

PLANET

April 2021

WATER IN THE 21ST CENTURY planning for the unknown



FORUM

Water management in uncertain times

FRONTLINE

Micropollutants in Lake Geneva, new targets for the city of Lausanne

OUTFRONT

New ways of thinking about sustainable water management

EXPLAINER

Enclosing the water treatment process

PLANET

TABLE OF CONTENTS – APRIL 2021

03 • THE POST

by Antoine Frérot

04 • CONTRIBUTORS

Séverine Le Bideau, Jacky Dallet, Xavier Leflaive and Christophe Mechouk

06 • IMPACT AWARDS

Discover the winners of the 1st edition

08 • INSIDE • TRENDS • DATAVIZ

The news in brief

INFOGRAPHIC Water management: risks and opportunities

14 • FORUM

Water management in uncertain times

Joint interview with Xavier Leflaive and Jean-François Nogrette

20 • #WEARERESOURCERS

Julien Prunaret and Hervé Faujour

24 • FRONTLINE

SWITZERLAND Micropollutants in Lake Geneva, new targets for the city of Lausanne

AUSTRALIA The power of crystallization: how an Australian lake produces fertilizers

FRANCE SEDIF, the world's first carbon-neutral water service

36 • GALLERY

The baobab-water tanks of Madagascar,
trees of life by Pascal Maitre

44 • OUTFRONT

New ways of thinking about sustainable water management

51 • COMMUNITY

MIDEWA, planning ahead for emergency supplies

52 • EXPLAINER

Enclosing the water treatment process

54 • FUTURIST

Treatment plants in the modular era



ANTOINE FRÉROT
CEO of Veolia

— **FEBRUARY 8, 2021. Tender offer for Suez's entire share capital**

Veolia wrapped up the first stage of a major strategic operation, aiming to create the global champion of ecological transformation, with its October 2020 acquisition of a 29.9% stake in Suez. The second stage of this long-term structural project, which will benefit all our stakeholders, was unveiled on February 8, 2020 with the formal filing of a tender offer for the remaining 70.1% of Suez's share capital. The merger will give us greater resources in terms of know-how, innovations and geographic locations, helping to ensure that the critical worldwide ecological transformation becomes a reality for everybody more rapidly. Joining forces means we can further improve the services we offer the world's largest companies and cities. These industrial and municipal giants want partners whose scale and range of skills mean they can address all aspects of their environmental impact.

— **FEBRUARY 25, 2021. Publication of Veolia's annual results**

The first year of our new strategic plan Impact 2023 was turned on its head by the financial and health crisis brought about by the coronavirus pandemic. Against the background of these exceptional circumstances, our annual accounts for 2020 highlight our Group's excellent resilience, responsiveness and ability to bounce back. At €26 billion, our revenue remained at a high level, returning to growth in the fourth quarter. EBITDA reached €3.6 billion, exceeding the revised target we set ourselves at the start of the pandemic. We made savings totaling €550 million, far outstripping our original target of €250 million. At €415 million, the Group's share of net current income remains very positive. Measures we put in place as soon as the pandemic started mean our Group wiped out the effects of the crisis and returned to its positive trajectory in just nine months.

— **MARCH 18, 2021. Partnering with Solvay and Renault to recycle electric vehicle batteries**

Veolia has launched a closed-loop metals recycling project for end-of-life batteries in partnership with Solvay and Renault. Our goal is to reuse at least 95% of metals to manufacture new batteries. Recycling nickel, cobalt and lithium is vital to reducing the environmental footprint of electric vehicles, meeting the growing demand for batteries and ensuring a European supply of these critical raw materials. Each partner brings its own expertise: Veolia in hydrometallurgy, Solvay in the extraction, separation and refining of metals, and Renault in vehicle manufacturing. After laboratory trials to perfect processes for producing the high-purity raw materials required to manufacture new batteries, we are now moving to the pre-production phase and have set up a pilot plant.

— **APRIL 6, 2021. Launch of our ecological transformation campaign**

The scale of the environmental emergency means that working for transition is simply not enough; we have to tackle it head-on, radically altering our economic models and behaviors. Climate emergency, collapsing biodiversity, overexploitation of land and sea, pollution of the air, soil and oceans, scarcity of raw materials, water, energy, and so on: the critical challenges of the 21st century demand radical remedies. The goal of our Impact 2023 strategic plan is to make our Group the benchmark company for ecological transformation. The plan focuses on decisive choices to promote activities with the greatest impacts, social and financial as well as environmental. Because at Veolia we believe that effective performance has to be multi-faceted, with a good balance between its various dimensions and providing benefits to all our Group's stakeholders.

A handwritten signature in black ink, appearing to read 'A. Frérot'.

CONTRIBUTORS



SÉVERINE LE BIDEAU

EDITOR-IN-CHIEF

Communications Director, Veolia Water Technologies

Preserving water resources during these uncertain times remains challenging. This is the topic we are tackling in the latest issue of Planet, at a moment when the convergence of several major crises — health, financial, social and climate — is having lasting impacts on our societies.

The rapid digitalization of society forced on us by COVID-19 is accelerating technological innovations that can ensure water is available and accessible. At the global level, these innovations also limit environmental impacts thanks to ever-more advanced wastewater treatments. The benefits need to be felt both by those who already have access to these services and by those who still do not — a third of the world's population.

At a time when the fragility of our planet has never been more evident, Veolia continues to provide solutions that are ever more responsive and modular. Its objective is to meet the new needs of its industrial and municipal clients, all of them anxious to avoid disruption to production or services while also saving energy. This is one of the reasons we want to create the global champion of ecological transformation.

Water is a complex subject with multiple facets, something that the various sections of this issue attempt to shed light on. Helping us to never forget that this precious resource is the origin of all life.

CHRISTOPHE MECHOUK

Head of Engineering, Water Services, Lausanne

After graduating in water treatment engineering from the École Nationale Supérieure d'Ingénieurs de Poitiers, he spent 15 years coordinating the design and construction of more than 40 drinking and wastewater plants in his role as project leader at the Hydratec engineering consultancy. As head of engineering for Lausanne water services since 2014, he divides his time between work on Saint-Sulpice II, the new drinking water plant (120,000 cubic meters a day) and construction of a wastewater plant.



XAVIER LEFLAIVE

Principal Administrator, OECD Environment Directorate (oecd.org)

Xavier Leflaive studied business administration and social theory in France, Canada and the UK. He holds a PhD in social and political sciences from the University of Cambridge. After ten years as a consultant with Deloitte, he joined the OECD in 2004 where he promotes policies for water security and sustainable development: determining water financing and tariffs, welfare policy reforms, and diffuse pollution. He recently coordinated the OECD Council Recommendations on Water and runs its Roundtable on Water Financing.

JACKY DALLET

President of Vendée Eau

Mayor of Saint-André-Goule-d'Oie and a trained agricultural technical adviser, in 2019 he was elected head of Vendée Eau, a public service drinking water provider to all 258 municipalities in France's Vendée department. In his work with Vendée Eau he is fighting to boost water quality, helping to secure supplies of water, among other missions, via the Jourdain project for reusing treated wastewater, and a program to create and restore a thousand ponds that is proving very popular with farmers.



