



Industrial air cooling

The optimum solution to increase workplace productivity

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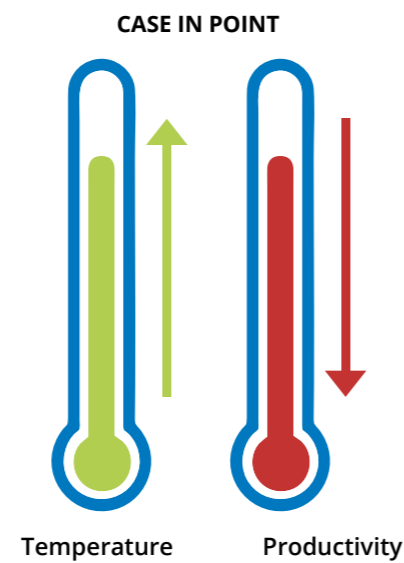
The optimum solution to increase workplace productivity

"A recent study by IIM-A suggests that air cooling is more efficient and worker-friendly than air conditioning at industrial workplaces."

Introduction

In today's world of fierce competition and competitive costs, worker productivity is the key to winning the market share battle. While low wages were corrected in the past, workforce comfort is becoming the key factor in driving efficiency and productivity in industrial workplaces.

During summer, industrial sheds, warehouses and manufacturing facilities witness temperatures above 24°C going up to 40 & 45°C. Machinery usage further adds to the heat. An increasingly hot working environment can result in a severe slowdown of production – both in tangible and intangible terms. For example, employee sickness or absenteeism are tangible causes of losses. Reduced productivity or defective jobwork due to uncomfortable working conditions are intangibles that can be immediately seen.



Air conditioners: Economically unviable & detrimental to health

Unlike offices where air conditioning is most suitable, factories, warehouses and outdoor sites cannot be centrally air conditioned unless production demands temperature-controlled facilities. This is due to various reasons:

Capital costs & initial investments

Significant capex is required as an initial investment for creating centrally air conditioned work environments. Such costs may burden the fixed costs making the per unit production cost unviable. Also, the company management would rather invest such a significant amount in the latest machinery or state-of-the-art technology.

High maintenance and running costs

The regular cost of running a centrally air conditioned area can be massive, running up significant energy bills, annual maintenance costs (AMC) and cost of replacement of parts. Studies suggest that the per unit cost of running an air cooling system is one fourth of an air conditioner.

Environment & health hazards

The usage of air conditioners results in the release of greenhouse gases and environmentally harmful CFC. Moreover, air conditioners reduce the water content in the atmosphere and lead to water loss from the lungs and skin. Apart from the resulting dehydration, it also leads to breathing of unhealthy air with limited air circulation.

Open areas cannot be air conditioned

Factories and workplaces often have large open areas for transportation of goods or movement of large number of workers during shift changes, etc. thus making central air conditioning unviable.

Why industrial air cooling is defining the future of blue-collar work spaces

Today, the ability to attract and retain blue-collar workers on the industrial shopfloor is becoming a competitive necessity. With increased pay and better lifestyles, workers' demand for a comfortable workplace is fast becoming the norm. Labour-driven industries like textiles, automotives and ancillary sectors cannot be 100% mechanised or automated.



Air coolers can replace the fan effectively

Most industrial workplaces still use ceiling fans for cooling. Air coolers can complement the fan and help bring down the temperatures in a natural way and create a comfortable work environment.



Low capex & maintenance cost

The capital cost of installing a central air cooling system is minimal as compared to a central air conditioner as also regular running it. According to estimates, the average cost of setting up an air cooling system is one fourth of a central air conditioning system.



Environment and health friendly

Air coolers are environment-friendly as they emit zero chloroflourocarbons (CFC) and can help combat climate change. Also, they circulate 100% fresh, filtered cool air into the workplace continuously, while in air conditioners, the same stale air is recirculated. Also, unlike air conditioners, the air contains moisture, thus preventing dehydration and other side effects like eye or skin irritation due to dryness.



Apt for open areas at factories & industrial sheds

Central air cooling systems do not require an enclosed area. Thus, open spaces for raw material and finished goods carriages or worker movements during shifts can be easily air cooled with minimum disturbance to the current.

