

mission water

magazine

Saur Industrial Water Solutions division

Close the Water Loop

Reduce - Remove - Reuse - Recover

-  flootech
-  aqua-chem
-  sodai
-  byosis
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-  econvert
-  nijhuis

Close the Water Loop

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Water as a Service

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a 5-step approach to consult you at the start of your new or revamp (waste)water project



'Closed loop water solutions to bring industrial and municipal water together'

Picture yourself a few decades from now, turning your kitchen tap for a glass of water enriched with minerals for your aging bones. Then you water your garden with water not needed for drinking, but enriched for irrigation. 'Mission Water is all about innovation and helping our valued customers and society to provide water the value it deserves and requires,' says Menno Holterman, President and CEO of Nijhuis Saur Industries, Saur's Industrial Water Solutions Division.

'A lot of people around the world still think of water as an inexpensive, plentiful and disposable resource,' says Menno M. Holterman. 'Many experts agree that as a society, we are failing to realize how valuable water is - and how so many other things that are important to us and to our planet depend upon it. Just think of all the United Nations' Sustainable Development Goals (SDGs): they are aimed at big themes ranging from poverty, hunger, lack of education and gender issues to caring for life in the oceans, on land as well as providing peace and economic growth.

The SDG 6 goal is to 'ensure availability and sustainable management of water and sanitation for all'. Water is the connector between all the different SDGs. Whatever the goal, you can put water at the heart of it. You name it, water plays a role in it: without water, we have bigger energy problems, no food, no hygiene or health, challenges in education - and, ultimately, no life. So for us at Saur, Mission Water is about delivering value-added services that will set up our society, our valued clients in different industries and our planet for a sustainable and resilient future.'



Menno M. Holterman
President and CEO of Nijhuis Saur Industries,
Saur's Industrial Water Solutions Division.

Innovation is key

Continuous innovation, says Menno Holterman, is one of the key aspects to an improved valuation of water - and to a brighter future for all. 'In the water domain, there is room for continuous innovation in a lot of different areas and directions. From resource management to the water-energy-food nexus, from digitalization or on-line monitoring - think quite simply of smart meters helping small and big users to act more efficiently - to industrial water solutions.'

The linear infrastructure is falling short

'A lot of this continuous innovation is going on as we speak. Our main objective within Saur's Industrial Water Solutions division is to deliver what we call (de-)centralized water on demand. This involves replacing the conventional linear system of water distribution - producing water in one place and transporting it through many, many miles of pipelines to the end user, then treating the wastewater, discharging the treated water into the environment and starting the whole process again from scratch at the front. With climate change resulting in longer periods of drought, heavy rainfall and flooding, this linear water infrastructure is becoming ineffective and inefficient. Water is being wasted in some places, and in other places it is taking extortionate costs to deliver it.'

Small-scale, closed loop water solutions

'One of the goals is to replace this linear system with a circular and (de-)centralized, on-demand system. In Poland, for instance, Nijhuis Saur Industries was the first water player certified to convert treated industrial wastewater back into drinking water. 'More broadly, we are working on circular, adaptive, small-scale closed loop water solutions for residential areas, cities and commercial buildings.

'Think of collecting rainwater from local roofs and converting it into drinking water, then treating the used water and reusing it for washing machines, dishwashers and toilets. Then we take the toilet water and make it suitable for fertilizing the garden or farmland. It's all about providing on-demand water at the right quantity and quality.

For example, drinking or process water converted from industrial effluent, drinking water with extra magnesium for elderly residents, or suitable, non-drinkable water for the garden or the toilet. Safe solutions, with no wastage of valuable resources.

Personalization will be a key to keeping water users - big or small, industrial or municipal - satisfied, while also valuing water more appropriately and increase the willingness to pay the right value for water on-demand.'

It's All About The People and everyone can contribute

The on-demand, personalized water concept integrates the different values of Saur, from taking responsibility to staying close to our stakeholders.

'One of Saur's strengths is that it brings together a comprehensive portfolio of game-changing and proprietary technologies, services and disciplines. There is a rich legacy in water services provided to communities, while the engineering and industrial water solutions divisions are rapidly expanding around the globe and gaining strength.

When it comes to the differentiation and continuous innovation our sector needs, there is a role for every person and every entity across Saur. And beyond that, we have a strong drive to partner with other specialists and value-adding players. Partnership is the new leadership. Our recent acquisitions of PWNT, Byosis, Sodai, Aqua-Chem, Flootech and Veolia Mobile Water Services Europe bring a wealth of knowledge and experience, increasing the value of water for our industrial and municipal water solutions.

As these are truly challenging and exciting times, we need everyone's expertise and willingness to successfully close the water loop and collectively contribute to a more sustainable and resilient future.'

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Safety first

Safety lesson examples



Safety lesson 01

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'I don't go down into a trench if it isn't completely safe.'



Safety lesson 02

02

'I always think before I act, even if it means putting an operation on hold.'



Safety lesson 03

03

'I act professionally, sticking to my expertise and calling in other experts whenever necessary.'



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Ready to transform the water sector with #missionwater

From water trends to practical solutions to close the water loop and reduce, remove, reuse and recover

Water is in the core of UN Sustainable development goals

While substantial progress has been made in increasing access to clean drinking water and sanitation, billions of people—mostly in rural areas—still lack these basic services.

Worldwide, one in three people do not have access to safe drinking water, two out of five people do not have a basic hand-washing facility with soap and water, and more than 673 million people still practice open defecation. The UN has therefore a challenging goal: by 2030, achieve universal and equitable access to safe and affordable drinking water for all.

Too many people, industries and ecosystems in our world are facing severe water challenges. In some places there is too much, in others not enough; in some places it is too contaminated to be of use, in others it's transportation is complex.

By taking a deep-dive in the trends we see in the market in combination with practical solutions, we turn severe water challenges into sustainable and profitable business models.

Trend 1: (a door-opener) stringent government regulations to remove pollution

Governments are setting-up more and more regulations to reduce environmental pollution of water.

Practical solution: For those plants which still need to be built, the latest technologies can be applied. However, as many existing water treatment plants already exist, refurbishment is needed in order to comply with new regulations. For decades solutions for pre-treatment and aerobic treatment were commonly accepted. Now new treatment building blocks like anaerobic treatment, membrane technologies and stripping can turn wastewater (which has previously been considered a potential legal and financial challenge) into a real water refinery, energy and recovery facility. By adding intelligence & automation, the performance of the treatment plant can be maximized.



Trend 2: Decentralised solutions to reuse and recover

It has been so common to build centralized treatment plants, that the additional challenges of transporting water back and forth have been taken for granted. With a strong focus on local decentralized solutions, especially for industrial and remote areas, we can develop local water loop infrastructures to be independent from the main water network.

Practical solution: We have seen examples of water reuse stations at industrial sites, but for households and commercial buildings local solutions have not been given proper consideration. Collecting rainwater from the rooftops is the first step to have fresh water available for sanitation. Sanitary water can then be reused within a house or building as toilet water and then be completely refined into clean (reusable) water and green minerals for fertilization.

Trend 3: Water reuse becomes a license to operate, making a difference in water stress zones

There is not a global water shortage as such, but individual countries and regions need to urgently tackle the critical problems presented by water stress. Water has to be treated as a scarce resource, with a far stronger focus on managing demand.

Practical solution: Have you ever considered the limitation of the business growth of your production plant due to water shortage? Unfortunately, this will happen more often in the future and it's better to be prepared. Production and processing plants can consider the use of mobile water solutions to make it flexible for them to relocate their production facilities. At one of the largest meat processing plants in Europe, Nijhuis Saur Industries treats 4000 m³/d into reusable water which is fed back into the processing plant, all certified as drinking water. With solutions like sand filters, ultra-filtration, reverse osmosis and disinfection, the client was able to expand their production, since there was no longer a limitation to their water use for production.

Trend 4: Energy transition, energy savings, reduction of emissions and recovering of resources

It cannot be neglected anymore, the energy transition, the savings on energy and CO₂ emissions. All our industries need to follow this trend and redesign their business model. The water industry can partly help to meet the energy goals.

Practical solution: Wastewater is 'enriched' with resources which can be recovered. It's commonly accepted in the beverage industry to treat wastewater with anaerobic digestion and convert the produced biogas into energy. While aerobic treatment plants where in the past a large energy cost, smart solutions are being implemented to reduce the aeration cost and reduce the CO₂ emissions at the same time. Even for municipal plants, energy savings can be realized if smart monitoring systems are applied on pumps and blowers. Agricultural sectors can reduce emissions by turning manure/digestate into green fertilizers and clean water, avoiding the use and production of chemical fertilizers and creating a regional circular economy of green fertilizers.



Trend 5: Removal of micropollutants and priority substances (API's)

An emerging challenge in industrial and municipal wastewater treatment is the presence of environmentally unfriendly micropollutants. Conventional treatment plants can only partly eliminate these active substances and in some cases, not at all.

Practical solution: With technologies like ozone, activated carbon, UV and sand filters, micropollutants can be removed. However, it's not only the technology which can help to remove these substances. The best method is the removal of micropollutants 'at the source' and at a centralized treatment plant. At the source solutions could be implemented at festivals, households, pharmaceutical plants or hospitals, the latter two of which are hotspots for medical residues.