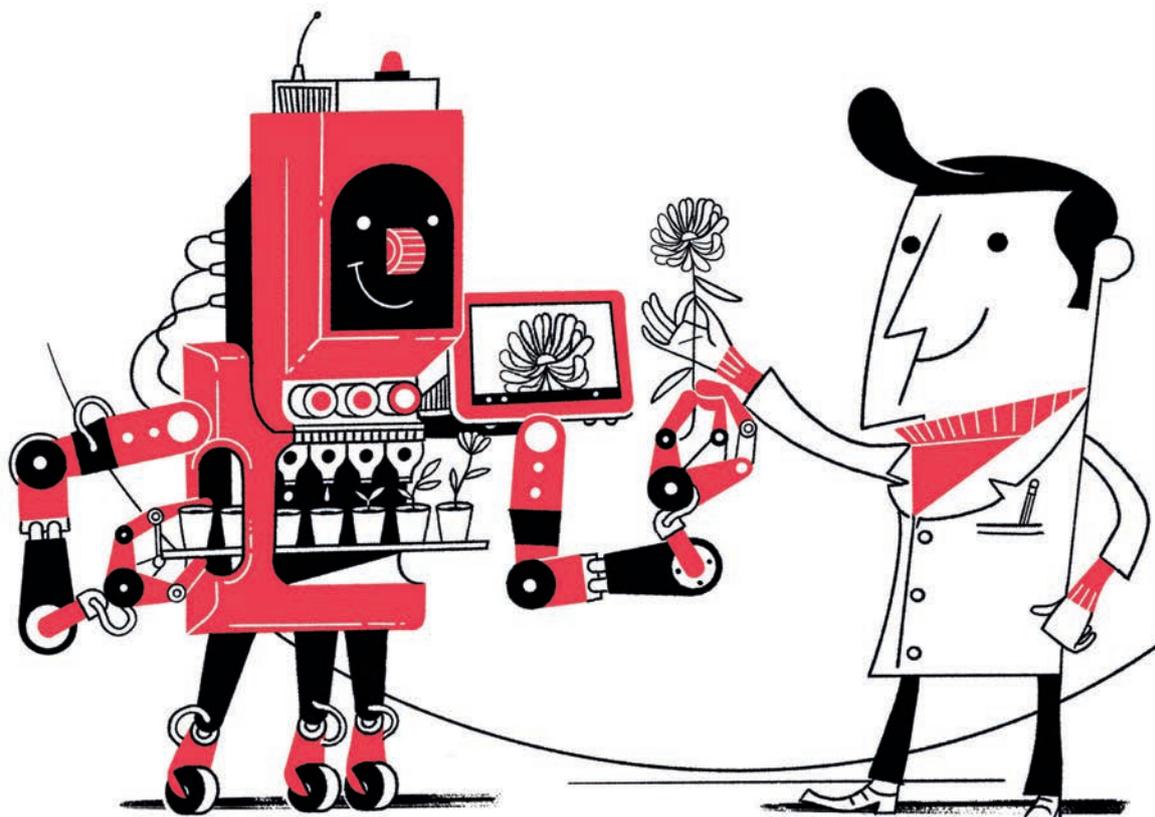
A Veolia publication - 30, rue Madeleine-Vionnet - 93300 Aubervilliers - France

Publication and Editorial Director: Laurent Obadia. ♦ Editorial direction: Anne Béchiri, Raphaëlle Cayla, Étienne Collomb, Alexia Dubois, Feryel Gadhroum. ♦ Editor-in-Chief: Séverine Le Bideau. ♦ Image content: Laure Duquesne, Angèle Noël. ♦ With special contributions from: Silvia Alonso Santos, Inès Aloui, Jill Browning, Marianne Cailliez, Maria Dinard, Mark Dyson, Mette Friis-Andersen, Stéphane Galfré, Anna Gioni, Maria J. Fernandez, Charlotte Kelma, Charlotte Kerihuel, Sandrine Khaznadj, Benoît de La Rochefordière, Elise Le Vaillant, Olivier Leclerc, Eugenia Llorca Respalidza, Kathryn Moore, Alain Nèner, Manon Painchaud, Pascal Pluyaud, Romain Prudent, Marion Pujó-Sausset, Philippe Sébérac, Emilie Talès, Sandra Vedel. ♦ Copyright: April 2021. ISSN Number: 1761-4996. ♦ Photo credits: Pascal Maitre/Myop, Avant Première, Hugh Brown/SO4, Getty, Benedikt Grünhag/EyeEm/Getty, Imagin3Photography, Tam Le/Veolia, Nuclear solutions, Heiko Rebsch/MIDEWA, Stefan Redecker/Snowbal, SEDIF, Lausanne water services, Juan Socas Architecte in Geneva and MAR & BORIS in Bagnolet (France). ♦ Veolia media library: Alexandre Dupeyron, Olivier Guerrin, Stéphane Lavoué, Christophe Majani d'Inguibert, François Moura/Andia. ♦ Cover photo credit: Médiathèque Veolia - Christophe Majani d'Inguibert.

Production Bords de Loir

Art Director, layouts and production follow-up: Angèle Noël. ♦ Editorial team: Anne Béchiri, Gabrielle Carpel, Étienne Collomb, Denis Deschamps, Damien Guillou, Virginie Little, Paul Sanderson. ♦ Illustrations, Contributors and Diary: Mariette Guigal. Dataviz and Explainer: Manuel Bortoletti. ♦ Coordination: Raphaëlle Cayla. ♦ Copyediting and proofreading: Alto International. ♦ Printed by: Quarante Six - The coated paper for the cover and inside is derived from sustainably managed forests. Packaging, sorting and mailing by Staci.

JUNE 15-16, 2021
ACHEMA PULSE



TAKING THE PROCESS INDUSTRY UP A GEAR

THE INTERNATIONAL EVENT FOR PROCESS INDUSTRY PROFESSIONALS, THE ACHEMA FORUM'S VIRTUAL PLATFORM PRESENTS THE LATEST DEVELOPMENTS IN THE SECTOR AND ENCOURAGES PARTNERSHIPS IN THE FIELDS OF CHEMICAL ENGINEERING, ENVIRONMENTAL PROTECTION AND BIOTECHNOLOGIES. ACHEMA 2022 WILL BE HELD FROM APRIL 4 TO 8, 2022 IN FRANKFURT (GERMANY).

WWW.ACHEMA.DE

Discover the winners

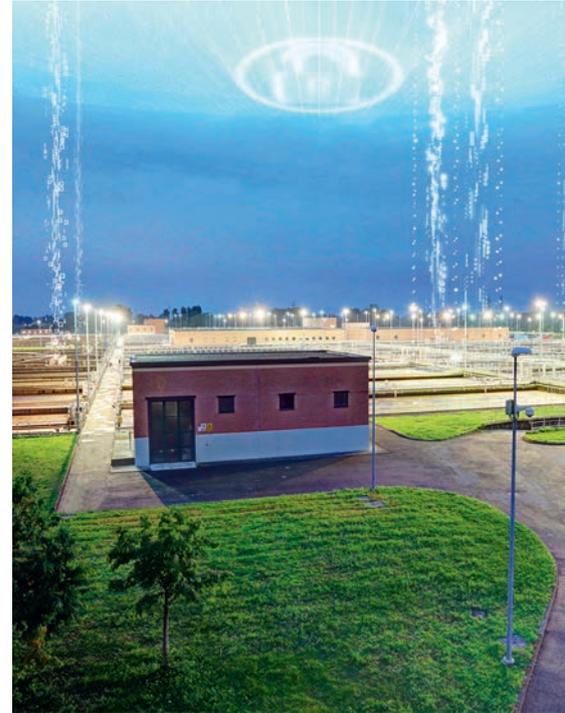
The 1st edition of Veolia's Impact Awards celebrates five outstanding and impactful in-house projects selected by the Executive Committee, each showcasing one of the five dimensions of the Group's multi-faceted performance — environmental, commercial, economic & financial, social, and societal.



