



The challenges of the future have long since arrived in the planning and operation of sewage pumping stations, in the form of new framework conditions and circumstances that make the life cycle from planning to maintenance and repair, operation and further development of the systems an increasingly demanding task.

Four problems in particular (sewage quality, extreme weather phenomena, compatibility and a shortage of skilled workers) call for new solutions in sewage management today. The challenges themselves are nothing new. However, what is new is the speed at which they are becoming increasingly noticeable. So it's high time that we examine these questions in more detail and look into the answers that smart, networked pump technology can already provide today.

The top 4 challenges in waste water management

**Sewage quality**  
**Extreme weather**  
**Compatibility**  
**Shortage of specialists**

→ **Sewage quality:** The amount of solids in sewage is continually increasing. We don't know the cause of this but at the moment we can't make a difference when it comes to fibre residues, e.g. from the increased use of wet wipes<sup>1</sup> or people throwing non-woven tissues down the toilet and reduced sewage quantities due to water-saving measures<sup>2</sup> and this makes the transport fluid slower, more aggressive, more problematic and increasingly difficult to process. All across Europe, over 380,000 tonnes of wet wipes are not thrown away properly each year<sup>3</sup>. Outdated systems in particular are reaching their limits, and pump malfunctions and failures are unavoidable here. This results in high maintenance costs, poor energy efficiency and malfunction repairs up to system failure<sup>4</sup>.

→ **Extreme weather:** Never-before-seen weather patterns present challenges to the sewage management as current systems are usually inadequately designed to handle this. This includes long dry periods, during which too little of the transport fluid is available, followed by heavy periods of rainfall, where suddenly occurring large water masses must be reliably processed. In North Rhine-Westphalia, for example, the state government speaks of an increase in heavy rainfall events since 1950, which is not classified as significant due to the high variability of precipitation data. Nevertheless, in their "Konzept Starkregen" ("Heavy Rainfall Concept") from 2016, the responsible ministries assume that these kinds of events are actually on the rise: "According to current climate projections up to 2050, this trend is likely to continue in the future<sup>5</sup>."

1 Cf. Sator, M. (2019): Sieben Sichtweisen auf die Feuchttuch-Problematik (Seven Perspectives on the Wet Wipe Problem), P. 34.

2 Cf. Umweltbundesamt (German Federal Environmental Agency) (2014): Wassersparen in Privathaushalten: sinnvoll, ausgereizt, übertrieben? (Saving Water in Private Households: Sensible, Exhausted, Exaggerated?), P. 5 and P. 39.

3 <https://www.edana.org/nw-related-industry/nonwovens-markets>, accessed on 03.06.2020

4 Cf. Sator, M. (2019): Sieben Sichtweisen auf die Feuchttuch-Problematik (Seven Perspectives on the Wet Wipe Problem), P. 36.

5 [https://www.umwelt.nrw.de/fileadmin/redaktion/PDFs/klima/starkregen\\_konzept.pdf](https://www.umwelt.nrw.de/fileadmin/redaktion/PDFs/klima/starkregen_konzept.pdf), accessed on 03.06.2020

→ **Compatibility:** Some sewage pumping stations have existed for over 100 years<sup>6</sup>. During this long period of operation, various technological and systemic components were installed and joined together through expansion, modernisation or replacement due to damage. Individual components are usually replaced and renewed every five to fifteen years, depending on what they are used for as well as the level of physical strain. Due to the shortened development cycles, new technologies are always finding their way into the pumping station's overall system. As a result, a large number of diverging automation standards exist side by side, that have grown over time. This often makes integrating new solutions a complex challenge.

→ **Shortage of specialists:** Increasing requirements in operation as well as maintenance and repair, reliable maintenance planning and the creation of more efficient processes (due to the personnel situation) mean that these tasks can often only be carried out inadequately. Acceleration pressure and the need for ever more precise and tighter planning leaves little room for the necessary quality assurance measures and causes processing bottlenecks that are difficult or impossible to resolve in the case of unforeseeable events. This situation is likely to get worse in the future. In its Arbeitsmarktreport 2019 (Labour Market Report 2019), the Association of German Chambers of Industry and Commerce documents that 49 % of the companies surveyed suffer from a shortage of skilled workers and are unable to find suitable employees. 71 per cent of the companies with staffing problems believe the cause of this as a lack of applicants. According to the employer survey, the reasons for this are insufficiently qualified applicants, excessively high (salary) demands of applicants or the fact that the location is not attractive enough for them<sup>7</sup>.