Trend 6: Close the loop to reduce, remove, reuse and recover by bringing industrial solutions to the water value chain

We live in a trust-based interdependence with the communities, industries and ecosystems around us. Whether you represent a city, municipality or industry, the agricultural sector, environmental, business or consumer interests, we invite you to join us in resetting humanity's relationship with one of our planet's most precious natural resources. A general view on both industrial and municipal water, the treatment lines are deeply connected with each other. However, we have taken a fragmented approach for decades with benefits for one party (industrial or municipal), without looking at the complete picture. This needs to be changed.

Practical solution: The easiest answer is that all parties need start to talk to each other first and understand each other's wishes and needs. In addition, the regional environment needs to be considered individually, whether this is a dry or wet area or if this changes dramatically during the seasons. The water infrastructure is complex, but by giving every party the

responsibility of their own actions, the loop can work. For example, industries can treat their wastewater into reusable process water, the municipality can check if decentralized or centralized wastewater treatment is needed. Agricultural sectors can treat their manure into local green fertilizers and clean water to river or reuse. And finally, households can make an contribution by reducing the use of drinking water for watering their gardens, showering for a maximum of 5 minutes and collecting rainwater with a rain barrel.

Leading from the front: #MissionWater

We have a huge responsibility as Nijhuis Saur Industries to transform our industry, so that we can rapidly transition toward circularity. If we falter, we will be unable to give water the protection and value it needs and deserves. Our 1,000 colleagues at Saur' Industrial Water Solutions in more than 100 countries have the tools and resources they need to make a difference and have commitment from the Group, leading from the front on all water management challenges. Taking action, campaigning and uniting our stakeholders around a shared vision of the true value of water, that is our corporate purpose.

For too long, mankind has treated clean water as an inexhaustible, cheap resource, neglecting its vital worth. With today's rising pressure on the quantity and quality of water, this precious resource is in dire need of revaluing - environmentally, socially, economically, technologically and financially. It's time to turn the tide.

To ensure that water is valued as the revitalizing force it has always been, and to make this value equally accessible to all living beings. We call it Mission Water.

And we invite you to join the movement!

#mission water

Econvert Water & Energy 10-year anniversary

A celebration of successfully applying anaerobic treatment to accelerate the energy transition

Anaerobic treatment is a well-known and proven technology to transfer organic matter into biogas. A perfect example of what nature can teach us to deal with man-made environmental challenges. Econvert Water & Energy was founded in 2012 based on the principle that this beautiful technology should be brought to as many customers as possible, as everyone should be able to benefit from the clear and present advantages: biogas production, small footprint and granular sludge as an asset.

In 2022 Econvert is celebrating its 10th anniversary. A decade of building a business around anaerobic wastewater treatment technology and biogas conditioning equipment. This strong focus enabled the company to grow into an international player with a leading position in, for example, the Pulp & Paper industry. Nowadays the company is known for its straightforward approach, in-depth knowledge and flexibility.

GM Ids Auke Boersma: "Looking back on this first decade I can only be very grateful towards the founders of the company. It has been a fantastic and successful journey. Under the umbrella of Nijhuis Saur Industries, Econvert now further expands its activities globally. Whilst preserving what makes us successful already, the international network of NSI enables even more customers to join Econvert on its #Missionwater. A second prosperous decade lies in front of us."

Latest project highlights

Paper mill Germany

Just at the year-end of 2021, Econvert was awarded the largest project in the company's history from a well-known paper mill in Germany. The scheduled paper grade change within their production, triggered the investment in an extension of the existing effluent treatment facility. Econvert was selected for its high-tech solution as well as a cooperative and flexible approach in the bidding stage. Not only will Econvert supply the technology for the full-scale solution, also the immediate need for additional capacity was fulfilled by renting out two Econvert-EGSB[®] ECO reactors and an Econvert-Dsulph[®] RTF.

Provided solutions: 4 * Econvert-IR[®]07330, Econvert-Dsulph[®]1.4-40, Pre-acidification, Biogas flare, Biogas buffer, Biogas blower, Biogas cooler and 8 * hyperboloid aeration system.
Provided mobile water solutions: 2* Econvert-EGSB[®]ECO, Econvert-Dsulph[®]RTF



Econvert proudly launches the Econvert-Dsulph®RTF at IFAT 2022

New to the anaerobic portfolio of Nijhuis Saur Industries is the Econvert-Dsulph®RTF. This inhouse development by Econvert is a regenerating trickling filter created to remove H₂S from biogas. Characterized by the fact that this trickling filter will not clog, it is possible to increase the volumetric loading rate about four times. By doing so, biogas desulphurization is brought to the next level.

Long running field tests in 2021 have proven the expected removal efficiency of over 99,5% and the volumetric loading rate of up to 4 kg S/m³ reactor volume per day. With H₂S concentrations of far over 10,000 ppm, the conventional trickling filters would run into clogging problems on at least an annual basis. Econvert-Dsulph®RTF is now ready for market and the first application is up and running at a paper mill in Germany.

Adding this new technology to the range strengthens the position of Econvert as Technology Excellence for anaerobic technology and biogas treatment.

Project example : Biorefinery Germany

Implementation is at full speed at a large effluent treatment plant in Germany. This industrial park management company is preparing for the effluent of a biorefinery under construction. This project fits into the Blue Green infrastructure portfolio of NSI, in which the Group enables customers in biorefinery/biofuels to comply with legislation in the most environmentally friendly way.

Provided solutions: 3 * Econvert-EGSB®10018, Anaerobic granular sludge storage, Biogas gravel filter, Condensate pit, Biogas buffer 1.250 m³ and Biogas

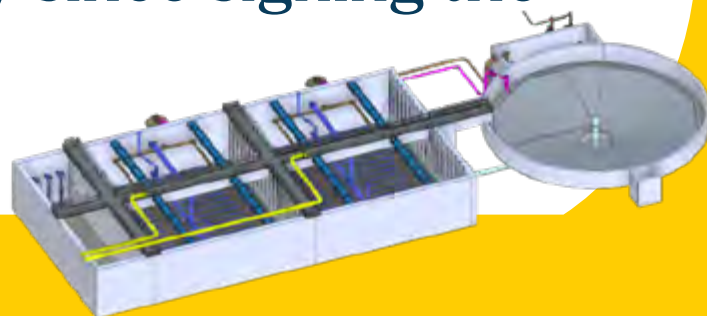
S&D Manager Benno Koopmans: "For years we have seen customers struggling with finding the right technology to solve biogas desulphurization issues. The Econvert-Dsulph®RTF solves clogging issues, developed based on the solid and robust Econvert desulphurization treatment philosophy, where conventional trickling filters cannot. Tackling H₂S concentrations in a solid system of over 10,000 ppm is a real gamechanger".

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NSI and Royal HaskoningDHV are joining forces for the first industrial project with NEREDA® technology since signing the licensed partnership



On November 2nd, 2021, Nijhuis Saur Industries announced a new partnership with Royal Haskoning-DHV for the award-winning Nereda® Technology. Through this collaboration, NSI became a licensed partner of Nereda® Technology for the industrial market. This strategic partnership ensures that we can offer our customers another proven and robust biological treatment solution which significantly reduces footprint, energy and chemical consumption, to ultimately lower the overall OPEX and CAPEX. The system is a perfect fit for existing (retrofit) plants as well as greenfield project opportunities.

We are very pleased to announce the first joint Nijhuis Nereda team project for our client ARASCO Industries to upgrade their wastewater treatment plant. This project will ensure the wastewater treatment plant's capacity to cover the expected increase in production in the coming years.

ARASCO Industries is a leading food manufacturer in the Kingdom of Saudi Arabia. The production of high-quality poultry is a large part of their complete offering, making them one of the fastest growing producers in Saudi Arabia. The company expects the processing capacity in their poultry slaughterhouse in Riyadh to double to 500.000 birds per day in the coming years, which gradually increases the wastewater volume to an estimated 4.700 cubic meter per day.

The current capacity of 3.200 cubic meter per day is, therefore, no longer sufficient and expansion is much needed. ARASCO Industries is focusing on a solution

with maximum reuse of the existing concrete tanks and minimum additional civil constructions, which results in significantly lower investment costs. Additionally, one of the customer's goals is to become the country's main facilitator of the environmentally friendly food supply chain. Therefore, it is essential that the proposed solution is focused on both water and energy efficiency. After an in-depth technical study including a site survey and evaluating different options, the best possible technical approach was selected. It comprises of an additional pre-treatment system, including chemical dosing which reduces chemical consumption by around 50%. At the same time, the existing biological system will be converted into a Nereda® system, reusing the existing infrastructure.

Introducing Nereda® technology as an alternative to the traditional expansion of the biological step, was one of the key reasons that ARASCO awarded us the contract. This compact advanced biological system purifies the water, using the unique features of the aerobic granular biomass. These unique process features result in high energy savings and a compact, easy to operate installation, allowing for minimal civil works.

