

Improving the energy efficiency of industrial dryers

Example applications

- Milk powder
- Whey product
- Coffee
- Tea
- Starch and starch derivatives
- Pharmaceutical products
- Cocoa
- Ceramics
- Carbon black
- Pulp and paper

Process operating objectives

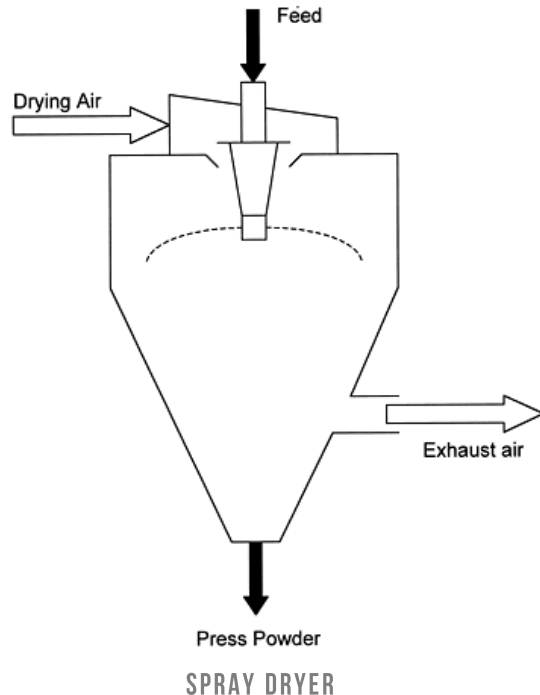
- ▶ Increase product yield while maintaining the required product specification and product quality.
- ▶ Minimise the amount of off-spec product due to changes in conditions: grade transition, feed rate, feed characteristics or atmospheric conditions.
- ▶ Decrease the cost of production due to: the energy consumption, the maintenance cost and the drying time.
- ▶ Avoid over-drying of the product.

Energy savings opportunity

Only a fraction of the heat input to a dryer is used to evaporate moisture. The thermal efficiency is the ratio of heat absorbed in evaporation to the actual heat input. Efficiency values in the range 10 % to 60 % are found in industry depending on the degree of process optimisation and heat integration.

“Drying is a highly energy intensive operation and represents between 15%-20% of total industrial energy consumption”

The complex and energy intensive nature of the industrial drying process creates significant energy savings opportunities by optimising control of this unit.



Typical KPI benefits of using Spiro on a spray dryer

- +8% in product moisture (e.g. 3.6% to 3.9%)
- +3.5% increase in product rate (t/h)
- -6.5% reduction in specific energy consumption (Gj/t)

Energy savings and reduced CO₂ footprint through tighter controls

The cost of over-drying

Most dryers operate in such a way that the product is often over-dried. This is done to avoid violating product specification limits. Spiro can provide consistent regulation of product quality which allows for a reduction of this operating margin. Having established quality control, Spiro can then optimise the operation to reduce energy consumption.

There are several cost factors associated with over-drying: product giveaway, fuel consumption, and production capacity are the primary costs. For certain products air pollution and fire risk may also be considerations. If the product is over-dried, higher outlet temperatures are required to overcome the reduced drying rate, consuming more energy. The relationship between heat requirement and product moisture is highly non-linear. Substantial incentives exist to operate at the highest acceptable product moisture content.

Most dryers are heat input limited. If heat input per unit feed can be reduced by controlling product moisture closer to specification, more feed can be processed. In many cases, the increased productivity can be worth more than the fuel savings or reduced product giveaway.

Responding to load changes

In a standard dryer control scheme, product moisture is controlled indirectly by maintaining a constant drier outlet temperature. But this method only works with constant feed, when dryer feed increases, a constant outlet temperature will not raise the

evaporation rate enough to satisfy the increased load. Moisture content can be regulated only by increasing outlet temperature as the load is increased. Spiro provides coordinated control action that adjusts heat input in response to changing load so that product moisture remains on target at all times.

A full return on investment can typically be achieved from the energy savings alone within
6 months

Plant wide energy optimisation

In many installations, fuel gas from incineration or other operations is available for use in drying. The difficulty in attempting to capture such sources of waste heat is the variability of the source. At times there may be more heat available than is needed and possibly at temperatures above the safe operating limit of the dryer. At other times there may be insufficient waste heat. Spiro can implement an integrated control scheme that can use all the available waste heat, tempered with outside air as necessary to provide the required inlet air temperature.

In many applications, the dryer operates in series with another unit operation such as evaporation followed by spray drying. The evaporator is much more energy efficient than the dryer but will be limited by the maximum solids content. Spiro can coordinate the operation of the evaporator and spray dryer to maximise overall plant efficiency.