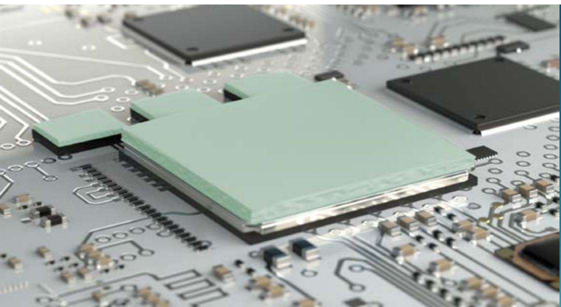
Henkel Adhesive Technologies

SUSTAINABILITY **IN MOTION**

Motors and Drives are Key to Energy Conservation

Justin Kolbe



Sustainability

Sustainability is good business practice. Companies that have developed solid sustainability strategies, long-term vision and ambitious targets fare better than those that have not prioritized this value. As compared to like organizations without such initiatives, sustainably-driven companies generally have higher employee retention rates, build strong brand loyalty through alignment with consumer consciousness and, as a result, yield better stock returns.[1]

> **Practically, sustainability should be applied at every level of the organization – from sourcing to product development and manufacture to employee protocols and customer outcomes, as the benefits of good corporate citizenship go far beyond just 'doing the right thing'.**

While there are numerous examples across the business spectrum detailing the payback, some of the most tangible results from intentional sustainability efforts center on the advantages of increased efficiency in production environments. In the industrial setting, efficiency and cost savings driven by improvements in system performance are inherently sustainable, delivering a solid return on investment (ROI).

In continuous operations, such as alternative energy wind and solar farms or data centers, the return is quick since systems are perpetually on. So, even a few percent efficiency gain provides a much faster payback than, say, on an automated production line that may run a single shift.

In either case, elevating the efficiency equation has become a competitive necessity, a bottom-line booster and an energy conservation element of sustainable operations.

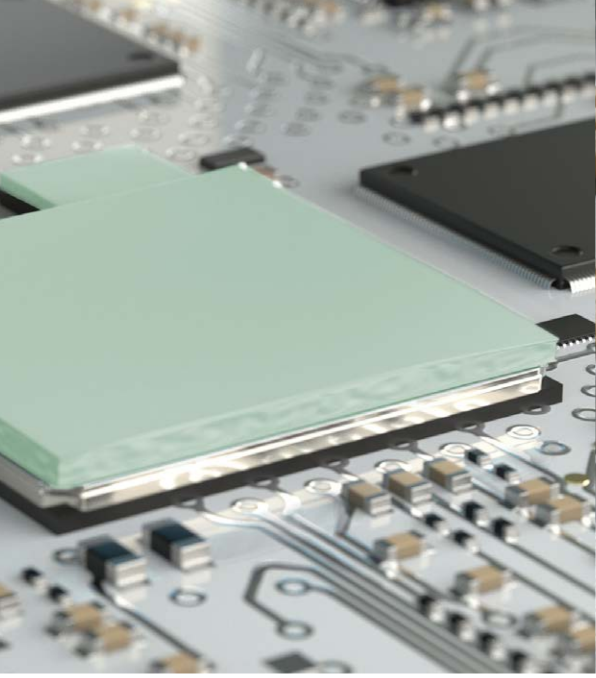
Electricity Consumption: A Global Issue, an Industrial Solution

