Efficient and resourcesaving solutions for wastewater treatment

AERZEN
EXPECT PERFORMANCE

Contents

Optimise aeration
Energy efficiency in wastewater treatment plants

How efficient is your wastewater treatment plant really? Are there untapped savings potentials? Many wastewater treatment plants consume a lot of energy and bind unnecessary resources due to outdated or oversized machine technologies for aeration of the aeration tanks. With a coherent overall concept you can save considerably.

Wastewater treatment plants and environmental protection

Urbanisation and climate change are central and hot topics, which also bring industrial and municipal wastewater treatment plants into the focus of public attention due to their high energy consumption. Operators of wastewater treatment plants are therefore faced with a number of challenges. Environmental regulations are becoming stricter and energy costs are rising. This is no coincidence, as global electricity consumption has tripled since 1980. Water resources are also dwindling worldwide. Resource-efficient treatment is therefore becoming increasingly important. Reason enough to increase the efficiency of wastewater treatment plants and thus save energy and resources in the long term. But how?

Use potentials with AERZEN

We are happy to assist you with this task. You are wondering, which set screws you can turn, to make your wastewater treatment plant more efficient. AERZEN finds the answer, develops an individual concept and accompanies you throughout the entire project. In addition, we remain available at all times as your contact partner and for maintenance and inspection of your machines.

In the search for savings potential, the first glance is always focused on process air generation. This is because the biological treatment stage alone accounts for 60 to 80% of the total energy requirement of the wastewater treatment plant. But AERZEN looks at the plant holistically and finds further optimisation opportunities. For example, machine room optimisations, intelligent control of the individual system components or the optimum use of waste heat.

Costs and Savings

Every modernisation first generates costs before it pays for itself. Especially for new aeration concepts, high investment sums are quickly required, but this usually pays off within less than 2 years by significantly increasing the economic efficiency of the plant. The replacement of existing machines by modern, efficient blowers and compressors can reduce the energy requirements of a wastewater treatment plant by up to 55%. When working with AERZEN you also avoid wrong planning and misinvestments, because a holistic view and planning according to valid standards avoids unexpected costs.

- How can energy costs be saved in wastewater treatment?
- What are the options for designing new plants?
- How can load profiles be determined and optimally operated?

On the following pages we would like to provide you with our answers to these and other questions.

LET'S TALK

"... about **resource-saving** and **efficient** aeration of your aeration tanks."

AERwater
Your way to maximum efficiency of resources

Get to know AERwater, our holistic approach for the activation process of the future. The target: to operate your wastewater treatment plant as energy-efficient, resource-saving and future-oriented as possible. All components prove themselves in any configuration, but of course also as individual services. Count on a saving potential of 55% and more!

Your advantages

- Recognise savings potential
- Calculation of profitability and investment security
- Individual and customised efficiency solution based on actual load profiles
- Plant safety and comprehensive know-how
- Reduce investment costs, improve financing and amortisation
- Networking and data analysis
- Sustainable efficiency, availability and data transparency

AERaudit
Volume flow measurement to determine the actual load profiles, analysis and reporting

Performance³ solution
Tailor-made machine and technology design with an individual mix consisting of Delta Blower, Delta Hybrid and Aerzen Turbo

Machine room optimisation
Support for room ventilation and sound concepts, as well as heat recovery

Financing
Support and cooperation with external partners for state subsidies of up to 90%

Implementation
Support with dismantling, commissioning and rental machines

AERsmart
Overriding machine control for up to 12 blowers, efficient control of different technologies

Service 4.0
Spare parts and service management as well as digital services AERprogress for sustainable increase of availability and efficiency

AERaudit
Make saving potentials visible

The load operation of wastewater treatment plants is subject to severe fluctuations. Binding operating data of a blower station form the basis for finding potential savings. With AERaudit, AERZEN offers a service which leads to an economic, tailor-made and future-oriented plant configuration.

Work more energy efficiently, remain competitive

Wastewater treatment plants are usually the largest energy consumers in municipalities. As municipalities have to be conscious in their use of public funds, it is particularly important for them to exploit savings potential. But also for industrial wastewater treatment plants, the reduction of energy costs is an important element of competitiveness. The biological treatment stage accounts for 60 to 80% of the total energy demand of a wastewater treatment plant. If you want to save money, this is where you start. The basis for a process- and energy-efficient wastewater treatment plant is the analysis of the existing situation and the evaluation of the current operating data.
As a member of the network German Water Partnership, AERZEN is focused on a sustainable and competitive water management. AERaudit is an innovative service, developed exclusively by AERZEN, to improve the energy efficiency of wastewater treatment plants.

3 blower technologies, one goal: maximum efficiency

High efficiency values are often achieved with a combination of positive displacement blower Delta Blower, rotary lobe compressor Delta Hybrid and turbo blower Aerzen Turbo. In some cases, however, the use of only one blower technology can lead to the desired goal. By means of the Performance^3 concept AERZEN configures the different blower technologies to the individual requirements of your plant, while AERaudit provides the necessary transparency. With this combination and paired with an aeration system adapted to the blowers or compressors, you can save up to 55% energy.

In 3 steps to economical plant configuration

1. On-site measurement

The AERZEN service team brings transparency to the key figures of your blower station. With a mobile measuring station, all relevant data of your process air generation and load curves are recorded: volume flow, system pressure, temperature and rating. This is done over a longer period of time, in order to take different load profiles into account.

2. Analysis

The recorded data are carefully and extensively evaluated and each low and peak load is assessed. Based on the results, AERZEN develops tailor-made concepts which are as efficient as possible for you.

3. Report

All data of your blower station are displayed in detail and transparently. We will also show you your Performance^3 solution, i.e. the optimised adaptation of the blower capacity to individual load fluctuations with the optimum machine configuration. This illustrates how great the potential for saving energy or CO_2 is and what amortisation times can be achieved.

Savings potential

Benefit from energy saving potentials of 55% on average and amortisation times of less than two years.

Thanks to AERaudit, you can achieve 55% savings in three steps with an amortisation time of less than 2 years.

Performance³
For a new level of efficiency

The energy consumption of the various process steps during wastewater treatment offers the potential for significant cost savings for wastewater treatment plants. With Performance³ AERZEN reacts to the different load profiles with efficient and individually tailored blower solutions.

The energy-intensive activation in the wastewater treatment tank

The aeration of wastewater treatment tanks is energy-intensive, above all because it has to cope with the constant fluctuations in the load profile at all times. Depending on the region, time of day and amount of precipitation, different degrees of pollution and strong fluctuations occur within the load profiles. For each constellation of environmental factors, the air requirement in the aeration tank changes.
Up to now, mainly blowers of one size have been and still are used. However, blowers of one size do not meet the constantly fluctuating demand profile, as they rarely run at the optimum operating point and thus consume unnecessarily much energy. The solution lies in a mix of one, two or all technologies or even different sizes, which interlock seamlessly and are operated optimally at their respective efficiency levels.

