Energy Savings and Sustainable Buildings

How Mars Air Curtains Reduce Energy & Save Money

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Across the globe, the drive to create more energy-efficient and sustainable cities continues to escalate. Policy makers, regulatory agencies, building owners, investors, and occupants all show increased interest and advance their approaches year by year. Global and national climate goals dictate sharp emissions reductions, which by default puts a significant focus on real estate because the built environment generates 40% of annual CO_2 emissions and accounts for 76% of electricity use. The need for an energy-efficient building is so important that it is said the energy efficiency of a building can dictate the building's value. Without reducing energy consumption in buildings, national energy and environmental challenges cannot be met.

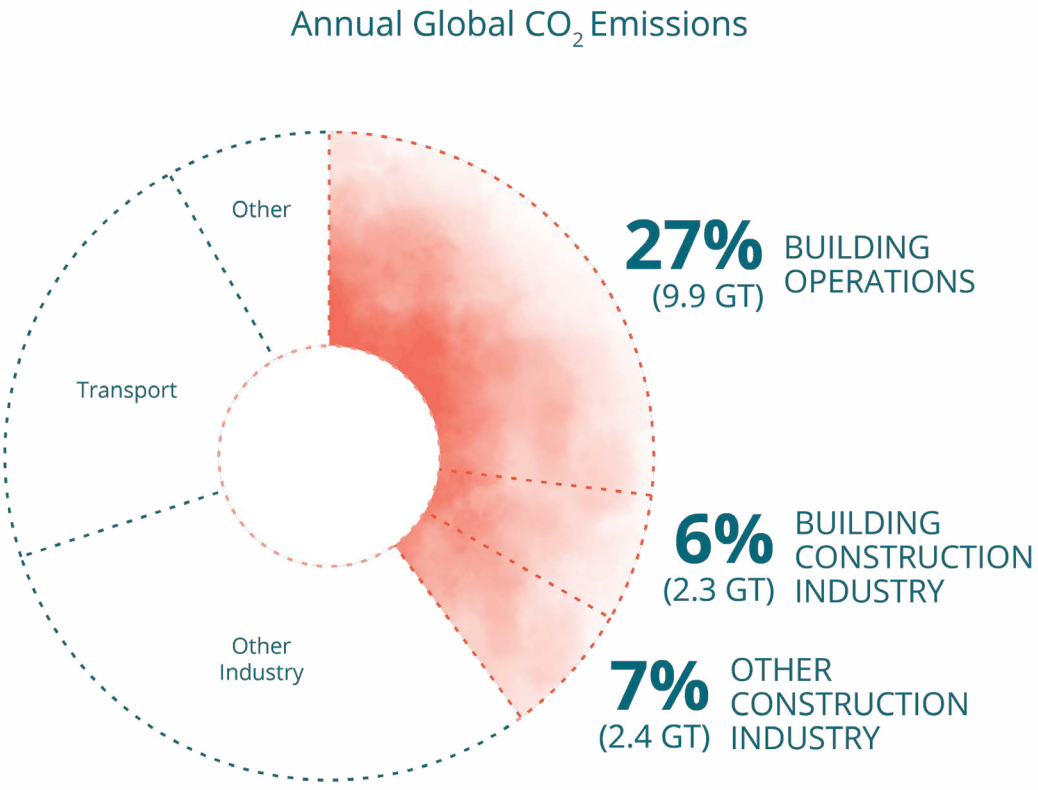
In the United States, the National Building Performance Standards Coalition is a group of government agencies committed to aligning around emission reductions and building upgrade and retrofit programs, in recognition of the need to decarbonize America's building sector. With 30 states governments and cities like New York City, Washington, D.C., and Boston committing to developing building performance standards by Earth Day 2024, regulations will increase and create non-negotiable participation requirements.

This report will evaluate how an air curtain contributes to energy efficiency in the built environment.

Did You Know?

