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ACEBA
ASEAN Circular Economy Business Alliance

CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA

AirX Carbon

Ho Chi Minh City, Vietnam

Manufacturing, Logistics

airxcarbon.com

Analysis period: 2019-2026

Turning Agricultural By-products into Pallets and Packaging

Business Spotlight

AirX Carbon is a Vietnamese start-up pioneering the production of bio-composites from the residues of agriculture and agro-processing sectors. By transforming these waste streams into versatile and customisable biomaterials, AirX Carbon is advancing agriculture-to-industry circularity and offering an alternative for fossil-based plastics. The company's two flagship product lines are:

- NetZero Pallets, bio-composite pallets for logistics and warehousing manufactured from coconut husks-based bio-composites
- Bioplastic, made from coffee waste, cocoa husks, coconut fibres and other agricultural by-products.

Using agricultural byproducts diverts them from waste disposal or incineration, contributes to reducing deforestation, lowers the carbon footprint, of their product applications and offers a climate-positive alternative for diverse industrial applications.

By directly integrating Vietnam's agricultural residues into high-performance bio-composites, AirX Carbon is generating new economic value for rural supply chains while reducing environmental impact. The company's innovations in bio-composite pallets lower shipping weight, while their nestable space-saving design enhances worker safety and supports sustainability across multiple industries, including warehousing and logistics. AirX Carbon positions itself as an enabler for the adoption of a circular economy in Southeast Asia, and it delivers climate positive solutions that combine environmental responsibility with versatility and quality on an industrial scale.

Keywords

Agricultural waste, Pallet production, Bio-composites

Innovation

Product/service design, Manufacturing, End of life management, Resource circularity

Analysis of AirX Carbon

Context and baseline

Vietnam generates over 150 million tonnes of biomass residues from agriculture and agri-processing annually, much of which is burned or dumped in landfills, contributing to air pollution and environmental degradation while wasting valuable biomass resources.[1] As the world's second-largest coffee producer, Vietnam produces around 1.4 million tonnes of coffee husk waste each year, typically disposed of or inefficiently burned.[2] As the world's sixth-largest coconut producer, Vietnam generates approximately 1.8 million tonnes of processing waste (husks and fibres), much of which is discarded, burned, or left to decompose along waterways in the Mekong Delta.[3] These untapped biomass residues represent both an environmental challenge and an untapped economic and innovation opportunity.

AirX Carbon was founded by Mr Thanh Le, a chemical engineer who, after studying sustainability abroad in Canada and Brazil, recognised the global demand for eco-friendly materials. Upon returning to Vietnam, he observed the country's pervasive waste problem and decided to launch a start-up dedicated to transforming organic waste into biomaterials. Operating at the intersection of material science and circular design and manufacturing, AirX Carbon integrates R&D, proprietary bio-processing, and scalable production to deliver drop-in, climate-positive alternatives to traditional wood and plastics use in packaging, warehousing and logistics. The company headquarter is situated in Ho Chi Minh City, and the affiliated contract manufacturing facility is located in the adjacent Binh Duong Province. The company's products are used in warehouse storage; transportation; and export across industries, including logistics, chemicals, textiles, oil and gas, food and beverage, electronics, packaging, healthcare, furniture and frozen-food supply chains.

Innovation

AirX Carbon is pioneering the conversion of agricultural residues into high-quality industrial materials via clean technology and a patented bio-based binder. The company's flagship innovations are the NetZero Pallet along with natural fibre-reinforced plastic materials for packaging and other applications, composed of 95% agricultural waste (coconut, coffee, and cocoa husks plus other residues). The design benefits are that these pallets are lightweight, nestable for warehouse space savings, safer for workers, and optimised for logistics efficiency.

The AirX Carbon NetZero Pallet is a new generation of durable, industrial-grade composite pallets for warehousing and logistics. They are engineered from coconut husks mixed with wood fibres reclaimed from end-of-life pallets, using a patented plant-derived binder that enhances cohesion, stability, and environmental performance while avoiding the emission of volatile organic compounds (VOCs). The coconut husks are processed into monomers that form complex polyphenolic polymers. These polymers, combined with coconut humus and plant-based additives, create a robust composite structure. The performance attributes of NetZero pallets are high load-bearing capacity, dimensional stability, and natural resistance to moisture, mould, fire, and termites, thus meeting or surpassing specifications for export-grade wooden and plastic pallets. At the end of their useful life these bio-composite pallets are fully recyclable.