"The results of the unique collaboration between Nijhuis Saur Industries and Royal Haskoning DHV will decrease the plant's footprint by up to 4 times. This contributes perfectly to our customers comprehensive sustainability goals and marks the first combined Nijhuis-Nereda projects in the industrial space"

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Energy recovery from biogas and water recycling in the industry

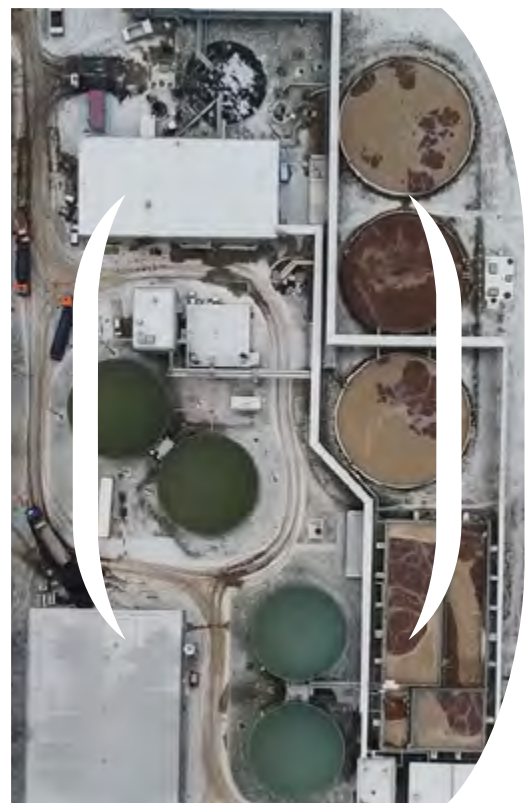
“The more companies that decide to use innovative solutions, the more universal they become”.

Our systems are a real support in achieving goals related to increasing production. After a significant increase in production, a Polish poultry slaughterhouse achieved their goals of sustainable development by investing in additions to the existing system of energy recovery from biogas in the installation of recycling and reuse of treated sewage. Due to the drastic limitations of freshwater resources, the possibility of expanding the plant’s production had previously been inhibited. The use of treated water from sewage has become an interesting solution, enabling the further development of the company. Thanks to the cooperation with Nijhuis Saur Industries, this highly efficient water recovery plant has been operating since the beginning of 2020.

Biogas plant and industrial water reuse.

One of the flagship solutions of Nijhuis Saur Industries is the installation for the treatment of sludge and slaughterhouse waste for biogas production. The biogas, produced in five fermentation tanks, is purified to a standard that makes it viable for energy production. The specially designed desulphurization units and gas scrubbers, installed within the fermentation chambers, ensure a high-quality gas, with a methane content of over 70%. This solution provides a number of benefits, including on-site waste and sludge treatment, avoiding the need to transport waste to dedicated storage sites, leading to lower costs and reduced environmental impact. Additionally, a natural fertilizer is obtained, enriched with minerals.

From 2020, another sustainability goal was implemented, which is to treat wastewater from a biological treatment plant to drinking water standards (with a drinking water certificate), which allows it to be reused for production purposes, leading to a significant reduction in water abstraction from external intakes and significant cost reduction.



From the Sewage Treatment Plant to the Resource Recovery Center in 10 years

In 2009, the chicken slaughter and meat cutting company partnered with Nijhuis Saur Industries on the first phase of a sustainable wastewater treatment and waste management project. The project involved treating production and treatment plant wastewater using pre-treatment technologies (including dissolved air flotation), aerobic biological treatment and a sewage sludge fermentation process.

At this stage, the objectives of the investment were to eliminate additional costs, to treat sewage to an acceptable level for discharge to the environment, recover as much biogas as possible from biological sludge and the chemical pretreatment process and finally, dewatering the digested sludge to reduce the costs of waste transport. In 2013, after the completion of the first phase of the investment, the plant developed rapidly.

In the years 2016 - 2019, thanks to the increase in the efficiency of the preliminary treatment system (using intelligent control of chemical reagent dosing) and the expansion of oxygen and fermentation technology (phases 2, 3 and 4), it was possible to treat the additional amount of wastewater from the increased production. In the third phase of the investment, a special, innovative stage of wastewater treatment was added, which uses the technology of high-efficiency nitrogen removal to purify the filtrate from the fermented sludge dewatering. Treatment of the filtrate from sludge dewatering, drastically reduces the nitrogen level, and so this water can be reused in the wastewater treatment process, which reduces the amount of fresh water taken in.



Water Recycle - "Water licensed to operate".

The increasing risk of insufficient groundwater in the future prompted the company in 2018 to consider investing in a water return and reuse system. Groundwater is used as process- and washing water for all production lines of the poultry slaughter and meat cutting plants. Along with the ongoing development of the plant, additional production lines will be installed, which will further increase the demand for water and raise the costs of obtaining it. The water management situation in the plant and the need for further development were the main reasons for choosing the most economical and business-related project to reuse the water recovered from wastewater up to drinking water standards.

Safe water recycling, up to 60% reduction in water consumption

The water recycle station became one of the flagship water recycling and reuse facilities. Nijhuis Saur Industries engineers installed a modern water reuse system in 2019, which will allow the company to reduce the water footprint by up to 60%, which is a real breakthrough in the global meat industry.

Over 4000 m³ of wastewater is today not any longer discharged to the nearby river but being recycled as drinking water to support the production requirements of one of the largest slaughterhouses in the world.

The concept of a water return system for the technological needs of the plant

The water return system consists of a sand filter, ultrafiltration system, reverse osmosis system and disinfection system. Each stage is designed to clean the wastewater more thoroughly - the sand filter is responsible for removing the total suspended solids, the ultrafiltration system (UF) removes bacteria and viruses, the reverse osmosis (RO) system eliminates dissolved substances, and the final disinfection uses the strong oxidizing and disinfecting properties of hypochlorite. The purified water goes to the storage tank as "certified drinking water" and is used in the production plant.



Experience gained and lessons learned

With the commissioning of the water recycling system, Nijhuis Saur Industries started to analyze the various project stages. Apart from the financial benefits for the plant, related to the reduction of the costs of water and wastewater management, the greatest success of the installation is the change of the way of thinking about water - from "waste" to "valuable resource". The on-site wastewater treatment plant is no longer a source of sewage discharged into the river, but an installation for the production of clean production water. As any fault in the plant can immediately affect the production of the plant's water, extraordinary safety measures have been implemented. For the process re-use of water from treatment plants, the Nijhuis Saur Industries installation was the first in Poland to obtain a drinking water certificate.

The plant operators have been trained to ensure that the wastewater treatment plant and the recycling system remain in optimal technical condition, operating as one system. At present, companies from all over the world are sending inquiries about the possibility of a reference visit and learning about the details of water recycling installations, which proves the growing interest in this solution.

The benefits of recycling water in the meat, food and beverage industries worldwide

Meat processing plants use significant amounts of water to process meat into ready-to-consume food products. The required action under stringent food safety regulations, combined with the potentially catastrophic consequences of food poisoning, mean that a large amount of water is used to clean and sanitize production lines. Recycling and reusing water from wastewater treatment plants is becoming a "license to operate" - more and more companies are deciding to expand their production facilities. Industrial plants need more and more water for production. If insufficient water can be secured, the reuse of water is one of the most effective and sustainable solutions. Hence why water recycling is becoming a new standard and common practice in the meat processing, food and beverage industry, especially in areas vulnerable for climate change and drought.



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The production of process water in the plant is the key to production expansion and further development

L'Oréal Warsaw Plant Water Recycling Station winner of the Global Water Awards 2021

A joint success for L'Oréal and Nijhuis Saur Industries

A water recycling project for one of L'Oréal's biggest factories is completely unique - proving that we already have a real influence on the environment and building a more sustainable future. The innovative project, carried out jointly by L'Oréal and Nijhuis Saur Industries, has been recognized internationally. On June 2, 2021, the L'Oréal Warsaw Plant Water Recycling Station won the top prize in the prestigious Global Water Awards, in the Industrial Project of the Year category.

The Global Water Awards have been presented by Global Water Intelligence since 2006.

Winners are water, wastewater and desalination companies and projects that contribute to the industry by increasing operational efficiency, implementing innovative technologies and introducing sustainable financial models. Commissioned in 2020, the plant was recognized as the most impressive technical and environmental achievement in industrial water and wastewater.



Project genesis

In 2013, L'Oréal announced the Sharing Beauty with All campaign. As part of this program, environmental targets were set in relation to the factory's 2005 footprint. By the end of 2020, the program aimed to achieve the following targets: a 60% reduction in water consumption, a 60% reduction in waste output and a 60% reduction in CO2 emissions. Water management programs have been carried out at the plant near Warsaw, including modernization of the washing and disinfection systems and water recycling in various loops.

Nijhuis Saur Industries was invited to discuss the possibility of recovering water from the plant for coproduction processes. In 2016, it was decided to conduct a pilot study to determine the parameters of the recovered water and the possibility of its use. The pilot station consisted of three containers, housing: 1. physical and chemical pretreatment, 2. a biological tank with MBR membranes, and 3. a reverse osmosis (RO) system. For each stage, research was conducted, and operating parameters were adjusted to optimize each of them. The final result needed to be clean water which could be reused as process water. The promising results influenced L'Oréal's decision to partner with Nijhuis Saur Industries to build a full-scale Water Recycling Station.

