TOWARDS SUSTAINABLE LOGISTICS: HOW SMART CONTAINERS OPTIMISE MULTIMODAL TRANSPORT

AELER

In the current logistics industry landscape, multimodal transportation is crucial for optimising the movement of goods. With increasing pressure to reduce carbon emissions and rising costs of traditional methods, sustainable and efficient logistics solutions are more urgent than ever. Multimodal transportation enhances efficiency, cost-effectiveness, and sustainability by seamlessly transferring cargo between different modes.

The European Union (EU) exemplifies the promotion of inland waterways. Recognising the environmental and logistical benefits, the EU is encouraging a shift from road and rail to its extensive inland waterway network. Europe boasts around 41,000 kilometres of interconnected waterways linking numerous cities and industrial regions across 13 member states, and the European Commission understands the reliability, energy efficiency, and substantial expansion capacity of inland waterway transport.

Inland waterway transport is a competitive alternative to road and rail in terms of cost and environmental benefits. It consumes only about 17 per cent of the energy per kilometre per tonne of goods compared to road transport and 50 per cent compared to rail. Additionally, it significantly reduces noise emissions and congestion on overburdened road networks in densely populated areas and offers enhanced safety, particularly for hazardous materials.

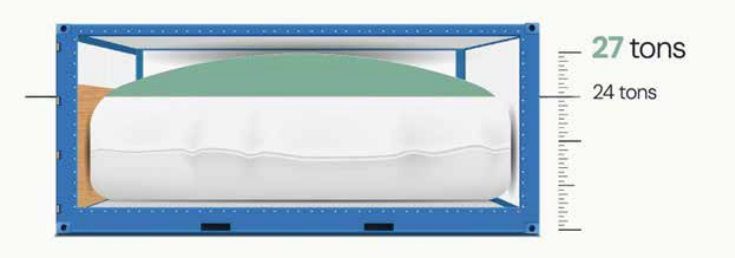

FIG 1.
The AELER smart container can hold up to 27 tonnes of liquid in a flexitank.

DRIVING SUSTAINABLE LOGISTICS WITH SMART CONTAINERS

In this context, smart containers have emerged as a transformative solution to support the transition towards more sustainable multimodal transport systems. By integrating advanced technologies, such containers enhance the efficiency and effectiveness of using inland waterways, thereby significantly reducing logistics operations' overall carbon footprint.

Smart containers represent a revolutionary leap in the shipping and logistics industry, integrating Internet of Things (IoT) technology into traditional shipping containers. This integration equips these containers with sensors that monitor and report real-time data on the container's location, temperature, humidity, and other critical environmental parameters. These sensors are part of self-powered IoT gateway devices that ensure continuous data transmission to a cloud-based platform, enabling real-time processing and global accessibility. Additionally, smart containers can incorporate alternative materials and designs to improve cargo transportation qualities and increase the payload capacity per container.

SUPERIOR PAYLOAD CAPACITY

New standards for containers not only emphasise intelligence but also incorporate robustness and sustainability from the design phase, resulting in increased payload capacity. For instance, smart

“SMART CONTAINERS HAVE EMERGED AS A TRANSFORMATIVE SOLUTION TO SUPPORT THE TRANSITION TOWARDS MORE SUSTAINABLE MULTIMODAL TRANSPORT SYSTEMS.”

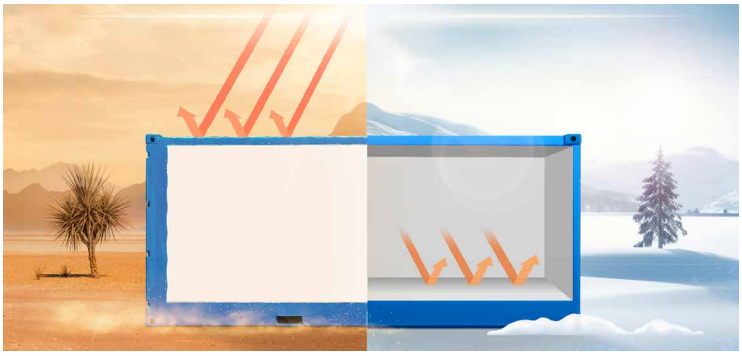

FIG 2.
Smart containers are designed with in-built native insulation.

containers built from composite materials can carry 17 per cent more bulk liquid payload than traditional steel containers—up to 27 tonnes compared to 22-24 tonnes.

One notable example of innovative smart container technology is the AELER container, which recently secured second place in the MultiRELOAD Open Innovation Challenge. The MultiRELOAD initiative supports the transition towards using inland waterways and rail for transportation, aligning perfectly with Europe's ambitious emission reduction targets.

AELER's recognition in this challenge underscores the company's commitment to promoting greener and more sustainable logistics solutions. The AELER container's superior payload capacity not only enhances efficiency by allowing more goods to be transported per journey but also contributes to significant reductions in carbon emissions, making it a pivotal component in the future of sustainable multimodal transport.

ENHANCED INSULATION FOR IMPROVED CARGO PROTECTION

Smart containers boast naturally insulating materials that protect cargo, ensuring safety over longer transport distances. These containers are three times better insulated than traditional steel containers, eliminating the need for additional, single-use insulation materials or desiccant bags.

Furthermore, the native insulation allows operators to transport 11 per cent more volume than a reefer/non-operating reefer, as no motor is required to control the internal temperature. This superior insulation contributes to the overall efficiency and sustainability of the transport process by maintaining optimal cargo conditions without additional energy expenditure.

