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"The use of Energy in Converting Equipment"

Extended abstracts

Just to clarify the nature of this paper: we will not be talking theory here. It's not about Energy, Power, Entropy, Thermodynamics, Boltzmann (Entropy I mean), diagrams, formulas and other exciting topics in physics. This is a little bit more on the practical side, it is about money, and, should you like, and just to save a little bit of the romantic side of this work, about being green.

The "energy" we are interested in, is the physic entity massively used in a conversion process. Energy, in different forms and shapes, makes motors turn, solvents (I like "resin vehicles" better) be evaporated, allows empowering the ability to control parameters in production. All in all it is the very core of a conversion process.

Historically energy is regarded under different points of view in function of the specific era and of the particular application. In the 18th century the ability to control and to actually source "energy", made it for the start of the industrial revolution. Bottom line, without the ability to master energy we will not be attending an AIMCAL convention, but possibly we may have been out there farming in some open ground in rural Italy (horse carriage farming I mean). Nothing wrong in being a farmer of course, I just feel as being more confortable to be into an air conditioned room at a conference in America instead. By the way what temperature is set the air conditioning in here?

I have been working in this industry for over 25 years now. I have visited plants on a global scale, and, after so many years, one of the things that still surprise me is the understanding that energy consumption is not given the proper attention. The margins for improving savings and cut consumption are huge, but that seems to be perceived as a secondary issue and the cut of energy costs doesn't seem to be taken into proper consideration.

I like to mention my visit at the Interpack Show in Dusseldorf a few months ago. Almost every booth there claimed for some sort of "green" related to the products: no one booth claimed for a "low energy consumption plant" or a low emission plant. Message seems to be: the product has to be "green"; the way we make it: doesn't matter. Energy is not a handless resource and comes for a price. Being green means to promote energy friendly products not just at consumer level, but as well at production level. Some attention is required in the way energy is used; in the way energy can be saved; in the way energy

is transformed. Paying the proper attention to every step of the process allows to save money and to reduce production costs, while protecting nature and therefore “be green”.

The purpose of this work, very simply, is therefore to allow avoiding us being re-converted into farmers due to lack of ability to handle the innermost part of our business.

Energy in a conversion process manifest itself in a variety of shapes, nevertheless the three forms that interest the most for the purpose of this work are; Electrical; mechanical and thermal energy.

So let’s roll up sleeve and go to work:

Mechanical inertia and friction have influence on motors. Motors are selected in order to take care of web handling, therefore the size is function of the max and minimum web tension a machine will be able to handle. System inertia and mechanical frictions will call for a percentage of that power to be implemented and used for “non-technological” reasons. With a proper selection of mechanical parameters and a proper selection of components passive energy can be significantly cut with two main advantages: web handling will be more accurate; motor size will be smaller.

Thermal energy is used in a conversion process for a number of reasons, among them:

- Drying systems: evaporation of resin vehicle (solvents or water)
- Resin viscosity control.
- Web thermal control.

The majority of the energy is of course spent in drying systems, a proper design of such units, targeted to: minimal energy consumption; optimization of thermal exchanges; recirculation etc. will dramatically cut energy consumption and reduce emissions. Once acting in this direction a few side advantages will be achieved, namely: a drying system with a higher thermal efficiency will minimize the web stress as generated by extremely long permanence of the web inside long and low efficiency drying systems.

In resin viscosity control another relevant amount of energy is spent. The need of controlling resin viscosity is primarily required in solvent free lamination and in the coating of thermoplastics.

The most recent developments in mixing systems for 100% solid adhesives allows for extremely high performances in temperature control with minimal energy consumption.

In thermoplastic the advantage to use “on demand” meter-melting dispensers for resins, versus the traditional “swimming pool like” melting systems, translates into significant energy consumption cuts. As always, a lower energy consumption system deliveries as well technological advantages, the ability to reduce stress to the chains of molecules of resins allows for longer structures and better coating performances once compared to results achievable with traditional systems where an over stressed and over processed molecule becomes very short with a dramatic reduction of mechanical performances.

Web thermal control is paramount in almost all conversion processes. The ability to rise pre-process temperatures and reduce post-process temperatures allows for optimal performances. Web

conditioning is in most cases achieved by using temperature controlled rollers. The use of properly sized temperature conditioning devices, associated to the proper engineering of thermal conditioning rollers gives advantages in both: energy savings and process parameters control.

The energy bill we said. How to cut this cost once the process and process parameters have been properly sized, designed, taken care. Primarily it is about designing electrics and electronics in accordance with the latest available components technology. In electrics and electronics, each components manufacturer is giving a lot of attention to reducing energy consumption. Using the latest systems, provided by leading brands, allows itself for some energy cut. It is nevertheless the machinery manufacturer choice to implement products with some “common sense” solution. I like to mention as an example regenerative systems. You have to agree with me that use of motors to control web tension on unwinds, is the best possible way to improve accuracy. Once you have a motor controlling the web tension on each unwind, what you will experience is that such motor is acting as “motor” or as “brake” in function of the mechanical characteristics of the unwound web, the weight and inertia of the unwound roll etc. A motor, during operation, will of course absorb power. Vice versa, once a motor is working as a brake, and if the system is designed as “regenerative’, will configure the effects of a power generator. A motorized unwind will act for the majority of time in such fashion. In a two ply laminator the electrical power consumption will be on average cut by 10% if the system is designed as regenerative with the relevant energy bill reduction.

All of the above to say that a properly engineered conversion machine, will not only delivery better performances and improve quality. A properly engineered machine is greener by definition, absorbs lees energy and provides lower emissions. In other words such machine, whatever the perception of costs associated to “sustainability”, will be more economical to operate.