SOCIETAL PERFORMANCE

AGUA DEL SINAÍ – LATIN AMERICA AND IBERIA

With 130,000 residents, Monte Sinaí is an informal settlement in the city of Guayaquil, Ecuador. It has the city's highest rates of poverty and is not connected to the drinking water network. Agua del Sinaí is a solution from Veolia that supplies the settlement with good quality drinking water delivered by tanker truck, at a 25% discount on the standard rate.



Awarded the employees' choice prize, from among the 15 Impact Awards finalists, by over 12,000 Veolia employees.

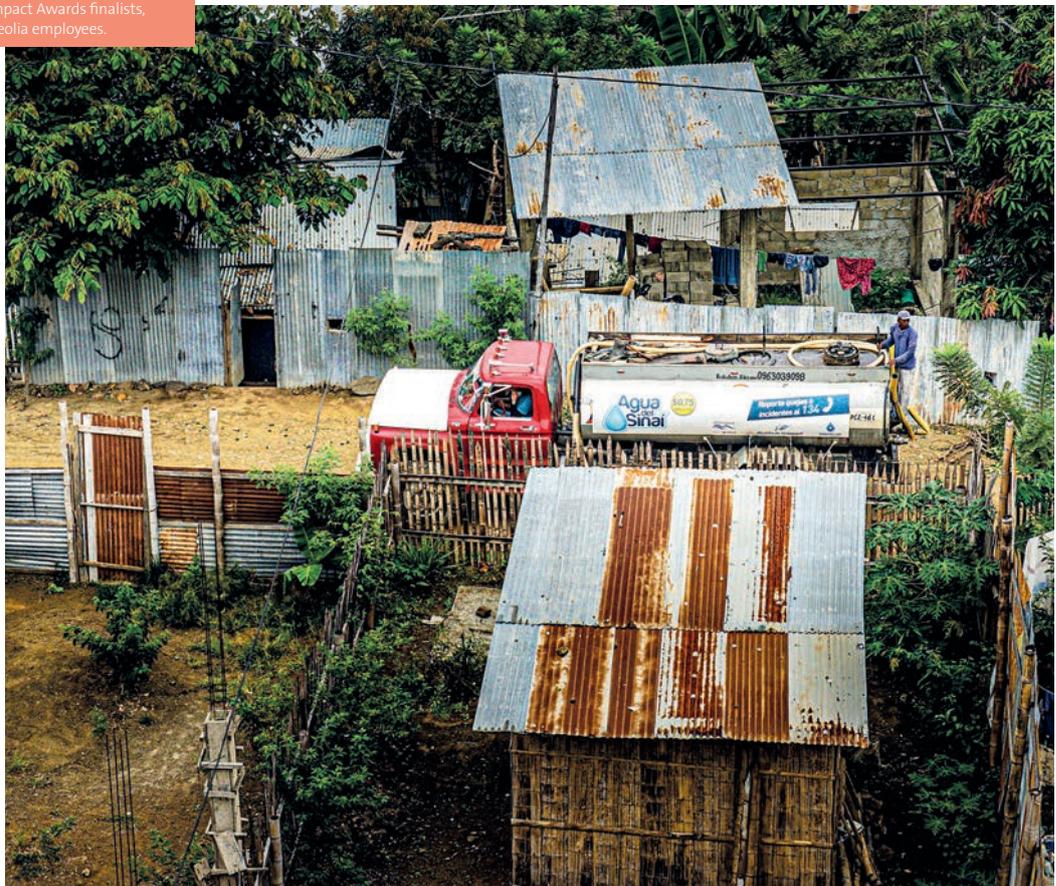
IMPACT AWARDS

15

finalists selected by an in-house jury of international experts

66

projects submitted from around the world



IMPACTAWARDS



COMMERCIAL PERFORMANCE

AQUAVISTA™ - HUBGRADE VEOLIA TECHNOLOGIES AND CONTRACTING

Aquavista™, the comprehensive digital platform from Veolia, offers modular scalable solutions to clients for the management of water treatment, with access to Veolia's global expertise. It optimizes operational and environmental performance at treatment plants, in line with local regulations. The solution is currently available in 25 countries and 7 different languages. 10 drinking water treatment plants, 80 wastewater treatment plants and 900 other water treatment installations are connected to Aquavista™, a total of 300 clients and 900 active users.



ECONOMIC & FINANCIAL PERFORMANCE

SMART UNIT – CENTRAL AND EASTERN EUROPE

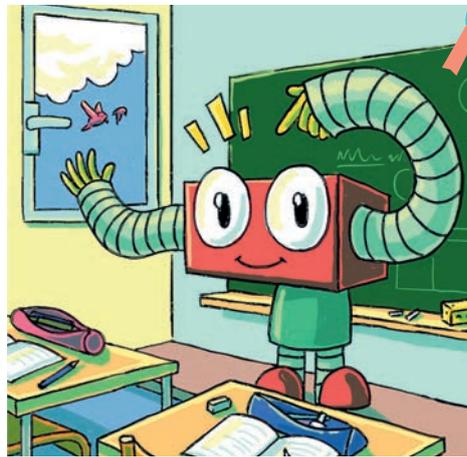
Veolia's virtual CHP power plant in Budapest offers real-time regulation of energy production and consumption for several Veolia-run power plants. Running all these plants as a single centralized virtual power plant makes it possible to improve the balance between types of energy sources.



ENVIRONMENTAL PERFORMANCE

DANS MON ÉCOLE, C'EST LE BON'AIR! ENVIRONMENTAL MAINTENANCE INDUSTRY & BUILDING

Dans mon école, c'est le bon'air!
[Welcome to my clean'air school!] by Veolia is an opportunity for Le Raincy, just outside Paris, to become the first French municipality to treat problems relating to air quality. Two of the town's public schools now guarantee pupils will enjoy 100% healthy air in their classrooms, every day.



SOCIAL PERFORMANCE

ICIAct - WECHAT APP – ASIA

With ICIAct (I see, I act), a mobile app developed by Veolia, employees can identify and report dangers and potential risks in their working environments. It also empowers everybody to actively improve operations by suggesting corrective measures.

THE 2ND SEASON
OF THE IMPACT
AWARDS IS NOW
OPEN!

All zones and business units are invited to submit their solutions for ecological transformation that have a positive and well-balanced impact in each of the five dimensions of the Group's multi-faceted performance.

Make sure to discover more high-impact projects selected as winners of the 2nd edition of the awards, to be announced at the end of the year!

UKRAINE AND MEXICO VEOLIA AND NESTLÉ WORKING TO IMPROVE WASTE COLLECTION

Ukraine and Mexico: two very distinct markets with two very different realities, but places where Nestlé and Veolia share the same goal, to improve the collection, sorting and recycling of waste materials. In Ukraine, the partners are trialing sorted curbside collections in the Kyiv region. The goal is to achieve compliance with European Union directives on waste management. In Mexico, Veolia will provide overall waste management for Nestlé's Nantli & Ocotlán plants in Jalisco. This is all a part of our zero waste to landfill commitment, which focuses on recycling, co-processing and managing energy use.

UNITED STATES WASTEWATER TREATMENT PLANT WITH SOLAR MICROGRID

In California, Veolia is partnering with the City of Rialto and Rialto Water Services for a microgrid project. It will use a unique combination of biogas cogeneration, solar energy and back-up battery storage to supply electricity to the city's wastewater treatment plant, which Veolia already has a 30-year contract to run and maintain, signed in 2013. Once the microgrid is in place in 2024, officials expect the plant will be less vulnerable to power outages and their impacts: shutdowns and potential wastewater spills into nearby waterways. This innovative microgrid is expected to save the city approximately \$350,000 per year in energy costs, with an average return on investment in about eight years.