Technological solutions and project implementation

The technology designed by Nijhuis Saur Industries at the contract stage, and the specified design assumptions were verified through tests carried out at the pilot station. It was essential for the project to have continuous access to water, therefore particular emphasis was put on eliminating potential risks and ensuring stable operation of the installation, and safety of the process. Nijhuis Saur Industries completed the design and build project including the commissioning of the plant and preparation of the Recycling Station for trouble free operation. White walls and a glass façade make the project an integral part of the factory and perfectly fit into the aesthetics of the Warsaw agglomeration.

3D design technology was used in order to streamline the project implementation, facilitate communication and to enable better visualization of the plant and processes.

Commissioned in March 2020, the Water Recycling Station has saved nearly 15% of the water used in the factory and significantly contributed to nearly 50% water reduction compared to 2005 figures. The recycled water is used to clean production tools and in additional co-production processes such as cooling. Today, the L'Oréal team operates the plant with the support of experienced Nijhuis process engineers.



L'Oréal and Nijhuis Saur Industries worked in partnership to develop the project with external experts at all stages, including health and safety, construction and installation. Nijhuis Saur Industries carried out all the turnkey works as a consultant, designer, technology provider and general contractor for construction and supervision. The designed technological solution uses equipment mostly produced by Nijhuis Saur Industries and smaller equipment provided by our supplier.

The Water Recycling Station recycles approximately 3,500 m³ of water per month, reducing mains water consumption by the equivalent of 7,000,000 half-litre water bottles.

The plant proves that the environmental impact associated with cosmetics production can be significantly reduced. The plant achieves both economic and environmental benefits by minimizing chemical use, reducing the associated costs and saving energy. The fully automated systems reduce maintenance effort and time.

The biggest challenge for water recovery is the high chloride concentration from the production processes, water treatment for production (ion exchange columns) and wastewater treatment processes. Nijhuis has solved this problem using several systems; online monitoring of chloride in the inflow and outflow of the plant, which allows correct regulation of the recovery rate, and the i-DOSE system, which selects the lowest possible reactant dosage for chemical pre-treatment of the wastewater. Nijhuis technologists also took part in an audit of the L'Oréal plant, highlighting where process optimization can effectively improve the quality of the wastewater produced. The Nijhuis i-DOSE intelligent chemical dosing system used is a unique feature of the plant. The i-DOSE uses real-time analysis of multiple effluent quality parameters to adjust reagent consumption to the current contaminant load and actual process demand. Through this optimization, the i-DOSE system reduces reagent consumption and increases the efficiency of the water recovery system by reducing the dosage of chloride coagulant.

The Water Recycling Station consists of the following processes:

The separation of large solids is carried out on a drum sieve. Solid particles with a diameter larger than the holes in the drum are retained inside the screen and transported to the screenings container. To ensure a consistent and controlled inflow to the water recycling facility, wastewater is collected in two balance tanks. These tanks are filled and emptied alternately. The balanced effluent is pumped to a physico-chemical pretreatment stage using a flocculation and flotation plant.

The reactants are dosed into a tubular flocculator which is equipped with static mixing elements. These allow for thorough mixing of the reactants with the wastewater and, as a result, optimization of the dosing process.



In addition, an intelligent i-DOSE measurement system based on flow, pH and contamination level measurements is used for better process control, this regulates the amount of dosed reagents according to the current needs.

Wastewater from the flocculator flows into the flotation tank. Flocs of sludge are lifted towards the surface (flotation) and then scraped into the sludge compartment and pumped into the sludge tank. The built-in carbonation system has patented, non-clogging carbonation nozzles which create very fine air bubbles that lift the sludge towards the surface. Wastewater is then directed to a separate tank within the aeration tank - the selector, which stimulates proper development of microorganisms and helps to maintain the amount of filamentous bacteria in the activated sludge at a sufficiently low level. Aerobic wastewater treatment with activated sludge takes place in a biological tank. Microorganisms decompose organic compounds present in wastewater into carbon dioxide, water, and new activated sludge.

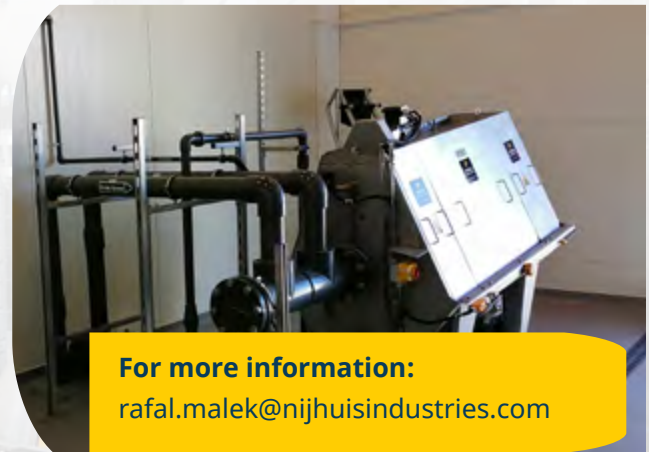
The plant effluent is generated by a membrane plant. Activated sludge is separated from the liquid phase in the ultrafiltration process. The sludge is returned to the biological tank and the filtrate is directed to a retention tank for the water after ultrafiltration, from where it is further directed to the reverse osmosis process. Reverse osmosis is a membrane process that separates dissolved compounds (ions) from water. The permeate after reverse osmosis is directed to a clean water tank, from here it is distributed to different areas of the L'Oréal plant as tap water.

RO concentrate is directed to the municipal sewage system. The sludge produced in the treatment process (chemical sludge from the pretreatment and excess biological sludge from the biological treatment) is directed to a screw and roller press. The plant operates continuously, is fully automated and is characterized by low energy consumption. The collected sludge is disposed of by an external specialist company. The decision to build the Water Recycling Station did not result from the need to meet environmental standards or the applicable law, nor was it the result of a cold financial analysis focused on a quick return of the incurred costs. The original purpose of the investment was to show the direction in which L'Oréal wants to

take its business - to reduce its negative impact on the environment and to pave the way for other industries in Poland.

The mutual trust and full commitment of L'Oréal and the Nijhuis Saur Industries team in the Water Recycling Station project is an example of a partnership that goes beyond a sale and purchase agreement.

The combined strengths of the two teams have made this project a global success, proving that we can already make a real impact on the environment through our actions and decisions, and build together a vision of a sustainable future , a nice example of our #MissionWater.



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Unidro awarded multiple large orders on giant LNG project in the Middle East

A joint venture has awarded Unidro the water treatment packages for a LNG project in the Middle-East. The project includes four new LNG trains, each with a capacity of 8 million tonnes per annum (MTPA) of Liquefied Natural Gas ("LNG").

In order to meet the very strict process performances, and comply with a set of extremely demanding quality and supply requirements, Unidro was selected as being the most reliable and experienced partner to design, engineer, manufacture and supply the integrated water treatment packages.

The solution:

an integrated water treatment package
The selected design consists of treating several water streams such as:

- + Sanitary Water Treatment Package, based on MBR technology.
- + Wastewater Filtration Package, including media and cartridge filters plus back wash wastewater thickening and dehydration.
- + Oily Water Treatment Package, to remove dispersed oil from a waste effluent stream.
- + Condensate Polisher and Carbon Filters Package, including two large trains of Mixed Bed exchangers and Activated Carbon Filters
- + CT Side Stream Filters, including 4 trains of pressure filters with capacity of almost 5000 m³/h each.

A strong, experienced and reliable partner

Francesco Riva, CEO of Unidro: "For over 20 years Unidro successfully delivered similar (waste)water systems, through the same contracting entity and for the same end user. Our experience and ability to deliver tailor-made solutions, together with the inhouse engineering and manufacturing capabilities, were some of the key factors in the decision by the client to select Unidro as their partner of choice for such a large and critical project scope."

We are very proud to have been awarded this important project, which is a great achievement of the whole team involved in the extensive and detailed proposal preparation process.

Unidro has carefully evaluated and placed the necessary resources for the execution of such an important project, to be completed on time and in full compliance with the customer's requirements. In addition, this project is a great example of our #MissionWater purpose, valuing the importance of sustainable water use, energy and resource recovery with all different stakeholders, to secure a smooth operation of the largest LNG production facility in the world and anticipating on the fast growing demand for renewable energy."

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Nitrogen Recovery solutions

Applying proven nitrogen recovery solutions for industrial and municipal sectors.

In the wake of ever-increasing costs, changing regulations around fertilizer use and tighter restrictions on Nitrogen and Nitrous Oxide levels, nutrient removal and recovery, especially Nitrogen is high on the list of priorities for industry and municipalities alike. Particularly when considering that around 2.5% of the global Natural Gas consumption is used to convert Nitrogen in air into Ammonia for artificial fertilizers.

One of the biggest concerns for Municipalities in particular is Nitrous oxide – or ‘laughing gas’, a harmful greenhouse gas which is the third biggest compound of concern behind Carbon Dioxide and Methane. It is also the largest human related threat to the ozone layer.

Seeking to rise to these challenges, Byosis have developed advanced, specially designed technologies to handle removal of Ammonia from heavily polluted streams such as digestate and industrial wastewater using minimal heat consumption and little to no chemical agents. Using this low energy economic method, they have seen impressive removal rates whilst also reducing the Carbon Footprint of the systems, setting them apart from traditional technologies.