Mars Air Systems Long History Increasing Energy Efficiency

Mars Air Systems has been part of the movement to create more energy-efficient building interiors since 1961. Well before the push for sustainable buildings was driving forward with widespread focus, the development and refinement of the air curtain was well underway. As a leader in air curtain design and one of the oldest manufacturers in the United States, the Mars engineering and product development team has led multiple advancements in air curtain technology. While the primary focus of the air curtain is to create a laminar air stream to deflect exterior climatic conditions and debris, Mars has led the development of using advanced technology that expands how air curtains serve building owners, operators, and tenants. This has included developing the quietest air curtain commercially available to enhancing the air curtain with UV light for added sanitation to the addition of True HEPA® filtration for particulate capture. Other accessories such as full BACnet®-capable controllers sync the air curtain with the most sophisticated building automation systems available, allowing for automated operation of the air curtain in response to real-time climatic conditions for even more energy efficiency.



Sustainability Goals Must Address Aging Building Infrastructure

No commitment to energy efficiency or emissions reductions would be complete focusing exclusively on newly constructed buildings. More than half the built environment in the United States was constructed prior to 1980, with large cities like New York and Chicago reporting more than 70% of their infrastructure at least age. SMR Research Corporation suggests that the average commercial building was 53 years old in 2021.

The adage "the greenest building is one that is already built" recognizes that retrofitting or refurbishing an older structure uses less energy than new construction and goes a long way to reduce the carbon footprint. Any city or state with aggressive energy, decarbonization, and climate goals must demand energy and emissions performance from the existing building stock.

Retrofitting Existing Buildings for Energy Savings

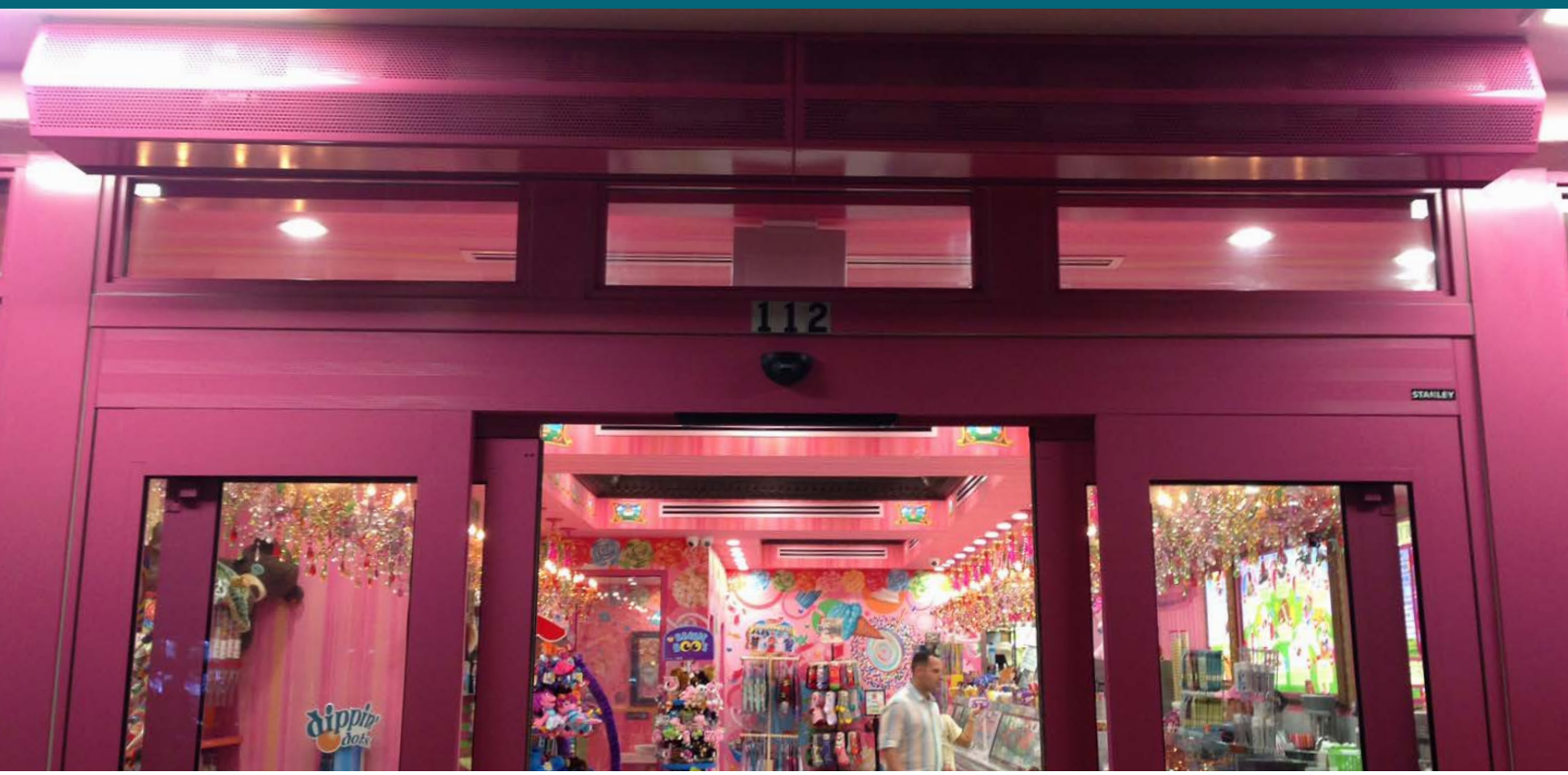
An existing building that has been enhanced for energy efficiency:

- will realize lower energy bills,
- may meet newer efficiency standards,
- can attract more competitive tenants,
- will realize a higher lease rate,
- has increased commercial value,
- Is more comfortable for occupants which in turn increases productivity

Did You Know?

Air Curtain Effectiveness Validated with Testing and Research

Air curtains have been studied and tested to establish their effectiveness for decades. Air curtain efficacy as a thermal barrier has been tested by many universities and research organizations. Validated testing affirms they are between 70%-80% effective in minimizing energy loss. Many adverse conditions such as pressure imbalance, wind load, high temperature differentials, etc., have been studied for their impact on air curtain functionality. While computer models are the preferred method to test and perfect air curtain design, computer models don't always reflect or capture the real-life conditions. Physical testing in a laboratory is possible with advanced techniques such as infra-red thermography, tracer gas, stereo particle image velocimetry, and temperature probe arrays to study and validate air curtain flow characteristics and infiltration. The evidence is undeniable — air curtains are effective with every type of building structure in every industry to provide a thermal barrier, save energy, protect from flying pests, create more comfortable condition for occupants.



The HVAC System Plays a Key Role in Reducing Energy Use

The HVAC system is at the epicenter of energy use in the commercial building. Climate change is putting additional pressure on energy use with a building HVAC system. It is expected that climate change will increase the need for cooling by 18%-37% by 2050. Some analysts suggest that an optimistic view of climate change will be average global temperatures rising by 3˚F. This rise in temperature will lead to intense and frequent heat waves that will then put even greater pressure on the HVAC system.

Whether it is the total annual energy use by the HVAC system or pressure put on the grid during high air conditioning use periods, HVAC system use in existing buildings is one of the first considerations when retrofitting to reduce energy use.

How Air Curtains Support the HVAC System to Lower Energy Use

Well maintained HVAC systems use up to 20% less energy than those not benefitting from regular upkeep. Poor HVAC system maintenance will also reduce the unit's lifespan, causing more energy consumption when raw materials must be processed to manufacture a replacement unit.

Air curtains support the optimal operation of the HVAC system. Air

curtains reduce the workload on the system and extend its lifespan. Of additional benefit, indoor air quality can be enhanced when air curtains are paired with technology such as UVC and True HEPA filters.

