



The top benefits of cold store automation

Cold Storage Whitepaper



No warehouse should be left behind when it comes to automation, even cold stores that impose their own specific challenges. Movu Robotics, pioneer in bringing easier Automation to the world's warehouses, and its CTO, Stefan Pieters, highlight four key automation factors driving efficiency in cold storage.



Four key advantages of accessible cold store automation



Some 60% of food products need **to be kept cold**, according to the European Cold Storage and Logistics Association (ECSLA).



Each year, one third of **global food production** is lost or wasted.



Breaking that down further, a study from Columbia University's Climate School found that around 13% of all food produced globally, amounting to over 1.6 billion tons, is lost every year due in part to poor **cold-storage supply chain capabilities**.



As volumes of temperature-controlled food and pharmaceutical products continues to grow worldwide, so too does demand for cold store warehouses, which play a vital part in creating **supply chain resilience** when it comes to preserving these goods.



Since the start of the coronavirus pandemic alone, consumption of chilled and frozen products has increased by an estimated 10%. Continued growth in healthcare and grocery products is resulting in the global cold storage market growing at a CAGR of 13.83% (from 2023) and is forecast to reach 145.71 billion USD by 2028, according to ResearchAndMarkets.

Cold store warehouses usually operate at two temperature levels, according to ECSLA. Frozen produce must be stored below -0.4°F (Chilled produce is typically held between 32 and 39°F).

Providing warehousing for these kind of temperatures presents significant challenges beyond the extreme working environment, which automation and robotics technology is increasingly able to meet. When evaluating automation for improving cold chain warehousing, there are four key advantages to consider:

In addition, cold stores present specific materials handling challenges, which include:

- Health and safety to protect workers from hazards associated with working in cold environments, such as slips, trips and frostbite.
- Space optimization to maximize storage capacity within a limited space while ensuring easy accessibility to stored items.
- Productivity achieved by workflow optimization through streamlined materials handling processes to minimize time and labor required for carrying out work in a cold store.
- Energy efficiency to maintain low temperatures while minimizing energy consumption and operating costs.

In the US, frozen cold storage is most commonly between -10 and -20°F (refrigerated cold storage has a range of 33 to 55°F).

These are challenges, which automation and robotics technology is increasingly able to meet. When evaluating materials handling solutions for automating cold chain warehousing, it is therefore important to examine the following:



Productivity achieved by
workflow optimization



Space optimization to
maximize storage capacity



Health and safety to
protect workers



Energy efficiency to
maintain low temperatures

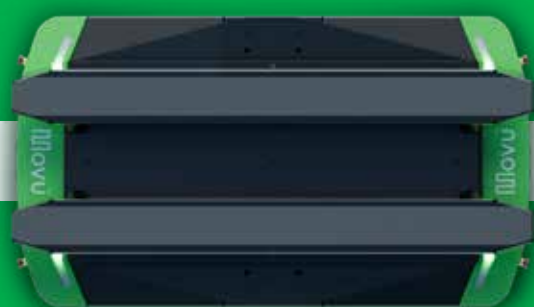
1 Improving health & safety

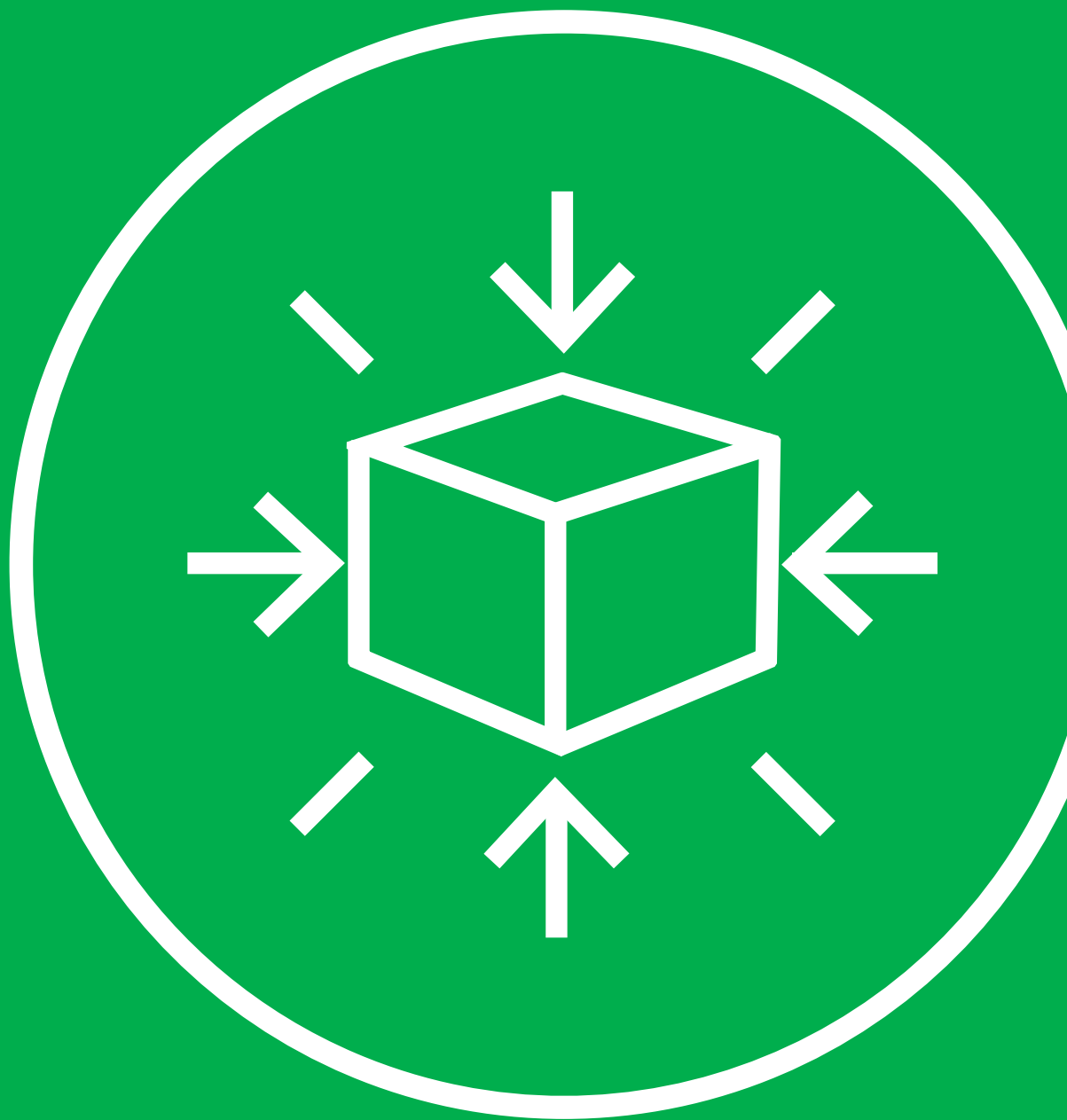
Low temperatures with icy and slippery surfaces make cold stores an extreme working environment for pedestrians or lift trucks. They are generally confined spaces in which lift trucks will find it hard to manoeuvre and there is an ever present risk of collisions with people or structures such as racking. In addition, specialised cold-store trucks are also not cheap.

Working in such cold, people are likely to move and react more slowly, their vision can be impaired and freezers can generate high noise levels. They will need essential but restrictive bulky protective clothing that limits manoeuvrability and dexterity, making picking, operating controls and data entry difficult. Working in the cold can also generate psychological stress along with conditions such as asthma or other respiratory conditions caused by dry freezer air.

In addition to protective clothing, people working in cold stores will require appropriate breaks to warm up, as well as shift and task rotation.

Automation will improve health and safety simply by minimizing the numbers of people working in the cold store and by making tasks less arduous, reducing the time they need to be in there.