Byosis stands for practical, feasible and customer specific solutions. Whether the input material is crops, agricultural residues, industrial waste, green waste, sludge, municipal waste or highly contaminated wastewater, Byosis offers solutions to recover the nutrients, remove ammonia and significantly improve the efficiency and capacity of your process.



Why applying innovative stripping technology over conventional stripping technology?

- No pre-filtration required, and in some circumstances no separation required
- No chemicals necessary to increase pH in the majority of systems
- Very low off gas bleed stream with low loads.
- Very low energy consumption
- Heat recovery

Benefits of renewable fertilizers / products:

- Production of ammonium sulphate and ammonium nitrate as replacement of artificial fertilizers
- Production of ammonia water (up to 20%). Once concentrated ammonia has been produced, it can be applied for many purposes such as the production of an ABC (ammonium bicarbonate)-solution, to replace urea of a DeNOx-installation and for other N-containing fertilizer products.
- Difficulties with the seasonal sales of Ammonium Sulphate Liquid can be avoided by producing Ammonium Nitrate Liquid or a blend of the 2, the so-called Ammonium Sulphate Saltpeter Solution. CAPEX and OPEX benefits:
 - The Byosis 'ByoFlex®' systems is competitive vs traditional technologies like Anammox, MBR with:
 - OPEX costs range from 0,15 to 1 €/kg N removed
 - TOTEX cost varies between 1-2 €/m3 throughput
 - The Byosis 'ByoNix®:' systems is competitive vs conventional technology depending on local availability of utilities and desired products.

Advantages over biological treatment; MBR-RO / nitrification-denitrification / anammox:

- Carbon footprint: Ammonia recovery is far more energy efficient than traditional processes.
- Potential revenue with production of high-quality liquid fertilizers: ammonium sulfate or ammonium nitrate.
- Simple physical process: more flexible than complex biological systems and less sensitive to fluctuations in load.
- Compact design, easy to operate and reliable equipment
- No need for an expensive carbon-source (with aerobic bacteria)
- No risk of legionella formation and exposure.
- Prevention or significant reduction of nitrous oxide emissions

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Project Example

Integrating ammonia stripping into a sewage treatment plant

Byosis has many success stories using these robust systems to help their clients. One such example is for their client Zwar.

The challenge

The effluent from the sludge digester of the new Bergen auf Rügen, Germany sewage sludge treatment plant created a major load on the existing biological water treatment plant. Instead of a traditional anammox system Byosis offered an alternative solution by integrating the ByoFlex® ammonia stripper.

Our approach

By removing and converting the ammonium from the effluent of the digester with the ByoFlex® technology, the existing nitrification and denitrification installation feedstock has over 80% less ammonia. This is especially valuable in summer when the loads are extra high during the tourist season.

The system is extremely flexible and is easy to start up and shut down. When the excess nitrogen load is low (e.g. in winter) the throughput or efficiency can be reduced or bypassed (full shutdown), but the system is readily available on demand and back to full capacity in less than an hour.

The results

The installation reduced the nitrogen load of the biological treatment. Additionally, this created a valuable circular process. The recovered nitrogen is, as ammonium sulphate, reused by the farmers on the island as a fertilizer. This provides a green, renewable fertilizer and has led to a significant reduction of the use of artificial fertilizers on the island.

- Specifications and features
- 5-7 m³/hr system ByoFlex® system.
- Built in prefab skids which form a closed building.
- Minimal heat requirement due to heat recovery.
- No addition of alkaline agent.
- >80% less nitrogen load on the biological treatment.
- Production of a high value fertilizer for local farmers.
- Significant reduction of the carbon footprint of the overall process.



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Construction of first Closed Loop Concept (CLC) in full swing at a new-build residential area in the Netherlands

The first application of the CLC is currently being constructed in a new-build residential area in the town of Silvolde, the Netherlands. It is one of the solutions implemented to reduce the impact of the local drought but also adapts to periods of heavy rainfall to reduce the potential risk of flooding from the nearby sewer. Rainwater is collected from the roofs, treated by sand filtration, ultrafiltration and UV, and supplied as drinking water. For 13 houses around 2.4 m³/d greywater will be treated in innovative units and supplied as water for washing machines and toilets. Around 2.5 m³/d of black water will be treated by filters and evaporation and permeated into the ground after reverse osmosis treatment. The filter cake will be treated into compost. The project is a showcase for optimization and testing, embracing sewage-less systems and H₂O neutral residential areas.

After winning the first-ever Aquatech Community Award, Peter Scheer, Business Development Manager at Nijhuis Saur Industries and CEO Semilla Sanitation, mentioned: "The award is an important recognition and a wake-up call for water-related challenges. Nowadays, the world is facing extreme drought, but on the other side extreme rainfalls. Our dream was to make our villages and cities water-neutral and sewage-less, to cope with these challenges based on space technology! Therefore, we have designed the first-ever Closed Loop Concept in the Netherlands. This concept consists of harvesting rainwater, buffering it locally, reusing it twice, and then permeating it into the ground. In this way, we fight local drought and adapt to heavy rainfall."

A special thanks to our partners

Nijhuis Saur Industries & Semilla Sanitation would like to thank the following companies and organisations for their trust and confidence in our partnership to realise closed loop concept in Silvolde: Wonion, Gemeente Oude IJsselstreek, Vitens, Waterschap Rijn en IJssel, Jotem Waterbehandeling, 8RHK ambassadeurs, Hydraloop, Provincie Gelderland en Wassink Installatie.



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A tip from Peter Scheer: "Closed loop concepts are not only applicable to houses. Festivals can reduce their impact on the water quantity and quality as well. The water can be reused as flush water for the toilets, reduce drinking water and treat medical residues. "

Thirsty?

Take a look at high-quality drinking water treatment solutions.

Meet the experienced PWNT team

Drinking water: For many people this is commonly available from the kitchen tap or for industrial process use. However, always providing the high-quality drinking water output is more challenging than you think.

PWNT provides innovative water treatment technologies for clients who require high quality drinking water output with low long-term operating costs. PWNT, meaning “Pure Water & Nature Technologies” developed efficient and sustainable solutions in water treatment based on suspended ion exchange (SIX®), In-Line Coagulation (ILCA®), ceramic membrane applications (CeraMac®) and advanced oxidation applications that can be used for a wide variety of water sources as integration into drinking water plants.

These solutions offer lower life-cycle costs, greater efficiency and much lower environmental impact.



Discover the global success stories:

SIX® and CeraMac®

PWN, Andijk III, The Netherlands



The Andijk III plant in the Netherlands includes PWN's SIX® (suspended ion exchange) and CeraMac® (ceramic membrane filtration process). It produces water of a high quality with low environmental impact and energy consumption.

Andijk III has a design capacity of 120 MLD (32 MGD). SIX® removes dissolved organic substances, as well as other anions, like nitrate and sulphate if present. Resin is in contact with the water for about 30 minutes before being regenerated.

SIX®-treated water then passes through the ceramic membranes, which serve as the main filtration barrier. All particles larger than 1/10,000th of a millimeter are removed. The treated water may still contain hazardous substances, such as pesticides, viruses or drug residues. That is why advanced oxidation is used after the CeraMac® process, which uses a combination of UV and hydrogen peroxide to render these substances harmless.

The clarity of water is increased thanks to SIX® and CeraMac®, and considerably less energy is required for UV treatment. Finally, an active carbon filter removes the remaining substances from the water, making it fit for consumption.

CeraMac® with Ozone

PUB, Choa Chu Kang WTW, Singapore

The Choa Chu Kang Waterworks (CCKWW) in Singapore has been in operation since June 2018. It is currently the largest ceramic membrane plant for drinking water treatment in the world. This plant was designed after an 18-month demonstration-scale study, where ozone was continuously applied to the membrane. The full-scale facilities include 12 CeraMac® vessels, each with 90 membranes. Ozone is applied to clarified water just upstream of the membranes, and this helps to achieve an extraordinarily stable operation at fluxes as high as 360 LMH (212 GFD). This plant has a design capacity of 180 MLD (47.6 MGD).



SIX®, ILCA®, and CeraMac®

South West Water, Mayflower WTW United Kingdom

After a successful pilot, SWW installed SIX®, in-line coagulation and adsorption (ILCA®), and CeraMac® microfiltration in their new 90 MLD (23.8 MGD) Mayflower water treatment works (WTW). With three source waters, the main challenges included varying and sometimes high levels of dissolved organics, along with the potential for high disinfection byproducts in the distribution system. This plant has been in service since 2020. The plant includes two trains of SIX® and ILCA®, and ten CeraMac® vessels, each with 90 membranes, all of which were installed in a compact layout.

CeraMac® with Ozone ewl energie wasser luzern, Switzerland

This 30 MLD (8 MGD) facility treats mountain spring water with ozone followed by three CeraMac® vessels, each with 37 membranes. The ozone pretreatment helps to achieve a sustainable high flux. This plant has been in operation since 19 October 2018.

Full-scale ozone installation at sewage treatment plant Houten in the Netherlands

How Nijhuis Saur Industries tackles the challenge in new projects caused by new bromate regulations.

