Cleantech Group

2025

APAC CLEANTECH25

INNOVATION • RESILIENCE • ADAPTATION

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CONTENTS 2025

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FOREWORD 2025

RICHARD YOUNGMAN, CEO

The world order is being rewritten right now -- and that is not just a comment on the isolationist "America First" ideology of the new Trump administration.

There are other forces at play too, and every company, country, and continent needs to be reimagining its place in the future world order, one which will be shaped and enabled, for good and for bad, by AI and other digital technologies and their intersect points with the world of industrial infrastructure and labor.

Asia is no different, even if the deeper sense of crisis is more obvious today in the West.

This century has been widely described as certain to be the Asian Century, given the growth in economic and population terms that has been happening and is (was?) expected to continue. In 2019, McKinsey estimated that Asia would account for more than 50% of global GDP and about 40% of global consumption by 2040.

A few years on from 2019, I believe there are major shifts that might not have been baked into such future forecasting, and there are many reasons to reassess the forces at play and the responses needed.

"EVERY COMPANY, COUNTRY, AND CONTINENT NEEDS TO BE REIMAGINING ITS PLACE IN THE FUTURE WORLD ORDER"

- Asia is on the frontline of a rapidly heating world. From heat waves to more frequent typhoons, from droughts to flooding, there is zero chance of status quo operating conditions. These will have bigger and bigger negative impacts on economic output, supply chains, and factories dependent on workers' productivity.
- Security and independence are to the fore of strategic thinking everywhere today. Access to the key enabling resources of energy, water, and critical materials at affordable prices, will be fundamental to a country's future economy.
- Affordable labor in global terms is not quite the competitive advantage it has been. In the era of AI and robotics, labor economics are to be rewritten. Re-industrialization has begun.

Innovative solutions, responding to these key forces, will be critical.

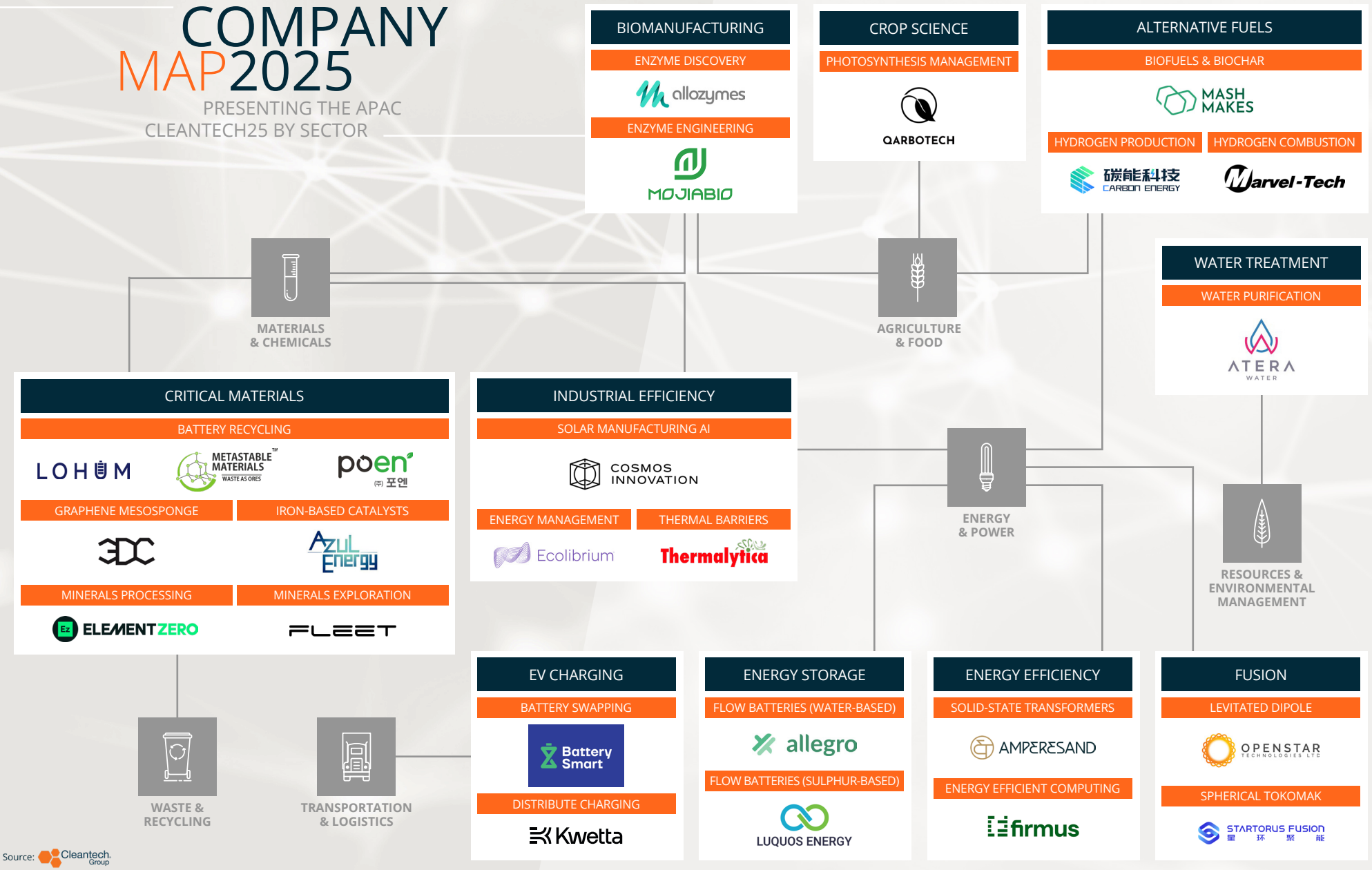
The range of solutions in this year's list – from fusion to near-term energy efficiency savings, from battery swapping to battery materials, from improving crop yields to generating valuable products from waste -- speak to a very different future.

And AI and its intersect with the energy and industrial world will be a major force. It is only a little bit evident as of now in this region's cleantech companies. We expect that to change and to change rapidly.

Against such a backdrop, we are delighted to bring you the 2025 APAC Cleantech 25.

COMPANY MAP2025

PRESENTING THE APAC CLEANTECH25 BY SECTOR



Source: Cleantech Group

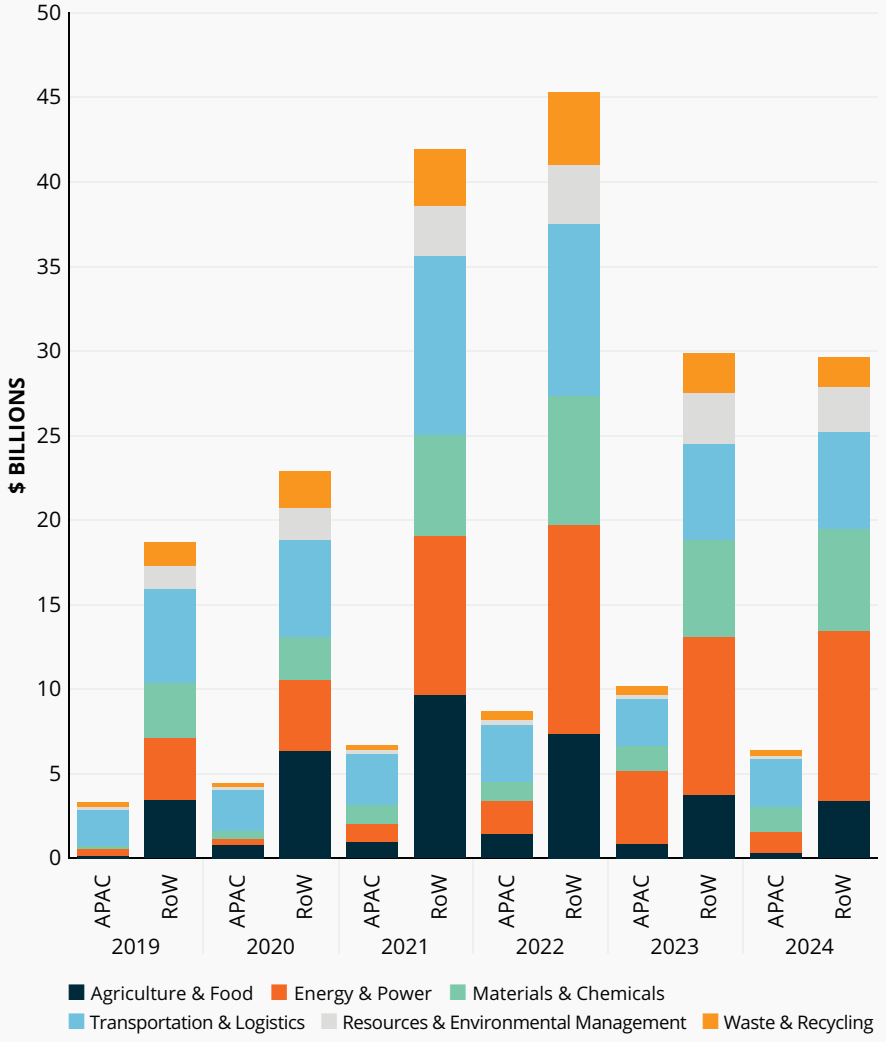
MARKET INSIGHT

ANTHONY DEORSEY
RESEARCH MANAGER

APAC in 2024: A Shift in Gears, Not a Fundamental Slowdown

Drop-offs are attributable mostly to a China trend in energy innovation settling into a post-equity ecosystem. Looking closer, a picture of young APAC-based innovators approaching new, future-facing problems emerges.

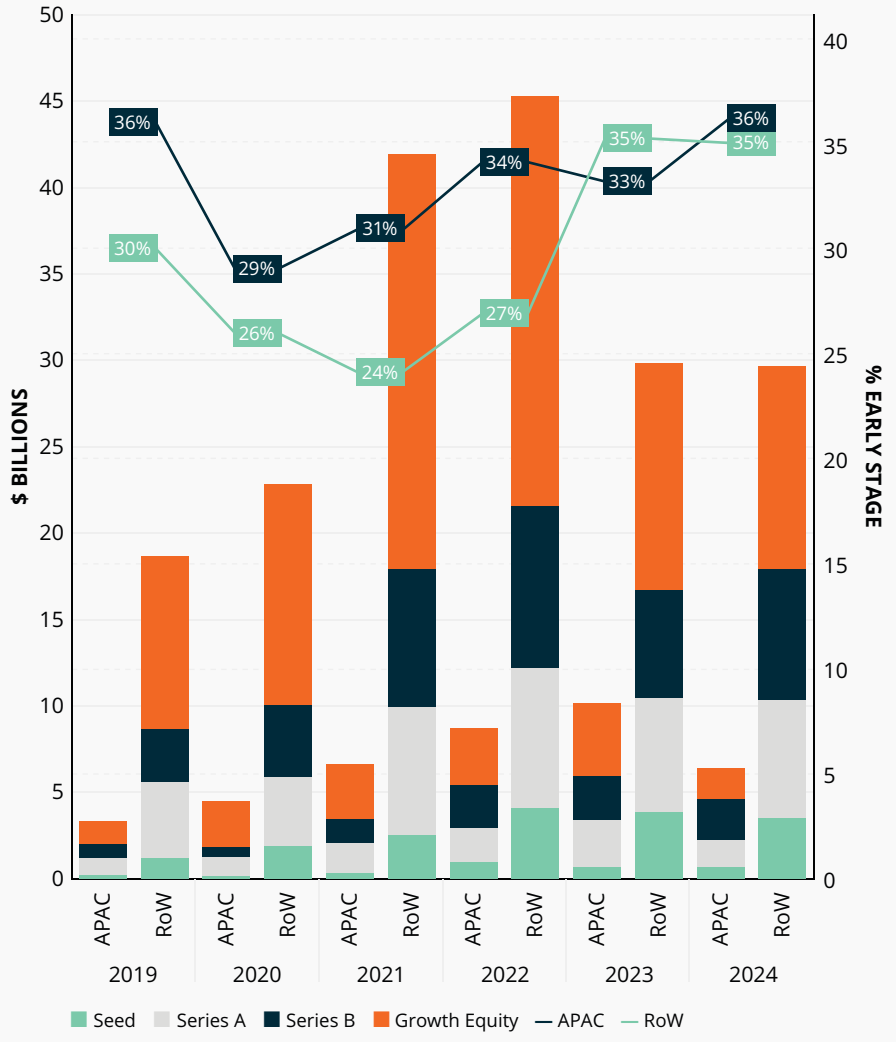
APAC vs. Rest of World, Venture & Growth Investments by Industry Group, 2019 - 2024



