Sustainable Production Pays Off

Photo: Gardena

Energy Efficiency. As part of the extensive modernization of its production facilities, Gardena Manufacturing GmbH partially replaced the material supply of its Heuchlingen plant. Its principal goal in realizing the project was to achieve optimization according to holistic points of view.

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As a member of the Husqvarna Group, Sweden, Gardena takes environmental protection at all its production sites very seriously. We are aware that the future of the various sites can no longer be secured simply through profit and growth in the long term; we also need to show social responsibility. That is why the environmental safety of our product lines is important to us", so reads the official statement on environmental policy. Thus, Husqvarna's internal guidelines provide for the certification of plants with over 100 employees according to the international standard for environmental management systems ISO 14001.

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Gardena has therefore committed itself to specific environmental measures, including action on energy saving. That includes, for example, the exchange of energy-wasting equipment, the use of energy-efficient computers and monitors, and optimization of the lighting in the production and administration areas.

As part of its self-commitment, Gardena Manufacturing GmbH, Heuchlingen, Germany, conducted an extensive modernization of its production facilities. Its principal goal in realizing the project, which was devised along ecological and economic principals, was to optimize the material supply according from an holistic point of view. The central points in the specification were:

- significant reductions in energy consumption,
- reduced radiant heat in the region of the drying unit,
- increased performance for the same connected power, and
- better monitoring of the system by integrating the control system into its own network.

Initial Situation and Project Planning

It is well known that plastics processing often requires a great deal of energy. That applies of course to cases where high throughputs are necessary because of the production quantities required, and additionally the material is to dry. The energy consumption associated with this inevitably causes correspondingly high costs. Environmental pollution also increases considerably.

On a 17,000 m^2 production area, the Heuchlingen plant produces technical parts and components for the Gardena

The centralized drying system supplies a variable air rate at up to 4,800 m³/h

(photos except title photo: Motan-Colortronic)

program. Working round the clock, seven days a week, 98 injection molding machines with clamping forces from 150 to 2,000 kN produce approximately 400 million parts per year. The company processes about 12,000 t of ABS, PP, POM and PA per year – with the material supplied almost via silos.

While the existing plant had continually been partly modernized, it was based on a system designed many years ago for lower throughputs and other requirements. Nevertheless, the specification was to retain as much equipment as possible from the existing conveying systems, comprising a total of about 150 conveying points and five drying systems with a total of 29 dryer bins.

The primary goal of modernization was holistic optimization according to human, ecological and economic aspects. Changes were only to be made to subprocesses when their effects on the overall process had been considered. Ultimately, it was not the individual optimization of conveying, drying, control or energy saving that counted. The only deciding factor was the overall result as defined in the corporate philosophy described above.

It was with this philosophy that Motan-Colortronic approached the project planning. "We wanted to achieve holistic material and energy management, focusing entirely on the overall result", explains Thomas Rittweg, project manager at Motan-Colortronic. "We therefore presented a concept with combined centralized systems for drying and material supply, taking into account centralized, energy-optimized process air supply."

The two companies have been cooperating since 1990. "It's very easy to optimize isolated sub-processes and secretly accept a worse overall result", continues Rittweg. "But true application specialists take into account both the individual processes and the process as a whole." In this, he is confirming the assessment of Jürgen Rock, project manager at Gardena, who values the flexible realization of his desires by Motan-Colortronic.

The control and operation of the system can take place both locally on the individual units and centralized via a visualization system

Automatic air flaps that feed air to the individual bins on demand

Implementation and Results

To anticipate one result of the modernization methods: as a proportion of the drying performance, energy consumption could be reduced by about 30 %.

Key aspects were the renewal of the complete drying and silo control systems, including the energy supply and the replacement of the old dryer with four new Luxor dryers with variable drying air supply via frequency converters. They supply the existing drying bins with dry air via a →

If the control system recognizes that the material in the bin is completely dry, the air flap reduces the throughflow

manifold, and thereby form a drying island within the integrated system.

Drying air supply takes place via the four interconnected dryer units, which are monitored and regulated by the centralized control system. The air output varies between 0 and 4,800 m^3/h depending on the individual requirements of the system. The dryers have a speed-controlled process-air fan. In addition, they are automatically disconnected and reconnected according to demand.

Control of the process air takes place via the ETA plus system, which analyzes and regulates both the individual process-air demand of the individual drying bins and the overall demand. As a result, each drying bin is provided with only exactly the amount of energy it needs to achieve and maintain the required material conditions.

The system's drying bins are equipped with automatic air-regulation flaps, which control the air supply to the individual bins according to the actual demand. At the same time, the dryer units generate only as much dry air as is required by all the drying bins together. The drying heaters are synchronized according to the actual demand.

