

# ACHIEVING THE COP28 UAE CONSENSUS

The vital role of high efficiency motors and drives in net energy addition and lower emissions globally

**JUNE 2025**

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# EXECUTIVE SUMMARY

The demand for energy is surging across the world. Energy efficiency is crucial in helping the industrial sector to reduce its energy consumption and operate more sustainably.

This paper will highlight the bottom-line benefit of investing in energy efficient technologies, including motors, drives, and digital technologies, highlighting the high and rapid return on investment for these solutions.

## ABB's Role in an Energy Efficient Future

A global leading innovator in motors, drives, and digitalization, ABB's technologies have had a significant impact on industrial company operations around the world. Pulling on case studies from South America, Asia, and Europe, the report highlights direct cost and energy savings from ABB technology adoption.

### Using more IE motors

Too many industrial electric motors today do not meet newer efficiency standards. Considerable gains in efficiency can be achieved simply by deploying industrial electric motors correctly dimensioned to the application in question.

### Pairing motors and drives

With 45% of the world's electricity converted by industrial electric motors into motion, and only 25% of these motors being controlled by drives, pairing high efficiency motors and drives can help reduce global total energy consumption by up to 10%.

### Energy audits

Identifying and measuring the scale of energy saving opportunities keeps ABB at the forefront of driving innovation across systems.

### Digitalization and connectivity

You can't manage what you can't measure, and digitalization is the basis of the energy monitoring and controls needed to improve energy efficiency.

The paper demonstrates the impact of ABB's Top Industrial Efficiency Initiative, one of many examples where ABB helps companies push beyond efficiency standards by identifying opportunities to collaboratively pilot innovation-led solutions with partners that can advance technologies from pilot to scale.

### Call to Action

The paper demonstrates how, with adequate investment, appropriate legislation, and an increased adoption rate of energy efficient solutions, it should be possible over the coming decades to make major progress towards global energy efficiency goals.

Governments and industry must work together to push forward better energy efficiency. By demonstrating ABB's role as a driver of innovation to support each of these stakeholders in achieving this goal, this paper aims to inspire collaboration between industry and governments towards achieving global energy efficiency targets.



# FOREWORD

## 10% net global energy addition with lower emissions



Brandon Spencer  
President, Motion Business Area, ABB

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The industrial sector is the beating heart of the modern world – powering, protecting, moving, and connecting us. How industries operate has become critical. Simply “running” is no longer enough – there is a constant need to outperform and “outrun”.

The threat of the climate crisis, paired with increasing pressure for industry to contribute to domestic growth, is pulling industrial companies in two directions: increasing productivity while reducing their carbon footprint. Trying to balance these two outcomes is a critical challenge in the modern industrial landscape.

This is especially the case for hard-to-abate industries where there is more work to do – but also a lot to rapidly gain. A huge range of proven energy efficient technology is already available, and new solutions are being constantly developed – the task ahead of us is bringing industries along on the journey.

The benefits of energy efficiency are much faster and cheaper than renewable energy. This is part of the solution but requires more time and capital.

By optimizing the energy efficiency of industrial electric motors, we can put over 10% of energy capacity back on the grid without the trillions of dollars in new infrastructure. It allows society to do more with less—now.

**The world is using more energy and we’re here to help it do so more efficiently**

Since I joined ABB, our appreciation of the importance of energy efficiency as the fastest and cheapest way to reach net zero has grown. Our premise is simple: the greenest unit of energy is the one you never consume. I’ve been in the room as the discussion on energy transition has moved from theory to practice to urgent need, and my connection and commitment to this issue has only grown.

I am proud of our leading technologies and our ability to enable industries to achieve high performance and sustainability. **At ABB, we help industries outrun - leaner and cleaner,** but I know we can’t do this alone. Supportive public policy and private capital are essential for reaching global climate goals. Clear regulation and faster permitting need to be the driving forces to push forward business innovation and technology deployment.

We’re excited to continue our work of bringing more cities, businesses, and countries into our mission to build an energy efficient future that can sustain ongoing innovation, growth, and service delivery while protecting the bottom line for businesses. Together let’s chase progress, not perfection.