The framework conditions, problems and market developments described above will not resolve themselves, but will determine the current and future situation of sewage management. That's why we urgently need new solutions. Keep on reading to find out how we can overcome the current challenges. The future starts now – and with it, five major technology trends are coming to the fore when it comes to pumps.

**A variety of solutions are derived from the so-called “Waste Water Management 4.0”, which can be defined on the basis of the following five trends.**

### TREND 1

#### Increasing requirements: More electronics, more sensors, more automation

“Waste Water Management 4.0” unfolds its potential among other things, via new, smart sensor technology. The total number of sensors and devices connected to IoT is expected to increase to more than 50 billion by 2022<sup>8</sup>. Nowadays everyone wants to record, analyse and control much more, much more precisely and now we can, be it leakage, winding and bearing temperatures or integrated vibration measurement. Pumps that provide real-time data on their status help to reduce effort and costs. For example, this includes by increasing energy efficiency, minimising wear, reducing maintenance requirements and fewer service calls. However, that being said, complex and susceptible electronics is one of the main problems that operators in the Water Management market segment have, according to a Wilo customer survey carried out as part of the “Customer Journey”. The operational reliability of the system is of vital importance, which also includes security against digital attacks and possible manipulation from outside.

#### Demand-based control is more efficient

According to the German Federal Statistical Office, more than 9.6 billion m<sup>3</sup> of sewage was produced in Germany in 2016, and the trend is rising<sup>9</sup>. A dense network of pumping stations is essential for safe disposal. Even small water and sewage associations have many pumping stations that have to be designed according to their individual specifications<sup>10</sup>. Thanks to sophisticated sensor technology alone, a large number of input parameters can now be recorded and processed in real time in order, for example, for analysing the water quality in wastewater treatment plants more thoroughly as well as precisely controlling which substances have to be added to the water and how much in order to achieve the desired target quality.

In the area of control, pumps are learning more and more and are taking over information and control tasks automatically, for example by sending fault messages or regulating their speed by themselves. Pumps regulating their own speed is no longer a vision for the future. It's here! Intelligent pumps such as Wilo-Rexa SOLID-Q with Nexos Intelligence already automatically adjust to the optimum speed nowadays. This means significant savings can be achieved, as pumps are among the largest consumers of energy in the industry<sup>11</sup>. In this way, water volumes can be processed more effectively and energy-efficiently under a wide range of conditions from heavy rain to dry periods.

6 Cf. Berliner Wasserbetriebe (2012): Die Berliner Kanalisation – Unsichtbar und unentbehrlich (The Berlin Sewer System – Invisible and Indispensable), P. 2.

7 <https://www.dihk.de/resource/blob/5908/0d81b300e10614a90e5c3db3bb133091/dihk-arbeitsmarktreport-2019-data.pdf>, accessed on 03.06.2020

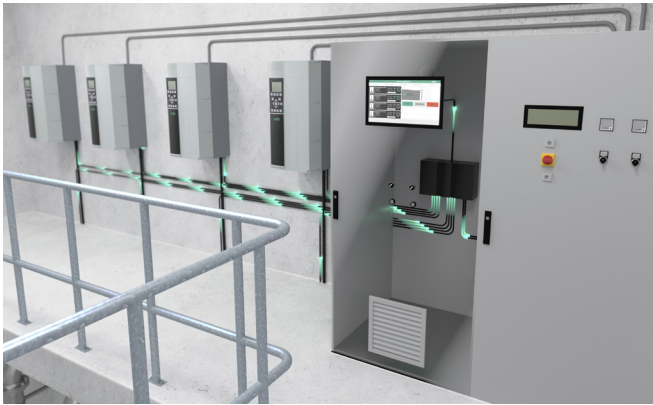
8 <https://www.it-zoom.de/mobile-business/e/50-milliarden-vernetzte-geraete-im-jahr-2022-19966/>, accessed on 31.08.2020

9 [https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/Wasserwirtschaft/Publikationen/Downloads-Wasserwirtschaft/wasserwirtschaft-2190213169004.pdf?\\_\\_blob=publicationFile](https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/Wasserwirtschaft/Publikationen/Downloads-Wasserwirtschaft/wasserwirtschaft-2190213169004.pdf?__blob=publicationFile), accessed on 02.11.2020

10 <https://www.wasser-wem-nord.de/ueber-uns/zahlen-a-fakten?jij=1583228180769>, accessed on 31.08.2020

11 Cf. Burghardt, M. (2010): Pumpen und Lüfter: Clever Energie sparen (Pumps and Fans: Clever Energy Saving), P. 21.

The increasingly sophisticated control electronics will therefore continue to optimise the existing mechanics in the future. Electronics combined with intelligence make products significantly more powerful than would be possible with mechanical development alone.



