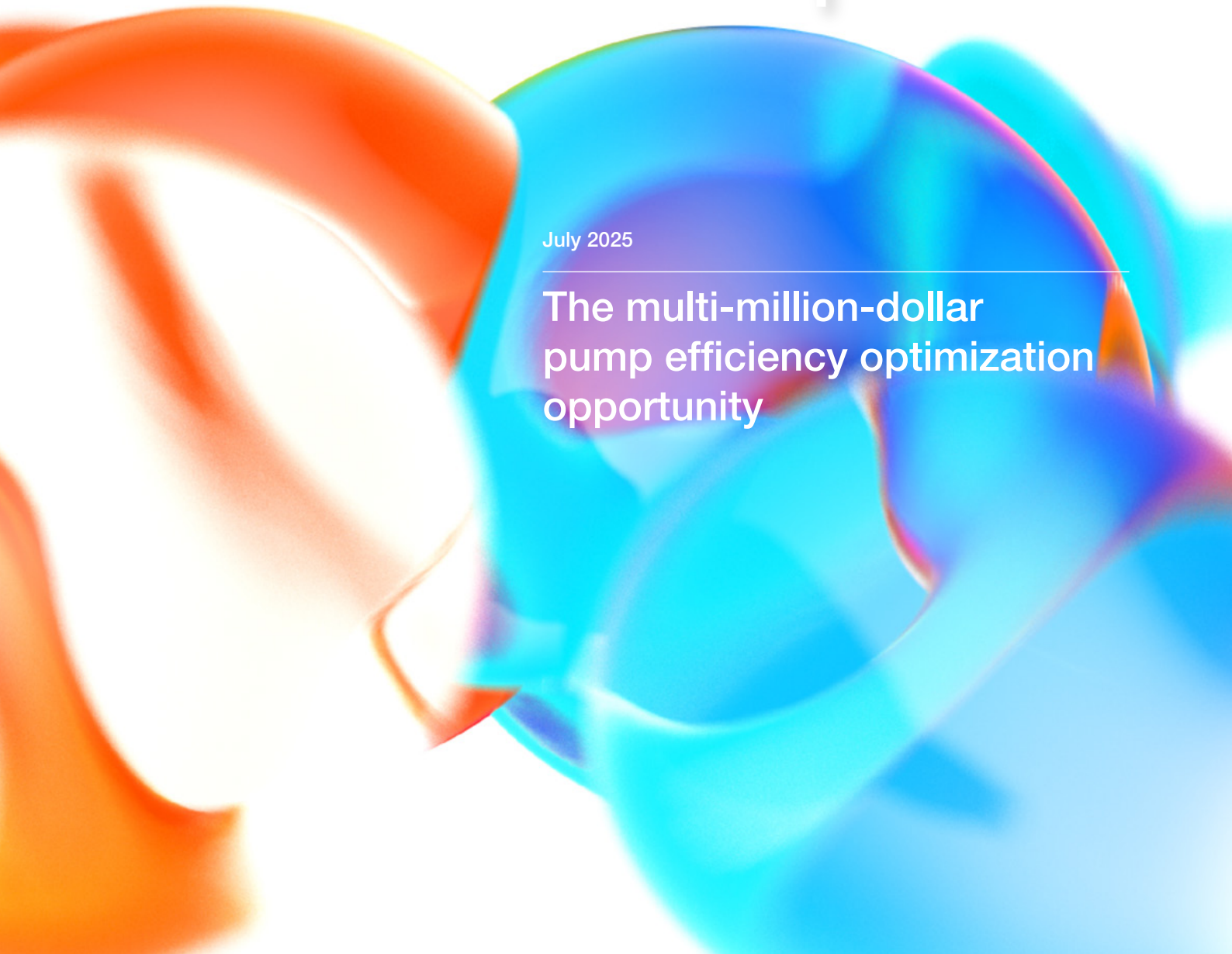
SULZER

White Paper



July 2025

The multi-million-dollar pump efficiency optimization opportunity

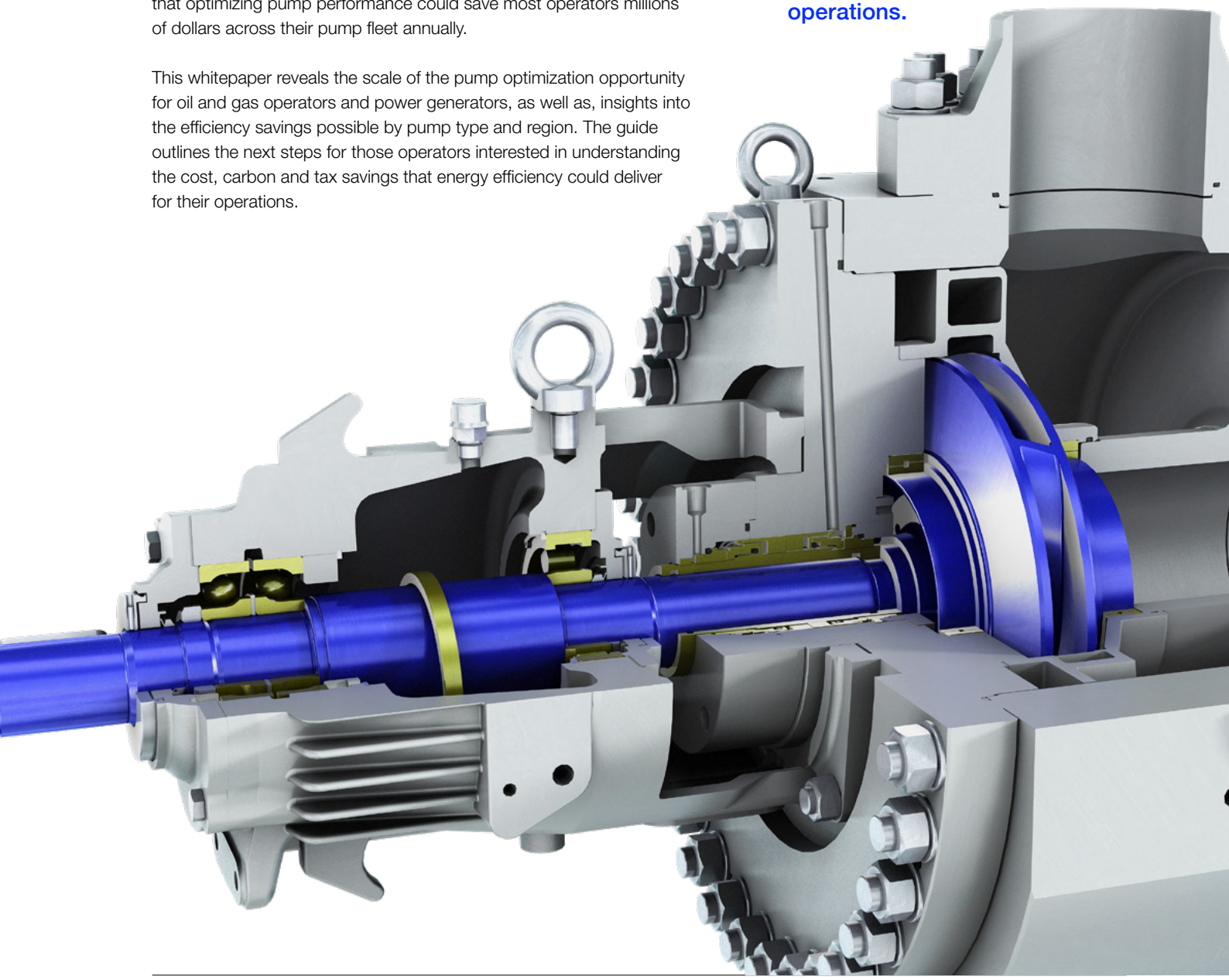
Executive summary

Rising energy costs have made energy efficiency a top priority for operators across the power and oil and gas industry. This whitepaper highlights the significant opportunity for cost savings through the optimization of pump operations – a piece of equipment that is widely installed, often goes unseen, yet is responsible for over 20 percent of global electricity demand. Sulzer's analysis of 464 pumps that is connected to their advanced analytics systems, BLUE BOX™ reveals that optimizing pump performance could save most operators millions of dollars across their pump fleet annually.

This whitepaper reveals the scale of the pump optimization opportunity for oil and gas operators and power generators, as well as, insights into the efficiency savings possible by pump type and region. The guide outlines the next steps for those operators interested in understanding the cost, carbon and tax savings that energy efficiency could deliver for their operations.

