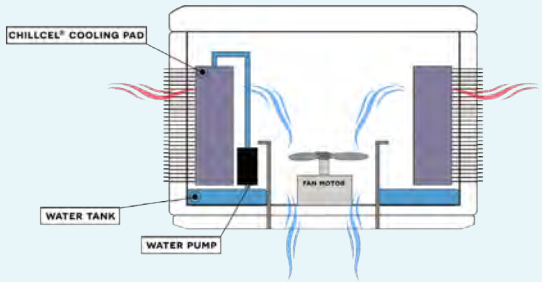
Breezair™
By SEELEY INTERNATIONAL

Direct evaporative cooling technology

Technical cooling with Breezair

Evaporative air conditioning uses evaporation to cool the air. In an evaporative cooler, a pump circulates water from the reservoir on to a cooling pad, which in turn becomes very wet. A fan draws air from outside the unit through the moistened pad. As it passes through the pad the air is cooled by evaporation.

The key to effective evaporative cooling is ensuring that each of the cooling pads are completely saturated at all times during operation and that the systems fan & motor are sized and designed to deliver the appropriate airflow for the space.



Evaporative cooling is often installed for comfort cooling reasons, to improve working conditions inside a manufacturing plant or a warehouse, for example.

There is a different way of approaching evaporative cooling, which is to use it to improve a process or lower the energy used by a specific machine.

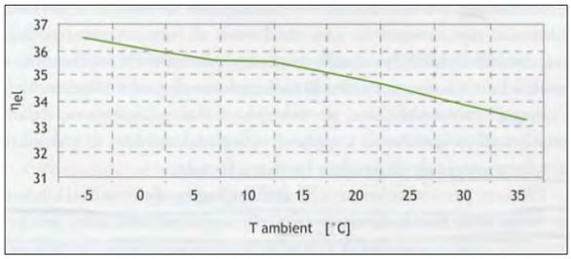
Lowering the temperature of a specific process or machine, can lead to significant energy savings, which also includes reduced running costs and CO_2 emissions.

Up to 80% more economical than conventional air conditioning systems, Seeley International's evaporative cooling systems have delivered proved cost reductions and operational returns throughout many industries.

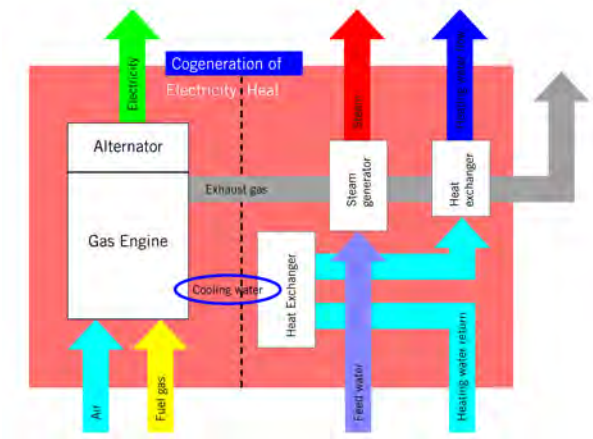
Cooling cogeneration plants

Cogeneration plants are becoming more and more popular, as they are used to produce electricity and heat at the same time within a single system starting from one fuel source. This way, cogeneration allows massive savings on power transmission and distribution, with higher flexibility.

Gas powered internal combustion engines are commonly used in cogeneration applications. One of the parameters that most influences engines performance and power is the inlet air temperature, since it determines the density of the air drawn into the cylinders. The warmer the air, the less efficient the combustion; this means that pre-cooling the inlet air would directly affect (increase) the efficiency of the engine. The graph below shows how the ambient temperature affects the generating system efficiency.



A cogeneration plant located near Turin (Italy), a generating set composed of an engine coupled to an alternator has been cooled using Breezair evaporative cooling. In this plant the heat generated by the engine combustion process is conveyed and used to produce heat in the form of carriers including hot water or steam for various civil and industrial uses. The cogeneration plant has a power production rating of 2 MW and hot water production of 90m³/h.

