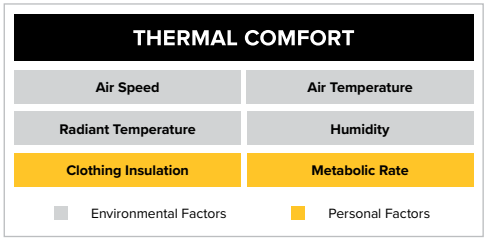
USING BIG ASS FANS TO IMPROVE ENERGY EFFICIENCY

BIG ASS FANS®

FANS IN AIR CONDITIONED SPACES

What Is Thermal Comfort?

Thermal comfort is how comfortable an occupant feels in a space. Many factors influence thermal comfort — some are in your control, and some are in ours. Most notably, Big Ass fans provide cooling effects by increasing occupant-level air speed.



Six important factors determine your overall thermal comfort, as defined by ASHRAE Standard 55.

Why Add Fans To Conditioned Spaces?

Air conditioning is great — but it's expensive and can be horrifically inefficient. Big Ass fans work with air conditioning systems to make them more effective and provide cooling effects that reduce AC system run-times. The fans use a fraction of the energy of an HVAC system, thereby reducing overall energy consumption. By incorporating Big Ass fans into HVAC designs and building automation systems, energy savings become easy and automatic.

Measuring Thermal Comfort

To comply with ASHRAE Standard 55, calculated conditions for occupants must meet the following conditions:

Predicted Mean Vote (PMV), a statistical prediction of population thermal sensation should be greater than -0.5 and less than 0.5, indicating thermally neutral conditions.

Predicted Percentage Dissatisfied (PPD), a statistical prediction of population thermal dissatisfaction should be less than 10%. It is worth noting that even in a perfectly thermal neutral environment (PMV = 0), that PPD will still equal 5%, reflecting the population variance in thermal comfort preferences.

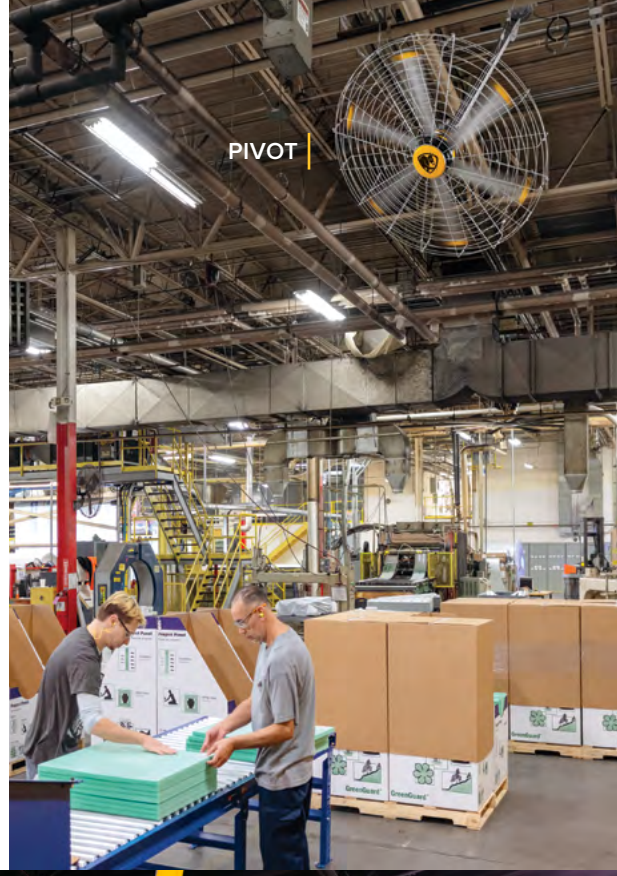
A/C ONLY	A/C AND FANS
Air Dry Bulb Temp = 75°F (24°C)	Air Dry Bulb Temp = 80°F (27°C)
Mean Radiant Temp = 75°F (24°C)	Mean Radiant Temp = 80°F (27°C)
Humidity Ratio = 0.009	Humidity Ratio = 0.009
Air Speed = 20 fpm (0.1 m/s)	Air Speed = 110 fpm (0.6 m/s)
Metabolic Rate = 1.1 met	Metabolic Rate = 1.1 met
Clothing Insulation = 0.75 clo	Clothing Insulation = 0.75 clo
PMV: -0.01 PPD: 5%	PMV: -0.01 PPD: 5%

