

WHITEPAPER

Challenges & Opportunities for Energy-efficient Climate Control

How to create a sustainable and comfortable climate within your production facility



World leader in adiabatic cooling



Introduction

A common challenge faced by production facilities today is how to create an indoor climate that is beneficial to their employees and production machinery, processes and products. Heat is an essential cause of complications in production processes. It not only results in employees to be demotivated, less productive and make more mistakes but also causes machine downtime. Other influences, such as dust or released vapors can also have a negative effect on the comfort and well-being of employees. Therefore, cooling and optimal ventilation are fundamental to your production facility. At the same time, production facilities need to reduce their energy costs.

As a consequence, production facilities need to rethink the way they can achieve optimal cooling and ventilation. Mechanical air conditioning, for instance, proves to be highly unsustainable and unaffordable. The goal of production facilities is thus to implement an energy-efficient climate system that maximizes production output, at minimal energy costs.

In this whitepaper, we describe what factors you need to take into consideration and how you can achieve energy-efficient climate control within your production facility.



1. Factors that influence the indoor climate of a production facility

When looking to create a climate within your production facility that is beneficial to the production process and energy-efficient as well, it is crucial to consider the factors that influence the indoor environment. In this chapter, we explore these factors further.

1.1 External Factors

External influences largely determine the temperature within a building. This includes the outside temperature, the position of the sun and the amount of sunlight or sun hours. Furthermore, the geographical location of the building plays a role as well, as this will determine the overall influence of wind and relative humidity. These factors need to be taken into account when looking to create a comfortable and sustainable climate within the production facility as these determine the design of your climate control solution.

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“Due to temperatures rising globally, it has become a challenge for many production facilities to maintain an indoor climate that is both healthy and sustainable”

1.2 Internal Factors

There are many fixed characteristics of the building itself that will influence the indoor climate. For example, the year the production facility was built, and with what type of insulation material influences the levels of insulation within the building. If a building is well insulated, the internal heat cannot easily escape, which is beneficial during the colder periods of the year, but less optimal during summer. The amount and type of windows also influence the indoor climate. Skylights provide an aesthetically pleasing and convenient natural lighting solution, but also let a lot of sun heat pass through. The same goes for single glazed windows. Besides, the presence of a natural ventilation system or ventilation hatches will also influence the indoor environment. Throughout the year, these ventilation options provide the facility with fresh outside air. Yet, the outside air that is ventilated in during summer isn't cooled down, and will only heat the facility even further. Furthermore, the type of electrical lighting in place will influence the internal heat load as some light bulbs give off a lot of extra heat.



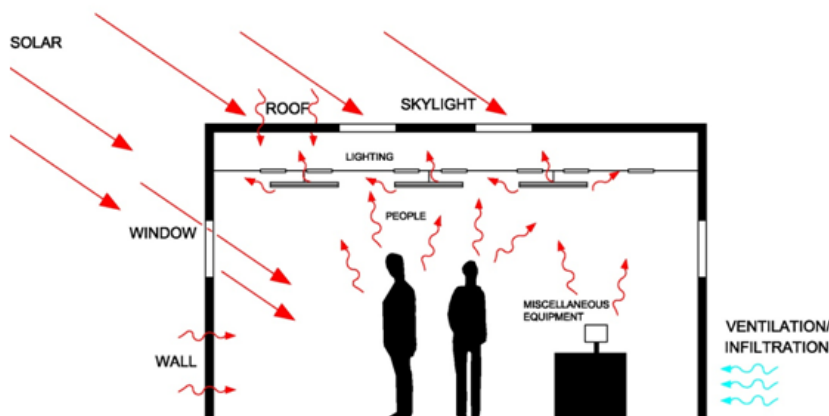
1.2.1 Production process

The temperature in a production facility also depends on the production process itself. The machines used in production give off a lot of heat during their running time and warm up the indoor environment. Compressors and process cooling machines also influence the indoor climate if they are placed indoors, as these generate a lot of heat as well. Furthermore, if there is any process extraction in place, it is essential to consider whether this extraction blows the heated air back into the production hall, as this heavily influences the indoor temperature. Last but not least, the number of people and their activities will further impact the indoor environment due to their body heat.



2. Opportunities & solutions for energy-efficient climate control in a production facility

As described above, many factors influence the indoor climate of a production facility. Once these factors have been taken into account and are analyzed, you can start looking at the opportunities and solutions for energy-efficient climate control within your production facility. The first step in this process is to determine what climate you want or rather need in your production facility and if this can be achieved using an energy-efficient solution.



2.1 An energy-efficient climate beneficial to the production process

Some production facilities are dead set on a stable climate of 20°C within their production facility, all year round. However, during the warmer periods of the year when outside temperatures quickly rise to 40°C, this can only be achieved with heavy mechanical cooling that uses a lot of energy. The question is then if this large discrepancy in temperature is necessary. Of course, some industries such as the medical industry and the food industry absolutely require their indoor temperature to stay below 25°C. Yet, for many other industries, this is not the case. Therefore it is essential to consider the temperature that you need to achieve within your production facility, and in



2.3. Energy-efficient climate control: two-stage adiabatic cooling

If the adjustments listed above are insufficient to create a comfortable and productive environment inside the production facility, an additional climate control system will have to be put in place. Traditional air conditioning can be a solution. However, these systems use a lot of energy to achieve the desired temperature. Two-stage adiabatic cooling, on the other hand, can cool up to 15°C below the outside temperature while using 90% less energy than traditional air conditioning. Furthermore, two-stage adiabatic cooling systems allow you to create a sustainable and productive climate throughout the whole year.

Oxycom's two-stage adiabatic cooling system, IntrCooll, uses 100% fresh outside air during free cooling and cooling. During spring, winter or fall, the system uses the outdoor air smartly to ventilate and cool without using any energy at all. When the outside temperatures increase beyond a temperature of 18-22°C, the IntrCooll system switches to two-stage adiabatic cooling; the outside air is cooled in the first stage using cold recirculation water and further cooled down by direct evaporation in the second stage. Only 1 kW of electricity is needed to provide up to 40 kW of cooling power. This so-called EER (Energy Efficiency Ratio) is a factor 10 lower with traditional cooling systems. During winter, the IntrCooll system can be enhanced using the Heat Reclaim module. This module reuses the residual heat that is generated from machines, processes, heating, lighting and people, mixes it with fresh outside air and thus supplies the production hall with preheated ventilation. In this process, the horizontal temperature layers in the production area are breached (anti-stratification), and the difference in temperature of the roof (between inside and outside) is minimized. This results in less heat loss and therefore provides significant savings.



Benefits of energy-efficient climate control



Happy and healthy employees



Zero machinery downtime



Energy (costs) reduction



Low running costs



Less production errors



Maximized output at minimum costs

