

Boosting industrial profitability with  
energy efficient drives and motors

# Improved energy efficiency helps solve the energy challenge

Today industry and commerce are facing an energy challenge. Pressures to reduce energy consumption, lower carbon dioxide (CO<sub>2</sub>) emissions while providing secure power supplies are coming from governments, consumers, legislators and shareholders alike.

All of these pressures are against a background of ever-rising energy prices and the dramatic effects climate change is having on the environment. As a result, industry and consumers are demanding ever more energy-efficient products and services.

## Demand for energy is rising

The world's demand for energy is rising steadily. Under current policies, energy demand is set to rise nearly 47 percent and electricity demand almost double between 2010 and 2035, according to the International Energy Agency (IEA), reflecting global economic growth and rising living standards.

## Biggest energy saving potential is in industry

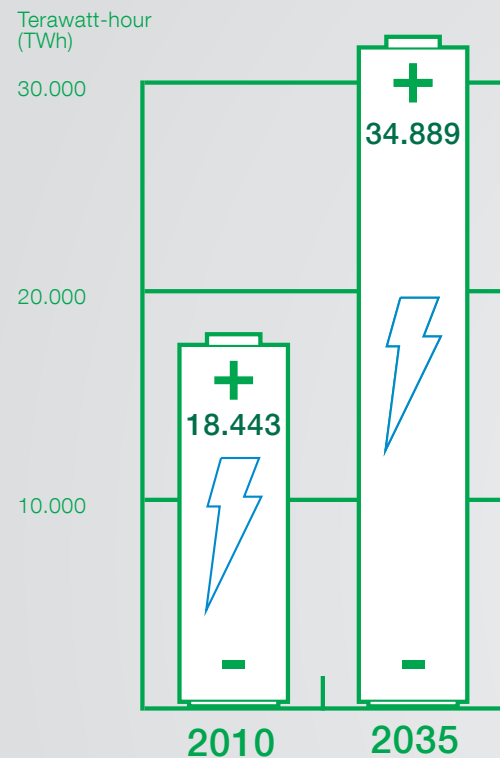
Industry consumes about 40 percent of all electricity generated, according to the IEA. The energy saving potential in industries and utilities is enormous just in electric motor-driven systems alone. Nearly 70 percent of all electrical energy consumed by industry is used by the millions of electrical motors installed worldwide. Every year, several more million electric motors are added. These motors are driving machines, compressors, fans, pumps and conveyors in virtually all industrial sectors. The most energy-intensive industries are cement, chemical, iron and steel. Pumps and fans have the greatest energy saving potential, and targeting those applications is a great way to begin an energy saving initiative.

Since 28 to 30 percent of electrical energy is converted to mechanical energy in electric motors, special attention is devoted to their efficiency and all industrialized regions have minimum efficiency performance standards (MEPS) for them. The majority of industrial motors either cannot adjust their power consumption or use very crude methods to do so. Many always run at full speed, regardless of the actual output needed.

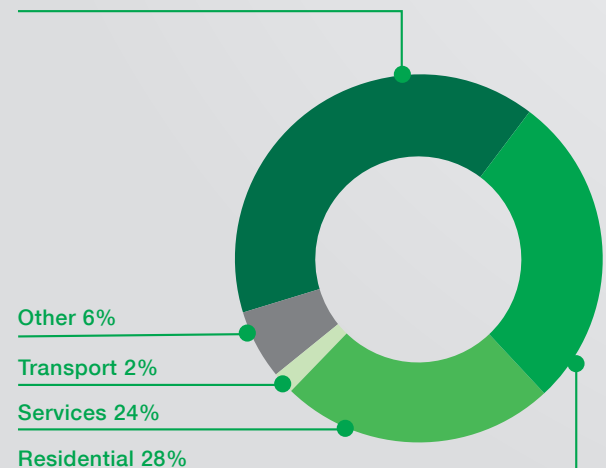
In many applications, energy use can be cut to one-eighth just by reducing the motor speed by half. Using energy more efficiently with readily available and proven technology is the most immediate, cost-effective and practical way to address the energy challenge. Our drives and motors can help lower energy use by reducing power consumption and losses, and improving productivity through better management of equipment.

