



A Cleantech Investment Plan for European Competitiveness

How the EU can become the industrial
and climate leader of the next decades

With the support of



EXECUTIVE SUMMARY

Over the last decade, the EU has become a cleantech innovation powerhouse, investing billions of euros and developing most of the technologies we need to decarbonise, become energy resilient and build industrial leadership. EU-based companies are ready to manufacture world-leading batteries, electrolyzers, supercapacitors, electric trucks and near-zero carbon steel and cement. This new generation of industrial leaders could underpin Europe's global competitiveness for decades to come, at a time when peers in America and Asia are investing significantly to take the lead in these new industries.

However, we still struggle to scale and industrialise these technologies in Europe, especially when they are developed by newcomers. At this critical “scale-up” stage, cleantech companies typically need to shift from raising tens of millions of euros in venture capital to validate their technology, to hundreds of millions of euros in debt instruments to build large-scale plants. In [previous research](#), we have pointed to why this scale-up is so difficult in Europe: unlevel playing field between newcomers and existing large industrials, lack of public and private funding, insufficient demand signals, fragmented markets and lagging regulation among others.

Some “scale-up” success stories are starting to emerge in Europe. Companies like H2 Green Steel in Sweden or battery gigafactory developer Verkor in France are pushing the boundaries of traditional financing, leveraging a capital stack of equity, commercial debt and subsidies to build multi-billion cleantech projects. But these companies are the exception, not the norm, and their fundraising success must urgently be replicated in other strategic technologies such as electrolyzers, ultracapacitors, long-duration energy storage, innovative renewables and many more.

« Developing a first-of-its-kind project requires all types of cleantech financing mechanisms and they need to interact. In H2 Green Steel’s case, this meant securing €4.2 billion in project finance, €2.1 billion in equity and a €250 million grant from the EU Innovation Fund for the world’s first large-scale green steel plant in Northern Sweden. »

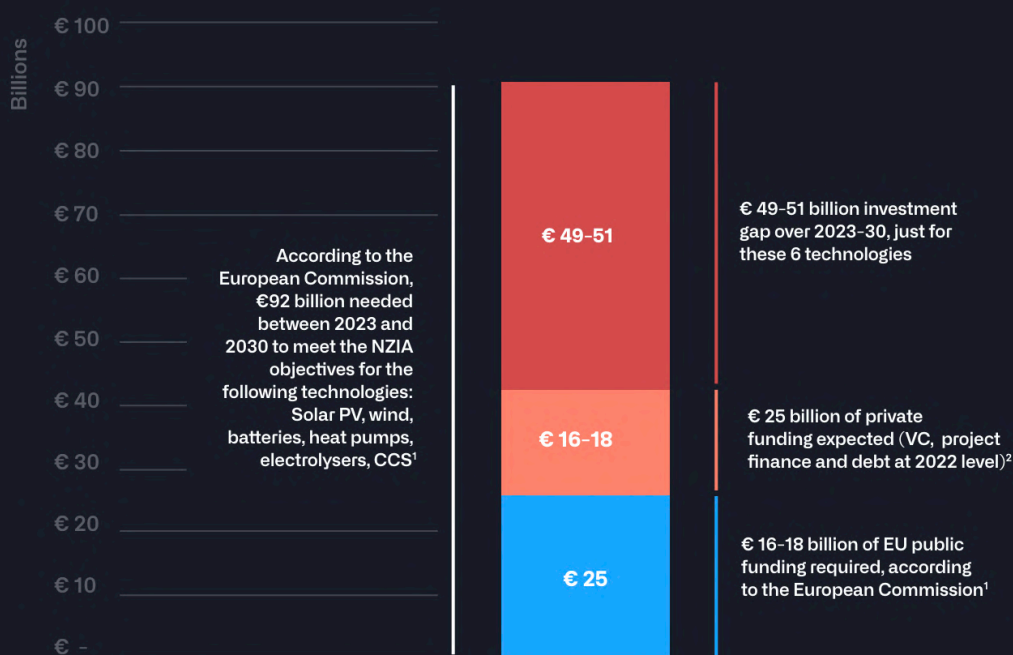
HENRIK HENRIKSSON

CEO
H2 Green Steel

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A €50+ BILLION INVESTMENT GAP FOR JUST 6 TECHNOLOGIES

In President Ursula von der Leyen's [words](#), the EU is vying to become "the home of clean tech and industrial innovation" with a focus on domestic manufacturing. The Net Zero Industry Act (NZIA) sets the goal of manufacturing at least 40% of the EU's annual deployment needs of strategic clean technologies: solar, wind, batteries and storage, heat pumps and geothermal energy, electrolyzers and fuel cells, biogas/biomethane, carbon capture, utilization and storage, and grid technologies by 2030.



Sources: European Commission¹, Cleantech Group², Cleantech for Europe analysis

THE EU CLEANTECH INVESTMENT GAP

To meet NZIA's 40% objective for a subset of technologies, the Commission estimates that the EU will need at least €92 billion investments over the period of 2023–2030³. From this €92 billion, the European Commission estimates that €16–18 billion should come from public investments⁴.

Even if that €16–18 billion materializes, **at the current rate of private investments in these technologies, this leaves a €50 billion gap, which could easily double once other NZIA strategic technologies are accounted for:** solar thermal, tidal and wave technologies, storage other than batteries, geothermal, fuel cells, biogas and biomethane technologies, grid technologies. The investment gap grows larger still when considering clean technologies not covered by NZIA, like green steel, green cement and chemical recycling.

While our latest research shows that the EU is closing its cleantech venture capital gap with the US, we are falling behind when it comes to investing in cleantech manufacturing and projects. The United States' Inflation Reduction Act will unlock \$1.2 trillion of cleantech incentives by 2032.⁵ China is not only the global frontrunner in cleantech investments—having spent \$546 billion in 2022⁶—but also has a growing lead on cleantech manufacturing over both Europe and the US⁷. Through the newly adopted GX (Green Transformation) Promotion Law, Japan will facilitate the issuance of GX Economic Transition Bonds, a ¥ 20 trillion (€127 billion) project over a decade, to attract over ¥ 150 trillion (€955 billion) in investments⁸.

1 https://single-market-economy.ec.europa.eu/system/files/2023-03/SWD_2023_68_F1_STAFF_WORKING_PAPER_EN_V4_P1_2629849.PDF

2 [Venture capital, debt and project finance invested into EU developers of Solar PV, wind, batteries, heat pumps, electrolyzers and CCS \(€3.2 billion in 2022, multiplied by 8 to cover the 2023–30 period\), Cleantech Group](#)