In the Nijhuis Saur Industries News edition of July 2021 an article was presented on the first full-scale ozone installation at STWP Houten. After successfully completing the engineering phase with our partners Pannekoek GWW (civil) and Witteveen+Bos for our customer, water authority 'Hoogheemraadschap De Stichtse Rijnlanden' (HDSR), is now developing to the next stage.

The Dutch Houten wastewater treatment plant emerged as a national hotspot from analysis of all WWTP's in the field of medicine residues in wastewater. That is why the Nijhuis Saur Industries ozone technology will be delivered to the Houten WWTP, for the additional removal of medical residues. The ozone installation reduces the quantity of medical residues that end up in the environment. The purified water from Houten effects the drinking water intake in the 'Lek' Canal. The removal of additional medical residues has a positive effect on the quality of the drinking water source.

During the start of the realization, the project team were invited on site for a ceremony to mark the commencement of the work. It was during this ceremony, that many of the project team members from Nijhuis Saur Industries, our partners and the customer met in real life for the first time. Despite working online during the engineering phase, due to the covid-19 restrictions, we have managed to successfully deliver the design.

The realization of the full-scale ozone installation started in September 2021 and currently NSI is testing and commissioning the installation.





Medical residues removal is on top of Dutch water authorities' agendas

In the Netherlands, traditionally municipal contracts were awarded based on a design made by the customer and engineering companies. Recently there has been a shift in this approach, moving towards a tender process. Tendering of "Construction Teams" is becoming more common, especially when new and more complex technology is required for additional treatment of municipal wastewater. Like the previous ozone project for SWTP Houten, a construction team tender consists of a 2-phase contract. With this type of contract, the customer wants all the relevant parties at the table to make the final design. In general, the customer wants to deal with the EPC contractor, engineering company and technological companies all at once.



Advantages of the new tendering process:

- In a successful Construction Team, a design can be made in a shorter time (no preliminary phase with only the engineering company).
- Risks can be allocated at the party that can control the risk the best. The traditional way of tendering will normally allocate it all at the EPC contractor.
- Providing process guarantees are easier for the technological company when involved early in the design phase.
- All the required knowledge and practical experience is at the table during the design phase, provided by both the engineering companies and the technological companies. This provides all relevant information, not only for the design but also for the operational and maintenance period after realization.
- Budget estimations and updates are more accurate since the companies that will do the realization are involved.

Based on this approach, Nijhuis Saur Industries is becoming a partner of choice for micropollutants removal installations in the Europe.

After realization of the first 2 projects (PACAS treatment at STWP Leiden-Noord and the ozone installation at SWTP Houten) more projects have been awarded to Nijhuis Saur Industries in the Netherlands for the removal of micropollutants.

1. NSI has been awarded the project for STWP Winterswijk (~860 m³/h – 6 kg O₃/h) last year, together with CLC Water (Combination Local Circular Water), a partnership between ADS Group, NSI, Witteveen+Bos, Pannekoek GWW and Moekotte.
2. Most recently we have been awarded the project for Water authority, Waterschap de Dommel for 2 ozone installations: SWTP Hapert (~650 m³/h – 4.5 kg O₃/h) and SWTP Soerendonk (~310 m³/h – 2.5 kg O₃/h).
3. In March NSI was granted the project for STWP Dinther (~300 m³/h – 4 kg O₃/h). Together with GMB as a civil partner we will design and build both a PACAS and a DEMO Ozone oxidation installation.

Reasons Nijhuis Saur Industries were chosen to realize micropollutants removal solutions:

- Modular and flexible design
- Data and in-depth process understanding from research and laboratory support
- Effective bromate management strategy
- Providing O&M services during different phases of the project
- Offering ozone rental solutions like at the Demo at Dinther
- Choosing solid and experienced project partners

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New Bromate regulation

Recently a new bromate norm of $<1 \mu\text{g/l}$ has been issued by the Dutch Government for discharge of surface water. In comparison to for example the regulations in Germany ($< 10 \mu\text{g/l}$), this is much lower. Bromate is an oxidation product of bromide that can be formed by ozone under certain conditions. The limit for drinking water intake from surface water is $< 1 \mu\text{g/l}$ and this limit has been applied to ozonation of municipal wastewater. The timing of the new regulation is precarious since it may have a direct effect on the technology selection for medicine removal.

Since there was no regulation before, the previous research container detection limits for bromate were < 5 or $10 \mu\text{g/l}$. Whilst most of the research showed there are perfectly adequate ways of controlling bromate formation to under the detection limit, the new regulation of $< 1 \mu\text{g/l}$ created a blind spot. When the result of an ozone oxidation installation is below the detection limit of $5 \mu\text{g/l}$, this could be anywhere in the range of $< 1 \mu\text{g/l}$ to $4 \mu\text{g/l}$.

Since the announcement of the new bromate norm, laboratories have developed more accurate methods of

analysis, detecting up to $< 0.1 \mu\text{g/l}$ of bromate. All of the above-mentioned project designs have to comply to this new bromate norm.

There are known ways of controlling or reducing bromate formation. The most important of which is to prevent overdosing of ozone to $< 0.6 \text{ g O}_3/\text{g DOC}$. By applying smart controls and a smart CFD modelled reactor design, this can already be avoided. In specific circumstances, where municipal effluent contains higher concentrations of bromide, other measures can be taken.

Lowering the dosing of ozone is the most effective method, by combining ozone and activated carbon. Another way of reducing bromate formation is to use AOP, adding hydrogen peroxide after ozonation. This effectively reduces or stops the reaction of bromide to bromate.

Thanks to the extensive R&D efforts supported by ongoing testing both at our laboratory and full-scale pilots, we proof the clients and regulators the effectiveness of our smart bromate management strategy and support the implementation of the most stringent bromate regulation in Europe.



New monitoring study shows big blower savings for UK's largest water and wastewater company

Following a highly detailed study with its proven monitoring equipment, optimisation experts Riventa has identified annual savings of £218,000 (€260,000) for nine blowers that serve aeration lanes for Thames Water in England, UK.

The Thames wastewater treatment works (WWTW) operates in tandem with another site (typically 32-35 MLD), as it takes the residual load within the catchment. As a result, there is a broad operating range, for which the aeration requirements need significant flexibility in blower output. There are 20 aeration lanes (numbered 3 - 23) in use and seven operational blowers that serve a common header that supply them with air.

Results

All available blowers ran during the course of the logging period, with a wide range of operating flow rates required (20,000-90,000 Am³/h), producing the need for solo operation to all seven blowers in parallel.

For 59% of the time, the blowers operate at more than 73% efficiency. The rest of the time is spent at efficiencies below 72%. This time includes operation during disruptive periods when there are planned change-overs from grid power supply to onsite generation. This shows that the site's control of the process is relatively robust, with limited impact on overall average aeration performance. Interestingly, it is noticeable that when there is a reduction in efficiency, it coincides with the removal of one of the HV blowers from operation.

▼ For 59% of the time, the blowers operate at more than 73% efficiency. The rest of the time is spent at efficiencies below 72% ▼

The electrical power for each unit of air or oxygen supplied to the aeration lanes has an average requirement of 0.018 kWh/Am³ or 61.9 kWh/TO₂ (equivalent to £6.81/TO₂). As air demand increases, so does the cost of oxygen supplied. Moving from the average flow of 18.5 TO₂/hr at 62 kWh/TO₂ to the most common operating conditions between 6 and 7 blowers operating (22 TO₂/hr), there is an increase in specific power of 3.2%.

With clean lanes and new diffuser heads it would be expected that the mass of oxygen should reduce (for the same average biological load) as the oxygen transfer rate (OTR) increases through better bubble formation and distribution. It should be noted that OTR is related to the area of the interface between the liquid and the air. Smaller bubbles in greater density will address this. Downstream, in each of the 20 aeration lanes, the dissolved oxygen (DO) is measured in two locations at progressively different parts of the aeration process.

One important observation is that the DO readings appear high (3.2-5.5 mg/l), given a set point expectation of approximately 2 mg/l as a final output. High DO will mean considerable additional energy usage, because more air is supplied than needed. It can also have a negative impact on settlement of the sludge downstream, as natural flocculation is less effective.

This would have the advantage in that there would be only marginal change in isentropic efficiency, with a change in speed, yet the blower shaft power would be substantially less.

For the full range of flows measured over the logging period, and using a variable speed drive throughout – instead of inlet guide vane control – would give Thames Water a potential saving of £20,000/year (€23,500) – (1.8%/year). Given the additional costs surrounding 3.3 kV inverters, and the associated equipment, the costs to achieve this for Blowers 1 to 3 could be prohibitive.

However, Blowers have a 250 kW rating, and generally demand an electrical load of no more than 230 kW. There could, therefore, be a comparison of 3,300 V inverter retrofit to 415 V electrical infrastructure replacement, making all equipment low voltage.

This has advantages of its own: safer to operate, ease of spares, less costly to maintain – and lower initial capital cost.

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Successful sludge dewatering test at Municipal site in France

Due to population growth, an increase in wastewater and thus sludge production is expected for both industrial and municipal markets. Transporting and disposing large amounts of watery sludge can be costly for the wastewater treatment operation. Therefore, reducing the sludge volume by mechanical dewatering steps (such as screw presses or centrifuges) is a common practice to reduce the related costs.

