


CARBON IMPACT REPORT 2023

How Intelligent Cube Storage Aligns Business and Sustainability Goals

 ATTABOTICS

“In the face of impending catastrophe, whose warning signs are already unbearably disastrous, weak action is unwise. No action is dangerous.”

- William Ruto, President of Kenya, [UN Climate Change Conference 2022](#)

The effects of worsening natural disasters and rising sea levels give us firsthand reasons to believe climate change matters. Carbon impact, or the amount of greenhouse gases released into the air by a given activity, contributes to climate change. What businesses can do now to lower their carbon impact will help all of us in the long run.

The good news is that more sustainable solutions can also align with business goals. Efficient and cost-reductive automated storage and retrieval systems (AS/RS) can also be more environmentally-friendly than conventional warehousing solutions.

This white paper will lay the groundwork for understanding carbon impact and why businesses should pay attention. We'll break down how forward-thinking design in Attabotics' intelligent cube storage can lower a company's carbon impact and deliver a more efficient solution without compromising its bottom line.

CARBON IMPACT BASICS

A meaningful discussion about carbon impact starts with a common understanding of the basic terms. Carbon impact, also known as carbon footprint, is the amount of greenhouse gas (GHG) emissions released into the atmosphere. GHGs include several types of gases, but carbon dioxide (CO₂) is the most referenced. When GHGs trap and release heat, they contribute to warming the planet, causing the climate to change.^{1,2}

Experts categorize the sources of carbon impact into three scopes (Table 1). Scope one includes emissions a company can directly control like the GHGs released by a truck fleet or heating a facility. Companies have less control over scope two emissions, the GHGs released by the power plant that generates the electricity they consume. Scope three, or value-chain emissions, covers all upstream and downstream activity from producing a product or service. This report focuses on scope one emissions.^{2,3,7}

SCOPE #	EMISSION TYPE	DESCRIPTION	INDUSTRY EXAMPLES
1	Direct	GHG emissions from manufacturing a product or completing a service	<ul style="list-style-type: none">• Truck fleet• Building maintenance• Production
2	Indirect	GHG emissions from the power source used in manufacturing	<ul style="list-style-type: none">• Local electrical power plant
3	Indirect	GHGs released during upstream and downstream activity	<ul style="list-style-type: none">• Mining raw materials• Supply chains• Disposing of used products

WHY CARBON IMPACT MATTERS ON A BUSINESS LEVEL

"The question is not 'sustainable' vs. 'non-sustainable.' Sustainability is the only option"

- **SCOTT THOMSON**
CORPORATE DEVELOPMENT SENIOR ANALYST, ATTABOTICS



The physical impact of climate change is well-known, as communities worldwide experience the effects of rising sea levels and more frequent and intense storms. Less newsworthy but equally serious consequences, such as ocean acidification, mass species extinction, food scarcity, and greater economic inequality, also hang in the balance.¹

Curbing climate change through more sustainable practices is becoming a necessity. Attabotics' Corporate Development Senior Analyst Scott Thomson says it well: "The question is not 'sustainable' vs. 'non-sustainable.' Sustainability is the only option."

Considering more sustainable business solutions is not only a pressing issue but also has tangible benefits for companies (Figure 1). According to a [2020 survey by Deloitte](#), 65% of respondents expect executives to take action on climate change, with reducing carbon impact a top global priority. Younger generations, who are increasing in buying power, care even more than previous generations. Brand value, competitive advantage, and even talent attraction can improve with investments in sustainability.^{4,5,6,7}

A push towards sustainability is also becoming normative. According to a [recent survey by Deloitte and the Materials Handling Industry \(MHI\)](#) of 2,000 supply chain professionals, 48% of respondents said they felt increased

influence to make their supply chain (including warehouses) more sustainable. Key stakeholders, like regulators, industry groups, and consumers, demand sustainability.⁷