BELGIUM UPGRADE BIO ENERGY: DELIVERING ENERGY FROM ORGANIC WASTE

Veolia unveils its first organic waste methanization plant in the country: Upgrade Bio Energy. Located in the port of Antwerp, the plant has a capacity of 60,000 metric tons and will supply a local industrial customer with 100% green electricity from cogeneration fired by biogas produced from organic waste. Upgrade Bio Energy is a successful example of inventiveness in the circular economy. Heat from cogeneration engines is recovered to dry out digestate residues left after methanization. The digestate is then used as an ingredient in the production of high-quality fertilizer.

In Australia, Veolia and the Army & Air Force Canteen Service

are testing a recycled coffee cup called RecycleMe™ among staff at the Williamstown base, and have installed 6 recycling cup stations. The goal is to help the Department of Defence in its war on waste by eliminating the 130,000 single-use cups used every year on the base.

In the Czech Republic, Veolia has won a five-year contract

to provide heat and hot water to 34 schools in Prague's 13th district. This is the 10th year of Veolia's collaboration with the 13th district, which has already benefited from a 50% cut in school energy bills.

WORLDWIDE VISTA FORCE, SUPPORTING THE WORK OF THE VEOLIA FOUNDATION

The Veolia Foundation has provided help during humanitarian emergencies since 2004, principally via its Aquaforce mobile water purification system. Leveraging the potential of our Hubgrade digital platform, teams from Veolia Water Technologies and the Veolia Foundation have developed VistaForce, a real-time monitoring solution for Aquaforce systems. VistaForce works as a modem embedded into each Aquaforce system, transmitting real-time water production data. This data is useful to the Veolia Foundation and its partners in terms of reporting and for providing proof of their activities in the field, particularly to donors.

VEOLIA AND SLATE LAUNCH THE GREEN MIRROR PODCAST

Veolia and Slate have teamed up to launch a joint content platform with a mix of articles and podcasts designed to provide insights into the importance of ecological transformation. Green Mirror offers a series of articles focusing on three critical issues: waste processing and recycling, water quality and availability, and start-ups committed to the environment. The podcasts take listeners on imaginary journeys to discover what our world might be like in 2050. Created using forecasts from top scientific institutions, they also feature testimonials from world-famous scientists and Veolia's experts. www.slate.fr/partenaires/veolia-green-mirror

COVID PANDEMIC AND THE URGENCY OF TACKLING INDOOR AIR QUALITY PROBLEMS

In addition to social distancing measures to limit the spread of COVID-19, the World Health Organisation recommends that indoor air is regularly renewed. Concentrations of carbon dioxide and fine particles are good indicators of indoor air quality. The higher the concentrations, the greater the possibility the air may contain viral particles, and so require renewal. With AIR Control COVID, Veolia offers tailored support centered on its expertise in managing indoor air. The system uses sensors with warning lights to measure air quality and alert occupants when spaces need to be ventilated.



🇺🇸 UNITED STATES TURBINE BLADE RECYCLING

GE Renewable Energy and Veolia have signed an agreement in the United States for recycling the energy company's onshore turbine blades. Composed predominantly of fiberglass, the blades will be shredded at a Veolia plant in Missouri. The resulting material will then be used in kilns to replace the coal, sand and clay needed in cement-making. Over 90% of each blade will be reused: 65% as raw material in cement plants and 28% as energy for chemical reactions in the kiln. This solution, which can be rapidly deployed at scale, increases the environmental benefits of the wind industry, particularly via a 27% cut in CO₂ emissions.

Acquisition of Energenix makes SourceOne Inc., the energy consulting firm and Veolia North America subsidiary, the leading supplier of utility meter reading and billing, serving over 700 buildings and 200 clients, in eastern Massachusetts.

Six master's students were awarded the 2020 Veolia Performance Trophy

for their highly innovative final dissertations, covering everything from digitizing wastewater treatment plant records to inter-seasonal storage of heat from road surfaces, and including validation of a physical model of a lithium-ion battery for reuse.



↑ **WORLDWIDE GEOMELT® EXTENDS ITS ABILITY TO PROCESS RADIOACTIVE WASTE**

Although waste management in the nuclear power sector is already very tightly regulated, the specific radiological characteristics of other types of nuclear waste mean that a reliable and cost-effective industrial-scale solution is yet to emerge. Veolia has adapted its GeoMelt® vitrification technology to deal with waste that has no dedicated treatment industry. The technology was first developed in the 1990s and has been used at many sites in the USA, UK, Australia and Japan. It creates an ultra-stable glass that is typically 10 times stronger than concrete and more durable than granite or marble. Its leach-resistance is among the highest of all materials and it is very suitable for use with a wide variety of mixed waste feeds.

JAPAN 10 YEARS ON-SITE AT FUKUSHIMA

Veolia was among the first to arrive at the site of the Fukushima disaster to help with the emergency clean-up of millions of liters of contaminated water. Over the past 10 years, Veolia has assisted TEPCO, the company that operates the plant, to remove over 10 million curies of radioactive cesium from over 370,000 cubic meters of water. As well as systems for treating liquid radioactive waste, Veolia has also designed remote-control robots for inspecting and repairing the damaged containment vessel. With radiation risks at the site now under control, this first phase has paved the way to the next stage, dismantlement. Veolia and its Japanese partners will be delivering an exploration robot that will enter the core of reactor 2 to make a detailed survey of the situation. New technologies and treatment options that are safe, efficient and cost-effective, such as vitrification, are under close study, with the aim of reliably eliminating waste from the site over the long term.

Sydney Markets and Veolia extend their collaboration through to 2025. Veolia has already helped Australia's largest operator of fresh fruit and vegetable markets to meet its sustainability targets by managing and recycling its waste since 2005. This has delivered savings of over AUD\$1M, with 70% of waste recycled on site.

Water and food security: the same battle



Preserving water quality and ensuring food security are part of the same battle. As we are reminded by the authors of the work *Un défi pour la planète*¹ (A challenge for the Planet) which was published in 2018 but is still relevant today: there is no shortage of water on earth; it is access to drinking water and sanitation that remains difficult for some 2.4 billion people.² And poor water quality, due to a lack of investment in renewing obsolete or building new infrastructure, leads to malnutrition and the spread of disease. This is aggravated by the fact that more or less the same geographical areas are hit by a lack of both food and water, affecting the poorest populations. “Guaranteeing healthy food (Sustainable Development Goal no. 2) for all, while developing a responsible farming sector, along with providing as many people as possible with access to water and sanitation (SDG6), are closely correlated goals to be taken into account, if we wish to decisively fulfill the ambitions of the 2030 Agenda,³” points out Patrick Caron, a researcher at CIRAD.⁴

¹ *Un défi pour la planète*, les Objectifs de développement durable en débat, edited by: Patrick Caron and Jean-Marc Châtaignier. Nov. 2018.

² OECD figure.

³ In September 2015, the UN's 193 Member States adopted the sustainable development program for 2030, entitled the 2030 Agenda.

⁴ French Agricultural Research Centre for International Development (CIRAD). Patrick Caron also chairs the United Nations' High Level Panel of Experts on Food Security and Nutrition.