20%

of global electricity demand comes through pump operations.



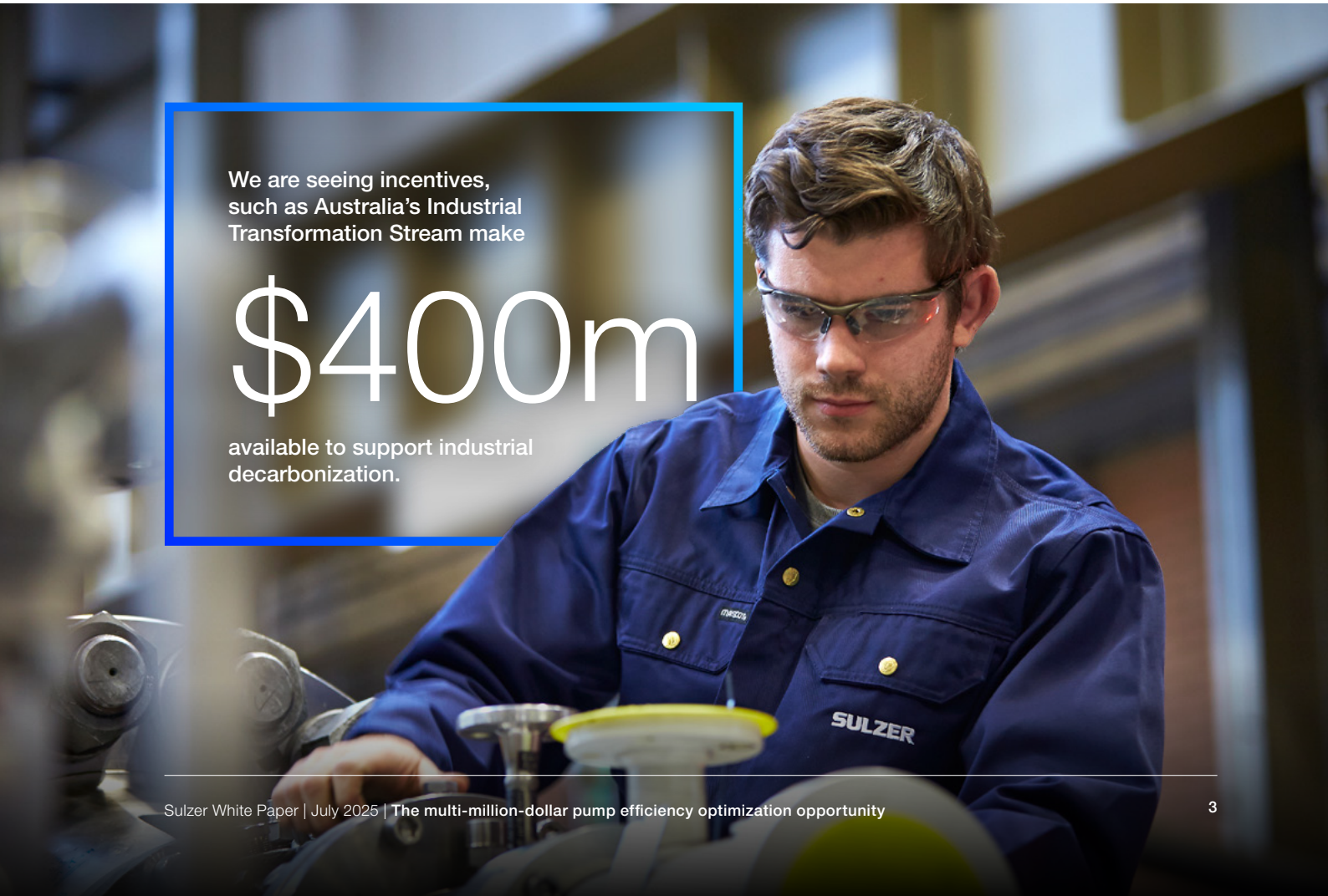
Introduction

Since 2022, industrial energy bills have increased significantly, with global events causing natural gas prices to reach record highs, impacting electricity prices. While global energy prices are now slowly declining according to **the Energy Commodity Price Index**, they remain higher today than at any time between 2015 and 2020.

This has led to strong growth in energy efficiency investment, with the IEA reporting an increase of **nearly 50 percent between 2019 and 2024**, as industrial energy users seek to improve affordability and energy security.

Interest and investment in energy efficiency is also being driven by its central role in achieving net zero and resulting government policies. At COP28 in 2023, 200 countries made a global pledge to double the rate of energy efficiency improvements before 2030, from 2 percent to 4 percent. As a result, governments representing more than 70 percent of the global energy demand **updated or created new efficiency policies** last year to meet this target.