3 https://commission.europa.eu/system/files/2023-07/SFR-23_en.pdf

4 https://commission.europa.eu/system/files/2023-07/SFR-23_en.pdf

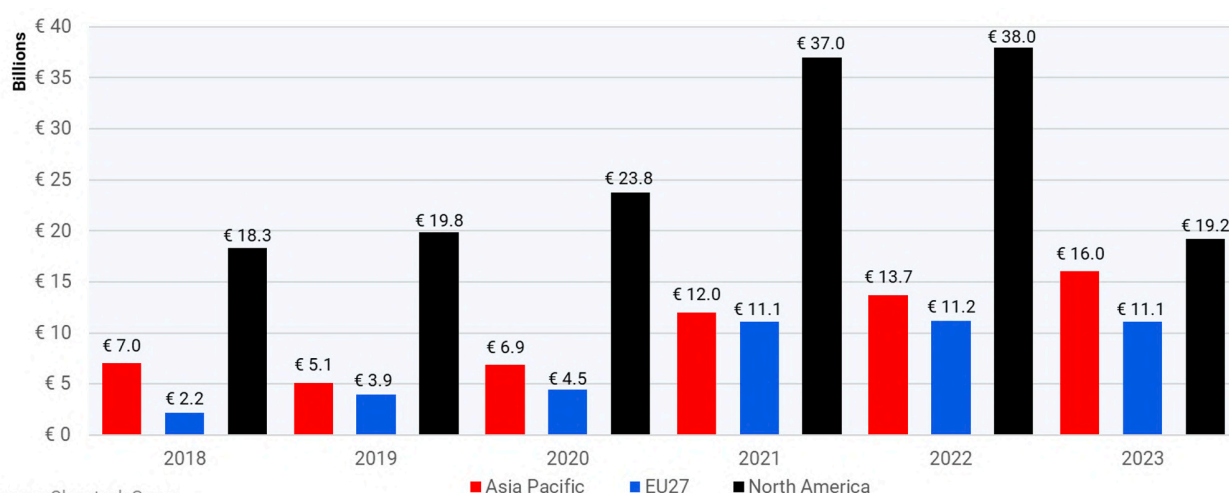
5 <https://www.goldmansachs.com/intelligence/pages/the-us-is-poised-for-an-energy-revolution.html>

6 <https://about.bnef.com/blog/global-low-carbon-energy-technology-investment-surges-past-1-trillion-for-the-first-time/>

7 <https://iea.blob.core.windows.net/assets/0a421001-6157-436d-893c-c37eeab54967/TheStateofCleanTechnologyManufacturing.pdf>

8 https://grjapan.com/sites/default/files/content/articles/files/gr_japan_overview_of_gx_plans_january_2023.pdf

To compete on the global stage and stand a chance at becoming a climate and industrial leader of the next decades, the EU urgently needs an ambitious Cleantech Investment Plan.



CLEANTECH VENTURE CAPITAL BY REGION, 2018-2023

« Europe is at risk of losing the cleantech race. It urgently needs a Cleantech Investment Plan to turn its innovation edge into industrial leadership. »

ANN METTLER
Vice President
Breakthrough Energy

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A CLEANTECH INVESTMENT PLAN FOR EUROPEAN COMPETITIVENESS

Europe's cleantech ambitions are meeting the hard reality of a challenging economic environment. High energy prices and interest rates are hurting EU manufacturing, and political resistance to the Green Deal is on the rise. In this context, it is vital to adopt a Cleantech Investment Plan that is both fiscally efficient and at a large enough scale to meet our ambitions. This will require the EU to embrace a public sector-enabled, private-sector-led transition to mobilise significant pools of private money.

STEP 1. Unleash institutional capital to create a step-change in EU cleantech investment

While US insurers and pension funds are prolific investors in venture and growth capital, this is not the case for their European counterparts. EU pension funds in 2021 invested less than 0.018% of their total assets in venture funds⁹, while in the US public pension funds invest 1.9% of their assets in venture funds.¹⁰

⁹ <https://2021.stateofeuropeantech.com/chapter/attracting-world-class-investors/article/fundraising/#:-:text=20%25%20of%20funding%20was%20captured,than%200.018%25%20of%20their%20total>

¹⁰ <https://www.jstor.org/stable/43503370#:-:text=Similarly%2C%20venture%20capital%20investment%20accounts,but%20only%201.3%25%20in%20Canada.&text=counterparts%2C%20while%20the%20venture%20capital,to%201.3%25%20and%203.1%25.&text=invest%20in%20private%20equity%20as%20compared%20to%20American%20funds.>

This 100x difference has massive implications for our ability to scale the innovations we develop. Cleantech for Europe's plan includes reviewing prudential rules to make it easier for institutional investors to fund the cleantech revolution and developing the de-risking instruments and fund-of-funds to crowd in private capital.

« The European cleantech VC ecosystem cannot match the fundraising capabilities of its US counterpart without institutional investors stepping up. »

PATRIC GRESKO

Head of Division – Sustainability & Innovation
European Investment Fund

STEP 2. Mobilise public guarantees to catalyse private investment

To build up manufacturing capacity, cleantech companies need access to affordable debt instruments. When selling innovative equipment, cleantech manufacturers are asked for a series of bank guarantees, to mitigate the buyer's risks in purchasing this equipment. Because of their lower bankability compared to industrial incumbents, innovators are not able to finance these guarantees at a reasonable cost, tying up precious working capital in collateral that could be used to ramp up manufacturing capacity.

Public guarantees offer policymakers an efficient instrument to mobilise more private capital towards cleantech manufacturing. Our Plan proposes to urgently expand the recently announced European Investment Bank (EIB) instrument for the wind sector to manufacturers of innovative cleantech equipment, for instance electrolyzers, long-duration energy systems and innovative renewables.

« Guarantees for first-of-a-kind project funding and manufacturing scale up could be the cheapest way for policymakers to target the mainstream financial firehose at European cleantech. »

BEN MURPHY

Investment Director
Kiko Ventures

STEP 3. Mobilise revenues from the EU Emissions Trading System (EU ETS) to scale up cleantech manufacturing

Bridging the EU's cleantech investment gap requires refocusing the EU's funding architecture on the challenge of cleantech industrialisation. In the wake of the Inflation Reduction Act and changes to State Aid rules, some Member States are forging ahead and providing large subsidies to cleantech manufacturing projects. While positive, it risks fragmenting the EU's cleantech scale-up and leaving behind large swathes of the EU.

One significant – and growing – pool of capital the EU could leverage further is ETS revenues. In particular, our Plan recommends the Innovation Fund is made more accessible to cleantech companies. We also recommend Member States invest 25% of their ETS revenues into cleantech manufacturing. Lastly, the EU should consider front-loading cleantech investment, for instance by borrowing against future ETS revenues to invest in manufacturing capacity now.

« ETS revenues are set to grow significantly over the next decade, but investments in cleantech need to happen now. The EU can find a way to front-load the investment, for instance by borrowing against these future ETS revenues. In short: use debt to increase the size of the carrot now (cleantech investment plan), and use the money generated by your stick (ETS) to pay back that debt. »

THOMAS PELLERIN-CARLIN

EU Programme Director
Institute for Climate Economics (I4CE)

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The cover image shows electrolyser manufacturer Enapter's Campus in Saerbeck, Germany, which includes both a production centre and extensive R&D facilities that will enable scaled-up manufacturing of their modular systems for green hydrogen production.



