2024 edition

Climate Solutions Casebook

SVCA

Editorial Note

Dear Readers,

Welcome to the inaugural edition of the Climate Solutions Case Book!

At the SVCA, we represent a diverse and ever-expanding investor community that is increasingly shaping the future of our region. As Southeast Asia faces some of the most significant climate challenges, it is encouraging to see a growing commitment from venture firms towards climate solutions. Many of us are beginning to recognize that investing in climate solutions is not only an imperative for our times but also an incredible investment opportunity.

This Case Book is a celebration of that emerging momentum, showcasing a selection of exciting climate investments made by our members. The range of opportunities is vast, spanning industry decarbonization, green energy, sustainable agriculture, waste-to-value, water treatment, electric vehicles, and more. It is particularly important to note that these are all for-profit investments, with the venture capital firms behind them anticipating returns comparable to traditional venture investments.

Our hope is that you, dear readers, will find this Case Book both informative and inspiring. We encourage you to be more intentional in seeking out and supporting groundbreaking climate solutions.

We extend our deepest thanks to all the firms that contributed to this edition and warmly invite new submissions for future ones.

Happy reading and may you be inspired to invest in a more sustainable future!

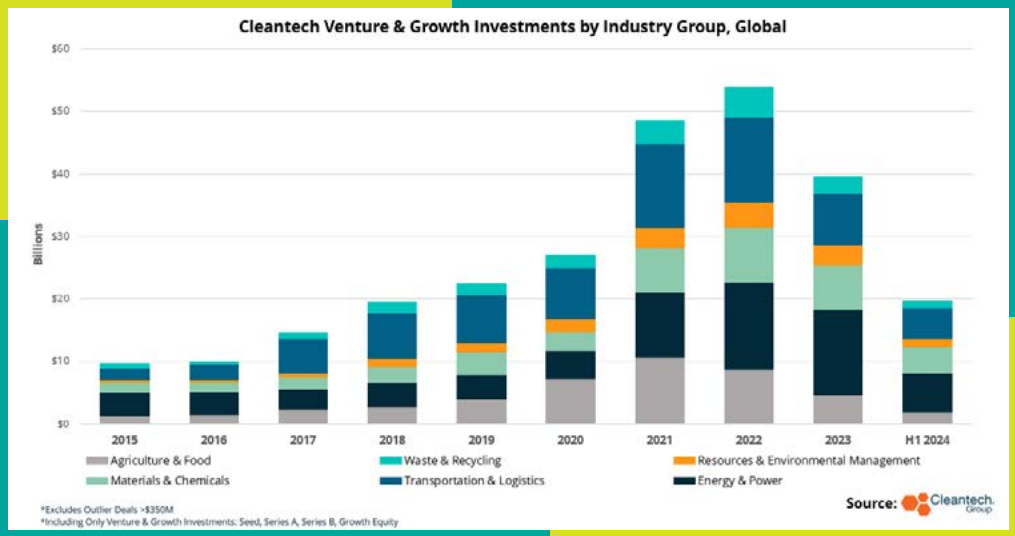
Milena Nikolova
Julien Mialaret
Co-chairs, Climate Solutions Committee

Contents

Foreword by Cleantech Group

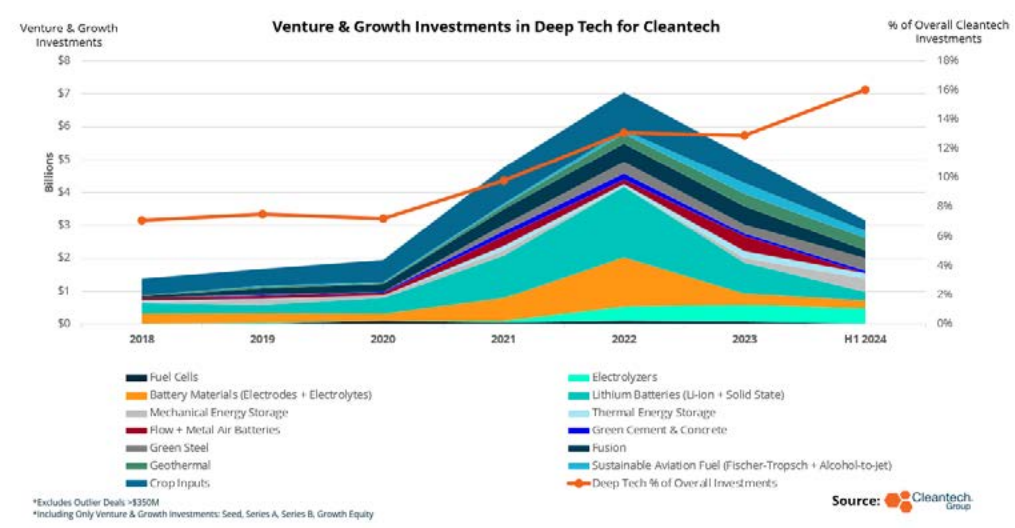
Cleantech innovation, globally and in Asia Pacific: The main event is just beginning

The past decade has brought substantial growth in cleantech innovation. And while many reference these recent years as a "rebound" from the early 2000's boom and burst of venture capital in cleantech, the more probable dynamic is becoming clearer now: cleantech innovation is only just now picking up in earnest. Even before the low interest rate environment of 2021-2022, enthusiasm for the space was building consistently each year, but as we can see, the "landing" on the other side of the pandemic was a new status quo of *45% more venture capital dollars flowing to the cleantech theme.*



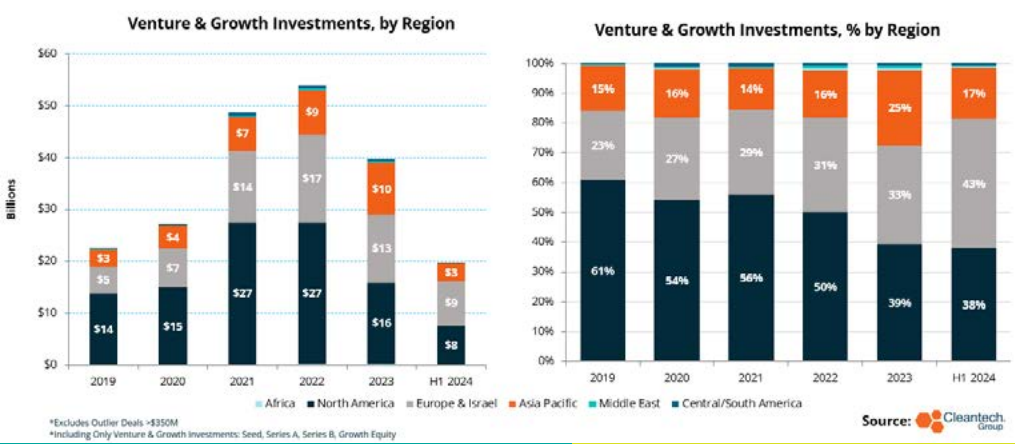
Some key dynamics that have taken shape in recent years, which are contributors to the upward trajectory of cleantech globally include:

- Cleantech is now a key player in the "real" economy. Perhaps the most defining characteristic of the recent 3 years has been the speed with which companies are moving from R&D and into real projects and manufacturing. This brings with it economic benefits such as job creation and stimulation of supply chains, as well as political will to create supporting policies.
- Innovators are taking aim at the hardest problems. Enough cleantech is now at maturity that innovators are seeking to solve deep physical problems and create exponential benefits. New molecules for batteries, crop science for increased resilience of food systems, new mediums of cement and steel production are all white-hot areas of innovation today (see below where deep tech for cleantech is at its all-time high as a percentage of all cleantech investments).
- AI is creating a new age of efficiency. The world's enthusiasm for general purpose artificial intelligence (AI) products has exploded in recent years. In the cleantech space, we are seeing innovators leverage AI to: increase efficiency of R&D, streamline integration with wider systems (think intelligent energy storage and smart grid tech), and optimize operations of technologies once deployed. The potential is for faster economies of scale in a manufacturing environment and better profitability in an operations or deployment environment.



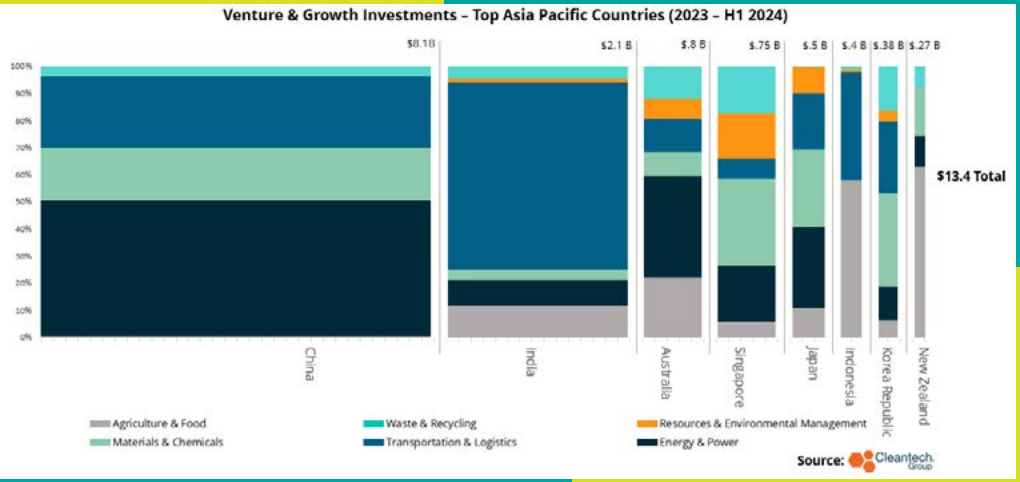
APAC's role in cleantech innovation is increasingly crucial to growth

In 2023, we observed a year that saw Asia Pacific cleantech innovators swim upstream with stunning success – *logging an increase in venture capital financing* while the rest of the world attempted to soften a drop-off.