The AirX Carbon pallets are manufactured at a part-owned affiliated state-of-the-art pallet manufacturing facility in Binh Duong Province with a total production capacity of 1.5 million pallets annually. This arrangement allows AirX Carbon to scale up rapidly as demand for eco-pallets increases and bio-composite production expands. The superior material qualities are designed and manufactured into lightweight, rigid and nestable pallets that support dynamic loads of 2.5 tonnes, and static loads of 8 tonnes, reducing warehouse footprint and shipping costs. The strong structural integrity of the pallets absorbs impacts and vibrations, thus improving workplace safety and product protection during transit. The pallets are 20–50% cheaper than conventional pallets and are compliant with ISPM 15 (International Standards for Phytosanitary Measures No. 15) for international export.

1 https://van.nongnghiepmoitruong.vn/agricultural-by-products-pollute-the-environment-waste-trillions-each-year-d758746.html

2 Flammini, A., Brundin, E., Grill, R., & Zellweger, H. (2020). Supply Chain Uncertainties of Small-Scale Coffee Husk-Biochar Production for Activated Carbon in Vietnam. Sustainability, 12(19), 8069. https://doi.org/10.3390/su12198069

3 Hien Luu, Canh Ta, Kieu Ha and Kieu Ton. Economics and market potential of value-added products from coconut processing waste. Int. J. Agric. Nutr. 2025;7(5):95-98. https://www.doi.org/10.33545/26646064.2025.v7.i5b.561

Beyond pallets, AirX Carbon has innovated natural fibre reinforced composite materials, with recycled plastic hybrid polymer matrices. This innovation produces polypropylene-reinforced and -hybridised bio-composites with spent coffee grounds, cocoa husks, and/or other biomass waste. Integrated into bio-based or hybrid polymer matrices, these materials reduce dependency on the fossil fuels use for producing plastics while maintaining commercial-grade performance. These materials merge performance, aesthetics, and sustainability, redefining what renewable feedstocks can achieve. AirX bio-composites are compatible for use in established plastics manufacturing technologies, such as injection moulding, extrusion, and compression moulding equipment, thus eliminating the need for costly manufacturing infrastructure changes. The bio-composites are suited for manufacturing:

- reusable and single-use consumer goods
- household and lifestyle products
- packaging components
- electronics housings and interior parts
- sustainable merchandising and branding items.

Circular Economy impact

AirX Carbon contributes to the low carbon and circular economy transition through the recovery and useful application of previously discarded agro-residues, organic waste and plastics, which demonstrates resource circularity. The coconut husks, coffee waste, and cocoa residues are being repurposed into durable composite pallets and products, bringing the previously discarded bio-residues into productive use.

An AirX pallet requires 33 kg of biomass waste, and thus diverts this waste from being landfilled or incinerated, and represents a substitute for either wood or virgin plastic use. A life-cycle assessment (LCA) has confirmed the associated greenhouse gas (GHG) emissions reduction of 41 kg/pallet when substituting a wooden pallet, to 62 kg/pallet when substituting for a plastic pallet. Eliminating the use of wood for pallet production reduces deforestation and preserves the carbon sequestration of trees during their lifespan. Upon reaching an annual production of 1.5 million pallets, 54,000 tonnes of biomass will have been recovered into pallets, thus averting between 67,000 and 102,500 tonnes of GHGs, depending on whether these substitute plastic or wooden pallets. AirX Carbon estimates potential to scaling up to 60 million pallets per year, and could then potentially recover 2 million tonnes of agro-residues, thus directly reducing from 2.5 to 3.7 million tonnes of GHG emissions.

AirX Carbon also transforms residues into bio-composite plastics and granules, suited for subsequent application in high-value applications for packaging, automotive, and consumer goods.

