Improve the environmental footprint with retrofit solutions

Fit for the future

Reducing a company's annual energy consumption by a fifth is more than impressive—but perfectly feasible with retrofit solutions. The retrofit team of Sulzer Pumps optimizes and upgrades pump systems and rotating equipment and improves their performance—with outstanding results—as the following examples show. Making the equipment fit not only reduces energy and maintenance costs but also contributes to a greener future.

Increasingly, in many countries around the world, the environmental impact of products and industrial processes is becoming a major topic. Currently, many possibilities are being discussed to reduce the environmental impact of state-of-the-art technology and the emission of greenhouse gases. Power generation from regenerative sources and low-carbon emission vehicles are two examples that get broad attention in the public discussion.

In the search for new technologies, companies often overlook the fact that upgrading pump systems offers a major opportunity to reduce the demand for electrical energy. According to studies by the manufacturer's association Europump, pumping systems use nearly 20% of the world's electrical energy. In certain industrial

Siberia has large resources of oil. The picture shows oil pumps in Western Siberia, where around 60% of Russia's crude oil is produced. Water injection pumps are used to increase oil well pressure.

plants, pumps account for 25–50% of the energy usage.

Thus, optimizing the energy use of these pumps significantly contributes to environmental protection. A retrofit reduces the environmental footprint of the pumping system as energy efficiency is increased. In addition, the modification of existing devices requires fewer resources than the construction of completely new machines.

Customers benefit from retrofits in many ways

Over time, the performance of pumping equipment declines due to wear. Sulzer Pumps provides customers with eco-friendly solutions that restore or enhance the performance and capacities of aging systems. Retrofitting the equipment makes it possible to improve hydraulics, augment mechanics, and fit for new duties.

As a result of improved performance and efficiency, customers benefit from:

- Lower investment cost
- Reduced maintenance costs
- Lower CO_2 emissions and energy usage

By improving the ecological footprint of existing systems, retrofit solutions contribute to a greener future.

Find more information about product lifecycle management in the sustainability video of Sulzer
www.sulzer.com/lifecycle

Successful retrofit of water injection pumps

Lukoil Western Siberia is the largest unit of the Russian oil company Lukoil. This production facility in Siberia had commissioned third-party water injection pumps and had upgraded them with Sulzer Pumps technology in order to maintain oil well pressure. During the process of oil production, these pumps inject water back into the reservoir to increase pressure and thereby stimulate production. The injected water increases the pressure in the reservoir, and it displaces oil from the reservoir, pushing it towards the well. Water injection increases the percentage of oil that can be extracted from a reservoir and keeps the well flowing longer.

Optimizing the energy use of pump systems significantly contributes to environmental protection.

The 46 water injection pumps at this facility needed an upgrade. They had been produced in the mid 1980s and had an average power rating of about 1300 kW. Sulzer Pumps performed an engineered retrofit that included a change of the casing. The new casing is based on that of the well-established Sulzer MD pump range. These are high-pressure stage-casing pumps with a modular design that allows changes in the number of pump stages according to the specific client requirements 1, 2).

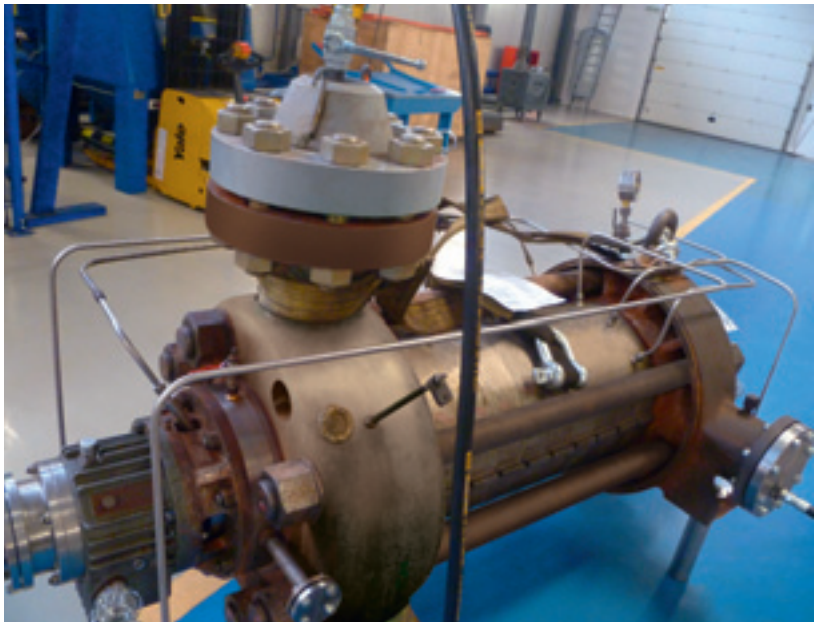
The retrofitted pumps now have 11 to 15 stages depending on the final pressure they have to deliver. With this specific adaption of the pumps to the actual process conditions, the engineers of Sulzer Pumps were able to realize energy savings of 95 000 000 kWh annually, which is a savings of about 18%. These savings are equivalent to a CO_2 reduction of 30 000 tons per year, assuming a carbon footprint of 0.316 kg/kWh.