### **TREND 2** **Keep it simple – all thanks to integrated functions**

More sensor technology paves the way for increased efficiency. However, as a side effect, it also requires a lot more components to be integrated – including their electronics and cabling. Nowadays, the cabling must still be wired in a typical way individually for each sensor in the switch cabinet. The complexity of applications also increases enormously due to the new possibilities. This is due to the fact that the possibilities of analysis and the resulting control and regulation options are complex and challenging.

#### **Ethernet connection instead of cable clutter**

So it's no wonder there's a strong need in the industry for compression, time saving and simplification<sup>12</sup>. Instead of many, individual connections and interfaces, complete packages and solutions are required that nevertheless allow personalisation. How great would it be, for example, if all sensors could be connected with just one cable? This is the path Wilo is taking: the Ethernet interface in the submersible pump, via which all sensor values of the pump are output, enables the full potential of the current sensor technology to be exploited with considerably reduced installation effort. Due to the standardised interface, no specific Wilo evaluation unit is required; instead, the pump can simply be connected directly to the existing network infrastructure.

A specific application example is the smart Wilo-Rexa SOLID-Q with Nexos Intelligence. The pump supplies digital data via an Ethernet interface and centralises all sensor data

and other pump information – with all the resulting efficiency potential that comes with this. In Lift System Intelligence mode, even the control of the pump is integrated, so that a separate control module is no longer required in the pumping station. The control is pre-programmed to a large extent, which significantly simplifies application and processes. In a main/standby arrangement, the system can also control a pumping station with up to four pumps.

### **TREND 3** **Connectivity and compatibility**

Despite the intelligence now available in the pump itself, intelligent connectivity is also required to create a functioning overall system. It's becoming increasingly clear that operators are demanding precisely these solutions. For this purpose, "isolated solutions" must be avoided and connectivity must be geared to customer requirements and driven forward via open interfaces. For a long time, Wilo has been working with the manufacturers to make components connective, because this way they can become part of a smart system. The individual components are becoming more and more closely networked with the aim of merging data and creating a complete overview. The obstacle is this: as a rule, different systems from different manufacturers must be combined with different connectivity standards. This is only possible via open interfaces.

#### **Remote monitoring instead of on-site use**

Through compatible products, the information from the pump can be transferred to the existing system. The operator can connect to a pump like the Wilo-Rexa SOLID-Q, and retrieve all of the information. In this way, the system provides data on vibrations, problems, rinse cycles and cleaning frequency. Malfunctions are actively displayed as error messages with a corresponding description, and can be reset remotely if necessary, which can then avoid numerous time and cost-intensive on-site operations. Given the shortage of skilled workers, remote monitoring technology can be a very viable investment economically. Switching to an existing system raises legitimate concerns for operators about access and data security. You can only connect to the Wilo-Rexa SOLID-Q with Nexos Intelligence via a secure connection, which prevents unauthorised access.

The pump can be operated and monitored conveniently and in a way that saves resources via the Wilo-Digital Data Interface with integrated web server, even from a distance. Our own information survey determined what customer fears and requests were. The issues of data security, system susceptibility & manipulation, switch-off capability,

<sup>12</sup> <https://www.chemietechnik.de/ct-trendbericht-ueberwachung-von-pumpen-und-kompressoren/>, accessed on 14.09.2020

remote control and mobile operation should be emphasised here. These problems are solved by flexible connectivity, where customers can decide whether the pump should be networked to existing interfaces or not. Based on its own safety requirements, the system can also be operated locally on site manually. Standardised protocols are used for connectivity and the pump is embedded in existing structures (VPN or Cloud systems). Here, the cloud-based system is structured in such a way that communication is separate from control – before you can access the communication infrastructure of the pump, you have to get through a gateway.



**TREND 4**  
**Centralisation vs. decentralised smart grids**

At the moment, there are two opposing trends: on the one hand, many wastewater treatment plants are shut down and replaced by larger plants<sup>13</sup>. At the same time, we're starting to notice that smaller, self-sufficient systems are increasingly being put into operation – the sizes range from district level to self-sufficient houses that offer more cleaning stages<sup>14</sup>. It's here in particular that the ability to connect to so-called

13 BDEW (German Association of Energy and Water Industries) (2019): Abwasserdaten in Deutschland (Sewage Data in Germany), P. 10.  
 14 BDEW (German Association of Energy and Water Industries) (2019): Abwasserdaten in Deutschland (Sewage Data in Germany), P. 10.  
 15 <https://www.fluid.de/hydraulik/pumpengeraeusche-direkt-an-der-maschine-messen-und-auswerten-107.html>, accessed on 14.09.2020  
 16 KPMG AG (2017): Mit Daten Werte schaffen (Creating Values with Data), P. 30.  
 17 KPMG AG (2017): Mit Daten Werte schaffen (Creating Values with Data), P. 31.  
 18 <http://kuras-projekt.de/>, accessed on 31.08.2020

“smart grids” plays an important role. Because the many small systems have to be connected together to form large systems.