STATE OF PLAY OF **CLEANTECH** INVESTMENT IN EUROPE

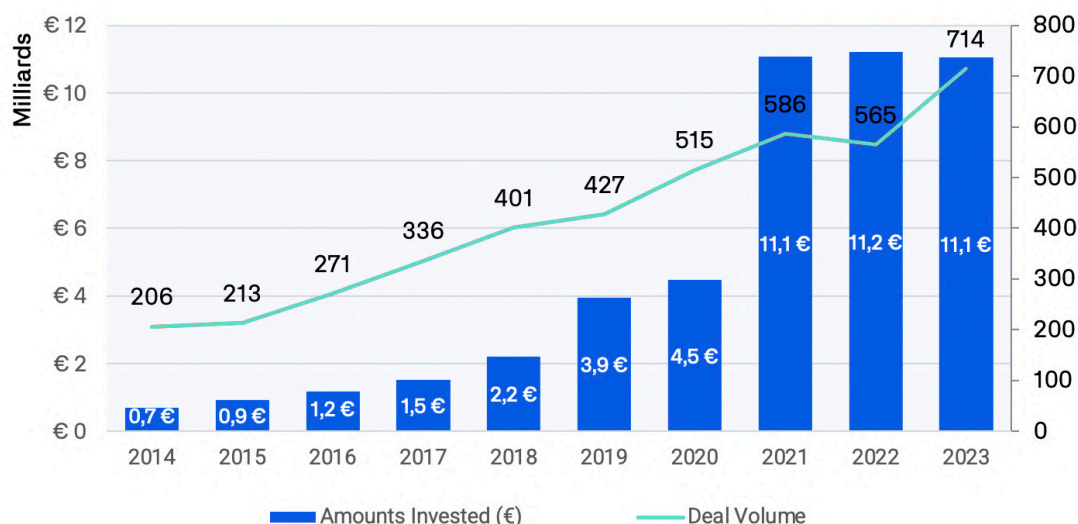
The EU cleantech ecosystem started some 25 years ago. In the early 2000s, while solar, wind and biomass innovators were sprouting up in Silicon Valley, European venture capital investors took notice. Some of the best-known names in EU cleantech investing, such as Demeter IM in France and Munich Venture Partners in Germany set up shop between 2004 and 2005, closely followed by SET Ventures in the Netherlands, Capricorn Partners' cleantech fund in Belgium and others.

At the time, the innovative companies they financed were developing technologies in solar, wind and geothermal power generation, home energy efficiency, recycling and wastewater treatment. Some were already looking at the early market for electric vehicles. A few hundred million dollars were invested each year. Public subsidies in Europe favoured biomass, wind, hydro and solar investments.

After a peak in 2008, the “cleantech 1.0” ecosystem was hit by a downturn. High-profile bankruptcies of cleantech innovators led to a common observation of the mismatch between the venture capital model and cleantech innovation, which requires significant patient capital and time to reach market. Strong competition and dumping from China decimated solar producers in the EU and North America. Yet, this first wave of innovation was instrumental in the global rise of affordable solar and wind power, as well as electric vehicles. We are still reaping the benefits of the efforts invested by these cleantech pioneers.

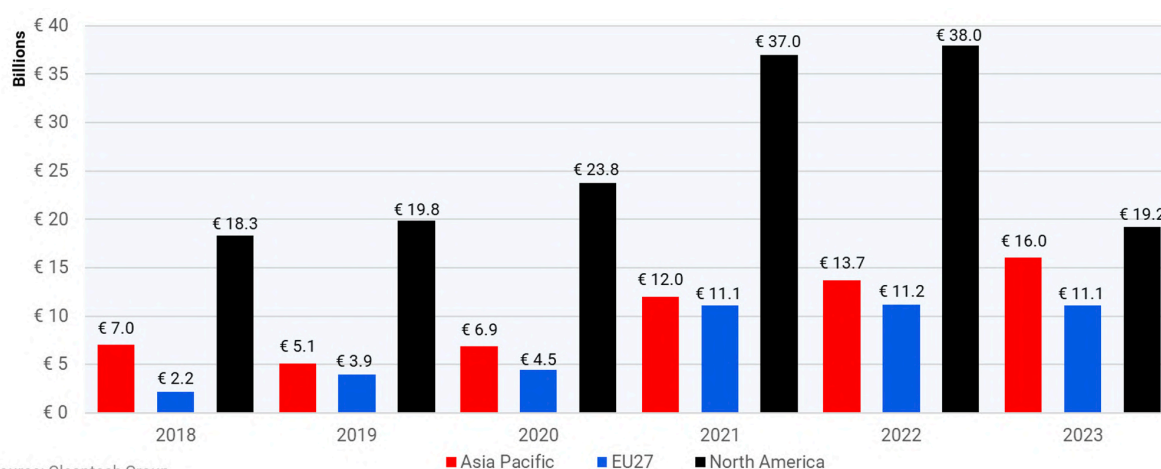
Fast forward to today: cleantech has entered into a 2.0 phase, transitioning has gone from a niche category to a key investment focus. The cleantech 2.0 phase is associated with strong policy signals to stimulate demand for cleantech solutions and support Europe's green reindustrialization.

Cleantech for Europe data reveals that in 2023, more than €11 billion of venture and growth capital was invested in EU-based cleantech, representing a 15x increase over 2011. A third generation of entrepreneurs and investors is emerging, with more appetite to tackle capital-intensive bets with strong decarbonisation potential.



EU27 CLEANTECH VENTURE & GROWTH INVESTMENT, 2014 - 2023

Compared to global peers, cleantech venture capital investments are still largely dominated by the United States, with the Asia Pacific region in second place and growing consistently over the last five years. While cleantech investment in the EU grew significantly over the last decade, and proved more resilient to high interest rates than US cleantech investment in 2023, it has reached a plateau at €11 billion with early-stage deals representing more than four times of the total number of deals. **The difference is even starker when considering scale-up capital, where the US has been attracting most investments for the past years.**



Source: Cleantech Group

CLEANTECH VENTURE CAPITAL BY REGION, 2018-2023

The growth of cleantech venture capital in Europe hides a more challenging reality, which is that we still struggle to scale and industrialise these technologies in Europe, especially when they are developed by newcomers. At this critical “scale-up” stage, cleantech companies typically need to shift from raising tens of millions of euros in venture capital to validate their technology, which is relatively costly and limited in volumes, to hundreds of millions if not billions of euros in debt instruments to build large-scale plants. Building a green steel plant, or an electrolyser factory, is very capital-intensive, and requires going beyond venture capital. To assess the availability of EU funding for cleantech, and develop a viable EU Cleantech Investment Plan, we need to look beyond venture capital and analyse the full capital stack available to cleantech companies in Europe.

« Unleashing Europe’s cleantech prowess requires more than just some light-weight venture capital injections. Let’s break out of the green ceiling by leveraging heavyweight players such as insurance firms. They’ve got the climate know-how and the resources to supercharge Europe’s climate transition! »