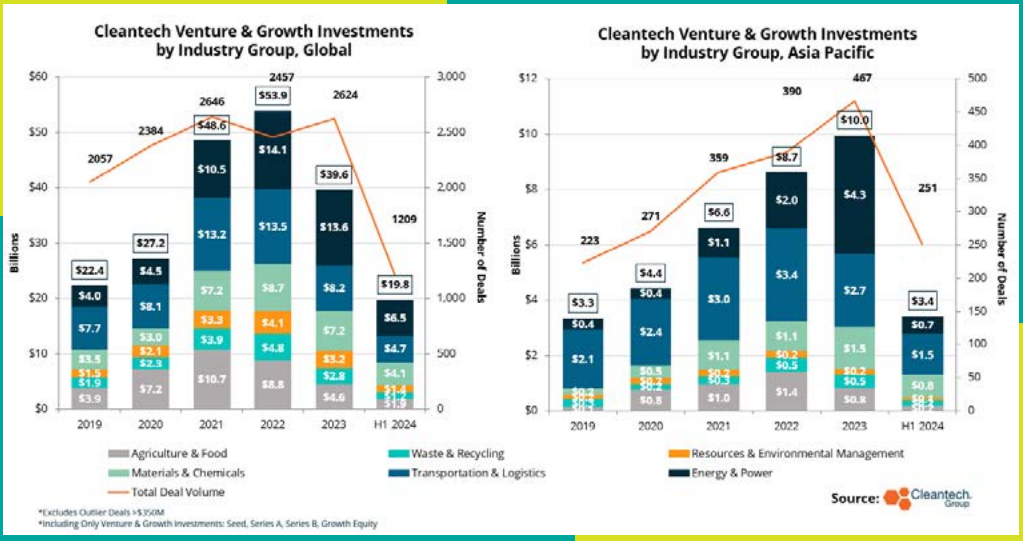
China and India are aiming for net-zero by 2060 and 2070, respectively, and other crucial economies in APAC (e.g., Singapore, Japan, Korea, Vietnam) have made 2050 commitments. China's movement is most notable, as *clean energy accounted for all investment growth in China in 2023,* as the country leans in to its "New Three" key industries of electric vehicles, solar, and storage.[1] These initiatives are bearing fruits in the innovation community as well: as we noted in our 2024 Cleantech APAC 25 report, most of APAC's recent cleantech investment growth was strongly underpinned by the performance of Chinese energy and power innovators.

[1] Carbon Brief, "Clean energy was top driver of China's economic growth in 2023" (https://www.carbonbrief.org/analysis-clean-energy-was-top-driver-of-chinas-economic-growth-in-2023/)



As of writing, we are nearly three quarters through 2024 – what do we make of this year's events so far, and what does it indicate for the future of APAC cleantech innovation?

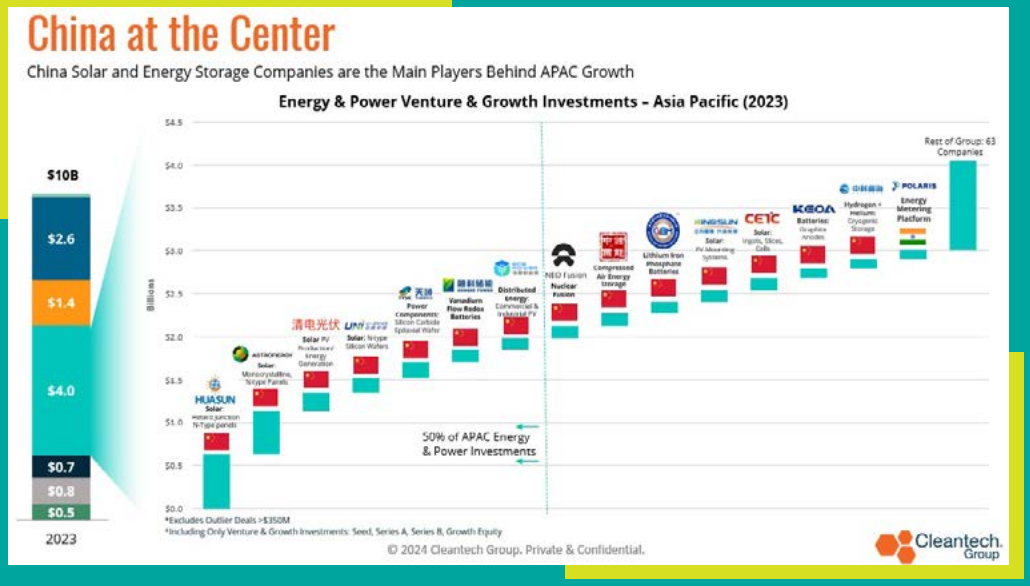
- The venture numbers have cooled, but don't be fooled. Much is attributable to maturing business models that no longer require reliance on venture financing alone – think solar innovators that are now accessing loans and project finance, electric vehicle companies that are some of the few still finding paths to exit (note 2024 listing of Thunder Power and SPAC announcement by AIWays).



- The regional emissions profile of heavy industry – steel, cement, chemicals, and high-heat industries of all order – is ripe for disruption. APAC will need a focused effort to demonstrate and de-risk locally-developed technologies on the same timeline as the U.S. and Europe.
- Rising to the AI challenge: APAC innovators are embracing the opportunity that lies in advanced AI to accelerate product development and optimization; the region also has opportunities to do so in controlling emissions from AI-supporting data centers.
- Missing the boat on blue economy: APAC innovators are beginning to embrace the regional "sandbox" at their fingertips in the blue economy; investors still aren't. Port and shipping decarbonization, coastal resilience, and aquaculture innovators are cropping up in multiple countries across APAC but are not raising capital as quickly as their counterparts elsewhere.
- Investors in the APAC region are launching new cleantech-focused funds that, if deployed to regional innovators, can catalyze entrepreneurs that previously may have relied on access to VC funds in the U.S. or Europe to launch and grow in APAC.

Energy & power – A shifting innovation imperative

In 2023, the cleantech venture landscape in APAC was driven almost singlehandedly by investments in Chinese solar innovators - the chart below shows that more than 50% of venture investments in APAC energy & power were just in Chinese solar innovators. This was likely not a surprise to many in a year that saw China commission solar projects in a volume that matched the world's 2022 total commissions (IEA).

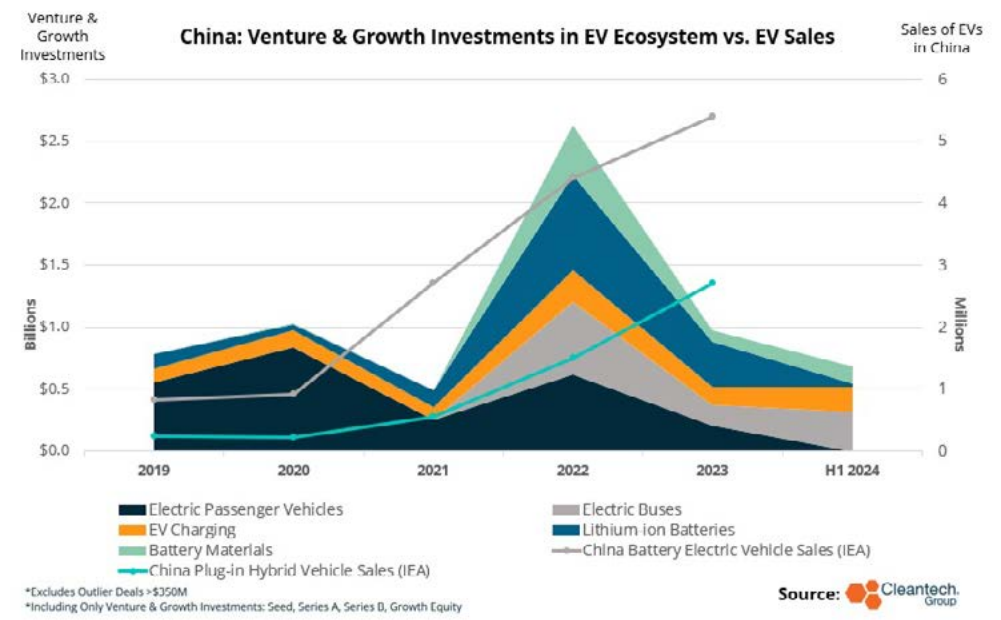


While China's incredible transition to renewables will have lasting effects on the regional "grid economy" through scaling of established technologies, where is the exponential tech? Encouragingly, we're seeing a few emerge, and not just limited to China:

- **Nuclear fusion:** There is no questioning that Asia Pacific will require new sources of baseload power in the coming decades, and despite the monumental challenges to de-risking fusion, it is a bet the region has a vested interest in making.
  - Already this year, we've seen Japanese innovator Kyoto Fusioneering raise an additional nearly $17M (including from U.S. intelligence strategic investor In-Q-Tel) on top of last year's nearly $80M to accelerate progress on the company's integrated fusion power plant system development.
  - Chinese EV producer Nio invested over $130M into fusion startup Neo Fusion in mid- 2023. Note the link here – Nio's EV growth is a business predicated on widespread access to high electricity loads, and the company has invested heavily in EV charging and swapping technology that supports grid stability, indicating the need for a whole-of-system upgrade to China's grid if electrification and electricity decarbonization goals are to both be met.
- **Rethinking the grid core:** While much attention has been paid to the need for increased electricity generation, much of the world is awakening now to the challenge of needing to prepare the electrical grid for increased capacity while becoming more resilient to climate change risks.
  - An early-but-ambitious example is that of Amperesand in Singapore, fully reinventing the transformer with solid state technology that can isolate faults and avoid grid disruptions.
- **Re-powering the world's manufacturing powerhouses:** Industrial energy transition will not be possible without flattening the heat profile of heavy industry facilities. *APAC's innovation activity and investment into heat decarbonization is not yet commensurate with the scale of manufacturing to be addressed within the region.* There are, however, some bright spots, including Australia's MGA Thermal and Vietnam's Alterno sand batteries (Alterno recently received first-of-a-kind financing demonstration system).

Electric Mobility: Can APAC "drift" on China's momentum?

Without question, China has moved into pole position as the top adopter and manufacturing market for EVs, which has stimulated a significant pull-through effect on innovation for the full ecosystem surrounding EVs (see the chart below).