## World electricity consumption

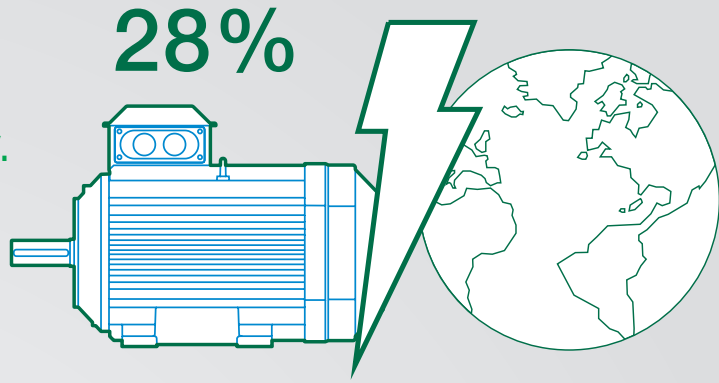
(Rise in electricity demand by 2035)



Industry  
**40%**



Motors consume about **28 percent** of the world's electricity.

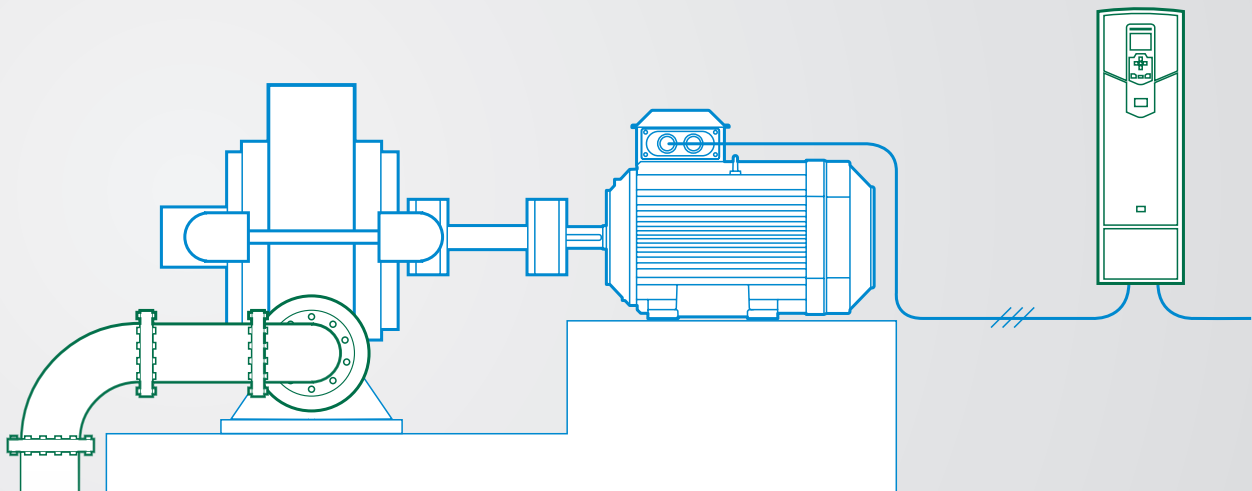


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## Let's look at the pumps

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**Pumps** are one of the most common motor applications and offer the biggest potential for saving energy.



Pumps annually consume approximately **10 percent** or 1,850 TWh of the world's electricity. If all pumps were controlled by variable speed drives – with an average saving potential of about 40 percent, total savings could be as vast as **740 billion kWh**.

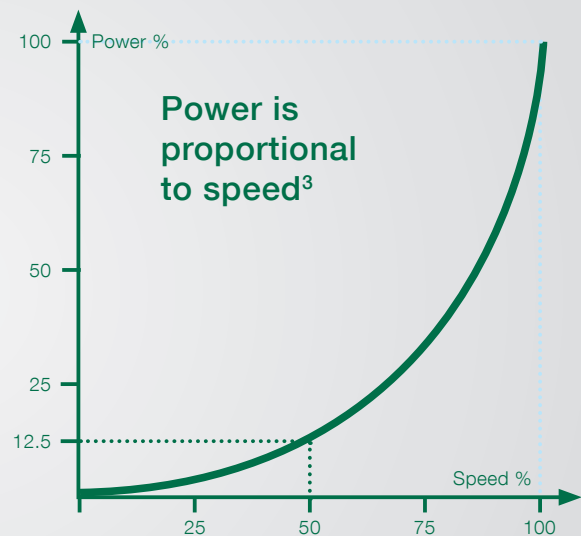
Think about this:



An average coal-fired power plant with a 500 MW power output generates **4.2 TWh of electricity**. The saving achieved by controlling pumps intelligently with variable speed drives would replace **176 coal-fired plants**. The CO<sub>2</sub> emission savings would amount to **592 million tons**.