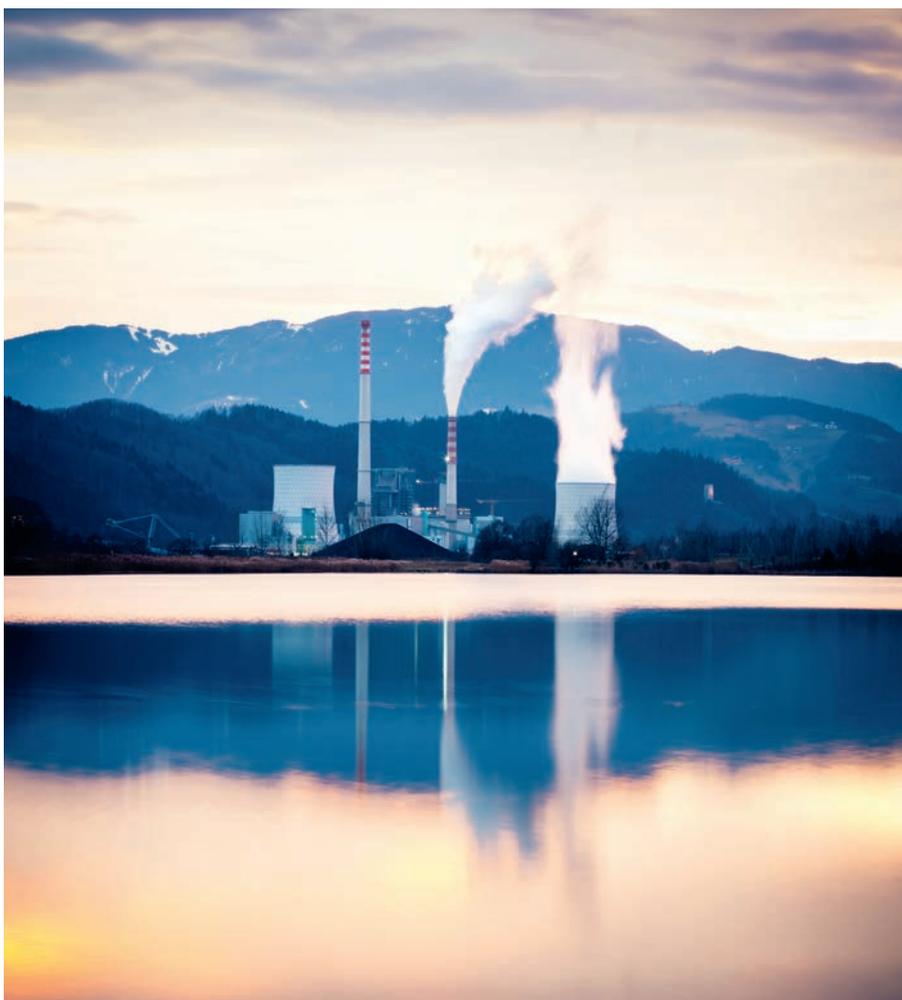
Water and energy: a strained relationship

The successful transition to carbon-free energy also depends on the thrifty management of water resources, cautions the International Energy Agency (IEA) in a recent report.¹ The international organization analyzes Water and Energy interactions in order to separate the growing demand for electricity from that associated with water needs. This natural resource is widely used in electricity production to cool industrial facilities, in the extraction of mineral raw materials, and in the irrigation of crops for producing biofuels. If it is poorly handled, the energy transition can contribute to heightened water stress:² certain alternative energies or techniques such as biofuels or carbon capture are proving to be extremely water-intensive. For instance, the Agency highlights that in China intensified water

stress, primarily due to climate change and accelerated urbanization, is having repercussions on cooling technologies. Incidentally, these technologies are still largely based on electricity production from fossil fuels. On a global scale, the IEA also points out the growing drinking water production capacities using seawater desalination and wastewater treatment techniques, which consume a great deal of electricity. And warns: “Over the period to 2040, the amount of energy used in the water sector is projected to more than double.”

¹ IEA: Introduction to the water-energy nexus (March 2020) <https://www.iea.org/articles/introduction-to-the-water-energy-nexus>

² Water stress occurs when the demand for water exceeds the available amount during a certain period. It also causes deterioration of fresh water resources.



Water management: risks and opportunities

Water quality, scarcity and access are all issues of concern to business leaders because they are vital to the success of their activities. And forward-planning to reflect the threat of greater water scarcity offers opportunities for winning new business. In Europe, the CDP survey¹ polled 193 business leaders for their views on these sensitive questions. The MarketsandMarkets report² offers projections for worldwide potential growth in the wastewater treatment industry alone over the period 2019 to 2024.

FINANCIAL IMPACTS FOR EUROPEAN BUSINESSES

Survey of 193 business leaders in Europe from key industries with a vital need for water of a consistent quality in their industrial processes: agri-food, energy, textiles and materials, chemicals, pharmaceutical and mining.

Managing risks

Responses from business leaders to CDP's online questionnaire on threats to water scarcity, access and quality:

62%

state they are highly dependent on water availability and quality



61%

consider water-related risks could directly impact their operations and alter their wider value chain in the event of severe drought or flooding



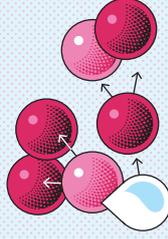
78%

declare that the availability of good quality water is important or vital to the financial health of their business



67%

feel this also applies in areas outside their operational control



100%

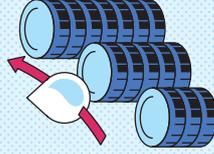
estimate the total financial impacts of risks relating to water scarcity, access and quality to be between €58n and €148n. The large spread in the estimates reflects the difficulty in evaluating these risks and suggests that this amount may actually be higher in the years ahead

Business opportunities

Responses from business leaders to questions in CDP's online questionnaire on the positive financial impacts of treating these threats:

74%

consider there are business opportunities in the water industry, mainly in the area of water efficiency



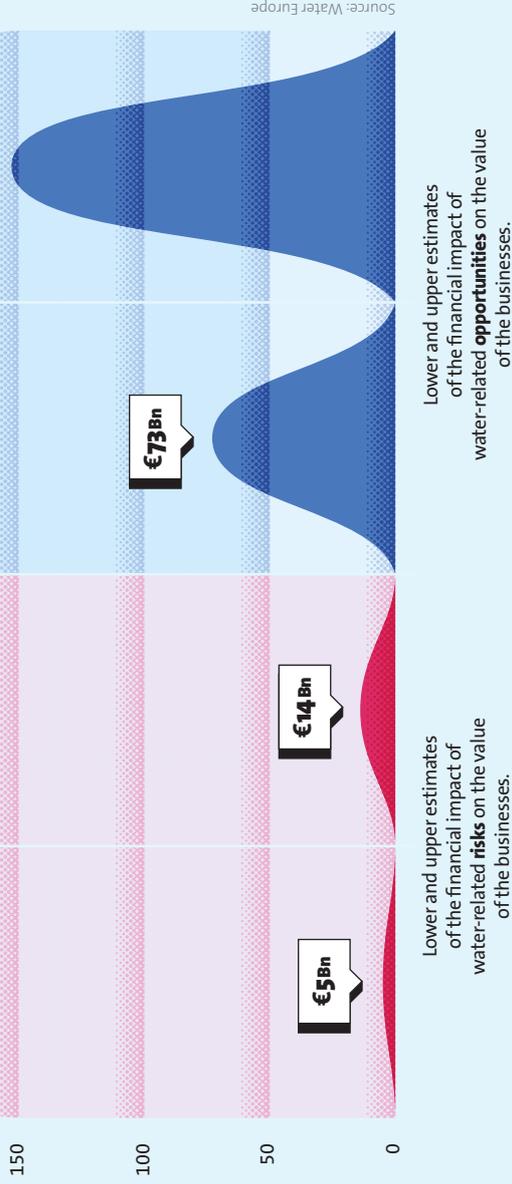
100%

have set targets and goals at several levels: 360 were identified, around 100 of them concerning water extraction and use. Targets align with the United Nation's SDG 6.³ Meeting these goals could deliver financial gains of between €73Bn and €153Bn



¹ Survey published on March 22, 2020 by CDP, an international non-profit, on behalf of the specialist platform Water Europe.
² Report published in 2019 by MarketsandMarkets.com, a specialist market research platform, based on data collected from 20 international wastewater treatment industry players.
³ SDG 6 is one of the 17 goals of Agenda 2030: ensure availability and sustainable management of water and sanitation for all.