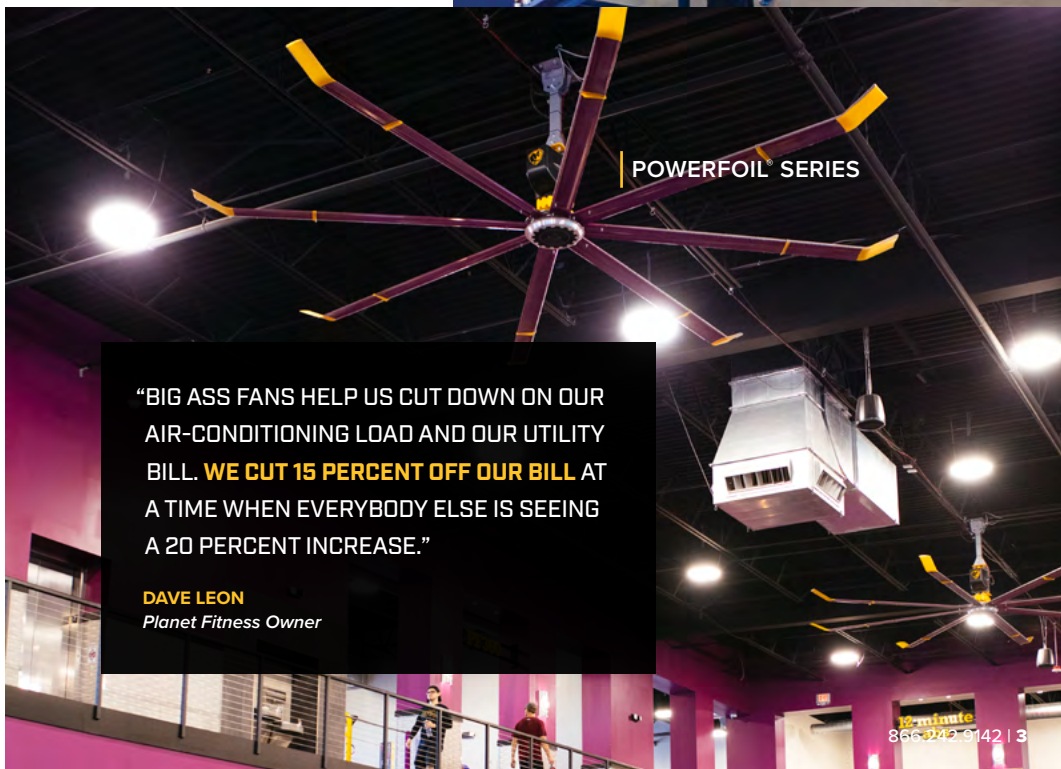
Source: CBE Thermal Comfort Tool

Combining A/C and fans means increased energy efficiency without sacrificing comfort

Fans and AC Energy Savings

Increased air movement from Big Ass fans make occupants feel cooler, allowing designers and users to raise thermostat setpoints without sacrificing comfort. Each Fahrenheit degree offset reduces HVAC-related energy usage by 3 to 6 percent.* In the example below, where the cooling setpoint has been raised 5 degrees Fahrenheit while maintaining thermal comfort, HVAC cooling energy savings of 15% to 30% would be expected. Credits can also be earned for elevated airspeed in designs that exceed the minimum requirements of Standards 90.1 and 189.1.**





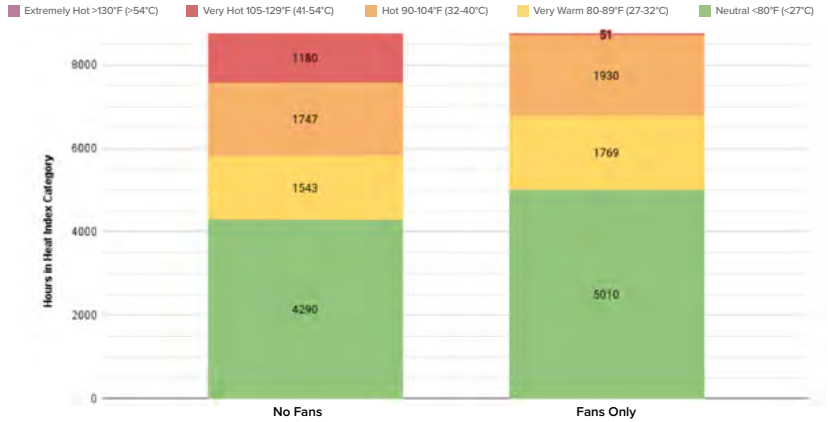
*US EPA & DOE Energy Savings Calculator
**ANSI/ASHRAE/IES Standard 90.1 and ANSI/ASHRAE/USGBC/IES Standard 189.1

COOLING WITHOUT AIR CONDITIONING

Why Is Heat A Problem?

First and foremost, prolonged and repeated exposure to heat is a safety concern and can lead to serious heat-related illness. Big Ass fans *(especially when coupled with Cool-Space® evaporative coolers - more info on page 10)* are a proven energy-efficient way to reduce heat exposure and provide a safer and more comfortable working environment.