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

APAC vs. Rest of World, Venture & Growth Investments by Investment Stage, 2019 - 2024



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

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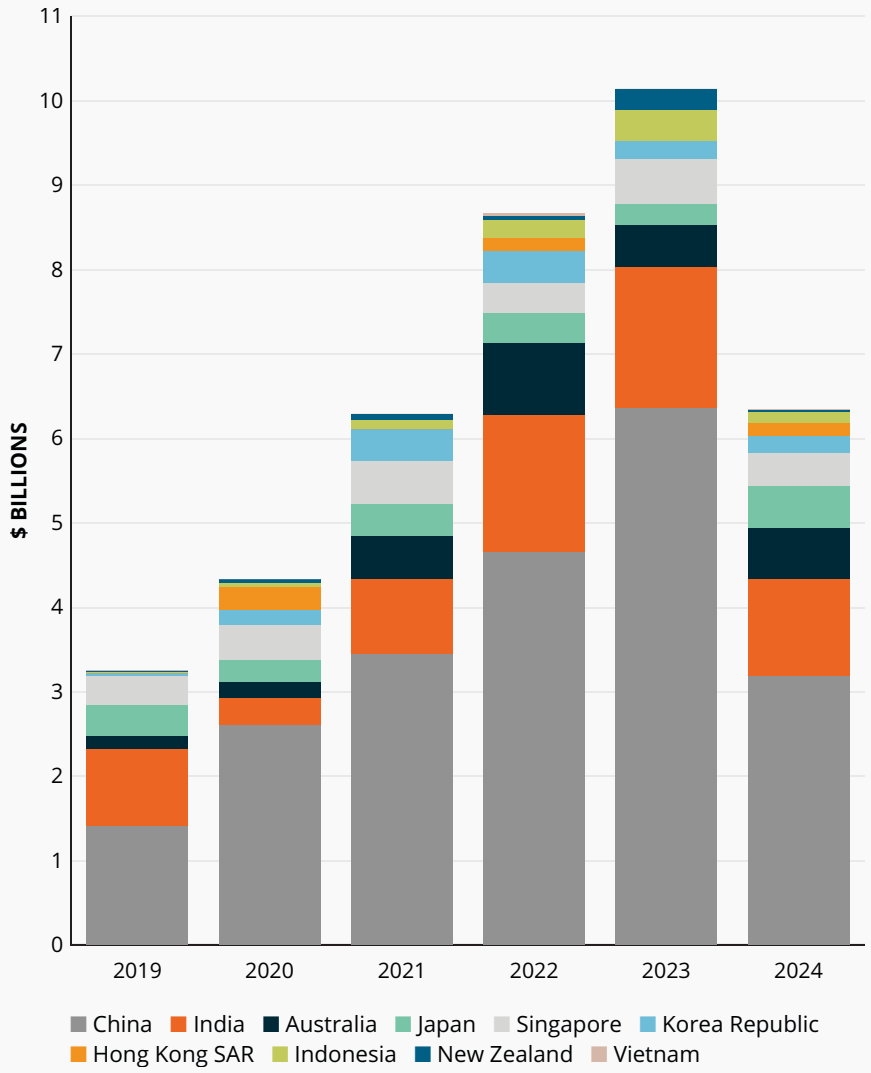
China Still Underpins APAC Activity

Outside of China, one sees a softer '24 drop-off – clearly the APAC innovation ecosystem is stronger than in the pre-Covid world.

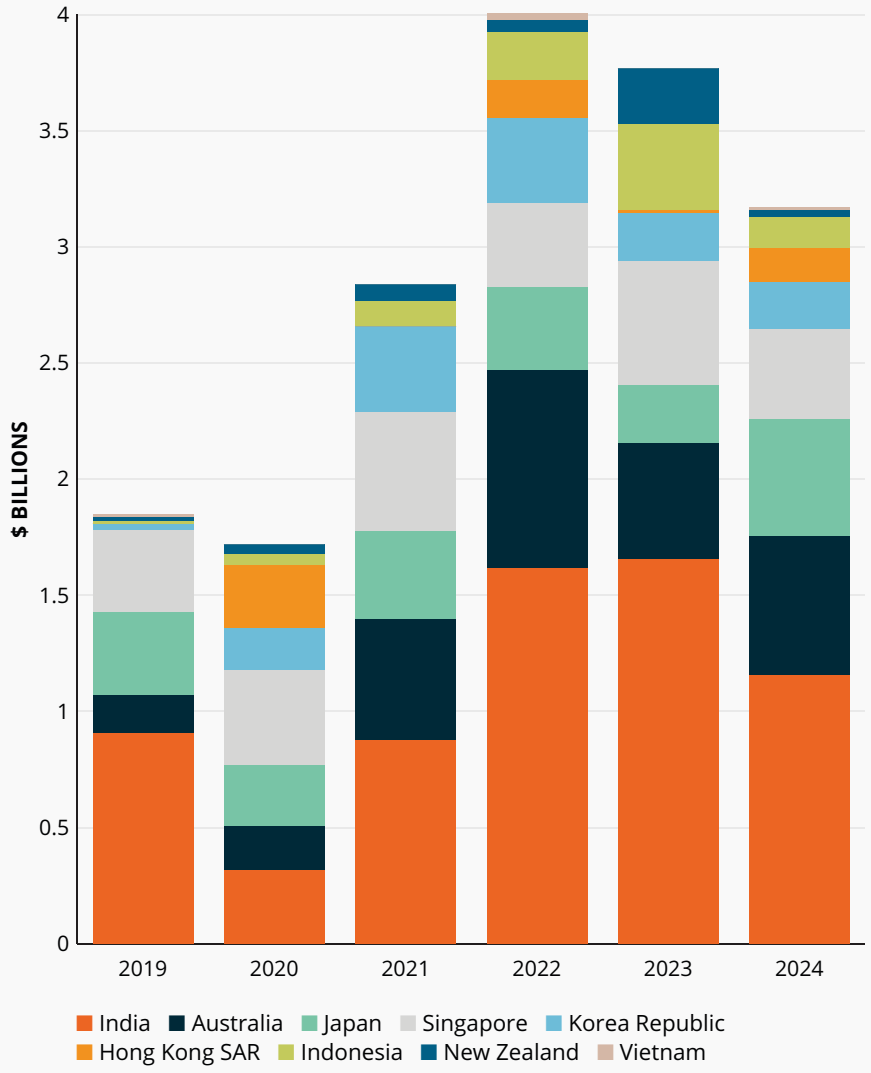
APAC Venture & Growth Investments, Top 10 2019 - 2024



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

APAC Venture & Growth Investments, Top 9 (Excludes China) 2019 - 2024



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

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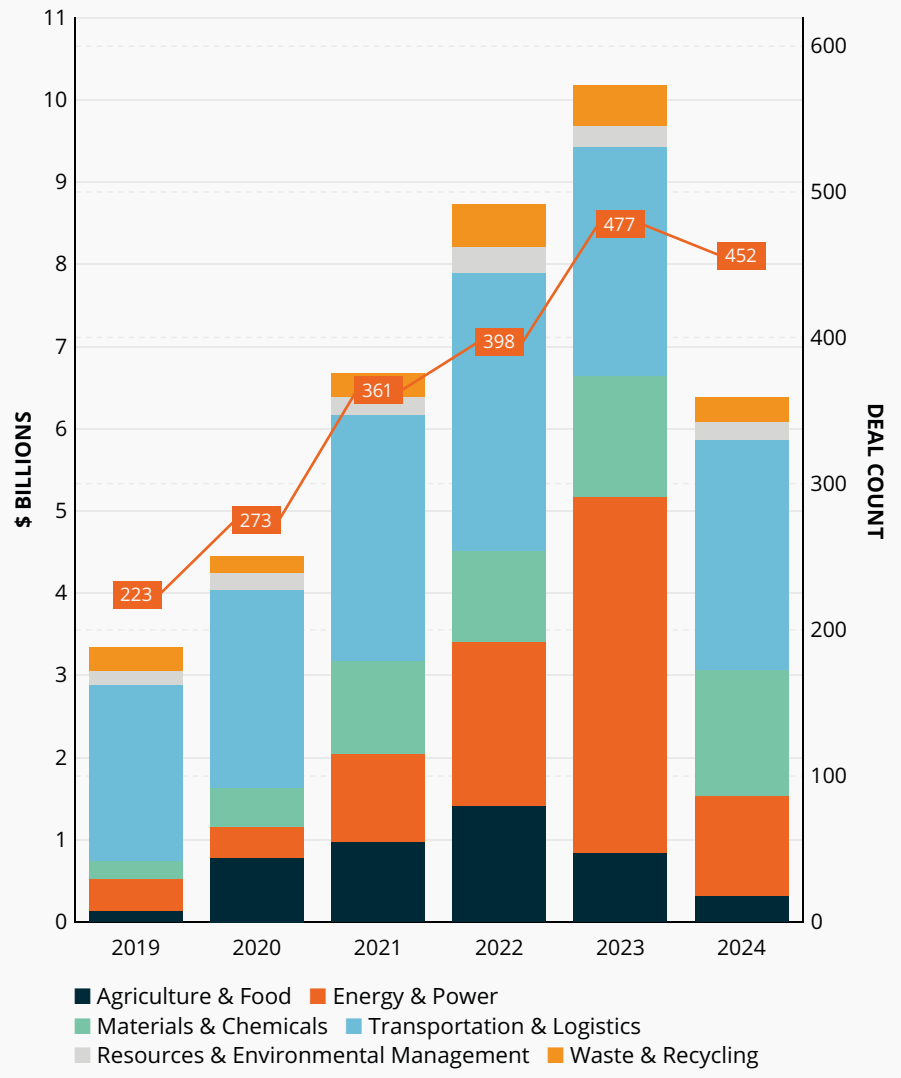
APAC Energy & Power – A Landing or a Leapfrog?

The Energy & Power details show a fast maturation of solar + storage past equity financing, and a fast shift to the next generation of technologies in APAC. Elsewhere, the rapid growth of transportation electrification is creating urgency in both infrastructure and materials for electric mobility.

