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Technical Article

# Reducing Energy Consumption in Rotating Industrial Equipment with Timken® EnviroSpexx™ Roller Bearings

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The push towards reducing energy consumption in industrial equipment is a significant component of broader efforts to achieve sustainability and carbon neutrality. With rising energy costs and decarbonization strategies in place, companies are recognizing the economic and environmental benefits of reducing energy consumption in their operations. According to a survey from Statista, 54 percent of C-suite executives noted that they are already using energy-efficient machinery, technologies and equipment as part of their companies' sustainability efforts.

Many industrial applications – including pumps, compressors, motors and gearboxes – operate continuously and therefore are constantly consuming electricity. While improving the efficiency of just one of these applications might not seem like it can greatly impact sustainability goals, the majority of industrial plants operate dozens, if not hundreds, of these pieces of equipment at once. When added up, making even a small change on one type of machine can significantly impact the plant level.

Total potential savings are impacted not only by the number of pieces of equipment in operation but also by the duty cycles under which they operate (such as operating time, load, speed, lubrication, and many other factors.

Selecting the right components used in industrial equipment can make a major difference in reducing carbon footprint. Timken® EnviroSpexx™ roller bearings are designed to increase efficiency and reduce energy consumption, which affects carbon footprint. These bearings are designed with geometries that minimize rotational torque for maximum system efficiency. Optimized geometry can lead to torque reduction, resulting in an overall decrease in the amount of electricity required to operate industrial machinery. By incorporating Timken EnviroSpexx bearings into industrial rotating equipment, users can reduce energy costs and carbon emissions.

Timken engineers leveraged knowledge gained through decades of producing fuel-efficient products for on-highway applications, as well as 125 years serving industrial markets, to create its energy-efficient industrial bearing offering.

The following case study describes the effects of Timken EnviroSpexx roller bearings can make in industrial gearboxes.

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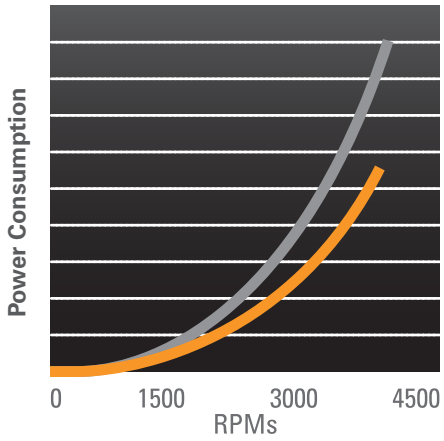


*Fig. 1. Up to 30% reduction in power consumption*

Timken® EnviroSpexx™ Bearings

Conventional Bearings

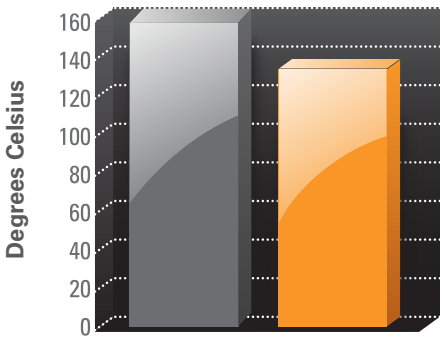


*Fig. 2. Up to 30% lower operating temperatures*

Timken® EnviroSpexx™ Bearings

Conventional Bearings

## Case Study: EnviroSpexx within light industrial gearboxes

Consider a light industrial gearbox with three parallel shafts supported by two tapered roller bearings per shaft – six bearings total. The gearbox is driven by an electric motor operating at 1800 RPM, with an operational time frame of five years. The cost of electricity in the United States averages $0.17 KWh, and the national average emission rate is 852.3 lbs CO2 per megawatt hour, according to the U.S. EPA national average.

**Timken EnviroSpexx Roller Bearings vs Standard Bearings**

To calculate torque savings when using EnviroSpexx bearings compared to standard bearings, bearing torque for each bearing was calculated under the nominal operating conditions, and then multiplied by the total number of bearings in the application.

- **Standard bearings:**
  6.6 newton-meters torque each x 6 bearings = 39.6 newton-meters
- **EnviroSpexx bearings:**
  6.0 newton-meters torque each x 6 bearings = 36 newton-meters
- **Torque Savings with EnviroSpexx bearings:**
  39.6 N-m – 36 N-m = 3.6 N-m (-9%)

The reduction in torque translates to lower energy consumption compared to standard bearings, calculated at approximately 0.680 kilowatt hours. Over five years, the lifetime of conserved energy consumption is projected at 29.8 megawatt hours. This reduction in energy use leads to an estimated cost savings of $5,066 over the life of the gearbox with the use of EnviroSpexx bearings.

**Environmental Impact**

Beyond cost savings, switching to energy-efficient bearings also has a notable positive impact on the environment. The projected emissions savings due to the reduction in electrical consumption over the five years amounts to 25,398 lbs of CO2. This substantial reduction underscores the environmental benefits of adopting more energy-efficient bearings in industrial applications.

**Product Validation**

The sample calculations above are based on analytical torque calculations completed in the Timken® Syber™ Bearing System Analysis software. These analytical calculations have also been validated by physical product testing as well. Timken EnviroSpexx roller bearings were tested directly against standard roller bearings to demonstrate efficiency savings. Tests were conducted in a laboratory under simulated application conditions. The results showed up to a 30 percent decrease in power consumption and a corresponding reduction in the system operating temperature as well.

## Conclusion

In a typical light industrial application, Timken EnviroSpexx roller bearings can reduce emissions and costs associated with energy consumption over the lifetime of the application.

The implementation of EnviroSpexx bearings in various industrial applications presents a compelling case for both cost and environmental savings. With an increase in efficiency, significant reductions in energy consumption, and a decrease in carbon emissions, the transition to EnviroSpexx bearings is a practical and impactful step towards more sustainable industrial operations. As industries continue to seek ways to improve efficiency and reduce their carbon footprint, EnviroSpexx bearings offer a tangible solution with measurable benefits.

This case study reflects the potential gains that can be achieved through relatively simple upgrades in equipment. These savings are possible over a wide range of other industrial markets and applications – potentially any application where roller bearings are specified. The Timken engineering team is available to analyze machine operations and make recommendations that can improve energy efficiency and carbon reduction within industrial applications.

## Author

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The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets bearings, gear drives, automated lubrication systems, belts, brakes, clutches, chain, couplings, linear motion products and related industrial motion rebuild and repair services.

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