

2025

Cleantech
Group 

Cleantech 50toWatch

A global list of groundbreaking early-stage innovators creating solutions for the world's most pressing environmental challenges.

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2025 Cleantech50toWatch

01 Trend Watch

In last year's Cleantech 50 to Watch, we opened the trend watch by commenting that just weeks from then, the U.S. presidential election would be decided, and with it, some semblance of certainty would come into place regarding direction of travel in the macroeconomic environment.

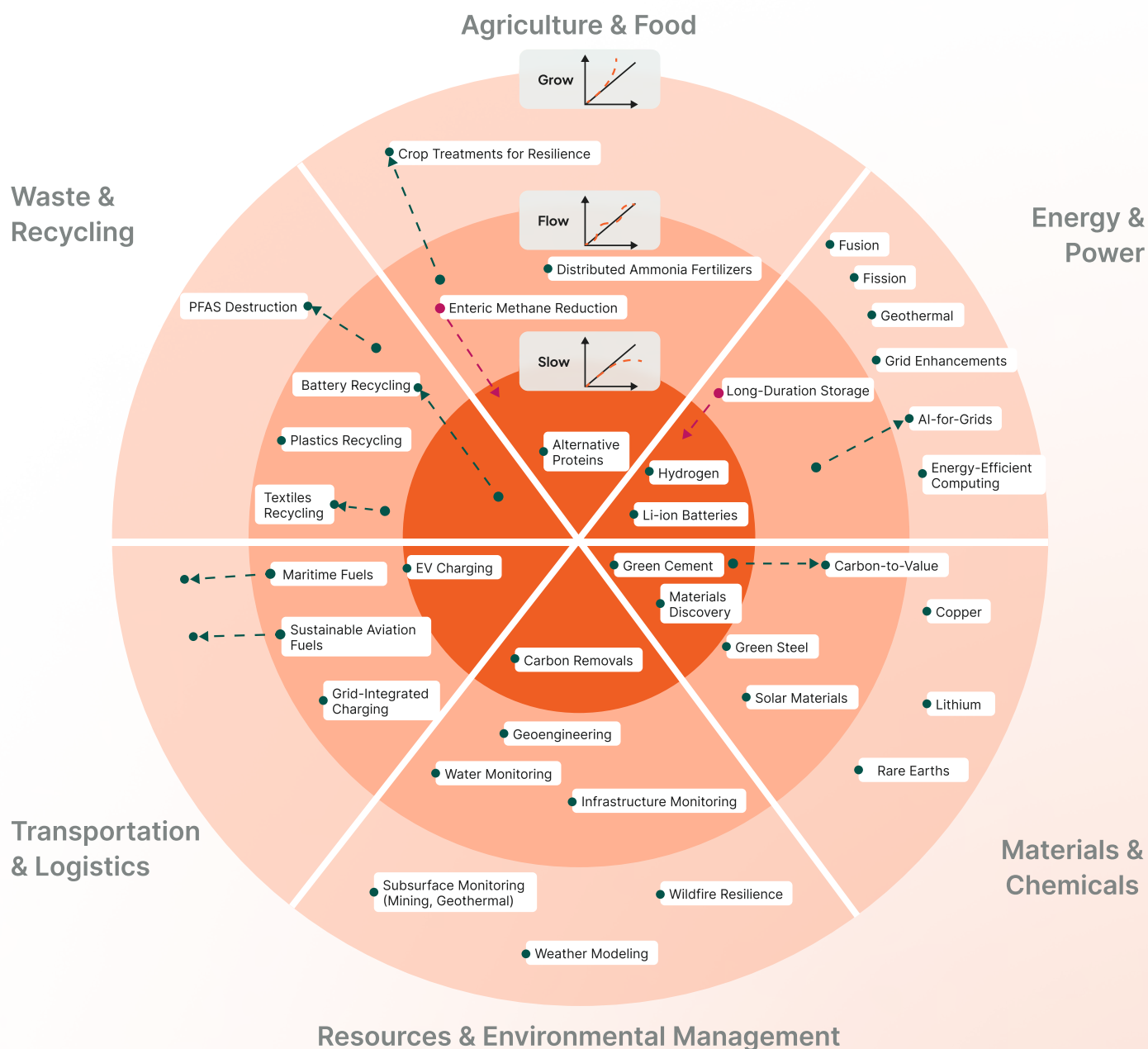
A year later, both the election result, and the impacts of it (in the U.S. and around the world) are being felt in clear ways. The combination of intense and frequently changing tariffs, the One Big Beautiful Bill Act, and blockades to renewables development and corporate sustainability efforts are blunting pull-through effects on many new technologies while also injecting uncertainty into project development cycles.

We began 2025 by attempting to see around a corner and indicate what would “Grow,” “Flow,” and “Slow” in 2025. Indeed, we have found ourselves updating the contents of this framework consistently over the past few months and expect to continue over these next few months! See Figure 1 for a non-exhaustive list of predictions.

Research Manager, Cleantech Group:
Anthony DeOrsey

A Rapidly-Evolving Landscape:

What Do We Predict to Grow, Flow, and Slow in Q4 2025 – 2026?



What will accelerate?



What will generally progress at pace, but with some nuance?

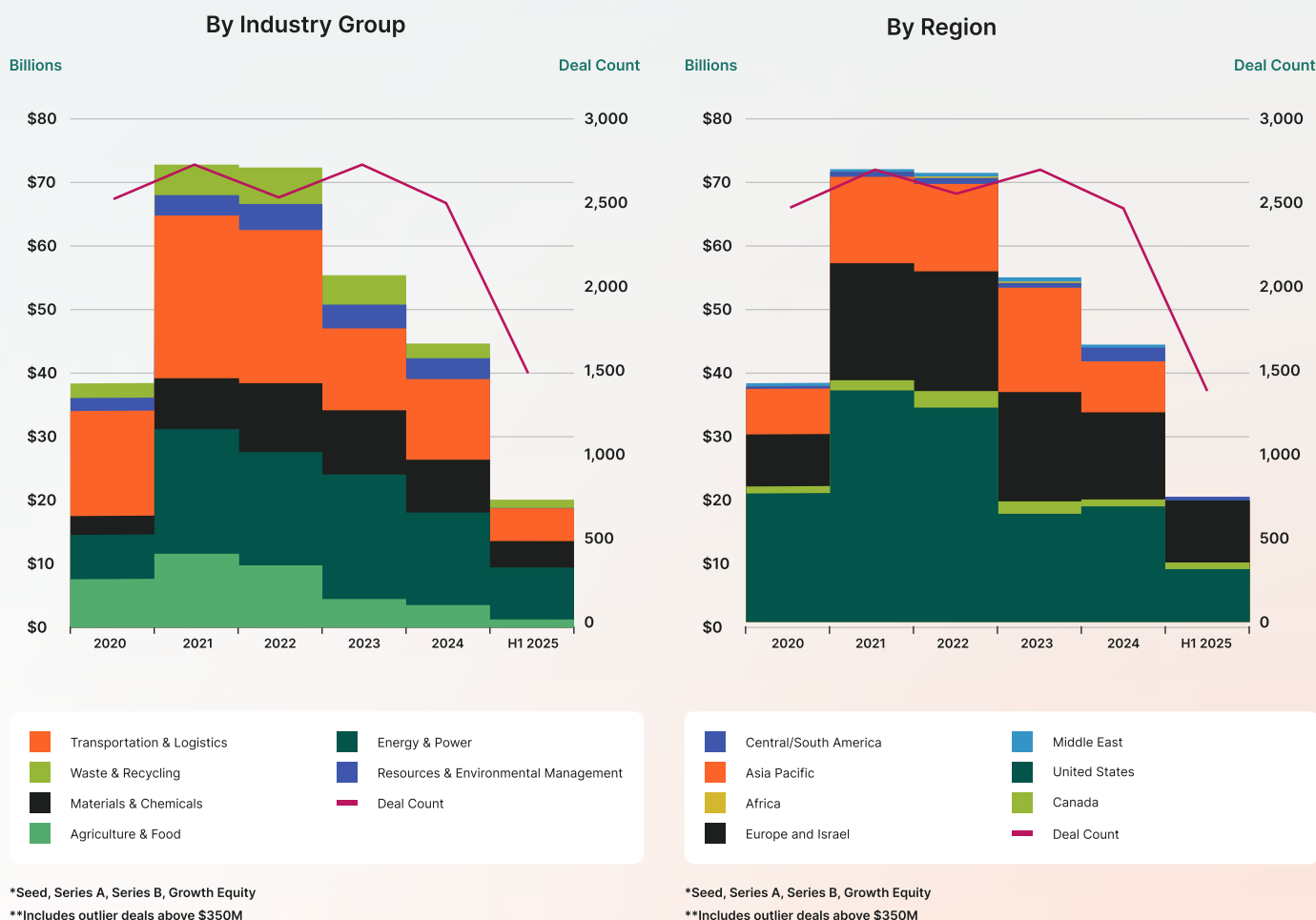


What will need to fight headwinds?

From an investment standpoint, 2025 appears to be proceeding much like 2024. And, while many expected a hollowing out of investments in Energy & Power, and especially in the U.S., there has been more of a shift than a drop.

The top-line numbers are misleading, however, and the trends underlying the numbers are different from previous years. This year's Cleantech 50 to Watch provides an instructive sample with regard to where cleantech innovation is heading next.