Optimal use of savings potential - the mix makes the difference

Perfomance³ reacts to the fluctuations in the load profile of a wastewater treatment plant with a combination of three different blower technologies. The concept is based on the positive displacement blower Delta Blower, the rotary lobe compressor Delta Hybrid and the turbo blower Aerzen Turbo. The strengths of each type of blower compensate for the physical limitations of the other technologies. In combination, it's the perfect way to react to load fluctuations. How the exact realisation on a system looks like always depends on the required daily characteristic curve. The turbo blower thus offers optimum energy efficiency at the design point. There, the efficiency of the turbo blower is significantly higher than of a positive displacement blower or screw blower. The air foil bearing of the turbo blower has many advantages, for example, it is up to 100% maintenance-free, proves a theoretical service life of more than 80,000 operating hours, independent of start and stop cycles, and is absolutely reliable during pressure peaks. However, the control range of turbo machines is limited to 40 to 100% and efficiency decreases in partial load operation.
This in turn is the strength of positive displacement blowers, which are characterised by a controllability of 25 to 100% and an almost constant efficiency, even in partial load operation. This is where the Delta Hybrid comes in, combining the advantages of blower and compressor technologies. With its low-pressure screw profile, it can respond more efficiently to fluctuations in flow and pressure. The rotary lobe compressor or screw blower has an adjustable capacity of 20-100% referred to the special process requirements in the clarification tank and, compared to conventional compressors, offers energy savings of up to 37 per cent. The positive displacement blower is characterised above all by its robust, easy to maintain and cost-effective design.

The overall concept from one source

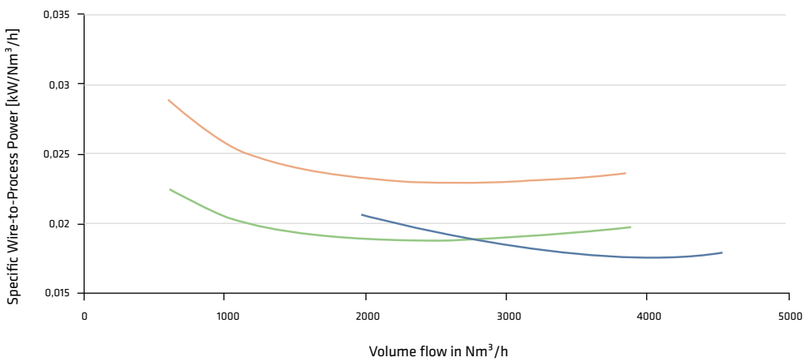
Searching for the most efficient solution, it is, therefore, necessary to configure the machine technologies to meet the individual requirements of each plant. While it used to be common practice to install blowers of just one size, today's plants often feature a mix of different sizes or even technologies. Savings of up to 55% are possible. The AERZEN Performance³ concept offers you a tailored solution based on Blower, Hybrid, and Turbo technologies.

Fast Return on Invest

Today, real efficiency means adapting the selection of blower technology precisely to the load profiles in wastewater treatment plants. Because every wastewater treatment plant is different and has its individual requirements. With a tailor-made performance³ design, you add up the advantages of each machine technology: that means maximum energy savings with an optimal control range and minimal investment volumes. Process optimisation can pay for itself within two years, depending on the plant. With our Performance³ product portfolio – consisting of Blower, Hybrid, and Turbo – we always find the most efficient and suitable solution for you.

You can find further information about our Performance³ products at **www.aerzen.com** in the application area water and wastewater treatment.

Guarantees best energy efficiency over the entire volume flow range



p1 = 1.013 bar; t1 = 20°C

Delta Hybrid
Aerzen Turbo
Delta Blower

Every AERZEN technology has its advantages: the best solution emerges through individual analysis and design.

Integrated approach: energy efficiency, control range, investment costs, service

Delta Blower

- Compact design and possible side-by-side installation
- 100% oil-free
- User-friendly and low maintenance
- Patented discharge silencer without absorption material
- High control range
- Various options and modifications

Delta Hybrid

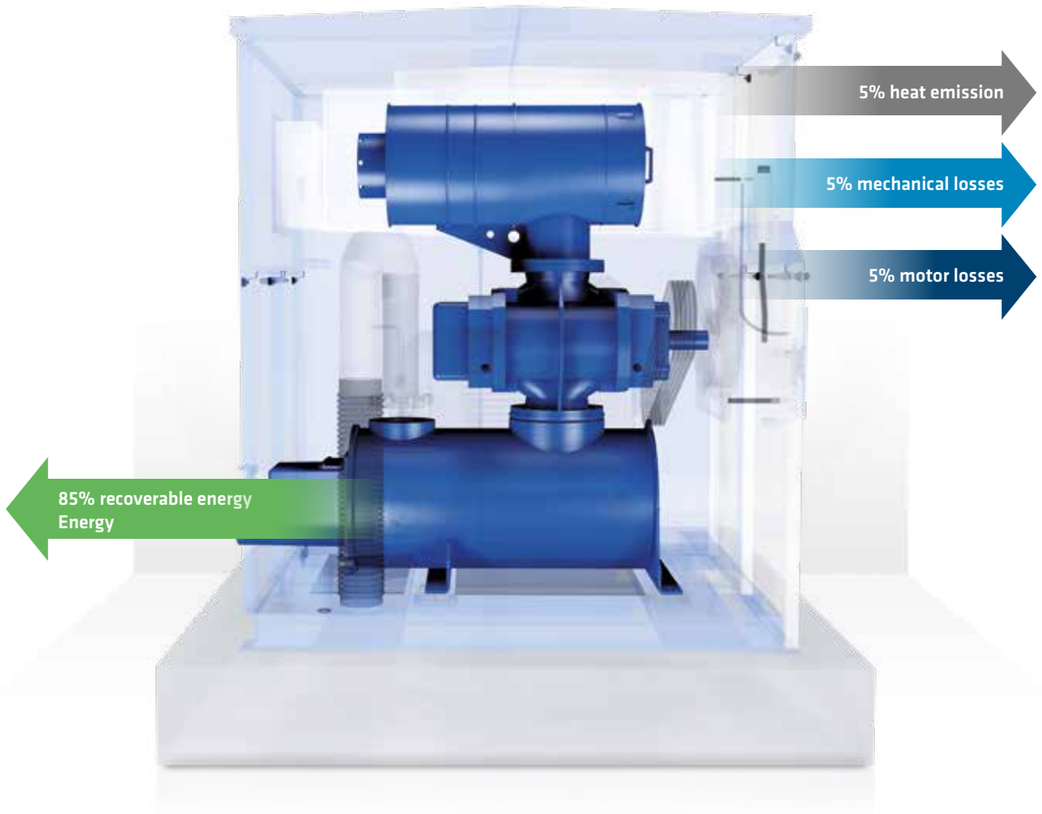
- **Up to 37% higher energy efficiency compared to roots blowers**
- **Extended volume flow control range up to 1:5**
- 100% oil-free
- **Maximum noise reduction thanks to customised silencer technologies**
- **Smallest footprint and side-by-side installation**