APAC Venture & Growth Investments, 2019 - 2024



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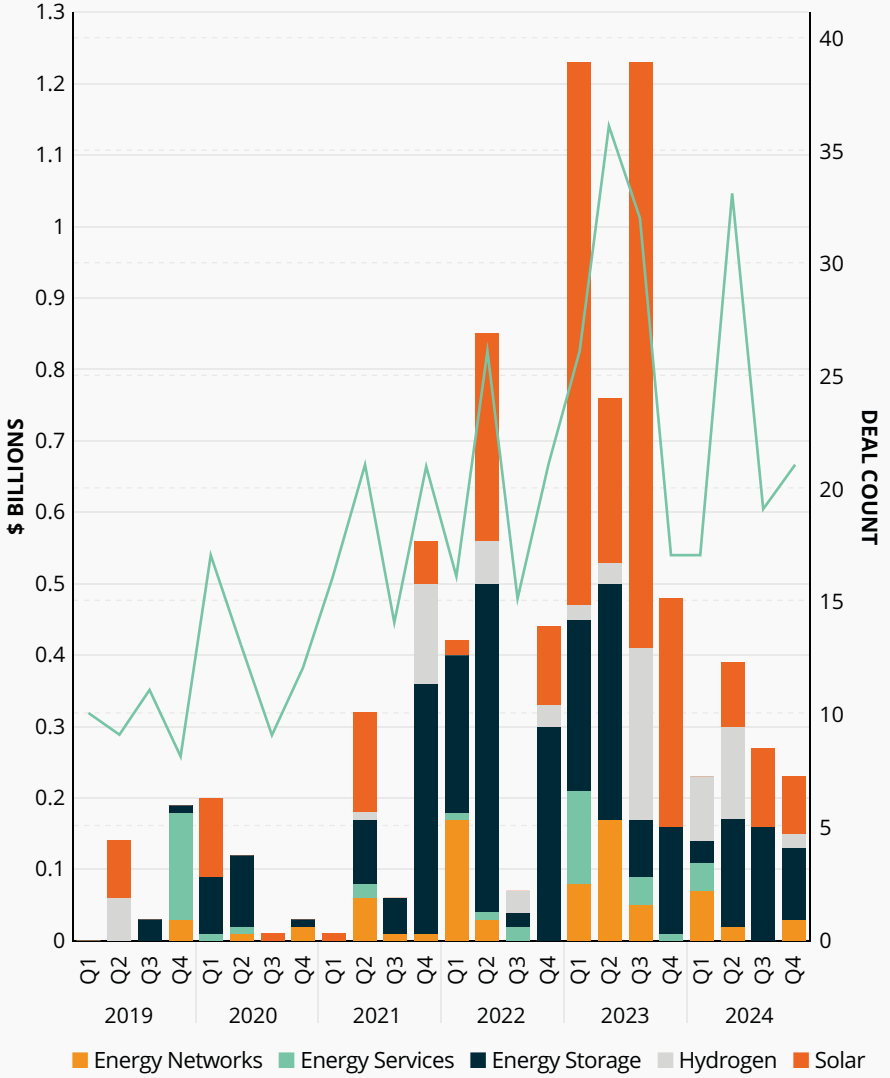
Source: Cleantech Group

APAC Energy & Power: Venture & Growth Investments, 2019 - 2024



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*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

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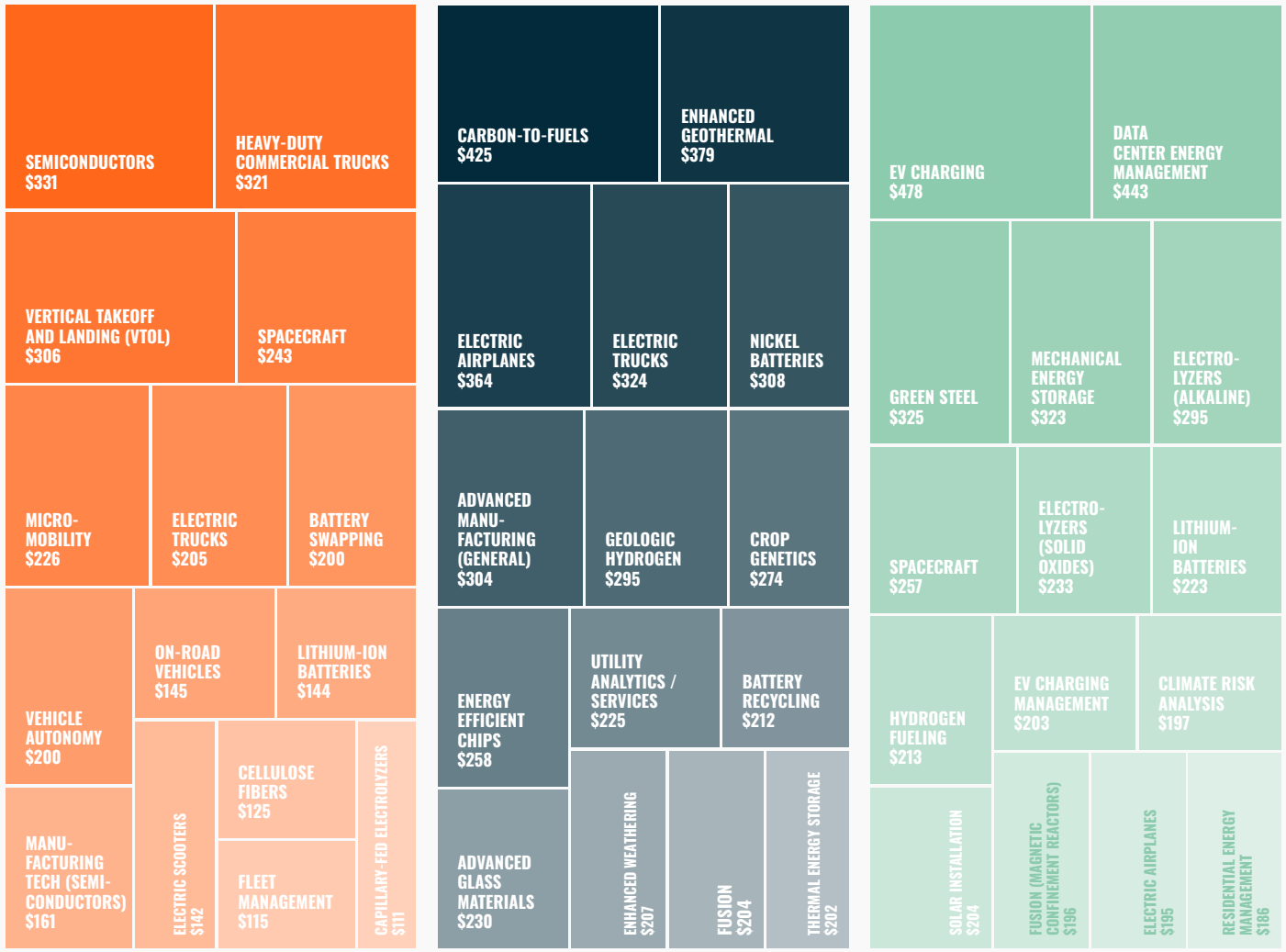
2024: The Year An APAC "Electro-Economy" Began Emerging

As renewables supply quickly hit scale, APAC transportation innovators are aggressively electrifying the demand side of the ledger.

2024 Top 15 Investment Areas by Region ($M)



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

We have noted in recent analyses that while APAC (principally China) has always been the globe's center of EV gravity, innovation is now moving beyond just on-road vehicles.

Everything from heavy-duty commercial trucks to off-road industrial trucks are seeing a wave of innovation to support electrification. What's more, infrastructure around charging and battery swapping is hitting mass scale, supporting easier adoption of EVs and reducing risk of developing electric heavy-duty and industrial vehicles.

2024 was the APAC region's best year yet in electric vertical take-off and landing (EVTol) and unmanned aerial vehicle (UAV) investments – see China's initiatives to develop a "low-altitude economy" as an indicator of emphasis.

Innovation in electric mobility infra-structure is coming from beyond China, too, as shown in examples from this year's APAC 25:

- Battery Smart (India): Launched in 2019, has grown to be India's largest battery swapping network for two- and three-wheel vehicles
- Kwetta (New Zealand): Modular EV, fleet, and bus charging depots without requiring grid upgrades

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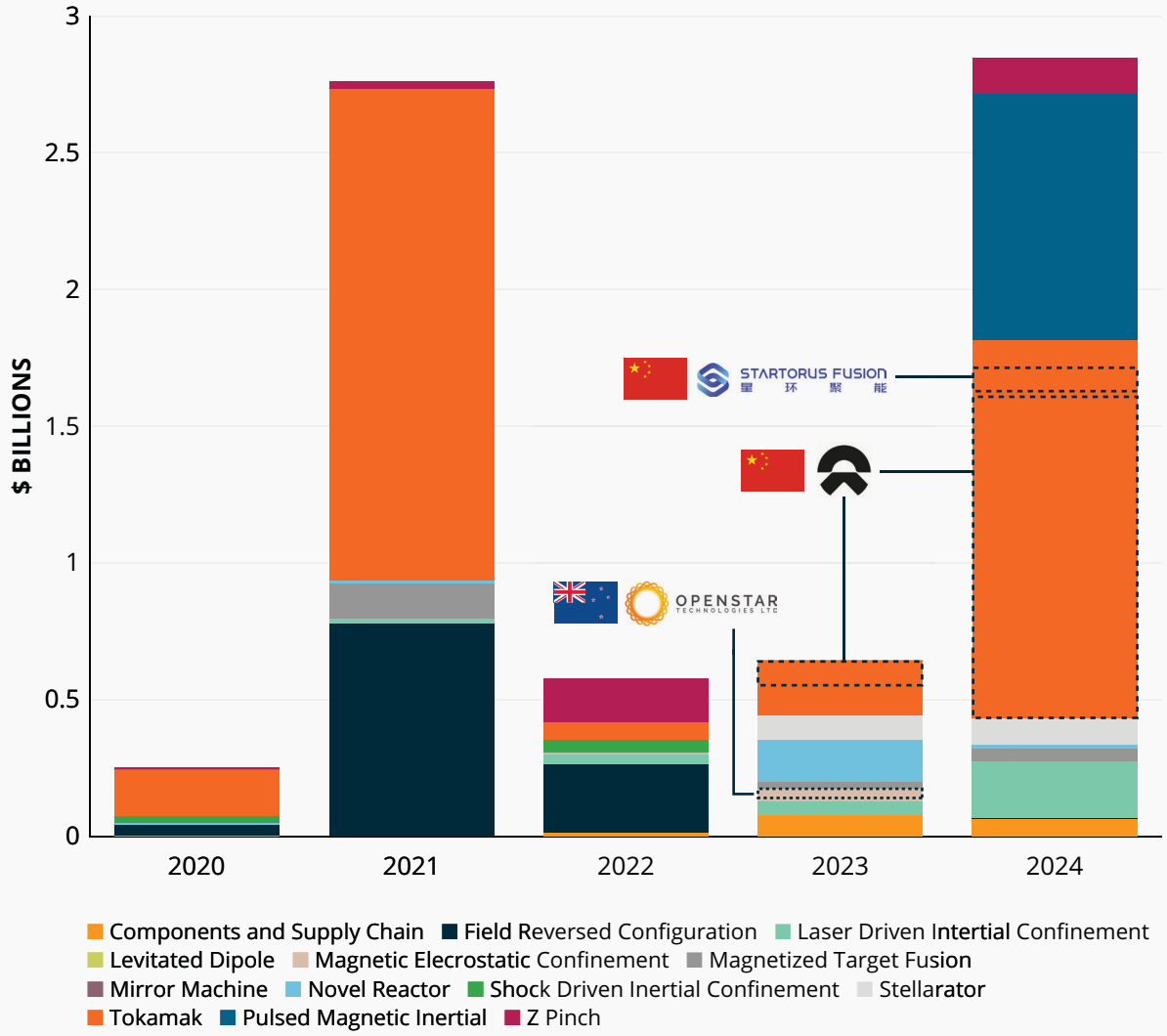
Fusion Innovation in APAC – A Preview of the 2030s and Beyond?

Recent momentum in fusion innovation across multiple reactor types and geographies shows APAC punching above its weight.