Venture & Growth Investments in Cleantech Innovators

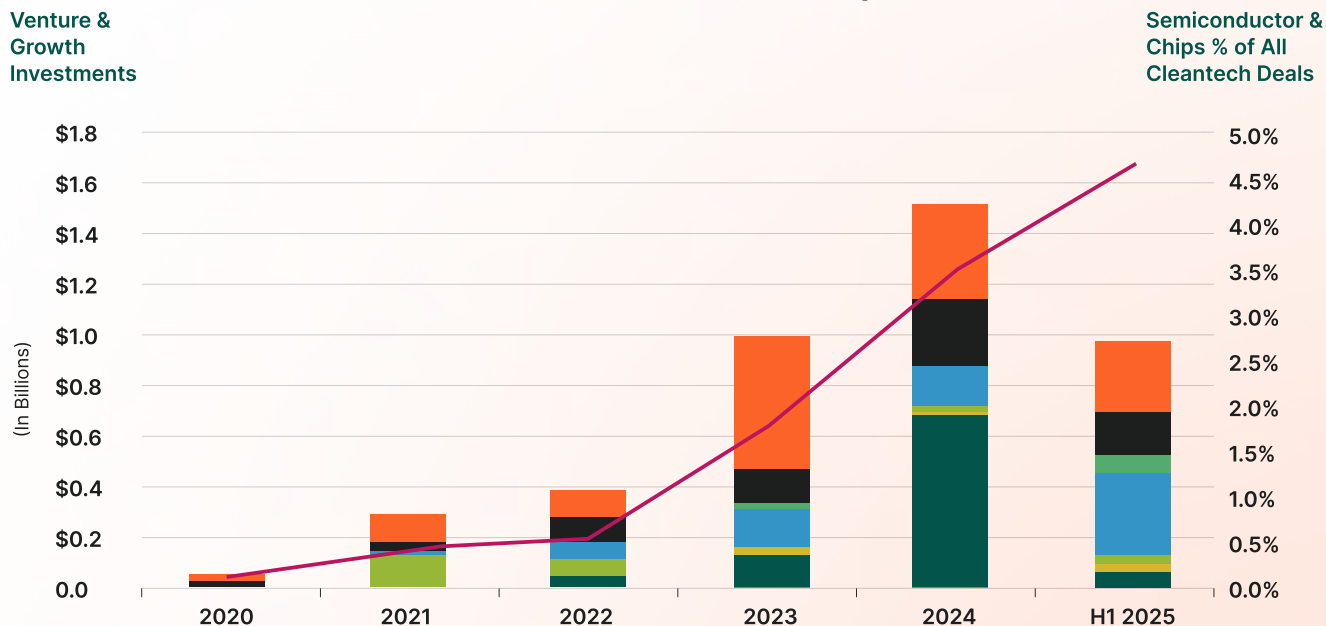


Energy Efficient Computing – the Next Frontier in AI Efficiency

The easiest area to point to for continued growth is the multiple facets of the AI revolution – as discussed in our Grow, Flow, Slow framework, baseload power sources to AI data centers are poised to see continued growth over the next year.

However, the value chain that goes into delivering bits from electrons is far more diverse than just power sources. We have seen a fast break in this space over the past 2 years – more ambitious innovation and at every link of the value chain.

Venture & Growth Investments in Semiconductors & Chips



- Semiconductor Packaging
- Semiconductors (Multiple)
- Gallium Based
- Energy-Efficient Chips

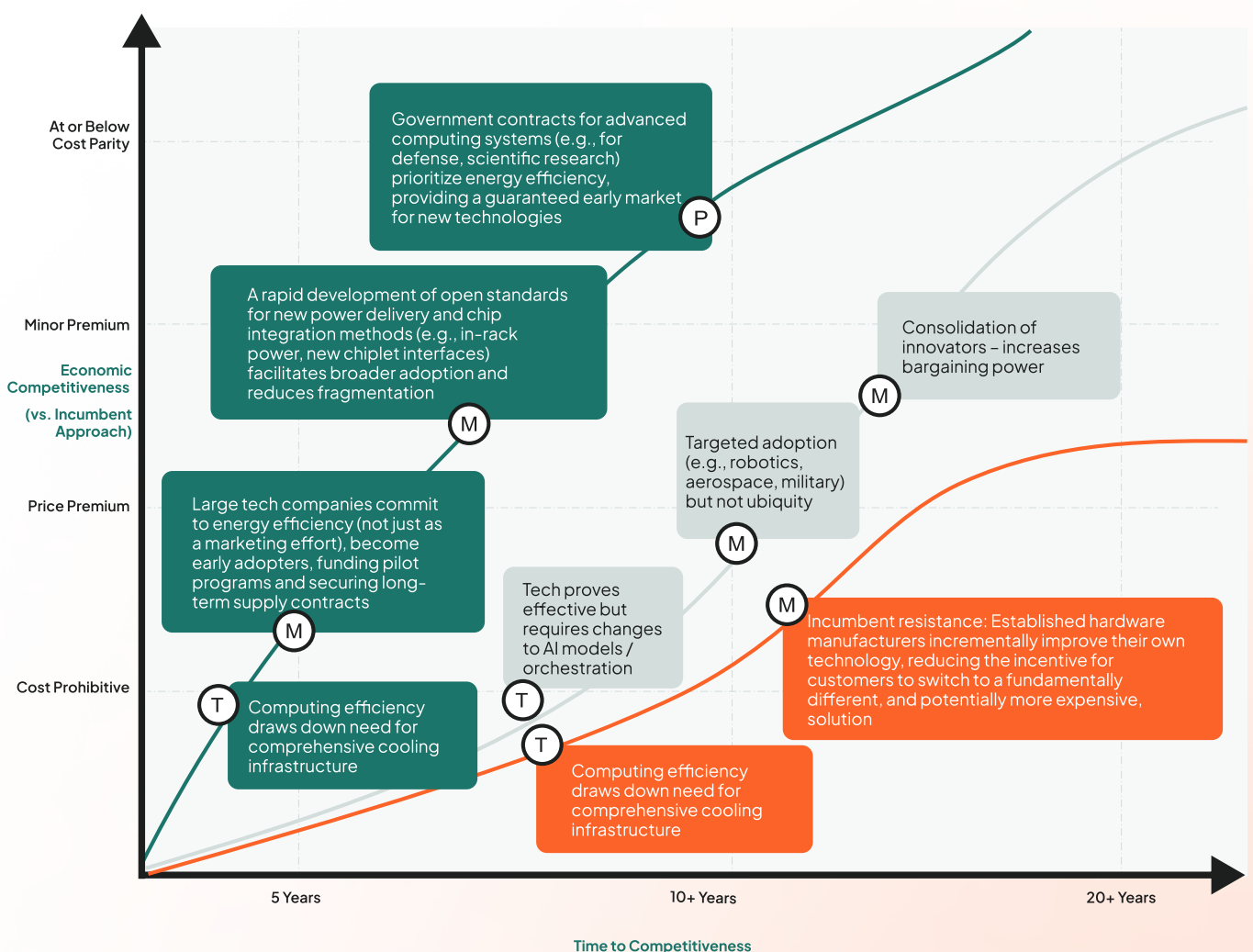
- Semiconductor Manufacturing / Pre-Manufacturing Tech
- Silicon-Based
- Semiconductor Design & Testing
- Chips & Semiconductors % of All Cleantech Venture Deals

*Seed, Series A, Series B, Growth Equity
 **Includes outlier deals above \$350M

The investment numbers certainly reflect a growing faith that these types of companies will be a source of growth in the future, but the true indicator will be earlier-than-anticipated corporate adoption. While many of these technologies have strong OPEX reduction credentials, the sticker prices are likely to remain high until manufacturing economies of scale are achieved.

However, operating in what today is a price inelastic market is a window of opportunity, that, if seized, could accelerate the trajectory to cost parity of the energy-efficient computing stack.

Time to Competitiveness



- Market-winning Scenario
- Niche Market Scenario
- Business-as-usual Scenario

- T Technology Indicators
- P Policy Indicators
- M Market Indicators

This year's Cleantech 50 to Watch features more companies innovating in computing efficiency than ever before. What's striking here is not only the emergence of this trend, but that there are a variety of solutions landing on the list – from the furthest upstream of materials for semiconductors all the way to software and power management at the rack level.

■ **Gallox Semiconductors**

Gallox's Gallium Oxide devices will first be adopted in mission-critical applications where a 3x efficiency gain over silicon carbide warrants a price premium (think high-speed EV charging, solid-state transformers for the power grid). The largest opportunity for Gallox will be where it can perfect the gallium oxide manufacturing process to outpace silicon carbide and gallium nitride on scale and cost.

■ **SEMRON**

SEMRON will first become cost-competitive in the high-value edge AI market. Think of applications in smartphones, VR/AR headsets, and autonomous systems where running generative AI locally is a competitive advantage. If manufacturing achieves scale, and the costs per compute/unit fall, SEMRON chips have the opportunity to become cost-competitive for a wider range of edge devices, e.g., industrial IoT and consumer electronics.

■ **Neuralwatt**

Neuralwatt is a software layer that optimizes power management for GPUs in data centers, requiring zero code changes to AI models or orchestration systems. This means customers can deploy it immediately to get a direct and measurable return on investment (ROI) by lowering energy costs and reducing carbon emissions.

■ **Palanquin Power**

Palanquin's focus is on the entire rack-level power delivery system, not just individual components. Their series-connected architecture allows for the use of cheaper, denser converters while maintaining high efficiency. As with other companies in the space – velocity of data center customer acquisition, within this high-demand environment, will be the deciding factor.

AI is a Force in Cleantech, and Not Just as Software

As we have stated in previous analyses, the ability for AI to be an enabler in cleantech is being proven out in real time. While for many, the first inclination is to think of AI as being limited only to software, we indeed see a mix of solutions ranging from pure-play software to digital-physical intersects, and to AI as an underpinning driver of deep tech development.