# INTRODUCTION

## Making the Most of our Energy

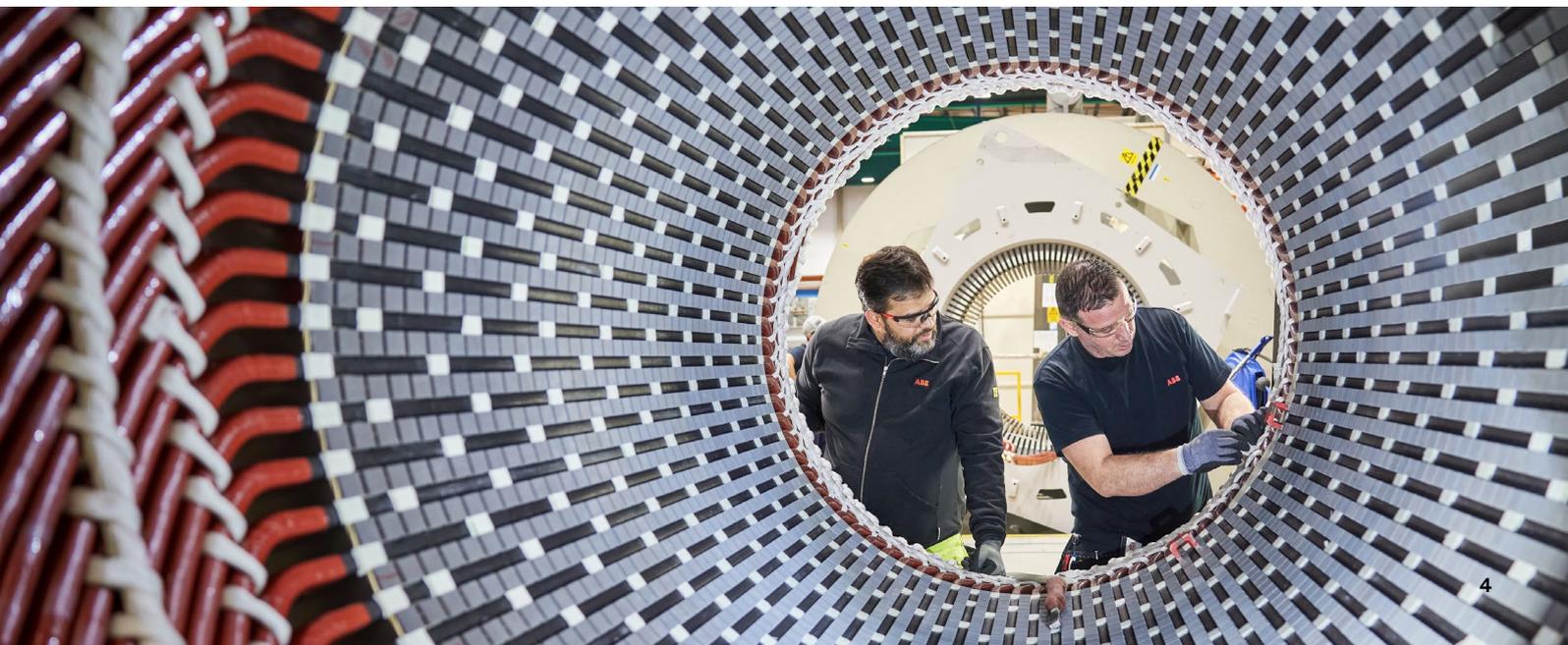
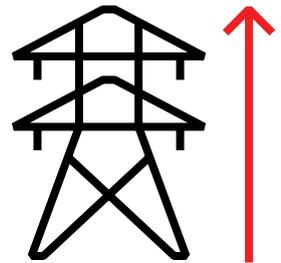
In 2024, Global Energy demand grew by 2.2%, outpacing the global average over the last decade<sup>1</sup>. Electricity usage is a top driver of this demand, with electrification, record temperatures, and digitalization rising alongside electricity-intensive manufacturing, driving global electricity consumption up by nearly 1,000 terawatt-hours (TWh) in 2024. This is more than twice the annual average increase over the past decade and comparable to the electricity consumption of Japan<sup>1,2</sup>. These trends indicate a significant opportunity for increased energy efficiency, especially through industrial electric motors and drives.

At ABB we're leveraging cutting-edge high-efficiency solutions to help our customers increase productivity while decreasing energy consumption. By optimizing, electrifying, and decarbonizing our customers' operations, they maximize the output from each unit of energy consumed, lowering their energy use and costs.

There is huge, untapped potential for energy efficiency in the industrial sector through electric motors and drives. According to the IEA, in 2024 nearly 40% of growth in electricity demand was driven by the industrial sector while industrial electricity use increased by 4%<sup>3</sup>.

While electricity and energy use has increased, the energy efficiency of motors has been neglected in comparison with other sustainable energy opportunities.

ABB is proud to support the Global Renewables and Energy Efficiency Pledge made at COP28 to double the global average annual rate of energy efficiency improvements from 2% to 4% annually through 2030<sup>4</sup>. In the network of businesses, governments, and industrial partners that must work together to drive forward this opportunity, ABB has been a leading partner to businesses around the world seeking to improve their operations and their impact locally. From tangible solutions across our product portfolio to our support for networks including the Energy Efficiency Movement, ABB is innovating to deliver solutions for customers, industries, and societies.



# THE BOTTOM-LINE BENEFIT OF ENERGY EFFICIENCY

In a world that is growing hungrier for energy while trying to reduce emissions from energy use, energy efficiency and decarbonization have become top priorities for business executives. As businesses increasingly look to their bottom-line, investment in energy efficiency has risen by close to 50% since 2019<sup>5</sup>. The ROI on energy efficiency used to be counted in years, but returns on current technologies in variable speed drives and motors are achieving these returns within months<sup>6</sup>.