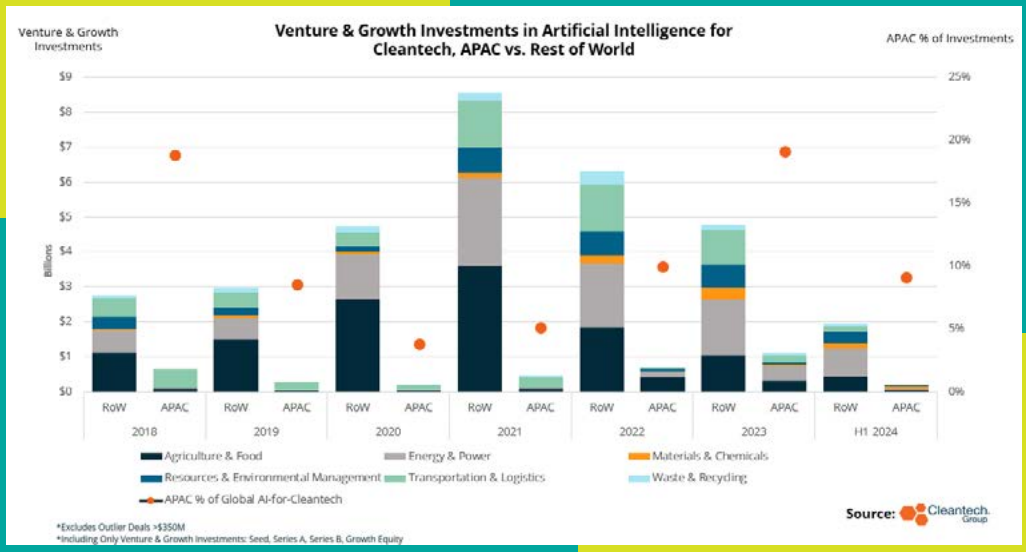


While Chinese EV companies are still raising significant sums (e.g., Hozon Motors' $688M round in prep for IPO), there is increasing activity outside of passenger vehicles and outside of China.

- The Indian ecosystem for local transport methods continues to forge ahead with companies like TI Mobility offering 2 and 3-wheel solutions and continued sophistication of fleet electrification and management, e.g., Alt Mobility and Blusmart.
    - The need to keep battery materials onshore is increasingly seen as an opportunity for Indian innovators as well, e.g., battery recycling and battery producer Lohum.
- India is not unique in this respect; the Australian ecosystem is beginning to innovate in alternative battery chemistries (e.g., silicon anodes company Sicona) alongside a budding lithium extraction innovation push (e.g., Electralith and Novalith).

Winning in the AI world

The world has now fully absorbed that the age of advanced AI is here, and while the use cases for mainstream large language models are well understood, many in the cleantech space are still catching up – leaving a crucial opportunity open for those willing to embrace it. In a recent study conducted by Cleantech Group, we found that in 2023, APAC-based innovators took home 1 of every 5 dollars invested in AI-enabled cleantech innovation (although 2024 has gotten off to a slower start).



Examples of APAC's AI-enabled cleantech innovation can be seen across a broad spectrum, including:

- Food ingredients discovery, e.g., Singaporean AI Palette
- Advanced battery analytics, e.g., India's Altergo and Australia's Relectrify
- Recycling and reverse supply chains, e.g., Australia's Samsara Eco

The world is also waking up to the precipitous demand in energy from data centers as a result of the AI revolution – indeed, the varying grid dynamics and generation sources across Asia will require highly localized solutions, as very few will be willing to pass on the opportunity to benefit from the AI boom. A great example is Singapore's Sustainable Metal Cloud, who is offering immersion-cooled GPU servers through a cloud service, allowing users of the platform to build AI starting from a low-emissions profile. In 2024, Singapore announced a Green Data Center Roadmap[2] aimed at growing the nation's data center capacity but at optimal power usage effectiveness – expect to see more experimentation in data center innovation in Singapore as a result.

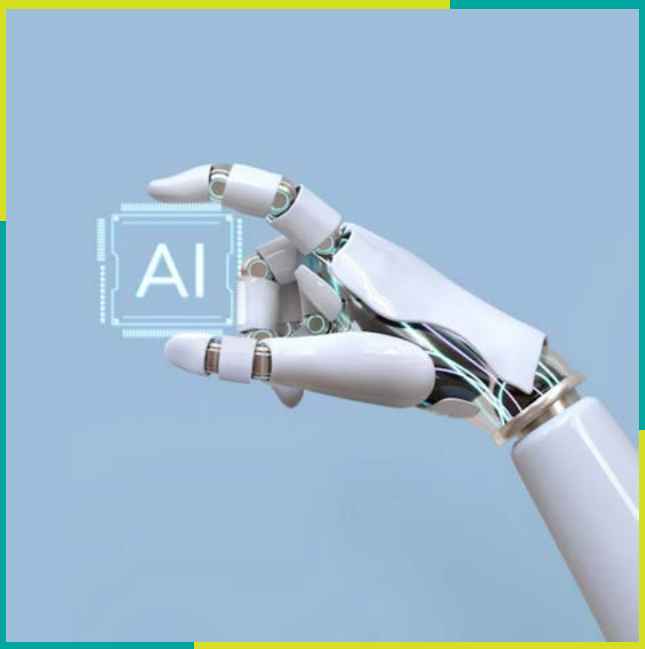
The Blue Economy: Can APAC innovation catch the wave?

A global trend is emerging around the sustainable "Blue Economy" – a growing cohort of innovators are addressing the impact of ocean shipping, resource and food extraction from oceans, and the infrastructure that surrounds it all. APAC has shown innovation power across the spectrum, including:

- Aquaculture, with companies like eFishery, reducing impact of fish and shrimp harvesting – eFishery is positioning itself as a potential global leader and has raised the funds ($295M) to be a regional powerhouse.
- Alternative shipping fuels: Ammonia is considered a potential means to support the transition of shipping away from bunker fuels to clean-burning fuels (or to be cracked back into hydrogen for fuel cell ships). Innovators like Jupiter Ionics and Tsubame BHB are capitalizing on the APAC advantage as an ocean economy to position their solutions to global shippers. Singaporean SungreenH2 has developed modular, scalable electrodes for hydrogen electrolyzers with a stated focus on supporting port hydrogen refueling infrastructure.

[2] Data Center Dynamics, "Singapore lays the groundwork for smart data center growth" (https://www.datacenterdynamics.com/en/analysis/singapore-lays-the-groundwork-for-smart-data-center-growth/)

Surprisingly, while so many of the target industries for blue economy companies are highly active in APAC, APAC-based innovators took home just around 15% of global venture investment in cleantech for blue economy – is an opportunity being missed?



Just In Time: APAC climate-focused funds a critical signal to regional entrepreneurs

Critical to getting high-potential entrepreneurs to take risks is the availability of local capital, both in volume and in specialty. APAC activity has been encouraging as of late, but more is needed. Temasek and Blackrock's Decarbonization Partners Fund close of $1.4B is a global coup for decarbonization technology. The recent fund close at Wavemaker Impact and Asia Development Bank Ventures announced raise for a $200M fund are all important steps to a better capital ecosystem in APAC.

However, specialized funds will also be required to support innovators that have niche or emerging sectoral focuses – circular economy innovators will view Circulate Capital's recent fund close as a welcome signal. Additionally, the nexus between climate change mitigation and adaption is becoming better addressed, as seen in the launches of Synapses in India and The Radical Fund in Thailand. With certainty, these new funds' effectiveness will be amplified by the emerging collaborative atmosphere developing across APAC – the Singapore Venture Capital and Private Capital Association's launch of the Climate Solutions Committee is an important step further in the direction of regional collaboration.

The APAC region has shown its ability to become a global pace setter in electric vehicles and energy storage, and as this casebook will serve to demonstrate, the spectrum of cleantech innovation in APAC is much wider, and the solutions are now going deeper. We watch with enthusiasm and suspense to see what the region will bring to the next phase of climate challenges.

Richard Youngman, CEO, and
Anthony DeOrsey, Research Manager,
Cleantech Group

ABC Impact

Iceotope: Facilitating the reduction of energy and water consumption in data centres and advancing the net zero agenda

A case study on the benefits of precision liquid cooling to accelerate an efficient and sustainable digital world

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Industry vertical: Data Centre Cooling
Location: Sheffield, United Kingdom
Investment year: 2022

For more information:
https://www.iceotope.com/
https://uk.linkedin.com/company/iceotope

Overview

Iceotope was founded in 2005 in Sheffield, UK with the goal of developing innovative liquid cooling solutions to address the growing thermal management challenges in high-performance computing and data centres. The company leverages precision immersion cooling to enhance energy efficiency, reduce water usage, and improve the sustainability and performance of high-density computing environments

The Mission: Delivering the most sustainable, scalable, and serviceable cooling solutions

Iceotope aims to enhance the efficiency of data centres by reducing energy consumption, water usage, and emissions, thereby helping to mitigate the negative impact of the digital ecosystem on climate change. Specialising in precision liquid cooling – an advanced liquid-cooling technique – Iceotope's solution achieves a 96% reduction in water use, 40% reduction in power consumption, and 40% carbon emission reduction per kW of IT equipment.

A typical data centre facility

The challenge: Data centres significantly impact the environment by consuming vast amounts of energy and water, contributing to global greenhouse gas emissions

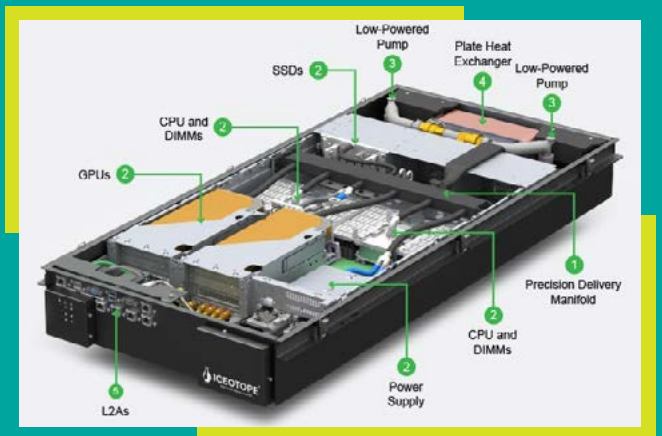
While data centres are essential to our modern and digitalised world, they also have a significant environmental footphrint. Rapid digitalisation, the surge in demand for cloud-based services and devices, and artificial intelligence have led to increased demand for data centres, which are expanding in size, complexity and number. The global data centre ecosystem consumes up to 320TWh of electricity, accounting for 1% of global energy-related GHG emissions[1].