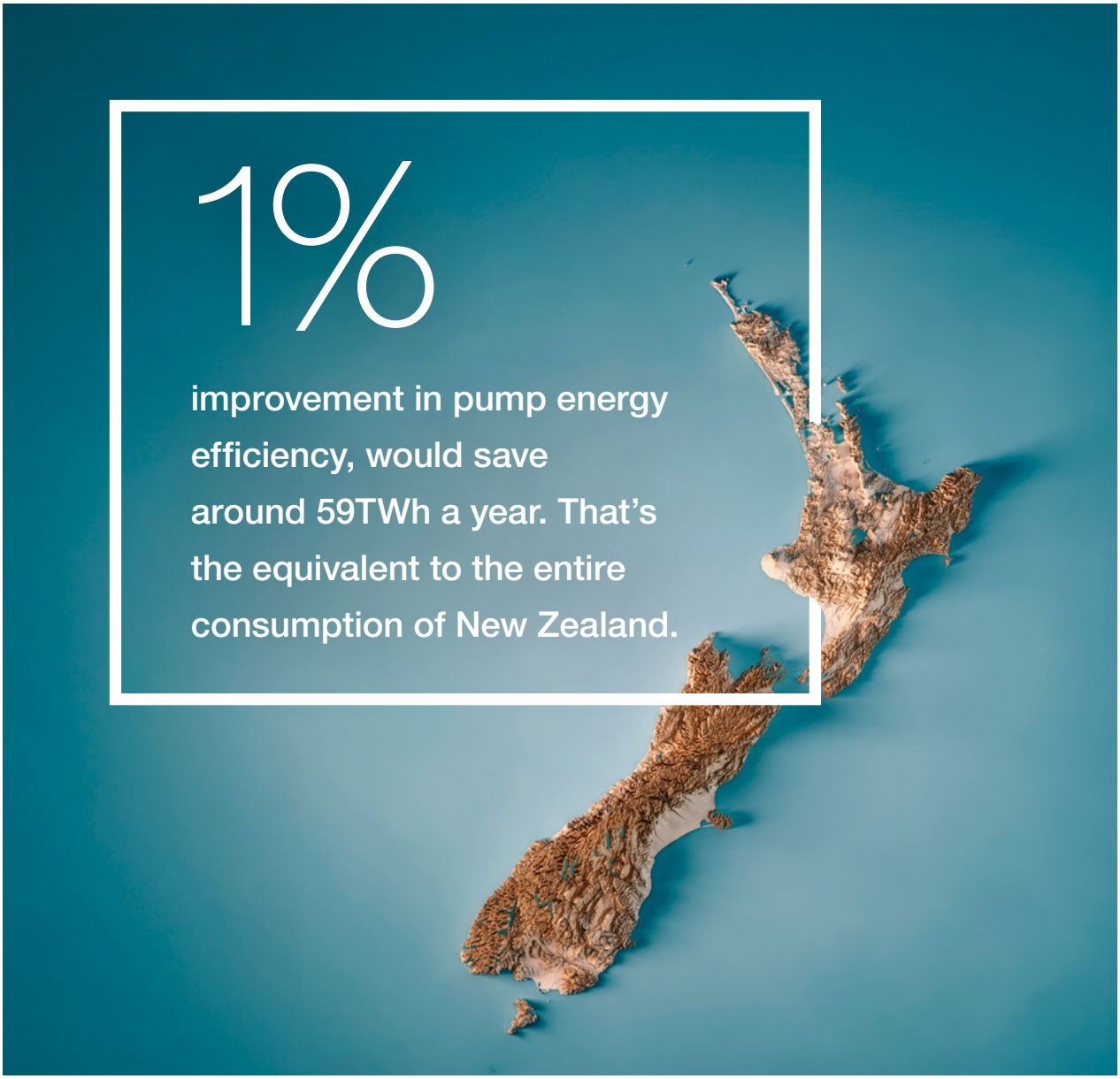
In February 2025, for example, the European Union introduced its Clean Industrial Deal which aims to turn decarbonization into a driver of growth. Using energy more efficiently is a key part of the action plan. This joins existing incentives such as Australia's Industrial Transformation Stream, which made $400 million available to support industrial decarbonization, including through energy efficiency. Meanwhile in South Africa, new legislation has been adopted requiring all new motors to have a minimum efficiency class of IE3 from 2025.



The hidden cost and carbon from pumps

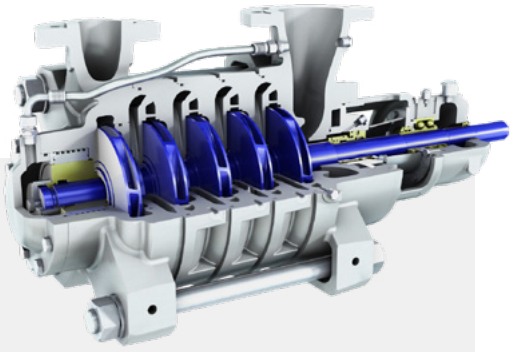
More than 20 percent of the world's electrical energy demand comes from pumps which makes them a substantial contributor to carbon emissions. In certain industrial plant operations, pumps can be responsible for up to 90 percent of the energy usage. However, as most pumps are small compared to turbines, heaters, coolers, compressors and boilers, they are often overlooked. The overall impact of a fleet of inefficient pumps on an operator's energy costs and carbon footprint can be substantial, but so too is the energy efficiency opportunity.

If all pumps were to achieve a 1 percent improvement in their energy efficiency, it would save around 59TWh a year – equivalent to the entire consumption of countries such as Singapore, Portugal and New Zealand. But in most instances, a much larger saving is possible. For example, retrofitting an old pump with a new, high-efficiency design typically reduces energy consumption by between 3 percent and 20 percent, and in some cases, by up to 50 percent.



Innovations in pump technology

There are several factors including technological advancements, changing process conditions and economic or contractual incentives that contribute to the large energy efficiency opportunity that is present for pumps.



1. Many operators have pumps that are 20 or more years old. While these pumps may continue to operate effectively, significant technological advancements across materials, manufacturing and digitalization mean older pumps are not as efficient as their new counterparts.

   The introduction of thermoplastics and composite materials such as PEEK, ceramic coatings and flame-spray technologies improve pump corrosion and erosion resistance and equipment durability. Laser metal deposition, additive manufacturing and multi-axis machining techniques have led to precision improvements in fabrication and more effective repair processes leading to improved pump performance and repairability. However, some pump operators remain conservative in their approach to applying innovation.

2. Improvements in computational fluid dynamics have allowed more accurate modelling of fluid behavior while design improvements and innovations continue to push performance limits. Data and digitalization can now offer real-time insights into pump performance, with operators able to monitor pumps across processes and locations to provide predictive analytics that can improve uptime and reliability while reducing costs.