1. Air curtains reduce HVAC load: With a stream of air protecting building openings, there is a barrier to protect the interior conditions from being affected by the entry of exterior air. This protection means the HVAC doesn't need to cycle on and off to return the interior to the set temperature. Reducing the use of the HVAC saves energy and lowers energy spend. Using an ROI calculator can give you a very close estimate for how quickly the air curtain pays for itself in the energy savings it creates. The ROI is calculated based on the local energy costs, operating conditions, entry dimensions and use of the air curtain. Most air curtains pay for themselves within 18 months in the energy savings they produce.
2. Air curtains extend the lifecycle of the HVAC: As an outcome of reducing the load on the HVAC, the system lifespan is increased. This saves energy by delaying the expense of purchasing of new units and avoiding the energy consumption of processing raw materials for the new equipment.

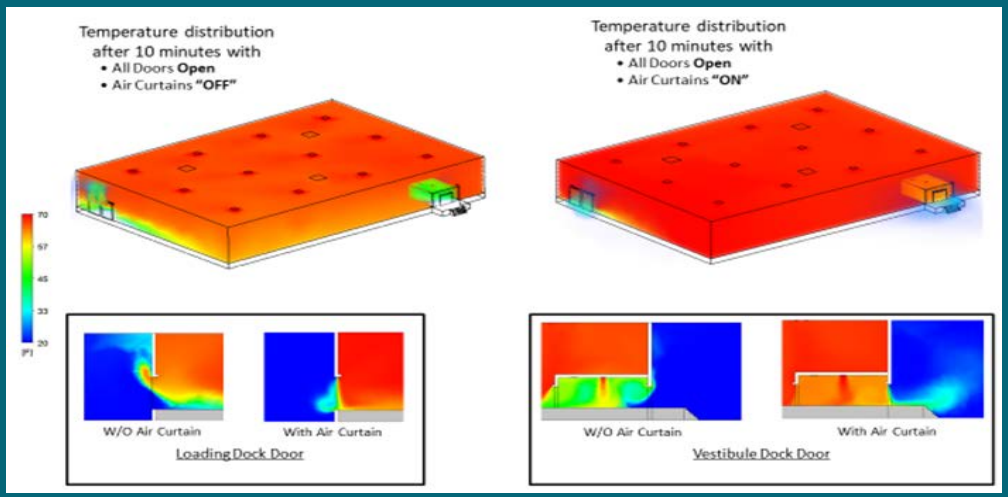
Air Curtains Link with Smart Building Technology for Heightened Energy Savings

Smart technology for buildings enables the automation of almost every function and component of the HVAC system such as building temperature, vents, and air quality. Controllers like SimpleLink® can link the air curtain to the building management system and provide additional enhancement of the HVAC operation and further increase the energy savings.

SimpleLink's self-adjusting, adaptive features sense ambient conditions near the entrance and adjust the air curtain parameters to operate at optimal energy efficiency. The most important adaptive feature of the SimpleLink controller is the ability to set the fan motor speed to the correct level based on the indoor and outdoor temperatures. According to the report, "Goubran, S. & Wang, L (2016), Energy Saving Impact of Air Curtains in Commercial Buildings", the air curtain fan speed is proportional to the difference in indoor-outdoor temperature which propels the exfiltration of conditioned indoor air and the ingress of outdoor air. SimpleLink sensors constantly measure these parameters to set the correct fan

Did You Know?

Computational Fluid Dynamics Prove the Thermal Separation Air Curtains Provide



How Older Buildings Retrofit for Energy Efficiency Using Air Curtains

When a circa-1888 cavernous brick Romanesque Revival-style structure in York, PA was recognized to suffer from energy inefficiency, drafty interiors, flying pest infiltration, and thermal discomfort for occupants, operators looked to find retrofit solutions. The heavily trafficked destination includes retail spaces which require consistent, comfortable temperatures for retail workers, as well as a steady stream of customers. With Eastern Seaboard cold air in the winter and stuffy conditions that pervade during humid summers, interfered with the ability to maintain thermal comfort across the series of wide entry doors running nearly a full city block.