## The Energy Efficiency Movement

The Energy Efficiency Movement launched by ABB in 2021, and now independent, rallies partners and competitors, to promote the use of industrial energy-efficient solutions and technologies. The Movement has fostered collaboration to share best practices, save energy, reduce costs, and reduce CO<sub>2</sub> emissions. Their report, “The Case for Industrial Energy Efficiency,” lays out the financial and carbon impacts of 10 key energy efficiency actions companies can take, across three strategic pillars: building an efficiency foundation,

### Energy and material savings

Energy efficiency is at the heart of our solutions. By optimizing the performance of motor-driven systems, we help our customers achieve substantial energy savings. This not only reduces their energy bills, but minimizes their environmental footprint, helping them meet regulatory standards.

### Reliability and optimal lifetime

By providing monitoring, support, and preventative maintenance services, we ensure that our products perform optimally throughout their life cycle.

This not only extends the lifetime of our products, but also enhances their reliability, reducing the need for frequent replacements and minimizing downtime.

driving efficiency returns, and gaining efficiency insights<sup>7</sup>. Four of these actions alone could avoid 2.53 gigatonnes of CO<sub>2</sub>, equivalent to around 600 coal fired power plants, annually by 2030. Taken together, their effects would not double but triple the annual rate of industrial energy efficiency improvements seen in recent years with financial benefits for industry<sup>8</sup>.

The proposal is also financially attractive. For industry, the gross financial benefit of the four priority actions identified could amount to a total \$4.1tn in savings between now and 2030, at 2023 prices. After investment costs are taken into consideration and an industry-standard discount rate of 6% is applied, these actions could deliver \$1.23tn in upside<sup>8</sup>.

Energy efficiency is one of the key factors ABB utilizes to enable significant customer outcomes. While improving business impact in line with international standards, these key outcomes also present significant opportunities for growth and cost savings.

Our retrofit services further extend the life of existing equipment, ensuring that our customers get the most out of their investments.

### Avoided emissions

By upgrading to higher efficiency industrial electric motors and pairing them with variable speed drives, we enable our customers to significantly reduce their energy consumption. With less electricity required to power their operations, this translates directly into avoiding significant amounts of carbon emissions, contributing to more sustainable and productive operations.

We implement energy appraisals and provide ABB Ability™ solutions that allow real-time monitoring, facilitate predictive maintenance and mitigate risks related to unplanned downtime.

### Efficiency Audits Set a Roadmap Towards Savings

One of ABB's energy efficiency audits - through joint research conducted between 2022 and 2023 with The European Laboratory for Particle Physics (CERN) – **identified a 17.4% energy-saving opportunity in cooling and ventilation motors in their laboratory in Geneva, Switzerland.** Using data-driven energy efficiency audits across a fleet of 800 motors, ABB and CERN developed a roadmap for reducing the energy consumption of the site's cooling and ventilation system.

The experts analyzed the efficiency of the whole system to pinpoint the motors with the best business case for energy efficiency upgrades. The audit identified potential annual energy savings of up to 31 gigawatt-hours (GWh). **If achieved, these savings could be enough to power more than 18,000 European households<sup>9</sup>.** Cooling and ventilation systems are a great first place to look for energy efficiency upgrades because they are often oversized, being specified to operate at a maximum load way above the average.



# SUPPORTING GOVERNMENTS IN THEIR DRIVE FOR GROWTH

Governments play a key role in inspiring this change. They can set the direction of travel to increase the uptake of existing technologies and incentivize research to develop new solutions. By prioritizing the role of energy efficiency in public sector procurement criteria and mobilizing finance to focus on new and innovative tools that bolster energy efficiency projects, governments can drive optimized growth through policy, establishing market leadership.

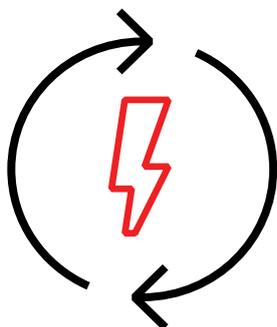
Governments should set the bar high for energy efficiency: requiring ambitious standards at national and supranational levels.

This can be achieved by encouraging industries to adopt energy efficient processes and technologies via incentives, subsidies, and tax breaks for installed base and new installations to bring businesses up to speed with the demands of a competitive future, where data centers and AI are pushing existing grids to unforeseen demand levels. According to the International Energy Agency, data centers consumed 415 terawatt-hours of electricity in 2024, about 1.5% of global electricity use<sup>10</sup>.

## Integrating Efficiency in Carbon Market Guidance

In India, the Government included industrial energy efficiency as an eligible offset in their new carbon market guidance. **This has allowed companies implementing efficiency programs to earn carbon credits in the national carbon market launch.**

Programs like these enable businesses to actively participate in environmental and energy efficiency programs in ways that better align with their best business practices, supporting their bottom-line while engaging with broader environmental initiatives<sup>11</sup>.



## Backing Governments' Goals for Businesses

ABB's installed base in China of more than 11 million high-efficiency motors and drives has **delivered energy savings of more than 510 billion kWh, equivalent to the electricity consumption of Shanghai for three years**, thereby avoiding approximately 500 million tons of CO2 emissions. The government's five-year plan and broader efforts to tackle climate change have resulted in leading action across businesses in China. ABB global survey found that China is leading overall investment in energy efficiency, with 86% of businesses in China planning to make their operations more energy efficient<sup>12</sup>.