Cases from this year's Cleantech 50 to Watch indicate which industries are hungriest for the AI accelerant:

- 01 Materials Discovery**

[Entalpic](#) is a generative AI platform that accelerates materials and chemistry R&D by designing new molecules and materials from scratch. Scaling requires overcoming computational and physical bottlenecks in material discovery, which they address by creating a "flywheel" where the AI learns from continuous feedback and data.
- 02 Agentic Factories**

[Juna AI](#)'s technology uses a multi-agent reinforcement learning platform to autonomously control and optimize complex industrial systems, such as chemical plants and factories, in real-time, improving with time and accumulation of processes run.
- 03 Weather Modeling**

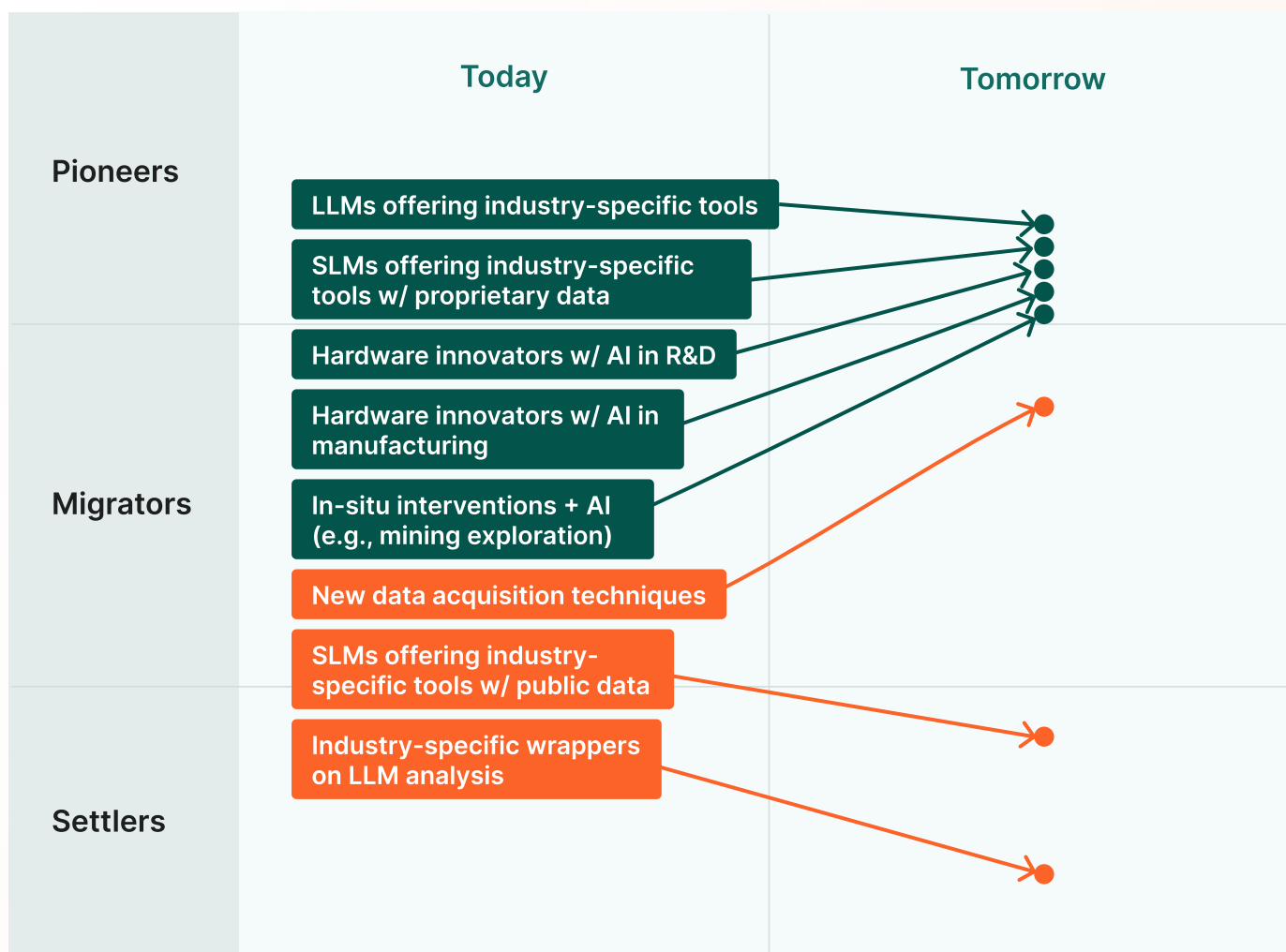
[Beyond Weather](#)'s AI-based weather modeling differs from incumbent technology, which primarily relies on Numerical Weather Prediction (NWP).

While NWP models use supercomputers to solve complex physical equations and fluid dynamics (very reliable for near-term extreme weather), Beyond Weather leverages machine learning to identify patterns in vast datasets of historical and climate data to provide faster and more cost-effective forecasts that extend beyond the typical 14-day horizon of NWP models, focusing on long-range, sub-seasonal to seasonal predictions.

Note that the opportunity in weather modeling is not just attracting innovators to the space, but incumbents as well. Google Deepmind's WeatherNext and Microsoft's Aurora are examples of incumbents with large-scale infrastructure and high-powered AI models that are developing application-specific offerings to industry.

With all of this said, it is misrepresentative to view AI as a golden ticket to success in cleantech (in any space, really) — many companies have ridden the wave of enthusiasm over the past few years, but we predict a melt-away of those without a distinct advantage.

Advantages for AI-enabled companies in cleantech will come from unique data acquisition and the ability to create differentiated outcomes in physical processes. And likely to the chagrin of many in the innovation space, the large tech companies developing generative AI capabilities will capitalize on the moment by launching industry-specific applications (e.g., the examples of weather modeling above, and also Google's Firesat).



AI in Cleantech: Expectations for Future Differentiation

Crop Science

Quietly Making its Way Into the Mainstream?

While 2025 has brought with it much controversy and debate around the world's will to pursue climate mitigation strategies, the effects of changing weather patterns, pest migration, and disease evolution pose a systemic threat to the world's food system. We have seen an expansion in recent years of crop science approaches, but the scientific challenges of developing a crop treatment and achieving on-farm adoption are daunting.

What has come through clear in this year's Cleantech 50 to Watch is that the innovators in the space are taking full aim at improving crop yield as a primary value proposition, while also generating an emissions reduction, pollution reduction, or resilience benefit.

IMIO ↗

IMIO creates regenerative, all-natural microbial inoculants to help farmers cultivate high-yield crops without chemicals.

NetZeroNitrogen ↗

NetZeroNitrogen has developed a non-GMO biofertilizer using endophytic nitrogen-fixing bacteria that colonizes plants and reduces the need for synthetic fertilizers.

Silvec Biologics ↗

Silvec Biologics is a biotechnology company developing a non-GMO, RNA-based vaccine to protect trees, vines, and bushes from harmful pathogens.

Qarbotech ↗

Qarbotech utilizes a patented biocompatible nanotechnology that enhances photosynthesis, leading to increased crop yields and improved fruit quality.

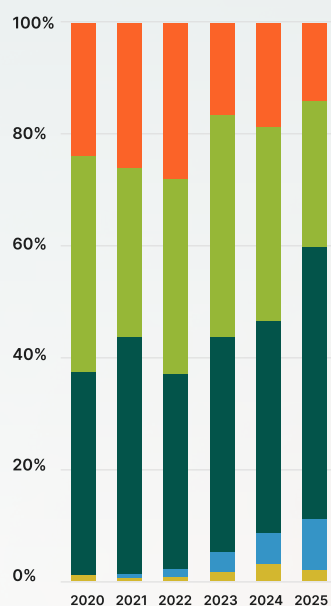
Bridging the Digital / Physical Intersect

A Key Innovation Opportunity

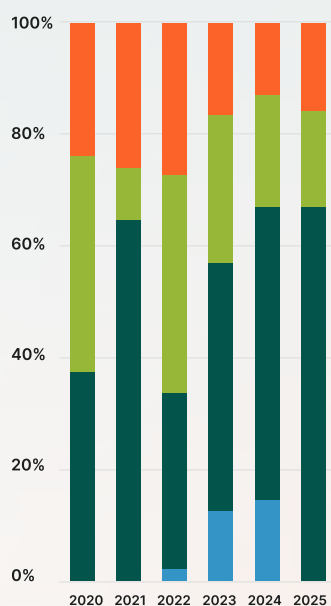
PAGE Technologies is an interesting enabler of the digital / physical intersect, re-inventing the sensors that go into soil and water measurement by employing particle-polymer inks so that sensors can be produced in a mass-scale roll-to-roll manufacturing process. This begs the question of where else there are “entry points” for AI into the crop science space. Interestingly, while crop science stands to be one of the biggest beneficiaries of the AI

revolution (think gene editing and fertilizer development), we do not see the same acceleration effect of AI on the ability of companies in the space to scale — yet. See the graphic below, where our data suggests that in deep tech at-large, usage of AI somewhere in the process is allowing younger, lower TRL companies to grow faster. The inverse is true for crop science companies, where the AI-enabled companies raising funds skew later-stage.

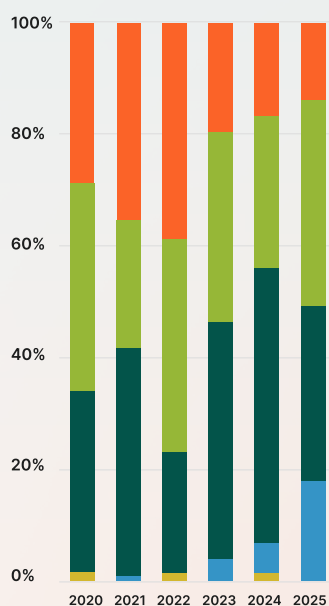
Maturity of Deep Tech Companies That Have Raised Funds



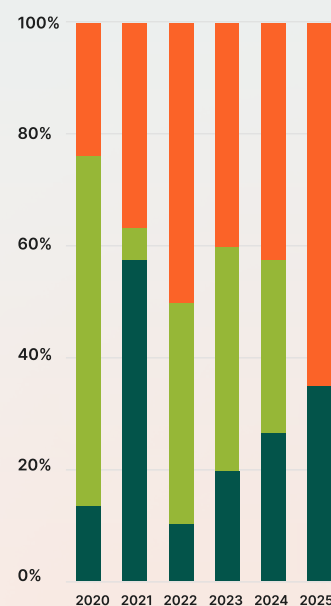
Maturity of AI-Enabled Deep Tech Companies That Have Raised Funds