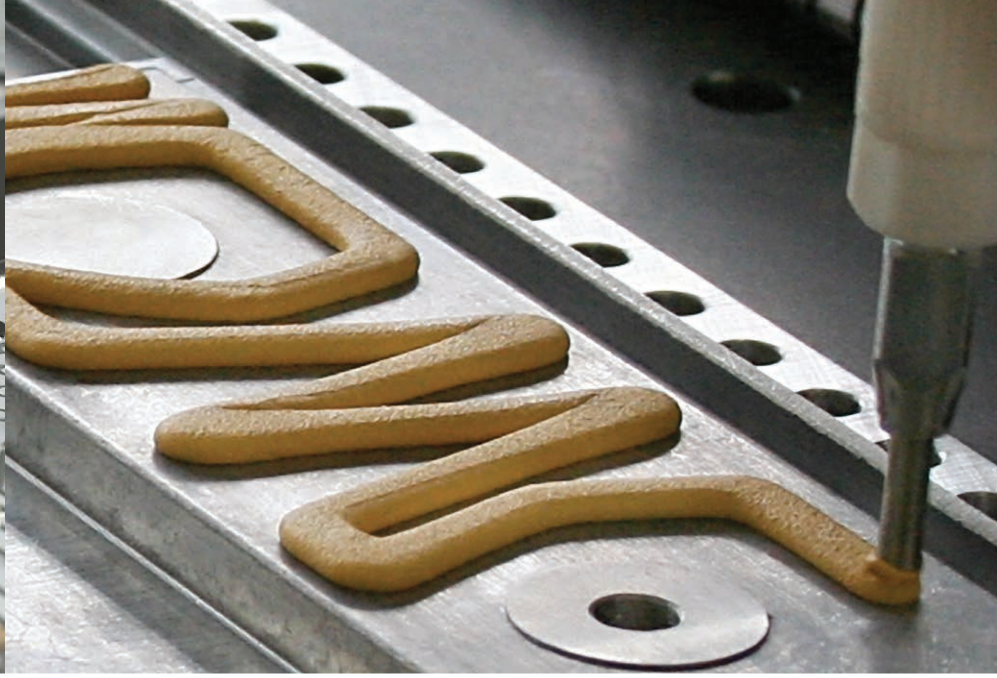
According to the U.S. Energy Information Association (EIA), global electricity consumption continues to rise faster than the rate of worldwide population growth.[2] Lighting, appliances, transportation and industrial processes have the highest electricity requirements, with industry being among the most profound in terms of energy use for product manufacture.

40% of all generated electricity is consumed by industry

In fact, it is estimated that as much as 40% of all generated electricity is consumed by industry and, of that, nearly 70% is used by motors.[3] Therefore, improving motor efficiency through application-specific functional optimization, among other techniques, can have a significant impact on energy conservation in industrial settings.

Consider that many motors simply operate in the 'on' or 'off' mode; they cannot self-regulate to accommodate speeds for different application requirements. Doing so, however, would dramatically reduce power consumption and emissions on a global scale.



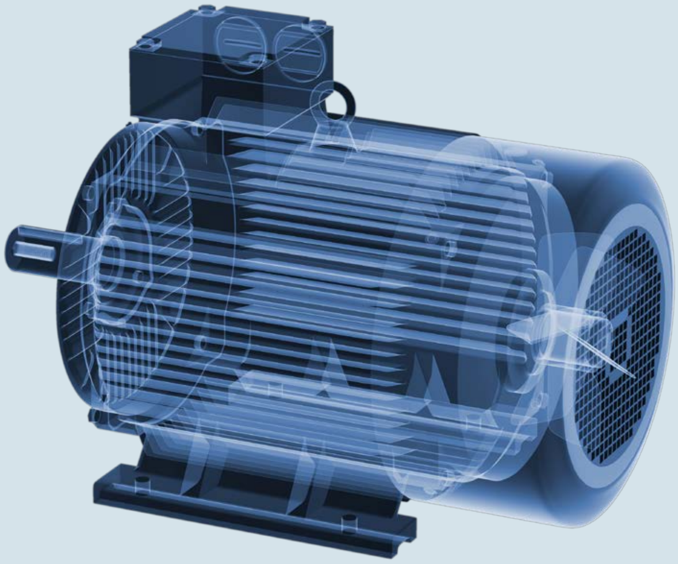


The reality of motor inefficiency and the drain on global energy has led to legislative efforts like the minimum efficiency performance standards (MEPS), which vary by region and country [4]. In the EU, for example, motors with power ratings from 0.75 to 375 kW have been subjected to gradual increases in efficiency requirements over the last 10 years. In 2011, the standard was IE2 (high efficiency) and, as of 2017 the requirement is now IE3 (premium efficiency) with new regulations expected for 2021.

While necessary, these are increasingly tough metrics to meet, though specific design considerations such as thermal management optimization and improved efficiency in motor applications such as pumps, fans and blowers can deliver substantive efficiency gains.

In addition to integrating controls like drives and PLCs to raise motor efficiency, one of the most effective ways to optimize performance is through the elimination of heat. Excessive heat generated during motor operation can slow down functional productivity through resistive or magnetic losses or, worst case, cause total failure due to overheating.