Despite their high energy demands and resource inefficiency, the adoption of liquid-cooling technology in Asia remains underdeveloped, with traditional air-cooling remaining the predominant cooling method. Servers and cooling systems can account for up to 40% of total energy consumption in a typical data centre, particularly in tropical climates like Southeast Asia[2], as many operators typically operate their equipment at temperatures of 22 degrees Celsius and below.

Air-cooling is generally inefficient for data centre cooling due to air's low thermal capacity and poor heat absorption. To ensure efficient heat transfer, passages for airflow within the chassis and servers must be a certain size, reducing the number of chips that can be placed in a server, hence reducing the overall power density per rack and increasing land requirements.

Besides energy, high water usage is another significant factor contributing to the environmental footprint of data centres. A recent study suggests that even a small 1MW data centre using air cooling can consume around 25.5 million litres of water per year[3].

Given data generation is expected to increase from 64ZB in 2020 to 175ZB in 2025 (23% CAGR)[4] as more complex operations increase, heavier processing loads may render current air-cooling systems inadequate and costly due to rising energy prices.



A layout of Iceotope's precision liquid cooling technology

The Solution: Liquid cooling technology revolutionises data centre efficiency and sustainability

In a quest for more efficient data centre cooling, liquid cooling has emerged as a promising solution. Unlike air, which has limited thermal capacity, liquids such as water and mineral oils ("dielectric fluid") excel at transferring heat away from servers. This means they can absorb much more heat from server racks without a significant rise in temperature.

Despite the potential of liquid cooling, its adoption in data centres has been slow. Existing technologies

such as tank-based solutions are incompatible with traditional vertical rack formats. Direct-to-chip cold plates directly cool only the hottest components, while fans are still required to cool the other components. Iceotope has combined the most effective thermal management principles of cold plates with the total heat capture of tank-based solutions, taking this technology a step further by developing a cutting-edge chassis-level cooling architecture with precision delivery technology, known as precision liquid cooling ("PLC"). This is done by partially immersing servers and other electric components in dielectric fluid, which has four to six times higher thermal conductivity than air, yet does not conduct electricity, eliminating the risk of short circuits.

This fluid absorbs heat directly from all components, eliminating the need for traditional air-cooling methods, provides uniform cooling, and minimises hotspots, leading to improved performance and reliability of the hardware and reducing maintenance cost. By doing this at the individual chassis-level, Iceotope's solution fits seamlessly into these conventional racks with minimal adjustments to existing infrastructure.

Iceotope's solution is industry agnostic, and can be adapted to support cloud service providers, telecommunications, enterprise IT, OEM/ODM, and high-performance computing/artificial intelligence ("AI"), achieving up to a 96% reduction in water use, 40% reduction in power consumption, and 40% carbon emission reduction per kW of IT equipment.

We invested in Iceotope in the pursuit of bringing this innovative and adaptive technology to Asia, supporting the decarbonisation agenda as the global climate intensifies and resource scarcity becomes more pressing. Southeast Asia, one of the fastest-growing regions in the world, is set to be a major driver of the APAC data centre market, accounting for around 13%[5] of the region's total size.

Our investment in Iceotope aligns with our impact mandate to identify and invest in innovative global solutions that address significant challenges in Asia. This investment is part of our Climate and Water investment theme, aimed at supporting solutions that reduce greenhouse gas emissions and enhance resource use efficiency.

Iceotope supports the United Nations Sustainable Development Goal SDG 9. "Industry, Innovation and Infrastructure" and SDG 6. The SDG target 9.4 seeks to upgrade infrastructure to make it sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies while SDG 6.4 seeks to substantially increase water-use efficiency across all sectors.

Iceotope's technology in a conventional rack

Progress to Date: Major milestones amidst emerging trends in AI and high-density computing

Since our investment into Iceotope in 2022, Iceotope has consistently demonstrated the capabilities of its technology.

A study with Meta successfully demonstrated the use of PLC to meet the cooling requirements of high-density storage disks being deployed and utilised by hyperscale data centres, additionally suggesting benefits of enhanced thermal management, reduced vibration, and uniform temperature distribution across the system to lower failure rates and cost for data centre operators.

Iceotope has demonstrated its core data centre cooling solution to the telco space, announcing KUL RAN in 2023 developed in partnership with Intel and HPE, and a second generation in 2024.

This solution is particularly beneficial for telco providers with numerous remote sites, as its sealed chassis provides complete protection from thermal shock, dust and other contaminants, reducing the need for on-site maintenance, reducing operational expenses, enhancing server uptime, and providing up to 20% savings on energy consumption[6] at the device level.

Amid the exponential growth of AI and machine learning, the overall rising thermal design power of IT equipment, the need for sustainable cooling solutions is fast approaching as 1000W to 1500W to 2000W CPUs and GPUs begin to be unveiled.

In response, Iceotope has launched Iceotope Labs in 2024 in partnership with Efficiency IT, a UK specialist in data centres. This state-of-the-art liquid cooling facility

Alceotope's telco solution, KUL RAN

in Sheffield aims to revolutionise high-density data centre research and testing for customers seeking liquid cooling solutions.

Recent research at the Iceotope Labs has demonstrated Iceotope's technology in cooling chips up to and beyond 1000W, offering an 11.4%[7] improvement in thermal performance compared to the best tank immersion.

Closer to home, Iceotope has teamed up with Korean telco SK Telecom and lubricant developer SK Enmove to design a new liquid cooling solution for AI data centres, collaborating to deploy Iceotope's PLC using SK Enmove's thermal fluid at SKT's AI data centre testbed.

In Singapore, Iceotope has collaborated with ST Telemedia Global Data Centres to develop a proof-of concept to explore the potential and applicability of the technology to improve their sustainability and future-proof local operations

We firmly believe in Iceotope's transformative potential to revolutionise the data centre industry. Their technology not only aligns with our commitment to sustainability and efficiency but also addresses critical challenges of our time. Iceotope is already at the forefront of driving change and is represented on the committee on standards for liquid cooling in tropical data centres under the Singapore Standardisation Programme, supported by Enterprise Singapore and IMDA. As we continue to support and collaborate with Iceotope, we are confident their solutions will play a pivotal role in advancing a greener and more sustainable future for data centres worldwide.

Iceotope's highly scalable Edge Computing solution

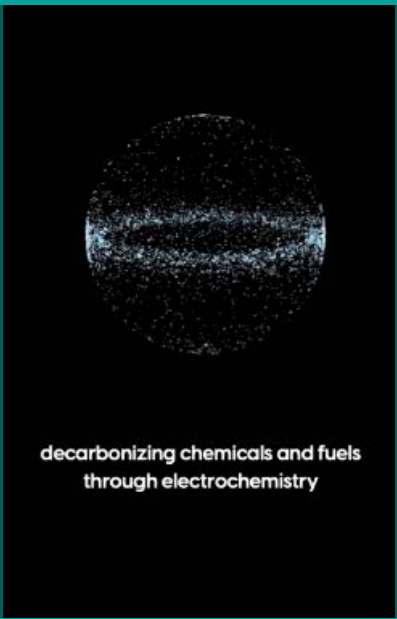
[1] International Energy Agency
[2] Infocomm Media Development Authority ("IMDA") Singapore
[3] Mytton, D. Data centre water consumption. *npj* Clean Water **4**, 11 (2021)
[4] International Data Corporation Forecast
[5] Cushman and Wakefield
[6] https://www.iceotope.com/company//news/iceotope-s-precision-liquid-cooling-can-significantly-reduce-telco-operators-total-energy-costs/
[7] https://www.iceotope.com/company/news/iceotope-achieves-chip-cooling-industry-milestone-at-1000w/

Aera VC

Twelve: Turning CO_2 into essential products through the power of electrochemistry

Industry vertical: CO_2 Transformation
Location: Berkeley, CA, USA
Investment year: 2019

For more information:
www.twelve.co



Twelve is the carbon transformation company, on a mission to eliminate global emissions and build a fossil-free future by turning CO_2 into essential products through the power of electrochemistry.

Their breakthrough "Opus" technology is an industrial-scale electrolyzer that works like photosynthesis, converting CO_2, water and renewable energy into hydrocarbons, the building blocks for chemicals, materials and fuels.

By using CO_2, Twelve can eliminate emissions from products and supply chains and eliminate the need for fossil fuels as a feedstock for thousands of industrial and everyday products.

Twelve has proto-typed numerous carbon negative products and is currently scaling its revolutionary sustainable aviation fuel "E-Jet®".

The Challenge

The aviation sector is responsible for a significant share of global CO_2 emissions (2-3%) consuming 100 billion gallons of fossil fuels and emitting one billion tons of CO_2 every year. Forecasts suggest fuel consumption is expected to increase to 150 billion by 2050 and unless drastic action is taken, dramatically increasing emissions as well. Sustainable Aviation Fuel (SAF) is quickly becoming the new standard for decarbonizing aviation and addressing Scope 3 emissions but is in limited supply. A number of countries in the world, including the EU and Singapore, have set ambitious targets on the gradual transition to SAF, but the supply of it is still limited and insufficient to meet such goals.

The Solution

Twelve is on a mission to decarbonize aviation and set a new standard for the future of flight. Twelve's E-Jet "power to liquid" SAF is made from CO_2, water and renewable energy and has up to 90% lower emissions than conventional jet fuel fuels, while using up to 1000x less water and 30x less land than biofuels which dominate the market today. While the industry will need all sources of SAF to scale quickly, Twelve's E-jet fuel maximizes emissions reductions and minimizes resource use around the world.

What are Power-to-Liquid (PtL) fuels: sometimes called synthetic fuels, E-Fuels, or Power-to-X, does not use direct organic compounds as feedstocks like other pathways, and is therefore not a biofuel. Instead PtL uses captured CO_2, renewable electricity, and water.

Water Use: Low
Land Use: Low
Scaleability of Feedstock: High

Progress to Date

Twelve has received notable recognition and substantial venture capital funding for its innovative approach to transforming CO_2 into valuable products including SAF.

