



Climate change: melting glaciers, diminishing water resources, trapped sunrays increase global warming



HIGH EFFICIENCY TECHNOLOGY FOR PROCESS COOLING

**R. SANDANO
CAREL**

HIGH EFFICIENCY TECHNOLOGY FOR PROCESS COOLING: A SIGNIFICANT CONTRIBUTION TO GREEN MANUFACTURING

Roberto Sandano
CAREL Business Unit Manager HVAC OEM

Abstract

High efficiency technologies development in HVAC industry, and in particular for process cooling, can give a significant contribution to reduce the use of material resources and energy in production systems.

More in detail:

1. Most of the manufacturing processes require a controlled temperature to guarantee productivity and quality. That is why process-cooling systems are so important. Modulating capacity process cooling systems, with the introduction of smart controllers, BLDC compressors and electronic expansion valves, lead both to a higher energy efficiency and to a better and more precise temperature control. This means lower energy consumption for the cooling system and higher process reliability (with lower material scraps).
2. Compressed air circuits are used in most of the manufacturing plants. In some industries, the energy consumption for the compressed air management can reach a significant percentage of the whole energy bill.
3. Today manufacturing is also data management, both with local servers and with cloud services. Green data center design in combination with high efficiency cooling systems can give an unexpected but significant contribution to green manufacturing approach.

This study provides examples of high efficiency solutions to HVAC/R industry.

Introduction

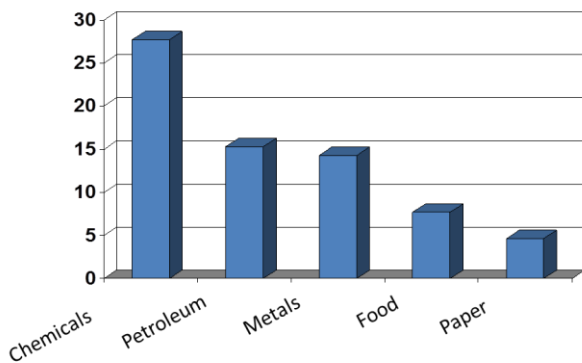
The topic I would like to bring to your attention today, on behalf of CAREL, concerns the importance of temperature control in industrial processes and the significant contribution that a modern approach can make to the concept of green manufacturing, improving both a plant's productivity and lowering its energy bills.

Firstly, a brief introduction to CAREL and our mission: our objective is to be the leader in temperature control and humidification technology in two clearly defined niches: air-conditioning and refrigeration. To achieve this goal, we have decided to put the focus on energy savings, and indeed my presentation today fits perfectly into this context. Secondly, our mission requires that we work closely with our customers. This aspect indeed is part of our day-to-day operations, as with seven production sites and nineteen subsidiaries covering every continent we speak the language of more than four thousand customers. Implementation of our mission is even more evident in the guidelines defined by our "key strategies", including the last two, which are specifically worth underlining: energy saving as the end result of innovation, and the proposal of integrated solutions based on vertical application know-how. I have emphasised these statements as they include the keywords that guide our day-to-day operations and our priorities.

Let me turn now to the topic of this presentation: we asked ourselves what proportion of a manufacturing plant's energy bills is due to cooling. It is natural to immediately think of temperature control of the actual industrial process itself; however, it is also necessary to consider the compressed air system and the company's data servers. Together these systems easily account for thirty percent of total energy requirements. So we then asked ourselves: "can current technology bring significant benefits to this aspect of industry?"

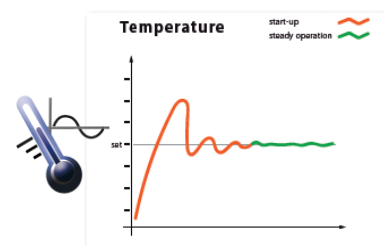
We will begin to answer this by looking at the need to control the operating conditions of an industrial process. It is accepted that stable and controlled operating conditions have a fundamental impact on the quality, repeatability and production capacity of standard industrial processes. The more precise and effective temperature control is, the better its impact will be on the process, with major benefits in terms of throughput, reducing rejects above during the transient stages at the start of the production process. How does this affect the energy bill? Here I can quote some easily verifiable sources: according to the website www.ptonline.com, such energy requirements range from eleven to sixteen percent of the total in a plastics moulding plant. Similar studies (in addition to our own experience) show how a chiller in such applications works the equivalent of 7500 hours a year, equal to eighty-five percent of total working hours. By comparison, a chiller used for comfort purposes in commercial applications works around 600 hours a year. Consequently, in accordance with our mission, we feel that there is ample margin here for innovations that bring energy savings. However, we can go even further: as mentioned earlier, there are other sources of consumption worth analysing, such as the compressed air system. The graph projected here shows the energy needed to operate compressed air systems in different industries.