Aerzen Turbo

- Increased energy efficiency of up to 10% compared to conventional turbo technology
- 100% oil-free
- Extended service life thanks to innovative AERZEN air foil bearing
- Low-maintenance and space-saving design
- New multilevel frequency inverter technology with highest overall efficiency and extended application range of up to 50°C ambient temperature

Machine room optimisation
Creating best possible conditions

Becoming more energy efficient means: using potential in a holistic way. Machines can develop their highest performance potential under ideal environmental conditions. An optimised machine room creates these conditions and feeds energy back into the system. AERZEN offers the suitable solutions.



Energy balance of a typical positive displacement blower package

Recovering heat

For thermodynamic reasons, waste heat is always generated during the generation of compressed air. It is often discharged outside, even though the heating is running in the building next door and potentially 85% of the heat from compressed air production could be reused. AERZEN offers intelligent heat recovery systems, with which this energy can be used for example for heat-controlled sludge drying process, for hot water preparation or for heating. The recovery of the heat generated in the compression process saves energy for the operator of wastewater treatment plants, reduces the CO2 footprint and thus significantly increases competitiveness.

Making sensible use of waste heat from the machines

Air-cooled blowers, turbo machines or compressors with acoustic hoods are optimally suited for the use of exhaust air for room heating. For this purpose, the exhaust silencer of the AERZEN assembly is equipped with an exhaust duct. This allows use of the cooling air for the compressor stage, the silencer and the piping system under the acoustic hood, while the exhaust air from the oil cooler can be used for room heating. The waste heat with a temperature of approx. 30 to 60°C is bundled via the exhaust air duct and can then be conducted into the rooms to be heated via air ducts. Temperature-controlled flaps are used to regulate the room temperature. A system that makes use of its waste heat reduces the entire energy consumption of the wastewater treatment plant.

Utilise heat from the process air

In the process air, which is conveyed to the aeration tank, up to 85% of the absorbed electrical energy is converted into heat. This energy would be lost without a system for using the waste heat. AERZEN offers heat exchangers with lowest pressure loss, which can be used efficiently for building heating or to support sludge drying process during continuous operation of the plant. Depending on machine type and performance, the installed heat exchangers pay off after two to three years.

A suitable ventilation system

In order to successfully reduce the room temperature, a suitable ventilation of the engine room is necessary. The room temperature must be taken into account, especially in the case of rotary lobe machines with frequency inverters, because they cause an additional temperature increase in the room. If the room temperature is permanently too high, this has a negative effect on the service life of your machines. And: the higher the prevailing ambient temperature, the more energy has to be expended for ventilation. As a rule, a reduction of the room temperature by 10°C results in an efficiency gain of approx. 3%. It is, therefore, always advisable to regulate the machine room climate to save energy and protect the machines. AERZEN supports you to arrange your blower station optimally in the room and to guarantee an efficient ventilation.

Successfully reducing noise

The sound development of a highly technical machinery of a wastewater treatment plant should not be underestimated. High noise levels affect the environment as well as the animal kingdom and weaken the performance of employees working in the immediate vicinity. AERZEN pays special attention to the machine installations in the blower station for the noise insulation of wastewater treatment plants. Blowers and compressors are among the main sources of noise. Therefore, it is worthwhile to take a detailed look, either in the run-up to the installation by exact calculation or in the course of a subsequent inspection: AERZEN helps to keep the noise of the plant as well as the pipe noise as low as possible, thus meeting even the strictest requirements for noise pollution.

Compact design and highest efficiency: pipe coolers made by AERZEN for nominal widths DN 100 to DN 600.

Financing
Use state support programmes

Wastewater treatment plants cause very high energy costs both in municipalities and in industrial environments. In order to ensure that efficient products are used, subsidies flow into energy optimisation. Use the innovative AERZEN technology for your resource management and secure governmental support.

Twice as good: save and recover energy

AERZEN products are designed under highest demands on energy efficiency. The well-conceived product solutions optimise energy generation, because they can also be used for waste heat recovery. In this way they contribute to safe and sustainable water management. The AERZEN blowers, turbos and compressors meet the political targets of energy saving and CO_2 reduction. Their purchase can, therefore, be encouraged in many countries.
Wastewater treatment plants can apply for state subsidies for climate-friendly wastewater treatment concepts, for improvements in the energy balance and for measures for energy generation or recovery. In general, state subsidies are available for a large number of energy optimisations.

Support relating to subsidies

If you decide to modernise your plant with AERZEN products, we are at your side with our expertise in financing. AERZEN supports you in the promotion of concepts with climate protection relevance and in intensive promotion of projects which are implemented due to federal and state programmes. Subsidies can also be used at EU level to reduce CO_2 emissions. The EU supports companies that modernise their machinery to meet the requirements of the Paris Climate Agreement. However, many countries outside the EU also have state subsidy programmes for energy saving. It is good that AERZEN has a worldwide sales and service network that will support you with words and deeds.

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Extensive reporting and concepts for applying for subsidies:

- Measurements of the actual volume flow requirement
- AERaudit: evaluation of the existing performance data of your compressor station
- Energy analysis and energy optimisation, as well as CO_2 calculation
- Design of the best possible compressor concept from all technologies and extensive ROI calculations
- Development of heat recovery concepts with presentation of the recovered
- energy and reduction of CO2 emissions
- Machine room optimisation with regard to room ventilation and sound concepts
- Intelligent machine control for more efficiency and transparency

Let us advise you! Benefit from up to 90% investment support.