3. Almost all operators will have experienced changing process and market conditions between when the pump was installed and the present day. Pipeline operators, for example, often face changing process conditions due to the variation in the fluids being pumped. Crude oil can change in viscosity, density and composition over time, and operators may also use additives to change its properties, moving the pump away from its original specification and reducing its efficiency. The increasing percentage of intermittent renewable power generation on the electricity grid has significant implications for traditional power plant operators. With higher levels of volatility, operators needed to become more flexible, requiring plant equipment to be adjusted to remain efficient.

4. The economic incentive for ensuring long-term efficiency has historically been low. In some cases, plants have been built on the ethos of minimizing upfront costs, rather than ensuring long-term operational efficiency. This may mean pumps are not optimized to their best efficiency point from the outset or do not feature the most efficient designs or technologies.

5. Similarly, where most plant operators are focused on uptime and revenue generation, longer-term energy efficiency upgrades can be overlooked in favor of quick fixes and repairs. This lack of focus on maintaining or improving efficiency of the lifecycle of equipment can lead to compromised equipment performance and poor energy efficiency. This may be particularly the case if maintenance is contracted out and there is no incentive to seek energy efficiency improvements.

6. There is a common misconception that energy efficiency investments have long payback periods, making them less appealing. **However, according to our research, a quarter of pumps could generate savings in the tens of thousands of dollars a year.** Some operators are also concerned about the impact of downtime to make energy efficiency upgrades, however, an experienced engineering partner will be capable of planning improvements to fit into scheduled downtime.

These factors suggest that most pumps have the potential to be optimized to some extent, however, very few studies have explored this. To investigate this potential further, Sulzer undertook a pump energy efficiency study.

Sulzer's pump energy efficiency study

In 2024, Sulzer randomly sampled the energy efficiency of 464 pumps using data collected by our advanced pump analytics solution BLUE BOX™ over 12 months. As an OEM-agnostic solution, BLUE BOX™ monitors pumps from several different designs of pumps from various OEMs.

The data collected included

- Pump type
- Location
- Industrial segment
- Pump application
- Percentage of time the pump was running in preferred, allowable, limited and restricted operating regions (POR, AOR, LOR and ROR)
- Percentage of the time the pump was stopped

From this data, we calculated potential cost savings by pump type, region and industrial segment. The cost calculation assumes that pumps can be operated at their BEP with some modifications to the pump or operation. The goal of the calculation is to reflect the potential improvements and the money and/or energy the users/operators are leaving on the table. While this is an oversimplification of what is possible, it provides an aspirational goal which we could achieve.

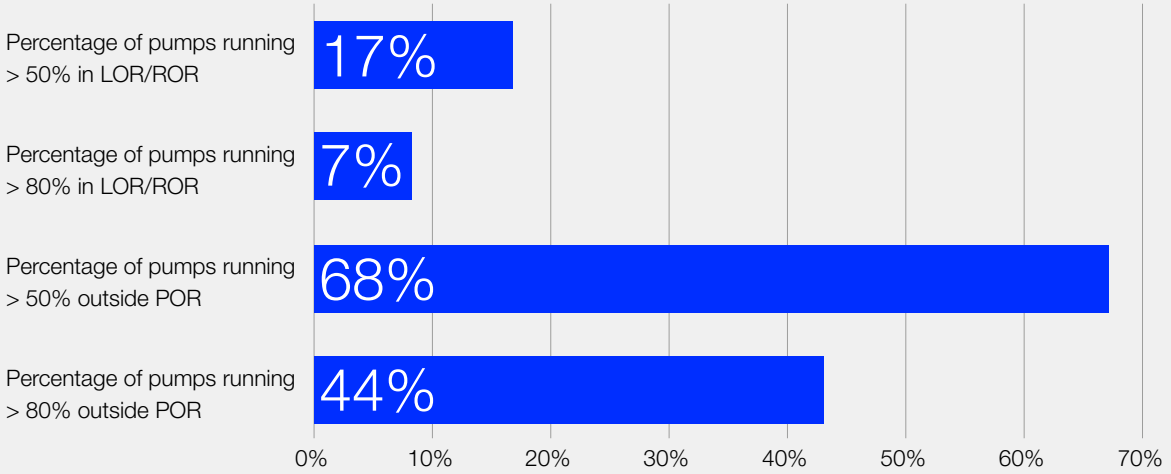
Study limitations

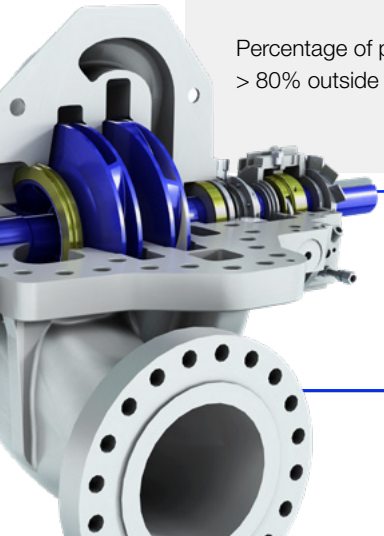
This analysis is useful in providing a preliminary assessment of the performance of pumps across oil and gas and power. However, as the sample size is relatively small, and problem pumps may be slightly overrepresented, the findings may not be fully representative.

Key findings

The analysis found that 68 percent of pumps were operated outside of the preferred operating region (POR) for more than 50 percent of the time, with 44 percent operating outside of the POR for more than 80 percent of the time. Over a sixth of pumps (17 percent) were operated in limited or restricted operating regions (LOR/ROR) for 50 percent of the time or more with 7 percent operating in this way for 80 percent of the time or more.