TOBIAS LECHTENFELD

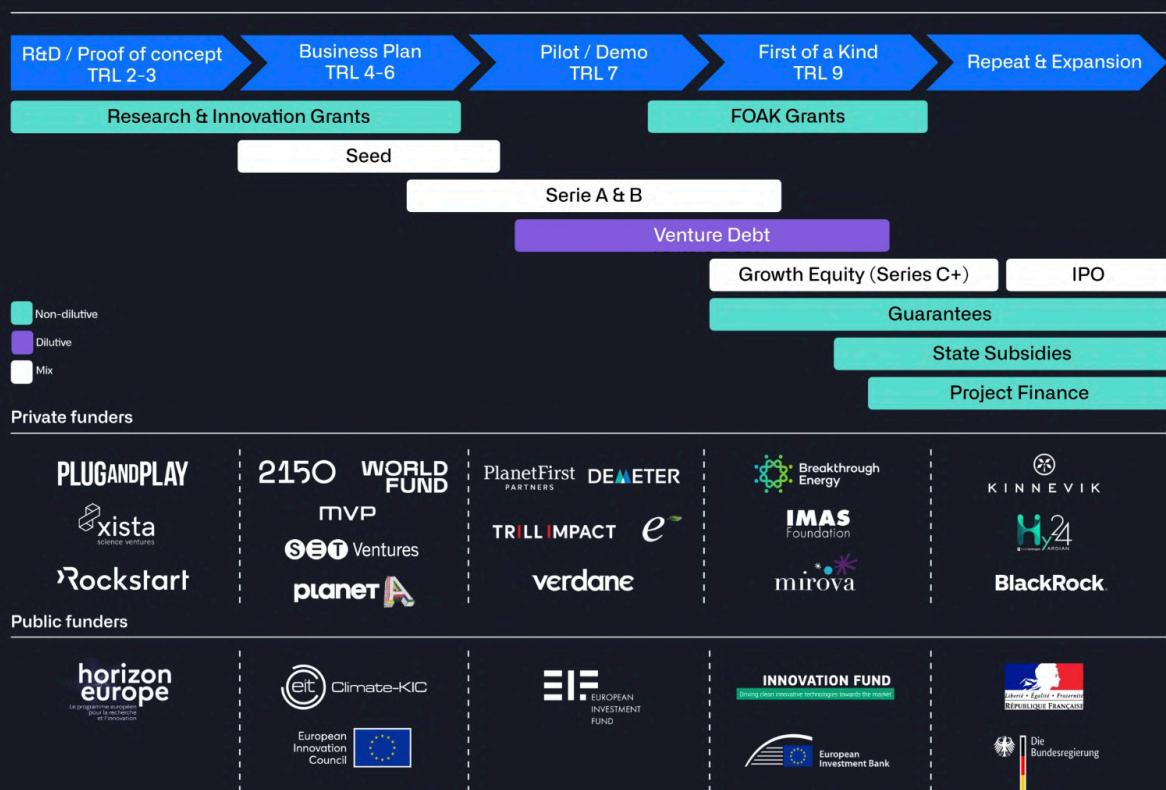
Executive Director
Tech for Net Zero



DEFINING THE EU'S **CLEANTECH CAPITAL STACK**

The cleantech capital stack is the pool of public and private funding and investments available to cleantech companies and projects in their journey from innovation to impact. It consists of various layers including: grants, equity including venture capital, venture debt, infrastructure investors, subsidies and guarantees. In this section, we provide an assessment of how these different instruments contribute to the cleantech journey in Europe.

Hardware: 10-20 years



GRANTS

Grants are non-dilutive funding instruments, meaning they provide funding to companies without asking for equity in return. Grants are provided both at the EU and national level and cover different stages of a company's development.

Available EU grants to consider:

- **Early-stage grants:** Horizon Europe Climate (Pillar 2, Cluster 5), Innovation Fund grants, Interreg, Just Transition Fund, European Innovation Council (Pathfinder, Accelerator, Transition), Connecting Europe Facility, European Research Council, EIT Climate KIC.
- **Late-stage grants:** EU Innovation Fund, EU-Catalyst Partnership.

Reality check:

The wide availability of research and innovation grants, including the Horizon Europe program, has contributed to Europe becoming a powerhouse of cleantech innovation over the last 15 years. However, few grants focus on the critical scale-up stage, and those that do are hard to access for cleantech innovators. For instance, in the 2021 EU Innovation Fund result, in the call for small-scale projects, big industrial companies were 70% of the recipients, and 100% of the recipients respectively in the large-scale call projects.¹¹

¹¹ https://s3.amazonaws.com/i3.cleantech/uploads/additional_resources_pdf/95/295/Innovation_Fund_Letter.pdf

Case Study:

In December 2023, the European Commission announced the EU-Catalyst Partnership. The EU-Catalyst Partnership is a partnership between the European Commission and Breakthrough Energy to fund cleantech first-of-a-kind and demonstration projects in the following sectors: clean hydrogen; sustainable aviation fuels; direct air capture; long-duration energy storage; and decarbonisation of industry, starting with steel and cement. The funding comes from both Catalyst and the European Commission. For demonstration projects in particular, grant funding comes from Catalyst, while the EIB provides venture debt.

Under the EU-Catalyst Partnership, Energy Dome received a project-level grant commitment of up to €35 million from Breakthrough Energy Catalyst and €25 million venture debt financing commitment from the EIB for its first storage facility in Italy.¹² In The award of a grant from Breakthrough Energy Catalyst and debt from the European Investment Bank for Energy Dome's energy storage facility is a great example of the combination of funding structures needed to support first-of-a-kind projects.

¹² <https://energydome.com/energy-dome-announces-funding-commitments-from-breakthrough-energy-catalyst-and-the-european-investment-bank-to-support-construction-of-its-first-standard-commercial-scale-co2-battery/>

EQUITY

Equity financing involves taking ownership shares in cleantech companies. Equity funding can come from a variety of sources, including angel investors, incubators, venture capital funds, private equity firms, and public funders both at the EU and national levels. In turn, these equity funds must raise money from larger investors, such as institutional investors (pension funds, insurance companies etc.)

Available EU grants to consider:

European Innovation Council (Accelerator, Fund), EIT InnoEnergy, InvestEU, World Fund, Planet A, Matterwave Ventures, Munich Venture Partners, Verdane, Eurazeo, Demeter, Meridiam, EQT Ventures, Vargas Holding, Wallenberg Investment, Macquarie Group, Ava Investors, IMAS Foundation.

Reality check:

While Europe is very good at deploying early-stage equity (up to Series A), growth equity remains a significant challenge. Innovators are left facing a funding cliff at the early industrialisation stage, especially for capital-intensive ventures. This dearth of capital for the cleantech scale-up comes from the fact that cleantech funds are failing to attract large institutional investors that could

increase their firepower. EU pension funds in 2021 invested less than 0.018% of their total assets in venture funds¹³, while in the US public pension funds invest 1.9% of their assets in venture funds.¹⁴

Case study:

In March 2022, Sunfire raised closed its series D funding round with €195 million.¹⁵ In July 2022, following the closing of its series D funding round, Amazon invested in Sunfire via its Climate Pledge Fund.¹⁶

13 <https://2021.stateofeuropeantech.com/chapter/attracting-world-class-investors/article/fundraising/#:~:text=20%25%20of%20funding%20was%20captured,than%200.018%25%20of%20their%20total>

14 <https://www.jstor.org/stable/43503370#:~:text=Similarly%2C%20venture%20capital%20investment%20accounts,but%20only%201.3%25%20in%20Canada.&text=counterparts%2C%20while%20the%20venture%20capital,to%201.3%25%20and%203.1%25.&text=invest%20in%20private%20equity%20as%20compared%20to%20American%20funds>

15 <https://www.sunfire.de/en/news/detail/sunfire-secures-further-growth-capital-and-an-agreement-for-up-to-640-mw-electrolysis-offtake>

16 <https://www.sunfire.de/en/news/detail/sunfire-secures-investment-from-amazon>

DEBT

Debt involves companies contracting loans from public or private lenders, either to increase their liquidities or to finance specific projects. To simplify our analysis, we distinguish three types of debt in the context of the cleantech scale-up.

Available EU grants to consider:

- **Venture debt:** loans to innovative companies, typically between equity funding rounds, and that can in some cases be converted into equity. In Europe, the main provider of venture debt is the European Investment Bank (EIB).
- **Corporate debt:** traditional loans to companies, with recourse on the company's assets. In Europe, this type of debt is very challenging to obtain for cleantech companies until they generate positive cash-flows, unless companies can secure loan guarantees from public institutions.
- **Project finance:** debt for a specific project, without recourse on the company's assets. While this type of debt is widely available for the deployment of mature technologies such as solar and wind power, it is not available to innovative clean technologies in their first deployments.

Reality check:

While the EIB's successful venture debt program has allowed many cleantech companies to scale faster, the absence of private venture debt in Europe is glaring. Despite a few notable and promising exceptions, EU cleantech companies currently cannot raise large amounts of commercial debt for first deployments. Some public funders, such as the European Investment Fund and BPI France are providing loan guarantees to ease access to commercial debt, but these are not widely available at the scale needed across Europe.