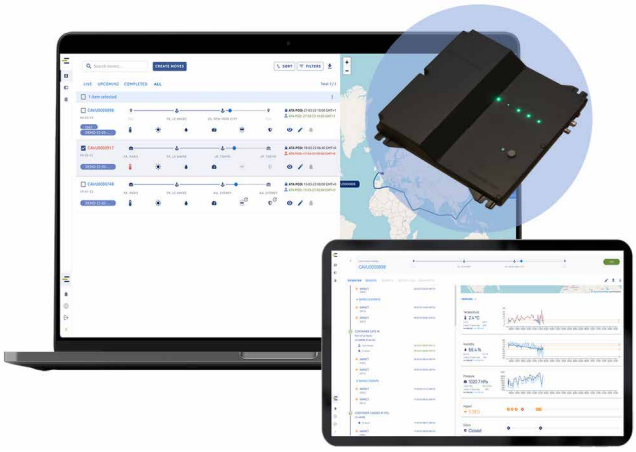

FIG 3.
Smart containers are equipped with IoT technology.

SEAMLESS TRACKING WITH IOT

Smart containers equipped with IoT technology for real-time tracking significantly boost operational efficiency. This technology facilitates seamless transitions between different transportation modes, including inland waterways, by ensuring efficient and timely transfers. The enhanced visibility of real-time tracking allows shippers to plan better, facilitating just-in-time inventory management and reducing unnecessary cargo movements. By improving planning and reducing delays, the efficiency and reliability of inland waterways are significantly boosted.

Additionally, IoT-enabled tracking supports comprehensive carbon footprint calculations for end-to-end shipments. While the industry typically calculates carbon emissions based on vessel fuels, smart container data enables a complete emissions assessment across all transportation legs, including empty turns and mileage statistics. This precise tracking and data analytics highlight the lower carbon emissions associated with inland waterways, clarifying their environmental benefits and encouraging their use. This results in a more accurate and holistic understanding of the transport chain's carbon footprint, promoting the adoption of more sustainable transport options like inland waterways.

ENVIRONMENTALLY-FRIENDLY LEASING MODELS

In addition to their operational advantages, smart containers can be leased through environmentally friendly models such as the container-as-a-service (CaaS) model, which offers several benefits that further enhance sustainability in logistics operations. The CaaS model

“ONE OF THE MAIN OBSTACLES TO THE ADOPTION OF SMART CONTAINERS IS THE INITIAL COST OF IMPLEMENTING IOT TECHNOLOGY AND UPGRADING EXISTING CONTAINERS.”

begins with a setup phase where businesses contact the leasing provider to discuss their cargo's needs. The provider collaborates with the business's existing service providers or offers options from their network of partners. Containers can be seamlessly collected from one of the provider's global depots, ensuring easy access.

Once in use, the containers can be tracked in real time, providing complete visibility of the cargo condition during shipment. This tracking ensures the security of the goods and contributes to more efficient inventory management. Upon reaching their destination, the containers are returned to one of the provider's depots, where the leasing company manages maintenance and repairs. This process eliminates the need for empty container returns, significantly reducing environmental impact by ensuring that containers are always utilised efficiently.

FUTURE PROSPECTS AND CHALLENGES

While the benefits of smart containers are clear, their widespread adoption faces several challenges. One of the main obstacles is the initial cost of implementing IoT technology and upgrading existing containers. However, as the technology becomes more widespread and costs decrease, more businesses are expected to adopt smart containers.

Another challenge is the need for standardised protocols and systems to ensure interoperability between different logistics providers and transportation modes. This requires collaboration between industry stakeholders, governments, and technology providers to develop and implement common standards.

Despite these challenges, the future prospects for smart containers are promising. Advances in IoT technology, artificial intelligence, and data analytics are expected to enhance smart containers' capabilities further, making them even more efficient and cost-effective. Additionally, growing awareness of the environmental impact of logistics operations is likely to drive increased demand for sustainable solutions like smart containers.

PAVING THE WAY FOR SUSTAINABLE LOGISTICS WITH SMART CONTAINERS

Smart containers are transforming the logistics industry by enhancing the efficiency and sustainability of multimodal transportation. Their integration of IoT technology enables real-time tracking, better insulation, and increased payload capacity, making them a cornerstone in reducing the carbon footprint of global shipping operations. The European Union's active promotion of inland waterways highlights this transport mode's substantial environmental and logistical advantages. With 41,000 kilometres of interconnected waterways, the EU is setting a precedent for greener logistics practices. This progress instils hope for a more sustainable and environmentally friendly future for global transport.

The advanced features of smart containers, such as superior payload capacity and natural insulation, reduce transportation costs and minimise environmental impact by cutting down on fuel consumption and emissions. The seamless tracking capabilities offered by IoT technology provide shippers with enhanced visibility, facilitating just-in-time inventory management and more efficient planning. This leads to fewer unnecessary cargo movements and a more streamlined supply chain.

Moreover, smart containers' ability to enable precise carbon footprint calculations for entire shipments, including all transportation legs and empty returns, represents a significant advancement in understanding and mitigating the environmental impact of logistics. As the industry continues to evolve, smart containers stand out as a vital component in transitioning to a more sustainable and environmentally friendly future for global transport.

The journey towards sustainable logistics is complex and multifaceted, but adopting smart containers represents a significant step forward. By leveraging advanced technologies and innovative designs, smart containers offer a viable solution to the challenges of modern logistics, paving the way for a more sustainable, efficient, and resilient global supply chain. As we look to the future, the continued development and deployment of smart containers will be crucial in achieving the sustainability goals of the logistics industry and beyond.

ABOUT THE COMPANY:
AELER develops next-generation smart containers, reshaping the landscape of container logistics through a unique blend of advanced materials and cutting-edge technology. The containers set new standards for sustainable maritime logistics, integrating IoT technology for real-time tracking and complete visibility of crucial parameters like location, temperature, and security.