Realisation
Security for your operation

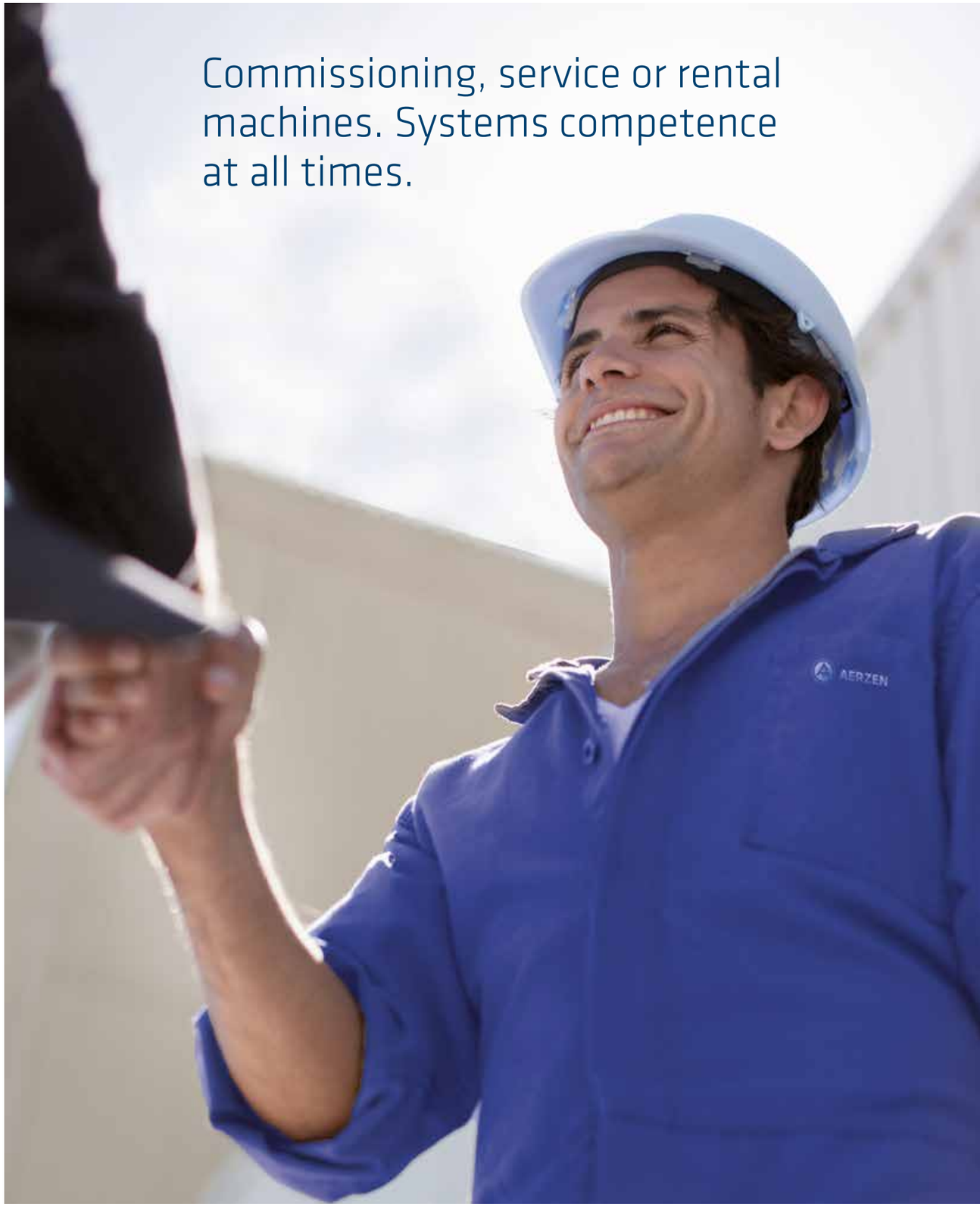
The importance of a smoothly functioning day-to-day business is often only noticed when it comes to implementation in practice. AERZEN wastewater experts have many years of experience with all the requirements of the branch. Whether it is commissioning, the expansion of old plants or the short-term provision of rental machines - you can rely on competent support.

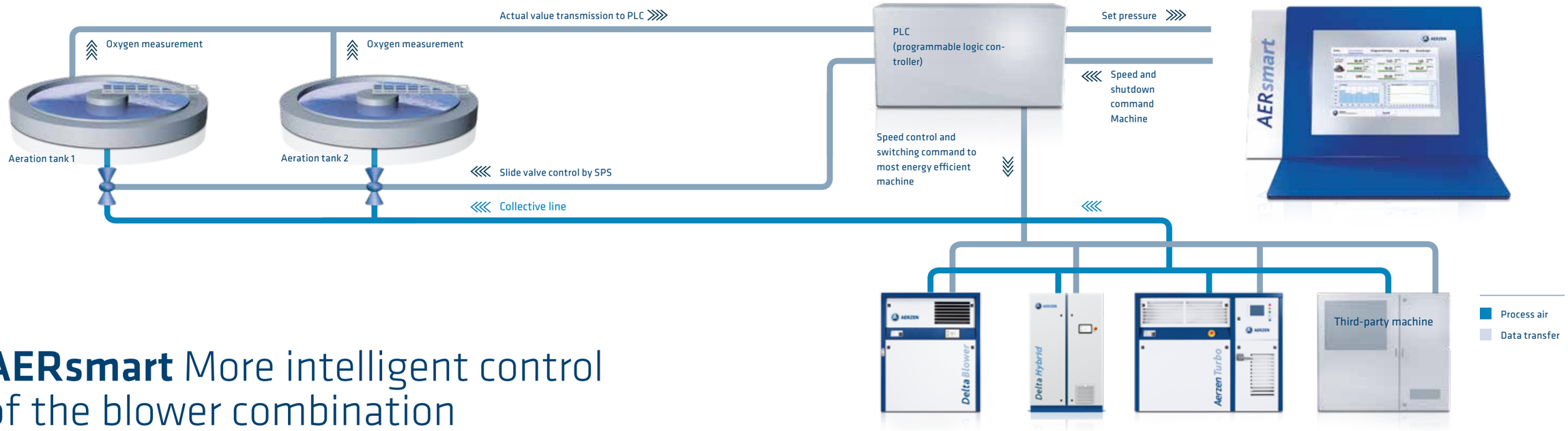
Commissioning - the safe start

Errors can be avoided by the competent commissioning of an AERZEN service technician. The integration of the new machine into your production operation is carried out both mechanically and electrically. As a result, all the potential hazards resulting from improper commissioning are avoided and a foundation is laid that will ensure the durability of the machine.
Especially the integration into the process control system with consideration of the start-up and shut-down processes as well as the connection of machines is adjusted exactly to the customer's requirement profile.

Rental service – short-term use of machines or accessories

Should a machine fail, AERZEN is available 24/7 at short notice with an extensive machine portfolio. In this way, bottlenecks or revision work can be bridged and process reliability ensured. Especially for the wastewater treatment, AERZEN offers a new trailer solution with mounted turbo blower, which is flexible, efficient and immediately ready for use.
You can also receive the AERZEN rental service as a turnkey total service - including transport, installation, commissioning and connected maintenance concepts.