Case study:

In January 2024, H2 Green Steel announced that it has raised €4.2 billion in project financing, while its total equity funding thus far amounts to €2.1 billion.¹⁸

¹⁸ <https://www.h2greensteel.com/latestnews/h2-green-steel-raises-more-than-4-billion-in-debt-financing-for-the-worlds-first-large-scale-green-steel-plant>

SUBSIDIES

Another stream of funding that cleantech companies can tap is subsidies. There are currently two frameworks under which Member States can provide subsidies to cleantech. These are:

1. The Temporary Crisis and Transition Framework (TCTF):

The TCTF is applicable until December 31, 2025. Under the TCTF, Member States can now adopt investment and operating aid schemes directly supporting private investments in specified strategic technologies necessary for the cleantech transition. The aid amount is either determined through a competitive bidding process or with a strike price set by the relevant energy regulator to cover expected net costs. In light of the global cleantech race, the TCTF introduces a clause allowing for higher individual support where a third country has made a subsidy offer to a company and there is a real risk of cleantech investment leakage.

2. The revision of General Block Exemption Regulation (GBER):

The GBER allows Member States to declare certain categories of aid compatible with the internal market without prior notification to the European Commission. The European Commission amended the GBER to grant more flexibility to Member States to design and implement support measures to boost investments in clean technologies. The revision of the GBER concerns aid for: deployment of renewable energy,

decarbonisation projects, green mobility, and biodiversity, etc.; projects involving beneficiaries from several Member States (Projects of Common European Interest); training and reskilling; regulating energy prices; research, development, and innovation; risk financing.

Reality check:

According to the European Commission, since March 2023, subsidies totaling around EUR 17 billion have been approved under the TCTF in Czechia, France, Lithuania, Hungary, Ireland, Italy, Slovenia; the assessment of more requests for subsidies is ongoing.¹⁹ Apart from subsidies under TCTF, the Commission has launched: (1) two Important Projects of Common European Interest (IPCEIs) on batteries with a total of EUR 20 billion of public and private investment in 68 projects throughout the EU; (2) two IPCEIs on hydrogen, with public and private investments for a total of EUR 26.4 billion for 76 projects across the EU.²¹

Case study:

In September 2023, battery manufacturer Verkor received French subsidies for its gigafactory worth around €650 million, subject to final approval by the European Commission.²³ Verkor's latest funding shows that when public subsidies are deployed strategically, a risky cleantech project can attract and mobilize capital from private investors. In January 2024, battery manufacturer Northvolt received a German state subsidy of €902 million for the construction of its new factory in Germany.²⁴

¹⁹ https://commission.europa.eu/system/files/2023-10/COM_2023_684_1_EN_ACT_part1_v11.pdf

²¹ [Idem](#)

²³ <https://verkor.com/en/verkor-secures-more-than-e2-billion-to-launch-high-performance-battery-gigafactory-in-france-and-accelerate-future-sustainable-mobility/>

²⁴ https://ec.europa.eu/commission/presscorner/detail/en/mex_24_82

STACKING IT ALL TOGETHER FOR FIRST OF A KIND PROJECTS

Once a cleantech company has demonstrated its technology at a pilot stage, it will seek to build a first-of-a-kind (FOAK) plant or project. This is typically a large, capital-intensive project which requires the company to scale its technology and deployment by one or multiple orders of magnitude. FOAKs are the hardest projects to finance, because of the intersection of technical, counterparty and commercial risks. Ideally, a well-functioning cleantech capital stack would enable a company to mobilise various types of funding to make FOAKs possible, in a timeframe that allows them to compete with large industrials and peers from other regions.

Challenges that are specific to FOAK financing:

1. Large capital requirements:

FOAKs require significant capital, as large installations need to be built, without the cost efficiencies of mature technologies. Investors may be hesitant to commit significant capital without a proven track record or guaranteed returns.

2. Uncertain returns on investment:

the lack of historical data or precedents for similar projects makes it challenging to predict the potential returns on investment accurately.

3. Technical uncertainty:

FOAK projects involve cutting-edge technologies with untested or unknown outcomes. This is why FOAK projects need technology performance guarantees to cover specific aspects of the projects such as functionality, efficiency, or reliability requirements .

4. Longer time horizons:

FOAK projects often require longer development and commercialization timelines.

5. Limited access to debt:

banks and financial institutions struggle to provide loans for innovative technologies or new business models. The lack of collateral and the higher perceived risks associated with first-of-a-kind projects can limit access to conventional financing. In some cases, bank regulation also prevents lending to companies that don't yet have positive cash flows.

6. Permitting:

the approval process for new projects is lengthy and complex, increasing the time and costs associated with implementation.

Avenues to facilitate FOAK financing:

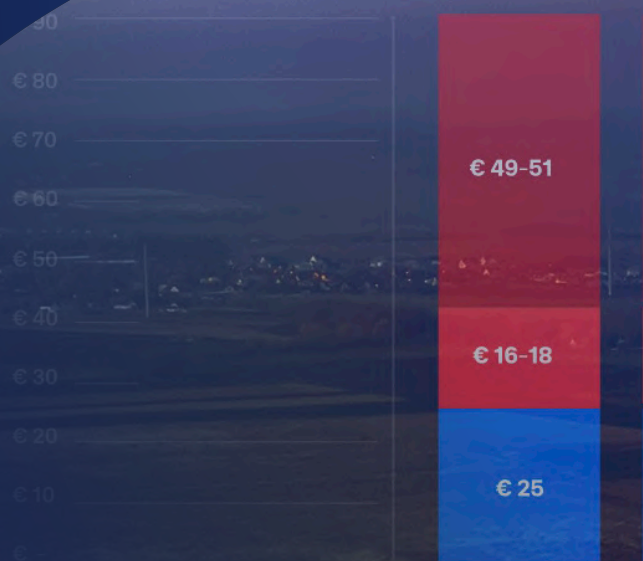
1. Technology de-risking with pilots.

The most important thing before launching a FOAK is demonstrating and validating at industrial scale the performance and reliability of the technology. As an example, Swiss-based carbon capture company Climeworks started with two demonstration projects before building their first large plant, Orca.

2. **2. A diverse capital stack which incorporates various layers and types of funders to complete a first project.** As an example, AFYREN, a France-based biochemistry specialist, stacked different funding sources including public grants from BPI France, State aid, funding from Bio-based Industries Joint Undertaking and private capital from financial and corporate investors to finance its first industrial facility.²⁵
3. **Flexible catalytic capital which is strategically deployed to take on the share of the risk that traditional financial actors are unable or unwilling to tackle.** Catalytic capital may involve a combination of grants, concessional loans, equity investments, or other financial instruments, tailored to the specific needs and constraints of the project. EU –Catalyst Partnership is an example of how private capital can unlock FOAKs with the recent financing of Energy Dome and Ørsted’s FlagshipONE project.²⁶
4. **Strategic offtake agreements, in which scale-ups pre-sell part of their future production and use those contracts to contract debt.** Engaging strategic partners is key in de-risking FOAKs as shown by the recent multi-billion funding round of H2 Green Steel, which was in part facilitated by creditworthy offtake agreements in place.
5. **Offering public guarantees for FOAKs can help them attract more private funding. By taking a share of the risk and acting as “insurance” on part of the project debt or advance payments, public banks can help mobilise private funding for FOAK projects.**

²⁵ https://assets-global.website-files.com/62c1fe8049a83b12fed1878/6537b2f6fde3f7eb46bae617_Re%CC%81ussir%20le%20passage%20a%CC%80%20l%E2%80%99e%CC%81chelle%20des%20cleantech%20en%20France.pdf