Based on the expertise in wastewater treatment and sludge dewatering, the Nijhuis Screw Press (NSP) was developed and widely installed during the last years to mechanically dewater flocculated flotation sludge or biological sludge, especially in industrial applications. In the typical NSP setup, sludge is transported by a rotational screw inside a wedge-wire drum, gradually pressed to filter out the water content of the sludge, resulting in dewatered cake.

Before the pressing process, the sludge is mixed with polymer in the hose flocculator system, which is space saving (right under the screw press unit) and easily adaptable according to sludge characteristics.

To apply the NSP in municipal sludge, an extensive testing program was successfully executed at two municipal WWTP sites in France.



At the first site, NSP has achieved a comparable dewatered cake dryness next to their existing screw press. However the sludge quality on the second test facility was better resulting in 16% DS before composting. Both NSP and the existing centrifuge at the second site have managed to achieve 18-20% DS for their site requirement. From these recent tests, the NSP has shown the proof to meet the specific dewatering objectives of the municipal market.

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Water as a Service:

a 5-step approach to consult you at the start of your new or revamp (waste)water project

A one-stop-shop portfolio does not only consist of game-changing solutions, an extensive range of consultancy services is also needed to develop tailor-made designs, aligned with the client objectives.

If you are reviewing your wastewater treatment objectives, you may uncover many challenges. When assessing your specific objectives, whether they are upgrading your current system, following sustainability requirements, or performance optimization of systems, understanding your wastewater situation can be challenging. Water treatment consulting will help you overcome these often-crucial challenges.

Our approach to meet your objectives in all stages of the project

Choosing for our team means working together with a trustworthy and experienced water specialist who aims for a long-term vision based on our "Customer For Life" approach. This unique approach ensures to add value to every stage of the project. We are adding intelligence by covering all the project questions during the consulting stage, which allows us to combine the best available technology, operation & maintenance, and innovation into one unique and endless learning circle.

A team of i-CONSULT engineers is providing a holistic approach to help you meet your sustainability requirements, improve productivity, efficiency and reliability of assets, reduce total costs of ownership and risks while increasing the sustainability in your water cycle through:

01. Performance optimization and debottlenecking of current assets
02. Energy, water and resource recovery
03. Value engineering
04. Training and knowledge transfer
05. Digital Monitoring and Service Tools

Our 5-step approach:

1. Data analysis & interpretation

We begin by analysing the water characteristics, for example by interpreting and benchmarking your data.

2. Flow and load assessment

if needed we can organize and manage an on-site flow and load survey to fully understand your water balance.

3. Feasibility study with alternative

comparison: we define different optimization, debottlenecking and additional treatment strategies and evaluate them based on technical, economic and sustainability criteria defined with the client. Especially for the economic criteria, you can either buy the plant and hire and train your own operator, or outsource the plant and pay per m³ of water you use and the wastewater which needs to be treated (see more about 'Water as a service' below).

4. Trials/pilot/ rental program

If needed, to minimize risks and better predict the Treatability, we could run bench-scale trials or design and execute a pilot program.

5. Translation of the chosen solution

to a design and executable package through knowledge transfer, technical assistance, and EPC / DBFOM / rental solutions.



Taking it to the next level:

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Water as a *carefree* service

Paying for water is like paying for postage. When you purchase stamps, you are not just paying for the stamps themselves; you are paying for ensured delivery. It is a simple process to attach a stamp to a letter and drop it in your nearest mailbox or post office, but beyond that, you don't need to worry about the process of its transfer because you know your letter will be in good hands.

Similarly, when you pay your water and wastewater bills, you are paying for the services utilities or water treatment/technology companies provide, to reliably deliver clean and potable water to your home, business, and community and ensure the treatment of your water in a reliable way.

Especially within businesses, the concept of

WaaS (Water as a service) needs to grow, and the benefits for industrial clients are the lack of investment costs for a new water treatment. Instead only pay for the water you use and produce, resulting in savings via reuse as well as profits from the resources you recover.

Within this business model concept, a reliable and experience partner is needed. At that point Nijhuis Saur Industries comes in, with a wealth of knowledge on mobile water, operations and monitoring.

Your new to build treatment plant can be completely outsourced to our highly-experience team of water experts, while you keep your focus on your production and processing plant. Instead of investing you are simply paying for the cubic meters of treated and recycled water and the support provided on-site by our highly experienced water experts.



Mobile Water Solutions to the rescue

Dwindling water resources can significantly impact plant safety, availability and performance reliability for municipal and industrial players - not to mention have financial implications. Many of them are not prepared for these scenarios and when they occur, have little time, money and manpower to change course.

Our proven Mobile Water Solutions include pre-treatment - for example, through DAF (Dissolved Air Flotation) - sludge management, aerobic treatment, nutrient recovery and anaerobic mobile solutions. Many of these are already well-known in the field. More recently, polishing and reuse solutions - including membrane technology - are gaining interest. This is because in recent years more stringent discharge limits have been set, while local (ground) water resources are providing less intake water for industrial processes.

Benefits of our mobile water solutions

- ⊕ A fast-track solution available around the globe.
- ⊕ Reduced construction costs.
- ⊕ State-of-the-art technologies: screens, DAF, (an)aerobic, nitrogen recovery, UF, RO, DNF and O₃
- ⊕ Can be used as a pilot plant, in emergencies, or as a temporary solution to treat water without investment .
- ⊕ High-quality effluent in compliance with stringent discharge limits.
- ⊕ Depending on the flow size, it can be an ideal solution to ensure continuity of production in case of an emergency.
- ⊕ Includes i-MONITORING for real time data checks and trends, operator notifications and maintenance warnings - Can be extended with several water treatment technologies, including disinfection, to make it a comprehensive mobile water treatment solution.

Up and running in a few days

A plastic recycling facility in the Netherlands urgently required additional capacity to secure their production requirements.

The mobile system, which included flocculation and flotation was quickly delivered and up and running in just a few days allowing the client to continue recycling plastics.

The one-stop solution provided by our Mobile Water Solutions team includes consultancy, design, delivery, installation and commissioning and if required operation & maintenance

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An interview with Marzia Chiesa, CEO of Sodai and Francesco Riva, CEO of Unidro

How NSI entities Sodai and Unidro plan to accelerate the circular economy transition in Italy and bring a wealth of knowledge to the global water market.



NSI recently acquired Sodai - a leading industrial water operation & maintenance player in the energy and transportation sector - a partnership which complements the already established relationship with Unidro, creating an Italian powerhouse in the Water and Wastewater industry. But not only Italy, Unidro and Sodai both bring additional value to the whole Nijhuis Saur Industries Industrial Water Solutions division with the added-value services and innovations.

We spoke with Marzia Chiesa, CEO of Sodai and Francesco Riva, CEO of Unidro, regarding their growth strategy in Italy, now two strong brands and companies jointly accelerate the circular economy transition in Italy. What trends and developments you see in the Italian market for water and the circular economy?



M: I think that the conversation around Circular Economy started long ago, but this historical period has helped to accelerate the transition process towards a more responsible and regenerative economy, based on sustainable and innovative practices and a circular economy. This is particularly important in the world of water where the solutions need to be successful for both the environment and for the business. And in this context, of course, water is the most precious resource for the health of the people too, so it deserves absolute protection and attention. The reality is that water recycling is no longer a choice, it's a necessity right now.

So, regarding the circular economy in Italy, according to last year's national report on the circular economy, Italy ranks first among the top 5 European countries actively in engaging the circular economy and in the water world. So, in Italy, we feel a lot of transition and focus on circular economy. But obviously this transition requires support. So I think everything is ready, everything has already started. And so this is definitely our moment.

F: I agree with Marzia, and we also have the same feeling in our business actually. Unidro is more focused on heavy industries, but these kinds of issues are felt here too, no-one can escape the conversation about sustainability or the circular economy.. Every business sector has a need to be accepted by the people and the community in order to stay in the market. And this means that our contributions and our values as a company are being perceived in different ways than ever before, so whilst technology is essential to the circular economy - because all these goals and targets need technology to be implemented on the ground - you are no longer viewed as a pure technology provider. So, when you talk about reuse or energy savings or optimization or circularization, it's all about technology in the end. However, the way technology is perceived by the public, by the clients and also by the decision makers, is changing and we need to not just to follow, but to lead this kind of change in the industry.

It is clear that companies like us must not only push forward as an advocate for the circular economy and water reuse, but also be an educator, so people understand the importance of water and can begin to treat it with the respect and value it deserves.

Protecting the Italian environment, water resources and nature



What are your company values and what makes you strong in the market?

F: Unidro has built a reputation on being technical experts in our field, we have a strong sense of identity, and as a team we work coherently and share a sense of purpose and commitment and our clients resonate with this. We also have strong technologies which are developed in house – so we can adapt and change to the new challenges of the business as a whole team.

What Unidro, Sodai and our Group have in common is our approach to the market, being clear and transparent in our business and being committed to what we do.