Hourly Heat Index Distribution For A Typical Year



Heat And Productivity

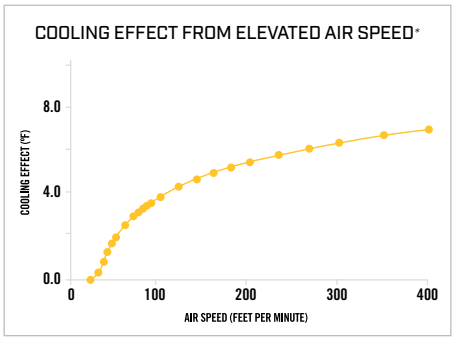
It's hard to work when you're too warm. Whether you are on the shop floor or in the offices upstairs, productivity and accuracy suffer. It sounds intuitive, and it's backed up by science.

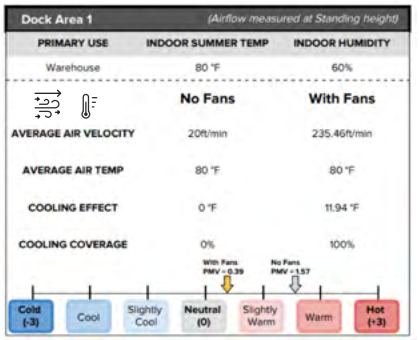
TEMP °F (°C)	RELATIVE PRODUCTIVITY	PRODUCTIVITY LOSS
50 (10)	63.8%	-36.2%
55 (13)	80.6%	-19.4%
60 (16)	91.6%	-8.4%
65 (18)	97.8%	-2.2%
70 (21)	99.9%	-0.1%
75 (24)	99.0%	-1.0%
80 (27)	95.8%	-4.2%
85 (29)	91.2%	-8.8%
90 (32)	86.2%	-13.8%
95 (35)	81.5%	-18.5%
100 (38)	78.1%	-21.9%
105 (41)	76.9%	-23.1%

Source: Seppänen, O., Fisk, W. J. and Lei, Q. H. (2006)

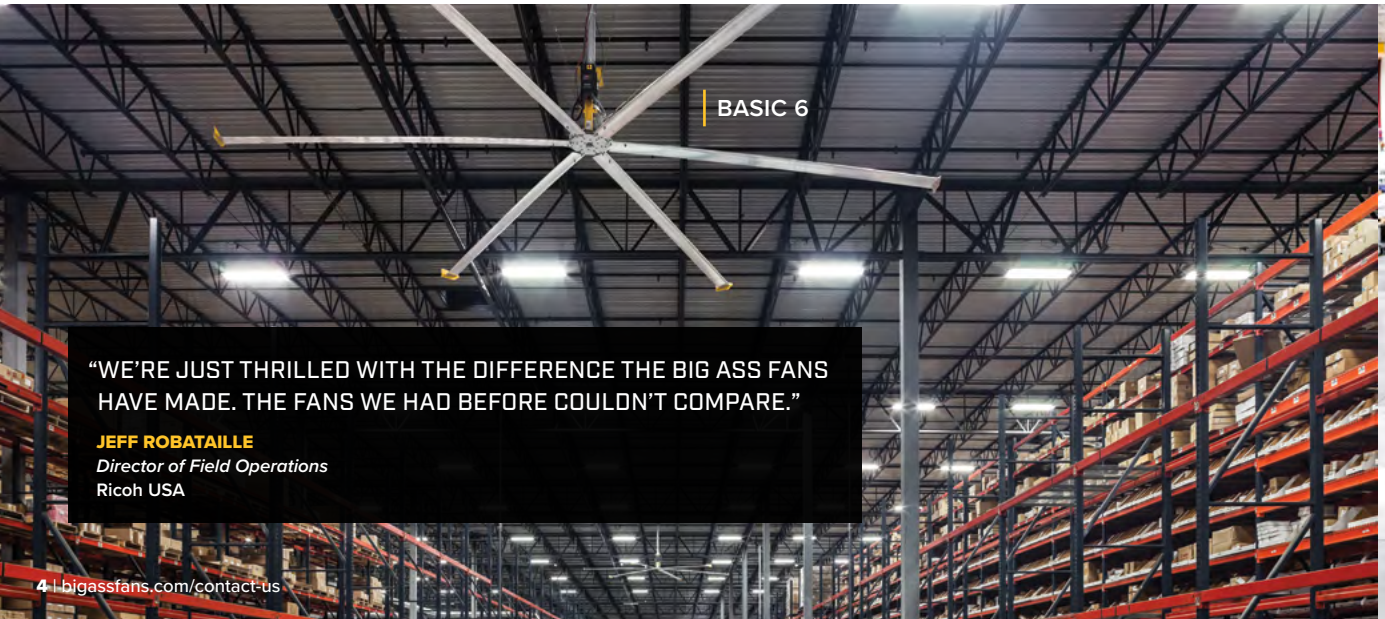
Why Use Big Ass Fans For This?

Increased air speed takes advantage of the body's natural cooling process to create a cooling effect through increased evaporative and convective means of heat rejection. Cool-Space evaporative coolers leverage the thermal properties of water to reduce the dry-bulb air temperature of the air they deliver. All Big Ass Fans products are incredibly effective, energy-efficient, and they are not loud like other industrial fans. Big Ass fans can often replace multiple existing fans, saving critical floor space and reducing clutter.