VC backers include Aera VC since its pre-Series A, TPG, DCVC, Capricorn, Microsoft and others. The company has also been the recipient of federal and local grants of over $25m for its polymer electrolyte membrane and electrocatalyst development to enable the conversion of CO_2 into fuels and chemicals.

The company was named in the world's 3 most innovative companies by Fast Company, was recognised as a BloombergNEF Pioneer in Decarbonising Aviation, and by Time Magazine as one of the Best Inventions of 2022. They were joint winners of the "Best CO_2 Utilisation 2024" for their SAF in Germany while Co-Founder and CSO Etosha Cave has recently been recognised as a CNBC 2024 Change Maker.

Twelve is now partnering with the world's biggest companies in aviation, sustainability and innovation including Alaska Airlines, British Airways, IAG and Etihad Airways for long term offtake agreements to be supplied by the first of its kind production facility that recently broke ground in Washington. At scale, that plant will deliver efuel of 40,000 gallons/151,000 litre per annum and provide a prototype to replicate around the world.

Twelve is currently in the final stages of closing its Series C funding round.

Further reading:

You can read more about Twelve and SAF here:
https://www.twelve.co/ejet

AeraVC

About Aera VC

Aera VC backs early stage startups at the frontier of innovation that are dedicated to combating climate change and propelling our planet towards a more sustainable tomorrow. Aera's logo expresses the world under protection, yet moving dynamically forward.

Based in Singapore with a global mandate, our funds have generated outstanding financial returns since 2017 while investing in pursuit of a better planet. We are currently investing a 2021/2022 vintage fund backing the innovators of tomorrow.

Antares

VFlowTech: Maximizing the utilization of renewable energy sources, improving grid stability, and minimizing emissions

Industry vertical: Renewable Energy / Energy Storage
Location: Singapore
Investment year: 2019

For more information:
https://vflowtech.com/

Overview

VFlowTech, a spin-off from Nanyang Technology University in Singapore, capitalizes on eight years of research and development to innovate long-duration, large-scale energy storage with alternative chemistries. Their Vanadium Redox flow battery outperforms competitors in terms of round-trip efficiency, energy density, and thermal operating window. The company has productized its unique technology into three modules: 1) 30kWh batteries for telecom towers or individual homes; 2) 250kWh batteries for commercial & industrial applications and micro-grids for remote communities; and 3) larger utility-scale deployments of up to GWh scale.

Founded in 2018, VFlowTech has actively delivered its energy storage solutions to commercial & industrial customers, independent power producers and utility operators across Asia. The company has deployed more than 3MWh of operational energy storage solutions across Singapore, Southeast Asia, India, Japan, Korea and Australia to support multiple applications, from commercial & industrial energy storage, solar tracker, EV charging, power grid, economic yield improvement of renewable power plants to powering green data centers.

The Mission

Their mission includes enhancing energy security and resilience by ensuring a stable power supply, promoting environmentally-friendly energy storage technologies and supporting economic growth with cost-effective, scalable solutions. Additionally, VFlowTech focuses on continuous technological innovation to improve affordability, reliability and scaleability of its energy storage solutions, aiming to support the transition to a more sustainable and resilient energy landscape.

The Challenge

COP26 marked significant progress, with countries representing 70% of global GDP pledging to reach net zero emissions, a commitment reconfirmed at COP27 and COP28. By 2050, renewable energy is expected to play a key role in reducing carbon emissions, potentially providing 70-80% of global electricity and lowering emissions by 50-70%, as estimated by various climate models, helping reduce the current 37.4 gigatons of CO_2 emissions. However, challenges remain including intermittency, grid stability issues, energy mismatch, infrastructure constraints, geographical limitations, and fluctuating energy prices.

Energy storage solutions have come under the spotlight as playing a key role in ensuring the stability of renewable energy. It can be incorporated to support smart grids, create more dynamic electricity markets, and make the overall power grid more resilient and efficient. Notably, energy storage systems offer several potential benefits including enhancing grid reliability, deferring transmission upgrades, and relieving transmission congestion. Therefore, renewable energy paired with energy storage systems offers a potential solution.

VSUN Energy's EV charging trial in Western Australia

Among all ESS solutions, the Vanadium Redox Flow Battery (VRFB) system is most suitable for large-scale long-duration energy storage, including but not limited to utility, commercial, industrial, and residential applications. However, this technology still faces challenges such as high parasitic losses, poor round-trip efficiency, restricted high temperature operations in tropical conditions, low energy density, chemical handling with potential leakage, and high upfront costs.

Pandit Deendayal Energy University's e-mobility charging trial in India

VFlowTech's Singapore Team

The Solution

VFlowTech leverages on ten years of research at Nanyang Technological University and the company has applied key innovations to the VRFB technology to have new battery products with :

- compact and scalable design
- minimal parasitic losses (developed a method to significantly reduce pump power, automatic capacity rebalancing approach)
- increased operating temperature -10 °C to 55 °C without active cooling, usual operation range is -10°C to 40 °C.
- no halide chemistry, environment friendly (UET uses halide chemistry)
- highest stack efficiency > 85%, others are 75-80 %, this helps VFlowTech to be cheaper and more compact
- proprietary BMS and EMS, applied IoT and advanced analytics to optimize load/charge management.

VFlowTech's first products have shown better performance compared to its peers running in VFRB products with (i) 10& higher round-trip efficiency, (ii) lower cost, and (iii) higher operating temperature.

VFlowTech's 100MWh India Manufacturing Facility

VFlowTech's Singapore Team members carrying out software testing and battery integration

Progress to Date

VFlowTech has established itself as a leading provider of energy storage solutions and engineering, producing 30 kWh, 100 kWh, and 250 kWh modular systems. Recent deployments including powering the island of Pulau Ubin 24/7, and a recent 1.6MWh project on Jurong Island for powering a tank terminal in Q4 2024, mark significant milestones for the company.

In addition to the revenue generated from battery sales, VFlowTech has received significant support from the government, including grants from NRF, EnterpriseSG, and EMA, totaling close to US$5M. Additionally, VFlowTech has raised close to $20M in equity and debt capital from a range of private and institutional investors over the last 5 years.

VFlowTech is dedicated to supporting Singapore's energy transition agenda. As Singapore works towards enhancing its energy mix by importing renewable energy from neighboring countries, the goal is to reduce its reliance on natural gas, which currently accounts for 95% of the country's electricity supply. VFlowTech has recently entered into a 1GWh MOU with leading energy developers in Indonesia related to renewable energy import into Singapore.

Furthermore, VFlowTech has established a robust pipeline of 50 projects across 18 countries, with an estimated contract value of US$1.28 billion to be delivered over the next five years.

All efforts to work on MOUs and to build pipeline projects in various countries showcase a broader mission to mitigate carbon emissions on a global scale and support international climate objectives. Through these strategic partnerships and projects, VFlowTech is not only aligning with national goals but also contributing to the worldwide push for sustainable energy and environmental stewardship.

VFlowTech's 500kWh battery

ANTARES VENTURES

About Antares Ventures

Antares Ventures is a pioneering early-stage venture capital fund taking a strategic approach to invest in Deep Tech ventures that address sustainability challenges for Asia Growth Markets. Our investment mandate is global in scope, yet sharply focused on generating economic value and sustainable impact in Asian growth markets. We focus on investments themes relevant to these markets, such as the energy transition, sustainable food & agriculture, sustainable transport, cities and infrastructure, and accessible healthcare.

Our partners and senior advisors bring more than 100 years of collective experience in advanced science & technology, business leadership, and distinctive network. With a proven track record as co-founders, CEOs, board members, advisors, and investors, we possess the expertise to identify, select, and accelerate promising deep tech ventures across Asia.

At Antares, we are committed to driving positive change, by accelerating deep tech ventures who have the potential to deliver distinctive returns and drive sustainable impact for our world.

East Ventures

Rekosistem: Reshaping waste industry: Indonesia's path to circular solutions

A case study of Rekosistem in managing waste in Indonesia

Industry vertical: Waste Management & Recycling
Location: Indonesia
Investment year: 2023

For more information:
https://rekosistem.com/

Overview

Rekosistem, a 2023 Google Play's Best Apps for Good winner, is revolutionizing waste management by connecting people and businesses with responsible waste solutions. Founded in 2021, the company is addressing the market through recycling and waste-to-energy development. Recently, Rekosistem, in partnership with PLN, Indonesia's state-owned electricity company, has begun utilizing waste as fuel for a coal-fired power plant in East Java[1].

Landfilling waste has caused significant greenhouse gas (GHG) emissions. In fact, the waste sector in Indonesia generates 138 million tCO2e, which ranks as the third largest source of emission in Indonesia[2]. Furthermore, the waste sector is the largest source of methane emissions in the country, generating an equivalent of 135 million tCO2e[3]. Through Indonesia's Enhanced Nationally Determined Contribution (NDC) commitment to UNFCCC of reducing 32-43% of GHG emissions by 2030, Indonesia aims to reduce 40-43.5 million tCO2e from the waste sector[4].

This reduction strategy includes implementing a circular economy, which involves reducing the use of resources, extending the lifespan of products and materials, and enhancing recovery and utilization from residues[5]. Improper waste disposal does not only contribute to environmental degradation, including pollution in rivers and oceans, but also negatively affects public health.

From Burden to Resource: Rekosistem's mission fuels environmental and social change

Rekosistem's mission is to "build a future where waste is a valuable resource, not a burden." By implementing circular economy principles, the company's services and products directly address environmental and social challenges:

- Environment: Rekosistem's waste management solutions reduce landfill waste, minimize pollution, and promote the use of recycled materials and waste to energy, contributing to a cleaner and more sustainable environment. By recycling waste, Rekosistem prevents greenhouse gasses (mostly methane) generated at the landfills.
- People: The company empowers local informal waste-workers with increased income and improved working conditions through technology-driven platforms for traceability, fair and fast payment systems. Additionally, Rekosistem's community engagement initiatives raise awareness on responsible waste management.