Tax incentives and government subsidies can often sweeten efforts to curb rising GHG emissions. On an even more practical level, sustainable practices can reduce unnecessary expenditures and improve cost efficiency. And a better bottom line means better business.^{5,8}

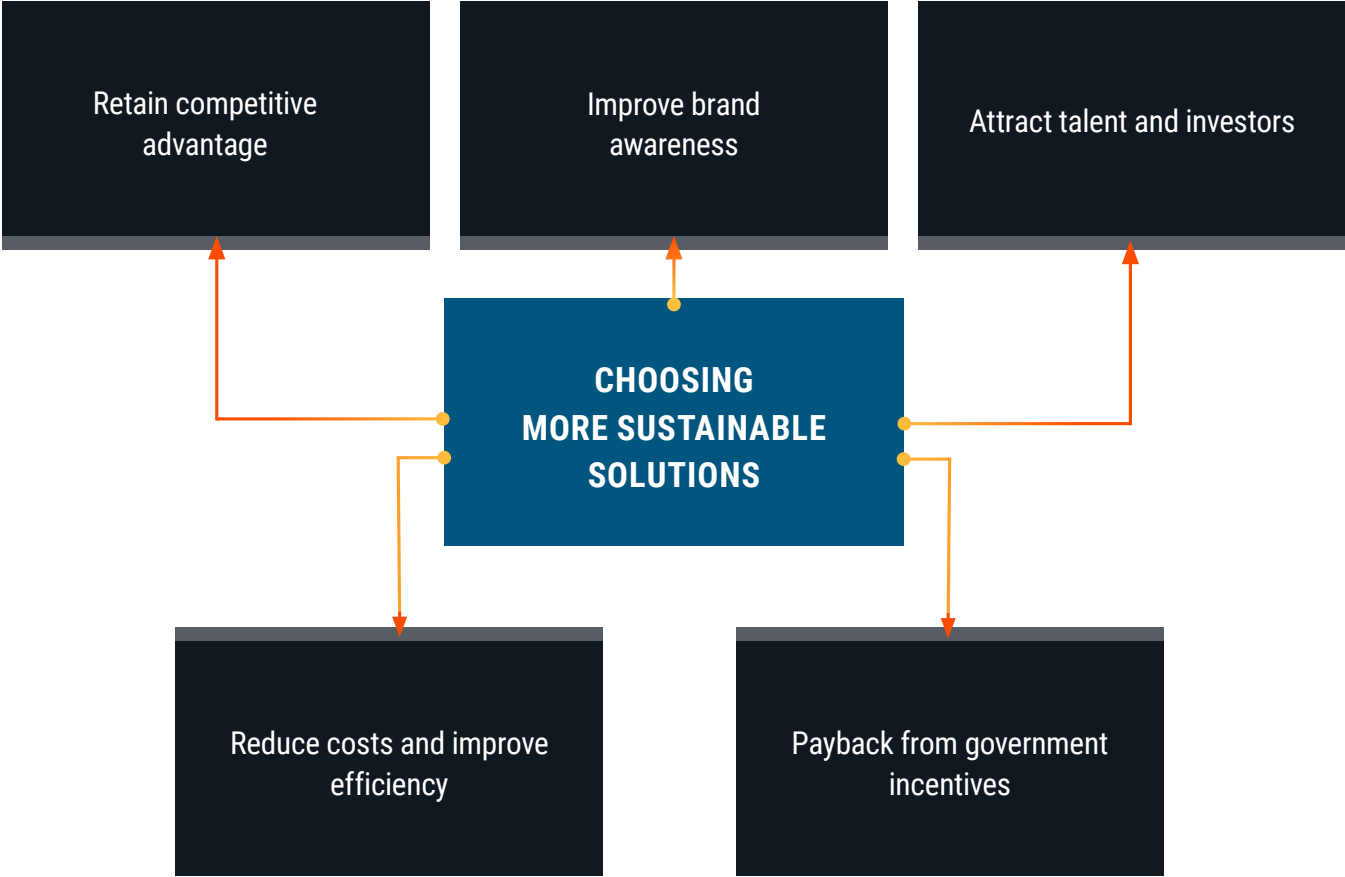


Figure 1. Business benefits for choosing sustainable solutions

INTELLIGENT CUBE STORAGE:

A MORE SUSTAINABLE STEP FORWARD

Choosing AS/RS, such as Attabotics' intelligent cube storage, over conventional warehouse systems is a step towards a more sustainable (and efficient) business practice. According to Julien Seret, Attabotics' Vice President of Products, "There are few occasions in life where reduction of cost and carbon impact are aligned."

Attabotics' intelligent cube storage system sits at the intersection between cost savings and sustainability. Although Attabotics' founder initially designed the system for efficiency, it is also more environmentally friendly than a conventional warehousing system. Attabotics' future-thinking design aligns naturally with future-friendly operations.

According to data from the Environmental Protection Agency (EPA), transportation and electricity production were the top [two sources of GHG emissions](#) in the United States in 2020. Solutions that reduce the need for truck drivers or warehouse workers to drive long distances and can fit into buildings with less space to heat and cool have a smaller carbon impact than traditional systems.

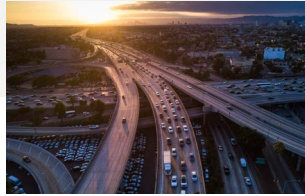
And this is where AS/RS, and especially Attabotics cube storage, rivals conventional warehouses. A review conducted by Attabotics and a third-party engineering firm for the Sustainable Development Technology Canada project found an average-sized Attabotics' intelligent cube storage can have an emission reduction factor of 268.219 tons of carbon dioxide per year. This is the same as taking 53 2010 Toyota Camrys off the roads in the United States.^{9,11}

FEATURE	ATTABOTICS	CONVENTIONAL WAREHOUSE
Physical footprint	15% of a typical warehouse ⁹	Range between hundreds of thousands to over a million square feet
Proximity to customers	Near urban centers	Far from urban centers
Facility expenses	A compact system means less space to heat/cool	Heat/cool an enormous building
Worker commute	Public transit may be available	No access to public transit. Workers drive personal vehicles to facilities
Last-mile delivery	Fewer miles spent getting products to customers to customers	Large fleets of trucks move products into cities
Packaging	Reusable bins protect products. Options for biodegradable or reusable bags as the warehouse is located at the last mile level	Cardboard packaging protects products as they move through parcel/postal sorting systems

The top ways Attabotics' intelligent cube storage solution reduces carbon impact are:



01
Product Transportation



02
Workforce transportation



03
Packaging



04
Facility electricity

We'll dive into each of these reasons below.

Reducing the carbon impact of transportation

Transportation, the top contributor in the US to carbon impact, also impacts global emissions. According to the United Nations, transportation includes nearly a [quarter of the worldwide carbon impact](#). Emissions from heavy-duty trucks are a huge factor. The International Energy Agency has found that [CO₂ tailpipe emissions](#) have increased by an average of 2.2% annually since 2000, due mainly (80%) to more trucks on the road. This steady upward creep shows no sign of stopping and is an increasingly important concern.^{12,13}

Improving operational efficiency, such as investing in AS/RS, helps companies optimize their transportation strategy to reduce their carbon impact (Figure 2).¹³



Figure 2. Reducing the carbon impact of transportation

More sustainable solutions put products closer to customers



Imagine driving past the rows of fulfillment centers that line the freeway connecting the US cities of Milwaukee and Chicago. The fulfillment centers may not initially look large from the freeway while driving at 70 miles/hour. Still, if you were to catch a glimpse of a person entering the facility, you'd see how the structure dwarfs the person. These enormous buildings can sometimes reach over a million square feet, [the same as ten city blocks](#).¹⁴

Now imagine the number of trucks needed to bring products from these fulfillment centers to customers in major cities. It's a lot of tailpipe emissions.