*Assumptions: 80°F (27C) Air dry bulb and mean radiant temp. 20 fpm air speed (base conditions.) 0.010 Humidity Ratio. 1.1 Metabolic Rate. 0.5 Clo Clothing Level



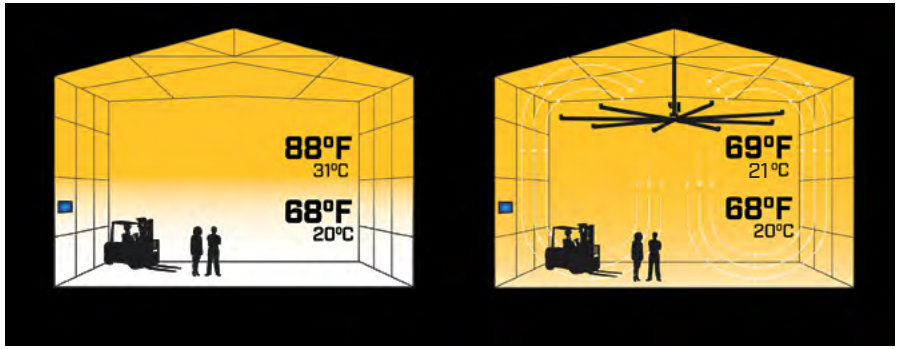
WINTER ENERGY SAVINGS AND DESTRATIFICATION

What Happens In The Winter?

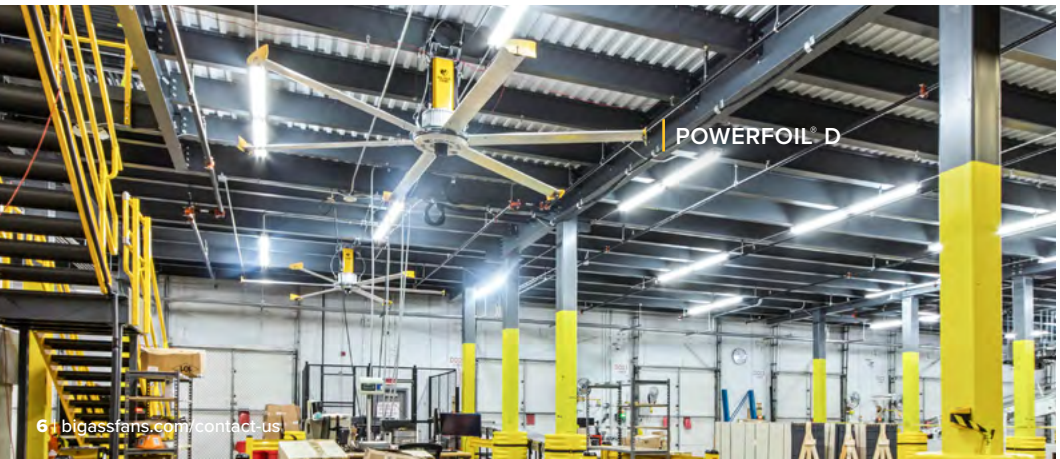
In the winter, heat from heating equipment and internal loads rises. This hot air can get trapped at the ceiling, leading to huge temperature differences across the building envelope, significant heat loss, and massive heating bills.

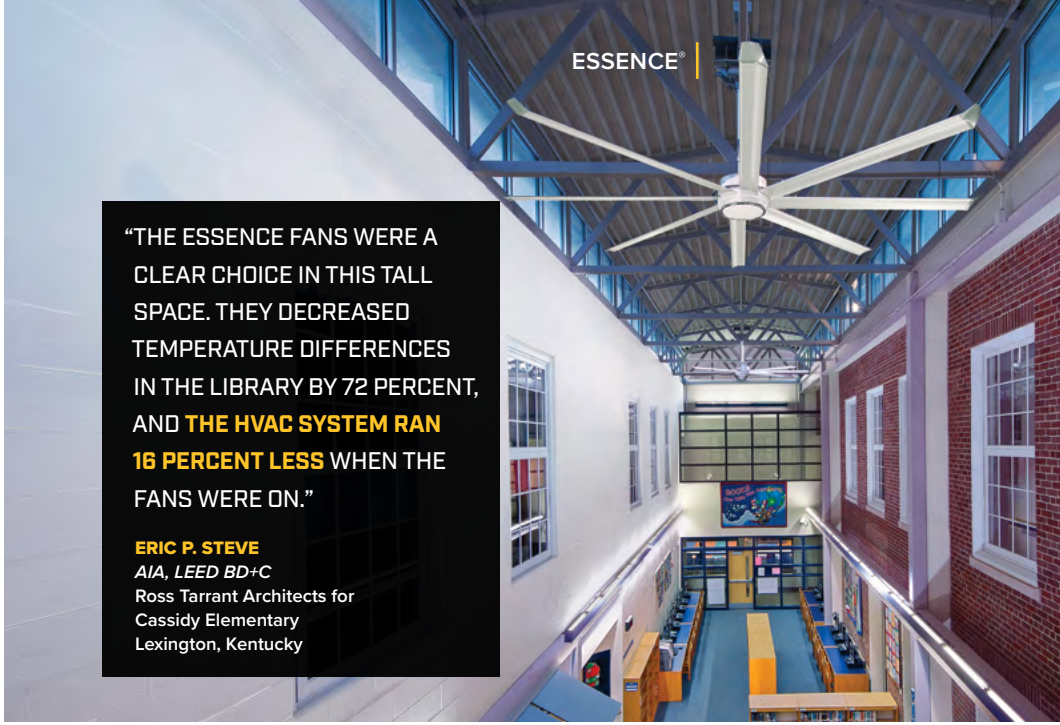
How Does Destratification Work?