If the control system recognizes that the material in the bin is completely dry, it decreases the throughflow and reduces the heating power and overall air output. As a result, the system can always operate in its optimum range.

The decisive factor here is the control of the individual and overall throughflow. For maximum efficiency, the energy supplied per unit time should correspond to the thermal energy removed via the product flow. If the material throughput of the system is reduced by, for example, 30 %, the demand for process air also drops by 30 %.

The centralized conveyor feeds 150 conveying points

The integrated drying organizer automatically recognizes reduced material throughputs and successively decreases the material temperature to the optimum stand-by value. This additionally saves energy and protects the material against thermal stressing.

To accommodate a planned combined heat and power plant, an additional interface was implemented in the heating circuit of the drying system. As a result, the waste heat from the combined heat and power plant can be subsequently used for preheating the material, which further reduces the power consumption.

The modernization of the material supply has a not inconsiderable beneficial effect on the employees' direct working environment, as project manager Röck explains. "Thanks to the modernized drying unit, the previously extremely high ambient temperatures in the dryer vicinity are reduced to a normal level", he reports. "Particularly in summer, the temperatures for the staff were very unpleasant. The new system has made the working conditions much more agreeable."

Centralized Control Reduces Energy Consumption and Costs

Measures for reducing energy consumption, and therefore also energy costs, usually concentrate on the energy consumers. However, such a strongly one-sided approach easily misses the target, in particular in complex plants with many consumers. At this point, the terms "connected load" and "load peaks" come into play. The connected load is the sum of the capacities (in kW) of all connected systems and equipment.

As background, the power costs are composed of the kilowatt-hour rate (EUR/kWh) and the demand charge (EUR/kW). The kilowatt-hour rate depends on the supplied work, while the demand charge depends on the maximum consumed power. While no refund is given for not reaching the peak demand, exceeding this is always additionally billed at the end of the accounting period. A demand peak of a few minutes results in considerable extra costs. These extra costs can be avoided with a load management system, which records and evaluates the consumption values. If there is a risk of exceeding the predefined limits, the system throttles back individual consumers or automatically disconnects them according to a priority list. [1]

Ultimately, it is not the reduced consumption alone that contributes to reducing energy costs, but to a large extent the avoidance of load peaks.

The value of a sophisticated control technology that ensures that the demand is not exceeded should not be underestimated. A holistic consideration of the system as a whole is thus essential for planning the energy management.

The plant control was completely integrated into the in-house network, and is in addition monitored by higher-level systems. For example, if there is a risk of exceeding the reserved capacity, the integrated Siemens Powerrate system triggers a staged load shutdown by throttling

Company Profiles

Since it was founded in 1961, **Gardena** has developed from a small gardening equipment merchant into an internationally regarded manufacturer of gardening products and systems. With a name recognition of 90 percent, it is Europe's leading brand for gardening equipment. Moreover, the company is represented in over 80 countries worldwide.

Since 2007, Gardena has been part of the Husqvarna Group, Sweden.
www.gardena.com

The **Motan Group**, based in Constance, Germany, is a supplier of modular system solutions for raw materials handling in the plastic production and processing and chemical industries. With about 450 employees, the Group, represented in 120 countries, achieves annual sales of over EUR 100 million.
www.motan-colortronic.com

back, or even disconnecting, the regenerating heaters of the dryers.

Conversely, on start-up, the control system ensures that the major consumers do not all start simultaneously. Instead, they are started up with reduced power at first and sequentially staggered.

The control and operation of the system can take place both localized on the individual units and centralized via a visualization system with two balanced WEBpanels. It can also be operated via a PC using the VISUnet control.

The centralized conveying unit feeds 150 feed points. The system operates according to the common-rail vacuum principle. A centralized 250 mm-thick vacuum line is supplied with vacuum via four pumps. Each of these speed-regulated pumps provides up to 1,000 m^3/h vacuum air. The pumps connect up or disconnect automatically according to demand. This technology allows up to 20 conveying points to be supplied simultaneously. For this, conventional systems require 20 conveying systems with 20 vacuum pumps.

Summary

In the face of rising energy costs, the strategic and well-considered modernization of existing material supply systems is a sensible and economically attractive measure. Gardena has thus reduced the energy consumption by 30 % in relation to the drying performance. The deciding factor is the holistic consideration, while maintaining all quality criteria of the overall process. This refined system was developed and planned in close cooperation between the application and project engineers of Garden and Motan-Colortronic. ■

REFERENCES

1 N.N: Stromkosten wirksam getrimmt. Advance, 3/2011, pp. 16–18

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