Ernest Layman (left) and Joshua Valentino (right) as co-founders of Rekosistem

Waste processing at Rekosistem Hub

[1] PLN (2023) https://web.pln.co.id/cms/media/siaran-pers/2023/11/dukung-pengembangan-bisnis-modern-pln-teken-kerja-sama-dengan-4-startup/
[2] ASEF (2022): Waste Management in Indonesia and Jakarta: Challenges and Way Forward - https://asef.org/wp-content/uploads/2022/01/ASEFSU23_Background-Paper_Waste-Management-in-Indonesia-and-Jakarta.pdf
[3] Climate Watch (2020) https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&chartType=area&gases=ch4&regions=IDN&source=Climate%20Watch
[4] Indonesia Enhanced Nationally Determined Contribution (2022) https://unfccc.int/sites/default/files/NDC/2022-09/23.09.2022_Enhanced%20NDC%20Indonesia.pdf
[5] Ministry of National Development Planning (2024): Indonesia Circular Economy 2025-2045 Roadmap and National Action Plan

Indonesia's Waste Crisis: Unpacking the obstacles to sustainable management

Indonesia, known for its natural beauty across its vibrant archipelago, faces a significant and escalating challenge—a rapidly growing waste crisis. Annually, the nation generates a significant amount of waste, posing substantial climate change and public health threats.

- Mounting waste generation: The annual waste generation in Indonesia surged to a staggering 32.1 million tons in 2023, escalating from 27.6 million tons in 2019[6]. With this amount, Indonesia is the largest waste producer in Southeast Asia, followed by Thailand (26.8 million tons), the Philippines (14.6 million tons), and Malaysia (12.9 million tons)[7].
- Unmanaged plastic waste: The country ranks as the second-largest global producer of plastic waste, trailing only China. Alarmingly, 4.9 million tons of unmanaged plastic waste is generated yearly, with approximately 767 thousand tons ending up in the sea, further endangering marine ecosystems[8].
- Fragmented waste management infrastructure: The waste supply chain in Indonesia remains fragmented, impeding efficient waste collection, segregation, and recycling. This disjointed system hampers effective waste management and curtails recycling rates.

These pressing challenges underscore the critical need for innovative solutions in waste management and recycling. Rekosistem's strategic initiatives aim to tackle these complexities head-on, transforming Indonesia's waste management landscape towards sustainability and efficient resource utilization.

Rekosistem's electric vehicle for waste pick-up

Rekosistem's waste station, equipped with solar panel

Rekosistem's innovative products and services

Rekosistem has pioneered innovative solutions within waste management, strategically deploying a platform to enhance productivity, uplift communities, and contribute to a sustainable future. The company has recovered and processed over 40,000 tons of waste and avoided over 35,000 tons of CO2e. Based on Indonesia's Ministry of National Planning Development (BAPPENAS) roadmap, implementing a circular economy in Indonesia could reduce GHG emissions by 126 million tCO2e through: plastic recycling, EPR implementation, etc[9]. The company's innovative services include:

- Reko Hub: Upgrading temporary waste shelters to advanced material recovery facilities resulted in a 5.1x increase in waste recovery rates and a 2.2x boost in waste workers' income in 2023.
- Reko Mitra: A platform that ensures fair prices and better services for waste stakeholders, increasing their recyclable waste volume capacity by 60% and achieving a 95% acceptance rate by recyclers.
- Reko Pickup: This waste management service reduces by 30% and up to 100% waste in landfills in covered municipal areas by enabling routing and fleet optimization (electric bikes, electric trucks, and compactors).
- Reko Waste Station: A point system that increases sorting and recycling by communities and offers digital rewards.

[6] National Waste Management System (SIPSN) (2023) https://sipsn.menlhk.go.id/sipsn/
[7] World Bank (2024) https://datacatalog.worldbank.org/search/dataset/0039597
[8] World Bank (2021): Plastic Waste Discharges - From rivers and coastlines in Indonesia https://openknowledge.worldbank.org/bitstream/handle/10986/35607/Plastic%20Discharges%20Indonesia%20Study.pdf?sequence=4&isAllowed=y
[9] Ministry of National Development Planning (2024): Indonesia Circular Economy 2025-2045 Roadmap and National Action Plan

In 2023, Rekosistem embraced climate-friendly practices, using electric vehicles for waste pick-up, as well as waste sorting and recycling initiatives for households equipped with solar panels, contributing to a waste management system with minimal emissions.

Rekosistem supports major property developers in Indonesia, including Ciputra, Sinarmas, Agung Sedayu Group, Alam Sutera, as well as prominent corporations like Astra International, P&G, Nestle, Blu BCA Digital, Mandiri, and many others. Together with these companies, Rekosistem encourages the wider community to sort waste, aiming to reduce waste disposal directly into the surrounding environment.

In the same year, Rekosistem also actively contributed to the beach clean-up activity "Bersih Bersih Bajo" – part of East Ventures' initiative to reduce emission and restore the environment in Labuan Bajo island, East Nusa Tenggara.

Bersih Bersih Bajo, a collaborative initiative between East Ventures and Rekosistem, at the Komodo National Park, Labuan Bajo, Indonesia

East Ventures: Investing in a sustainable future for Indonesia and Southeast Asia

East Ventures takes an active role in shaping a more sustainable future. As a prominent Southeast Asian venture capital firm, East Ventures is going beyond funding innovative startups to actively drive positive change to the environment and society.

Leading by example to build a greener ecosystem

- Fostering climate tech ecosystem: East Ventures, together with Temasek Foundation, launched Indonesia's largest climate tech competition – Climate Impact Innovations Challenge (CIIC) in 2023, a multi-year initiative that continues in 2024. Through the program, the firm showcases and supports climate-tech startups in energy transition, sustainable agriculture and circular economy to pilot their solutions within Indonesia.
- Strategic partnerships: In collaboration with the Indonesian Chamber of Commerce, the firm launched "ECOVISEA", a free web-based GHG calculator that empowers businesses in the region to accurately measure their emissions, facilitating the transition to a low-carbon economy. Since its soft launch in February 2024, ECOVISEA has assisted 240+ companies to calculate ~500 billion kgCO2e of emissions.
- Hands-on actions: East Ventures contributes to reducing emissions and environmental restoration through initiatives, including mangrove planting in Komodo National Park and Semarang Mangrove Center in Indonesia. The firm also joins the "Tree Planting Joint Movement" with the President of the Republic of Indonesia and the Ministry of Environment and Forestry to help reduce air pollution in Jakarta.

East Ventures

About East Ventures

East Ventures is a pioneering and leading sector-agnostic venture capital firm. Founded in 2009, East Ventures has transformed into a holistic platform that provides multi-stage investment, from Seed to Growth stage investments, for over 300 tech companies across Southeast Asia.

As an early believer in the startup ecosystem in Indonesia and the most active investor in Southeast Asia, East Ventures is an early backer of prominent tech companies in the region, such as Tokopedia, Traveloka, Ruangguru, ShopBack, Waresix, Xendit, IDN Media, KoinWorks, Sociolla, Tech in Asia (acquired by SPH), Kudo (acquired by Grab), Loket (acquired by Gojek), and MokaPOS (acquired by Gojek).

East Ventures was named the most consistent top-performing VC fund globally by Preqin and the most active investor in SEA and Indonesia by various media. Moreover, East Ventures is Indonesia's first venture capital firm to sign the Principles of Responsible Investment (PRI), supported by the United Nations (UN). East Ventures is committed to achieving sustainable development and positively impacting society through its initiatives and ESG-embedded practices.

Read our Sustainability Report

Emerald

Indra Water: Decentralized water treatment & recycling – accelerating the transition to sustainable water management with electrochemistry

A case study of technological and environmental benefits of electro-chemical water treatment

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Industry vertical: Water & Wastewater
Location: Mumbai, India
Investment year: 2024

For more information:
www.indrawater.com

Overview

Indra is driving the world away from use of harmful chemicals and over reliance on chemical or biological systems towards a cleaner and energy efficient future. Founded in 2018 with support from Department of Science & Technology, Government of India, Indra's innovations in water & wastewater treatment technology have enabled unparalleled savings in cost, footprint and energy consumption. Indra's electrically driven solution has also achieved industry-first improvements in manufacturing and operations through standardization and productization in the water sector.

The Mission

Indra's mission is to drive the world's transition to sustainable water and energy management by making clean water more available, accessible and affordable for all.

The Challenge

Less than 1% of the water is reused globally and over 50% [1] of the globe is water stressed. About 74% [2] of the wastewater is discharged untreated into fresh water bodies in India alone, thereby severely polluting them. Indian Government's think tank, Niti Aayog estimates that more than 21 [3] major Indian cities will run out of ground water reserves within the next decade. The gap between demand and supply of water is set to double by 2030 resulting in a steep rise in fresh water cost across India. Rapid urbanization, industrialization and population growth have accelerated the exploitation of water resources and their pollution. New emerging pollutants pose a serious threat to the quality of water supplies as does the aging infrastructure which is vulnerable to both accidental and deliberate contamination. We are dealing with a 3-pronged problem statement - water scarcity, pollution and extreme inefficiencies in water treatment & distribution.

Indra team photograph

Indra Production and Assembly Centre

Existing water treatment solutions have the following challenges:

- Chemically or biologically driven solutions require large footprints and civil infrastructure. Large EPC style projects are resource intensive and are slow to build. They lack modularity and cannot easily fit into existing building schematics. Most establishments and buildings require additional space.
- Chemically or biologically driven solutions are also erratic and have over 40% downtime resulting in penalties, water pollution and lack of financial viability.
- Upgrading these solutions is challenging. Norms across the world have become 5 times stricter with an emphasis on minimum or zero liquid discharge thereby increasing reliance on membranes and evaporation-based solutions. Membranes are sensitive and expensive and designed for polishing applications only. Evaporation based technologies are very expensive.
- Challenges include low shock load handling capacity, poor nutrient removal capacity, very high sludge generation, poor water recovery, heavy reliance on manpower, frequent break-down among others.

Coloured wastewater (extreme left) from textile facility in Noida, India (garment washing) and treated water (extreme right) using Indra Electrox module (3 m3/hour) for process reuse

The Solution

Decentralization is the key to solving some of the most difficult challenges in the water sector. Indra is pioneering decentralized treatment of water at the point of source using electricity. It's electrochemical solution, is a major step in this direction ensuring availability of clean water for all through effective point of source treatment and maximum reuse of water thereby offsetting fresh water demand and reducing water pollution. Indra's Electrox technology is versatile and excels at treating industrial as well as domestic wastewater at up to 90% lower footprint compared to conventional chemical and biological solutions. The patented solution is chemical free, eco-friendly, saves 25% in energy consumption, reduces 70% solid waste or sludge and recovers up to 99% of the water for non-potable reuse applications. Its modularity allows easy capacity scale-up, effluent segregation and cost-effective customization.