Overhead fans aren't just for cooling. Big Ass fans are designed to be able to operate very slowly in the forward direction, so they are able to thoroughly mix the indoor air without creating a draft. This mixing delivers uniform temperatures throughout the space, keeps heated air at the occupied level, reduces the required run-time of heating equipment, and ultimately results in up to 30 percent savings on winter heating bills.



Winter heating, with and without Big Ass fans



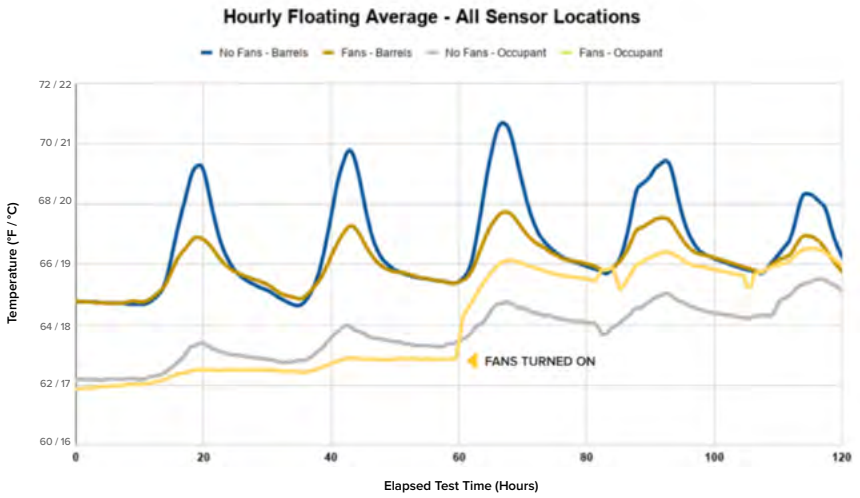


"THE ESSENCE FANS WERE A CLEAR CHOICE IN THIS TALL SPACE. THEY DECREASED TEMPERATURE DIFFERENCES IN THE LIBRARY BY 72 PERCENT, AND **THE HVAC SYSTEM RAN 16 PERCENT LESS** WHEN THE FANS WERE ON."

ERIC P. STEVE
AIA, LEED BD+C
Ross Tarrant Architects for
Cassidy Elementary
Lexington, Kentucky

Other Destratification Applications

The dynamics and thermal properties of large warehouses can pose difficult challenges when you have racks and racks stacked with temperature-sensitive products. How do you keep products both on the top and bottom shelf within temperature specifications? The answer is Big Ass fans. By utilizing fans to mix the air in the storage areas, temperatures are more uniform top to bottom, improving product stability, and reducing the risk of spoilage.