Percentage of time pumps spent in different operating regions



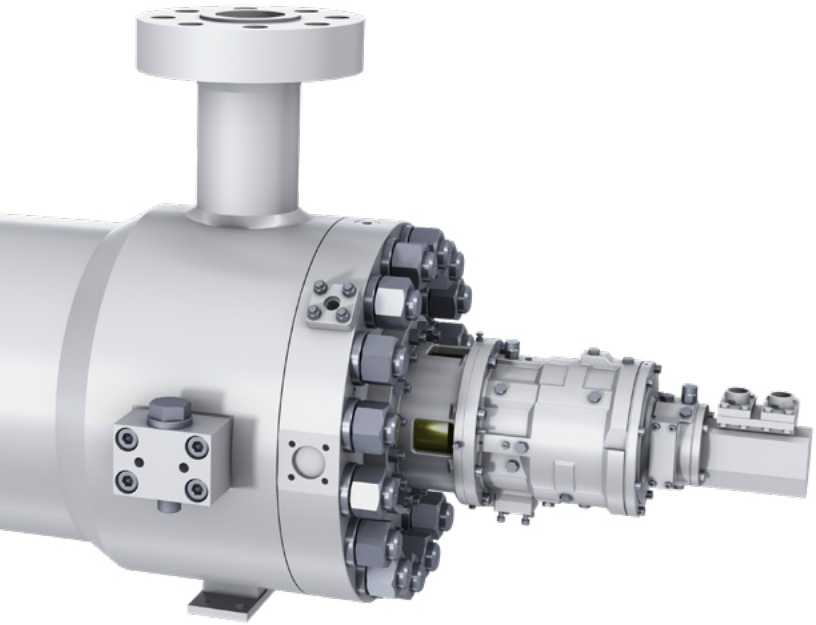


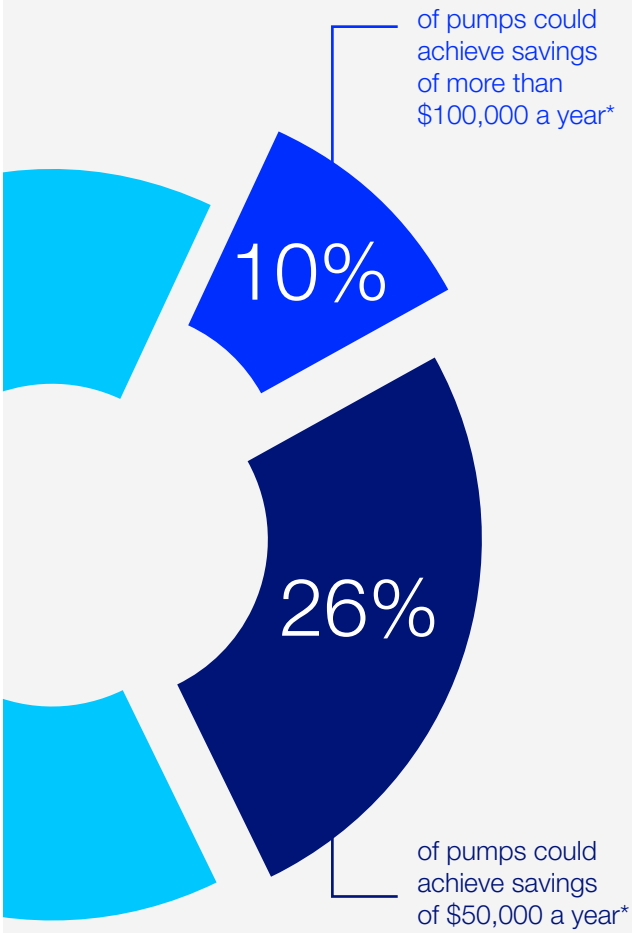
68% of pumps were operated outside of the preferred operating region for more than 50 percent of the time.

Based on conservative estimates, operators could save

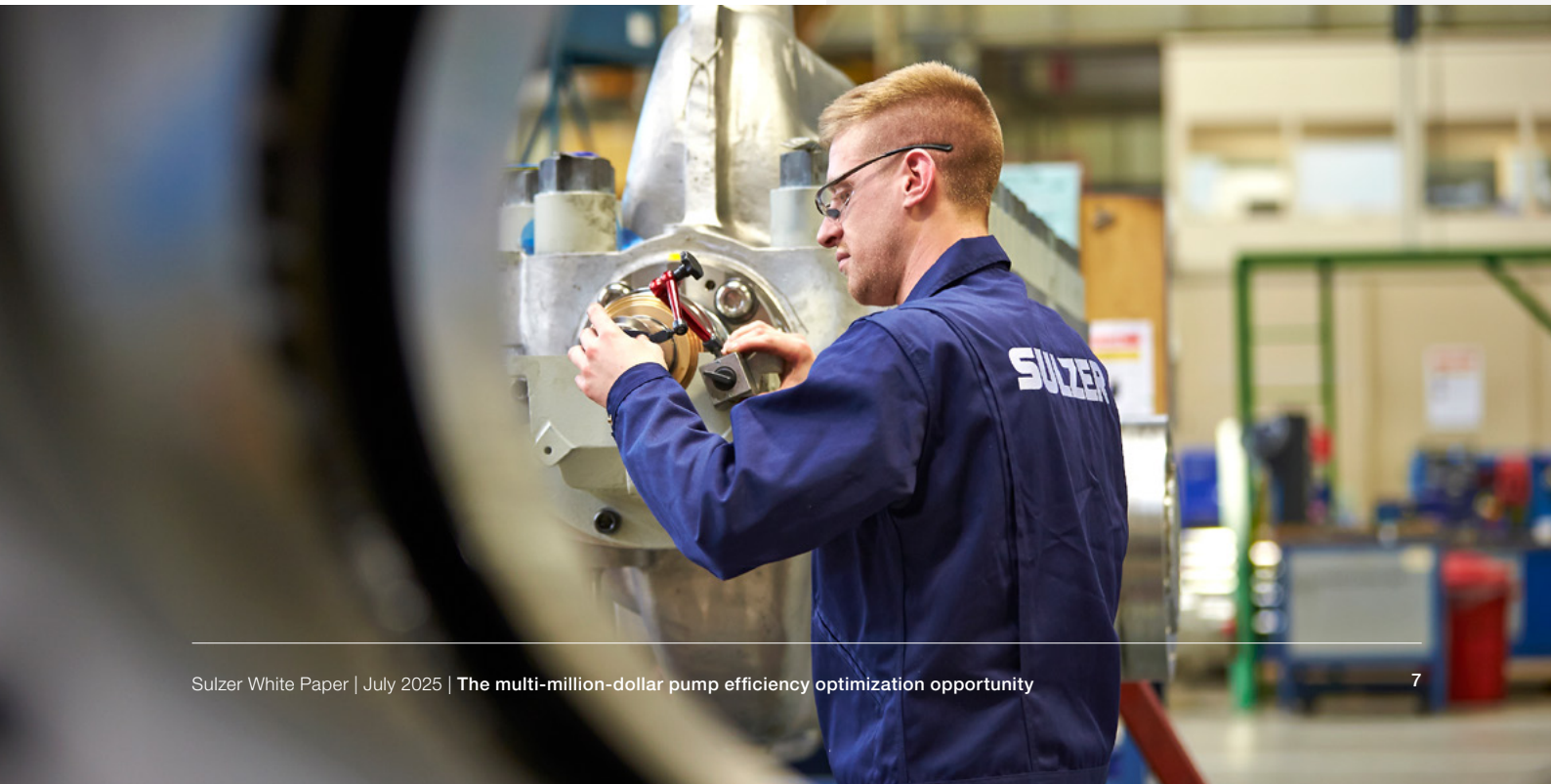
$28,000

a year per pump on average by undertaking energy efficiency measures that would bring the pump closer to its best efficiency point.





