



GRUNDFOS E-PUMPS SUPERIOR VALUE FOR THE SUSTAINABILITY AGENDA

Combining energy efficient pumps, motors, drives and controls into a solution that adds more value, more efficiency, more energy savings and a lower carbon footprint

While many component suppliers can deliver energy efficient pumps, motors or drives, Grundfos is the only one who develops, designs and manufactures all of these elements and puts them together into one compact solution: the E-pump. Furthermore, Grundfos designs its E-pumps specifically to application in industrial processes, buildings and water supply.

Through Grundfos iSOLUTIONS digital cloud connectivity, E-pumps offer a major opportunity for energy and carbon savings and can also benefit the overall system performance.

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INTRODUCTION

Customers are calling for climate action – from manufacturers, water utilities and building owners. Shareholders want it. The United Nations’ climate reports continue to give dire warnings – “Every tonne of CO₂ emissions adds to global warming,” says a headline in the 2021 report, recommending urgent action¹. The UN Sustainable Development Goals (SDGs) are driving that action.²

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In response, companies all over the world are pursuing new ways to be more sustainable. They are forming new visions and strategies based around the SDGs. They are pledging bold CO₂-reduction targets and energy-saving goals. While there are many “low-hanging fruits” in ways to save energy and cut carbon, there is a major, often overlooked opportunity for nearly every factory, building or utility: the pumps, their processes and the potential for savings.

“It’s hard to actually imagine making a more sustainable operation without actually considering the pump, which is the heart of many processes within most facilities,” says Anupam Bhargava, Sr. Vice President, Industry Solutions & Marketing at Grundfos.³ “If we look at how the world operates today, pumps play a critical role in just about everything you can imagine, whether it’s in your house, in your apartment building, in your hospital, in your hotel, in your office building, in your factory, in your data centre, in your water treatment plant, in your power plant. Pumps are just integrated into society. They’re usually hidden, so we don’t think about them. But they also use an awful lot of energy. And that energy consumption is directly related to carbon emissions and global warming. The link is very clear.”

Electronically controlled pumps – known as “E-pumps” – offer a unique and superior prospect to save energy, cut large amounts of carbon emissions and improve pumping systems overall.

Danish consulting engineering company Rambøll declared that pumps will “play a major role in the sustainable society of the future.”⁴ With this paper, we want to show how Grundfos E-pumps with iSOLUTIONS can be part of that future in sustainable manufacturing and smart cities.



“The number of improvements that we can create from such a small change is pretty extreme,” says Scott Curran, maintenance team leader at William Grant & Sons’ Girvan Distillery in Scotland, after installing Grundfos E-pumps for boiler feed.

CASE: UK DISTILLERY

WHISKEY DISTILLERY USES E-PUMPS FOR BOILER FEED FOR MASSIVE SYSTEM IMPROVEMENTS

Commercial whisky production relies heavily on steam. William Grant & Sons’ Girvan Distillery in Scotland was having a problem with its steam quality. This was because plant operators had to control the levels manually. This wasted energy and affected the whiskey production negatively.⁵

The company replaced its fixed speed pumps on the boiler with Grundfos E-pumps automatically controlled the level in the steam boilers, going up and down in speed depending on demand. At the same time, digital E-pump functions reduced other complex system operations.

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Case at William Grant & Sons’ Girvan Distillery, Scotland

CASE: UK SOFT DRINK MANUFACTURER



UK soft drink manufacturer Britvic installed a Grundfos E-pumps booster system for water supply. System performance increased 70% while Britvic saved 45% on energy, with payback time under two years. “Not only have we seen an immediately improved water supply with stable and constant pressure, but we have also been able to monitor and trend the flows, enabling continuous improvements on our processes,” says engineer Calvin Winch of Britvic.⁶

FROM OLD TO INNOVATIVE PUMPING TECHNOLOGY

Electric motors consume about half of the world’s electricity,⁷ and pumps use around 20% of that.⁸ Therefore, pumps consume about 10% of the world’s electrical power. In Europe alone – the world’s third-largest electricity consumer behind China and USA – pumps consume 300 terawatt hours (TWh) per year – or the equivalent to 30 coal-fired plants.⁹

By improving efficiencies around pump systems – pumps, motors, drives, controls – we can reduce large amounts of energy consumption to help meet carbon emission targets. How is this possible?