Studies on heat stress and its impact on worker productivity

Human comfort zone and heat stress

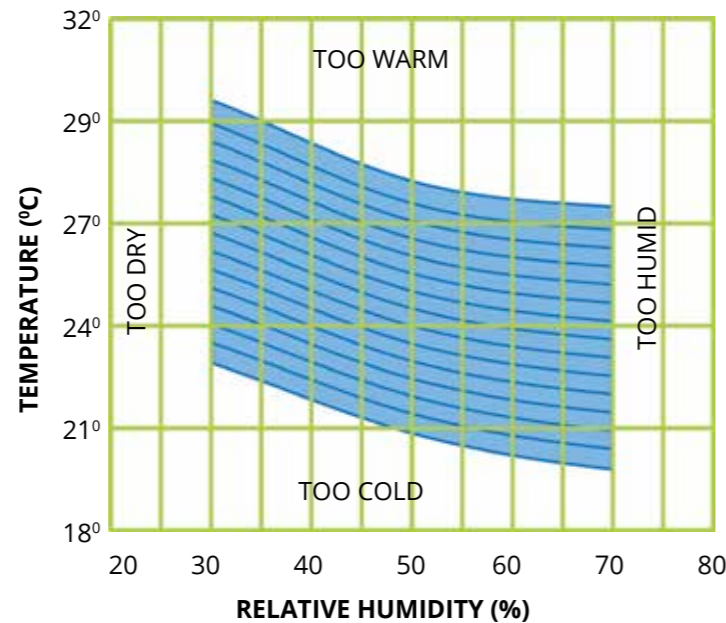
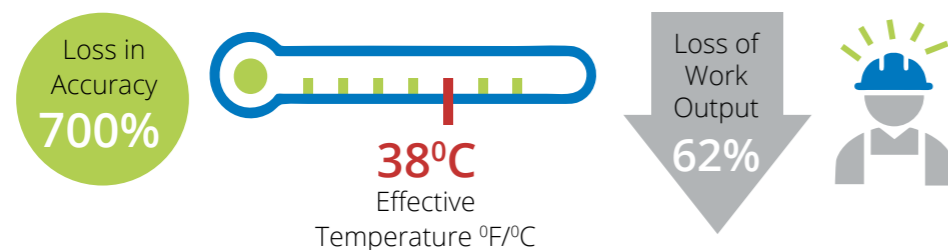
The range of temperature and humidity conditions that most people find comfortable. People working in such a zone are likely to be at their most productive state

The human body, even when exposed to environmental temperatures that exceed 38°C, has the capacity to maintain the core body temperature of around 37.2°C to sustain the normal functioning of enzymes. However, under extreme temperatures, this balance is disturbed.

Heat stress is a physical and psychological hazard, which can impact the health and safety of industrial workers. Its effect depends upon many conditions, primarily environmental factors such as ambient temperature, relative humidity, radiant heat, air velocity and conduction.

According to a heat stress report CR-1205 (1) released by NASA temperatures over 24°C negatively affect both the productivity and accuracy of work. Refer table below for the relationship identified during NASA tests between temperature, work output and accuracy.

Effective Temperature °F/°C	75/24	80/27	85/29	90/32	95/35	100/38	105/41
Loss of Work Output	3%	8%	18%	29%	45%	62%	79%
Loss in Accuracy	0%	5%	40%	300%	700%	>700%	>700%



Impact of heat stress on physical health

As per studies conducted by Parsons, working in excessive ambient temperatures such as temperatures above 35°C may produce health hazards as well as productivity losses.

When a human body is exposed to temperatures exceeding 38°C, it causes heat strain which may lead to heat stroke, and even death in some cases. The heatstroke, which usually occurs with dehydration can damage the kidneys, brain, heart and muscles. It requires emergency treatment.

It has been reported that the current rate of climate change will cause a further 20% loss of annual work ability of workers exposed to heightened heat conditions. In a study conducted in 2016 across

eight work places, it was indicated that 87% of the workers experienced health problems related to heat during the three hottest months, with almost half of them reporting a decrease in productivity.

Furthermore, a study by Ahasan (1999) on metal shops in Bangladesh reports that heat actually reduces the work performance. This reinforces similar studies conducted in India by various scholars such as Hyatt, Lemke, & Kjellstrom (2010) as well as Nag, Nag, & Ashwekar (2007).

Effects on mental health

Heat stress not only has physical, but also mental and psychological effects on employees' health.

A number of studies have indicated that the effect of heat on mental performance is dependent upon the type of task as well as the skill of the worker. Complex tasks like tracking, vigilance and multi-tasking are more affected by heat compared to simple monotonous and repetitive tasks such as those testing reaction time. Similarly, operators with a high skill level are better at withstanding effects of heat stress than their less skilled counterparts. The length of exposure too has certain effects.

In his study, Hansen Alana, established positive association between ambient temperature (above a threshold of 26.7°C) and hospital admissions (increase of 7.3%) for mental and behavioral disorders like symptomatic mental disorders; dementia; mood (affective) disorders; neurotic, stress related, and somatoform disorders.

A landmark study by two IIM-A professors

The recent study commissioned by two professors from the Indian Institute of Management (IIM) Ahmedabad, Dheeraj Sharma and Rajesh Chandwani, measures the co-relation between a high temperature work environment and its resultant impact on employee productivity.

The study of climate change in India poses a huge challenge due to the variance in climate systems as well as the occurrence of four distinct seasons. Large geographical expanses and variations in temperatures & rainfall further add to the complexities.