Emission factor 0.8 kg/kWh.

Drives regulate the speed of a motor and can reduce energy consumption by 30 to 50 percent in many applications and in extreme cases by as much as by 70 percent.



## How much energy could I save with a better motor control?

### Inefficiently controlled and oversized motors waste a lot

Motors are often oversized to cope with a maximum demand that rarely or never occurs. Also when inefficient control methods such as dampers, vanes or valves are used, the motor runs at full speed and the flow is mechanically restricted. For instance, the flow through a pipeline may be reduced by a valve. This is wasteful, because the motor keeps running at its nominal speed regardless of the demand. A centrifugal pump delivers maximum output and the excess is reduced at the valve, where the surplus energy is wasted through friction.

### Matching the actual process demand is the key

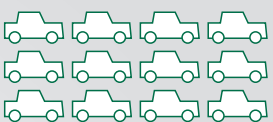
The relationship between centrifugal pump or fan speed and its energy demand is known as the cube law, because the demand for power increases with the cube of the speed. This means that a small increase in speed requires a lot more power, but also that a modest speed reduction can give significant energy savings. A pump or a fan running at half speed consumes only one-eighth of the power compared to one running at full speed.


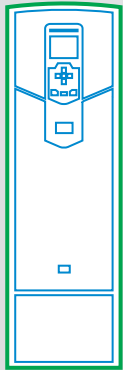
### Even small improvements count over the system lifetime

Drives adjust the speed of electric motors to match the actual demand of the application thereby reducing motor energy consumption by typically 30 to 50 percent, and in extreme cases by as much as 70 percent. And as every 1 percent reduction in energy consumption can make a big impact over the lifetime of the motor-driven system, controlling properly sized high efficiency motors with drives is a key to maximal savings.

