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Painting line optimization achieves savings of 55%

Based in Saint-Jean-sur-Richelieu, Termaco manufactures medium- and large-size welded parts. This successful company wanted to produce even larger parts. To do so, it planned to replace the existing painting line with a new, larger capacity powder coating line, thus optimizing its energy consumption.

Optimizing the process

After forming and welding, the parts are hung on a chain, which transfers them to the powder coating line. The main steps of the process are as follows:

- clean the surfaces with hot water in a parts washer maintained at 49°C, using a submerged tube and a natural gas burner;
- dry the parts by evaporating water through a convection heating process, using a burner that heats recirculating air maintained at 137°C;
- apply powder coating using an electrostatic process;
- bake in a curing oven measuring 9 m (30 ft.) long by 6 m (20 ft.) wide.

The curing oven is divided into two areas:

- the first houses infrared radiation units comprising 20 natural gas catalytic burners;
- the second houses a convection heater, with a 1,200 MBH burner.

Each step of the coating line has similar characteristics:

- heating powered by a natural gas burner at each step;
- no heat recovery system;
- evacuation of hot air directly to the outside in excessive amounts.

To carry out its project, the company solicited the services of Valtech Énergie for the design of controls and modifications needed to improve energy performance at each step of the process. Without reinventing the wheel, the principle used was to install a new curing oven and optimize thermal energy by reducing the energy lost at each step of the process and recovering heat in order to re-use it during subsequent steps.

New oven optimization

The new oven with added capacity for longer parts was optimized by:

- harnessing the heat contained in the combustion products in the radiant area by incorporating them in the convection heating area.
- reducing energy loss released into the atmosphere by limiting the volume of air flowing through the openings at each end of the oven as the parts are transferred from one process to the next (upon entering and leaving the oven).
  - Before the modifications, an extractor fan continuously expelled air out of the oven to keep the heat inside. Air was replaced via the two openings (oven inlet and outlet), substantially increasing thermal energy consumption.
- controlling air flow output, which limits the amount of gas extracted by the chimney, while ensuring a safe environment around the oven. This results in the efficient evacuation of combustion products, and a reduction in air infiltration in the oven.
  - This innovative control approach reduces natural gas consumption and limits fluctuations in the oven temperature, thus ensuring a uniform temperature.
- controlling air movement in the oven before releasing it into the atmosphere between the oven's heating area and cooling area.

These modifications helped increase the speed of the oven's painting line and the number of parts to be painted, while reducing natural gas consumption.

Drying section optimization

The following modifications were made to the dryer section:

Harnessing gases released from the oven, introducing them directly into the dryer.

When the energy released from the oven exceeds the energy needed to operate the dryer, the hot gas supply from the oven is adjusted so that the operating temperature is maintained. Contrastingly, the gases from the oven are all introduced into the dryer. The operating temperature is reached and maintained by modulating the speed of the dryer burner.

Managing gas flow released into the dryer.

Similar to the oven, the dryer was equipped with a device to control the gas flow output. While the operating principle of this control is similar to that implemented on the oven, there is a difference in that in addition to the combustion products from the dryer's burner, it also incorporates the gas supply coming from the oven to power the dryer.

Results

Once the work was completed and after a breaking-in period, the resulting cost and energy savings met expectations:

Cost of work	$516,072
Grant offered by Énergir under the program encouraging the implementation of energy efficiency measures	- $50,000
Net cost of work	**$466,072**

Natural gas consumption for the painting line

Before the modifications	585,933 m³/year
After the modifications	- 260,427 m³/year
Natural gas savings: 55%	**325,506 m³/year**

These natural gas savings translate into significant cost savings for Termaco:

Energy costs before the project	$287,107/year
Energy costs after the project	- $127,609/year
Savings	**$139,698/year**

Economic and environmental benefits

At the end of the day, the project payback period is 3.34 years. While attaining the objective to increase its production capacity by reducing energy consumption without diminishing the quality of production, Termaco has made significant savings and emits 607 fewer tonnes of CO_2 equivalent/year.

The main energy-saving measures implemented as part of Termaco's project could be applied to an existing facility already in service.

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