Venture & Private Equity Investments in Fusion Innovators, 2020 - 2024



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

While most areas of Energy & Power innovation saw a fundraising downturn over the past two years, fusion provides a case to the contrary. A technology that many see as a beacon of the future, we at Cleantech Group have observed that the sector experienced a critical breakout year in 2024, with more geographic diversity in fundraising but also more diversity in reactor types (see chart on the left).

With certainty, part of the equation is that investors are now more familiar with the fusion milestones and have developed a level of comfort with the amount of financing required to fund a company through its next milestone. This contrasts with previous years, where companies were being funded through smaller milestones, leading to down rounds and overall facing a higher cost of capital.

However, a perhaps more important part of the equation is the progress through milestones that are being observed across different reactor types. Some cases from the APAC 25:

- Startorus Fusion (China): Spherical tokomak company launched out of Tsinghua University, in 2024 reported being the first in the world to achieve an optimized spherical tokamak plasma configuration
- Openstar Technologies (New Zealand): Levitated dipole reactor, achieved first plasma in November 2024
- Kyoto Fusioneering (Japan) (2024 APAC Cleantech 25): While not a reactor company, is developing components and providing fusion plant design and engineering for multiple reactor types (magnetized target, magnetic confinement, inertial confinement). Multiple testing facilities planned

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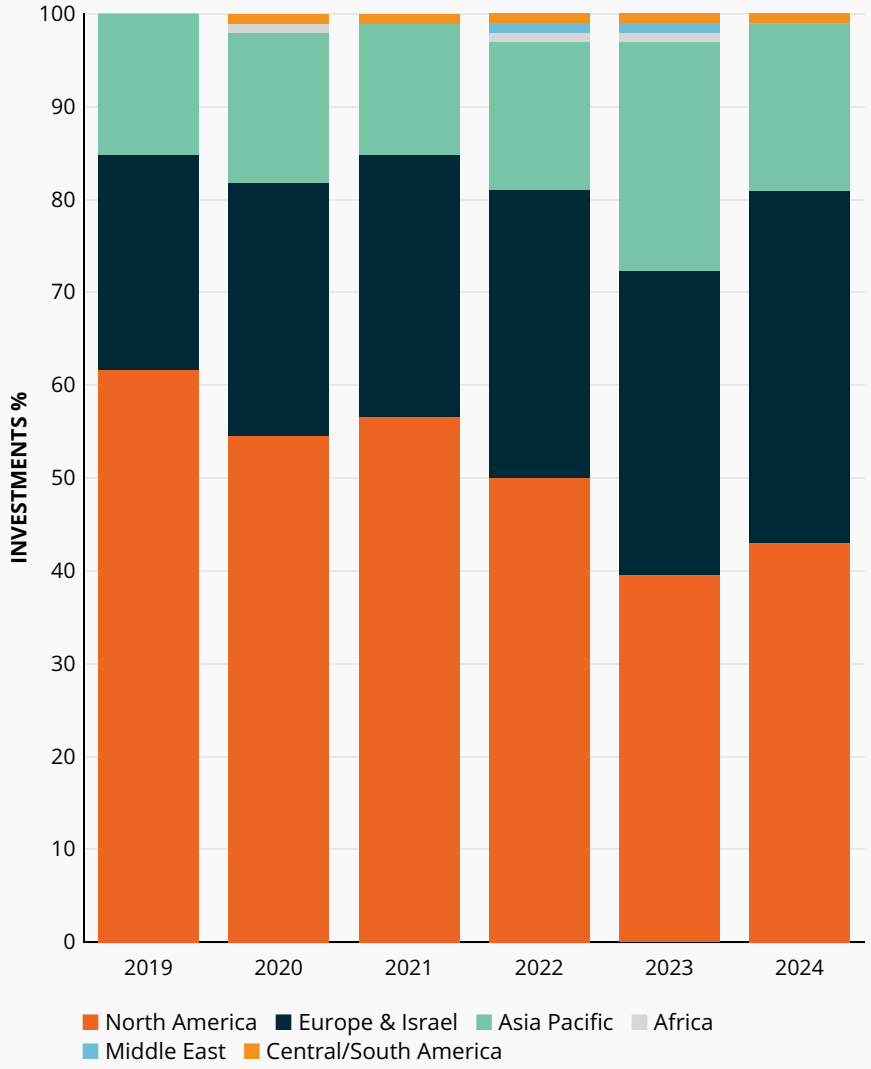
AI for Cleantech Has Not Emerged in Force in Asia—Yet

APAC-based AI innovators are not showing up in force, but we see emerging cases through this year's APAC 25.

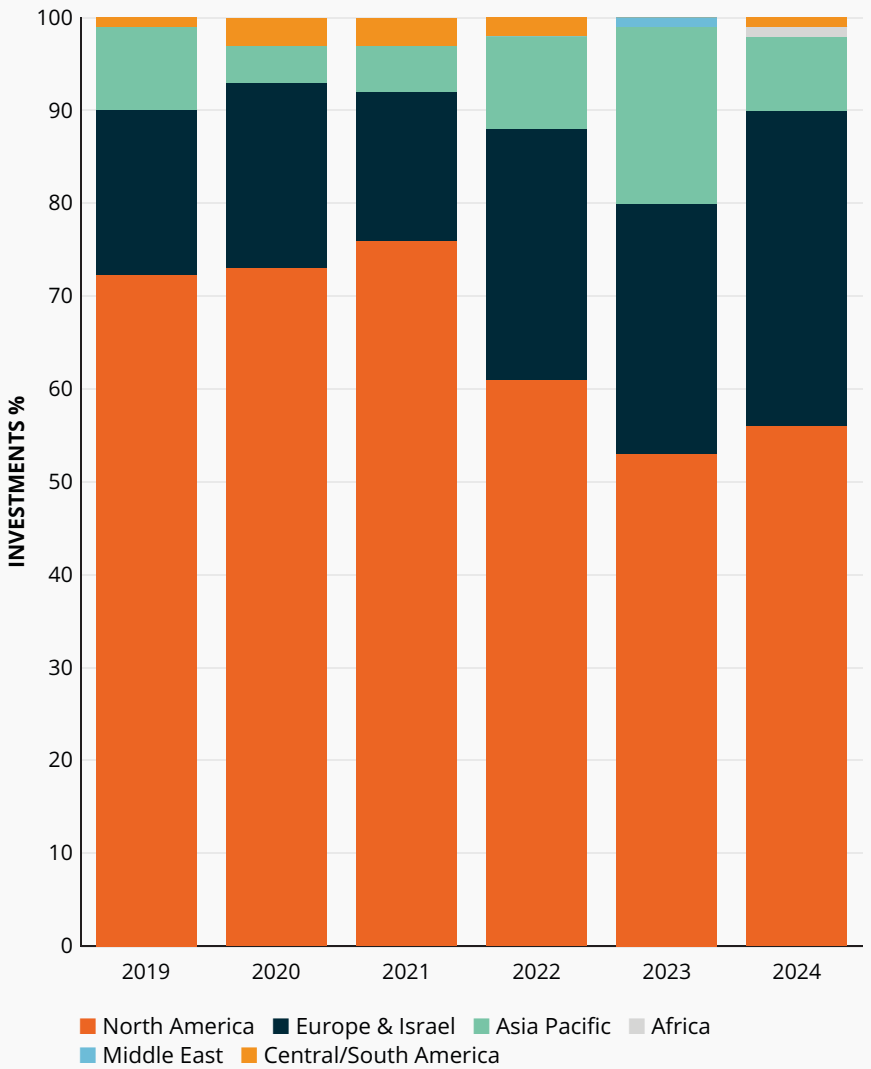
Venture & Growth Investments, % by Region (All Cleantech)



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

Venture & Growth Investments, % by Region (AI for Cleantech)



*Excludes outlier deals above $350m
*Including only venture & growth investments: Seeds, Series A, Series B, Growth Equity

Source: Cleantech Group

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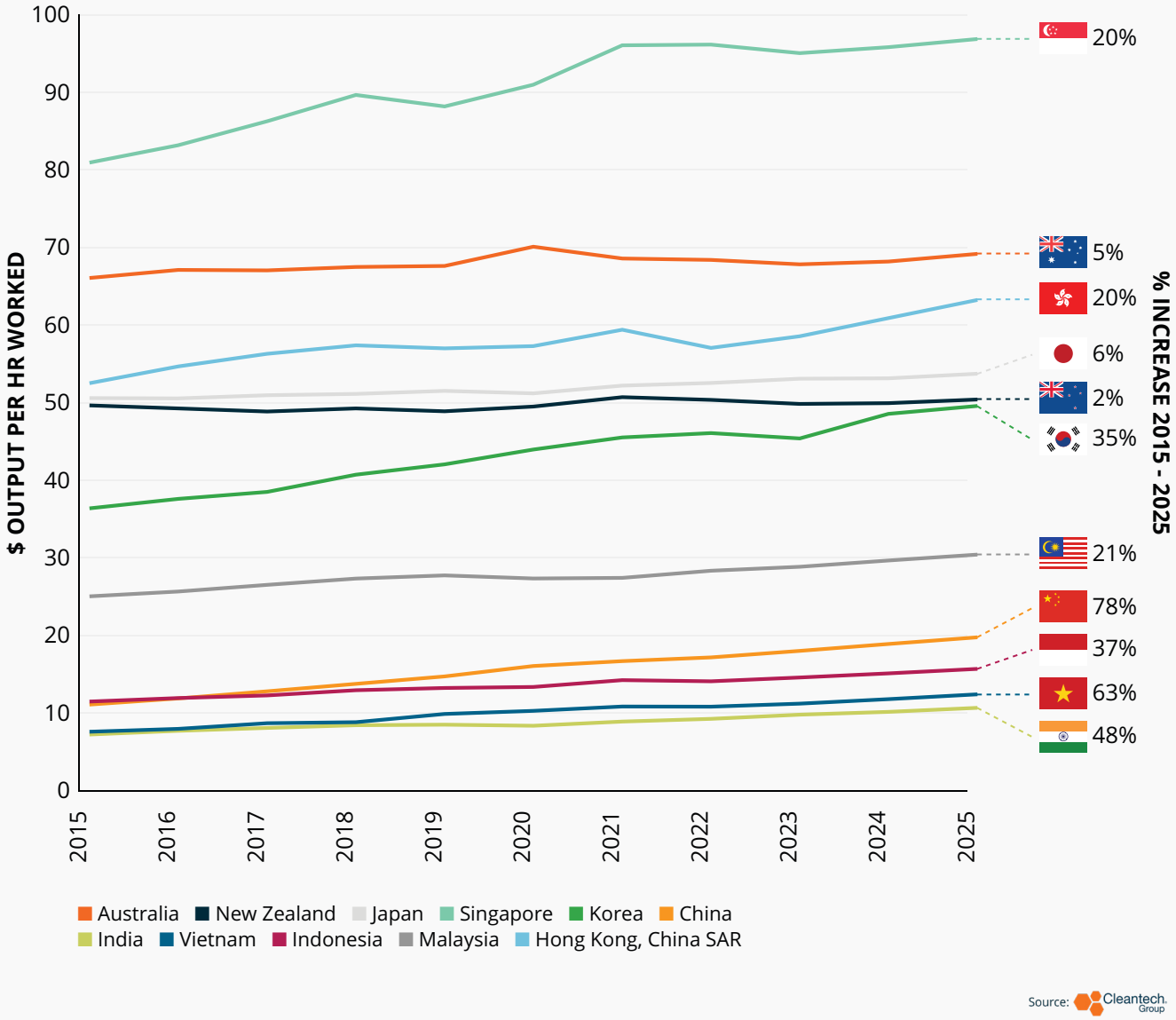
Industrial Efficiency Poised to Explode in Asia-Pacific

On the back of enormous gains in output per hour in China, Korea, Vietnam, and India, AI offers a generational opportunity to level up.