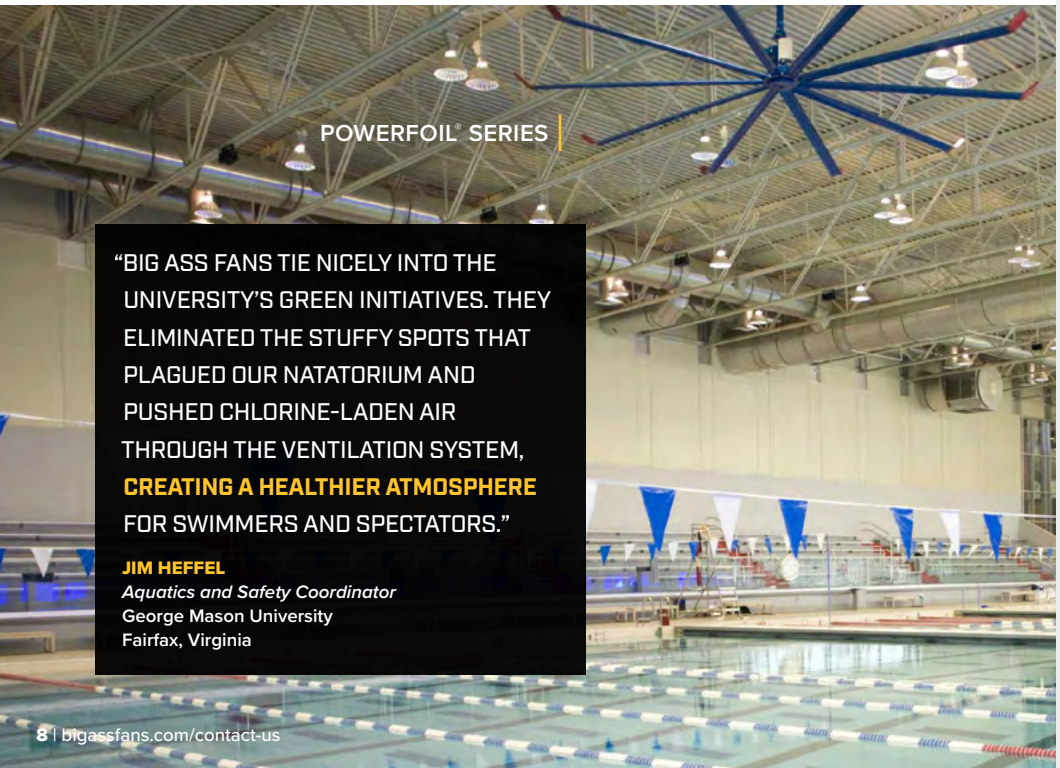
IMPROVING VENTILATION AND IAQ

Ventilation Effectiveness

When supply and return vents are located at the ceiling, it's often difficult to distribute the supplied air throughout a space and to the occupied zone. This issue can be further exacerbated in heavily obstructed spaces such as office cubical zones and industrial facilities and is worst in winter heating modes when IAQ concerns are at their peak.

How Do Big Ass Fans Help?

Big Ass fans can improve zone air distribution effectiveness by pushing supply air down to occupant level, helping to deliver 20 percent more fresh air to the occupant level, or enabling the reduction of fresh air intake by 20 percent without a negative effect on indoor air quality (IAQ). Big Ass fans provide air circulation that also enables what we affectionately call "solution by dilution" where fans reduce the local concentrations of pollutants in stagnant areas or near the source while using the entire indoor air volume as an effective buffer for any pollutant and improving the access of existing ventilation systems.



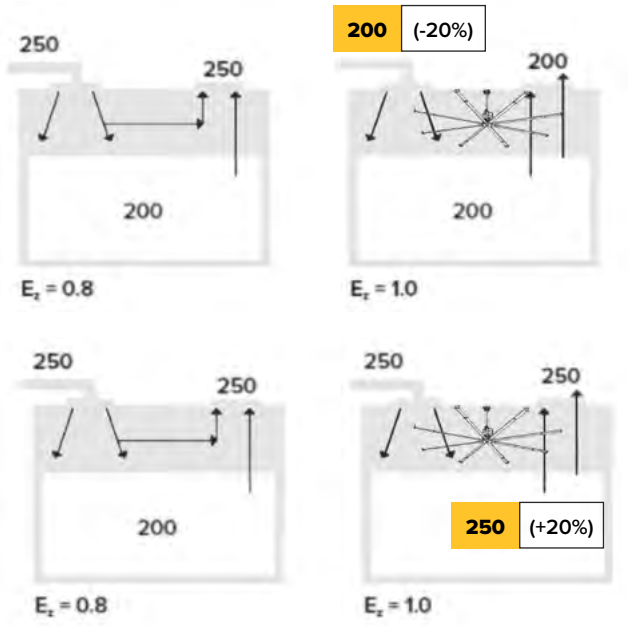
"BIG ASS FANS TIE NICELY INTO THE UNIVERSITY'S GREEN INITIATIVES. THEY ELIMINATED THE STUFFY SPOTS THAT PLAGUED OUR NATATORIUM AND PUSHED CHLORINE-LADEN AIR THROUGH THE VENTILATION SYSTEM, **CREATING A HEALTHIER ATMOSPHERE** FOR SWIMMERS AND SPECTATORS."

JIM HEFFEL
Aquatics and Safety Coordinator
George Mason University
Fairfax, Virginia

ANSI/ASHRAE STD 62.1 & OVERHEAD HEATING

Zone floor area (ft^2)	2000	2000
Zone population (people)	16	16
Breathing zone outdoor airflow (cfm)	200	200
Typical zone air distribution effectiveness (E_z)*	0.8	1.0**
Outdoor air intake flow (cfm)	250	200

*Table 6-4 of ASHRAE Standard 62.1-2019
**Must be approved by local code official