Indra's novel broad-spectrum pollution removal technology can handle a wide variety of pollutants like oxygen demanding substances (COD, BOD), heavy metals, emulsified oils, fats, grease, nutrients (Nitrogen, ammonia, phosphates, reduced sulfur etc.), fluorides, bromides, radio-active waste, silica, hardness, petrochemical waste, pathogens, suspended and dissolved solids among others. This allows industrial, residential and commercial establishments to meet compliance, reduce water bills and ensure continuous availability of water thereby safe-guarding economic benefits and human health.

Indra Electrox Modules installed at a hotel in Mumbai, India, to treat laundry effluent (80 m3/day) and sewage (blackwater & greywater - 250 m3/day) for water recycling and non-potable reuse

Indra Operations Team

/ Indra Electrox Modules installed at a FMCG facility producing soaps, hygiene & personal care products in Medan, Indonesia, to treat oleochemicals wastewater (1650 m3/day)

Progress to Date

Indra has achieved significant recognition, being named one of the winners of the Urban Freshwater Challenge by Uplink (World Economic Forum) and HCL Technologies. Additionally, they were listed among the prestigious APAC Cleantech25 companies in the Asia-Pacific region for 2023. Indra was also shortlisted by Global Water Intelligence for the 'Breakthrough Technology Company of the Year' category in 2024. The company has already deployed assets with a treatment capacity exceeding 3.5 million litres per day and is on track to add an additional 4.5 million litres per day within the next 6 months. This expansion will serve prominent clients, including Unilever, Tata Steel, Taj Hotels (IHCL), Grasim (Aditya Birla Group), and NACL Industries, among others.

/ Indra Electrox Module installed at a textile facility in Noida, India, to treat garment washing and coloured wastewater (66 m3/day) for process reuse

Our Investment Rationale

We chose to invest in Indra due to their innovative approach to decentralized industrial wastewater treatment in high-impact regions like South and Southeast Asia. Their smart and compact electro-chemical modules have the potential to revolutionize wastewater management in these areas. This investment aligns with the United Nations' Sustainable Development Goals 6 and 12, which focus on 'Clean Water and Sanitation' and 'Responsible Consumption and Production.'

[1] https://www.wri.org/insights/highest-water-stressed-countries
[2] https://timesofindia.indiatimes.com/blogs/voices/cooperation-and-collaboration-across-all-sectors-needed-to-solve-global-freshwater-crisis/
[3] https://niua.in/c-cube/blog/content/impacts-changing-climate-water-resources-%E2%80%93-consequences-indian-cities#:~:text=A%20recent%20report%20by%20the,of%20India's%20population%20would%20be
[4] https://emerald.vc/about/

emerald

About Emerald

Emerald is a globally recognized venture capital firm founded in 2000, that manages and advises assets of over €1 billion from its offices in Zurich, Toronto and Singapore. The firm invests in start-ups that tackle big challenges in climate change and sustainability, with 4 current funds, hundreds of venture transactions and four third-party investment mandates, including loan guarantees to over 100 start-ups.

Eurazeo

Alt Mobility: Accelerating the transition to electric vehicle at scale through data-driven fleet management

A case study of the how providing superior lifecycle management and unlocking financing can catalyse the growth of electric vehicles and reduce pollution in major Indian cities.

Industry vertical: Electric Mobility
Location: Delhi, India
Investment year: 2023

For more information:
https://alt-mobility.com/

Overview

Alt Mobility is a technology-enabled electric vehicle (EV) leasing and lifecycle management platform. Alt offers electric vehicles for lease on a subscription basis to clients in logistics. The companies' data platform is designed to help users maximise the utilisation and value of their EV assets.

The Mission:

Alt Mobility aims to offer cost-effective, dependable, and emission-free transportation solutions to businesses. Switching from gasoline-powered vehicles to electric light commercial vehicles (LCV) reduces on average CO_2 by 10.35 tons throughout the vehicle lifespan- equivalent to planting 500 trees yearly. Alt Mobility's fleet will offset 6 MT of lifetime CO_2 by 2025.

The Challenge: High air pollution and heavy vehicle traffic clogs up transportation networks and the lungs of citizens

Of the 30 cities with the worst air pollution in the world, 21 of them are in India. The consequence – over 2 million annual deaths are caused by air pollution in India [1] and internal combustion engine (ICE) vehicles are responsible for 27% of this pollution [2]. Electric Vehicles (EVs) are an immediately available solution, but barriers to adoption such as the lack of affordable financing options, a shortage of charging infrastructure and concerns over the residual value of EVs hamper progress.

The Indian EV financing market is disjointed and inefficient, with high interest rates affecting Total Cost of Ownership (TCO). There are concerns over component performance in the long term, availability of maintenance support which further inhibit the greater adoption of EV by fleet operators.

Banks and lenders are reluctant to reduce interest rates given the lack of confidence of the residual value of an asset over the medium/long term, potential asset downtime brought about my patchy servicing and maintenance availability as well as a lack of affordable insurance for EVs.

EV fleet operators are benefiting from positive pressure from governmental policies that are paving the way for 80% of commercial 2-3 wheeled fleets to be electric by 2030 and enabling lower TCOs. But on the other hand, they are facing complexities around financing, deployment and maintenance of EV vehicles. This puts them in a difficult position: do they decide to purchase and deploy commercial EVs given that EVs bring much more complex operating requirements?

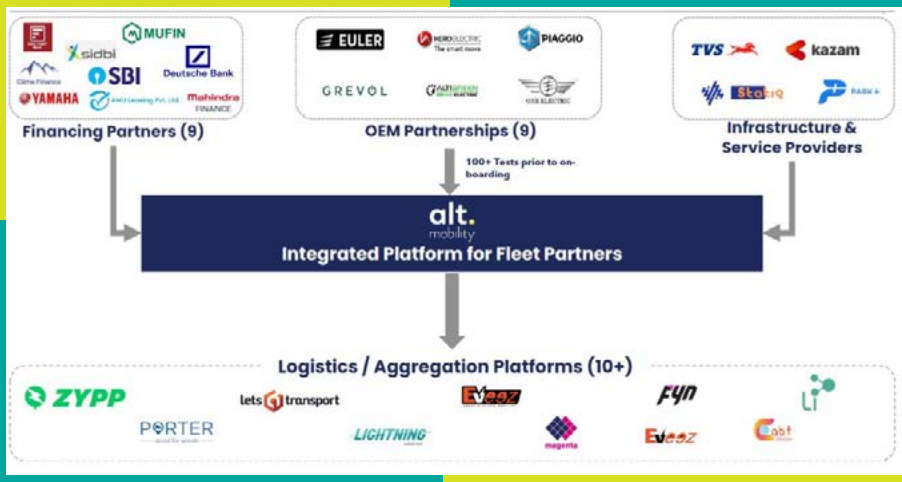

Figure 1. Alt. Mobility's Platform EV Flywheel

The Solution: Using data to unlock insights that drive profitable adoption of EV mobility at all levels of the value chain

Alt Mobility provides an integrated platform for fleets. They partner with lenders such as banks and Non-Banking Financial Institutions (NBFIs) to lease EVs which Alt Mobility procures from vehicle OEMs. These EV are leased to commercial fleet operators at a lower

Figure 2. Alt Mobility has leased >7,500 vehicles since inception in 2022 and runs logistics hubs that service and shelter EVs in a nascent ecosystem that still lacks infrastructure to support the EV transition at scale.

interest rate (Fleet Lease) than if these fleet operators purchased and financed the EV vehicles themselves. This also allows fleet operators to stay asset-light, while Alt Mobility serves as their EV asset manager over the EV lifecycle.

Bundled with their fleet management solution, Fleet OS, which thoroughly vets vehicles with a 100+ point checklist and supported by additional real-time fleet diagnostics, insurance management and roadside support, Alt Mobility ensures clients can operate well-maintained EV fleet at all times. Alt also aggregates EV vehicle insurance- which reduces the insurance premiums on the EV fleets and provides maintenance and charging services for a monthly fee.

Through acquiring data from close to 100 million kilometers travelled on vehicles that they have leased, Alt has also developed comprehensive proprietary data around asset utilisation, component performance,

Figure 3. Alt Mobility launched one of the earliest structured finance solutions to mobilise low-cost debt finance from both domestic and international financing institutions for the electrification of commercial fleets in India.

Figure 4. 2 and 3-wheelers are the lifeblood of passenger and commercial transportation and are primed to be transitioned into electric vehicles

which allows the company to be a valuable partner to OEMs, financiers and fleet operators – informing them on how EV assets should be sold, deployed, maintained and de-risked.

Ultimately, Alt Mobility's full-stack tech platform allows for the proliferation of commercial EVs at lower TCOs and operational costs for all. The company provides a win-win situation for all stakeholders involved: OEM, Fleet operators, lender partners. Alt is accelerating the flywheel of EV adoption in India while offsetting over 6MT in carbon emissions and reducing pollution across major Indian cities.

[1] Clean Air Fund
[2] Indian Express coverage of COP14 by the UNCCD

EURAZEO

About Eurazeo

With teams in Singapore, Seoul, Tokyo, Shanghai, Paris, London, Berlin and NY, Eurazeo is a global player in venture capital and private equity investment. Since 2017, Eurazeo has been recognized as one of the largest technology funds in Europe with €10 bn AUM and €35bn overall with additional activities in Private Equity, Private Debt, Infrastructure. Eurazeo is listed on Euronext.

Eurazeo is deploying in Asia Smart City Fund II which is dedicated to new technologies and digital innovation in sustainability, climate and decarbonization. The fund support companies in advanced mobility, logistics, new energy, circular economy, industry 4.0, property tech, construction tech. These are fast-growing solutions to major issues of our times: resource-scarcity, climate change and the imperative of renewable energy transition.