M: Sodai and Unidro have a lot in common as Francesco said, and the three main strengths for Sodai are;

- **Research**, which leads to our technological innovations. Since the beginning, we have believed in and invested a lot into research and technical innovation towards the circular economy and working on sustainability.
- **The People**, our O&M capabilities lead to our presence across the whole of Italy, this is down to how we value both our people and our clients. Our colleagues are experienced professionals who uphold our values of quality and transparency and because of this we build partnerships with our clients which allows us to have long term relationships with a view to continuous improvement and sustainable development.
- **Sustainability**, Sodai has been working for a number of years on the 'green transition', combining business with the attention of innovation, the environment and the social issues and collaborating to achieve our sustainable development goals. Sodai is also among the 100 Italian companies awarded with the Sustainability Award, so sustainability really is at the heart of everything we do.

How do you see the future of both Unidro and Sodai working together in the Italian market?

F: As we have said both companies have similar values and ways of working so the partnership will be easy, we also benefit from both companies having strengths in different areas, so they complement each other well. The integration of our operations and communications will improve our approach to and increase our reach to the Italian and global markets, boosting the capabilities of both companies and therefore the group as a whole.

M: I agree, our strengths lie in both our similarities and our differences. I also see that together we can have a 360-degree approach to not only the market, but also to our responsibility to be leaders in the industry.

What have been your most successful projects in the last year?

F: The first project I'd like to highlight is in Uzbekistan. The plant is a zero liquid discharge for a fertilizer complex where we supplied a complete set of technologies all developed in house, these include the treatment of the fresh water to be used in the process plant, the collection of the wastewater and the treatment to recover the water from the waste. Any water rejected from the process was not wasted but subjected to further thermal treatment, enabling a 90% water recovery rate for the plant.

This project was being delivered in the middle of the pandemic period, so it is a real testament to the dedication of Unidro team to continue working to ensure the project was delivered during the critical time period.

The second project is a new liquid natural gas plant that is now being built in Texas, Unidro was selected to supply all the water treatment units for both incoming waters, using a demineralization plant, Reverse Osmosis, freshwater treatment, also wastewater treatment and cooling water treatment.

All the plants were designed and fabricated in our workshop at the end of last year and will be completed this month and shipped to Texas. Our people will then be dispatched to supervise the installation and set-up of the plant later this year.

The last project I want to discuss is another liquid natural gas plant, this one in Qatar. A joint venture of Chiyoda (Japan) and Technip (France) 'CTEP' awarded Unidro the complete water treatment packages for the North Field East Project (NFE) in Qatar. In order to meet the very strict process performances, and comply

requirements, Unidro was selected by CTEP as being the most reliable and experienced partner to design, engineer, manufacture and supply the integrated water treatment packages.

This project is a great example of the benefits of being part of the larger Nijhuis Saur Industries group – the client felt secure knowing we had the support of the larger group behind us, so I think working together is so important and beneficial for these larger projects.



M: I'd like to talk about our own developed technology – which is currently pending a patent. That is a system which allows for the separation of purified water – which can be recovered for irrigation or for industrial use – from digestate. The digestate can then be sent for biomethane production, or to be used as fertilizer. This project is so exciting and so important for the circular economy and water reuse. The second project is regarding a Bio Refinery, which is a design, build, operate and maintain project. Sodai built the plant last year, and we now have the O&M contract for the plant. This is the largest Italian purification plant with zero liquid discharge of the wastewater, it is recovered and recycled into the plant. This project highlights the importance of our people, because the bio refinery never stops – the plant is active 24/7, 365 days a year and so must be managed all this time. All of the people are trained both technically, and in Health and Safety to a very high standard.



What are the next steps for Sodai and Unidro as part of the larger NSI group?

F: I think the challenge for Unidro and Sodai combined as NSI Italy – and indeed the whole group – is to integrate all of the great services and technologies available across all of the group brands, and combine the real added values from each of us, to the benefit of our clients and the ecosystem we serve. I think this can be achieved with effective communication, both internally amongst the group and also externally, so we are all delivering the same message to our clients. This is an exciting opportunity to grow together with the group and become leaders in the water and wastewater world.

M: I agree with Francesco, I think it's all about communication and working together to build the brand and develop the complete 360 degree approach for our clients. I also think it's important so you can support other companies within the group to develop their services and technologies, as well as your own to further everyone's potential. It is exciting times for Nijhuis Saur Industries, not only in Italy but across the globe – we are building a strong driving force within the water and wastewater industry to lead us all to a safer, more sustainable future. Our Mission is #MissionWater.

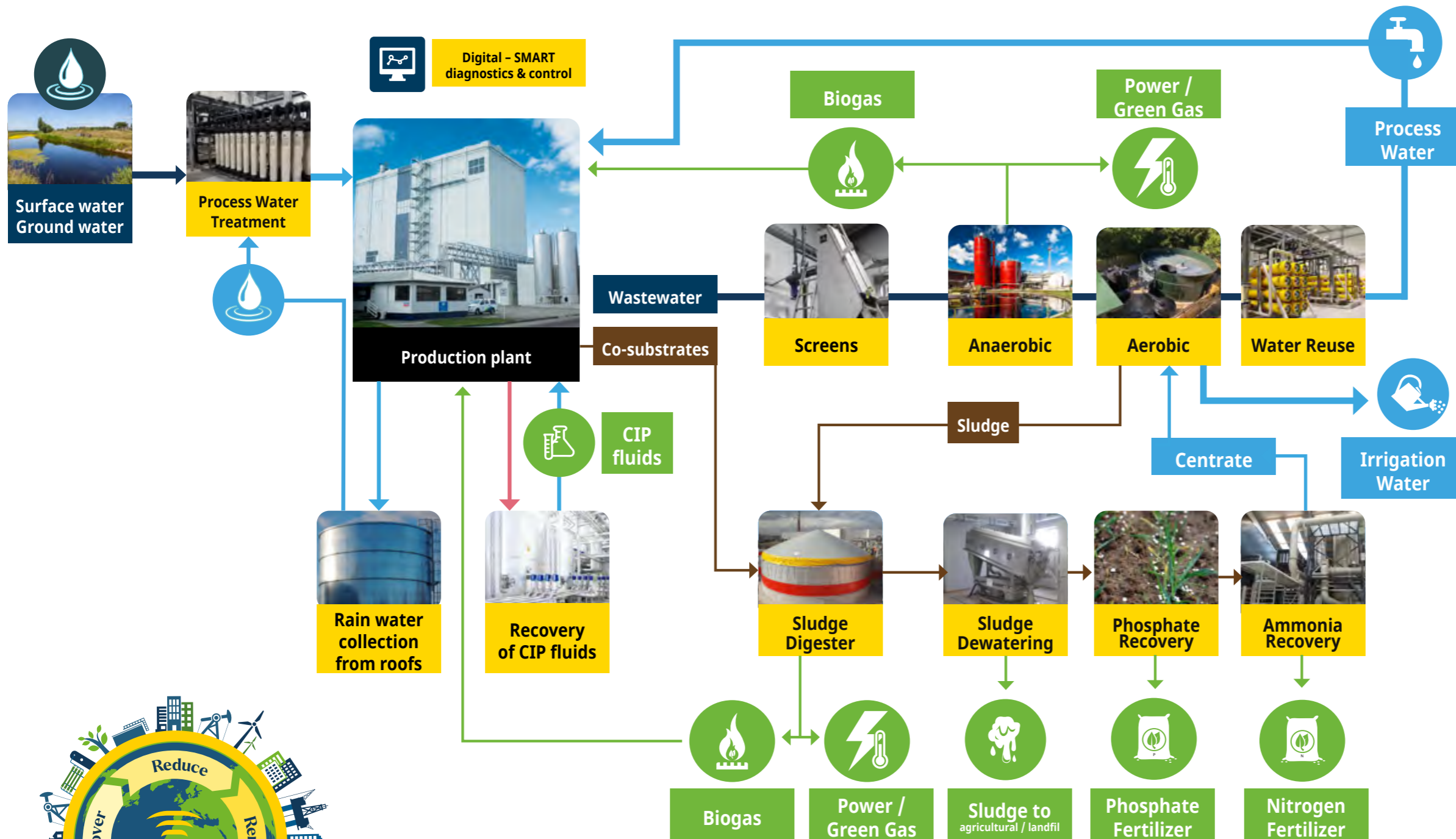
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Water Refinery and Energy Factory

An integrated industry solution example for light industries

Your Benefits



- + Environmental compliance and meet legislation
- + Reduce discharge and surcharge savings
- + Energy positive
- + Low sludge production
- + Water savings/reuse

Recovered Products:

- + Clean process and/or irrigation water
- + Internal recovery of water and chemicals for cleaning
- + Nitrogen and phosphorus fertilizer for local farmers
- + Energy as biogas/ green gas and/or electricity

#missionwater

Where to meet us

Exhibitions/Conferences July–October 2022

July

12th to 13th - EWWM (UK)

August

3rd to 5th - ILDEX (Vietnam)

September

5th to 8th - Gastech (Italy)

12th to 16th - Drinktec (Germany)

21st - ISPE Boston Product Show (US)

October

8th to 12th - Weftec (US)

25th to 27th - Energia (Finland)

25th to 27th - Finnateria (Finland)

30th to Nov. 2nd - ISPE Annual Meeting Orlando (US)