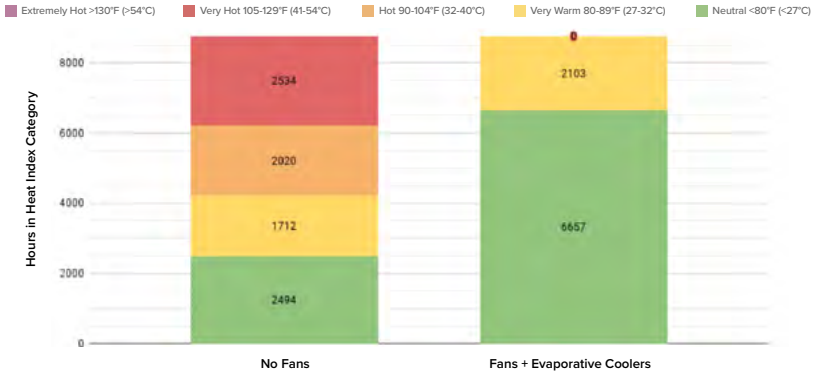
Without circulating fans (left), HVAC systems and other ventilation equipment can struggle to distribute supply air and to maintain acceptable IAQ. The addition of circulating fans (right) allows for a reduction in outdoor air ventilation rate without impacts to IAQ (top) or can enable more outdoor air to reach the occupied zone, improving IAQ (bottom)

NATURAL SYNERGY BETWEEN HVLS FANS AND EVAPORATIVE COOLING

What If Fans Aren't Enough?

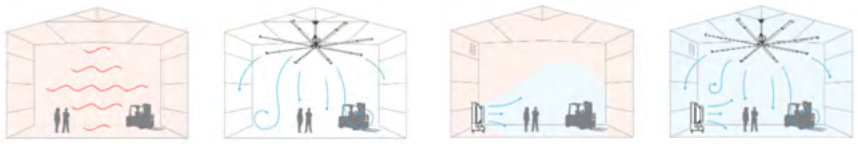
While Big Ass fans provide cooling effects when air temperatures are well into the triple digits (>100°F / 38°C), your facility may need even more assistance to become the safest and most comfortable environment. For unconditioned facilities in hot and dry climates, this is an all too common problem with few evident cost-effective and energy-efficient solutions.

Hourly Heat Index Distribution For A Typical Year



How Do Evaporative Coolers Work?

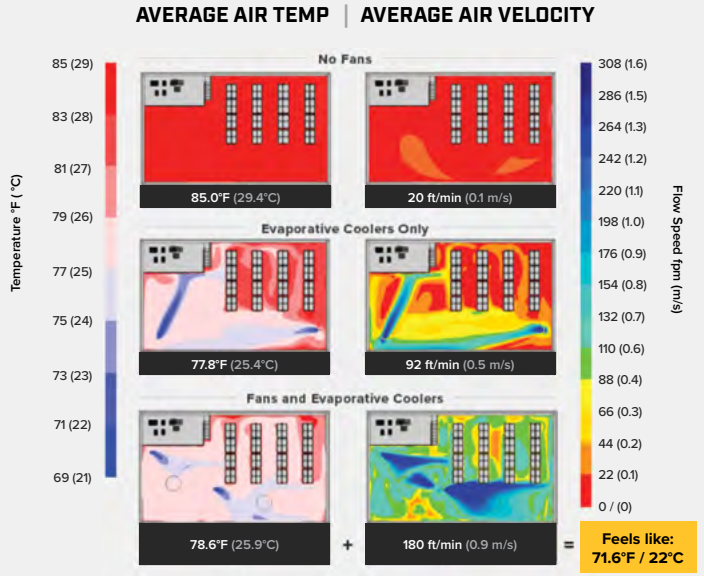
Cool-Space evaporative coolers leverage the vaporization energy of water to rapidly cool air without large amounts of energy consumption. While limited by ambient humidity, the temperature depression through the evaporative units can be significant (Ex: 16°F drop at 90°F/35% RH):



Evaporative cooling, with and without Big Ass Fans

How Do Cool-Space Evaporative Coolers Help?

To deliver the final step for comfort, Big Ass Fans has the Cool-Space line of portable evaporative coolers to provide dramatically lower air temperatures precisely where they are needed or to distribute cool air throughout a space when coupled with overhead Big Ass fans.



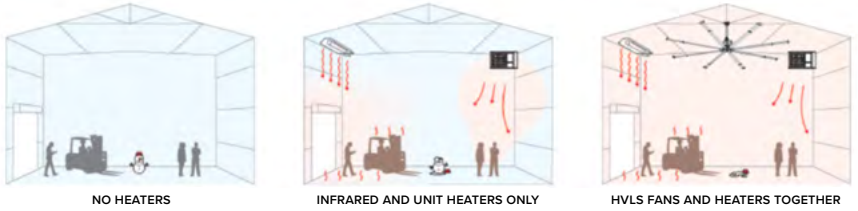
TARGETED HEATING FOR YEAR-ROUND FACILITY SOLUTIONS

What About Keeping Warm?