The production of pallets in a state-of-the-art industrial facility ensures minimal waste generation. By sourcing agro-residues as feedstock, AirX targets non-edible agro-residues in order to avoid competition for food, and eliminates genetically modified crops. NetZero Pallets and bio-composite plastic products both address environmental and social concerns by reducing deforestation, supporting farmer livelihoods, and reducing Scope 3 emission, and thus aligning with corporate sustainability frameworks and environment, social and governance (ESG) indicators for product users.

Business and market impact

AirX Carbon's NetZero Pallets and bio-composite plastics deliver a commercially viable, climate-positive solution that combines sustainability with profitability. By ensuring economic viability, the company provides a win-win model for businesses seeking eco-friendly materials without compromising their bottom line. Market readiness and integration are achieved by maintaining conventional pallet specifications for smooth adoption into existing logistics systems without requiring changes in handling or equipment. The NetZero Pallets are 20–50% cheaper than conventional pallets, and they offer superior durability, nestable design for 70% storage space savings, and export compliance. The revenue potential of monthly sales of 125,000 pallets costing approximately $10 each generates USD 1.25 million, demonstrating strong market traction and scalability.

The product differs from common pallets available on the market by its unique features of functional excellence and operational efficiency. The functional excellence of the biodegradability and chemical-resistance of AirX pallets conforms with stringent safety standards across industries. Their bio-fibre content enhances stiffness, reduces density, and creates distinctive natural textures, delivering a premium sustainable look favoured by consumer brands. The operational efficiency of lightweight design contributes to reducing freight energy consumption, while smooth, moisture-resistant surfaces protect the stored goods and extend pallet lifespan.

Stakeholders

AirX Carbon's NetZero Pallets and bio-composite plastic solutions recover and usefully apply underutilised biomass residues such as coconut husk, spent coffee grounds, cocoa husks, and waste pallet wood, transforming them into valuable, durable and reusable materials. With 15 employees, AirX Carbon leverages AI-enabled business processes to maximise productivity, while rural networks expand job opportunities in the collecting, sorting, and processing of biomass waste. Pallet designs prevent tipping and collisions, reducing workplace accidents and protecting goods, workers and communities. The rural aggregators and local cooperatives are empowered to standardise the feedstock, ensuring consistent raw material quality and building resilient supply chain for waste biomass.

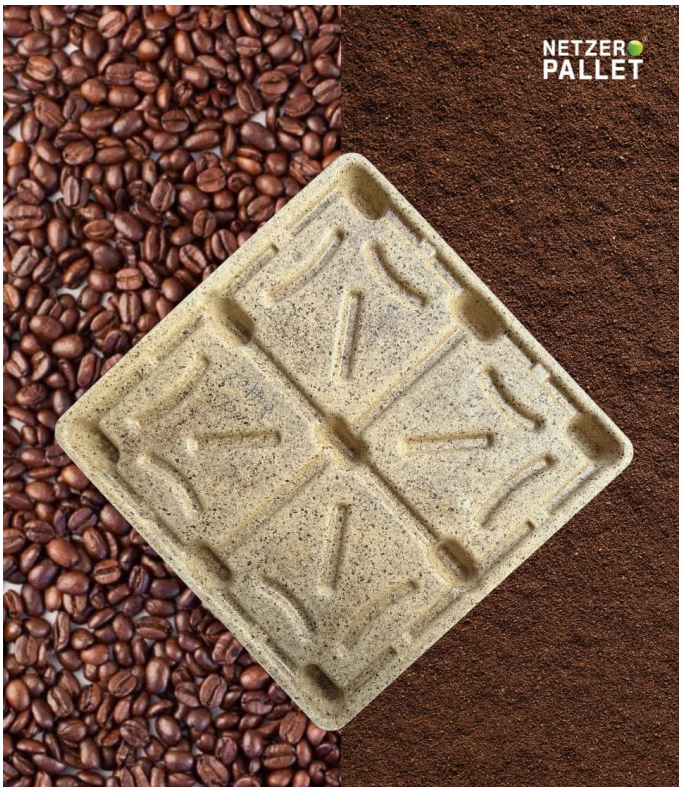
AirX Carbon assists businesses in obtaining food safety certifications, fire-resistant compliance and export approvals, strengthening brand reputation and market access. The main corporate and industry partners are foreign direct invested (FDI) companies. NetZero Pallets are trusted by FDI firms for export packaging to Europe and the USA, meeting phytosanitary and other compliances. Current users include global brands in the soft drinks, fast moving consumer goods and sports goods sectors. The strategic partnership of the EU-SWITCH Asia Cocoa Project supported extending the networks to include NPC Korea, Hyosung, Olam International, and Pakko Australia. The innovations of AirX Carbon have further been recognised by the Australian Department of Foreign Affairs and Trade (DFAT), P4G Global Partnerships, Climate Launchpad of Hanns Seidel Foundation and supported by UNDP, EU-SWITCH Asia, GIZ, Action on Poverty, and Helvetas.