Output ($) Per Hour Worked, APAC 2015 - 2025



Source: Cleantech Group

When we first began landscaping AI-for-cleantech companies, we noted a surprising absence of APAC innovators. However, our hypothesis at the time was that many were simply not yet in a stage of market-facing publicity yet. That hypothesis was partially confirmed with the announcements out of Deepseek in late January 2025.

While industrial efficiency has improved greatly in much of APAC, it remains a reality that even those countries making the greatest leaps (China, Vietnam, India) are nowhere near the ceiling of output per hour worked. Take with that a tightening global economy and emerging challenges of overcapacity in China, and we expect process and resource efficiency to become top priorities for APAC firms. AI provides a tailwind to those firms already on the improvement path.

We are seeing an APAC AI-for-cleantech ecosystem that is solving highly local problems to start and is not limited to the boundaries of its other cleantech strength areas (see page 8). Some instructive cases of localized models, but with decidedly global markets, can be observed in this year's APAC 25:

- Cosmos Innovation (Singapore): Leveraging an internal AI (Mobius) for materials discovery and process optimization in perovskite / tandem solar cells production, increasing solar cell performance but controlling R&D cost
- Ecolibrium (India): An industrial efficiency AI platform aimed at reducing process waste and operational costs in high-volume, low-margin industries such as commodity manufacturing and mining. Working to optimize high-load sites such as data centers as well

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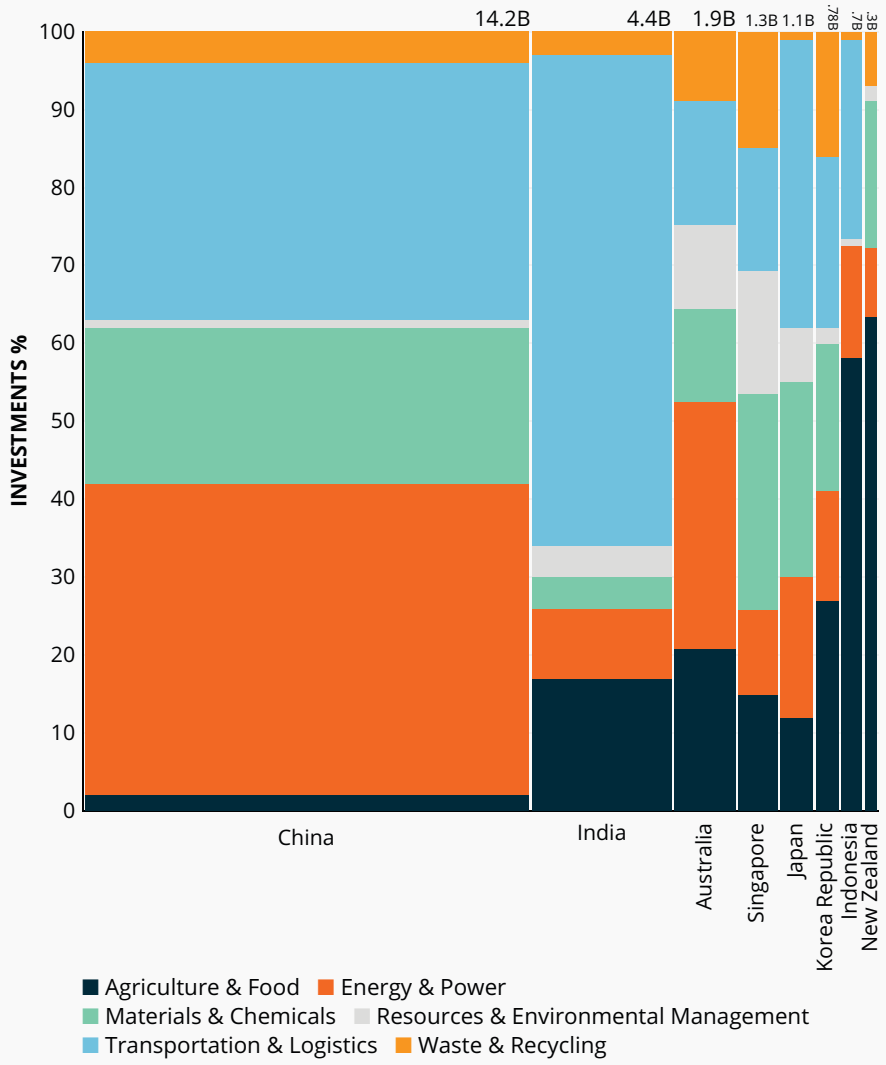
APAC's AI-for-Cleantech Leadership – Open for the Taking?

The investment figures for AI innovation are far less predictable, both on country of origin and industry group focus.

Venture & Growth Investments, Top APAC 2022 – 2024 (Total $24.8B)



*Excludes outlier deals above $350m
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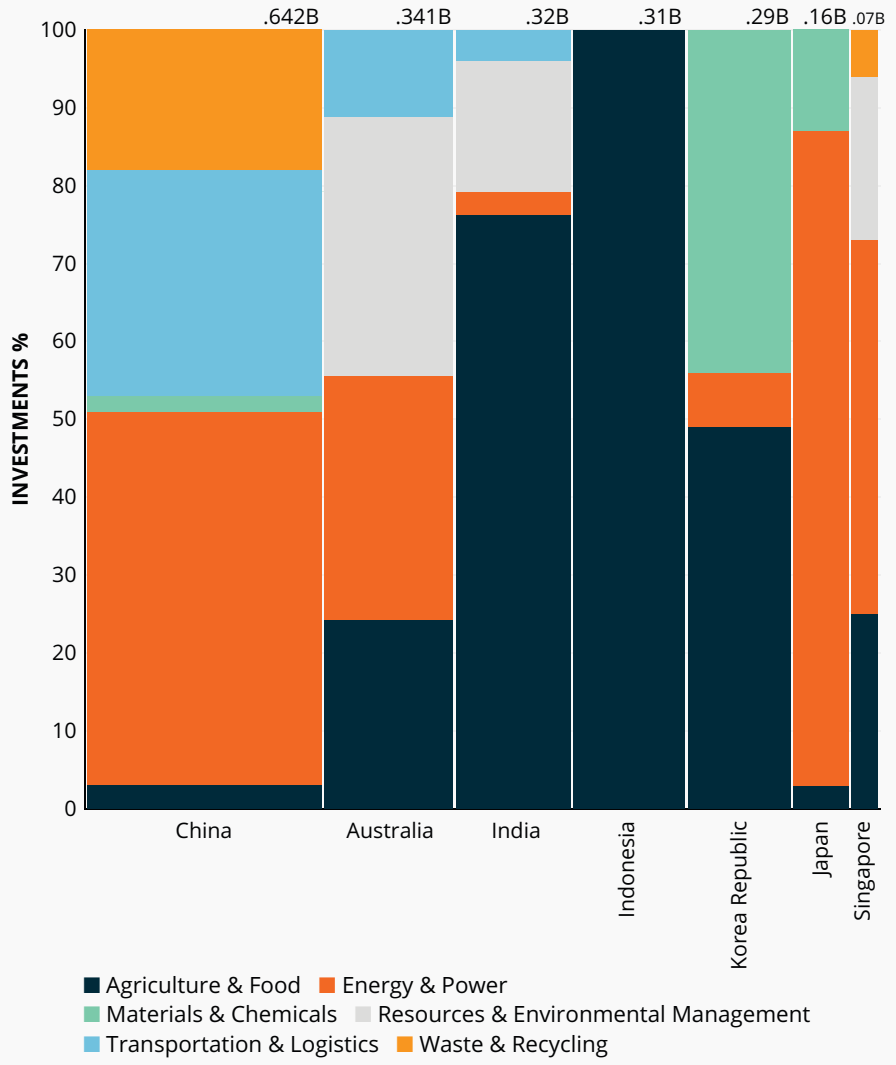
Source: Cleantech Group

Venture & Growth Investments in AI for Cleantech, APAC 2022 – 2024 (Total $2.1B)



*Excludes outlier deals above $350m
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Source: Cleantech Group

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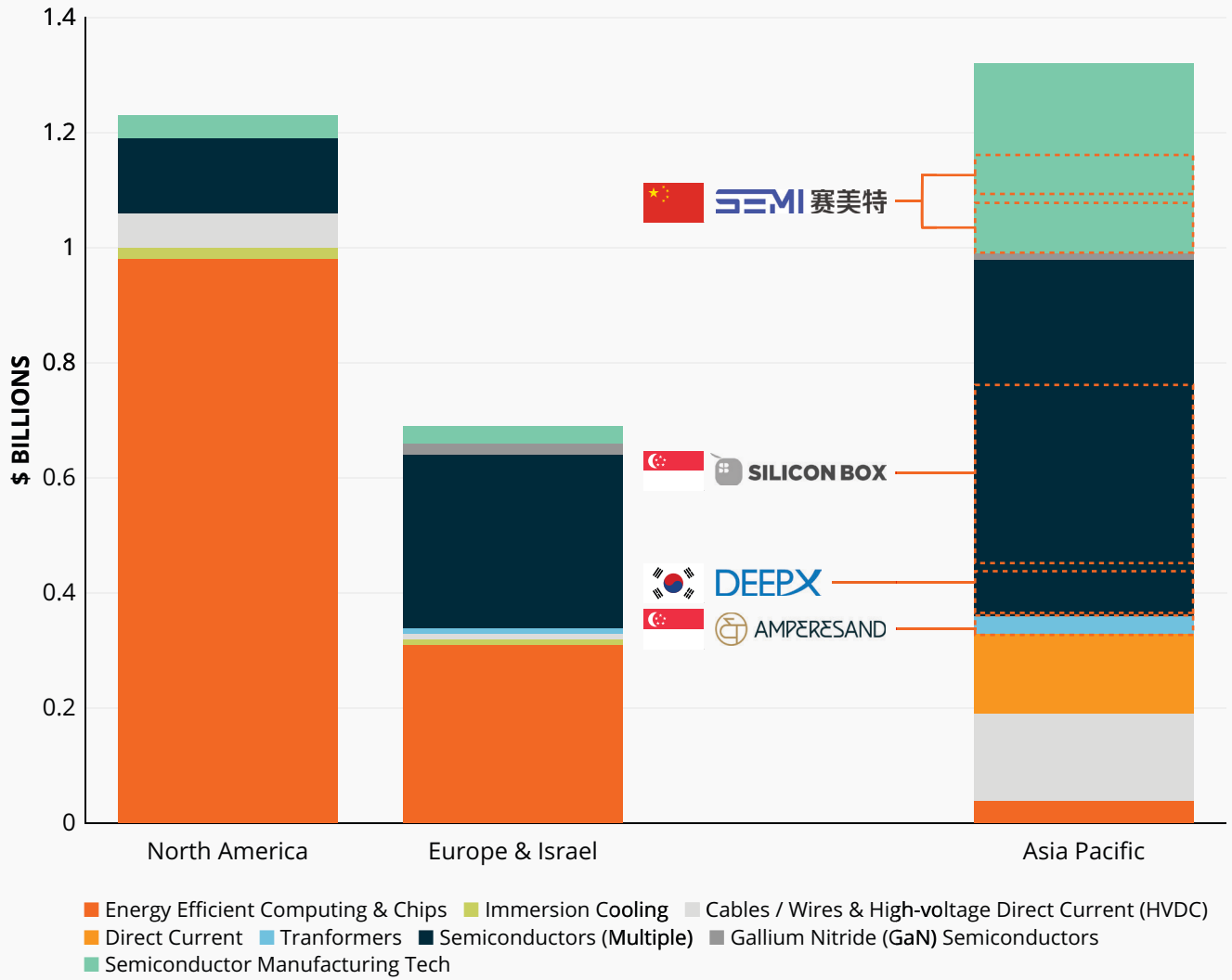
APAC is Making an Early Play for Energy-Efficient AI Infrastructure

A pull-through effect on technologies enabling advanced AI deployment is already being felt; innovators are taking position.