**Governments alone cannot drive greater energy efficiency. To realize the full benefits of high-efficiency motors and drives, all stakeholders have critical roles:**



**Businesses, cities, and countries** all need to be aware of both the cost and energy savings associated with high efficiency motors and drives and be willing to collaborate on making the investment.



**Manufacturers** must continue to develop innovative technologies that improve energy efficiency.



**Investors** need to reallocate capital towards companies better prepared to address climate risk.



**Public education programs** will be required to explain and promote the value of these upgrades.



# ABB'S ROLE IN AN ENERGY EFFICIENT FUTURE

While they may not be highly visible, industrial electric motors are ubiquitous. They are an integral part of global industry and our everyday lives.

**45% of the world's electricity is converted by industrial electric motors into motion<sup>13</sup>.** Modern, high-efficiency motors, paired with variable-speed drives, are designed to be flexible and reliable. Yet above all, they are extremely efficient, offering significant reductions in power consumption compared with older systems. Their importance in driving energy efficiency across networks cannot be overstated.

Smaller motors are found in the compressors used in air conditioners and refrigerators, in car windows, computer printers, cooling fans of electronic appliances, and countless other common devices. Mid-sized motors appear in heating, ventilation, and air conditioning (HVAC) systems, as well as in elevators, rapid transit vehicles, and electric and hybrid vehicles.

They are used extensively in industry, for pumps, conveyors, fans, and mechanical motion of all kinds. The largest industrial electric motors are found in railway engines, cable cars, ship propulsion systems, and heavy equipment of the sort used for mining and paper mills.

With motors integrated and essential in so many functions of daily life and business operations, there is a clear drive to maximize opportunities to improve efficiency. Roughly 75% of the industrial motors in operation today are used to run pumps, fans, and compressors, a category of machinery that is highly susceptible to major efficiency improvements<sup>14</sup>.

40% of businesses report energy as the biggest source of waste<sup>15</sup>. At ABB, we're supporting businesses to integrate efficiency throughout their entire organization, and these companies are seeing results in cost control, waste reduction, enhanced business reputation, and energy savings.



## Innovation and technology integration

The trend in industrial engineering has been toward the utilization of more and smaller motors, optimized for specific tasks. Matching the output of a motor to the maximum power required for a task already represents a step toward achieving greater energy efficiency. Arguably, this efficiency can come at the cost of greater complexity. But, in the latest systems, this complexity is being addressed through smart sensors and internet-connected monitoring systems that alert operators when a motor shows signs of needing repair or replacement.

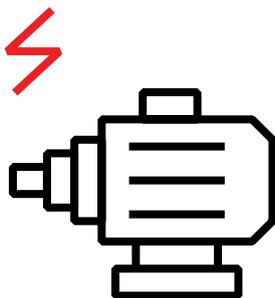
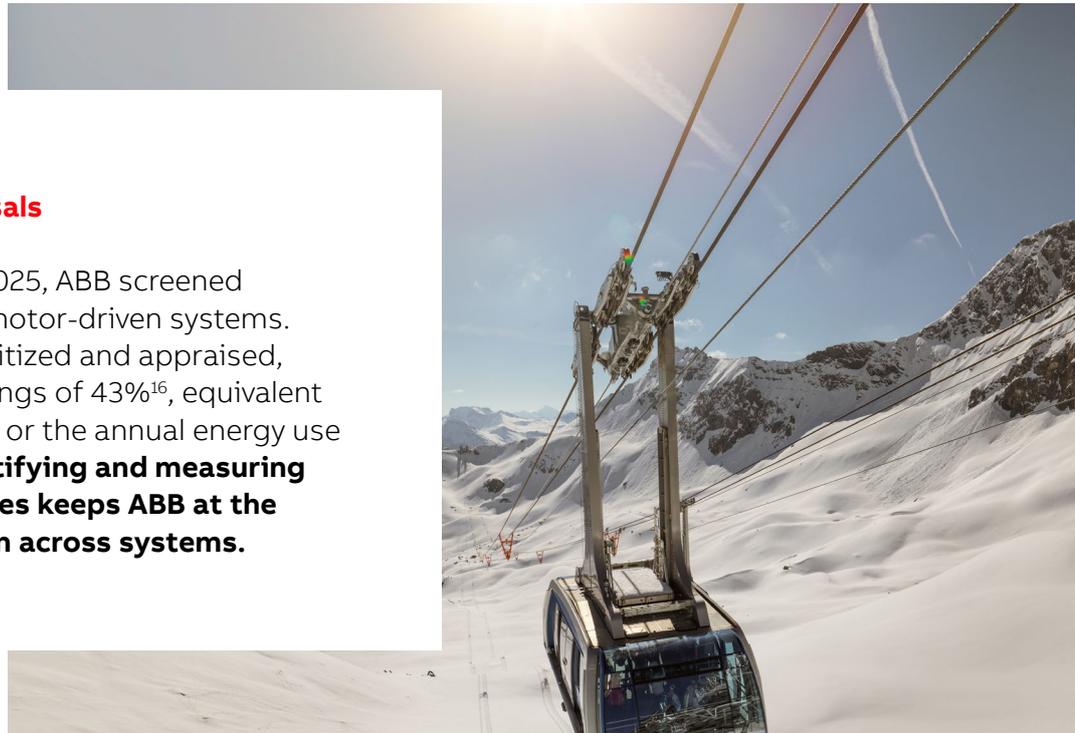
With more than 300 million industrial electric motors in the world, there is great potential to save energy and CO2 emissions through the adoption of innovative technologies. More than half of motors in use globally are at least 20 years old and have been superseded by modern high-efficiency technology<sup>16</sup>.