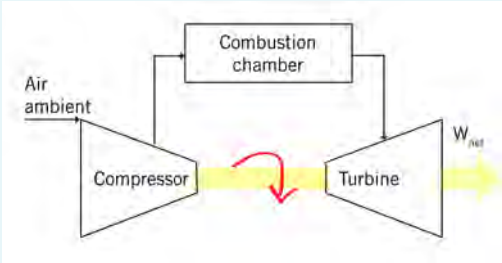


3x Breezair TBS580 evaporative coolers have been installed to cool down the engine ambient temperature. With total air flow of 30.000 m³/h, Breezair coolers are able to reduce the internal engine temperature from 34°C with 33% RH to 22°C with 77% RH.

This temperature drop has generated a significant increase in terms of electrical efficiency of the plant.

In the case of **gas turbine engines**, compared to an internal combustion engine, pre-cooling the inlet air is even more beneficial, because the efficiency of the turbine is more affected by the temperature of the inlet air.

Gas turbine engines consist of a compressor to raise combustion air pressure, a combustion chamber and a turbine that extracts energy from the combustion gases through expansion.



Combustion turbines are constant-volume engines and their power output is directly proportional to the air mass flow rate entering the engine.

Thermal efficiency of combustion turbines decreases with the increase of ambient temperature; therefore, their specific power output will decrease as well. This is a result of the decrease of air density, and consequently, of the reduction of the mass flow rate.

Different methods are available for reducing gas turbine inlet temperature, but the most cost-effective system is evaporative cooling. Studies demonstrate that with **evaporative cooling**, turbine power output and thermal efficiency increase up to 10%.

Marazzi Ceramic industry

Marazzi is a well known brand within the Italian ceramic tile industry.

Marazzi has been responsible for the main technological, process and design innovations in the ceramic tile industry that have made the company and the district a benchmark for the entire ceramics world.

Ceramic tile production utilises many different processes according to each different finished product. The process is composed of the following stages:

- Clay preparation by wet milling and atomization.
- Forming or molding of the tile by either dry pressing or by extrusion.
- Glaze preparation.

- Drying, glazing and decoration of the tile.
- Kiln firing.

Raw materials are mixed and wet milled in rotary mills and then the liquid material is stored in underground tanks, equipped with stirrers.

Special pumps take the liquid and introduce it into the atomizer where the high pressure and high temperature cause the drop of the liquid material to explode and the water to evaporate producing a very fine and homogeneous powder, ready to be pressed.

Atomization process produce a large amount of heat dissipation increasing indoor plant temperature and reducing reliability of machineries and components.

In Marazzi's ceramics manufacturing plant in Sassuolo **20x Breezair coolers** have been installed in the atomizer tower to reduce the indoor temperature from 60° C to 30°C. This has strongly increased the MTBF of all the electrical components inside the machines with high maintenance cost savings.

Process industry cooling

Evaporative cooling is increasingly used in the process cooling for the industry, for example to cool process cooling water instead of using cooling towers.

Apart from this use, evaporative coolers can be installed to decrease ambient temperatures in all applications where manufacturing processes generate microclimate conditions with very high temperatures.

Machines and components in manufacturing industries reduce their reliability as operating temperatures increase, so their MTBF (Mean Time Between Failures) on datasheets, is typically only valid at relatively low room temperatures.

Reliability is inversely proportional to temperatures, because all chemical processes reactions are accelerated by temperature increase, speeding up the machines' aging process.

Most machines' datasheets specify 25°C room temperature: doubling the ambient temperature from 25°C to 50°C, the aging effect increases by a factor of 6. If temperatures increase of additional 25°C (until reaching 75°C), the aging effect would increase by around 30 times.

Evaporative cooling could be the best solution to keep ambient process temperature low.

Plastic manufacturing plants & temperature destratification

Blown film extrusion is the most common method to produce plastic films, especially for the packaging industry. The process involves extruding a tube of molten polymer through a die and inflating to several times its initial diameter to form a thin film bubble. This bubble is then collapsed and used as a lay-flat film or can be made into bags. Usually polyethylene is used with this process.