Venture & Growth Investments in Energy-Efficient Computing Infrastructure & Components (2022 – 2024)



*Excludes outlier deals above $350m
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Source: Cleantech Group

With the exception of China, much of APAC will not have the option to deploy renewables at the same pace that AI develops (and supporting infrastructure needs to be stood up). As a result, Asia-Pacific will fast become a venue of competition for technologies that reduce energy consumption in data centers.

APAC innovators have an opportunity to compete across the spectrum, from chips and semiconductors that can support AI workloads with less energy use, to deep cooling of compute operations, to more efficient IT equipment (see Singapore's Green Data Center Roadmap). Indeed, if the investment numbers of the past three years are any indicator, the opportunity is being seen with clear eyes.

This year's APAC 25 gives us immediate cases of companies seeing the urgency:

- Firmus Technologies (Singapore): Liquid-cooled data centers (both retrofits and new builds), low-carbon hosting solutions with Sustainable Metal Cloud service
- Amperesand (Singapore): Solid-state transformers that can more granularly control power flows across high electricity load sites. Modular and scalable, offers additional resilience with the ability to isolate faults when they occur

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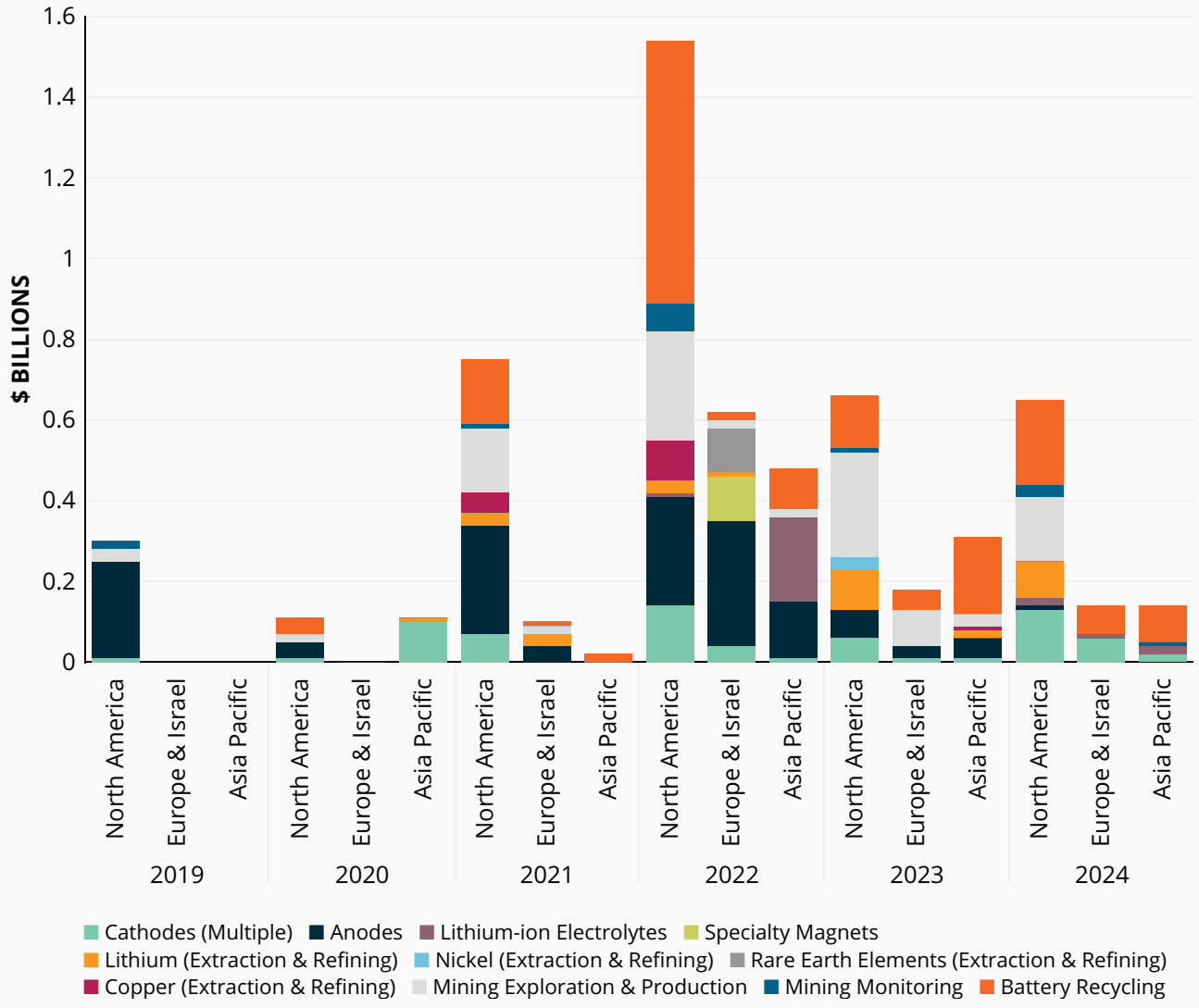
Critical Materials Innovation – This is Just the Beginning

Innovation until now has focused on the potential for future trade fractures; those fractures will become real in 2025.

Venture & Growth Investments in Critical Materials, APAC, North America, Europe & Israel, 2019 - 2024



*Excludes outlier deals above $350m
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Source: Cleantech Group

For years, the hypothesis around critical materials innovation was two-fold: 1) that demand for materials for batteries, electric motors, and power electronics would outstrip supply in the coming decades, and 2) that the high concentration of supply in China would require other countries to increase their onshore supply.

Hypothesis #2 is accelerating in real-time as global trade tensions rise and previously predictable supply relationships are now at high risk of fracture. The next half of this decade, with certainty, will see more demand-side insecurity around these challenges.

Meeting both challenges means improving mining efficiency and precision, developing new refining techniques, and utilizing materials from waste. The full value chain, as well as a diverse geographic mix, is on display in this year's APAC Cleantech 25:

- Fleet Space (Australia): Satellite-based critical mineral detection
- Element Zero (Australia): Non-aqueous electro-chemical processing of ores (iron, nickel, silica) into high-value materials
- 3DC (Japan): Three-dimensional graphene material sponge that can be applied in today's lithium-ion batteries, or future (e.g., solid state) chemistries
- Poen (South Korea): Spent and damaged battery assessment, remanufacturing, re-purposing
- Lohum (India): Battery recycling, recovery of lithium, cobalt, nickel, graphite through a hydrometallurgical process

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CASE **STUDY**

BATTERY SMART

ACCELERATING EV ADOPTION THROUGH BATTERY SWAPPING

Battery Smart

ABOUT:

Country: India

Founded: 2019

Employees: 450

KEY FACTS:

Battery-as-a-Service model tackles EV adoption barriers and lowers EV costs by **40%**

Has deployed 1,500 swapping stations across over **40 cities**

2025 APAC CLEANTECH 25

CASE STUDY
BATTERY SMART

What is the company and what do they do?
Battery Smart aims to provide the infrastructure needed to accelerate electric vehicle adoption across India and address key challenges of high upfront costs, range anxiety, long charging time and the shortage of reliable charging infrastructure.

How it works
Their key offering is a Battery-as-a-Service (BaaS) model for electric two- and three-wheelers. BaaS reduces upfront vehicles costs, and eliminates long charging times and costly battery maintenance and replacement: the key barriers to electrification of first-and-last mile delivery sectors.

Key differentiator
In the increasingly crowded and competitive electric mobility space, Battery Smart's key differentiation points are an asset-light business model and an emphasis on collaboration with local businesses and communities. In terms of technology, the battery management system optimizes battery performance and swap station efficiency. Through employment of NFC-enabled smartcards, drivers do not have to rely on smartphones to access swap stations, removing digital and data literacy as a barrier to access.

Potential impact
In India, two- and three-wheelers make up approximately 30% of transportation energy consumption. Since 2019, Battery Smart has facilitated over 68 million battery swaps, displacing over 310,000 tonnes of CO_2 emissions, 150 million liters of oil, and contributed to the growth of local economies by facilitating accessible EV adoption.

Ambition/Next steps for company
Looking forward, Battery Smart's goals include deeper market penetration, bringing swapping solutions to underserved areas, and increasing efficiency through technology innovation. By the end of 2025 they aim to have deployed 2,500 swap stations across India.

Key things to watch in this sector
India is emerging as a leader in transport electrification and the impact of solutions such as battery swapping can be clearly seen: the Indian EV market grew 30% in 2024, with electric two-wheelers accounting for 60% of EV sales. Similar solutions will be critical for regions such as Southeast Asia and sub-Saharan Africa, where high energy growth, low consumer purchasing power, and volatile or unreliable local grids pose key challenges to EV adoption.

Why this company made the list
Full decarbonization and electrification of the transportation sector will require closer collaboration and interconnection with the energy sector, particularly local grids. Battery swapping networks provide an untapped source of energy storage to support grid flexibility and stability and increase integration of renewables into local grids. Keep an eye out for innovators developing solutions to integrate battery swapping stations as DERs (Distributed Energy Resources), to offset peak charging costs, and provide grid balancing services.

> "OVER THE PAST 5 YEARS, OUR CUMULATIVE SWAPS HAVE EXCEEDED 68 MILLION, MARKING A NATIONAL FIRST IN THE EV INDUSTRY"
> BATTERY SMART TEAM

CASE **STUDY**

FIRMUS TECHNOLOGIES

DEVELOPING ENERGY AND **COST-EFFICIENT** AI DATA CENTER INFRASTRUCTURE

firmus

ABOUT:

Country: Singapore

Founded: 2019

Employees: 63

KEY FACTS:

Verified up to **61% better energy** total cost of ownership than air cooling

7 years of deploying and operating AI Factories across multiple regions with continuous innovation ensuring readiness for next-generation NVIDIA GPUs

2025 APAC CLEANTECH 25

CASE STUDY
FIRMUS TECHNOLOGIES

What is the company and what do they do?

Firmus Technologies is developing energy- and cost-efficient AI data center infrastructure. Firmus optimizes existing data centers and greenfield builds with liquid cooling and high performance computing infrastructure. Its turnkey solutions integrate advanced cooling technology and optimize layouts for GPU clusters for better performance.

How it works

Applying immersion cooling, direct-to-chip and two-phase cooling solutions enhances efficiency, reduces waste heat, and improves power usage effectiveness (PUE). High density racks of 100-250kw can handle future growth. Firmus Technologies' integrated solutions include three main components: the hypercube, validated server, and AI Factory OS. The hypercube includes 16 immersion tanks, servers can house 8 high performance graphics processing units (GPUs), and the AI Factory OS software solutions support management and efficiency between nodes, chips, and clusters.

Key differentiator

Modular and integrated design can support existing data centers and new builds, while improved performance allows for 45% more floating-operating points per second (FLOPs) per utility picojoule (one million millionth (10^{-12}) of a joule) than traditional data centers and can dramatically reduce total cost of ownership compared to existing solutions.

Potential impact

Firmus Technologies is operating in a space where they are providing a fully integrated approach to sustainable data centers and cloud services. By being able to customize and optimize various nodes along the data center supply chain and solution portfolio, they can provide specialized systems to fit the environment and customer's needs. As data centers in Southeast Asia and abroad look to incorporate renewable energy, driving improvements in efficiency and operations will also be crucial so that they can be scaled to areas where renewable energy may not be readily available but still require low carbon and energy efficient data solutions.