This makes systems and components with open interfaces and high compatibility the basis for future-proof planning. Wilo offers solutions that can be easily integrated and therefore prepared for the new requirements that arise in the area of conflict between centralisation and decentralisation. A system such as the intelligent Wilo-Rexa SOLID-Q with Nexos Intelligence is smart grid-ready, so to speak, and is therefore ready for the networked future.

**TREND 5**  
**Predictive wastewater management**

Data collection can also be used in many ways in the field of water management. Among other things, this data can be used for predictive maintenance and repair, e.g. to detect possible undesirable developments at an early stage using audio signals<sup>15</sup>. These data refer to systemic data, consisting of log data, sensor data and location data<sup>16</sup>. In a survey conducted by the KPMG AG, systemic data have 86 % influence on corporate decision-making processes<sup>17</sup>. With the appropriate sensor technology, intelligent, networked pumps can not only detect and evaluate actual conditions and control the waste water systems accordingly. They can also act with foresight. And this doesn't just include predictive maintenance, i.e. the intelligent forecasting of when spare parts, maintenance measures, cleaning work etc. are due, including the initiation of appropriate measures.

**Capacity in the pump chamber thanks to weather forecast**  
 Additionally, a look into the future can also help to anticipate wastewater management in extreme weather conditions, for example. By linking the waste water system to weather data, for example, the pumps could receive information that heavy rainfall is to be expected and could help to mitigate these events with appropriate advance notice. In this way, the pump can pump out water even before the start of precipitation in order to maintain a larger impoundment volume in the pump chamber. Again, the most important prerequisites here are smart technology and networking capability. KURAS at the TU Berlin is a reference project for this<sup>18</sup>.



**Practical example: Buchbusch pumping station in Pforzheim**

Sewage transport is facing increasing challenges in connection with changes in general water consumption. Nowadays, sewage pumps have huge problems when it comes to handling unpredictable mixtures of sewage. Thanks to the highly efficient and digitally networked Wilo-Rexa SOLID-Q pump coupled with Nexos Intelligence, Wilo makes a considerable contribution to overcoming this challenge. The pumping station in Buchbusch (Pforzheim) was fitted with Wilo pumps and, with the help of Nexos Intelligence, meets the requirements of a smart sewage pumping station – energy-efficient, reliable and network-compatible. These three pillars are the latest developments in connecting intelligence to the motor and hydraulics. Thanks to the integrated control intelligence, the system can react intelligently to changes in the environment and requires no physical support from the operator. Absolute reliability is guaranteed and travelling to the building can therefore be avoided. Depending on the requirements, the application can be perfectly tailored to the customer, as the system can be easily integrated into existing installations. Through this type of energy-efficient digitisation, local authorities can solve the problem of congestion and at the same time protect the environment from pollution in the long term.

**Pumps are always getting smarter**

The pump of the future will be much cleverer. As part of so-called cyber-physical systems, they will help to continually optimise mature mechanics. Through connectivity and intelligent technology the products become significantly more powerful than it would be possible through purely mechanical development. The potential is huge – as are the challenges facing water management.



*Thanks to the use of Wilo-Rexa SOLID-Q with Nexos Intelligence when modernising the pumping station Buchbusch, cloggings could be greatly reduced thus service calls have also been minimised. Operating costs could be significantly reduced.*

Our work with the precious resources of water and energy, as well as our approach to protecting the environment, basically requires a sustainable mindset and actions. In its sustainability strategy, Wilo has come up with the goal of supplying more people with clean water worldwide while reducing its own environmental footprint. Wilo's goal is to make access to clean water easier for at least 100 million people by 2025 through our innovative and smart products, intelligent systems, solutions and services.

Replacing obsolete technology with the latest generation of modern high-efficiency pumps offers huge energy and CO2 saving potential. A large proportion of pumps in use today are outdated and inefficient. Realistic estimations indicate that pumps consume approximately 10 % of all electrical energy worldwide. With its products and system solutions, Wilo can make a significant contribution to slowing down climate change and achieving the climate protection targets set.

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