*potential outcomes vary by pump type, location and industrial segment.

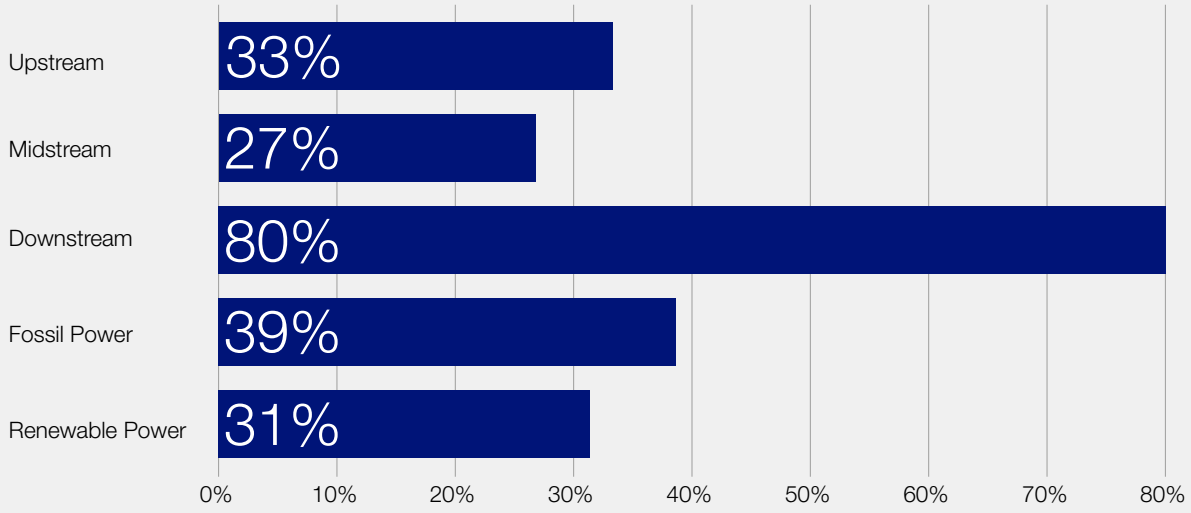


Pump savings opportunity by industrial segment

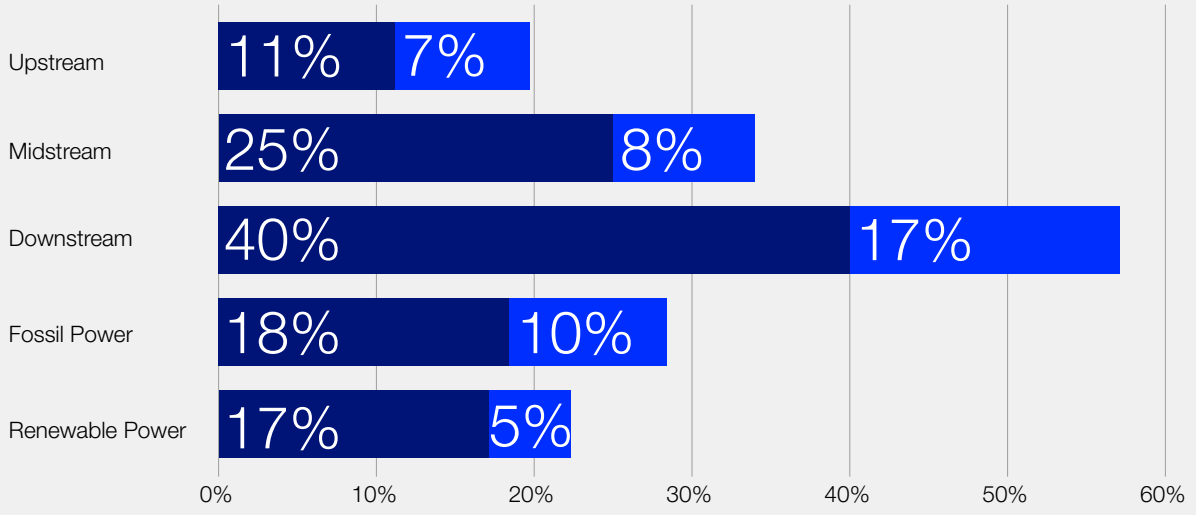
Midstream operators were found to have the most efficient pumps but also represented the biggest potential cost savings due to the types of pumps in use. Around a third of pumps in renewable power (such as those found in concentrating solar plants) and upstream facilities ran outside of the POR more than 80 percent of the time. Downstream operators were considered to have the least efficient pumps with 80 percent of pumps operating outside of the POR over 80 percent of the time.

Note: The downstream sample size was smaller than other segments and may not be reflective of broader industry trends.