Integrating high performance thermal interface materials as part of the motor system design strategy not only controls motor temperature for greater efficiency, but heat dissipating materials such as high conforming GAP PADs or liquid gap fillers also serve to help raise reliability, so their use is a win-win for motor operation and longevity. By some estimates, for every 5 degrees of temperature reduction, motor efficiency can realize an increase of as much as 15%. Thermal control strategies, among other solutions such as protective potting and gasketing materials, provide motor performance efficiency, reliability and lifetime use benefits for sustainable operation.



Drives: The Ultimate Regulator

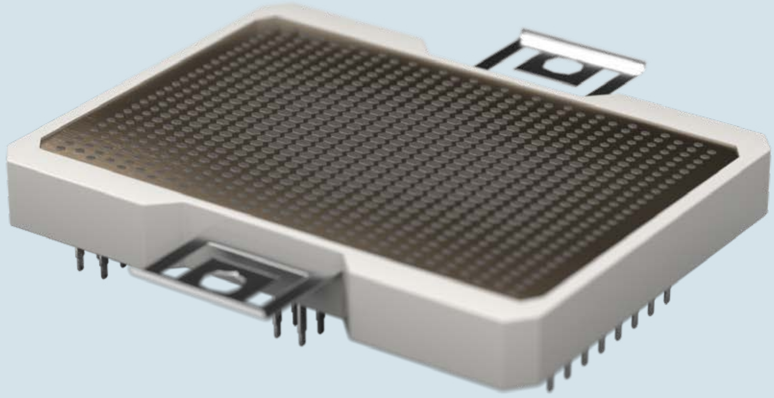
In addition to optimized motor engineering design, integrating drives is one of the most effective ways to reduce motor energy consumption and save on operating costs. When one considers that a drive – such as a variable frequency drive that can control speed and torque based on application demand – can reduce motor energy consumption by as much as 70% in some cases[(5)], the potential impact across global industry is stunning.

> **The current IE3 standard comes with an exception, allowing motors that are controlled by variable speed drives to meet the lower IE2 efficiency rating.**

The importance of drives to sustainability in the form of energy savings, motor reliability and longevity is not lost on the EU's MEPS legislation either. Notably, the current IE3 standard referenced earlier(3) comes with an exception, allowing motors that are controlled by variable speed drives to meet the lower IE2 efficiency rating since the drive improves efficiency by matching the motor operation's required load.

Like motors themselves, drives are also increasingly sophisticated with advanced electronic controls driven by components that are employing next-generation semiconductor technology. Powerful IGBT and MOSFET components, for example, help drives control power conversion in different directions.

Faster and more frequent adjustments to align power requirements with demand help deliver greater motor efficiency. The higher power densities of advanced power devices designed into next-generation drive technologies require mechanisms to eliminate heat generated from internal losses for optimal performance.



Solutions such as phase change thermal interface materials, often employed between an IGBT and its accompanying heat sink, help regulate required thermal dissipation and offer a more long-term solution than conventional thermal grease which can lose effectiveness over time due to material migration. When integrated as part of an overall cooling strategy, phase change thermal interface materials can reduce functional heat in drives – depending on the application – and are a key factor in the efficiency equation.

All of the Above

Clearly, industry stands to deliver the greatest potential outcome when it comes to the energy conservation piece of global sustainability efforts. And, like a majority of sustainability initiatives, the approach is multi-faceted, involving automated control technologies and IIoT approaches down to designing in electronic materials that positively impact performance and reliability. Likewise, legislative standards such as MEPS are encouraging innovative design engineering mindsets, and meeting these ambitious objectives will require optimization at all levels.

Justin Kolbe

The Author

Justin Kolbe currently serves as Henkel's Director of Market Strategy for Power and Industrial Automation within the company's Adhesive Technology business unit, where he is focused on setting broad strategic guidance and market insights. In 1996, Kolbe joined The Bergquist Company (acquired by Henkel in 2014) as a Process Engineer and has since worked in various capacities including process development, applications engineering, R&D and marketing. A chemical engineer by training, he has extensive experience in thermal management solutions and electronic materials development and processing.

With an impressive professional track record and a long history of providing reliable solutions for customers in multiple markets including power conversion, automotive, industrial automation and power electronics, Kolbe is passionate about ensuring Henkel materials not only deliver on performance, but also on cost and sustainability objectives. Based in Henkel's Chanhassen, MN facility, Kolbe holds a Bachelor's degree in Chemical Engineering from the University of Minnesota.

Sources

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