemental.

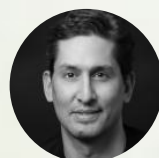
# Contributing Authors



**Michael Bernstein** is a Senior Advisor at BCG.



**Katie Hill** is a Partner and Associate Director in the Nairobi office of BCG.



**Raju Sarma** is a Managing Director and Partner in BCG's Manhattan Beach office.



**Veronica Chau** is a Partner and Director in BCG's Toronto office.



**Dawn Lippert** is the Chief Executive Officer of Elemental Excelsator.



**Vinay Shandal** is a Managing Director and Senior Partner in the Toronto office of BCG.



**Danya Hakeem** is Vice President of Portfolio at Elemental Excelsator.



**Saritha Peruri** was Head of Corporate Partnerships at Elemental Excelsator.



**Avra van der Zee** is the Chief Operating Officer of Elemental Excelsator.

# Acknowledgements

We thank Christina Angelides, Jonah Goldman, Sharon Mwale, Rachit Sharma, Patt Talvanna, Fiona Tokple, Natalie Volpe, and Christine Zhang for their significant contributions to the development of this report.

We also thank the many industry practitioners and experts who graciously shared their insights with us in bilateral interviews or through participation in our various Traversing the Scale Gap convenings:

Angeleno Group	Heirloom
B Capital Group	Howden Group
Banyan Infrastructure	Just Climate
Bayshore Global Management	Keyframe Capital
Breakthrough Energy Catalyst	Lafayette Square
Brookfield Asset Management	LanzaTech
CAC Specialty	Lendistry
California Infrastructure and Economic Development Bank	Lowercarbon Capital
Carbon Direct Capital	Meta
CIBC Capital Markets	Microsoft Climate Innovation Fund
Citizens Capital Markets Inc.	Milken Institute
Climate Asset Management	Morgan Stanley
Climate Pledge Fund	Navajo Power, PBC
Climate Policy Initiative / Precovery Labs	Nexus Development Capital
Closed Loop Partners	NYCEEC
CPP Investments	Ontario Teachers' Pension Plan
CREO Syndicate	Pleiades Strategy
Deep Science Ventures	Prime Coalition
Decarbonization Partners	Radial Power
Dimensional Energy	Rondo Energy
Earthshot Ventures	S2G
Emerson Collective	Schmidt Family Foundation
Encourage Capital	Schmidt Futures
Energy Impact Partners	Solar and Energy Loan Fund
ETM Advisors	Spring Lane Capital
EVRNU	Streetlife Ventures
Extantia Capital	Sublime Systems
Fervo Energy	Technip Energies
Fifth Wall	Temasek
Foobar.vc	Terviva
Galway Sustainable Capital	The Kresge Foundation
Generate Capital	The Rockefeller Foundation
Generation Investment Management	U.S. Department of Energy
Government of Singapore Investment Corporation	UBS Investment Bank
Goldman Sachs Asset Management	US BANK
Google	Wallace Global Fund
Gratitude Railroad	Wavelength Infrastructure
Great Circle Capital Advisors	Wilson Sonsini Goodrich Rosati
Grok Ventures	Wells Fargo
Harwich Partners	Wollemi Capital
	Working Power

For more information:

Please contact our lead authors **Melissa Uhl** at [melissa@elementalexcelerator.com](mailto:melissa@elementalexcelerator.com)  
and **Parham Peiroo** at [peiroo.parham@bcg.com](mailto:peiroo.parham@bcg.com)

**BCG** + **BCGX** +  **Elemental  
Excelerator**