An induction motor that meets the IE3 standard achieves roughly 96% efficiency, and IE4 motors bring energy losses about 15% lower than those delivered by IE3 motors. Less than five years ago, the IE5 “ultra-premium efficiency” motor represented the highest level of efficiency that has been met by any design. These IE5 motors have 20% lower losses compared to an IE4 motor. ABB is continuing to push beyond previous standards through its commitment to innovation. This led to its first in the world IE6 hyper-efficiency motor<sup>17</sup>.

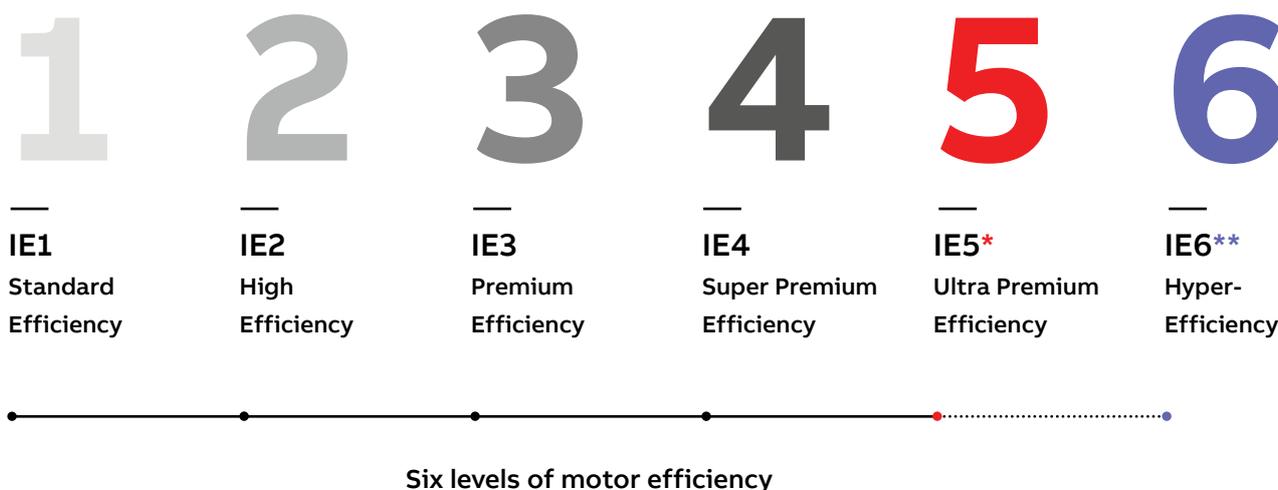
Too many industrial electric motors today do not meet these standards and rely on older IE1 or IE2 designs. In addition, many of these motors are over-dimensioned to the uses they serve, frequently delivering much more power than required, resulting in wasted energy. **Considerable gains in efficiency may be achieved simply by deploying industrial electric motors that are correctly dimensioned for the application in question.**

## Net Savings from ABB Appraisals

From November 2024 to May 2025, ABB screened over 10,500 industrial electric motor-driven systems. Among these, 5,900 were prioritized and appraised, identifying average energy savings of 43%<sup>16</sup>, equivalent to approximately 941,000 MWh or the annual energy use of 91,715 US households<sup>17</sup>. **Identifying and measuring the scale of these opportunities keeps ABB at the forefront of driving innovation across systems.**



International Efficiency (IE) standards stipulate the energy efficiency of low voltage AC motors. These IE codes serve as a reference for governments who specify the efficiency levels for their minimum energy performance standards (MEPS).



\*IE5: Applicable to motors operated with Variable Speed Drives (VSDs)

\*\*IE6: Not officially standardized; development is ongoing

While there are significant efficiency gains to be reaped from upgrading an industrial electric motor, still greater energy savings are achievable when a high-efficiency motor is used in combination with a variable-speed drive.

Drives control the speed of an AC motor by varying the frequency and voltage of the power being fed to it in such a way as to optimize its operation. It accomplishes this by adjusting the speed and torque of a motor as it operates to match the system's load requirements. With the right drive, an industrial electric motor will run only as fast as is called for by the underlying load, leading to significant power savings.