What if we could put products closer to urban centers?

That's where high-density AS/RS come in handy. At only 15% of the square footage of a conventional warehouse, companies can incorporate Attabotics' intelligent cube storage into existing facilities close to urban centers. And it doesn't require hefty renovations, such as slab remediation.

Storing products closer to customers dramatically reduces emissions from last-mile delivery. According to a [model built by Accenture and Frontier Economics](#), the supply chain made possible by local fulfillment centers could lower emissions from last-mile delivery between 17% and 26% through 2025.¹⁵

Local fulfillment centers help lower emissions by reducing the number of trucks and passenger vehicles on the road. Since AS/RS can improve last-mile delivery to meet customer expectations, more people may choose to shop from home instead of taking their personal vehicle to the store.

Even though eCommerce growth is not skyrocketing as it did during the beginning of the pandemic, its continued growth shows that it is here to stay.¹⁶ [Faster last-mile delivery](#) helps businesses keep promises to customers by getting products quickly from warehouses to doorsteps as customers continue to have high expectations for same or next day delivery.

Attabotics' intelligent cube storage differs from other AS/RS because it doesn't need to process by batch. Since robots pick orders as they are received, they have a flexible cut-off time and can process orders until the very last minute. It's another efficiency businesses can tap into to get products more quickly to customers.

Warehouses nearer public transportation = fewer commuters on the road

Fulfillment centers need space, so they are often outside urban areas and unreachable by public transportation. This means that the large crews employed by fulfillment centers must commute to work, adding vehicles to the road. And cars, especially when driven by a single person, have the [second highest carbon footprint](#) of any other kind of transportation.¹⁷

In contrast, companies can put high-density AS/RS near workers' homes and along public transportation lines. Workers drive fewer miles to work or can take buses and trains, which have a much [lower carbon impact](#) than cars.¹⁷

Forward-thinking design helps reduce carbon impact



Unlike conventional warehousing solutions, Attabotics' intelligent cube storage doesn't rely on cardboard packaging. Eliminating cardboard is a major factor in lowering a company's carbon impact. The instant visibility involved in managing products can also counteract the safety stock that smaller facilities often invest in—reducing expensive and unsustainable waste from incorrect predictions.

Workers at conventional warehouses package products in cardboard for protection during their long journey from fulfillment centers to customers' homes. Cardboard protects products from being damaged by the high-speed sortation systems used by standard parcel post networks.

Although cardboard packaging keeps products safe during transit, it is not so good for the environment. According to research recently published by Statista Research Department, the global production of cardboard was about [66 million tons in 2020](#), estimated to increase in the following years. Recycling cardboard also has its own carbon impact, and cardboard has a limited number of recycled lives before it must be thrown away.^{18,19}

Unlike conventional warehouses, Attabotics' intelligent cube storage [does not use cardboard](#). Robots pick products in two-by-two-foot totes and transport them to packing stations. Workers can pack products into biodegradable or reusable packaging. Packages go directly from the warehouse to customers' homes (Figure 3). This system is gentler on products and helps lower the overall carbon impact of the service.



Figure 3. Intelligent cube storage eliminates cardboard packaging

Warehouses need large numbers of stock-keeping units (SKUs) to keep up with fluctuations in demand and customer expectations. Smaller warehouses with space limitations need a sophisticated forecasting system to have the right SKUs on hand.

Attabotics' intelligent cube storage and other AS/RS give instant visibility into how products move through a warehouse. This transparency lowers safety stocks, which are the margin companies must keep on hand in case of inaccurate forecasts. Safety stocks may go to waste if they aren't needed, especially if products are perishable.

Intelligent cube storage uses reliable forecasting and eliminates cardboard packaging to help companies reduce their carbon impact.