Take an application like cooling or heating, in which the flow requirement changes depending on the demand. “Old solutions use valves to decrease the flow,” says Professor Anibal Traça de Almeida, Department of Electrical Engineering and Computers, University of Coimbra in Portugal.¹⁰

Thus, the pump is going at full throttle, but the operator can open valves to let out some of the liquid and pressure in the pipes, “slowing” down the flow. “But this does not save energy on a pump that is going at full power,” says Almeida. “To use a valve is as stupid as driving a car with one foot on the accelerator and controlling the speed with the brake. Nobody does that.”

Instead, the operator can use a variable speed drive (VSD) with the pump. This is also known as Variable Frequency Drive (VFD) or a frequency converter. These allow you to adjust the speed and flow of the pump to the requirements of the application, avoiding waste.

“If you decrease the flow in a pump to 80%, you only need roughly half the power.”

Professor Anibal Traça Almeida, Dept. of Electrical Engineering and Computers, University of Coimbra, Portugal.

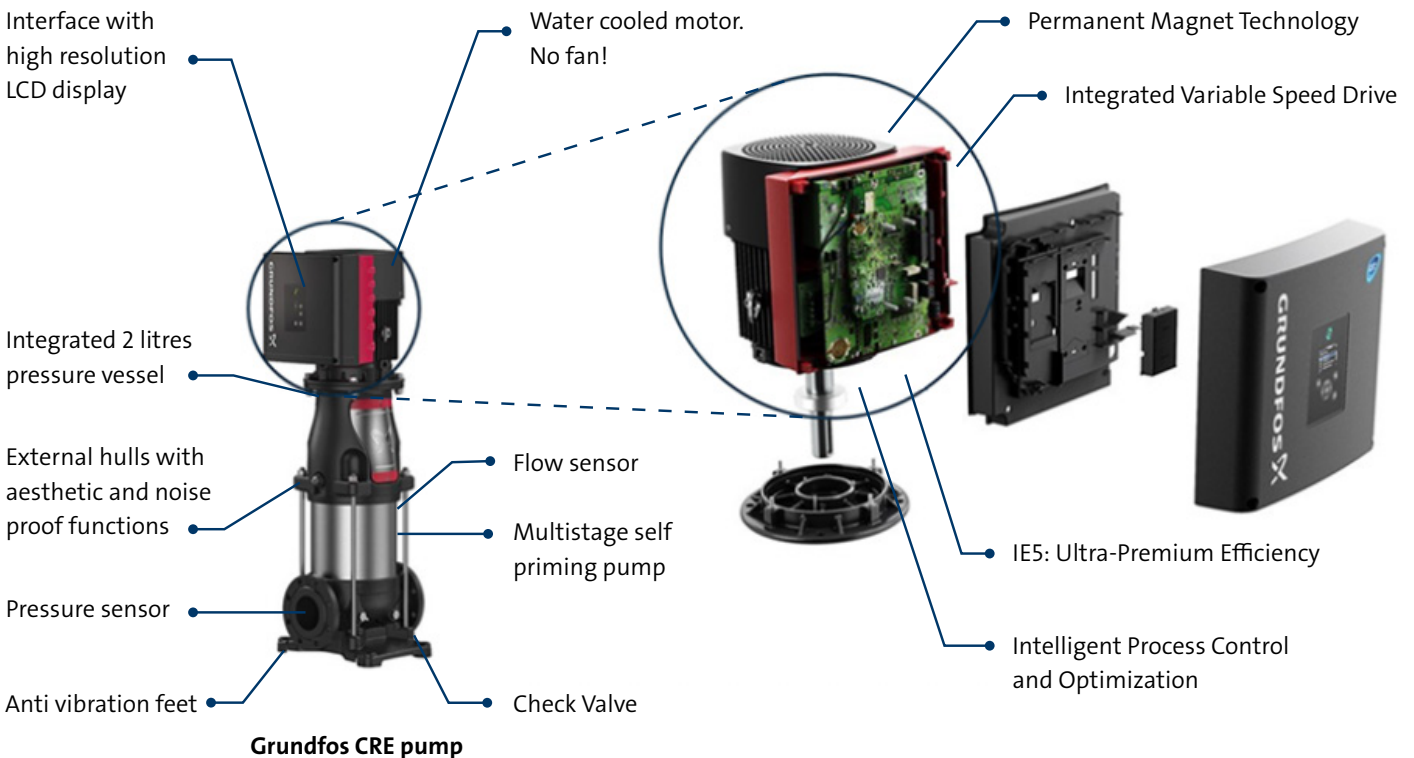
Electronic VSDs slow down or speed up automatically according to the application’s demand, producing energy and environmental savings in variable flow, pressure or temperature applications such as heating, cooling and water supply when compared with other conventional technologies.¹¹ Additionally, VSDs bring process improvement.