AERsmart offers extensive and flexible possibilities for integration into the process control system.

AERsmart More intelligent control of the blower combination

AERsmart is the master control for the process air blower combination. The innovative AERZEN control system ensures efficiency values close to the ideal values by distributing the air volumes optimally to the technologies and their individual efficiencies.

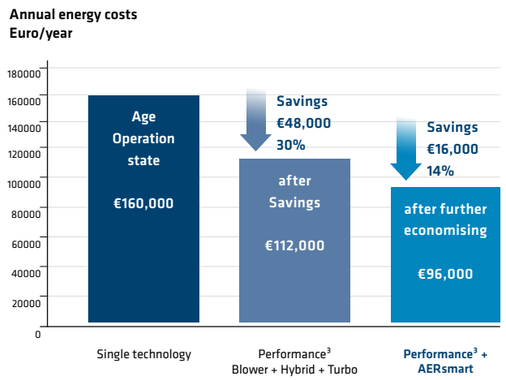
Integrated control system for a new level of efficiency

With AERsmart, the master control system for the blower combination consisting of blower, hybrid and turbo, the performance of Performance[3] can be further perfected, so that you as the operator can save a further 15% of the energy expenditure of your wastewater treatment plant. Because AERsmart distributes the necessary air volumes ideally to the available machines. This allows blower, hybrid and turbo machines to operate in the optimum range of their respective efficiencies. With AERsmart, you can achieve efficiency values with your machines that are very close to the theoretically possible ideal value. At the same time, AERsmart offers maximum transparency and a 360-degree view of your blower station. In this way, you get the best performance out of your machine park in terms of efficiency and transparency.

AERsmart. The energy manager

Until now, the blowers and compressors of a wastewater treatment plant have been operated in so-called groups. Due to the load fluctuations, this control system was often far from the highest efficiency. Machines were simply added or switched off and run at the required volume flow rate by means of frequency inverters. The efficiency ranges of the individual assemblies were not taken into account. AERsmart differs from this classic control system by offering more flexibility. Because AERsmart also controls assemblies of different technologies, above all Performance[3] configurations of AERZEN, but also combinations of foreign makes. AERsmart distributes the air volumes according to the technologies and their individual efficiencies and reacts fully automatically and in real time to load changes.

Savings potential in figures - shortest ROI times



Example of the German wastewater treatment plant with 326,000 population equivalents (PE)

In this way, the maximum efficiencies of the individual blower stages or the overall configuration can be achieved.

Also efficient with fluctuating load profiles

The load operation in biological wastewater treatment plants is subject to strong fluctuations. Using the existing machinery in an energy-optimised way at any time is difficult with a conventional control system. Here, AERsmart is the clever solution. The innovative machine control system distributes the required volume flow intelligently to the compressed air generators, connected to the system. This is achieved with an innovative AERZEN algorithm, which accesses the characteristic maps and efficiency of the individual compressors, and thus controls the volume flow efficiently, automatically and according to demand.
In this way, weak, medium and heavy loads can be handled efficiently - always in the best possible way in the respective system combination. AERsmart also works detached from the Performance[3] systems of AERZEN. The software can be configured to meet different requirements, so that systems with only one blower technology or third-party products can be efficiently controlled. With AERsmart, the efficiency of your plant can be increased without replacing the machinery.

Autopilot for up to 12 machines

AERsmart takes over the complete control and regulation management of a compressor group, thereby exploiting the enormous energy-saving potential that results from the combined operation of different machine types. Even third-party products and installations with only one machine technology can be controlled via the overriding control system. With AERsmart, the system is operated with the highest possible energy efficiency, i.e. close to the theoretically highest efficiency. The intelligent machine control system ensures that even the last energy saving potential is exploited. It can do this for up to twelve machines of one plant. AERsmart's software contains detailed information about the connected machines and uses it to calculate the optimum load distribution in combined operation.
AERsmart also constantly accesses data from the machine park and makes it visible in the interface or control room, so that detailed real-time data on each individual machine can be called up at any time. Malfunctions, configuration problems or service intervals can thus be quickly detected and rectified. Even the natural wear and tear of the aeration system, in particular blocking, can be detected at an early stage via a pressure trend characteristic.

Safety standards
Reliability and purity

Operating a wastewater treatment plant as safely and reliably as possible is the measure of all things and saves costs in the long term. In the event of an accident, penalties and a considerable amount of effort are involved in order to repair the damage caused. Prevention through high safety standards is better than aftercare.

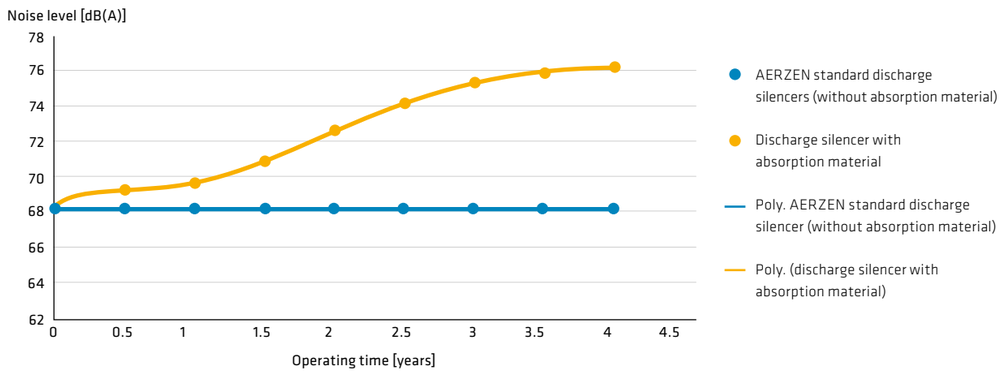
Oil-free operation as constructive stipulation

Even the choice of the compressed air generator influences the safety standard of the plant. Whoever uses absolutely oil-free machines avoids the risk of oil-contaminated wastewater and damage to the aerators. Thanks to the oil-free class 0, AERZEN sets a new safety standard, which was defined in cooperation with TÜV Rheinland LGA Products GmbH. With the AERZEN machines Delta Blower and Delta Hybrid, you secure the operating air oil-free according to "ISO 8573-1:2010 Part 1 of class 0".