The financial value of water-related risks and opportunities



Analysis

According to CDP, understanding the true importance of proper management of water-related risks, and having a clear vision of the business opportunities relating to the quality of this management, is a challenge that these business leaders have yet to fully come to terms with. On the one hand, there are many stakeholders involved: elected representatives, citizens and businesses must work together to protect water resources. On the other hand, businesses that are heavily dependent on water for maintaining and expanding their activities are also required to contribute to protecting the wellbeing of local communities and the health of ecosystems, in line with the targets of SDG 6 (see the previous note).

REGULAR GROWTH IN THE WORLDWIDE WASTEWATER TREATMENT MARKET (2019-2024)

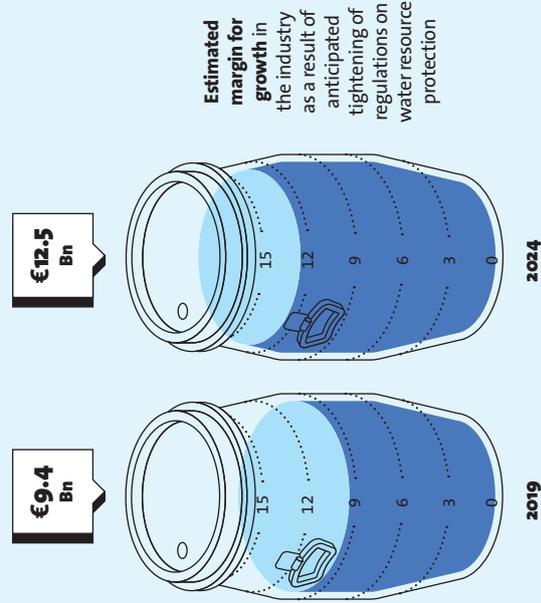
Survey of 20 major players in the industrial wastewater treatment market in the five global regions defined in the report: North America, Asia Pacific, Europe, Middle East and Africa, South America.



India, Brazil, China and Germany: four countries with high demand for water treatment chemicals, driven by industrial growth (2019 and 2024)



In 2018, the estimated market size was €8.85Bn (\$10.6Bn). **The 5-year compound annual growth rate** is 5.8% (2019 to 2024)



Analysis

Growing demand from industrial users for products such as biocides and disinfectants in particular, as well as the use of zero liquid discharge technologies (ZLD),⁴ are driving growth in the market. This is a worldwide trend, caused by industrial companies' needs to ensure the uninterrupted continuity of their activities, particularly in the power generation industry, and by increasingly strict regulations on water quality and protection.

⁴ZLD processing offers a twofold advantage: by using evaporation and crystallization technologies, the process allows treated water to be reused, as well as making it possible to recycle and recover solid waste that was separated during filtration. This waste can contain valuable components to be recycled and recovered.

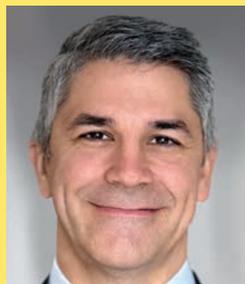
Water management in uncertain times.

We meet Xavier Leflaive and Jean-François Nogrette.

14/15



Xavier Leflaive
Principal Administrator,
OECD Environment Directorate



Jean-François Nogrette
Chairman of Veolia
Water Technologies

Whether fast-moving like extreme weather events and the COVID-19 pandemic, or evolving relatively slowly like pollution or declining biodiversity, concurrent crises highlight the need to coordinate more integrated forms of water management. Managing uncertainty is one of the main keys to tomorrow.

To what extent do the converging major crises — climate, social, health, economic, pollution, and biodiversity — currently afflicting the planet impact on water and its availability?

Xavier Leflaive: Every one of these crises affects either demand for water or its availability, in terms of quantity or quality. The climate emergency highlights vulnerabilities to water-related risks. The financial and social dimensions of these crises can adversely impact the ability of governments and other actors to finance investments needed to ensure access to water and for protection against water-related risks. There are two core lessons to take away. First, we need to change how we plan for the future, acknowledging uncertainty, placing greater importance on the ability to stay flexible, to adapt and avoid becoming trapped on pathways that may prove unsuitable. This requires new methods for planning the amount of water we need, and the investments required. Second, we're learning to understand that these crises are concurrent and have to be managed in a coordinated fashion. COVID-19 hasn't halted the climate emergency and its impact on water demand and availability. We have come to understand that resilience is measured where it is weakest.

Jean-François Nogrette: I agree. The question of resilience is central. For water managers, the main threat is biodiversity loss, which leads to a decrease in water's self-cleansing capacity. The accumulation of diffuse pollution also raises problems: water is a solvent and every river ultimately flows into the sea or ocean. Finally, we also have to confront extreme weather events. Optimizing our management modes is an initial response: reducing leakages, reusing water, desalination, and so on. We learned a lesson when Hurricane Katrina hit New Orleans in 2005. Our plants were very badly hit, submerged beneath the flood

water. We now protect them better, and we've strengthened defenses all over the world.

How can smart digital technologies for water management help identify solutions able to meet the scale of current crises?

J.-F. N.: Digitization is part of our day-to-day operational reality. But when a crisis hits, a digital tool is generally less useful than an operator. However, digital tools are great for spotting if a parameter is out of range or a machine becomes less efficient over time. Our Hubgrade solution considerably reduces in water quality non-compliance by detecting variations that are invisible to the naked eye, and avoiding the need for chemical treatments that are hard to control at later stages in the process. In the Danish capital Copenhagen, integrated management of the sewer system and wastewater treatment plant is combined with close monitoring of weather forecasts to plan ahead for rainfall and maximize use of the entire network, avoiding overflows. And digital technologies make remote operations possible. During the pandemic, if we couldn't send experts to a site we could use augmented reality to assist plant operators during restart procedures.

X. L.: Digital certainly opens a fast-moving and highly diverse range of possibilities. These include monitoring and reporting techniques as well as data processing and modelling using big data and artificial intelligence. Other technologies are emerging, such as video and shape recognition. When used in network management, these technologies help optimize network operation and maintenance, providing enhanced oversight of water quality. New applications are improving relationships with users: residents in Busan, South Korea, are able to access real-time information about water quality in their network. ▶

The health crisis has had a significant impact on human activities for more than a year. How is this a threat to the management of the water resources that are indispensable to domestic, agricultural and industrial activities?

X. L.: To the best of my knowledge, most of the direct impacts concern changes in the demand for water and the capacity to finance services. Demand in business districts is falling, with less water being used in offices, but rising in residential areas as a result of people working from home. This may impact water companies' revenue streams. And, against the background of the health, social and financial crises triggered by COVID-19, a number of local and national governments have removed sanctions on users who fail to pay their water bills. Although this can help households in need, it also weakens the ability of public or private water companies to finance their network's operating and maintenance costs in the future.

J.-F. N.: Much is being demanded of Veolia during these uncertain times, in common with all other essential services. In manufacturing, process water requirements are critical and have to be altered rapidly: hospitals and the pharmaceutical industry need large quantities of ultra-pure water. But the drugs industry also produces hazardous waste: worldwide, we have maintained operation of facilities that treat water containing toxic waste. The health crisis has also led us to develop expertise in tracking pathogens in wastewater, providing an indicator for health in the general population. VIGIE COVID-19 and VIGIE COVID-19 PLUS detect and determine the level of SARS-CoV-2 and its variants in wastewater. We were the first company able to quantify variants in wastewater.