Grundfos E-pumps integrate the VSDs inside a Grundfos MGE pump motor, bringing built-in intelligence and premium efficiency. But Grundfos does not stop there as it also integrates other components like controller and sensors into Grundfos E-pumps.

“Our approach is not just making great pumps or motors or VSDs or sensors,” says Morten Gylling, Multistage Product Director in Grundfos. “We have competitors who can do good pumps, good motors, good VSDs. But

Grundfos is the only solutions provider that puts it all together into one unit.”

He says: “To become world class, you need a world class pump, a world class motor, a world class drive, world class sensing technology and world class algorithms to adapt to the specific application. That’s why we put our efforts into developing and mastering all these technologies and their ideal interactions.”



CASE: UK OEM FUEL POLISHING SYSTEMS



Richard Massara of WASP, an OEM producing fuel polishing systems in the UK, says Grundfos CME E-pumps use 75% less energy than the previous pumps the company used in its systems. "It's more than just a pump for us. We're running all of our sensors and feedback into this unit. Although we were aware of intelligent and variable speed pumps, we weren't aware of their capabilities."¹²

EU MOVING TOWARD PUMP SYSTEM EFFICIENCY LEGISLATION

The European Union is in fact updating its "Eco-Design" directive from 2009, which considers minimum efficiencies for the pumps alone. A proposed legislation will require minimum efficiencies of the combined system of pump, motor and VSD. This is called the Extended Product Approach.¹³

This approach focuses on optimising the energy consumption of the full pump unit in the actual flow system it is intended to operate, in this way only using the electrical energy necessary to operate at the desired flow.¹⁴

The potential energy savings by this approach are enormous, according to Europump, the European pump association. A Europump Eco-Design study found that if pumps were looked at in isolation to trim their electrical consumption, they would save 5

TWh in Europe by 2030. But with an Extended Product Approach, they would save between 35-43 TWh/year or more.¹⁵

THE DIGITAL LAYER

Grundfos E-pumps are part of the Grundfos iSOLUTIONS digital universe, combining intelligent pumps, cloud connectivity and digital services to create a full system approach. Together, E-pumps and iSOLUTIONS enable real-time monitoring, remote control, fault prediction and system optimisation.¹⁶

"When you move from a standard pump to an E-pump – and especially with an iSOLUTION from Grundfos – you unlock a lot of value," says Anupam Bhargava.

Grundfos iSOLUTION systems like Smart Filtration Suite, iRO (Intelligent Reverse Osmosis) or Condition Monitoring are fundamentally software-based to help

operate plants in a better, smarter way. But they need E-pumps to get the full benefits of these software solutions and advanced algorithms.

“If you are the head of a factory or the head of a business, you really want to know that your processes are operating in the most optimal manner,” he says. “That you are getting the uptime that you want, you are getting the efficiency that you want. You are using your resources as wisely as possible, whether it’s water, or chemicals or energy. Smart pumps – especially Grundfos E-pumps with iSOLUTIONS – enable that to happen. The savings and the waste avoidance are significant.

“In addition, the more intelligence that goes into governing a process, the more your people can actually focus on adding value in other places, as opposed to spending time monitoring what is happening in the pump,” he adds. “Is it operating efficiently? Is it optimising

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Anupam Bhargava, Sr. Vice President, Grundfos

my process? Well, the intelligence around that whole application has already been baked in. So you’re actually unlocking creative intellectual operational power to go do other things, so you add more value in your business.”