Silencers without absorption material

The AERZEN concept for safety standards also includes silencer technology. Due to the high susceptibility of conventional silencers, it represents an essential adjustment screw for the process reliability of the plant. New compressor stations are often still equipped with discharge silencers containing absorbents. These wear out under the influence of hot air flow which hits the lining and washes out fine particles. The particles ultimately settle in the ventilation system. This gradually increases the pressure. Energy costs increase by 1 to 2% with a pressure increase of 10 mbar. Maintenance costs are also incurred. The noise pollution is also increasing insidiously. AERZEN therefore equips Delta Blower and Delta Hybrid with absorbent-free pulsation silencers. With the AERZEN silencer technology the required guidelines are not only fulfilled, but also maintained over the whole life cycle of the machine. Also in terms of work safety (occupational safety ordinance on noise and vibration protection), it has been ensured that the employees are not exposed to any creeping increase in the noise level.
The patented silencer technology reduces the sound without wear and tear and is therefore easy to maintain through air deflection. Even more maintenance-friendly is Aerzen Turbo, which completely dispenses with oil as lubricant due to its air foil bearings. The three AERZEN assemblies Blower, Hybrid and Turbo are "Made in Germany" and, therefore, meet highest quality requirements for absolutely safe processes.

Absorption-free silencers maintain the promised sound pressure level over the entire service life



Noise development due to wear of the absorbent in the discharge silencer
Pipe sound level at constant volume flow 30 m³/min at 600 mbar (g)

ISO standards
AERZEN standards for performance measurement

The more complex a system, the more complex a performance definition or even a performance comparison can be. So that your measurements and calculations are always correct, AERZEN works according to recognised standards.

Explanation of ISO 1217

This international standard specifies methods for a power measurement relating to the volume flow and the power requirements of positive displacement machines. ISO 1217 describes the operating and test conditions that must be used for a complete performance measurement. In general, the standard defines the volume flow as "volume flow measured at the discharge connection calculated back to the conditions on the suction side".

Volume flow range (m³/min)	Useable intake volume flow (%)	Spec. power consumption (%)
< 0.5	± 7	± 8
0.5 to 1.5	± 6	± 7
1.5 to 15	± 5	± 6
> 15	± 4	± 5

Tolerance values for assemblies with fixed speed.

Attention: the different standards have a great influence on the standard volume flow and its efficiency.

Standard	Medium	Volume flow		Air
Operating conditions	Intake volume flow t1=20 °C, p1=1.013 bar, rF=0%	Q1	1500	m³/h
DIN ISO 1343	Volume flow in standard condition related to T1=273 K, p1=1.013 bar, rF=0%	QN	1397	Nm³/h
DIN ISO 2533	Volume flow in standard condition related to T1=288 K, p1=1.013 bar, rF=0%	QN	1474	Nm³/h
ISO 1217	Volume flow in standard condition related to T1=293 K, p1=1.000 bar, rF=0%	QN	1519	Nm³/h

Influence of the standard on the standard volume flow.
Different standard validities of the standard volume flow,
t1= intake temperature.

Electrically driven compressors must be measured as completely mounted assemblies (as specified by the customer) and evaluated with their terminal power. The same rules and tolerances apply to compressors with inverters as to compressors with fixed speeds.
AERZEN implements ISO 1217 as standard, but remains flexible. Because as an international company, AERZEN also works with international standards. Depending on the combination of the scope of delivery, a different standard or tolerance can be used. For turbo compressor packages, so-called turbo machines, for example, ISO 5389 is taken into account worldwide with different tolerances. After consultation, the performance specifications are always calculated for you according to the standard and tolerance you require.

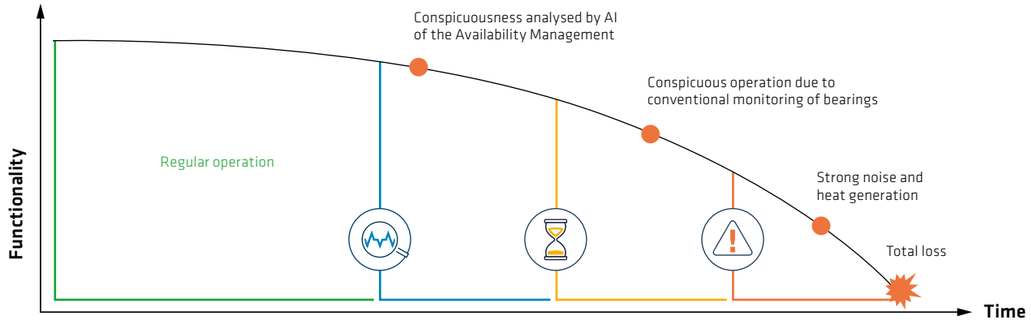
Other relevant standards

The ASME PTC 13 - 1997 standard applies primarily to North and South America. It describes the procedure for determining the thermodynamic power of axial and centrifugal compressors and blowers under specific conditions. ISO 5389 on the other hand defines the test conditions for compressor packages with a centrifugal compressor and an electric motor. It applies to drive power of 75 kW to 1865 kW.

AERprogress
Digital Transformation of Blower Technology

The digital transformation is also having a major impact on blower and compressor technology and is becoming increasingly important. By using digital technologies, plant operators can increase their energy efficiency and improve their environmental footprint. This requires digitising and networking all plants and machines as well as continuously monitoring data.

Our vision for the AERprogress product is to shape the future of industrial process air optimisation. We strive to create a pioneering platform that supports companies in making their production processes more efficient, sustainable and forward-looking. By connecting advanced digital technology, big data analytics and machine learning, we strive to create a world where businesses are able to make the best use of their resources and minimise their environmental impact while increasing their competitiveness.



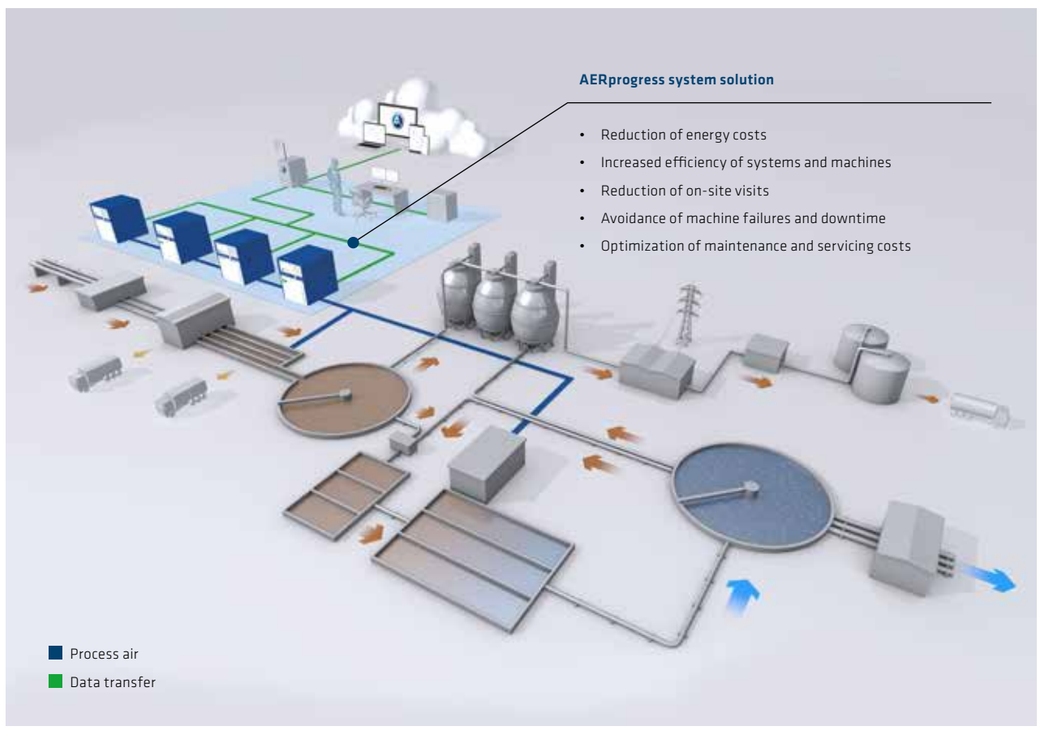
Availability Management - Reliable early warning system to avoid plant downtime