Implementation

Industries avoid risks by adopting a product that performs as well as or better than existing pallets and packaging solutions, with no need for costly testing or changes in processes and equipment. NetZero Pallet is a "drop-in" solution, that seamlessly integrates into existing supply chains without requiring equipment upgrades or changes. This practicality ensures that industries can adopt circular innovation without disruption, exactly the kind of measurable, scalable solution industries are looking for.

Rather than owning factories outright, AirX Carbon has invested in the shares of partner manufacturing facilities, installing proprietary machines and moulds to provide 80% of demand. This approach has accelerated commercialisation and avoided scaling bottlenecks. In-house production ensures strict quality control and rapid R&D, including advanced material testing. The consistent sizing maximises warehouse space, supports efficient stacking, and ensures compatibility with shelving systems.

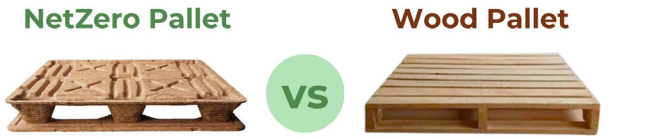
AirX Carbon seeks market extension through partnerships with aligned producers in different geographical locations to replicate their circular solution, making it possible to scale impact while maintaining focus. Expansion into Indonesia, India, The Philippines, Australia, and Korea takes advantage of locally-available agro-residues, and replicating the circular products for rapid scaling.



Takeaways

AirX Carbon exemplifies climate-driven material innovation by transforming biomass waste into valuable products, converting coconut husks, coffee waste, and cocoa residues into industrial-grade, climate-positive materials or NetZero pallets and bio-composite plastics ready for immediate adoption in global supply chains. By embedding agricultural residues into durable products, AirX Carbon closes the loop and thereby reducing waste, preventing biomass burning, and promoting resource efficiency across borders. NetZero Pallets and bio-composite plastics are designed as drop-in solutions that fit directly into an existing manufacturing process or supply chain, requiring no equipment upgrades or changes. Scalability and rapid integration into logistics and manufacturing systems are thus ensured.

AirX Carbon enables industries to reduce emissions while maintaining operational continuity and aligning with corporate sustainability goals. Leveraging abundance of agricultural residues and local innovation, AirX Carbon demonstrates how regional biomass streams can be scaled into global solutions, reshaping industries from agriculture to packaging, textiles, chemicals, and logistics. When businesses and consumers choose green materials, they collectively drive a more sustainable future supporting farmers, protecting ecosystems, and advancing climate resilience for generations to come.



$7	Price	$10
Exempt	Heat treatment & fumigation	Required
≤ 8 ton	Static load	≤ 4 ton
≤2.5 ton	Dynamic load	≤1.5 ton
Can be washed	Water	Creates mold and rot
From agri-wastes	Deforestation	Yes
-50 150 oC	Fridge and open environments	-20~100 oC

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Acknowledgements

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The business case was produced by Sri Shalini Sathyanarayanan (circular economy expert) and reviewed by Rene Van Berkel and Thomas Thomas (regional experts and ACEBA co-convenors) on the basis of information provided and validated by AirX Carbon, Vietnam.

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