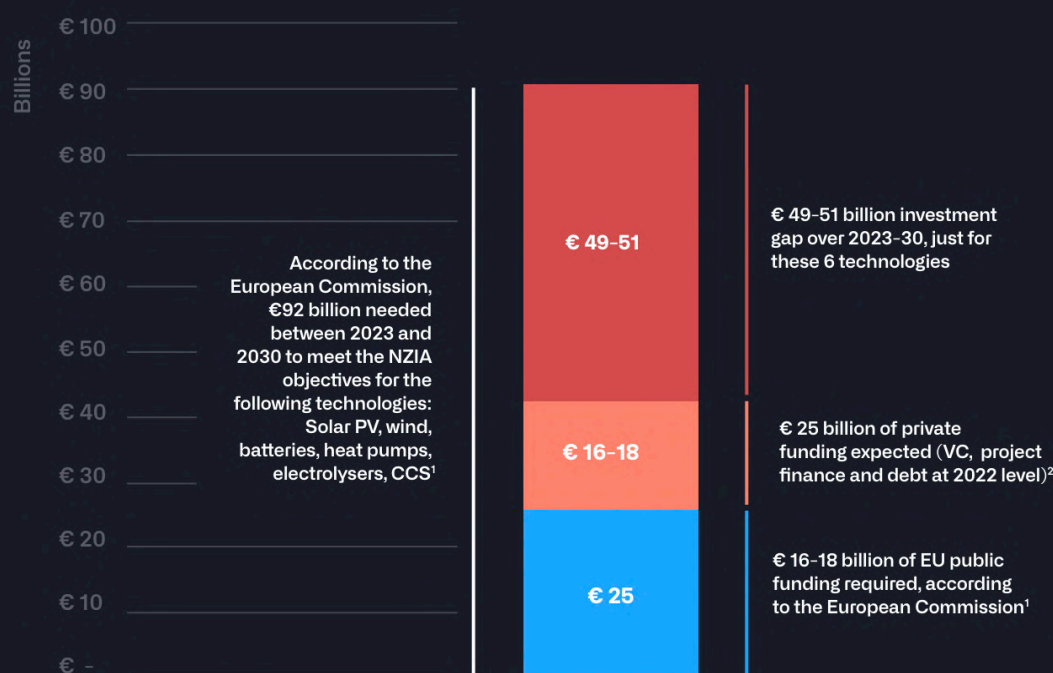
²⁶ https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6169



A €50+ BILLION INVESTMENT GAP FOR JUST 6 TECHNOLOGIES

In President Ursula von der Leyen's words, the EU is vying to become "the home of clean tech and industrial innovation" with a focus on domestic manufacturing. The Net Zero Industry Act (NZIA) sets the goal of manufacturing at least 40% of the EU's annual deployment needs of strategic clean technologies: solar, wind, batteries and storage, heat pumps and geothermal energy, electrolyzers and fuel cells, biogas/biomethane, carbon capture, utilization and storage, and grid technologies by 2030. To meet this 40% objective for a subset of technologies, the Commission estimates that the EU will need at least €92 billion investments over the period of 2023-2030.²⁷

From this €92 billion, the European Commission estimates that €16-18 billion should come from public investments.²⁸ Even if those €16-18 billion materialize, at the current rate of private investments in these technologies, this leaves a €50 billion gap, which could easily double once other NZIA strategic technologies are accounted for: solar thermal, tidal and wave technologies, storage other than batteries, geothermal, fuel cells, biogas and biomethane technologies, grid technologies. The investment gap we've identified grows even larger once other clean technologies are considered: green steel and cement, electric trucks and chemical recycling, for instance. Even worse, the European Commission recognizes that very few EU public funding instruments currently support strengthening manufacturing capacities.



Sources: European Commission²⁹, Cleantech Group³⁰, Cleantech for Europe analysis

THE EU CLEANTECH INVESTMENT GAP

How can we explain this large funding gap?

1. On the public side, funding is insufficient and hard to access for hardware scale-ups:

Few public funding instruments target the three main funding constraints hardware scale-ups face. These include: equity funding for growth (research and development, expand operations, hire talent); project finance for first-of-a-kind deployments; and debt financing commercial rollouts without diluting ownership. The EU Innovation Fund is one of the few instruments targeted at this scale-up phase, but to date this instrument has been very hard to access for cleantech start- and scale-ups. The EIB's venture debt offering fills some of this gap, but is at risk if the budget it draws from InvestEU dries up. Public funding for cleantech is extremely hard to pass. In June 2023, the European Commission proposed the

²⁷ https://single-market-economy.ec.europa.eu/system/files/2023-03/SWD_2023_68_F1_STAFF_WORKING_PAPER_EN_V4_P1_2629849.PDF

²⁸ Idem.

²⁹ https://single-market-economy.ec.europa.eu/system/files/2023-03/SWD_2023_68_F1_STAFF_WORKING_PAPER_EN_V4_P1_2629849.PDF

³⁰ [Venture capital, debt and project finance invested into EU developers of Solar PV, wind, batteries, heat pumps, electrolyzers and CCS \(€3.2 billion in 2022, multiplied by 8 to cover the 2023-30 period\), Cleantech Group](#)

Strategic Technologies for Europe Platform (STEP), its aspiring funding pillar of critical technologies. Under STEP, €10 billion is allocated to different funding instruments to support cleantech, deeptech and biotech. STEP also includes a critical top-up of InvestEU. As we go to press, STEP negotiations are headed towards failure, with even this modest funding increase for cleantech unlikely to be agreed by Member States.

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In the meantime, fossil fuel subsidies are skyrocketing. Fossil fuel subsidies in Europe doubled in 2022 compared with 2021.³¹ In 2022, while most of the fossil fuel support went to oil and refined oil products (€56 billion) in 2022, natural gas subsidies reached €46 billion.³² While some clean energy subsidies are ramping up, such as for solar and wind, the balance still heavily favours fossil fuels.

2. On the private side, the EU's largest pools of money are absent from the cleantech race:

Institutional investors, such as pension funds, insurance companies, mutual funds, endowments, and hedge funds, are broadly absent from cleantech funding, particularly when it comes to venture capital. The EU venture capital industry is 20 times smaller than that of the US³¹ and most venture capital investments are concentrated in few EU Member States. The average fund size in the EU is €120 million,³² while the average fund size in the US is \$1.5 billion.³³ In Europe, cleantech funds are typically in the €100–200 million range. One reason for this stark difference between EU and US venture funds is that institutional investors in Europe like insurers and private pension funds shy away from investing in cleantech venture funds.

Public markets have largely failed to materialise for cleantech. Although the European Commission has put forward two comprehensive plans to develop the EU's capital markets, we are still nowhere near an EU-wide capital markets union fit for the necessary massive investments into cleantech. European companies, even listed ones, still rely heavily on bank loan financing. Meanwhile, commercial banks are unable to lend to cleantech companies without positive cash flows.



We need to instill a sense of urgency to institutional investors if we want to up our cleantech game.