2 Providing storage density

Storage density is crucial for cold stores due to the costs of keeping goods cold. The use of a building's volume must therefore be maximized for storage. Providing sufficient space for lift trucks to manoeuvre runs against this philosophy. Fixed conveyors will also take up refrigerated space that isn't being used to store goods. Manual warehouses might comprise racking of several levels served by reach trucks. But this cannot compete with the height to footprint ratio achieved by automation.

How can automation in the cold store help?

- Automation makes use of height because it can be built taller on a relatively small footprint, which maximizes storage space and makes cooling it more efficient to reduce the energy costs.
- For automated storage and retrieval of pallets, shuttles provide a flexible alternative to stacker cranes, which need even surfaces and long runs of straight aisles. A shuttle system can be built on irregular sites to provide a high density, multi-pallet position deep Automated Storage and Retrieval System (AS/RS).
- It can be used in cold environments down to -13°F, with robot shuttles carrying up to 3307 lb. Self-powered robot carriers transport pallets on rails within the storage lanes of the racking where the pallets are housed, and on the rails of the main lane that runs across the storage lanes it serves. Intelligent software manages the shuttle traffic within the shuttle rack.
- Another automated solution for cold stores comes in the form of Autonomous Mobile Robots (AMRs). They do not require the segregated space of fixed conveyor-based systems and, unlike most larger and heavier Automated Guided Vehicles (AGVs), they can turn in their own footprint rather than require a defined bend to corner and do not require predefined pathways.
- AMRs will work on not especially smooth and even floors, while existing infrastructure does not need to change for robots to work around. Indeed, implementation doesn't usually require any expensive infrastructure at all, giving freedom for flexible layouts.