In 2025, ABB celebrated the 50th anniversary of Martti Harmoinen's invention of the variable speed drive at Strömberg, a Finnish electric

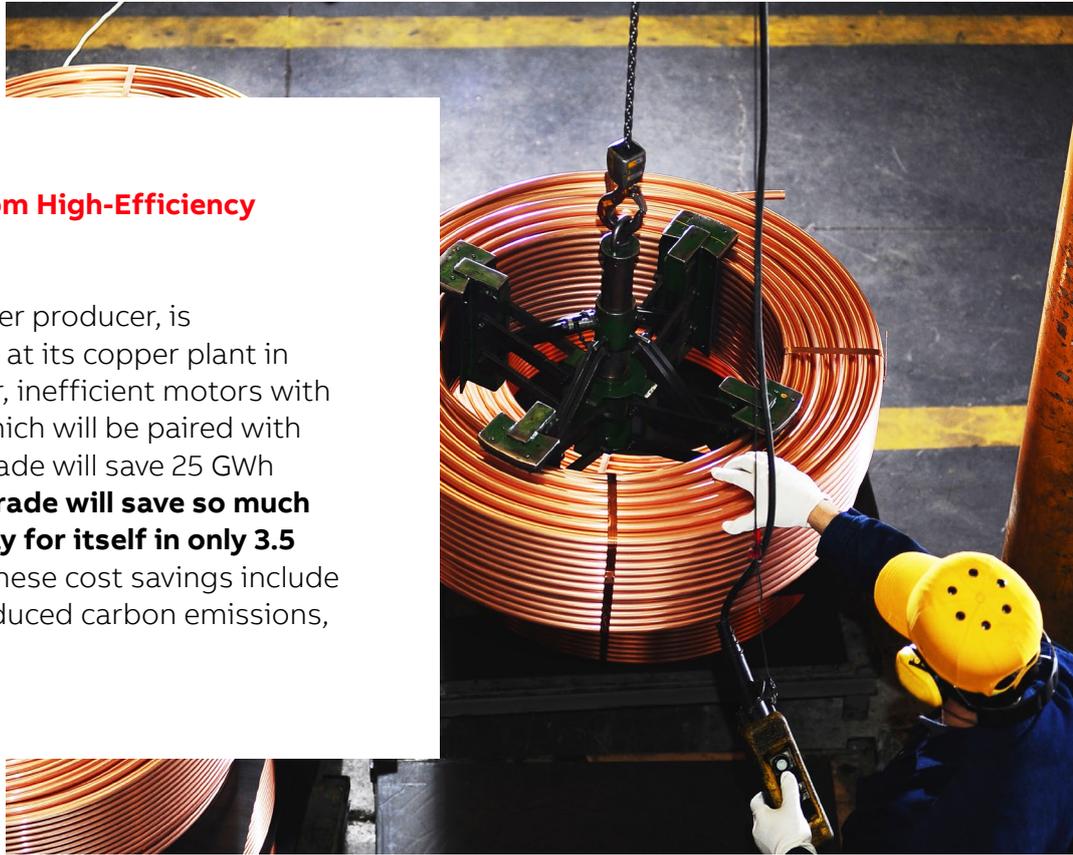
engineering company that later became part of ABB. This invention changed the industry, and Harmoinen's technology spread rapidly across sectors and continents, particularly after Strömberg joined ABB in the 1980s<sup>18</sup>. As solid-state electronics have advanced in recent decades, drives have become dramatically more sophisticated and less expensive, and today ABB is a global leader in variable speed drive technology.

**Today, drives can typically reduce power consumption by 25%.** With 45% of the world's electricity converted by industrial electric motors into motion, and only 25% of these motors being controlled by drives, there is a significant opportunity to reduce power consumption through increased utilization of drives. This combination of high-efficiency motors and drives can help reduce the global total energy consumption by up to 10%<sup>13</sup>.



## High Return on Investment from High-Efficiency Upgrades

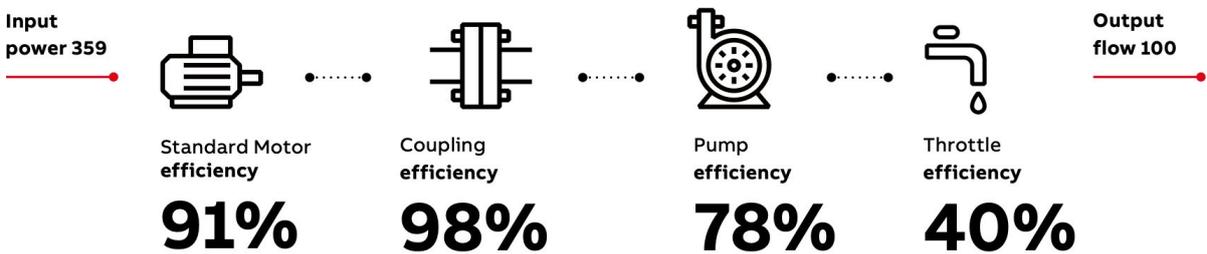
Aurubis, Europe’s leading copper producer, is implementing a major upgrade at its copper plant in Bulgaria. By replacing 460 older, inefficient motors with IE4 and IE5 motors, many of which will be paired with matching ABB drives, this upgrade will save 25 GWh of electricity per year. **This upgrade will save so much energy that the project will pay for itself in only 3.5 years.** Other benefits beyond these cost savings include increased process flexibility, reduced carbon emissions, and improved performance<sup>19</sup>.