Extending reliability and service life

The positive ecological impact of retrofitting is combined with significant economic benefits. The retrofit at the Russian oil company led to a substantial annual reduction of power consumption and operating costs, which translated into a return on investment of less than two years. The overall cost of running pumps throughout their operational life is several times higher than the initial capital expense for new machines. As the costs for a retrofit are lower than those for a new pump, upgrading the hydraulic design with an engineered retrofit reduces overall cost of ownership even more based on a cost/effect consideration.

In addition to the increased efficiency, the Russian client also benefits from improved reliability of the pumps. As a result of the mechanical upgrade, the mean time between repairs (MTBR) increased from one to at least three and up to six years.

1 The modular design of the retrofitted pumps allows the number of pump stages to be adapted to the actual process conditions.



The best choice for existing systems

Existing systems provide a great potential to reduce the environmental impact and the overall energy demand of pumps. The number of pumping systems in operation is at least 20 times higher than the number of systems that are built each year. Usually, pumps in oil and gas, hydrocarbon processing, power, and pulp and paper industries as well as in many other markets operate as part of a complex system. If the system is properly designed, the pumps, the design of the installation, and the method of operation are balanced. Normal degradation of pump performance over years of operation or a change in system requirements may disturb this balance and may lead to the need to repair or retrofit the pump. Additionally, in many of the existing systems, pumping tasks and operational requirements have changed over time, whereas the pumps, motors, or controls have not been modified. Considering the goal of achieving the lowest operational and maintenance costs and of extending equipment life and reliability, just repairing the pump performance at the end of the operational life cycle to a new condition may often not be the best choice.

Repair or retrofit?

Sometimes a significant degradation of performance forces the pump operator to take immediate action. In such a case, the client has to decide between repair (i.e., reproducing the original state of the machines) and retrofit. The following example shows that a retrofit makes it possible to target the root cause of damage, thus leading to higher reliability and reduced maintenance costs.

A retrofit makes it possible to target the root cause of pump damages.

The 655 MW gas-fired power station in the Indian state of Gujarat was commissioned in the 1990s. This power plant is equipped with three units, in which six boiler feed pumps are installed. Three pumps are working continuously and the other three are in standby. The pumps were supplied around 1991 and were put into commercial operation from 1996 onwards. Over the years, the efficiency of the boiler feed pumps dropped due to wear and erosion. This decline in performance led to a significant monthly loss.

Analyzing the causes

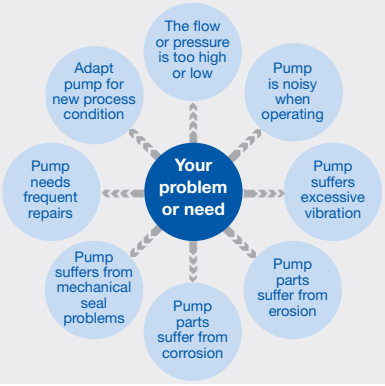
An inspection at the Indian power station revealed inter-stage erosion and metal-to-metal sealing-face erosion in all pumps. The seals of the stage casing were metal-to-metal seals. The stage casing and upstream diffuser device were made of cast carbon steel, which could not sustain the eroding forces during operation. Through exposure to pressure and temperature, hairline marks developed. Due to continuous operation and liquid flow at high velocity, these grew into large-sized holes. This damage at

2 After the retrofit of the water injection pumps, energy consumption was decreased by 95 000 000 kWh annually, which is equal to a CO_2 reduction of 30 000 tons per year.

Retrofit Solution Finder

In making a decision about the exact scope and target of a pump retrofit, a company has to consider a variety of boundary conditions. Sulzer Pumps simplifies the first steps on the way to a tailor-made solution. On its homepage, the company offers an online tool that allows customers to identify retrofit solutions that meet their operational requirements:

www.sulzer.com/retrofit-solution-finder



the seals caused internal leakage from the stage casing to the barrel and within the stage casing. By contrast, the other parts of the pump, e.g., impeller, diffuser, shaft, which were made from 11–13 chromium steel, were in excellent condition.

Using improved material

The engineers of Sulzer Pumps offered a retrofit solution that included replacing the stage casings with ones made from chromium steel. This option restored the original efficiency and extended the operational life of the pumps at a cost lower than that of the replacement of a new cartridge.

The improved cartridge delivered outstanding results. Sulzer's engineers succeeded in boosting the efficiency and in increasing the reliability of the boiler feed pumps 3. Reliability is essential for this performance-critical equipment, as a failure of the boiler feed pumps in a power station would disrupt the process of power generation. The retrofit solution convinced the client, who placed the first order for a complete cartridge in 2010. Following the strong performance of the retrofitted pumps, the customer subsequently placed an order for one additional cartridge to be upgraded to chromium steel in 2011.

3 The Sulzer facility in Navi Mumbai, India, is fully equipped to repair and upgrade all types of centrifugal pumps.

Competitive and future-proof option

Sulzer Pumps has broad experience in retrofitting, or upgrading, existing pumps. Its engineers can perform retrofit upgrades on any piece of equipment regardless of age or original manufacturer. In many cases, retrofit is a competitive solution allowing existing machines to be adapted to evolving needs. With concerns about the environment rising and with legislation aimed at reducing greenhouse gas emissions and energy consumption, the use of premium-efficiency pumps becomes crucial. Sulzer Pumps' retrofit solutions help customers ensure performance and efficiency while supporting the environment for a greener future.

The improved cartridge of the pump delivered outstanding results.

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