Smaller facilities save energy

Electricity, the second highest source of GHG emissions in the US, plays an enormous role in a company's carbon impact.¹⁰ High-density AS/RS need less space than conventional warehouses. The smaller facilities that house these systems require less electricity to heat, cool, and illuminate than conventional facilities.

Compact systems also use energy more efficiently because robots have less space to travel between bins. Attabotics' intelligent cube storage has an innovative 3D design that allows for maximum density without making products inaccessible to robots.

AS/RS have a smaller physical footprint than conventional warehouses, which means they need less energy for facility maintenance. However, we need to be realistic about overall energy benefits. Current research doesn't account for scope two and three emissions, such as the GHGs produced by power sources or upstream activities like mining and processing the aluminum used in the system's frame. More research is necessary to establish the official carbon impact of energy.

The sweet spot: When business goals and sustainability align

AS/RS, like Attabotics' intelligent cube storage, have many benefits: they can help businesses keep their promises of swift delivery to customers, streamline operations, and cut unnecessary costs. But they also offer a more sustainable alternative to conventional warehouses (Figure 5). As Thomson says, Attabotics is "delivering a better product that has a better impact on the environment."

Businesses may hesitate to adopt more sustainable solutions for various reasons—perceived cost, potential disruptions to systems already stretched to the limit, and worry about changing something that has been an industry standard for many years. But considering more environmentally-friendly alternatives is quickly becoming less of a choice and more of a necessity.

Current industry standards, such as pallets and cardboard boxes, were also once innovative new technologies. Attabotics' intelligent cube storage totes may also one day become the industry standard. Investing in more sustainable solutions is a logical step forward for your business.

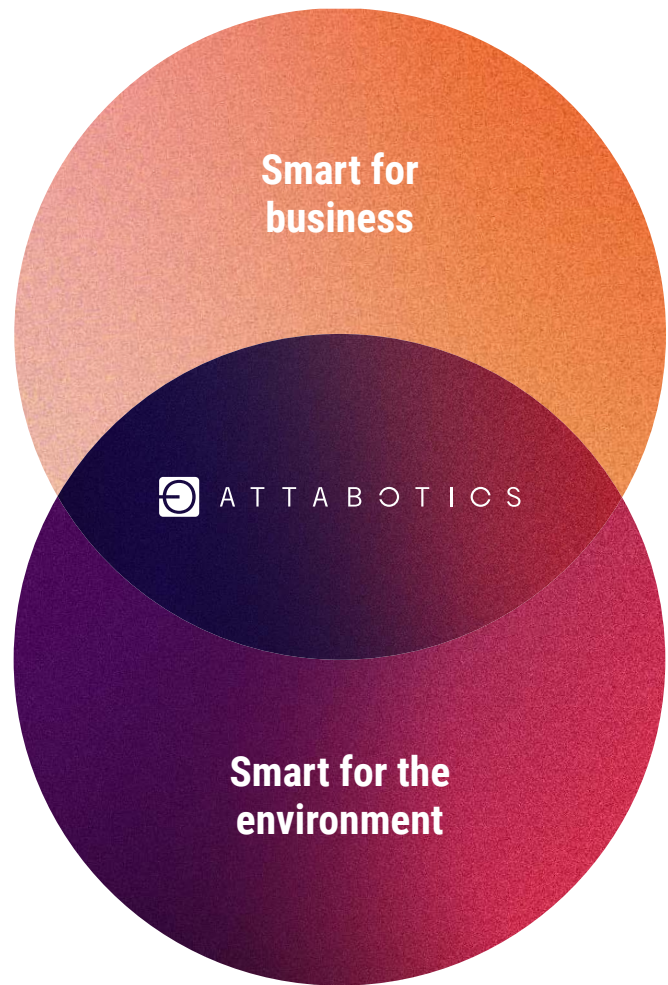


Figure 4. Attabotics aligns with business and carbon impact goals

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