Maturity of Crop Science Companies That Have Raised Funds



Maturity of AI-Enabled Crop Science Companies That Have Raised Funds



Technology Readiness Level

0 1-3 4-6 7-8 9

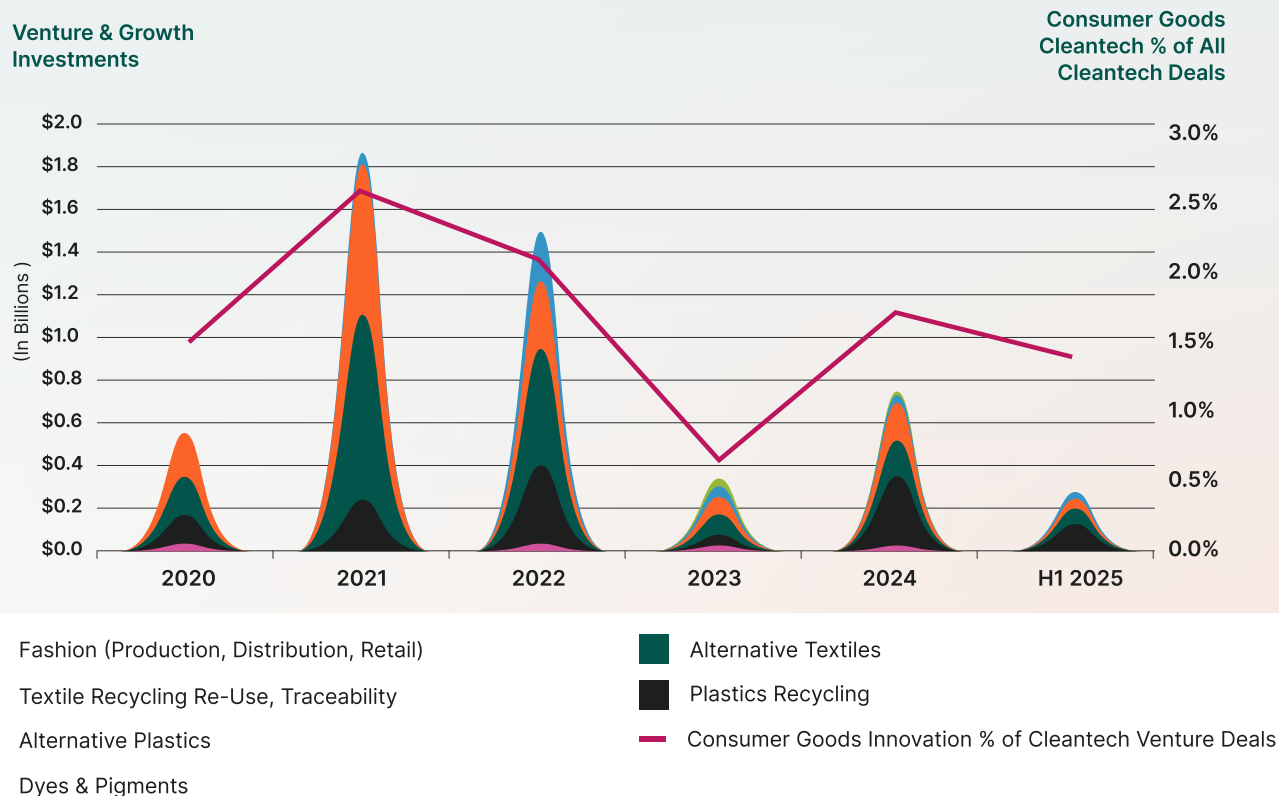
Consumer Goods Cleantech

Are We Finally at the Starting Line?

At the beginning of this year, we posited that with a macroeconomic downturn on the horizon, resource efficiency would be back in vogue. And while we have indeed seen activity on plastics and textiles happen in fits and starts over the years, the difficulties of feedstock management and low-cost valorization processes are formidable.

Given the size of the problems, the mix of alternative solutions and circularity has never amounted to a significant percentage of the cleantech investment mix. Beyond the investment numbers, what gives us reason to believe that the 2025 Cleantech 50 to Watch indicates something new?

**Venture & Growth Investments in
Cleantech for Consumer Goods**



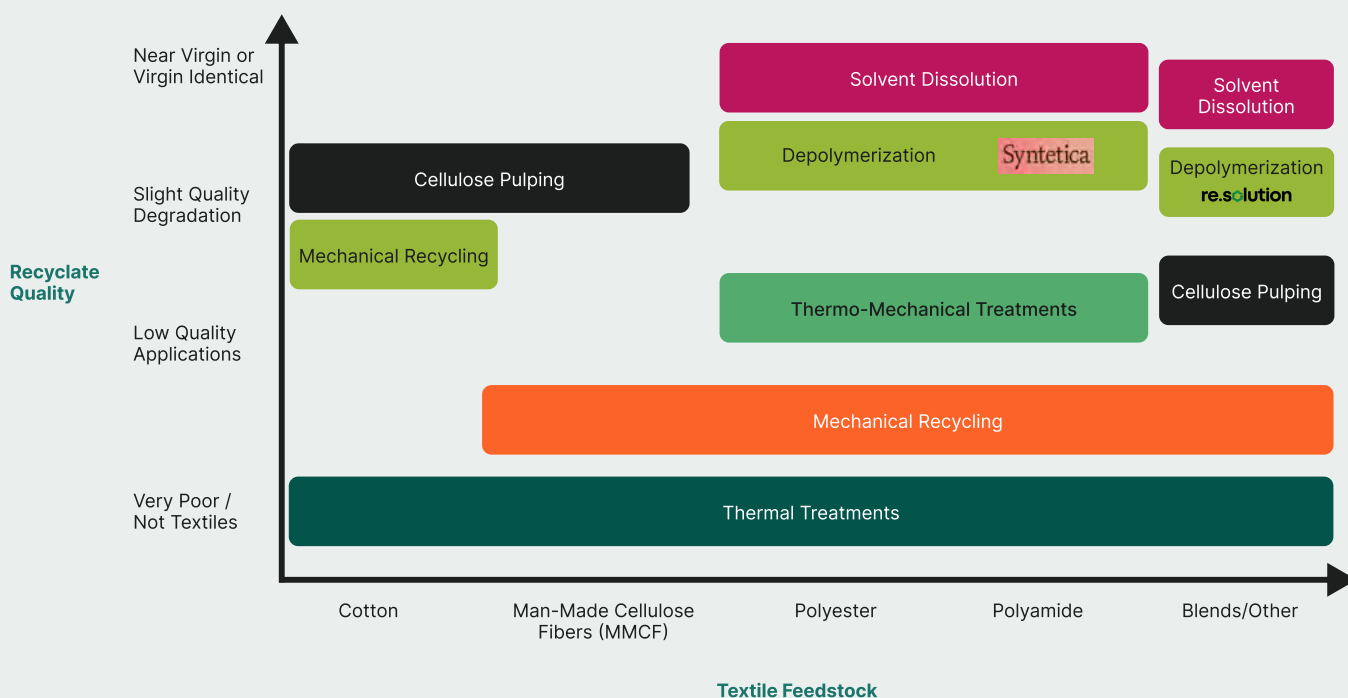
*Seed, Series A, Series B, Growth Equity

**Includes outlier deals above \$350M

At least 9 companies on this year's list are tackling consumer goods sustainability – from textile recycling ([re.solution](#), [Syntetica](#)) and plastic recycling ([Radical Dot](#), [Driven Plastics](#), [Extracthive](#)) to the creation of bio-based materials from waste ([Tomtex](#), [Carbon Cell](#), [Sengong](#)). [Dispersa](#) is delivering the world's first waste-derived biosurfactants for cleaning and personal care products. This focus on advanced recycling and novel materials is a direct response to the limitations of traditional, mechanical recycling, which struggles with

mixed and contaminated waste and often results in lower-quality products. The innovators on this list are not simply addressing the "easy" waste; they are tackling the last-mile problem — the complex fiber blends, multi-layered plastics, and carbon fiber composites that have historically been unrecyclable. In addition, as both plastics and textiles recycling innovators continue tackling the challenge of blended materials, there is likely to be an opportunity for collaboration and technology transfer.

Textiles Recycling Challenges & Solutions



The broader market for sustainable materials is substantial – with a projected value of over \$800B by 2032 – but very geographically “pocketed” (think China and EU). Look for solutions that bring new production methods close to the demand markets. Take special note of Sengong, who has reported that their manufacturing

process for PVA (Polyvinyl Alcohol), a material that can be used 50 times over but is also water soluble, is near par cost with PET-based plastics. With a mature and at-scale manufacturing base at their fingertips, expect Sengong and other Chinese innovators in these spaces to become more prominent, fast.

Ecosystems

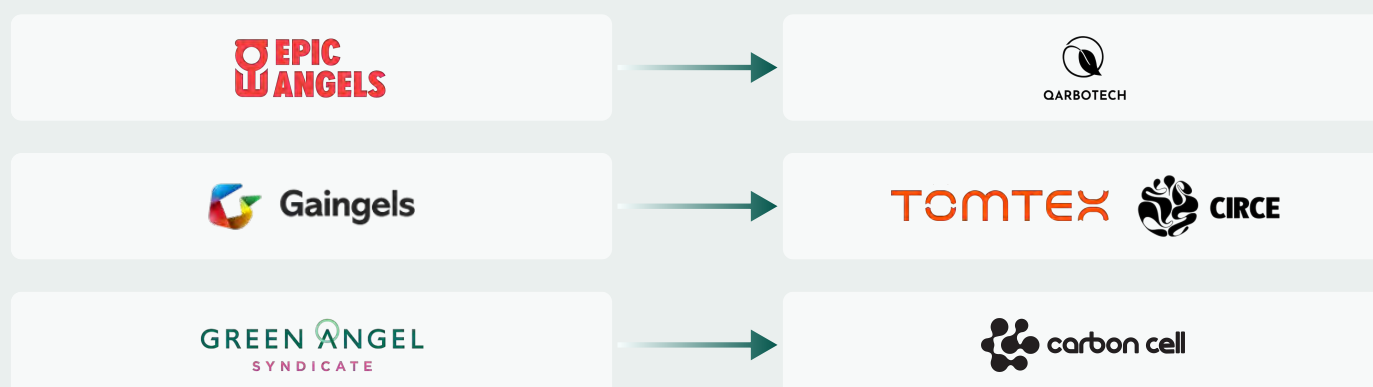
At the early stages of company development, the importance of ecosystems is being felt more acutely than ever. Since we began tracking the early-stage journeys of companies, we have seen a further “tightening” of ecosystem journeys, with this year’s Cleantech 50 to Watch demonstrating the most overlap we’ve ever observed in the list (i.e., multiple companies engaging the same ecosystem actors).