Percentage of pumps running outside of POR for more than 80 percent of the time



Percentage of pumps with potential savings by industry

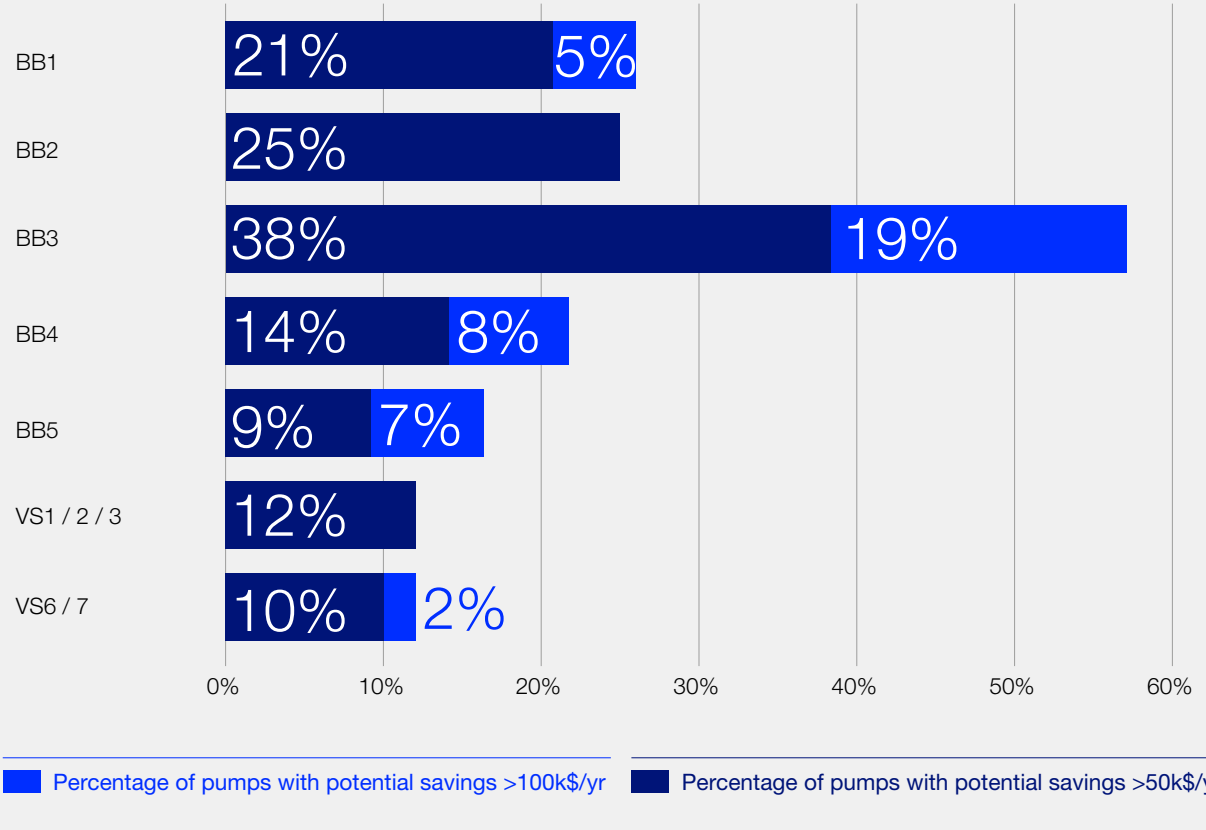


Pump savings opportunity by pump type

Despite being the unsung hero of many industries, the energy efficiency savings potential of smaller BB1, BB2 and BB3 pumps is too often overlooked in favor of larger pieces of equipment. However, across all pumps, BB1, BB2 and BB3 pumps were found to have the highest combined potential savings. 56 percent of BB3 pumps, 26 percent of BB1 pumps and 25 percent of BB2 pumps were estimated to have savings of $50,000 or more. Simpler in design, these pumps are typically more cost effective to upgrade, creating shorter payback periods.

Larger pumps were also found to have compelling savings potential. The study revealed that one in ten BB5 and VS6/7 pumps, along with 15 percent of BB4 pumps offer potential savings of $50,000 or more.

Potential savings by pump type



Four BB4 pumps at a biomass powered industrial site in Portugal could generate nearly $600,000 a year in energy savings and

459 tonnes

in carbon.

Thirty-eight BB1 pumps across a pipeline in the USA could generate over $1,500,000 a year in energy savings and

5,609 tonnes

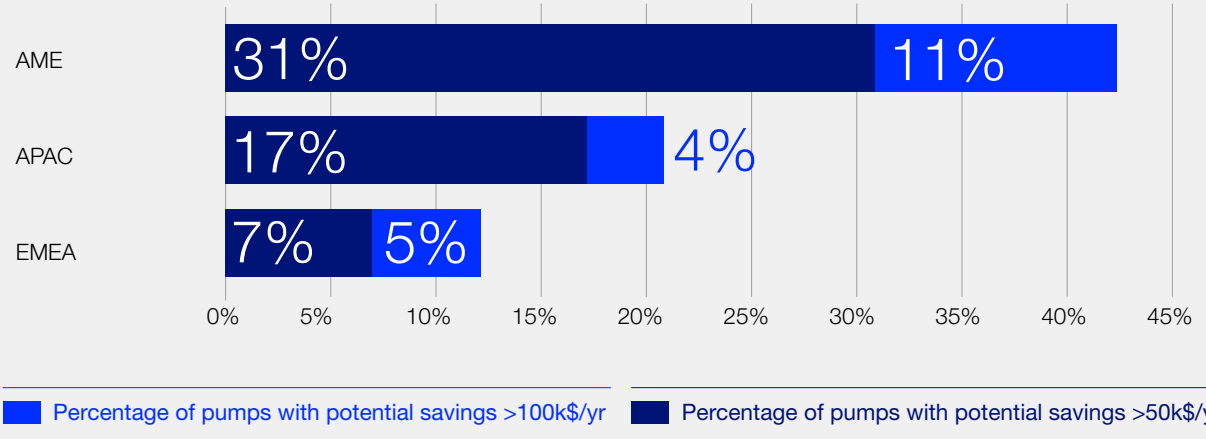
in carbon.

Pump savings opportunity by region

The highest potential pump savings were found in the Americas, where 42 percent of pumps were estimated to have potential savings of $50,000 or more a year, followed by 21 percent in Asia-Pacific and 12 percent in Europe, Middle East and Africa.

In the Americas, 12 percent were considered to have potential savings of $100,000 per year or more.

Potential savings by region



Midstream in focus

Pipeline operators could make some of the biggest savings among all pump users according to our data. On average, a pipeline operator could save $38,825 a year by improving the efficiency of their main line or booster oil line pumps.

However, there were several pumps within our analysis that could achieve savings of between $150,000 to $465,000. With a wide range of potential savings, operators should consider undertaking an energy efficiency audit to gain a holistic view of their pump operations. Pipeline operators are also particularly strong candidates for energy efficiency improvements due to changes in fluid viscosity, additives and evolving fuel types such as the blending of e-fuels to create more sustainable forms of aviation and maritime fuel.

As more fluid types and applications emerge, pipeline operators and pump manufacturers will need to continually adapt. For example, several countries including Japan, Australia, the USA, the UK, Denmark, Norway, Canada, the Netherlands, Belgium, and Germany are all pursuing projects to repurpose existing oil and gas infrastructure to support hydrogen transport and carbon capture and storage which will have implications for the efficient operation of pipelines.

The energy optimization journey

What is the Energy Optimization Service?

One of the main challenges faced by operators seeking to make energy efficiency improvements is knowing where to start.

Recognizing this, Sulzer launched the Energy Optimization Service to take the complexity and time out of making operational, environmental and financial performance improvements to pumps. Starting with an energy efficiency audit to highlight the largest potential cost, carbon and tax savings possible, the result is an end-to-end energy efficiency and carbon reduction solution that delivers improved pump efficiency regardless of OEM, with rapid ROI.

The Service brings a suite of services together to leverage the power of digital analysis, machine learning and ongoing monitoring with the hands-on experience of our problem solving and retrofit experts.