The retrofit included a bank of Mars Air Systems Standard 2 Series air curtains with optional heating elements. The heating element is useful in the Fall when the crisp air will infiltrate interiors and drop temperatures that in turn trigger the HVAC system to cycle on and off to return the tall-ceilinged space to the set temperature. During notoriously difficult winters, the heating element can heat the strong, top-of-door to floor stream of air protection that protects from long, frigid Northeastern winters.

speed without the need for user inputs. Other adaptive features such as heat setting and time delay are also constantly monitored and set to improve user comfort at the entrance. Such enhancements are beneficial to reduce energy spend and energy use.

Air Curtains Increase Thermal Comfort and Reduces HVAC Cycling

Thermal comfort in the building interior is critical for occupants. Temperatures colder than 68˚F or higher than 72˚F have measurable effects on occupants. Consistent temperatures in the building interior have been scientifically shown to enhance workplace safety, increase productivity, decrease lost work days, and enhance the physical health workers. Even cognitive function and cardiovascular and respiratory health has been linked to maintaining temperature in the 68˚F – 72˚F range.

Keeping temperatures consistently within this range is beneficial to the HVAC system because it reduces the on/off cycling of the HVAC system.

1. Heated air curtains regulate temps when the exterior air is cool. In this instance the heated air curtain unit will be switched on by the controller (triggered by the opening of the door or window) and the unit can be set to continue operating to add additional heat to compensate for any air transfer produced by the opening.

2. In the summer, air curtains block humid hot exterior air from entering and will keep conditioned air intact. This protection reduces HVAC system cycling.

Mars Air Curtains Enhance Indoor Air Quality (IAQ) and Mitigate the Conditions that Deteriorate Air Quality

There is a perceived inherent conflict in the dual goals of energy savings and good indoor air quality. The common belief is that an airtight building holds temperature well although this conflicts with adequate ventilation and air flow as key tenets to good indoor air quality.

Sustainable IAQ is an emerging concept still evolving with a focus on:

1. Cleaning and recycling building air, as is done with water and other goods
2. Deploying filtration and ventilation technologies
3. Using smart building controls to dynamically adjust air cleaning and ventilation
4. Retrofitting the ventilation system to a variable air volume system (VAV), with which the ventilation can be optimized with smart controls. The U.S. EPA suggests ventilation upgrades from constant air volume (CAV) to VAV can realize annual energy savings of up to 21%.
5. Pathogen management by retrofitting with UV lights to kill or inactivate mold, mildew, dander, bacteria, and viruses. The technology can be mounted in ductwork or packaged units, helping them stay clean and run more efficiently.
6. Air curtains enhanced with UVC and True HEPA filters to protect entryways and openings, aiding by helping to "filter" and sanitize air by keeping exterior air outside

Improving indoor air quality is traditionally perceived to be a wellness measure, but there is also a significant economic benefit for building owners and tenants. According to Jones Lang LaSalle Incorporated, payroll and other labor expenses are 10 times larger than utility bills in commercial buildings. It is said that a 1% improvement in office productivity is comparable to a 10% improvement in energy efficiency and water efficiency. Because indoor air quality measures make buildings healthier and more comfortable, it can directly improve productivity.

Concluding Thoughts

As efforts to create more energy-efficient and sustainable cities march on, and regulations launch to force energy efficiency in newly built and existing buildings, there are active steps building owners and occupants can take to increase the energy efficiency of the built environment. In taking these steps, the additional benefit of a lower utility spend and increased productivity of occupants will be realized.

Serving at multiple building openings of every kind, including pass-thru windows, man doors, overhead doors, revolving doors, and rolling shutters, Mars air curtains provide the protective air stream that acts as a sort of filter at the opening. This reduces the incoming air that the HVAC system would ultimately have to address. The air curtain saves energy and utility spend and minimizes the infiltration of dirt, debris, flying pests and wind-driven products. And the energy savings means the air curtain unit pays for itself typically in 18 months or less. With these benefits any existing building retrofit should include an air curtain at the entry points to help building owners and operators reduce their own operating costs while contributing to larger city and state sustainability initiatives.

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