CASE: UNIVERSITY HOSPITAL BRUSSELS, BELGIUM



In 2012, the University Hospital Brussels, Belgium, planned to grow 40% over the next decade without letting energy consumption grow. It replaced 217 pumps with Grundfos E-pumps in its heating system, among other initiatives. Savings: more than 643,000 kWh per year, corresponding to about 65,000 euro and 140 tonnes of CO₂/year. “We will earn back all the money spent on pumps in four years,” says Energy Engineering Manager Jimmy Van Moer. “Some of the pumps consume up to 80% less than their predecessors.”

“E-pumps and motors are known to improve the efficiency of the entire system, but also help in reducing energy consumption, and helping us mitigate climate change,” says Grundfos Chief Technology Officer Markus Brandstetter. “This is what we push further to the benefit of our customers and end-users in reducing cost and CO₂ emissions. We at Grundfos are proud to pioneer in creating the digital products and solutions of the future.”

Grundfos estimates that the yearly avoided CO₂ emissions from E-pumps in 2020 alone was 270,000 tonnes.¹⁸

IE5 EFFICIENCY AND THE SYSTEM APPROACH

Grundfos E-pumps are rated IE5, or “Ultra-Premium Efficiency,” the highest efficiency under the International Efficiency (IE) standard rating system

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for motors. These IE codes serve as a reference for governments who specify the efficiency levels for their minimum energy performance standards for motors in their respective countries.¹⁹

While the market standards or requirements are at IE3 level, Grundfos offers superior efficiency with its IE5 motors, which in reality exceed the IE5 efficiency requirements by as much as 2%.²⁰

“Our aim is not just to obey legislation,” says Morten Gylling. “Our technology allows us to go above that. And that’s why we do it.”



CASE: UK ENGINE AND TURBINE MANUFACTURER

INDUSTRIAL COOLING: ACHIEVING 33% ANNUAL ENERGY SAVINGS

A leading UK engine and turbine manufacturer had been using 19 fixed speed pumps on full speed. The uncontrolled pumps were influencing the efficiency in other individual components in the cooling circulation system, exerting a major influence on overall system performance.

The company secured energy savings of 33% by replacing the existing pumps with 19 Grundfos E-pumps.²⁴ The E-pumps with integrated frequency converters ran under a constant pressure program, adjusting speed according to signals from the internal, digital pressure sensors. Grundfos iSOLUTIONS ensured that pump operations always matched system loads, resulting in maximum efficiency and minimum energy use. Pumps stopped automatically when they were not needed. The built-in controls and frequency converters increased system intelligence and flexibility, reducing life-cycle costs. Payback time: 1.8 years.



An NBE E-pump at the ARLA Foods Arinco dairy in Denmark

CONCLUSION

As Grundfos customer and end users attest, E-pumps offer superior value for their sustainability agenda. Grundfos E-pumps and the digital iSOLUTIONS combine energy-efficient pumps, motors, drives and controls into a system solution that adds more value, more efficiency, more energy savings and a lower carbon footprint.

“If I step into a senior executive’s role, I know I have good, capable people on my team,” Bhargava says. “But wouldn't I also want to benefit from best practices around the globe? When we as Grundfos take those best practices, take that application knowledge, create these iSOLUTIONS and deploy those iSOLUTIONS in an E-pump, we're not just helping a customer optimise. We're actually bringing industry best practices into the new solutions. So each business, each factory can actually benefit from what has been optimised from within the industry.”



A row of Grundfos CRE E-pumps for circulation of cooling water in a machine tool factory



Grundfos Senior Application Manager Michael Rasmussen at one of the new CRE pumps for the boiler feed level control at William Grant & Sons' Girvan Distillery in Scotland.

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Cover image: Alibek Karaulbekov, Lead Manager, Design Department, Astana EXPO 2017, Kazakhstan. He says the EXPO enjoyed 25% energy savings from the ultra-efficient Grundfos E-pumps in the heating, ventilation and cooling system. "We are entirely happy with Grundfos pumps. They require minimum attention. Their performance is clear to all the engineers who work at EXPO," he says.