Is your facility challenged by frequently opening and closing dock doors? Have an aging HVAC system that can't keep up with old man winter? Big Ass Fans Infrared Heaters and Unit Heaters are the reliable, cost-effective way to keep your team warm and productive through colder weather.

How Do Big Ass Fans' Heaters Help?

Big Ass Fans has the heating solution for your industrial or commercial space regardless of size, location, and project goals. For areas where infiltration or rapidly changing conditions are an issue, Big Ass Fans Radiant Heaters can provide direct heat to occupants and objects, dramatically improving thermal comfort without wasting energy on heating large volumes of air. For projects where air temperature matters most, use Big Ass Fans Unit Heaters to deliver heating capacity to the space and use Big Ass overhead fans to evenly distribute. For best results, use unit heaters to temper the air, and radiant heaters to go the extra mile and deliver the best thermal comfort for occupants.

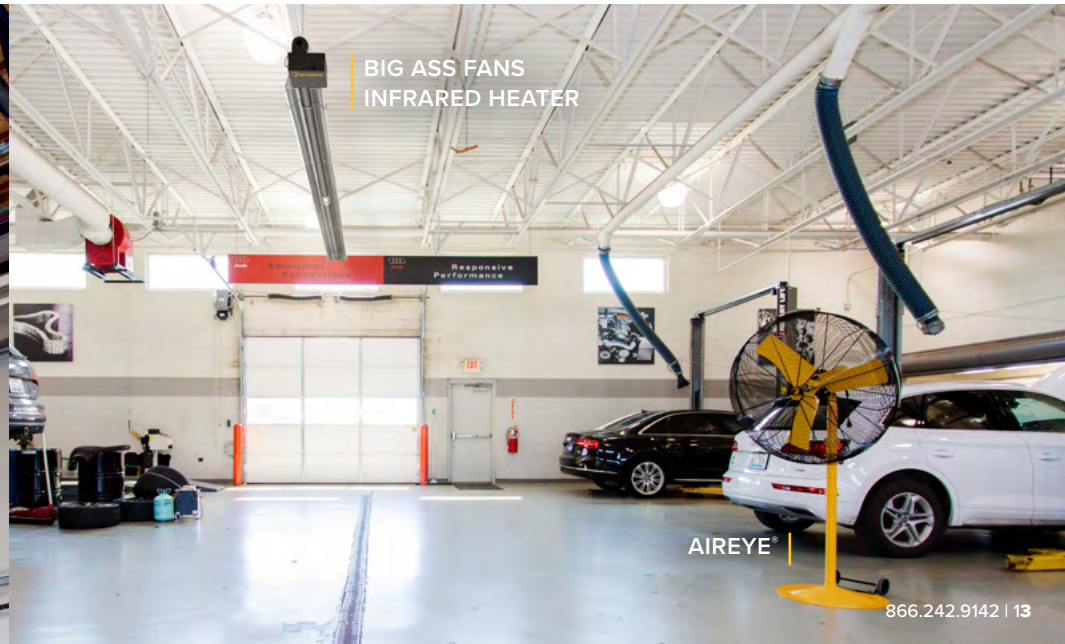


Heating, with and without Big Ass Fans

See How Heat Can Help

While most think about productivity losses in hot conditions, losses can be even more significant in spaces that are too cold. Using Big Ass Fans' heaters to raise the effective temperature even 5 degrees F can result in more than worthwhile savings.

TEMP °F / °C	RELATIVE PRODUCTIVITY	PRODUCTIVITY LOSS
50 / 10	63.8%	-36.2%
55 / 13	80.6%	-19.4%
60 / 16	91.6%	-8.4%
65 / 18	97.8%	-2.2%
70 / 21	99.9%	-0.1%



GREEN RATING SYSTEMS

The use of Big Ass Fans as an element of an overall design strategy can contribute to credit achievement in the following sustainable living programs:

LEED® v4.1 Building Design + Construction

- EA Prerequisite: minimum energy performance
- EA Credit: optimize energy performance
- EA Credit: grid harmonization
- EQ Prerequisite: minimum indoor air quality performance
- EQ Credit: enhanced indoor air quality strategies
- EQ Credit: thermal comfort
- IN Credit: innovation

Living Building Challenge™ 4.0

- Petal - Energy, Core Imperative 07 - Energy + Carbon Reduction
- Petal - Health + Happiness, Core Imperative 09 - Healthy Interior Environment
- Petal - Health + Happiness, Imperative 10 - Healthy Interior Performance

Green Globes® for New Construction 2021

- Section 3.1 - Energy Performance
- Section 6.1 - Air Ventilation and Quality
- Section 6.4 - Thermal Comfort

NEED MORE INFO? CONTACT OUR EXPERTS FOR MORE DETAILS.

Interested in free design assistance or learning more about how Big Ass Fans can benefit your projects? Our applications engineers and LEED accredited professionals would love to help! Visit **bigassfans.com/contact-us** or call **866.242.9124** to learn more.

BIG ASS FANS®