Note the prominence this year of regionally-focused ecosystem actors such as [SGInnovate](#) (Singapore), [Invest Nova Scotia](#) and [Nadarra Ventures](#) (Canada), [Sprin-D](#) (Germany), and [Innovate UK](#) with a mandate to provide a springboard for local companies to succeed on the global stage.

The corollary to the “push” ecosystem actors is the “pull”, focused on leveraging a given geography’s strengths to help companies land there and leverage local advantages. Massachusetts is clearly maintaining a position of strength as a place where cleantech companies can grow or land but generally need to be – as seen in the results from the [Massachusetts Clean Energy Center](#) and [Greentown Labs](#).

Early-Stage Ecosystems: Where Cleantech 50 to Watch Companies Are Emerging From

Angel Networks and Syndicates





Public Sector Innovation Programs

Innovate UK

N2N
NETZERONITROGEN



ACTIVE SURFACES

SPRIN-D

UP
UNIVERSITY OF PLYMOUTH



Early-Stage Incubators

Greentown Labs

ACTIVE SURFACES **CIRCE**

THIRD^Δ
DERIVATIVE

DARCY
Sustainable Heating and Cooling



Venture Builders

Carbon13

carbon cell **Ki H₂**

SUSV
THE ACCELERATOR VC

TOMTEX **STILL BRIGHT**

LUMO
LABS

Beyond
Weather

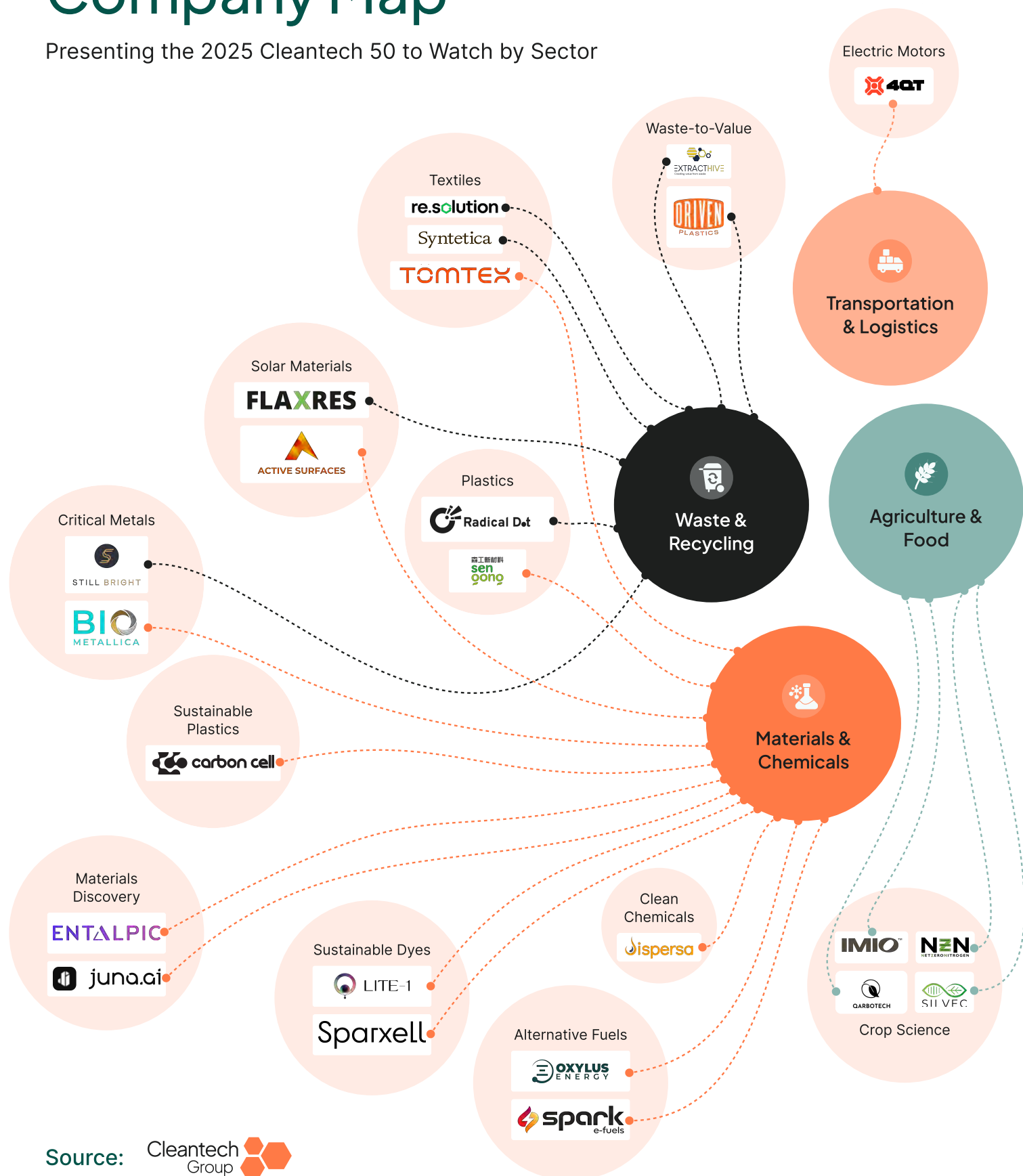
We extend our congratulations to all 50 companies receiving this recognition in 2025 – a year when innovators are tasked with pushing the limits of their respective fields, but also the global macro conditions.

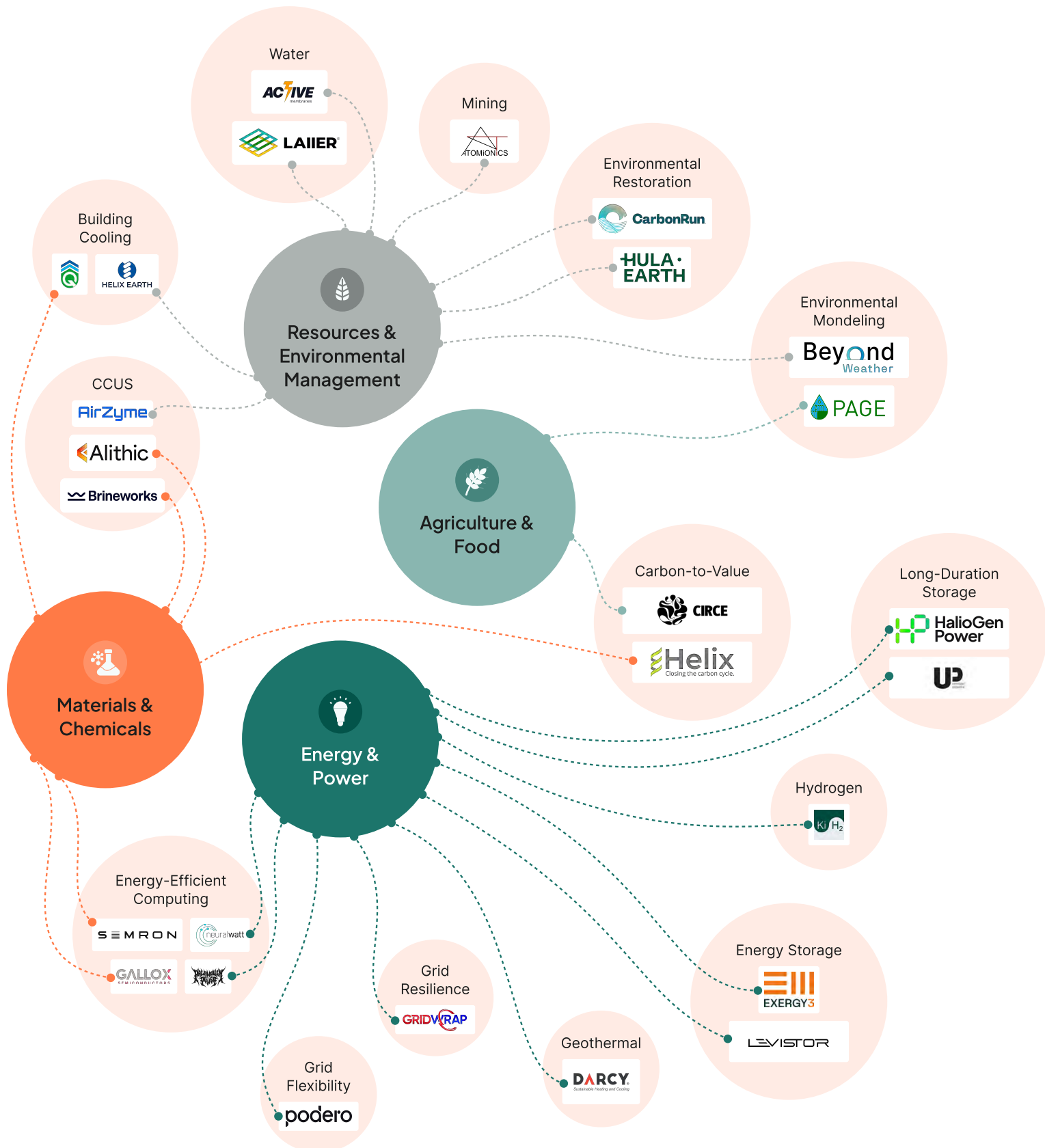
2025 Cleantech50toWatch

02 Company Map

Company Map

Presenting the 2025 Cleantech 50 to Watch by Sector







2025 Cleantech50toWatch

03 Case Studies

01

4QT by Nicole Cerulli

Associate, Transportation & Logistics,
Cleantech Group



02

Active Membranes by Sunena Gupta

Associate, Resources & Environmental Management,
Cleantech Group



03

GridWrap by Zainab Gilani

Associate, Energy & Power,
Cleantech Group



04

re.solution by Parker Bovée

Associate, Waste & Recycling,
Cleantech Group



05

Still Bright by Diana Rasner

Group Lead, Materials & Chemicals and Waste & Recycling,
Cleantech Group



Case Studies

Case Study



Transportation & Logistics

4QT



Company Name: 4QT

Country: Switzerland

Company Founded: 2020

TRL: 7-8

Key Facts

50% drivetrain efficiency improvement; up to 40% TCO reduction compared to diesel counterparts

35-50% upfront cost reduction of existing electric options, while improving payload and enabling full-day operations on a single charge

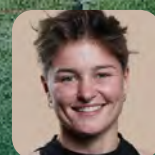
What Is the Company and What Do They Do?