Fund II was closed in 2023 and the team is working with 25 corporate and institutional partners in Asia and Europe: automotive, mass transit, logistics hubs, energy groups, property groups, industrial conglomerates. Fund II is a US$ 400m investment program, invests in from Seed to Series B, with US$ 1-20 m checks. The team has completeds 18 investments to date and targets 25 investments. Fund II has obtained EU ESG certification from Luxflag and is Article 8+ SFDR.

www.eurazeo.com

TRIREC

Green Li-ion: Building sustainable battery supply chains with a cutting-edge battery rejuvenation technology

A case study of lithium-ion battery recycling to spur EV adoption

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Industry vertical: Mobility and Battery Recycling
Location: Singapore
Investment year: 2022 / 2023

For more information:
https://www.greenli-ion.com/

Overview

Founded in Singapore in 2020, Green Li-ion is a pioneering battery recycling technology company focused on creating sustainable solutions for battery production. Its patented technology converts unsorted battery waste into battery-grade materials for new cathodes and anodes, effectively addressing the challenges posed by the growing demand for EVs.

The Mission: Circular EV supply chains

Green Li-ion aims to establish a circular economy for lithium-ion batteries. The company is dedicated to transforming end-of-life batteries into valuable materials for new battery production, thereby minimizing waste and reducing reliance on raw material mining with a focus in Asia.

The Challenge: Complex supply chains with inefficient technologies

As the demand for electric vehicles continues to grow, the supply of critical minerals such as lithium, cobalt, and nickel is becoming increasingly strained. This situation poses a significant challenge for the EV industry, as these materials are essential for battery production. Lithium production levels need to increase by 270% by 2030 to meet forecast demand from the EV battery sector. Additionally, geopolitical tensions and trade conflicts can disrupt supply chains, raising concerns about the security and reliability of sourcing these minerals. As countries navigate the complexities of global trade, ensuring a stable supply of critical materials is more important than ever.

At the same time, the recycling of lithium-ion batteries presents its own set of challenges. Current recycling processes are often long, costly, and carbon-intensive, primarily due to large, centralized plants and diverse recycling methods. This complexity makes it difficult to efficiently recover valuable materials from spent batteries. Green Li-ion is focused on addressing these issues by developing on-site affordable recycling technologies.

The Solution: Green, profitable and modular on-site recycling

Green Li-ion offers modular, on-site battery recycling plants to clients through long-term licensing agreements that include profit-sharing or tolling arrangements. Their patented Green HydroRejuvenation technology employs a proprietary four-step process that transforms unsorted black mass directly into precursor cathode material (pCAM), effectively bypassing the traditional intermediate steps of converting materials into battery metal salts. This streamlined approach enhances the economic viability of recycling while providing a sustainable alternative to existing technologies, facilitating easier integration into business operations.

Our decision to invest in Green Li-ion was driven by the growing interest in battery recycling and the company's advanced technology, which positions it ahead of competitors. The battery recycling sector has seen increased activity from investors, corporations, and regulatory bodies, alongside inflated commodity prices (driven by scarcity) that incentivize recycling efforts. Although the short-term outlook for the industry may be challenging due to a slowdown in EV demand, trends of electrification and need for critical minerals

remains strong. Green Li-ion distinguishes itself with its innovative closed loop system, co-precipitation technique, and agnostic approach to black mass inputs. Unlike many existing technologies that operate at a smaller scale, Green Li-ion's solutions are designed for flexibility and scalability, enabling them to meet the growing demands of the industry effectively.

Progress to Date: Front-runner with Proven Technology
Green Li-ion has made significant advancements in the battery recycling sector, achieving recovery rates of up to 95% and producing battery-grade materials with over 99% purity at commercial scale. The company successfully commissioned and began operating one of the world's first battery rejuvenation plants. It has attracted substantial interest on both commercial and investment fronts with a strong customer pipeline across South Korea, Eastern Europe, and Japan, and an investor base including energy and battery players like Twin Tower Ventures, EDP Ventures, Equinor, Banpu, TES and more.

About TRIREC

TRIREC is a Singapore-based venture capital firm dedicated to addressing global decarbonization challenges. Founded in 2015, TRIREC has successfully managed two funds and is currently headed to First Close for its 3rd vintage in 2024. The firm focuses on investing in early-stage companies (pre-Series A and Series A) that enable decarbonization and climate transition across five key sectors: electricity and power generation, industries, mobility, buildings, and food and agriculture.

TRIREC has invested in 23 companies, with 3 of its portfolio companies achieving unicorn status, showcasing its strategic approach and success in the climate tech sector. By investing upstream, midstream, and downstream, TRIREC contributes as an ecosystem builder for deploying climate solutions. It works closely with portfolio companies to grow and scale their operations, partnering with sector-specific expertise across the verticals.

In 2023, TRIREC launched its third fund, structured as an Article 8 fund under the EU Sustainable Finance Disclosure Regulation (SFDR) to advance the transformation to a low-carbon economy.

Wavemaker Impact

Rize: Decarbonising Rice Cultivation While Improving Farmer Yields

A case study on implementing sustainable farming practices

Industry vertical: Agritech
Location: Indonesia, Vietnam
Investment year: 2023

For more information:
https://rize.farm

Overview

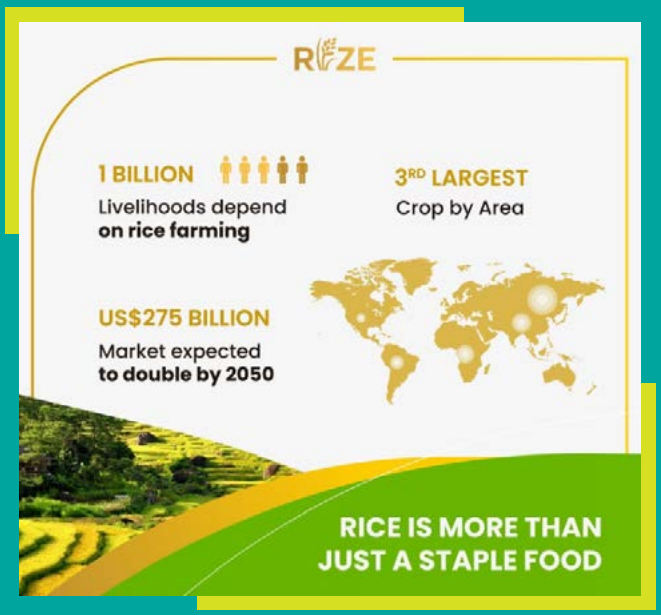
Founded in 2023, Rize is an agri-tech startup formed through a joint venture between investors Temasek, Wavemaker Impact, Breakthrough Energy Ventures and GenZero to decarbonise rice cultivation in Asia. Starting in Vietnam and Indonesia, Rize's mission is to transform rice into a sustainable, lower emission food source while enhancing the livelihoods of farmers. To do so, Rize is building a tech platform to drive the adoption of sustainable cultivation techniques, with the goal of eliminating 0.5 gigatonnes of carbon emission units by 2040.

The Impact of Rice: An emissions- and water-intensive staple food crop

Rice is a staple food crop for half the world's (growing) population as over 4 billion people depend on it almost every day. Rice is grown by more farmers than any other crop, covering around 11% of the world's arable land. At the same time, rice cultivation poses significant environmental challenges due to its contributions to greenhouse gas emissions and intensive use of water. Rice is responsible for 12% of global methane emissions, with methane being 30 times more potent than CO_2 in terms of climate warming potential. As a bowl of rice requires over 200 litres of fresh water to produce, total rice cultivation is responsible for over a third of the world's irrigation water.

With the world population depending on rice expected to grow, this immense issue will only become bigger. These factors highlight the pressing need for more sustainable farming practices to address heavy emissions and water usage.

Rize's solutions being adopted by rice farmers in Karawang, Indonesia



Rice Cultivation: The Impact on People and Planet

The Challenge for Farmers: Lacking organised credit to implement sustainable practices

At the start of the rice growing season, smallholder farmers typically incur high borrowing costs to finance the necessary inputs. This vulnerability is further exacerbated by the increasing cost of these inputs and frequency of crop failures due to climate change. Additionally, agricultural practices employed by the farmers often rely on traditional methods, dating back to times where only limited data-based agronomy was used. While farmers are aware of newer ways to farm rice, many lack the resources – financial and operational – as well as knowledge to make the change happen successfully.

This situation highlights the need to support farmers in transitioning to more efficient and sustainable agricultural practices, to secure their livelihoods against the backdrop of evolving economic and climate challenges.

The Solution: A tech platform that leverages the farmer last mile to critical third parties

By tackling market fragmentation and inefficiencies such as low yields, overuse of inputs, outdated farming practices and high borrowing costs, Rize incentivises farmers to adopt lower carbon, higher yielding cultivation practices.

Rize has built a technology platform that identifies and implements the most effective strategies to reduce greenhouse gas emissions in rice cultivation, and the right economic incentives to drive the adoption of sustainable cultivation techniques. Over the past 1.5 years of existence, Rize has been able to test and offer solutions including Alternative Wetting and Drying (AWD), efficient agriculture inputs, biologicals and nitrogen-fixing to name a few. Thanks to the adoption of these practices, emissions have been lowered by up to 40%, water inputs have reduced by up to 20% and most importantly, farmers' incomes have increased by up to 30% over a base of US$1,200-2,000 per year.

Lower emissions by up to 40%

Improve farmer income by up to 30%

Save water inputs by up to 20%

AWD reduces water demand for irrigation and greenhouse gas emissions without reducing crop yields.

Today, Rize has successfully serviced more than 7,500 hectares of rice paddy with farmers continuously signing up for support into subsequent seasons. Over the next two years, Rize will be expanding its platform to service up to 100,000 hectares while cooperating with the right partners. This growth will facilitate even broader adoption of sustainable farming techniques across the region, driving further decarbonisation and enhancing the economic viability of smallholder farms.

CEO Dhruv Sawhney (first from the left) and the Rize team with Indonesian Rice Paddy Farmers.

About Wavemaker Impact

Wavemaker Impact is Southeast Asia's first climate-tech venture builder VC firm. Wavemaker Impact's mission is to build a portfolio of companies that can abate 10% of the global carbon budget (5 GT). To achieve this, we partner with experienced entrepreneurs to co-found and fund 100x100 businesses - startups with the ability to abate 100 million tons of CO_2e and achieve $100 million in revenue on an annual basis at scale.

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