4 simple steps on the pathway towards success

Step 1: Audit

For a preview of what could be achieved, using single point snapshot data, our proprietary calculator PumpWise provides a preliminary assessment of the pump efficiency gains possible. Following this, we conduct a thorough audit with our advanced pump analytics tool BLUE BOX™ using detailed historic pump data to understand the current position of the plant's pump assets and the root cause of inefficiency.

Step 2: Proposal

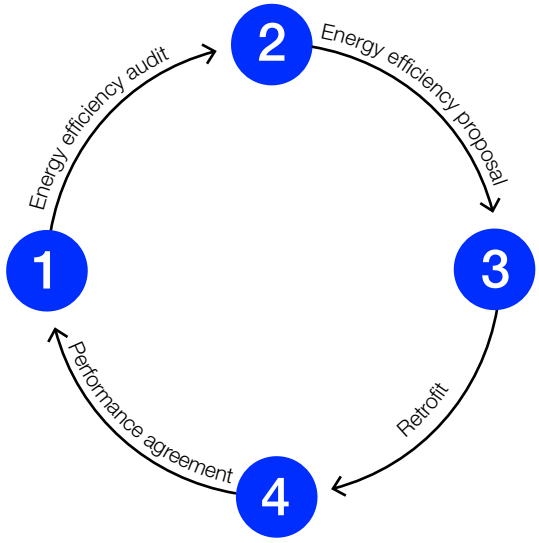
Our experts then produce a bespoke technical proposal to bring your pumps back to their best efficiency point (BEP). Accurate data and initial indications of potential energy and carbon savings support the origination of a tailored, best-in-class retrofit solution.

Step 3: Retrofit

Our seasoned retrofit experts work with your teams to implement your chosen proposal, from process improvements and new equipment to retrofits.

Step 4: Performance Agreement

Proactive asset support for continued uptime, energy efficiency & costs, through predictive maintenance all powered by our proprietary technology – BLUE BOX™. Receive dedicated support for field services, parts and more.



Input your pump data to uncover potential savings and take your energy efficiency assessment to the next level with our advanced audit tool. Monitor performance, leverage data for operational improvements, and unlock substantial energy savings. **Calculate savings today.**

Case study

An ambitious international oil company challenged Sulzer to reduce the energy consumption and emissions of four BB5 lean amine pumps. Once the audit was completed, a hydraulic upgrade was proposed with a new hydraulic bundle designed to fit within the existing barrel. This allowed for the existing end covers, barrel, bearings, seal and drive coupling to be retained to minimize costs and downtime. A combination of PEEK and SUME coated wear parts were also proposed to achieve tighter running clearances. The hydraulic bundle was manufactured in advance, enabling the upgrade to be performed as part of a planned overhaul.

As process conditions evolved over time – including lower pressure requirements due to well depletion, a second upgrade was commissioned. This involved de-staging from four to three impellers and reducing the number of pumps in operation to three. The result was a more efficient system that continued to meet performance needs with a lighter energy and emissions footprint. Site tests verified a more than 5 percent improvement in pump efficiency.

PROJECT KEY FACTS

INDUSTRY

Upstream oil and gas

LOCATION

Europe

SITE SAW ANNUAL SAVINGS OF:

€11.7m

IN OPERATING COSTS AND CARBON TAXES

63.7k MWh

IN ENERGY CONSUMPTION

20,138 tonnes

OF CARBON EMISSIONS

Case study

An LNG plant operator challenged Sulzer to bring its aging boiler feed pumps back to their best efficiency point. On reviewing the LNG plant's nine boiler feed pumps, six were found to have leakages of around 25m^3 / hour, equating to 10 percent losses.

As the lead time for OEM replacement parts was long, Sulzer proposed to use 3D laser scanning technology to produce its own engineering models to manufacture from. Sulzer manufactured the parts using the latest techniques, reducing the lead time by several weeks compared to traditional casting. The drive coupling design was also updated, and the gear coupling and membrane coupling were updated to improve performance and to ease maintenance. Site tests verified a more than 5 percent improvement in energy efficiency.

PROJECT KEY FACTS

INDUSTRY

Midstream oil and gas

LOCATION

SE Asia

SITE SAW ANNUAL SAVINGS OF:

$560,000

IN ENERGY COSTS

172 tonnes

OF CARBON EMISSIONS

< 3 years

PAYBACK PERIOD

Why choose us?

High energy costs have many operators evaluating the energy efficiency of their operations. While it is common for operators to focus on large pieces of equipment, there is a significant cost saving opportunity associated with improving the energy efficiency of pump equipment.

In some cases, this opportunity could represent millions of dollars a year across an operator's fleet of pumps with some individual pumps having the potential to generate hundreds of thousands of dollars in savings. As each operator's circumstances are unique, pump performance analysis is vital for quantifying the opportunity within each plant.

Sulzer's Energy Optimization Service offers operators across all industries a simple step-by-step process to audit their pump fleet to uncover efficiency opportunities and act upon them. Backed by its deep pump lifecycle expertise, Sulzer offers a range of retrofit options to bring pumps back to their best efficiency point. Through a performance agreement, operators can be confident in the improvements to deliver the cost and carbon savings forecasted.

Engineering heritage

Leverages 190+ years of pump engineering expertise and experience.

Track record

Over 5,000 global pump retrofits, upgrades and modifications across 20+ OEM brands.

Industry expertise

In complex industrial pump applications engineered by industry specialists.

Customer centricity

No 'one size fits all' solution, but only the right solution and approach that matches all your needs.

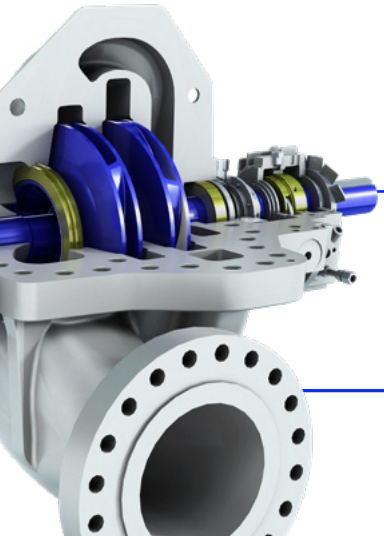
Flexibility

We adapt to your needs, whether it is schedule, technical requirements, supply chain, geography and more.

Global experience, local support

More than 130 service centers and 1,000 experts across all continents, offering support to clients in the most remote places on earth.

Get in touch today for more information.



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This opportunity could represent millions of dollars of savings per year across an operator's fleet of pumps.

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Sulzer | Services

Life-cycle solutions for a sustainable world.

We are your partner for uptime and enhanced performance for your rotating equipment and more. Our dedicated people provide unrivalled service and expertise to meet your operational needs – anytime, anywhere.

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