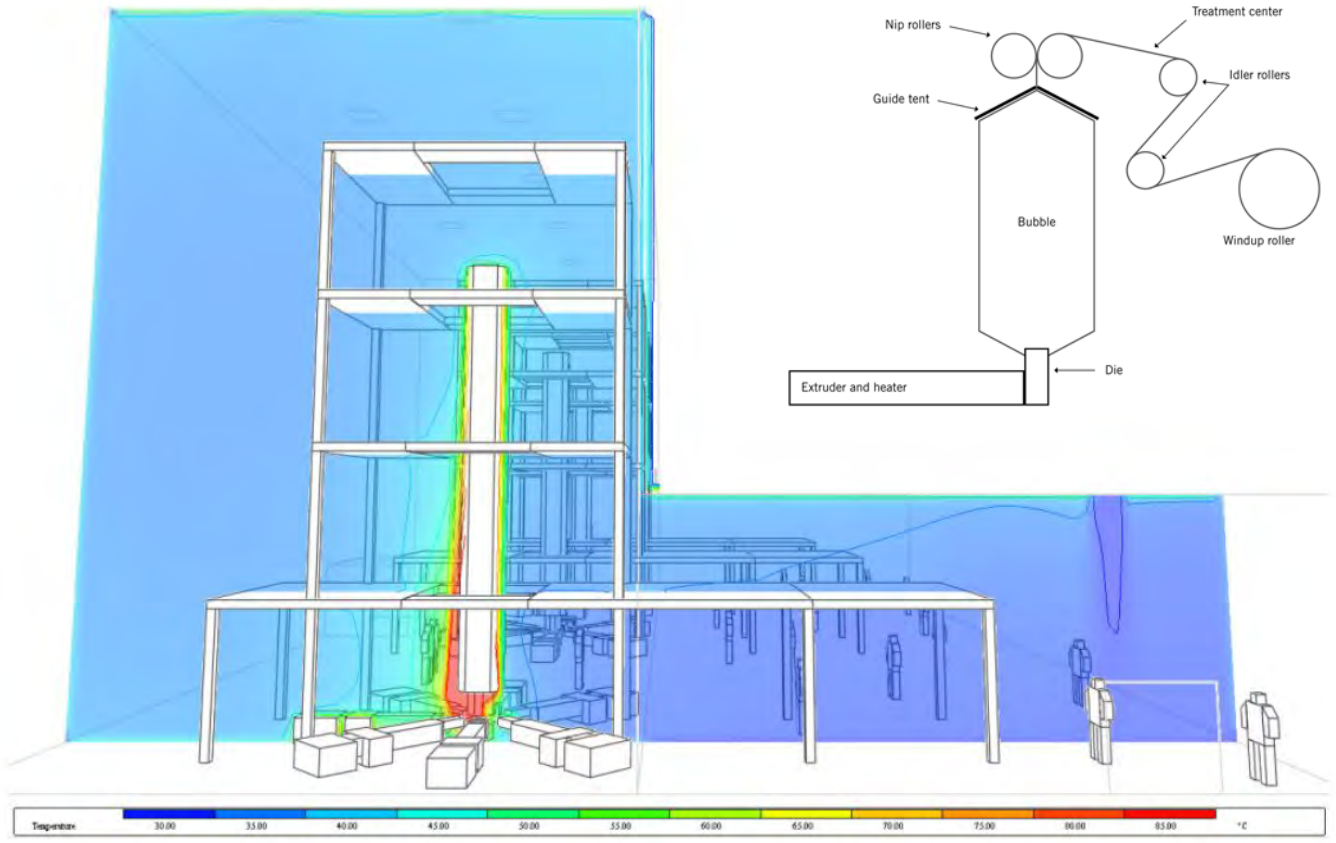
Controlled cooling is an essential part of manufacturing polyethylene stretch film and it's always required to establish temperature according to the blown film extrusion process.

In a plastic manufacturing plant located in Dubai (United Arab Emirates) Breezair evaporative coolers have been installed to cool down the tower where the plastic solidification process occurs at different levels.

This process requires warm temperature at low levels (near to the die machine), where the bubble is produced, in order to avoid sudden cooling of the film. This is in contrast with the normal temperature stratification (hot air rising).

Before installation of Breezair coolers, air temperature stratification was very much evident, allowing lower temperatures at the lower zones and letting levels near the roof approach up to 70°C. The coolers have been installed at different levels around the blow film tower, allowing colder air at high levels and warm air near to the die machine.

The below temperature profile of the Blown Film Line Area, shows the results of the new temperature stratification.



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