Ambition/Next steps for company

Firmus Technologies will expand its services across the Asia-Pacific region and beyond. As data centers and energy demands grow globally, natural gas and fossil fuel-based energy will be used to support these systems, and so, investments in driving operational and energy efficiency will be needed. Firmus will add additional services to bring edge computing and denser data centers closer to metropolitan areas. As renewable power gets integrated into data centers, managing energy loads and responding to dynamic systems will require additional tools that Firmus Technologies will build out to further support data center control and management.

Key things to watch in this sector

Malaysia, Singapore, Australia, and Indonesia are seeing rapid growth in the computing sector and technologies that can create solutions for the environment and energy mix in Southeast Asia can look to scale globally in other regions as well.

Why this company made the list

Few companies provide as many services as possible to the technology industry. As Firmus works alongside leading partners in the field such as NVIDIA, AMD, Dell Technologies, Chevron, and more, they will be able to prepare computing infrastructure for future data needs as well as upgrade today's existing infrastructure.

> "BY RETHINKING DATA CENTRE DESIGN, WE HAVE CREATED A PLATFORM THAT SUPPORTS THE GROWTH OF AI WHILE PROMOTING ENVIRONMENTAL SUSTAINABILITY. IF WE CAN DO IT IN SINGAPORE, WHERE SPACE IS CONSTRAINED AND THE HUMID CLIMATE IS AGAINST US, WE CAN DO IT ANYWHERE"
> TIM ROSENFIELD, CO-CEO, FIRMUS TECHNOLOGIES

CASE **STUDY**

LUQUOS ENERGY

A **CHEAPER** BATTERY ALTERNATIVE PROVIDING MEDIUM- AND LONG-DURATION ENERGY STORAGE SOLUTIONS

LUQUOS ENERGY

ABOUT:

Country: Hong Kong

Founded: 2020

Employees: 12

KEY FACTS:

Developing a **5,000Wh energy storage pilot** with Towngas Smart Energy at the Shenzhen Shajing car charging station to support with energy arbitrage

Expected to **save 70%** of costs during hours of peak energy usage and pricing

CASE STUDY
LUQUOS ENERGY

What is the company and what do they do?
Luquos Energy is developing a sulfur-based aqueous flow battery to provide a medium- and long-duration energy storage solution ranging from 6-8 hours and beyond that will initially target commercial applications. Cheaper, safer batteries will be required as various stationary storage applications grow and lithium-ion batteries become costly and inefficient for longer duration applications.

How it works
The aqueous flow battery uses a sulfur-based electrolyte providing a cheaper alternative to lithium-ion batteries for stationary storage. Where crossover has previously been a challenge for these types of batteries, advancements in membrane architecture reduces crossover and provides an economical solution for energy storage.

Key differentiator
Sulfur-based aqueous flow batteries, while cheaper to produce than lithium-ion batteries in the long run, have struggled to commercialize before. Challenges with crossover and precipitation of active materials can occur, causing maintenance challenges. However, integrating a novel charge-reinforced ion-selective membrane reduces loss of active materials. Additionally, Luquos Energy is using homogenous catalysis to enhance the energy efficiency and power density of polysulfide flow batteries.

Potential impact
Many countries will see the expansion of renewables. As a result, cost effective alternatives for lithium-ion batteries will be needed to support grid infrastructure and to capture and store energy. While China is looking to advance a range of different battery technologies including vanadium flow batteries, vanadium can be costly and fluctuate in price especially in regions outside of China where supplies are more limited. Various battery technologies will be trialed as the market for medium- and long-duration battery storage is immense and cost-effective battery systems using abundant materials will scale to meet customer demands as they commercialize, and costs come down.

Ambition/Next steps for company
Luquos Energy is partnering with Towngas to develop the largest polysulfide-based aqueous flow battery system in Hong Kong storing 5,000Wh to support electric vehicle charging in Hong Kong. Further investment and growth of strategic partners will advance the production capabilities of Luqous Energy to meet customer demands and expand across Asia and Europe.

Key things to watch in this sector
While many companies are looking to tap into the market for long-duration energy storage, Luquos Energy is selecting specific regional markets and customers to first gain traction and scale with. As countries like China look to move beyond lithium-ion batteries and battery chemistries tied to critical material supply chains, alternative battery chemistries that can compete on costs, safety, and materials will be competitive solutions.

Why this company made the list
Sodium-ion batteries and vanadium flow batteries will be developed and commercialized to support grid-scale deployments. However, given the large size of the market, multiple technology types will advance to solve the problem. Luqous' first step will be to work with commercial partners and develop its production line to bring down costs and meet current customer demands before scaling to larger markets.

> "POLYSULFIDE AQUEOUS BATTERIES ARE NOT NEW TECHNOLOGIES, BUT CRITICAL ADVANCEMENTS IN MEMBRANE TECHNOLOGY AND CATALYSTS THROUGH LUQUOS ENERGY ENABLE THESE STORAGE SOLUTIONS TO BECOME COST EFFECTIVE AND ENERGY EFFICIENT FOR USE IN COMMERCIAL AND GRID APPLICATIONS"
> YI-CHUN LU, FOUNDER, LUQUOS ENERGY

CASE **STUDY**

MOJIA BIO

SUSTAINABLE CHEMICALS AND MATERIALS DELIVERING **ENHANCED** PERFORMANCE

MOJIABIO

ABOUT:

Countries: China / Singapore / U.S.

Founded: 2018

Employees: 200+

KEY FACTS:

Raised **$80M** for its June 2022 Series B round, led by Temasek

R&D centers in Shanghai, Singapore, and Tampa

CASE STUDY
MOJIA BIO

What is the company and what do they do?
Mojia Bio makes more sustainable versions of chemicals and materials, with enhanced performance and at a cost-competitive price point, compared to conventional production. At present, the company targets two key end markets: agricultural inputs for crops and livestock, and specialty materials for industries such as paint and automaking.

How it works
Many of the larger biomanufacturing players today rely on cell-based fermentation, which typically involves complex metabolic engineering, as well as feedstock requirements which are both specific and substantial.

Mojia Bio uses an enzyme-based approach. By leveraging orthogonal metabolic pathways, it is able to exert more control over the production process, which allows Mojia Bio to reduce costs and expand feedstock options.

Key differentiator
Mojia Bio has developed a distributed approach to bio-manufacturing, focused on smaller-scale, resource-efficient production using locally available agri-food resources and sidestreams from the petroleum industry as feedstocks.

This means that, in addition to reducing costs and production timelines, Mojia Bio's tech can be located close to renewable feedstock sources, and to potential downstream customers and supply chain partners.

Potential impact
By offering an alternative to traditional petroleum-based refining, as well as more resource-thirsty biomanufacturing processes, Mojia Bio can improve the economics of precision fermentation by reducing energy requirements, production timescales, and feedstock limitations. Its initial target markets include sectors such as agriculture and chemical production that have significant environmental footprints and are heavily reliant on petroleum products; its technology could also have a positive impact in industries like electric vehicles, robotics, and transport.

Ambition/Next steps for company
The company aims to scale up production and expand internationally through joint ventures with corporate partners, while also building and operating its own plants in situations where it makes commercial sense to do so. The team's near-term focus is to begin producing a wider range of biomaterials, and to increase its use of AI to drive R&D.

Key things to watch in this sector
The continuing transition away from petroleum-based materials and chemicals, and towards more sustainable bio-based alternatives, will create more opportunities for solutions like those offered by Mojia Bio. At the same time, geopolitical trends around shifting supply chains, deglobalization, and onshoring could increase demand for localized, modular biomanufacturing, using feedstocks that don't compete with food resources.

Why this company made the list
Mojia Bio's tech platform can bypass some of the key bottlenecks associated with biomanufacturing today, such as long lead times, high costs, and feedstock availability. And with feet on the ground in China, Singapore, and the U.S., the company is well-placed to compete in multiple markets as it continues along its growth path.

> "IF YOU GO TO MARS OR THE MOON, YOU CAN'T TAKE EVERYTHING WITH YOU... [THAT'S] A SIGNIFICANT ADVANTAGE OF DISTRIBUTED, MODULAR BIOMANUFACTURING"
> KEVIN LI, CO-FOUNDER & CHAIRMAN, MOJIA BIO

CASE **STUDY**

QARBOTECH

IMPROVED CROP YIELDS BY INCREASING THE RATE OF PHOTOSYNTHESIS

QARBOTECH

ABOUT:

Country: Malaysia

Founded: 2018

Employees: 20

KEY FACTS:

Biostimulant can boost crop yields by **up to 40%**

Partnerships with **major Southeast Asian corporates** including Petronas and Sinar Mas

2025 APAC CLEANTECH 25

CASE STUDY
QARBOTECH

What is the company and what do they do?
Qarbotech has developed a biostimulant that can be applied to the leaves and root systems of plants to enhance the rate of photosynthesis. This increases carbon uptake and the production of oxygen and sugars, resulting in improved crop yield.

How it works
Co-founder and Chief Scientist Suraya Abdul Rashid discovered a way to produce a renewable carbon nanomaterial from agri-waste streams such as rice husks. The nanomaterial acts like chlorophyll, boosting the light-absorbing capacity of the chloroplasts that are naturally present in the plant.

Key differentiator
Qarbotech's product contains neither active chemicals, as is the case with conventional fertilizers and pesticides, nor microbes or other complex biological agents as may be found in many novel biostimulants. This makes it relatively inexpensive and simple to produce from circular waste sources.

Potential impact
Early field trials on rice, vegetable, and fruit farms have shown yield increases of around 20 – 40% after Qarbotech's QarboGrow biostimulant has been applied. Ongoing trials indicate that the product may also enhance a plants' ability to sequester carbon in soil.

Ambition/Next steps for company
After establishing itself in Malaysia, Qarbotech plans to expand across Southeast Asia, with Indonesia, Thailand, and Vietnam as key target markets. The company is also exploring regulatory approvals in Europe and North America.

Key things to watch in this sector
More farmers are becoming aware of biostimulants and how they can be integrated into their operations. This is happening alongside an increase in interest around regenerative agriculture and soil carbon capture. The convergence of these trends provides fertile ground for input innovators like Qarbotech.

Why this company made the list
Qarbotech's non-toxic biostimulant can boost crop yields, which is critical for lower income smallholder farmers across Asia-Pacific who are already operating on extremely tight margins while facing some of the most immediate consequences of climate change. Moreover, Qarbotech is able to convert waste streams from those same farms into a high-value input, driving circularity and waste valorization in the agri-food ecosystem.