4QT is a Swiss technology company pioneering hybrid-electric drivetrains for heavy off-road machinery. Founded in 2020, the company was created to address one of the most stubborn decarbonization challenges: construction and mining equipment, a sector that accounts for significant global CO₂ emissions but has remained largely untouched by electrification due to high costs, infrastructure build-out, and challenging performance requirements.

By designing a practical and scalable solution that works in power-intensive, infrastructure-poor environments, 4QT enables OEMs, contractors, and fleet operators to lower emissions while improving cost efficiency and performance.

Nicole Cerulli

Associate, Transportation & Logistics, Cleantech Group



How It Works

4QT has developed a high-performance hybrid drivetrain specifically designed for heavy machinery such as dumpers and excavators. The system combines the efficiency of electrification with the autonomy of combustion, enabling full-day operation without reliance on charging infrastructure.

Its modular powertrain integrates proprietary axial-flux motor technology, optimization software, and a downsized battery system that stores and reuses energy from regenerative braking. This design reduces fuel use and emissions while maintaining payload capacity and machine uptime.

Key Differentiator

Upfront cost is one of the key barriers to electrifying heavy-duty machinery. The premium for BEV solutions can be 80%-120% of the cost of a diesel machine.

Unlike traditional approaches that focus solely on electrification, 4QT takes a holistic systems-level approach. Beyond simply electrifying the drivetrain, 4QT's solution optimizes the full powertrain architecture enabling a 70% reduction in battery size compared to conventional BEV. As a result, 4QT's solution reduces the upfront cost premium compared to diesel to ~20% and reduces total cost of ownership (TCO) by 40%.

The modular design allows both new builds and retrofits, accelerating adoption in a conservative industry. By requiring no structural changes to the chassis and eliminating dependence on charging infrastructure, 4QT offers a solution that is both flexible and fast to deploy.

Potential Impact

Heavy machinery accounts for nearly 40% of global construction-related CO₂ emissions, making it one of the hardest-to-abate sectors. By delivering practical, cost-effective hybrid systems, 4QT can significantly reduce emissions in construction, mining, and tunneling while also improving operator economics. 4QT's solution paired with low-emissions distributed energy solutions present a practical, cost-effective net-zero path for offroad heavy machinery without relying on widespread infrastructure buildout.

Early field tests of 4QT's dumper demonstrator showed a 33% reduction in TCO under real-world conditions, validating both the environmental and economic impact of its approach. At scale, this technology could reshape how high-emission equipment is powered worldwide.

Ambition/Next Steps for Company

4QT is preparing to scale production, starting with a 15-unit first production series and a demo fleet to accelerate adoption. The company has secured pre-orders, signed its first OEM pilot deployment, and partnered with rental customers to validate performance in the field.

The next phase involves raising capital to expand its engineering and sales teams, strengthen its IP portfolio, and advance R&D for next-generation drivetrains. Longer term, 4QT aims to expand from construction into adjacent markets like mining, tunneling, and other high-emission off-road sectors.

Key Things to Watch in This Space

The electrification of heavy machinery faces systemic barriers: limited charging infrastructure, high upfront costs, and the industry's reluctance to embrace disruptive technologies. Hybrid solutions like 4QT's will play a critical role in bridging the gap until full electrification becomes viable.

Other important dynamics to monitor include battery pricing, the sourcing of power electronics, certification processes, and increasing regulatory pressure on construction emissions. Partnerships with OEMs and Tier 1 suppliers will be key to scaling adoption in this traditionally slow-moving sector.

Why 4QT Made the List

4QT addresses one of the "last mile" challenges in decarbonization: how to cost-effectively decarbonize high-emission heavy machinery without sacrificing performance or uptime. Where emissions and cost reductions have conventionally been mutually exclusive, 4QT's solution provides simultaneous decarbonization, cost-efficiency, and performance benefits.

By combining modularity, retrofit capability, and smart system optimization, 4QT provides a promising blend of near-term impact and long-term scalability to position itself as a standout innovator in the industry.

“

Our solution doesn't just electrify: it optimizes the entire powertrain system to reduce emissions and costs without compromising uptime. That's how we unlock decarbonization in one of the hardest-to-abate sectors.”

– 4QT team interview

Case Study



Resources & Environmental Management

Active Membranes



Company Name: Active Membranes

Country: U.S.

Company Founded: 2022

Number of Employees: 9

TRL: 6-7

Key Facts

30–60% lifecycle cost savings for desalination plants from capital and operating efficiencies

30–50% reduction in physical footprint and ~25% lower carbon emissions compared to conventional systems

What Is the Company and What Do They Do?

Active Membranes is tackling global water scarcity by developing smart membranes that reduce the cost, carbon footprint, and physical footprint of desalination by at least 50%. The technology can retrofit existing plants or streamline new installations, delivering substantial operational savings, lower emissions, and reduced infrastructure needs. By addressing both municipal and industrial markets, Active Membranes aims to make desalination accessible far beyond high-budget regions.

Sunena Gupta

Associate, Resources & Environmental Management, Cleantech Group



How It Works

Conventional desalination membranes operate passively and quickly succumb to fouling and scaling, which drives the need for extensive pretreatment infrastructure and raises costs. Active Membranes' innovation controls these phenomena within the membrane itself, removing much of the need for costly add-on systems. This shift from passive to active separation changes the design paradigm, enabling simpler, leaner, and more efficient plants. The system works for both retrofits and new builds, using minimal additional energy through a proprietary low-cost power unit (Active Box) that energizes the membranes.

Key Differentiator

While most industry innovation focuses on either material changes or process tweaks, Active Membranes fundamentally re-engineers the separation mechanism. By embedding active control into the membrane medium, it minimizes fouling and scaling without heavy pretreatment, enabling higher recovery rates and smaller plant footprints. This approach delivers both economic and environmental benefits at varying scales, positioning the technology for adoption in more resource-constrained communities in addition to the large-scale industrial facilities that most innovation targets.

Potential Impact

By reducing lifecycle costs by up to 60%, cutting physical footprints nearly in half, and lowering carbon emissions by around 25%, Active Membranes can significantly expand global desalination capacity.

In addition to easing the financial and environmental burdens that have slowed desalination adoption, the technology could play a critical role in brackish water treatment, seawater desalination, and industrial water reuse, which can support resilience in water-stressed regions worldwide.

Ambition/Next Steps for Company

The company's immediate goal is to build its first large-scale production facility to meet growing global demand following successful pilots. Parallel to scaling manufacturing, Active Membranes is building a commercial network to convert early interest into long-term sales and recurring revenue.

Geographic priorities include high water-scarcity markets such as the Mediterranean, Australia, Texas, and Florida. The company is also actively competing in the XPRIZE Water Scarcity competition as a qualified team, viewing it as both a funding and product development opportunity.

Key Things to Watch in This Space

Rising water scarcity, coupled with population growth and industrial demand, is pushing desalination into the mainstream. However, cost and sustainability remain critical barriers to adoption, making solutions that address both simultaneously especially valuable. Additionally, geopolitical trends and climate-related droughts are accelerating interest in decentralized, small-scale desalination systems, opening new markets for adaptable membrane technologies. Regulatory drivers around brine management and energy efficiency could further incentivize adoption of Active Membranes' approach.

Why Active Membranes Made the List

Active Membranes directly addresses the two greatest limitations of desalination: high cost and large environmental footprint. The technology is cost-effective and its ability to retrofit existing plants and enable smaller, more sustainable new builds offers flexibility across diverse markets. With proven pilot results, significant international interest, and a strong pipeline in both municipal and industrial applications, the company is well-positioned to scale globally and make desalination a more practical option for communities facing acute water stress.

“

We're trying to do for desalination what smartphones did for communication—make it simpler, leaner, and cost-effective so it can be adopted by anyone, anywhere.”

– Arian Edalat, CEO, Active Membranes

Case Study



Energy & Power

GridWrap



Company Name: GridWrap

Country: U.S.

Company Founded: 2023

Number of Employees: 4

TRL: 9

Key Facts

83% of power outages are caused by extreme weather

Reinforcing poles with pole wrap are just 10% of the costs of replacing poles

What Is the Company and What Do They Do?

GridWrap is developing a series of solutions using lightweight composite technologies that can be rapidly deployed to enhance and reinforce existing grid infrastructure including poles and wires. The two main solutions are Gridwrap's WiRe Wrap technology and Pole Wrap systems. The WiRe Wrap and Pole Wrap systems can be used to improve transmission capacity, reduce costs for aging infrastructure, and support existing infrastructure to better withstand changing temperatures and extreme weather.

Zainab Gilani

Associate, Energy & Power, Cleantech Group



How It Works

Gridwrap's WiRe Wrap system is applied to overhead power lines to improve performance and reduce ignition risk, claiming a 75% reduction in thermal sagging, which reduces the probability of vegetation contact during extreme heat events and potential fire risks. Although the conductivity of the wire is not changed, additional electricity can be unlocked and transmitted using the wires if there is less likelihood of sagging - with the potential to improving transmission capacity 2x under certain conditions. The Pole Wrap system also uses a fast-curing composite-based product, that can be adhered to wooden and concrete poles using water to improve the pole's strength and durability. This technology has shown that it can increase load-bearing capacity by up to 3X, protect poles against wildfires, and extend the useful life of existing poles.

Key Differentiator

Composites have been explored and established in various industries, but few companies have directly used composites to wrap around existing grid infrastructure and support aging and vulnerable assets. Outside of the composition of the composite itself, GridWrap is researching unique ways to work with customers and utilities to integrate their product. The company is exploring autonomous tools that can install the solution without using manual labor and powering down the wires to reduce the amount of downtime required to assemble. The company has also initiated various partnerships with utilities and will work with strategic partners to distribute their technology to increase market reach.