FRIDTJOF DETZNER

Co-Founder and General Partner
Planet A Ventures

31 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0651>

32 https://energy.ec.europa.eu/system/files/2023-10/COM_2023_651_1_EN_ACT_part1_v4.pdf

33 https://commission.europa.eu/system/files/2023-03/Communication_Long-term-competitiveness.pdf

34 <https://my.visme.co/view/016mp816-inside-the-minds-of-european-vcs-speedinvest>

35 <https://fundcomb.com/overview/venture-capital/united-states-region#:~:text=There%20are%20approximately%2092%20relevant,fund%20size%20is%20%24550m.>



BUILDING AN EU CLEANTECH INVESTMENT PLAN

Europe's cleantech ambitions are meeting the hard reality of a challenging economic environment. Europe's fiscal and financial context has changed for the worse since Russia's invasion of Ukraine: the energy crisis is far from over, high energy prices are hurting EU manufacturing, interest rates are high and political resistance to the Green Deal is on the rise. Over the coming months and years, the EU will not be able to match the United States in terms of the billions of dollars provided by tax credits and public subsidies. While Europe does not have a centralized tax system as the United States, it does have a centralized investment system which can be leveraged for funding cleantech. In other words, fiscally efficient solutions exist, and mobilizing existing pools of public money, and new sources of private capital is possible. These solutions will require deep changes to the EU's prudential, financial and industrial policy, and demand that the EU embrace a public sector-enabled, private-sector led cleantech revolution.



Europe won't be able to finance the cleantech transition without a three-pronged approach that prioritizes innovation, demonstration, and deployment to scale, and that integrates dynamically public and private funding. 

SERGIO CARVALHO

Partner, Head of Sustainability
Planet First Partners

Below, we outline a three-pronged cleantech investment plan which will require political will, buy-in from the private sector, policy changes, and targeted public de-risking.

STEP 1 **Incentivizing institutional investors to invest in cleantech**

The European Commission underlines the importance of capital markets for unlocking the investments needed to build Europe's cleantech manufacturing capacity.³⁶

36 https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510

Despite the great ambitions of a single market for capital, Europe is still making little progress in growing the scale of its financial markets, widening the investor base, and increasing capital supply. Some improvements are in the pipeline³⁷, for example, building a resilient clearing system, harmonizing aspects of insolvency proceedings and making listings more attractive. However, the EU's capital markets still remain largely undeveloped. Member States with deeper stock markets (i.e., Western and Northern Europe) tend to be frontrunners in cleantech innovations. Addressing this discrepancy can be achieved through building a Cleantech Capital Markets Union, focusing on the two C's: Cleantech and Capital. As the EU faces a critical juncture, European Central Bank President Christine Lagarde recently called for the development of an EU Securities and Exchange Commission (SEC)³⁸ to coalesce around a single unifying project and rulebook.

The call for a Capital Markets Union focusing on spurring green innovation is not new. Christine Lagarde had already called for green capital markets union in May 2021.³⁹ One way to unlock the potential of markets to finance clean technologies is through incentivizing institutional investors to orient some of their capital into cleantech investments. In the European Economic Area, in Q1 2023, (re)insurers held €8.57 trillion in assets⁴⁰ while pension funds held approximately €2.4 trillion⁴¹ in Q3 2023. Due to the size of their balance sheets, insurers and pension funds are prime candidates to unleash the capital we need for the cleantech transition for two reasons. First, the financial losses from unmitigated exposure to climate change are already impacting their businesses. Second, the investment case for European cleantech companies is already strong and underpinned by strong policy signals.

While US insurers and pension funds are prolific investors in venture and growth capital, this is not the case for their European counterparts. EU pension funds in 2021 invested less than 0.018%

37 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_7348

38 <https://www.ecb.europa.eu/press/key/date/2023/html/ecb.sp231117-88389f194b.en.html>

39 <https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210506-4ec98730ee.en.html>

40 <https://www.eiopa.europa.eu/system/files/2023-09/EIOPA%20-%20Insurance%20statistics%20factsheet%20Q1%202023.pdf>

41 https://register.eiopa.europa.eu/_layouts/15/download.aspx?SourceUrl=https://register.eiopa.europa.eu/Publications/Pensions%20Statistics/PF_Q_BalanceSheet.xlsx

of their total assets in venture funds,⁴² while in the US public pension funds invest 1.9% of their assets in venture funds.⁴³ This 100x difference has massive implications for our ability to scale the innovations we develop in Europe. One example of a North American pension fund supporting a European cleantech company is the recent participation of the fund Teachers' Venture Growth (TVG), part of the \$250 billion Ontario Teachers' Pension Plan, in off-grid portable battery systems company Instagrid's series C funding round.⁴⁴

« European pension funds can be the next champions of cleantech. »

MATTI LEPPÄLÄ
Secretary General
Pensions Europe

So, what holds both pension funds and insurers back from investing in cleantech? Four barriers: (i) prudential rules; (ii) the perception of high-risk of cleantech investments associated with the bankruptcies associated with Cleantech 1.0; (iii) minimum ticket sizes of cleantech funds; (iv) prudential rules do not encourage cleantech investments. Below, we present three proposals for overcoming these barriers.

1. Accelerating regulatory changes to lift barriers to cleantech investment.

The simplification of the long-term equity investment category which incentivizes insurers to invest in venture funds and private equity funds through a lower capital charge could unlock significant investments in cleantech. As regards pension funds, the regulatory framework is not enabling investments in venture capital. One of the key reasons is that Member States have different asset allocations and prudential limits.

42 <https://2021.stateofeuropeantech.com/chapter/attracting-world-class-investors/article/fundraising>

43 <https://www.jstor.org/stable/43503370#:~:text=Similarly%2C%20venture%20capital%20investment%20accounts>

44 <https://tech.eu/2024/01/23/instagrid-raises-95m-in-series-c-funding-for-portable-battery-systems/>

For instance, in Finland, there is a limit of 10% for investments in unlisted equities.⁴⁵ In countries like Denmark which does not impose quantitative investment limits, pension funds and insurance companies allocated 27% to unlisted investments by June 2020.⁴⁶

2. Developing fund-of-fund initiatives and first-loss mechanisms, for instance the European Investment Fund for VC, and infrastructure fund for larger investments

Overcoming the perception of cleantech investments as high-risk can be done by giving institutional investors access to better information about cleantech investing, as well as facilitating connections between cleantech fund managers and institutional investors. This could be achieved with the help of the European Investment Fund (EIF), which has considerable experience introducing large investors to venture capital funding. An additional proposal is to launch an EU-wide awareness initiative regarding the performance of European cleantech venture capital to present successful made-in-Europe cleantech companies.

One initiative to replicate at the EU-level could be La French Tech. La French Tech prioritises the scale-up of existing companies and facilitates institutional investors investments in venture capital. The success of the initiative is telling. In 2019, France aimed to reach 25 unicorns by 2025.⁴⁷ Through La French Tech, this goal was met promptly by early 2022.⁴⁸ The Tibi initiative is another French success story in scaling up tech companies.⁴⁹ By making investing in tech high-growth companies a political priority, France managed to secure commitments of 28 institutional investors to invest €7 billion in tech funds.⁵⁰

45 <https://www.oecd.org/daf/fin/private-pensions/2021-Survey-Investment-Regulation-Pension-Funds-and-Other-Pension-Providers.pdf>

46 https://www.oecd-ilibrary.org/sites/288cb3cf-en/1/3/5/index.html?itemId=/content/publication/288cb3cf-en&csp_08ca935b1fe8d568306cdfa712b24095&itemIGO=oecd&itemContentType=book

47 <https://world.businessfrance.fr/nordic/2022/02/02/26-unicorns-and-e11-6-billion-the-french-tech-fairy-tale/>

48 Idem

49 <https://www.tresor.economie.gouv.fr/banque-assurance-finance/financing-the-fourth-industrial-revolution>

50 <https://sifted.eu/articles/how-french-vcs-beat-the-fundraising-odds-2023>

Concerning minimum ticket sizes of cleantech funds, two potential solutions to this problem are to: a) multiply the number of fund-of-fund initiatives in the EU; and b) encourage institutional investors to instruct fund-of-fund managers to deploy capital in cleantech ventures. The EIF is already spearheading fund-of-fund initiatives to support the next generation of tech leaders in the EU. Establishing more initiatives like the European Tech Champions initiative, a partnership between EIF and Member States, which aims to enable the creation of 10 to 20 pan-European funds of over €1 billion each to spur tech innovation, is a step in the right direction. A further idea to make these fund-of-funds initiatives more enticing to institutional investors is to set up a first loss mechanism in the case of failure or investment write downs.