**Despite these advances, drives have been deployed at a modest pace thus far.** Without being controlled by a drive, many motors run at full speed even when the load requirements are minimal. For example, to control the mechanical power generated by the motor in pumping applications, a technique called “throttling” is used. This is akin to reducing the speed of a car by applying the brakes without letting up on the accelerator. This represents a substantial waste of energy and money.

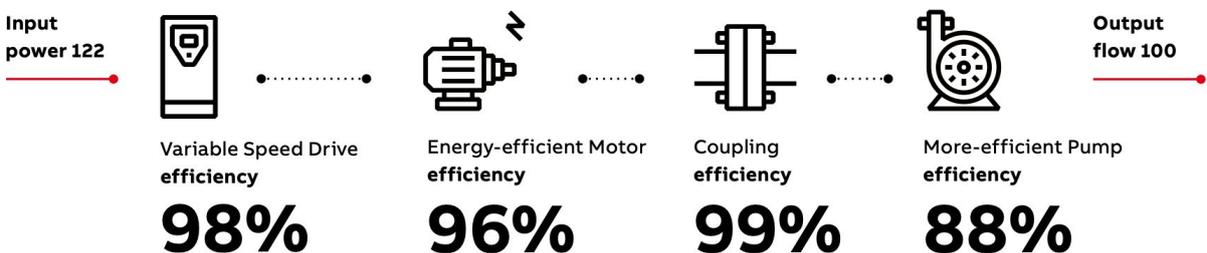
### Conventional pumping system

System efficiency = 28%



### Energy-efficient pumping system

System efficiency = 82%



## The impact of digitalization and connectivity

Another technological development that is poised to improve the efficiency of the world's industrial electric motors can be found in digitalization and connectivity—the “industrial internet of things”. By attaching wirelessly connected sensors to existing motors, it becomes possible to monitor their performance transparently and remotely. In a complex industrial installation or a large building's heating, ventilation, and air conditioning (HVAC) system, the resulting data can make it possible to optimize processes and realize significant efficiency gains and energy savings.

You can't manage what you can't measure, and digitalization is the basis of the energy monitoring and controls needed to improve energy efficiency.

Digitalization provides insights into where energy is being used. In data centers, for example, this allows operators to optimize usage, avoid waste, and establish a more sustainable operation<sup>20</sup>.

When the motors being monitored are controlled by variable-speed drives, they truly become smart motors, since they can then be controlled remotely or even automatically, further optimizing performance, system efficiency, and energy savings. Data provided by the sensors can be analyzed along with other control data and then used by a central control system as the basis for real-time adjustments to the entire installation.

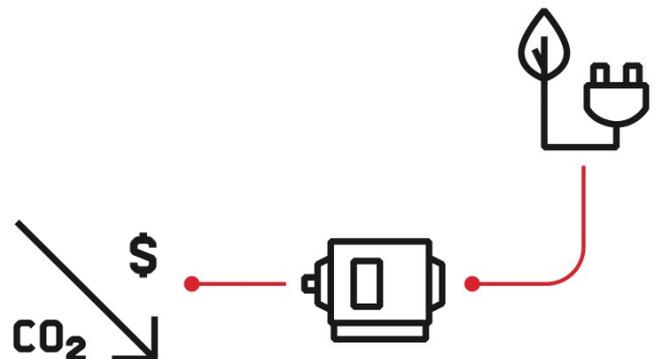
## ABB Ability Improves Savings and Uptime

ABB drives, motors, and ABB Ability digital services played a major role in helping the Brazilian water and wastewater company **Saneago cut pumping energy bills by around US \$700,000 annually**. At the same time, the ABB Ability Digital Powertrain solution improved uptime by giving valuable new insight into the condition of the equipment and maintenance needs<sup>21</sup>.



## Going beyond standards: ABB's Top Industrial Efficiency (TIE) Initiative

At ABB, we're helping companies push beyond efficiency standards, maximizing potential for growth and savings in every decision-making process. Through ABB's Top Industrial Efficiency Initiative, we're ensuring that every company is offered the option for our highest efficiency solutions.