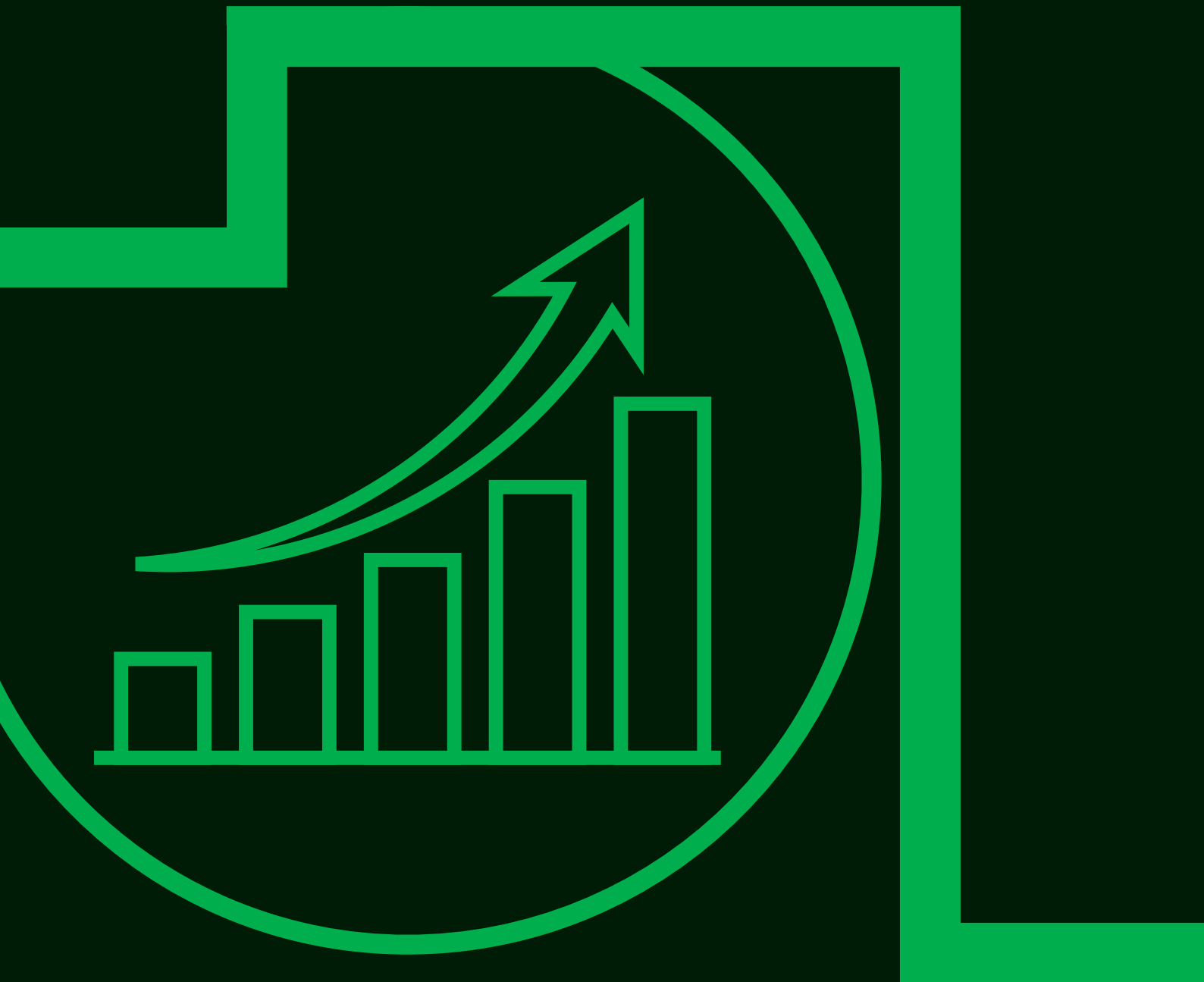
3 Improving productivity

Contrary to popular opinion, cold chain warehousing is not usually about minimally manned, long term, bulk storage. Many cold chains move goods in and out of store rapidly, and involve all the break-bulk, order-picking, stock rotation and other operations familiar from ambient warehousing. They must be performed just as efficiently and productively, but in much more arduous conditions. Fluctuations in demand present cold store operators with the challenge of maintaining adequate capacity, while still ensuring efficiency and productivity.

Increasing staff levels for peak periods has become a less viable option as the pool of workers prepared to perform arduous, even hazardous, tasks in cold conditions decreases. The length of time that workers spend in the cold before taking a break in warmer areas is limited, and there are potentially long-term impacts from carrying out heavy manual tasks in cold conditions.

1 Automating picking will facilitate increased pick rates and accuracy while minimizing the requirement for labor, particularly during peaks. It maintains a continuous high frequency of storage and retrieval that cannot be guaranteed by human operators.

2 When managed through intuitive fleet management software, AMRs can move pallets, roll cages and other load carrying units in cold stores to serve as the operator's right hand during order picking and order preparation. An operator might work with one or two mobile robots within a defined pick zone, which can yield 90% better productivity compared to a conventional manual approach.



3

Models capable of running in cold stores from -13°F will easily switch from cold to a warmer environment, thanks to a servo system controlling the temperature of electronic components, eliminating condensation at low temperatures. Batteries are protected from icing and condensation, preserving their power, lasting from 8- 10 hours on a charge time of just 2 hours. Fewer battery charges or changes obviously improve productivity, but also reduce the space needed for recharging.

4

Robot technologies that can work collaboratively together, coordinated and monitored via intelligent software will ensure a smooth flow of materials in cold store warehousing.

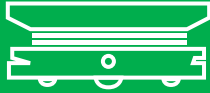
4 Reducing costs & improving energy efficiency

Labor and energy are the two dominant cost components for European facilities. The Global Cold Chain Alliance's 2021 benchmarking survey found that labor accounted for 44% of total costs, with energy accounting for 15%. Given the significant amount of energy cold stores need to maintain low temperatures, energy-efficiency is a necessity economically, especially when energy costs are at a high level. It is also vital in helping to reduce CO2 emissions. The cost of using labor, meanwhile, is increasing while its availability dwindles.

