Managing Energy With Modern Drive Systems

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While it is valid to state that energy efficiency is defined as the same level of production being achieved at an overall lower energy cost, it is equally important for today's machine builders and automation engineers alike to remember than an energy-efficient system can actually translate into higher productivity. This is achievable through a comprehensive approach to energy management.

Energy management is a process, rather than a product or series of products installed on a machine, or inline, to achieve a basic energy saving of kW hour consumption. This process must be ongoing and perpetual, meaning that any defined goal should be viewed as a momentary metric of achievement, rather than a final end. While any vendor, including our company, can supply the right products and support services to hit a target mark of energy savings, the mindset of the customer is key in keeping the process recurrent. This ensures a continual increase in the productivity levels achieved, defined as a factor of the energy consumed. In many ways, it can be viewed in the same manner as an ongoing, effective but constantly evolving quality management system at your company.

Three essential elements are the basis of such a process.

First, energy monitoring systems must be in place to effectively determine the current consumption. These can include, but are certainly not limited to, energy consumption displays, infeed/supply monitoring devices, power factor meters and more. Next, the proper calculation tools are needed to properly evaluate the life cycle costs of any investment. These tools can be as simple as a motor sizing chart or the software programs used to parameterize drives. However, a more formal mechatronics protocol may be beneficial to your operation. In this scenario, a thorough evaluation of both mechanical and electrical/electronic influences on your system, be it a machine or a process line, is conducted. The results can often open the eyes of machine designers, process engineers and system integrators alike. To

realize the benefits this analysis the proper products and system solutions must be implemented.

This is where a competent supplier can be an effective partner for your operation. For example, the solution you need might involve a vector drive that utilizes an energy optimization function to enhance the efficiency of the motor during partial load operations. In a system with multiple motors, energy savings might be realized to a substantial degree by the use of a drive unit with a common DC bus. The designer can also select the most appropriate infeed solution for the machine, pump or process operation, given the particulars of performance and required output. This may include an appropriately sized infeed unit with regenerative capability, the ability to put unused or braking energy back on the incoming power line.

Some applications may allow the use of high efficiency standard induction motors and, in the process, realize a potential savings of 1-3%. The use of frequency converters (VFD) for speed control might raise this to an 8-10% savings.

Optimizing your entire system through mechatronic analysis of the machine or process design, can result in a potential savings of 15-20% by the avoidance of over dimensioning of motors, plus partial load optimization by means of energy-related flow control. This analysis may also point to the ability to use controlled energy infeed and recovery.

In order to determine the true efficiency of any drive system, it is necessary to demonstrate the amount of energy required by its power components and a corresponding examination of how the system uses energy. How different drive concepts used on the same system under identical power load must also be considered. This latter exercise might look into partial load efficiencies with various motor and drive combinations, straight comparisons betweens synchronous servo vs. asynchronous induction motors or direct drive vs. motor/gearbox combinations, drives with braking components vs. regenerative drive technology, as well as solutions with single vs. multi-drive, common DC bus solutions.

A corollary to this discussion should also include a review of potential hydraulic/pneumatic component change outs in certain applications where replacement with an integrated package of motion control and PLC technology might better resolve closed loop pressure control of axes, for example. Fewer components and their related power consumption can lead to overall system productivity improvements, as well as ongoing enhanced energy efficiencies. Reduced programming, diagnostic and commissioning times can also flow from such an approach, providing even more opportunities for overall machine or process improvements. Tracking the energy efficiency of such a system may seem problematic at first, but here again today’s sophisticated mechatronic and virtual production protocols can be utilized to validate the real-world performance characteristics of such designs, far in advance of their implementation.

As the emergence of new technologies has impacted many of the products used in energy-efficient systems, it is equally important to take a more holistic look at

operational sequences and the overall integration scheme when designing, retrofitting or rebuilding for improved energy utilization.

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