One example of digital transformation in blower technology is the implementation of IoT (Internet of Things) solutions. The networking of blowers and sensors enables plant operators to collect real-time data on the operational state and performance of the machines. As a result, maintenance requirements are detected at an early stage, downtimes are minimised and the service life of the machines is extended.

Furthermore, digital transformation also enables the integration of AI (artificial intelligence) and machine learning. By analysing large amounts of data, patterns and trends can be identified, which can be used to further optimise existing processes. AI-driven algorithms help reduce energy consumption and maximise the efficiency of the machines.

AERprogress value proposition

- Innovation: we always offer the latest technologies and solutions to meet changing industry requirements.
- Excellency: quality, technology and expertise are the foundations of our first-class products and services.
- Partnership: as a partner, we understand the individual needs of our customers and offer standardised or bespoke solutions.
- Sustainability: we convey resource efficiency, energy saving and environmental protection for a sustainable future.
- Trust: data privacy and data security are our highest priority.
- Customer orientation: the needs of our customers are the prime focus of our attention.



References
Successful worldwide

In our more than 160 years of company history we have acquired extensive know-how as manufacturer of blowers and compressors. Besides numerous other branches, the wastewater treatment is a key industry - many innovative and successful technologies from AERZEN have found their beginning here. We see ourselves not only as a pure service provider, but as an application specialist and partner of our customers, with whom we try to implement optimal solutions together.

Individual efficiency solution

As market leader for aeration technologies in wastewater treatment plants, AERZEN offers with its unique portfolio of positive displacement blowers, rotary lobe compressors and turbo blowers a tailor-made solution for every application. Whether consulting competence in the pre-project phase, matching the compressor to the ventilation system, heat recovery, commissioning or worldwide service in over 50 subsidiaries. AERZEN accompanies you as a competent partner and offers you hardware, software and services from one source. With AERwater AERZEN has created a new solution concept for all questions around maximum resource efficiency in wastewater treatment, which gives you the possibility to start very individually in your project. We can determine the annual performance curve for you, design the right machines based on it, help with financing, optimise the machine room, install and commission the machines, run the plant at the energy optimum with AERsmart and finally visualise all recorded data and network it with higher-level systems. With this bundled know-how AERZEN is currently repre-sented in more than 100,000 wastewater treatment plants worldwide and delivers custom-fit, highly efficient solution concepts for the wastewater market. See for yourself!

Liebenwalde Wastewater Treatment Plant

Optimisation:	activation
Technology:	2x Delta Hybrid D62S inkl. Container-Station
Wastewater:	approx. 2.000 m³/day
Size:	20,000 equivalent population
Savings:	55% | 65.000 €/Year

Jabl Asfar Wastewater Treatment Plant (Egypt)

Optimisation:	supply of the activation
Technology:	9 x Delta Hybrid GM150S, 4 x Delty Hybrid GM30L
Wastewater:	2 million m³/day
Size:	14,000,000 equivalent population
Savings:	25%

Grüneck Wastewater Treatment Plant

Optimisation:	Oxygen input into the aeration tank 2
Technology:	1 x Delta Hybrid D50S 4 x Delta Blower GM 25S
Plant size:	160.000 population equivalents
Wastewater:	28.000 m³/day
Saving:	Up to 30% energy saving

Anjar Wastewater Treatment Plant (India)

Optimisation:	supply of the activation
Technology:	4 x Aerzen Turbo AT200 0.8S
Wastewater:	30.000 m³/day
Savings:	25% energy/35% space saving

Industrial Wastewater Treatment Plant Sloftnaft refinery (Poland)

Optimisation:	purification stages
Technology:	6 x Delta Blower GM90S
Wastewater:	35.000 m³/day
Invest. volume:	€1.3 million
Savings:	€280,000 annually

Rheda-Wiedenbrück Wastewater Treatment Plant

Optimisation:	activation
Technology:	1 x Aerzen Turbo AT150 0.8S, 1 x Delta Hybrid D62S, 2 x Delta Blower GM80L, AERsmart
Wastewater:	3000 m³/h
Size:	20.000 population equivalent, 326,000 population equivalent Industry
Savings:	€40,000 per year

Everything – expect ordinary
The service world of **AERZEN**

The long service life of AERZEN machines is legendary. So why is service an issue at all? Because it's about more than availability and OEM original parts. The services from AERZEN secure investments, productivity and a decisive competitive edge. And this worldwide.

AERZEN on-site service

Our service teams work where our machines are. All over the world. Onshore or offshore. Often under extreme conditions. How do we achieve this? With short distances. AERZEN has a dense network of service centres and decentralised parts warehouses around the globe. More than 200 excellently trained service technicians can come to your aid from there. Any time and anywhere you need us