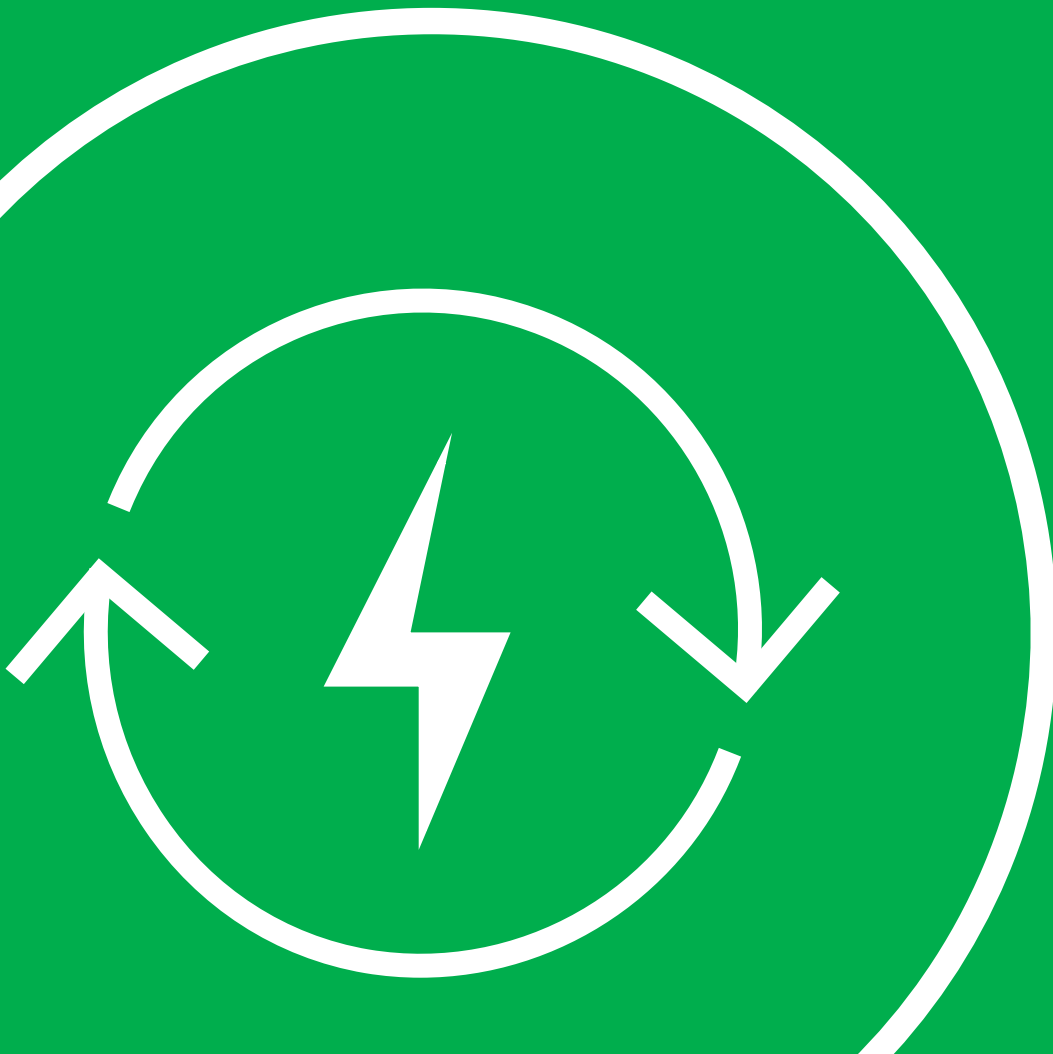
Another cost factor for cold stores is their critical role in avoiding the wastage of temperature sensitive goods. It is vital to have the ability to transfer goods in and out of a cold store as smoothly and quickly as possible using solutions that maximise energy efficiency to reduce food waste as well as energy costs and emissions.

Automation reduces the numbers of staff, and therefore costs, required for running a cold store, while also increasing energy efficiency and improving the environmental performance of the warehouse. In many scenarios, automation can run without the lights on where labor is not required, or limit the times cold store doors open and close to save energy. Goods can be moved efficiently and accurately to maintain their necessary temperature and therefore avoid being consigned to waste.