> "OUR PRODUCT IS NEITHER A FERTILIZER NOR A PESTICIDE, BECAUSE IT DOES NOT CONTAIN ANY NUTRIENTS OR ANY ACTIVE COMPOUNDS. IT IS JUST CARBON"
> CHEE HOE CHOR, CO-FOUNDER & CEO, QARBOTECH

THE 2025 APAC CLEANTECH25 LIST

THE 2025 APAC CLEANTECH25 LIST

AGRICULTURE & FOOD

2 COMPANIES ↔

2 COUNTRIES ↔

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
MASH MAKES	Containerized pyrolysis and gasification technology to produce biochar and biofuels from agrifood waste	2015	India
QARBOTECH	Photosynthesis enhancement nano-technology that results in shorter growing times and increases crop yields up to 60%	2018	Malaysia

ENERGY & POWER

10 COMPANIES ↑

6 COUNTRIES ↑

KEY: ↑ Increase on 2024 list ↓ Decrease on 2024 list ↔ Same as 2024 list

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
allegro	Water-based redox flow batteries and energy storage systems that are non-flammable and easily recyclable	2021	Australia
AMPERESAND	Novel solid state transformer to support grid infrastructure solutions and will target fast charging infrastructure	2023	Singapore
碳能科技 CARBON ENERGY	Carbon capture and utilization solutions for industrial processes, manufacturer of composite membranes for alkaline water electrolysis, and provider of wastewater solutions	2015	China
COSMOS INNOVATION	AI platform (Mobius) that determines and optimizes solar cell efficiency	2020	Singapore
Ecolibrium	Technology platform to monitor and control electricity usage for commercial and industrial customers	2009	India
firmus	Sustainable AI data centers, delivering energy-efficient compute through new builds and retrofits, including offering GPU cloud service from immersion-cooled data centers	2023	Singapore
LUQUOS ENERGY	Flow battery storage systems for applications in grid scale and commercial energy storage	2020	Hong Kong
Marvel-Tech	Hydrogen-based power generation technology and products	2015	China
OPENSTAR TECHNOLOGIES LTD	Magnetic fusion confinement using levitated dipole systems for stable plasma physics and rapid development pathways	2021	New Zealand
STARTORUS FUSION 环聚能	Spherical tokamak fusion technologies	2021	China

THE 2025 APAC CLEANTECH25 LIST

MATERIALS & CHEMICALS

7 COMPANIES ↑

4 COUNTRIES ↔

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
3DC	Graphene mesosponge material for compact batteries with longer lifespans and improved performance that elastically deforms like rubber	2022	Japan
allozymes	Enzyme Engineering-as-a-Service for chemical, agriculture, and food applications	2020	Singapore
Azul Energy	Iron-based catalysts for battery storage, water electrolysis, and carbon dioxide electrolysis	2019	Japan
ELEMENT ZERO	Mineral processing platform via a non-aqueous electrochemical process to convert metal ores into pure metals with zero carbon emissions for iron, steel, and critical metals industries	2022	Australia
FLEET	Satellite-based exploration platform for critical minerals	2015	Australia
MOJIABIO	Bio-manufactured food ingredients and chemical materials	2019	China
Thermalytica	High-performance insulation that prevents energy loss in various energy production processes	2020	Japan

KEY: ↑ Increase on 2024 list ↓ Decrease on 2024 list ↔ Same as 2024 list

RESOURCES & ENVIRONMENTAL MANAGEMENT

1 COMPANY ↓

1 COUNTRY ↓

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
ATERA WATER	Nanocomposite membranes for water purification in potable water, commercial, industrial water applications	2022	Singapore

KEY: ↑ Increase on 2024 list ↓ Decrease on 2024 list ↔ Same as 2024 list

A CRITICAL MATERIALS INNOVATION ECOSYSTEM IS CRYSTALLIZING ACROSS APAC, AND NOT JUST IN CHINA. THIS YEAR'S LIST BOASTS TECH ACROSS THE VALUE CHAIN, FROM MINERALS EXPLORATION, TO PROCESSING, TO BATTERY MATERIALS

THE 2025 APAC CLEANTECH25 LIST

TRANSPORTATION & LOGISTICS

2 COMPANIES ↓

2 COUNTRIES ↓

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
Battery Smart	Battery swapping network	2019	India
Kwetta	Grid-first highpower EV charging solutions with a focus on commercial vehicles	2021	New Zealand

KEY: ↑ Increase on 2024 list ↓ Decrease on 2024 list ↔ Same as 2024 list

THE ELECTRIC MOBILITY ECONOMY IS CREATING INNOVATION OPPORTUNITIES BEYOND VEHICLES AND BATTERIES. THIS YEAR, WE SEE A CLEAR INDICATION THAT THERE IS APPETITE FOR INFRASTRUCTURE (E.G., CHARGING AND BATTERY SWAPPING) AND CIRCULARITY OF BATTERY MATERIALS

WASTE & RECYCLING

3 COMPANIES ↓

2 COUNTRIES ↓

COMPANY	DESCRIPTION	FOUNDED	COUNTRY
LOHUM	Lithium-ion battery packs and recovering solutions for critical battery materials	2017	India
METASTABLE MATERIALS™ WASTE AS ORES	Unique metal extraction methodology designed to reduce capital and operational expenditure of lithium-ion batteries	2021	India
poen (주) 포엔	Battery recycling solutions	2019	South Korea

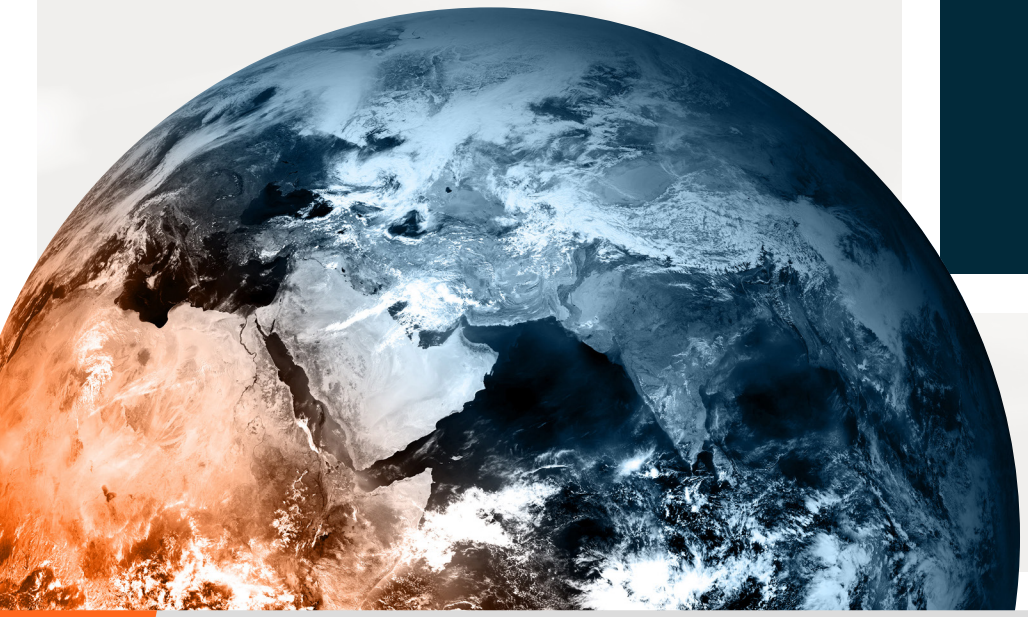
KEY: ↑ Increase on 2024 list ↓ Decrease on 2024 list ↔ Same as 2024 list

ABOUT CLEANTECH GROUP

Cleantech® Group is a research-driven company that helps corporates, public sector, investors and others, identify, assess, and engage with the innovative solutions and opportunities that are related to the world's massive, and growing, environmental and climate challenges.

Our insights and expertise are delivered to clients all over the world through our Research, Consulting, Events, and Advocacy. We have been the leading authority on global cleantech innovation since 2002.

Contact us anytime, info@cleantech.com.



RESEARCH

The solution to information overload, our research cuts through the noise to monitor the market and deliver the insight you need on the themes central to your goals on markets, innovators, investments, trends, and the future.

CONSULTING

To de-risk the future and seize opportunities, leaders need to understand the impact the emerging future might have – only when you clearly see what's coming can you plan for the future.

EVENTS

Cleantech Forums empower corporate change-makers, investors, entrepreneurs, and innovative stakeholders to forge connections, change the narrative, make deals, and be part of an unforgettable experience.

ADVOCACY

Collective action and hyper-collaboration, moving at record speeds, are needed to bring together all key stakeholders to ensure that innovation can have impact at scale for the transformative changes needed to address the climate crisis.

METHODOLOGY2025

HOW WE SELECT THE APAC CLEANTECH 25

The question we seek to answer

According to the region's cleantech community, which 25 private companies located in APAC 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:

- The expert panel of 35 investor and multinational corporation representatives from the region. See page 32 to learn more about these individuals.
- Our i3 platform, which tracks the investment and partnership history of thousands of relevant companies.
- Third-party awards where expert assessment has been applied.
- Our analysts, who cover Agriculture & Food, Energy & Power, Materials & Chemicals, Resources & Environmental Management, Transportation & Logistics, and Waste & Recycling.
- 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 25

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 25.

EXPLORING THE DEPTH AND BREADTH OF THE CLEANTECH COMMUNITY

To create the list, inputs are collected from the APAC Cleantech 25 expert panel, who are active in technology and innovation scouting and are regularly connecting with innovators in the region, as well as other sources.

This year, the number of nominations from the public, our expert panel, i3, awards and Cleantech Group totaled 1,317 from over 16 countries. These companies were weighed and scored to create a short list of 101 companies that were reviewed by the 35 members of Cleantech Group's Expert Panel.

The list offers a fair representation of APAC innovation and private company creation. It is not Cleantech Group's editorial voice, but the collective opinion of many individuals within the wider international cleantech innovation community. It's not just about ideas; it's about real-world solutions making a tangible difference.

VIEW EXPERT BIOGRAPHIES

EXPERT PANELISTS LIST

35 leading specialists from across the APAC region provided their inputs into the process

Jugnu Pati
Senior Fund Manager
ADB Ventures

Phil Anderson
Business Innovation Advisor
Callaghan Innovation

Gayathri Gopal
VP Venture Build
ENGIE Factory Asia-Pacific

Dmitry Govorov
Global Head of Strategy
Aramco Ventures

Nicolas Ducray
Partner
Cathay Innovation

Julien Mialaret
Operating Partner
Eurazeo

Alexandra Clunies Ross
Partner
Artesian Venture Investments

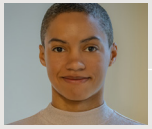
Anthony DeOrsey
Research Manager
Cleantech Group

Varis Charoenvaravoot
Partner
ExpreSso NB (CVC of PTT)

Sophia Nadur
Managing Partner (New Markets)
bp Ventures

Brendon Joe
Head of Research & Ecosystems
CLP Holdings

Nattawat (Nik) Nirdnoy
Investment Manager
GC Ventures (CVC of PTTGC)



Janina Motter
Climate Tech Program Manager
Brinc

Julien Dillon
Investment Director - Finance
Emerald

Takuro Kimura
Founder & CEO
G-Cubed Partners

EXPERT PANELISTS

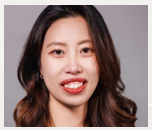
VIEW EXPERT BIOGRAPHIES

Adam Milgrom
Partner
Giant Leap

Dr. Eric Wang
Managing Partner
GRC SinoGreen Fund

Hoi Ying So
Global Head, Portfolio, Disruptive Technologies and Venture Capital
IFC

Om Kaosa-Ard
Head of Venture Capital
InnoPower



Yichen (Lily) Lu
Director of Business Development and Operation
New Energy Nexus

Carl Guan
Managing Director
NIO Capital

Dr. Ashwath Sundaresan
Associate Partner
Pacific Channel

Shrikant Deo
Vice President-Innovation
Reliance Industries

Jing Zhou
External Ventures Manager
Saint Gobain NOVA

Yuko Shimada
Program Manager
Scrum Ventures Group

Kaixin Tan
General Manager
SEEDS Capital

Yoonmin Cho
Partner
Sopoong Ventures

Teng Lip Khoo
Head
ST Engineering Ventures

Karthik Chandrasekar
Co-Founder & Managing Partner
Synapses

Steve Prawiromaruto
Senior Investment Associate
The Radical Fund

Priya Shah
Founder & GP
Theia Ventures

Melvyn Yeo Hak Boon
Founder & Managing Partner
TRIREC

Fariz Ali
CEO & Managing Partner
Twin Tower Ventures

Jonathan Green
Fund Manager
Twynam

Yosuke Yamamoto
Partner
Universal Materials Incubator

THE CLEANTECH GROUP

CHAMPIONING SUSTAINABLE INNOVATION.
CATALYZING BUSINESS OPPORTUNITIES

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