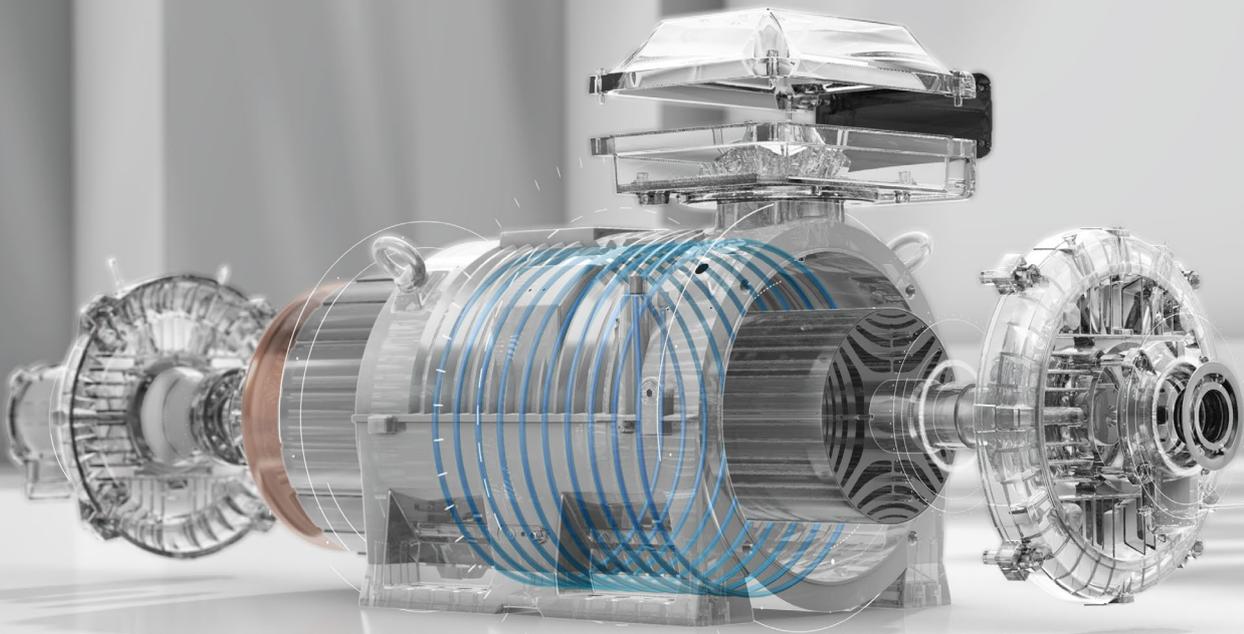
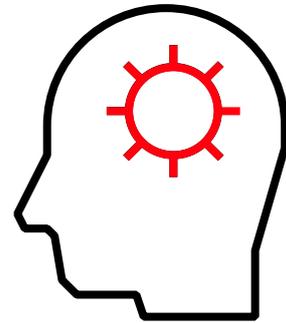


## Setting the Record in Energy Efficiency for Industrial Electric Motors

In 2025, ABB set the new world record for motor energy efficiency. By specifying the Top Industrial Efficiency motor rather than a standard design, an Indian customer achieved an efficiency rate of 99.13%, surpassing the previous record of 99.05%, making it the most efficient industrial electric motor in the world. **The steel plant will save around \$5.9 million in electricity costs over a 25-year lifespan and reduce energy consumption by 61 GWh.** With an increase in purchase price of only 1% between the TIE design motor versus the standard design, the customer had made back the costs of the upgrade in just over 3 months<sup>22</sup>.



At ABB, we're setting the standard that the best efficiency solution should always be on the table. One way we do this is by **identifying opportunities to collaboratively pilot innovation-led solutions with customers that can really shift the needle in advancing these technologies from pilot to scale.** We're committed to pushing the boundaries of efficiency in ways that will best support the businesses we work with, without ever compromising on reliability or unproven technology.



# CONCLUSION

The technology that the world needs to dramatically improve energy efficiency is in hand. Much of it, such as high-efficiency motors and drives, is well established and time-tested. Accelerating the adoption of these existing technologies – in industry, cities, and transport – would achieve significant energy savings around the world. **Doubling the current rate of energy efficiency improvements both in advanced and developing economies from 2% to 4% per year until 2030 would avoid a third of the total emissions reductions required to achieve Net Zero—the equivalent of final energy consumption for China in a year<sup>23</sup>.**

High-efficiency motors and drives offer great returns on investment. By promoting their adoption through tax incentives, public investment, and system-based regulatory imperatives, governments can spur further private investment and research, moving the world closer to meeting the Global Renewables and Energy Efficiency Pledge made at COP28 and driving economic growth and competition in the most efficient way.

The benefits of greater energy efficiency contribute directly to energy independence and stronger economic growth and development. **Energy efficiency helps the world to do more with less, avoiding emissions and allowing for more investment in economic projects beyond energy infrastructure.** Since the start of the industrial era, improvements in productive efficiency have always led directly to periods of economic expansion. With the latest technological advances, we are embarking on an era in which greater efficiency contributes simultaneously to economic growth. Accelerating the adoption of these solutions is simply common sense.

## What next?

**At ABB, our premise is simple: the greenest unit of energy is the one you never consume.** That's why we're encouraging industry leaders to unite through the Energy Efficiency Movement to share their collective knowledge and resources, striving to advance energy efficiency across all industrial sectors. The Movement aims to advance energy efficiency solutions, share best practices, provide platforms for collaboration, and work with strategic partners to demonstrate the benefits of energy-efficient initiatives. Through these efforts, we are going beyond addressing immediate efficiency needs and looking towards future innovations across industries to drive transformative change.

*The world needs more energy, not less. With adequate investment, appropriate legislation, and an increased adoption rate compared to renewables, it should be possible over the coming decades to make major progress towards global energy efficiency goals.*

**Moreover, by optimizing the energy efficiency of industrial electric motors we can put over 10% energy capacity back on the grid without the trillions of dollars in new infrastructure costs<sup>13</sup>.** As the environmental and economic impacts of obsolete technologies have grown, it is clear just how much we stand to gain by embracing innovations in current and existing proven technologies that can transform the way we manufacture goods and operate our buildings and transport networks. To put it simply, energy efficiency is net energy addition with lower emissions. The faster we can make this happen, the more we all stand to benefit.

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