In their study, Dheeraj and Rajesh studied two key aspects:

- a. **Impact of high temperature on performance within the workplace environment**
- b. **Impact of cooling solutions (that reduce the ambient temperature) on performance enhancement**

Various parameters were taken into consideration like job stress, job performance, job effort, burnout, job satisfaction, job commitment and psychological well-being. As a result of this, ten hypotheses were formed basis which the tests were conducted. The findings from the study also produced interesting insights on the effective measures to reverse the process.

Key insights from the IIM-A study



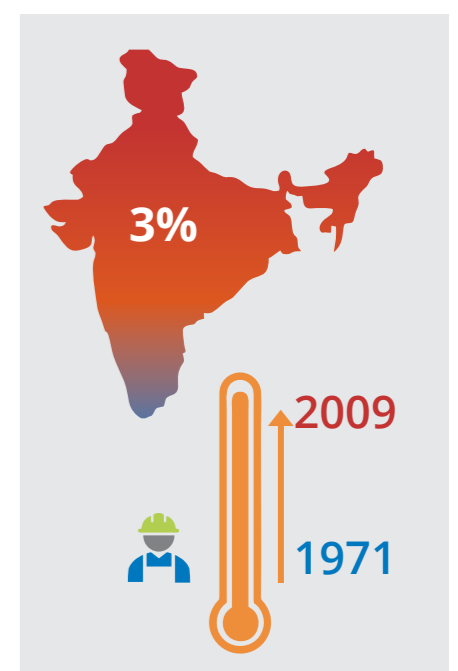
- ▶ Regulatory support is important for preventive measures such as use of information and communication technologies.
- ▶ Role of regulatory bodies is critical to encourage environment friendly and feasible measures for cooling solutions such as high capacity industrial coolers, solar panel driven cooling etc.
- ▶ Role of organizations is equally important, especially those which employ machineries that lead to increased workplace temperature such as textile industry, steel industry, bakeries etc.
- ▶ Importance of regularly monitoring employee morale and psychological state to address their concerns in time.
- ▶ Investment in educating the workers about heat stress and its effect on physical health as well as training on methods to mitigate the effects of heat stress.
- ▶ Providing additional facilities at workplace such as plenty of drinking water, ensuring appropriate clothing to preventing heat stress related hazards etc.

Collective impact on the manufacturing output

In August 2015, the Economics and Planning Unit of the Indian Statistical Institute released a discussion paper titled The Impact of Temperature on Productivity and Labour Supply: Evidence from Indian Manufacturing.

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Methodology - Quantitative method

A list of organizations where cooling mechanisms had been installed was obtained from Symphony Limited - the market leader in the industrial cooling segment in the Indian context.

Two companies each in the northern, western, south eastern regions of India were identified for an even geographic spread. A matching number of companies in the same geographical region, and within the same industry were selected (these were the companies where the cooling mechanisms were yet to be installed).

The principle investigators personally visited the plants to interact with the top management as well as provide them a project overview.

The need for a policy & regulatory framework

Countries across the globe, especially, in tropical climates have mandated temperatures for workers. For example, South Korea has mandated a temperature of 24°C for its workers and the ideal temperature according to the research study should be between 24-30°C. However, the Indian law does not have any temperature regulation or any optimum temperature requirement in effect.

The Workmen Regulations Act, 1923 only mentions the installation of ceiling & exhaust fans. This Act needs to be modified. Making an air cooling system mandatory across all industrial units of a particular scale and above will help in not only enabling worker safety and health but contribute to India's commitment to reduce global warming. As an additional benefit, reduced absenteeism and illness will lead to increased productivity and profitability for industries. This will again add up the overall industrial production numbers.

Conclusion

Considering worker absenteeism, overall morale, energy & productivity levels and high attrition rates, not managing workforce temperature can prove to be very costly. The economics of an air cooling system have made it a viable option for vast numbers of industrial and commercial organisations.



Maintaining the temperature at a comfortable level increases worker morale and lowers stress-induced errors. In India and in developing countries, progressive corporates have already started installing central air cooling solutions in their factory premises.

This has not only led to increased productivity but ensured harmonious industrial relations between the workforce and the factory management. A sense of respect for blue-collar workers by making their workplace air cooled is a great measure of employee friendly HR practices.

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NASA Study on Heat Productivity

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About Keruilai

Keruilai (Guangdong Symphony Keruilai Air Coolers Co., Ltd. erstwhile known as Munters Keruilai Air Treatment Equipment (Guangdong) Co., Ltd.) is a global evaporative air cooling company. It is part of the world's largest air cooling company - Symphony Limited. As pioneers and the largest air cooling solution providers in China, we serve every cooling need of customers across indoor, outdoor, spot, semi-open and hybrid cooling environments.

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