Potential Impact

Grid infrastructure and utilities need solutions to address the changing climate given that 83% of power outages are caused by extreme weather. Additionally, 70% of the U.S. electrical grid requires repairs. With these technologies, GridWrap allows for better reinforcement, cost-effective repairs, and timely solutions. For example, Pole Wrap costs 1/10th of the cost of replacing poles and doesn't require special permits which may cause delays.

Cheaper and faster solutions will be critical to support an aging and vulnerable grid infrastructure. As utilities work with various start-ups and innovators, a more streamlined approach to working with vendors and procurement processes will be established to integrate a variety of solutions. There is a large market for this technology as there are over 185 million poles and miles of distribution lines that can be addressed.

Ambition/Next Steps for Company

GridWrap works with multiple customers and utilities. There are

3,000 utilities that can be addressed but the company's team would not be able to reach all of them. They are working with third-party distributors and partners that can be trained on the product to find customers and expand reach. Further steps may include integrating technology with other various markets in transportation and telecommunications. Their product portfolio will also include solutions to support challenges related to vehicle accidents, and natural damage from woodpeckers, to support the variety of challenges utilities face.

Key Things to Watch in This Space

GridWrap is working with PG&E, XCEL Energy, Hydro-Quebec, and others to scale solutions for large-scale projects. As multiple parties look to expand energy infrastructure, GridWrap will see continued success in regions and areas that require immediate solutions such as those in disaster-prone areas or in areas where transmission capacity needs to be greater. Particularly as data centers get built out, utilities will be encouraged to build out additional infrastructure and support existing assets to manage loads. GridWrap's solutions will be critical as "first response" solutions to firm up grid reliability.

Why GridWrap Made the List

While there are numerous grid-related tools and software & sensor companies that can also improve and make existing assets more efficient, there are few easy to deploy, fast hardware solutions that support reliability. GridWrap's ease of application (15 minutes to cure composite) and lack of complex permitting means that they can enter and support regions that need immediate relief.

Additionally, GridWrap has achieved multiple awards, certifications, and recognition including being part of the Free Electrons 2024 Cohort and Dominion Energy Innovation Center. They have also tested their product with UCLA SMERC Testing, Western Fire Center, PG&E Applied Technology Services evaluation, and others. These certifications have allowed GridWrap to validate their technology and partner with large-scale utilities delivering and deploying over 300 utility pole wraps in the last year.

“

GridWrap is for customers who want fast solutions to save time and money. The composite solutions are cheaper than rebuilding, reconductoring, undergrounding, and have higher traction allowing them to be deployed faster along a combination of other technologies addressing grid infrastructure and resiliency.”

– Talieh Zargar CTO, GridWrap

Case Study



Waste & Recycling

re.solution

re.solution



Company Name: re.solution

Country: Germany

Company Founded: 2023

Number of Employees: 7

TRL: 4

What Is the Company and What Do They Do?

re.solution is a polyethylene terephthalate recycler establishing the first commercial process using salt-free recovery in hydrolysis. They currently focus on TPA recovery

Key Facts

re.solution

Novel hydrolysis technology achieves a 90% reduction in carbon footprint compared to virgin PET

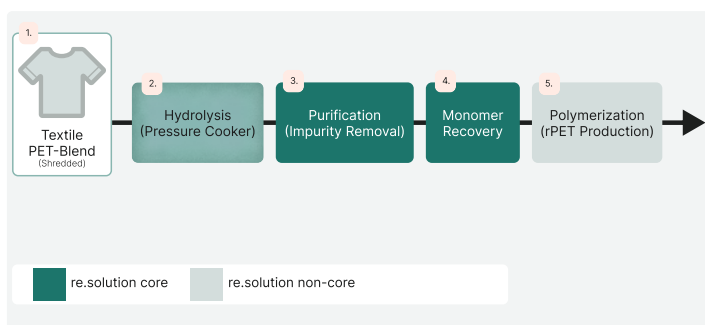
re.solution's process reduces chemical use by 94% and water use by 74% compared to competitive hydrolysis recyclers



Technology

re.solution

re.solution process: Efficient process that uses mild operational conditions to first depolymerize the polyester, before recovering the monomer



Parker Bovée

Associate, Waste & Recycling, Cleantech Group



How It Works	Textile waste containing polyethylene terephthalate is processed using hydrolysis but only targeting terephthalic acid (TPA) to maximize efficiency and reduce waste creation. The proprietary process can be stood up as a commercial treatment or licensed to polyethylene terephthalate (PET) recyclers.
Key Differentiator	The re.solution process can build on the existing hydrolysis benefits but completely avoids the salt waste, while also recovering the process water and chemicals that are required for the depolymerization.
Potential Impact	While hydrolysis processes are a promising pathway for circular textile recycling, they still generate chemical waste, salt residue and wastewater. re.solution is positioned to address these inefficiencies by integrating its technology across the hydrolysis value chain—upstream with chemical management and downstream with material recovery.
Ambition/Next Steps for Company	re.solution built an end-to-end demonstration plant that is up and running in Aachen, in which textile feedstock is recycled into high-quality PET monomers. Together with waste management companies, hydrolysis recyclers, and polyester fiber producers, the start-up aims to establish a semi-industrial plant which should serve as technical validation.
Key Things to Watch in This Space	Textile waste is poorly collected and often highly contaminated; small improvements in sortation and preprocessing are high value-adds for partnerships and integration. Conversely, many textile recyclers believe massive breakthroughs are expected, especially in the recycling of blended textiles, a key competition point for re.solution.
Why re.solution Made the List	Regardless of how competitors redefine blended textile recycling, re.solution is now making a dynamic market play. Operating as both recycler and efficient complimentary technology, the company is targeting industrial partnerships alongside their own standalone facilities.

Re.solution is emerging aggressively and dynamically; the company is targeting all three major issues with PET recycling:



Limited feedstock compatibility (blends)



Poor drop-in output



Low efficiency and high waste creation

Case Study



Materials & Chemicals

Still Bright



STILL BRIGHT



Company Name: Still Bright

Country: U.S.

Company Founded: 2022

Number of Employees: 12

TRL: 4–6

What Is the Company and What Do They Do?

Still Bright is a U.S.-based cleantech start-up replacing traditional copper smelting and unlocking non-traditional resources with its RACER extraction process. Their modular, low-impact system enables high copper recovery from low-grade ores, waste streams and challenging feedstocks in record time, all while saving costs and unlocking untapped value

Key Facts



STILL BRIGHT

Achieves up to 99% recovery of copper within minutes from waste, copper concentrate, and/or low-grade ores using proprietary RACER extraction process

Plans for 500 TPA demo system by 2027–2028, scaling toward 10,000 TPA commercial units

Diana Rasner

Group Lead, Materials & Chemicals and Waste & Recycling, Cleantech Group



How It Works	Inputs including waste materials, concentrates, and/or crushed ore are soaked and agitated in a vanadium solution that extracts solid copper into an aqueous solution. The solution is then electrically regenerated in a closed-loop system inspired by vanadium flow battery chemistry — entirely electric, fast extraction (minutes to an hour), and avoids toxic emissions.
Key Differentiator	Compared to smelting, the RACER process is cleaner, cheaper and easier to permit, avoiding toxic pollutants typical of smelting with up 90% CAPEX savings. Unlike heap leaching, Still Bright's platform can recover valuable co-products and is highly efficient (~99% recovery in minutes). Compatible with a range of inputs, its modular solution offers quick deployment at mine sites and dramatically lowers permitting barriers.
Potential Impact	It could unlock vast copper resources in the U.S. and other copper-rich nations, reduce reliance on foreign refining, maximize value and efficiency while minimizing harm, and secure the copper needed for economic growth, electrification, and AI infrastructure.
Ambition/Next Steps for Company	Having raised \$18.7M in Seed funding, Still Bright plans to deploy a 500 TPA demonstration unit by 2027–2028. Alongside further pilot campaigns, they are targeting strategic partnerships and scaling toward 10,000 TPA commercial operations.
Key Things to Watch in This Space	Fueled by a clean energy transition, copper demand is forecasted to require an additional 40% in supply growth by 2050 according to the IEA in their Stated Policies Scenario. Ore grades are falling globally forcing mines to have to dig more rock for the same amount of copper and start seriously exploring how to extract more with what they already have. Geopolitical tensions are also starting a wave of domestic production initiatives to reduce the reliance on single points of failure in the supply chain. Innovations in this space are embracing the same “do more with less” mantra to tackle this challenge. From reduced water and chemical usage to faster and more efficient extraction from stubborn ores such as chalcopyrite, expect to see systems that seamlessly integrate with existing mining flow sheets and try to onshore copper production, helping alleviate supply chain bottlenecks and import costs.
Why Still Bright Made the List	Still Bright offers a compelling combination of breakthrough recovery efficiency, operational agility, domestic production capability, and environmental sustainability—positioning it as a disruptive force in clean mining.

2025 Cleantech50toWatch

04 Watch List

Congratulations!

To all of the **50 innovators** who made the list.