Are we seeing geographical disparities in water management in parts of the world impacted by the health crisis?

J.-F. N.: The whole world is adapting to regulations and arrangements decided locally. In the Middle East, where we are building major desalination plants in the United Arab Emirates, Saudi Arabia and Bahrain, our construction sites were locked down so that construction work would not be impacted. Continuity of service was maintained everywhere, sometimes under very difficult conditions. In Guayaquil, Ecuador, deliveries of water to people living in areas without access to the water network continued uninterrupted. The city-state of Singapore has accelerated water

“Ensuring wider uptake of technological innovations in water should happen through policies that recognize and signpost water's value.”

Xavier Leflaive

reuse, including for drinking water. They all have one thing in common: everybody adapted in the face of their differing realities.

Meeting growing demand for water is a planet-wide challenge. How is it possible to reconcile protecting water resources with availability for all and fairness in the ways a service is delivered?

X. L.: They go hand-in-hand. Preserving water resources is the best way to ensure that water of appropriate quality will be available for a multitude of uses. Protecting ecosystems contributes to the proper management of water: responsible land use, wetland and forest conservation, and so on. You also need to pay very close attention to ensuring that water is used efficiently. This begins with making sure that the frameworks used for allocating water resources are aligned correctly with the future challenges. Most countries have set up allocation frameworks that offer some degree of sophistication. However, these systems are usually built to reflect problems of the past, and they now need reform to properly reflect the challenges that lie ahead. Work by the OECD¹ shows that reforming these systems takes time. Efficiency in the network also has a role to play by reducing losses. Having a capacity to reuse treated wastewater is a further issue to consider. Aside from specifics about the technologies used, above all this requires unambiguous and deliverable standards to be set in terms of the water quality required for each type of use. Many of these questions, and the answers to them, depend on ideas about how we put a value on water: improving how we understand and reflect this value will help us reconcile resource management with resource use. This is a complex issue that involves more than just the financial value and the question of how much to charge for water. ▶



变电站一次系统模拟图



“We are moving towards an integrated, territory-based model for water management, where barriers between uses are increasingly blurred.”

Jean-François Nogrette



J.-F. N.: Keeping a close eye on infrastructure quality certainly helps to limit leaks. Reuse is also a solution, particularly for industry. In China, Mexico and South Africa, Nestlé makes powdered infant formula from cow's milk extracting the water and reusing it in the production loop. Nestlé draws no water for use in these factories. In farming, using fertilizers that are more organic paves the way to solutions that cause less pollution and use less water. Our Recirculating Aquaculture System (RAS2020) technology means salmon can be reared far from the fjords using very small quantities of recycled water, from eggs right through to adult fish. Aquaponics is another solution, one that combines fish farming and market gardening. We are moving towards an integrated, territory-based model for water management, where barriers between farming, urban and industrial uses are increasingly blurred. Loops are emerging between different users. We are now producing drinking water from wastewater. In Namibia, wastewater provides 35% of the water used by people in the capital, Windhoek. In Australia, treated water from coal gas plants run by QGC is used to irrigate farmland. The circular economy challenges us to find ways of maximizing wastewater reuse.

How does the OECD encourage member countries to ensure industrial companies take greater account of the scarcity of water in their industrial processes?

X. L.: We work on two areas directly relevant to industrial uses. First of all, improving water allocation frameworks has impacts for industrial uses. Frameworks can be dissuasive for uses that add little value, in the wider sense, where water is scarce. We have also worked on technological innovations in water, including technologies that manufacturers can use in their processes. We found that the water industry is full of ideas. Ensuring wider uptake of these technologies is still a weak point. This should happen not so much through aid or subsidy as through policies that recognize and signpost water's value: making sure that a user pays when their use deprives other users of access to the resource; also making sure that causing pollution is always expensive. Regarding emerging forms of pollution such as pharmaceutical residues, microplastics from textiles and tires, a recent OECD report² shows that targeted approaches are now needed for every stage of product lifecycles: these entail specific responsibilities on the part of companies that design, produce and market these products.

“For water managers, the main threat is biodiversity loss.”

Jean-François Nogrette

What other significant threats are there to well-balanced and sustainable management of water resources during the decade ahead? What are your recommendations for avoiding these threats?

J.-F. N.: Rapid urban growth means sanitation is a major issue that remains to be addressed. The other issue is the increasing use of desalination. These plants will need to be powered by renewable energies. Reuse is a further challenge, not just in terms of keeping a watch on water quality, but also in terms of choosing the least polluting energy sources. Finally, there is the threat of pollution in diluted forms. Water from industrial uses is often mixed with municipal wastewater, making treatment very expensive. Manufacturers should treat wastewater close to their production sites. Smaller industrial companies could use shared treatment plants. For major industrial companies, reuse reduces overall water use and improves the quality of discharge.

A 2012 report from the OECD³ looked at the consequences of inaction, particularly in terms of water management. How are we doing today?

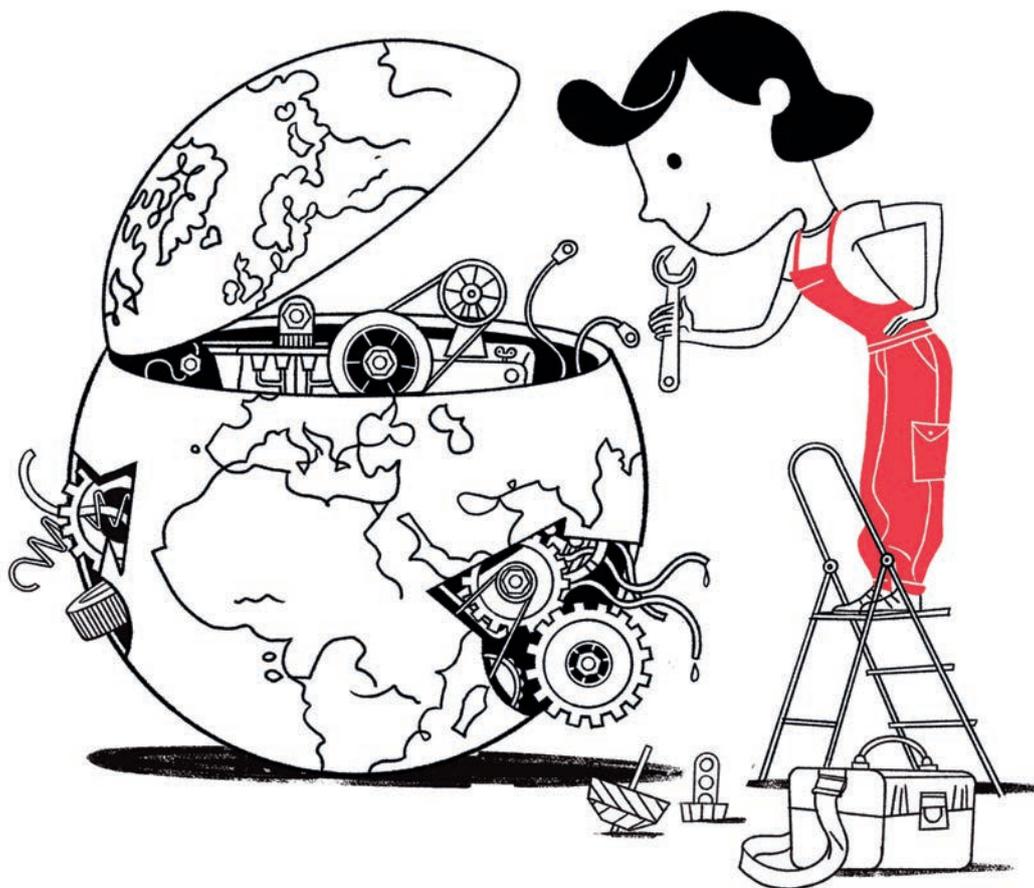
X. L.: This was a future-looking report that set out the consequences of inaction, and attempted to highlight its costs. It played an important role in raising awareness among our member countries and in setting out the areas where we should concentrate our efforts to find answers to the questions raised. Much, of course, remains to be done. Progress reports on the United Nations Sustainable Development Goals, particularly in terms of water and sanitation, remind us that we are not on target to meet our commitments. ■