3. Creating a high-level dialogue between policymakers, institutional investors and cleantech manufacturers to align and get to the next level

Unlocking institutional capital requires bridging the gap between policy imperatives and private sector financial innovation to accelerate the cleantech transition. A dialogue under the umbrella of the Commission's clean transition dialogues that invites institutional investor representatives and cleantech innovators could serve as a platform to foster collaboration and understanding between these stakeholders.

Case studies of pension funds investing in cleantech:

In Europe, the Swedish pension fund, AP Fund, can invest directly into unlisted companies, thus enabling direct venture capital investments. One of its investments in cleantech is in battery manufacturer Northvolt.⁵¹

In January 2024, the infrastructure arm of PGGM, the Dutch pension fund service provider, led the series B funding round of Electra, an Electric Vehicles (EV) company.⁵²

⁵¹ <https://ap2.se/en/joint-ap-funds-company-invests-usd-400-million-in-northvolt/>

⁵² <https://www.pggm.nl/en/press/pggm-infrastructure-fund-acquires-stake-in-charging-station-operator-electra/>

« For institutional investors, investing in cleantech should not be a binary choice: accelerating climate action or generating returns. »

MARTIN KROENER

Partner
Green European Tech Fund

STEP 2 Mobilise public guarantees to catalyse private investment

To build up manufacturing capacity, cleantech companies need access to affordable debt instruments. At this critical stage, cleantech companies have typically raised tens of millions of euros of venture capital, validated their technologies, built demonstration plants and hired teams ready to industrialise them. They have a very different risk profile than early-stage start-ups. But they remain relatively young entities with smaller balance sheets, and bear higher technical and counterparty risk than their larger competitors. As a result, they don't have the same bankability and low cost of capital as existing large industrials.

Cleantech companies have a hard time financing their FOAK projects via commercial loans. What's more, when selling innovative equipment, cleantech manufacturers are asked for a series of bank guarantees, to mitigate the buyer's risks in purchasing this equipment. Because of their lower bankability compared to industrial incumbents, innovators are not able to finance these guarantees at a reasonable cost. This ties up precious working capital in collateral that could be used to ramp up manufacturing capacity.

« What needs to be understood is that the problem of guarantees needing to be collateralized with equity is compounded with every new sale, ultimately jeopardizing order book delivery, which can lead to lost sales. »

CLAUDIO SPADACINI

Founder & CEO
Energy Dome

An EU public counter-guarantee instrument could step in to take some of the counterparty risk from banks, allowing scale-ups to respond to high traction and build more plants and equipment faster, creating jobs and meeting the EU's climate and industrial ambitions. The latest announcements from the European Commission to offer this type of counter-guarantee instrument to the wind industry is promising – but now needs to be widened to other strategic clean technologies, including hydrogen and long duration energy storage (LDES).

The International Chamber of Commerce estimates the average ultimate loss rate for performance and financial guarantees is currently between 0.2% and 1.7%. While the loss rate would likely increase in the case of earlier-stage companies, this would still represent a significant leverage effect. This means for every euro of public money spent, tens to hundreds of euros of working capital could be invested in cleantech manufacturing.

Public guarantees can be deployed along the scale-up journey:

- Loan guarantees can accelerate the funding of first-of-a-kind cleantech projects with medium TRLs.
- Counter-guarantees should be issued by public institutions to enable banks to issue advance payment and performance guarantees to cleantech manufacturers.

We propose to set up an EU-wide scheme managed by a leading EU institution such as the EIB, which would provide counter-guarantees for cleantech equipment, starting with advance payments. The scheme should focus on the scale-up of cleantech manufacturing and cover at least 80% of the risk. An initial scheme should cover at least €2 billion of cleantech counter-guarantees, and if successful expand significantly by 2027. The next Multiannual Financial Framework (starting in 2028) would be an opportunity to scale this by another order of magnitude. For inspiration, EU policymakers could look to Export Development Canada (EDC), Canada's state-owned export credit agency.

EDC offers an instrument called Account Performance Security Guarantee,⁵³ which allows cleantech innovators to issue letters of guarantee with their bank without putting any cash collateral in escrow. The scheme has been offering guarantees for cleantech companies for 12 years, underwriting 100% of the risk, with minimal losses and hundreds of projects facilitated.

For more information on how public counter-guarantees can facilitate the scale up industrialisation of clean technologies, please see Cleantech for Europe's [recent report on the topic](#).

« Banks are willing to support the Greentech transition, turning investments into a sustainable future. Let's redefine finance for a resilient world and a competitive Europe. »

ALICIA SANCHIS ARELLANO

Head of EU Government Relations
Santander

STEP 3 Mobilise revenues from the EU Emissions Trading System (EU ETS) to scale up cleantech manufacturing

Bridging the EU's cleantech investment gap requires a refocusing of the EU's funding architecture on the challenge of cleantech industrialisation. In the wake of the Inflation Reduction Act passing US Congress and the changes to State aid rules, some Member States are forging ahead and providing large subsidies to cleantech manufacturing projects. While positive, this risks fragmenting the EU's cleantech scale-up and leaving behind large swathes of the EU. Contrary to the US federal subsidies, EU State subsidies will increase regional disparities, since governments with more fiscal space will be able to allocate more money to support their industries. Moreover, the proposed reform of the EU's fiscal rules does not enable Member States to invest in cleantech projects on the scale required. Under the proposed reform, high and medium-risk countries will have to reduce their debt, while low-risk countries will have to maintain debt levels below 60% and deficits below 3%.

One significant – and growing – pool of capital the EU could leverage further is ETS revenues. In 2022, total auctioning revenues generated under the EU ETS system were of a magnitude of €38.8 billion of which €29.7 billion went directly to Member States.⁵⁴ From the remaining revenues, €3.2 billion went to the Innovation Fund.⁵⁵ Given that these revenue streams are large enough for Europe to compete with global peers, we put forward three recommendations on how to make them fit for purpose:

- First, with Member States now legally mandated to use their auctioning revenues for climate action, Member States should invest 25% of their ETS revenues into cleantech manufacturing.
- Second, the EU should consider front-loading cleantech investment, for instance by borrowing against future ETS revenues to invest in manufacturing capacity now. For this, EU policymakers can look to Japan's plan to release ¥20 trillion in transition bonds, the so called GX bonds, to catalyze public and private spending investments of ¥150 trillion to scale clean technologies.
- Third, with a portion of these revenues falling under the Innovation Fund, it is important that the Innovation Fund is made accessible to cleantech innovators with more dialogue between companies and evaluators, and an always open call for applications.

« Over the last decade, European companies like Enapter have become global clean technology leaders. But without a massive increase in scale-up capital, Europe will lose its competitive edge. »

VAITEA COWAN
Co-founder
Enapter

⁵³ <https://www.edc.ca/en/solutions/working-capital/account-performance-security-guarantee.html>

⁵⁴ <https://www.eea.europa.eu/en/analysis/indicators/use-of-auctioning-revenues-generated>

⁵⁵ Idem.

THANK YOU

Feel free to contact us with any questions you have.

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