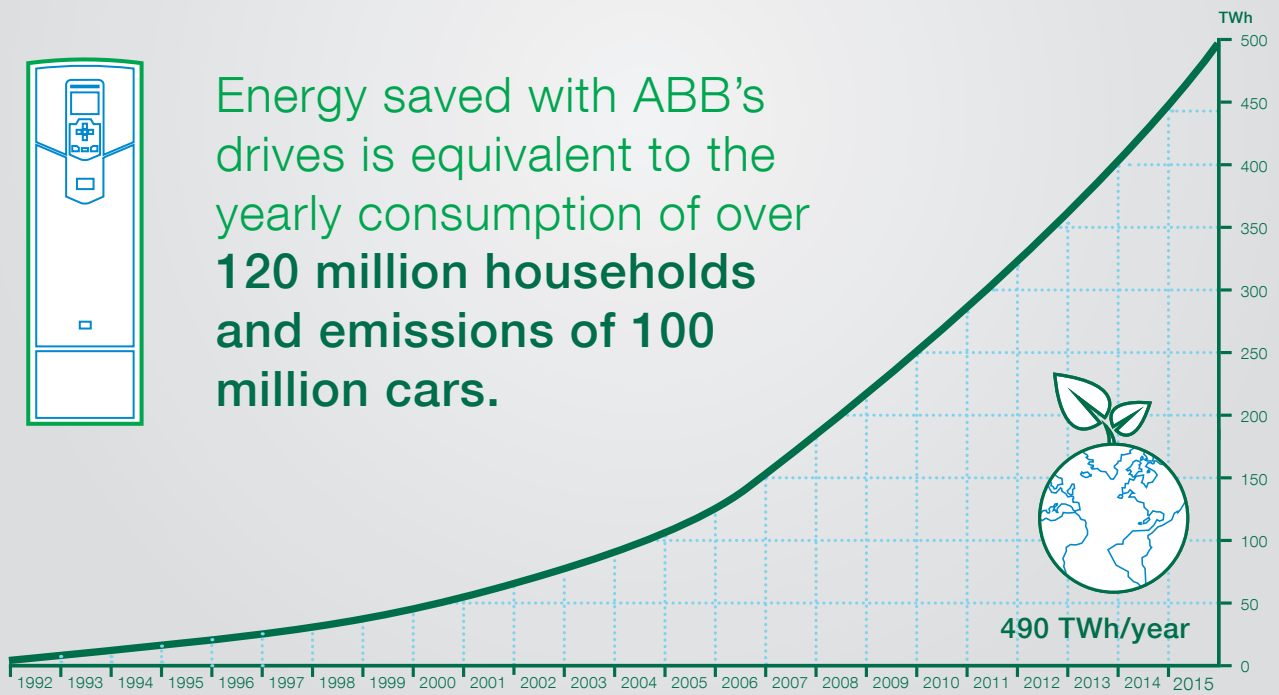
**120**   
million households



**100**   
million cars

Energy saved with ABB's drives is equivalent to the yearly consumption of over **120 million households** and emissions of **100 million cars.**



## For a more sustainable future

Ever since the first drives appeared 40 years ago, ABB has delivered millions of units across the globe. During this time, vast experience has been gained of how industry can most effectively save energy.

The installed base of ABB drives has been estimated to save about 490 TWh in 2015, equivalent to the yearly consumption of more than 120 million households in the EU-27. In terms of CO<sub>2</sub> reduction, these savings equate to 410 million tons, more than the yearly emissions of over 100 million cars.



# Reduce energy consumption and increase productivity with drives



**Installing ABB drives not only reduces energy costs but can significantly contribute to improving process control and reliability, increasing production capacity, reducing maintenance costs and lowering reactive power.**

## **Substantial energy savings**

Rather than have an electric motor running continuously at full speed, an electric drive allows the user to slow down or speed up the motor as necessary. Reducing motor speed to meet the actual demand of the process often means substantial energy savings and reduced operating costs.

## **Optimal process control**

An electric drive enables a process to achieve the right speed and torque while maintaining its accuracy – this contributes to a more consistent quality and throughput of the end product.

## **Reduced need for maintenance**

Being able to vary the speed and torque of an electric motor means there is less wear and tear on the motor and the machine being driven. For example, the ability to bring a process up to speed slowly prevents the sudden shock loading that can damage the motor and the driven machine over time.

## **Efficient system upgrade**

In many cases an electric drive permits the removal of valves, gears and belts from the system. It also ensures network dimensioning based on a lower starting current and can save costs by eliminating reactive power compensator.

# At the forefront of high efficiency motor development



**ABB motors deliver not only maximum efficiency, but also higher reliability, easier maintenance, and a longer life cycle – factors which reduce the overall cost of ownership.**

## **Reducing energy consumption**

The electric motor industry is going through its biggest change ever. Regional minimum efficiency standards (MEPS) push efficiency levels of standard motors higher and higher. Today ABB is at the forefront of efforts to reduce global energy consumption and carbon dioxide emissions by supplying safe, reliable and efficient motors. We welcome the growing number of MEPS and other efficiency regulations around the world. As a leading player in the market, ABB helps to advance MEPS and plays an active role in the bodies that set efficiency standards.

## **Optimizing solutions**

ABB aids motor users to comply with MEPS requirements and help them find the most cost efficient and sustainable solution based on their requirements. We meet the growing demands of energy efficient solutions by offering an extensive range of IE2, IE3 and IE4 motors available from stock and paving the way for IE5 and higher.

## **Continuous dedication for design**

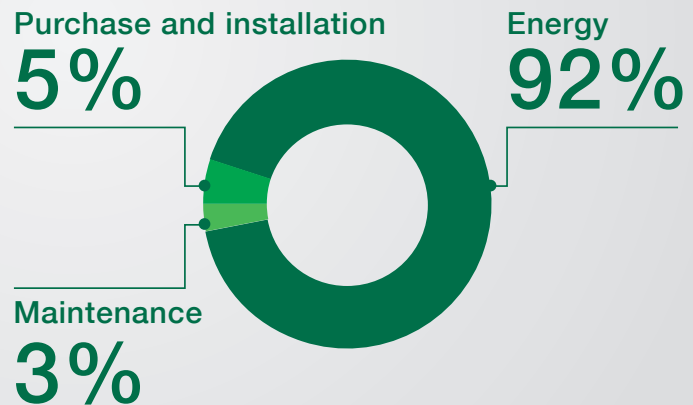
ABB is dedicated to provide the right motor solution for you from our wide technology portfolio. As an example of our dedication, we have constantly developed more efficient induction and permanent magnet motors. The environmental credentials of ultra-efficient SynRM go beyond energy saving due to their completely rare earth free construction. We are helping you to maintain your competitive edge and footprint reduction while taking responsibility for the future.