How can automation in cold store help?

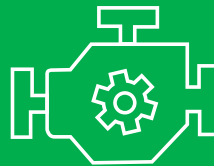


Highly adaptable collaborative mobile robots can transport pallets to and from a storage and retrieval system. Movu ifollow AMRs, for example, can carry two roll cages at once offers an advantage in the cold store environment where greater loads reduce the need for doors to open and close.



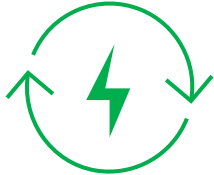


The Movu atlas pallet shuttle system provides a substantial saving in energy consumption simply from not having to move massive cranes around – a shuttle weighs 662 lb; a stacker crane may weigh up to 15 tons, and so a shuttle system can be up to five times more energy efficient than craneage. When comparing the Movu atlas versus a stacker crane for same speed dynamics, the atlas demonstrates a remarkable energy efficiency, consuming between 73.2% and 82.5% less energy compared to the stacker crane when covering the same pick-to-storage movement with an equivalent load.

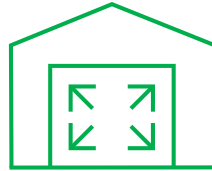


It is important to optimise machinery and equipment, such as adjusting the running times or using speed-controlled motors. Regular maintenance also helps to lower energy consumption. The precise DC-brushless motors with integrated drive of the Movu atlas, for example, results in minimal maintenance and high availability to deliver considerable cost-savings.





Energy costs are not only incurred during operation but also during the installation of a storage system – making energy consuming modifications to the building, for example. In addition, some transport solutions may require guidance systems to be sunk into the floor. Simple plug and play automation that is easy to install will help reduce installation costs and ensure the cold storage is ready to go as quickly as possible.



In addition to enabling a fast roll out for projects, modular design acts as a set of building blocks to maximise flexibility and minimize complexity and the cost of upgrading. Robots can be added or removed according to requirements, creating highly scaleable installations that can start small and then expand or, if needed, downsize just as easily.



Finding automation that can work in cold stores

Automation and robotics can improve the efficient use of cold store space by increasing productivity, efficiency, flexibility and minimizing 'wasted' space, while reducing reliance on labor to fulfil growing volumes and handle regular peaks. And importantly, the safety and welfare of both goods and staff is addressed.

But not all automation can work effectively in cold storage. Cold temperatures can be harsh on materials and degrade battery performance while ice and condensation can cause problems for electronic components as well as racking. It is important to find solutions that have specific cold chain logistics versions.

Movu Robotics, for instance, brings easier automation to the world's cold store warehouses with its range of low capex ifollow AMRs and atlas pallet shuttle system, which are designed specifically for cold storage temperatures as low as -13°F, to ensure that when it comes to opportunities for automation, no warehouse is left behind.

A good example of this capability is Movu's deployment of innovative technologies to meet stringent temperature-controlled warehousing requirements. This ensures operational excellence for a company partnering with premium consumer brands to serve millions of consumers daily, either directly or through wholesalers and resellers. The Movu atlas and Movu ifollow AMRs, combined with a pallet conveying system and fast pick stations provide a state-of-the-art and scalable pallet-based Goods-to-Person solution.



Another example is provided by Clarebout, a leading global manufacturer of frozen French fries. Its fully automated warehouses are kept at a constant -4°F. Pallets with the frozen French fries are buffered in a Movu atlas pallet shuttle automated storage and retrieval system by a conveyor belt 24 hours a day. Every hour, 300 pallets are stored in the system. During the day, as soon as a truck arrives to pick up a delivery, the corresponding pallets are issued. The system has a capacity of 600 pallets per hour. 36 shuttles in the 46 ft-high system ensure that the trucks are loaded as per the order after an hour at the latest. The logic for letting automation and robotics carry the load in freezing temperatures is clear. Choosing intelligently designed, flexible and easy to install robotic warehouse solutions will create an impressive business case for cold store operators.

Did you know that...



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