For rental service and other services

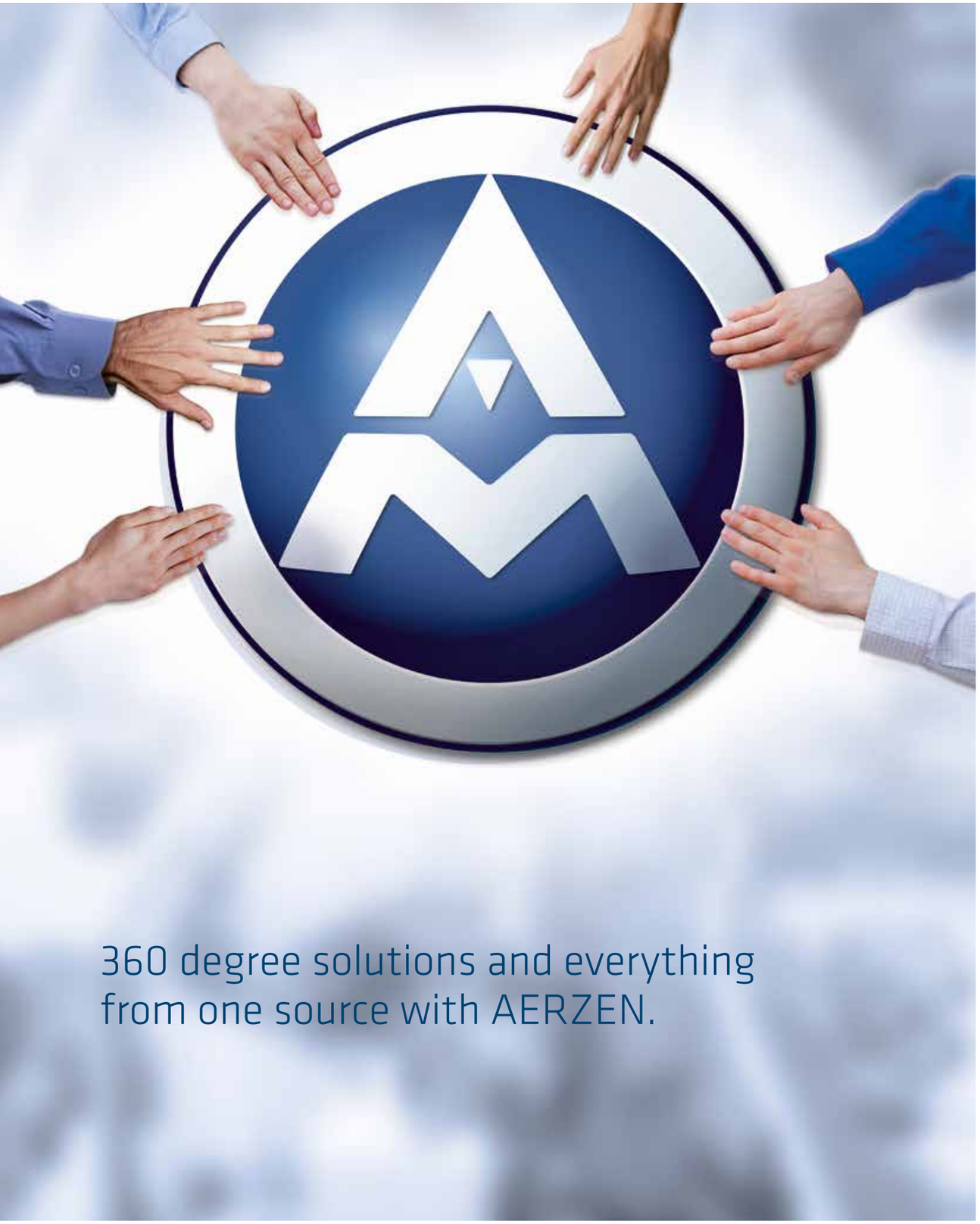
AERZEN's service world has a lot on offer. Tailor-made service kits, for example. Replacement stages, machine diagnostics, sound optimisations. One of our most important services is AERZEN Rental Division, which provides a large fleet of rental machines. Blowers, turbo machines and compressors - made by AERZEN. In a wide range of performance classes. For all common pressure ranges. Can be used immediately and delivered turnkey on request. What does that mean for you? You are also well prepared for unexpectedly upcoming needs
www.aerzenrental.com

Contact worldwide
2,600 employees work for AERZEN. On every continent. With six sales offices in Germany alone, we're there for you. And with more than 50 subsidiaries in over 100 countries around the world. Hence we're never far away – should you ever need us. Give us a call:
+49 5154 81 0

Service-Infoline
Our German Service Centre is available for customers and operators. We are happy to help you. We look forward to your call:
+49 700 49318551

Customer Net
Where you can learn more about the company and the leading compressor technologies from Aerzen? It's simple: In our Customer Net on our website, where we have stored everything that is worth knowing for you:
www.aerzen.com

LET'S TALK
Find your local contact
www.aerzen.com/worldwide



LET'S TALK

We will be happy to advise you.

Operators of municipal and industrial wastewater treatment plants are facing constantly increasing challenges. To meet these requirements, processes must be continuously optimised.
Side by side with AERZEN, this happens smoothly.

Approach optimisation

The energy efficiency of wastewater treatment plants depends largely on the design of the aeration tanks and their aeration system. Overhauled compressors or even surface aerators, which bring air into the aeration basin by means of paddle wheels or propellers, work extremely inefficiently, but are still frequently in use. Modern pressure aerators bring the air into the basin in the form of fine bubbles and work up to 40% more efficiently. But this is only one of many starting points. Optimising the machinery often results in further savings potential.

AERZEN - a competent partner at your side

With AERZEN you have with the modernisation or new project planning and following maintenance of your process air station a partner at your side who is set up holistically and offers machines and service from one source. For more than 155 years AERZEN has been the application specialist for process air generation in wastewater treatment and has system competence in more than 100,000 wastewater treatment plants worldwide.

AERZEN has the 360 degree view of the entire aeration process and, therefore, also assists you with machine room ventilation, financial support and in every single project phase. As a member of German Water Partnership (GWP), AERZEN can access international networks while using global expertise.

Let's talk about efficiency and saving resources

Thanks to comprehensive know-how, modern technology as well as smart control and regulation technology, AERZEN optimises the aeration process of your wastewater treatment plant sustainably. After all, it is no longer just the pure blowers and compressors which provide more efficiency with simultaneously increasing requirements and differentiated load requirements.

Together we will find out which measures are appropriate for your wastewater treatment plant and which are not. Let's talk about it. LET'S TALK! We will be happy to advise you.

AERZEN. Compression is the key to our success

The Aerzener Maschinenfabrik GmbH was founded in 1864. In 1868, we built Europe's first positive displacement blower. The first turbo blowers followed in 1911, the first screw compressors in 1943, and in 2010 the world's first rotary lobe compressor package. Innovations "made by AERZEN" keep driving forward the development of compressor technology. Today, AERZEN is among the world's longest established and most significant manufacturers of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. And among the undisputed market leaders in many areas of application.

In more than 50 subsidiaries around the world, more than 2,600 experienced employees are working hard on shaping the future of compression technology. Their technical competence, our international network of experts and the continual feedback from our customers are the basis of our success. AERZEN products and services set standards. In particular, with regard to reliability, stability of value and efficiency. Challenge us.

LET'S TALK

Find your local contact

www.aerzen.com/worldwide

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Wastewater (A1-045-06)_EN
04|2024