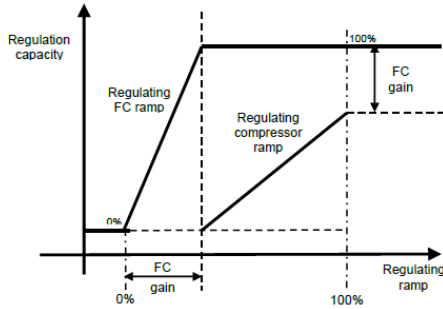
Compressed Air Energy Use as a Percentage of Total Electricity Use



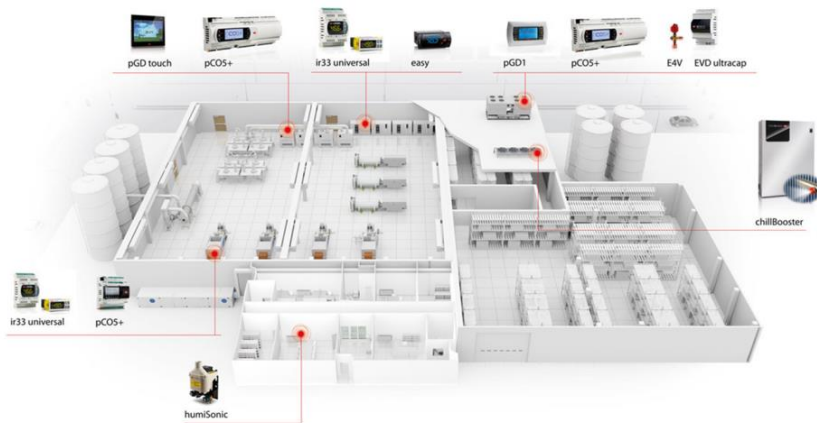
Even without looking at the most extreme cases, the values are in any case much higher than would normally be expected. As we know, practically all compressed air systems require a drier, and ninety-five percent of the time, drier units use a refrigerant circuit. How can precise control and energy efficiency come together in this case? Here are some examples:

- The introduction of advanced control algorithms to reduce transients, the stages when the highest declines in efficiency occur;
- The introduction of electronic expansion valves to best exploit the most favourable operating conditions, when present;
- Integration and optimised management of free cooling strategies, which bring the highest benefits when combined with variable-capacity systems.





This is an example of how CAREL interprets this scenario.

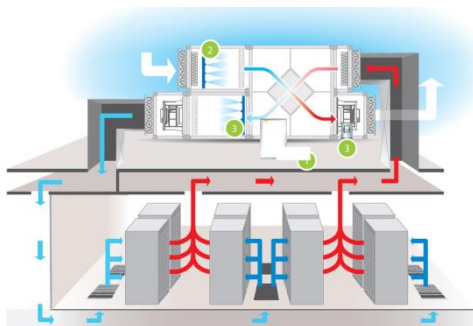


Finally, I mentioned a third source of energy use: data management. In the IoT era, everyone produces and uses huge quantities of data; companies may use cloud services or manage their own servers, yet the need is still the same; rather, it is being transformed into an opportunity. Some data

better highlights this phenomenon: in 2007, the number of data centers in the world was roughly equal to the number of oil wells. Today, there are more data centers than petrol stations in G7 countries. And according to industry insiders we are still connecting people together, just imagine the scenarios when we have finished connecting things too.

Here too we believe there are ample possibilities for improvement! How? At CAREL, we are strong believers in the combination of different technologies. The most innovative layouts see a combination of free cooling, evaporative cooling and mechanical air-conditioning.

Conclusions



To conclude, the guiding element of CAREL's approach is "High Efficiency Solutions"; this is found in our mission, in our strategies and in our communication. Here today we have analysed a case that is often underestimated in terms of overall impact, yet that at the same time can easily account for thirty percent of a manufacturing plant's energy bills. We then looked at some of the solutions and technologies that CAREL offers the market and that can bring a significant

improvement in plant performance and efficiency. Our conclusion is that such significant improvements can have a major impact on a company's energy requirements, with cost savings that can easily reach fifteen percent. Some of our internal simulations - which I will be happy to discuss with you another time - show how return on investment may be as little as just a few months.