Agriculture & Food

6 Companies ↑ 3 Countries —

Company	Name & Description	Sector	Country	Year Founded
	Circe Bioscience Alternative fats and proteins made with carbon dioxide produced by genetically engineered microbes.	Carbon-to-Value	United States	2021
	IMIO Microbial solution that strengthens soil health and enhances crop productivity.	Crop Science	United States	2018
	NetZeroNitrogen Sustainable alternative to synthetic nitrogen fertilizers.	Crop Science	United Kingdom	2021
	PAGE Technologies Printable sensors to advance water efficiency and soil management for healthier, more productive farms.	Environmental Modeling	United States	2023
	Qarbotech Photosynthesis enhancement nanotechnology that results in shorter growing times and increases crop yields up to 60%.	Crop Science	Malaysia	2018
	Silvec RNA technology that inoculates perennial crops against disease, offering an alternative to genetic modification.	Crop Science	United States	2019


Energy & Power

10 Companies ↓ 4 Countries ↓

Company	Name & Description	Sector	Country	Year Founded
	<u>Darcy Solutions</u> Groundwater based geothermal systems for heating and cooling in buildings.	Geothermal	United States	2018
	<u>Exergy3</u> Ultra-high temperature thermal energy storage technology.	Energy Storage	United Kingdom	2023
	<u>GridWrap</u> Grid resilience solutions using composite materials.	Grid Resilience	United States	2023
	<u>HalioGen Power</u> Membraneless redox flow batteries for long-duration energy storage using non-flammable, affordable materials.	Long-Duration Storage	United Kingdom	2023
	<u>Ki Hydrogen</u> Biomass electrolysis technology that produces green hydrogen from biomass waste.	Hydrogen	United Kingdom	2022
	<u>Levistor</u> Flywheel short-duration energy storage solution for EV charging applications.	Energy Storage	United Kingdom	2021
	<u>Neuralwatt</u> Power management tool to reduce emissions from AI computing.	Energy-Efficient Computing	United States	2024
	<u>Palanquin Power</u> Power conversion architecture to reduce rack-level power conversion.	Energy-Efficient Computing	United States	2024

	<u>Podero</u> Software platform that helps utilities reduce energy costs for flexible consumer devices by over 25%.	Grid Flexibility	Austria	2022
	<u>Unbound Potential</u> Long-term energy storage solutions using membraneless redox flow battery technology.	Long-Duration Storage	Switzerland	2023



Materials & Chemicals

18 Companies ↓ 8 Countries —

Company	Name & Description	Sector	Country	Year Founded
	<u>Active Surfaces</u> Perovskite solar cells designed for high throughput manufacturing.	Solar Materials	United States	2022
	<u>Alithic</u> Captures CO ₂ directly from the air and stores it permanently as a supplementary cementitious material.	CCUS	United States	2023
	<u>Brineworks</u> Direct carbon capture and clean hydrogen from ocean water using seawater electrolysis.	CCUS	Netherlands	2023
	<u>Carbon Cell</u> Home-compostable polystyrene alternative from biochar, offering fire resistance and sound insulation for packaging and construction.	Sustainable Plastics	United Kingdom	2022
	<u>Dispersa</u> Biodegradable surfactants from fermentation for use in wide variety of industrial applications.	Clean Chemicals	Canada	2018

	<u>Entalpic</u> Artificial intelligence-based materials discovery platform for the chemical industry.	Materials Discovery	France	2024
	<u>Gallox Semiconductors</u> Gallium oxide-based transistors and diodes that reduce energy waste in semiconductors.	Energy-Efficient Computing	United States	2024
	<u>Helix Carbon</u> Electrolyzers that integrate with existing heavy industry facilities to upcycle waste emissions into additional feedstock.	Carbon-to-Value	United States	2024
	<u>Juna AI</u> Industrial process control through AI-driven automation.	Materials Discovery	Germany	2024
	<u>Lite-1</u> Sustainable colors and pigments from biowaste feedstock via engineered microbes.	Sustainable Dyes	Canada	2021
	<u>Oxylus Energy</u> A direct electrochemical process to convert CO₂ into fuels and chemical feedstocks, such as methanol.	Alternative Fuels	United States	2023
	<u>Q Gen-Next Sustainable Technology</u> Corrosion-resistant coatings for passive daytime radiative cooling.	Building Cooling	India	2023
	<u>SEMRON</u> Single chip combined memory and information processing for mobile devices and consumer electronics.	Energy-Efficient Computing	Germany	2020

	<u>Sengong</u> Sustainable PVA film manufacturer for use in commercial and industrial packaging materials.	Plastics	China	2018
	<u>Spark e-Fuels</u> e-Fuels through an integrated Fischer-Tropsch production chain.	Alternative Fuels	Germany	2021
	<u>Sparxell</u> Plant-based pigments for cosmetics, fashion, paint, and packaging.	Sustainable Dyes	United Kingdom	2022
 STILL BRIGHT	<u>Still Bright</u> Novel electrochemical process for rapid extraction and refining of copper ore at ambient conditions.	Critical Metals	United States	2022
	<u>Tomtex</u> Plastic-free biobased leather alternative using chitin from shell seafood waste or mushrooms.	Textiles	United States	2020



Resources & Environmental Management

8 Companies ↑ 7 Countries ↑

Company	Name & Description	Sector	Country	Year Founded
	<u>Active Membranes</u> Electro-active membranes to improve desalination and water treatment efficiency.	Water	United States	2022
	<u>AirZyme</u> Point-source direct air capture and biocatalytic gas-to-gas membranes for CO ₂ removal.	CCUS	Sweden	2022

	<u>Atomionics</u> Quantum sensors for precise resource exploration and subsurface mapping.	Mining	Singapore	2018
	<u>Beyond Weather</u> Long range AI weather forecasting solutions tailored to industry-specific needs.	Environmental Modeling	Netherlands	2021
	<u>CarbonRun</u> Restores river health and removes CO ₂ by enhancing river alkalinity.	Environmental Restoration	Canada	2022
	<u>Helix Earth</u> Hardware that accelerates liquid-gas reactions to improve HVAC efficiency and enable cost-effective carbon capture.	Building Cooling	United States	2022
	<u>Hula Earth</u> Biodiversity monitoring platform utilizing AI, sensors, and satellite imagery.	Environmental Restoration	Germany	2023
	<u>LAIER</u> Ultra-early liquid leak detection with adhesive printed sensors to protect assets from damage, water waste, and downtime.	Water	United Kingdom	2021



Transportation & Logistics

1 Company ↓ 1 Country ↓

Company	Name & Description	Sector	Country	Year Founded
	<u>4QT</u> Software-enabled hybrid-electric drivetrain for heavy duty off-road vehicles and machinery incorporating axial flux motor and optimization software.	Electric Motors	Switzerland	2020



Waste & Recycling

7 Companies ↓ 4 Countries ↓

Company	Name & Description	Sector	Country	Year Founded
	<u>BioMetallica</u> Sustainable metal recycling system using biorecovery technologies.	Critical Metals	Singapore	2022
	<u>Driven Plastics</u> Upcycling of thin-film plastics into asphalt additives for enhanced pavement durability.	Waste-to-Value	United States	2020
	<u>Extracthive</u> Solvent extraction technology to recycle waste carbon fiber composite.	Waste-to-Value	France	2015
	<u>FLAXRES</u> Solar panel recycling solutions using thermal separation technologies including flash lamps.	Solar Materials	Germany	2017
	<u>Radical Dot</u> Converts unrecyclable plastic waste into high-value chemicals through catalytic process with low temperature and energy.	Plastics	Germany	2024
	<u>re.solution</u> Polyester textile recycling with the first commercial process using salt-free recovery in hydrolysis.	Textiles	Germany	2023
	<u>Syntetica</u> Low-temperature nylon depolymerization recycling technology.	Textiles	France	2023

2025 Cleantech50toWatch

05 About Cleantech Group

Cleantech Group is the human intelligence authority on global cleantech innovation. Since 2002, we've helped decision-makers across industry, finance, and policy navigate the rapid shifts transforming the global economy.

We go beyond market intelligence — offering insights, strategic guidance, and curated connections to help leaders stay ahead, identify opportunities, and act with confidence. Our insight is built on over 20 years of human intelligence, proprietary data, and direct relationships with the ecosystem leaders driving change.

Through our Membership, we help corporations, investors, financial and professional services, governments, non-profits, foundations, and start-ups track breakthrough technologies, make informed decisions, and connect with the right partners to accelerate their impact.

Industries everywhere are moving toward a cleaner, more resilient future. We're here to make sure you not only keep pace, but lead.

Global Presence, Local Insight

With experts across Europe, the Americas, and Asia-Pacific, we're on the ground where cleantech innovation is shaping the future, bringing local knowledge and global perspective to every connection and insight we deliver.

How We Select the Cleantech 50 to Watch

06 Methodology

The Question We Seek to Answer

According to the global cleantech community, which 50 private companies across the world today are most likely to make significant market impact over the next five to ten years? We answer this question in three phases:

Phase 1: Nominations

Nominations come from five sources:

- 1 The expert panel of 28 investor and multinational corporation representatives.
- 2 Our platform, which tracks the investment and partnership history of thousands of relevant companies.
- 3 Third-party awards where expert assessment has been applied.
- 4 Our analysts, who cover Agriculture & Food, Energy & Power, Materials & Chemicals, Resources & Environmental Management, Transportation & Logistics, and Waste & Recycling.
- 5 Public nominations from the global ecosystem, as well as additional data points from the Global Cleantech 100 nomination process.

Phase 2: Evaluation

Since our aim is to objectively synthesize and represent consensus, nominations are scored in a system rewarding companies that have multiple validations from our nomination sources. From this, a shortlist is created and sent to our panel of industry experts comprised of representatives from investors and multinational corporations. The panel votes positively or negatively based on their knowledge of the company's innovation, market, and ability to execute.

Phase 3: The Final 50

A combination of data from Phase 1 and Phase 2 are pooled and adjusted for geographic or other biases. Companies with the highest points overall make it to the final 50.

Exploring the Depth and Breadth of the Cleantech Community

To create the list, we put together a diverse panel of 28 early-stage innovation and investment experts. We asked them to nominate and review the companies that most impressed them and combined that information with our own nominations and research on early-stage awards.

This year, the number of nominations from the public, our expert panel, our platform, awards, and Cleantech Group totaled 3,305 from over 60 countries. These companies were weighed and scored to create a short list of 182 companies that were reviewed by the 28 members of Cleantech Group's Expert Panel.

It's not just about ideas; it's about real-world solutions making a tangible difference.



07 Expert Panelists

28 leading specialists in early-stage companies from across the world provided their inputs into the process



Laurie Menoud
Founding Partner
At One Ventures



Djoann Fal
General Partner
Atlas Capital



Miki Yokoyama
Managing Director
Aurum Impact



Bennet Barth
Managing Director,
RESPOND
BMW Foundation



Ashley Grosh
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Iain Meager
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Barbara Mehner
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UnternehmerTUM



Pippa Gawley
Founding Partner
Zero Carbon Capital

The expert panel is comprised of pioneers, leaders, veterans, and new entrants in cleantech and is broadly representative of the global cleantech community.

[View Biographies](#) →



Cleantech Group

The human intelligence authority on global cleantech innovation since 2002.

Our team is global

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