# Energy covers 92% of the total life cycle costs

## It pays back

The payback time for using variable speed drives is **very short**, and the return on investment can come **within months**.

**According to the life cycle approach**, the purchase price of a motor and a drive is just a few percent compared to the energy spent to run the equipment over its entire lifetime.



**One of the quickest ways for industries and utilities to lower energy consumption and therefore reduce their bills is to employ high efficiency motors and drives. The purchase price of an electric motor and drive, for instance, is just 1-3 percent of the equipment's energy costs over its lifetime.**

In many instances the return on investment can come within months. While such payback can have a significant effect on profitability, other benefits come from reducing carbon dioxide emissions and contributing to the environmental objectives of the community.

To achieve the best return on investment, users of production equipment need to apply a life cycle approach when considering investing in major equipment. The life cycle cost (LCC) is the total cost for purchasing, installing, operating, maintaining and disposing of a piece of machinery.

The purchase price of an electric motor and drive, for instance, is just one to three percent of what the owner will spend on energy to run the equipment over its lifetime. Considering the long lifetime of a motor – 25 to 30 years – the lifetime costs play an even more important role.

LCC should be calculated not only for new installations, but also for existing ones. Existing systems provide much greater scope for efficiency improvements than new installations. The volume of systems in use exceeds the volume of annual new installations many times over. Additionally, many existing installations can offer considerable scope for improvement if the duty has changed since the system was first installed.



# Identifying the energy save potential on site

We have devised a simple and methodical Energy Appraisal service that is able to analyze the energy savings potential in your business by using ABB drives and motors. The starting point for a successful energy appraisal is to identify applications where energy can be saved the most.

## Identified potential savings

An Energy Appraisal is normally carried by an ABB engineer or one of ABB's authorized local channel partners who help

identify relevant applications that will generate energy saving results. Following the Energy Appraisal service, an action plan is prepared, usually comprising an executive summary of findings and a detailed engineer's report.

## Reduced cost of ownership

The report presents the payback time of an investment in ABB drives and motors. Implementing high efficiency motors and drives promotes energy savings and lowers the total cost of ownership.

## ABB Energy Appraisal service delivery



### Outlining the scope of the appraisal

An ABB-certified engineer plans a visit to your facility to get an understanding of the environment. This includes location of the applications, an inventory of motors, any health and safety restrictions, as well as anything unusual that might affect the energy profile.



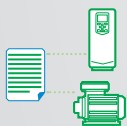
### Monitoring and data collection

During a site walk we identify potential applications, understand the operations, load profile, collect necessary data including drive applications, site conditions, etc. We collect empirical data on the selected applications in order to accurately determine the energy consumption or process requirements.



### Data analysis

We analyze the findings and identify potential savings. The available data includes an estimate of present energy usage, areas of potential savings, payback time if an investment is made in drives and/or motors, carbon dioxide emissions reduction, to name a few.



### Recommendations

We prepare an action plan, usually comprising a report, highlighting applications that can save the most. The figures will be normally translated into annual savings, and there will be detailed recommendations for suitable drives or motors.

## Optional services available



### Implementation

Using the recommendations from the energy appraisal, ABB identifies the correct drive and motor for the respective application. In many instances, we can help with the installation and startup or commissioning of the drive and motor. This includes setting the correct parameters to ensure that the drive or motor is operating at its optimum energy efficiency.



### Verification and follow-up

Once new equipment is fitted, ABB tracks the actual electrical energy consumption against the predictions shown in the report. This will also help justify the investment in drives and electric motors.

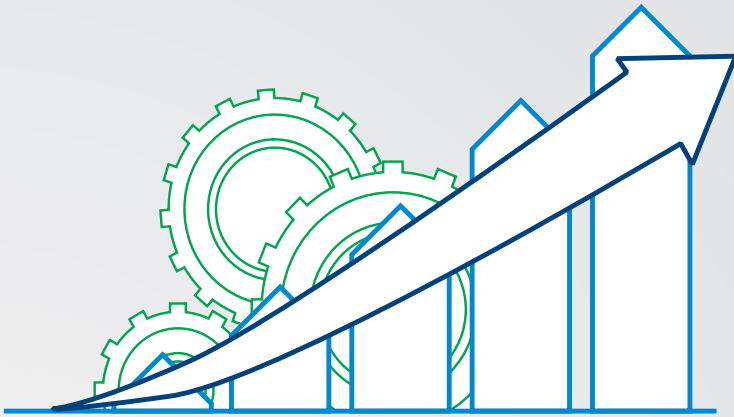
# Life cycle services for improving energy efficiency

For a high efficiency motor and a drive to maintain their energy saving potential it is important that they are looked after throughout their life cycle. **To make sure this happens, ABB has devised a series of energy-related services that can be used throughout the entire life cycle value chain.**



## Installation and Commissioning

On your request, ABB-certified engineers can undertake installation and commissioning of drives and motors for you. The installation and commissioning will be performed using the latest tools and instructions, and following local safety regulations and functional safety requirements. Correctly installed products work reliably and proper commissioning leads to efficient operation, energy savings and best value for the money.

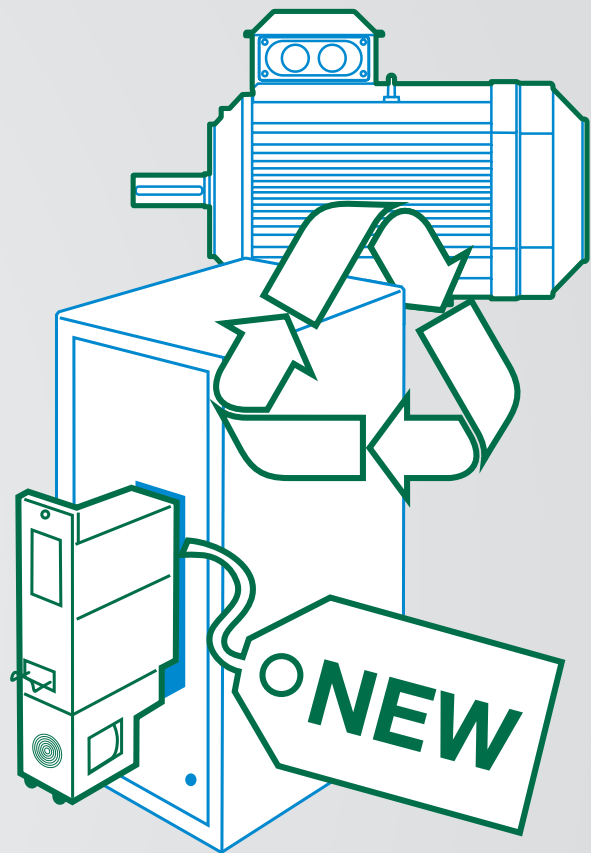


## ABB Customer Care

The ABB Customer Care agreement helps you keep your motor-driven systems running efficiently without unexpected costs letting you focus on your core activities. The process starts with a risk analysis of all the drives and motors on your site. We will carefully review the condition of your equipment and its importance for your operations, and recommend the most appropriate services to be added in the agreement.

Based on our recommendation you can select the service elements like preventive maintenance, technical support and remote support to be included in the agreement. For additional convenience, a number of service plans can be coordinated under a single agreement. Preventive maintenance, repairs, and other support activities are offered at a fixed annual price, regardless of how often the support is used, thus eliminating any concerns about unplanned expenditure.

The ABB Customer Care agreement is the most efficient way to manage the condition of the drives and motors on your site during their total life cycle, while minimizing production risks.



## Upgrades and Retrofits

A variety of drive and motor upgrades and retrofits lower energy and maintenance costs of your production by bringing it up to date with the latest technology. In many cases upgrades can also enhance the efficiency and reliability of the systems. We will be pleased to advise you on the feasibility of upgrading or retrofitting your equipment.

# Contact us

For more information please contact your local ABB representative or visit:

[www.abb.com/drives](http://www.abb.com/drives)

[www.abb.com/drivespartners](http://www.abb.com/drivespartners)

[www.abb.com/motors&generators](http://www.abb.com/motors&generators)

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