¹ OECD (2015), Water Resources Allocation: Sharing Risks and Opportunities, OECD Studies on Water, OECD Publishing, Paris, <https://doi.org/10.1787/9789264229631-en>

² OECD (2019), Pharmaceutical Residues in Freshwater: Hazards and Policy Responses, OECD Studies on Water, OECD Publishing, Paris, <https://doi.org/10.1787/c936f42d-en>

³ OECD Environmental Outlook to 2050: The Consequences of Inaction (2012). https://read.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050/water_env_outlook-2012-8-en#page1

APRIL 22, 2021
EARTH DAY



RESTORE OUR EARTH™

BUILDING ON CLIMATE CHANGE MITIGATION AND ADAPTATION MEASURES, 2021'S EVENT IS SHINING A LIGHT ON THE PROCESSES AND TECHNOLOGIES HELPING RESTORE ECOSYSTEMS. FEATURING ON THE CALENDAR IN 193 COUNTRIES, EARTH DAY IS THE LARGEST CIVIC ENVIRONMENTAL MOVEMENT.

WWW.EARTHDAY.ORG/EARTH-DAY-2021/

Above and beyond

Meeting Veolia employees from all over the world

Water is becoming scarce and precious, a resource under threat on our great blue planet. Julien and Hervé are both helping in their different ways, one to measure it and the other to ensure its availability.

Julien Prunaret

Systems Engineer,
Veolia Nuclear Solutions

Julien first became fascinated by atoms during an internship as a student of microelectronics and telecoms engineering. “There’s something mystical about nuclear. Everybody has heard of it but nobody seems to know what it really is,” he tells us. His natural curiosity and a profound sense of having found his element led him to make a career in this field. After four years studying the mechanics of nuclear measurement systems, he joined Veolia Nuclear Solutions (VNS) in 2020. “Sensors and measurement apparatus are at the heart of what we do at VNS. And where there are sensors there are electronics.”

This international subsidiary, specialist in decontaminating and dismantling nuclear facilities and processing radioactive waste, designs custom technologies with an emphasis on supporting leading global players in the nuclear industry to provide optimal and secure management for their waste and installations. And, on occasion, it is called on to solve some highly unusual environmental challenges. Working in these temples to the atom brings new discoveries every day. “Having access to sites that are closed to the general public is a great privilege, a chance to get close to symbols of French know-how,” Julien adds with more than a hint of pride.

And when VNS successfully bid for a contract from EDF for improving water management at its hydropower dams, Julien was put in charge of coordinating the project team. He found himself working alongside a team of engineers from EDF and physicists from CNRS — the French national center for scientific research — who were convinced that the answer would come from space! They had been working since 1997 on the concept of cosmic radiation, a stream of particles

known as neutrons that constantly bombard the earth. “Neutrons react to the presence of water, even as snow, and we spent 11 months fine-tuning their prototype.” The idea was for a ground-based sensor fitted with a mini weather station and a seven-meter mast topped with a solar panel. When the sensor was covered in snow, it would measure the snow in terms of its liquid water equivalent, making it possible to predict the volume of water freed when the snow melts. “We then send the data to EDF, where it is used to predict future water levels behind its dams.”

This is critical information, because knowing the volume of water available at its hydropower dams allows EDF to anticipate future electricity production, which helps to better meet peaks in demand for power. “Electricity from hydropower plants is an adjustment variable that helps to keep electricity supply and demand in balance. Unlike power from nuclear plants, this is a reserve of energy that can be called on to offset variations in the grid at short notice,” explains Julien. There’s no room for mistakes as a false reading has the potential to cost EDF billions of euros. “Accurately controlling production from this delta avoids EDF having to purchase electricity on the international market from sources that are often higher-carbon and, therefore, greater greenhouse gas emitters.”

Fitting the first three sensors in the high mountains was a race against time before the first snowfalls, a special moment that Julien looks back on with a sense of accomplishment. And this is just the beginning of the story, with a total of 35 sensors due to be installed by 2025. A number of other countries are now showing an interest in this technology 2.0 that is long-lived, self-contained and environmentally friendly.





Hervé Faujour
*Chief Operating Officer,
Veolia Middle East*

Hervé was already passionate about one vital resource, water, when he first joined Veolia as a graduate process engineer in 2000. And so began a career proudly spent protecting the environment in all corners of the world, an adventure that Hervé says is “nowhere near its end.”

As his career progressed to postings in Asia, the Middle East and France, where his work often involved projects with an international focus, he repeatedly noted the differing social and geographical contexts that underpinned the tremendous disparities in the availability of water and people’s attitudes to it. These observations led him to turn his mind to the challenges of water reuse in urban settings. “I’ve lived in an arid part of the world for the past 15 years, and this led me to reflect on the best way to produce water for household and industrial use from wastewater that is treated as near as possible to the point of reuse, while keeping the main wastewater treatment plants located outside city limits.”

His lightbulb moment came on a visit to Mexico for a seminar. The solution was right there in front of him, in the form of a proprietary Veolia technology: Opaline Duo®. “My idea is to use this membrane technology to produce recycled water from wastewater taken from the sewage network, in a way that is decentralized and self-contained.” And so the Contain’O project was launched in 2016. Hervé believes differentiating between water uses is vital in a world where the resource is under threat. “Drinking water represents a minute portion of our overall water use. We obviously don’t need drinking-quality water for all household purposes, for the toilet and so on, and for industrial use. One solution for better management of water resources is to adjust

tolerance thresholds for water quality according to each type of non-food use,” he explains.

As with every new project, Contain’O threw up a number of challenges. First was the concept itself, which is counter-intuitive from a technical standpoint. “Injecting wastewater, which is heavily loaded with pollutants and suspended solids, directly into ultrafine membranes is the complete opposite of the usual process.” But his vision and determination led him to persevere, overcoming obstacles one by one. At first he worked alone, while he won over his colleagues to the project, then with a team. It was a period when he truly brought the Veolia slogan to life: “We Are Resourcers.” “My long experience working for Veolia Water Technologies’ design branch, the Business Support and Performance Division at head office, and for various Veolia operations across the Middle East has given me a keen awareness of the financial and technical constraints facing every stakeholder, and of the importance of listening to what customers need when trying to get innovations off the ground.” His optimism and courage trumped the fear of failure that can unsettle project teams during a project’s early days. His perseverance eventually paid off when his management agreed to invest €300,000 in developing a prototype, a signal that the project was about to take on a whole new dimension.

Five years after the Mexican seminar, the first mobile demonstrator, with a daily capacity of 250 cubic meters, was up and running in the Middle East. Contain’O is without doubt the longest project Hervé has led during his career. But for somebody who describes himself as a typically stubborn Breton, the time and energy spent were a measure of the importance of the task because, as Hervé observes, “water is too precious to only use once.”





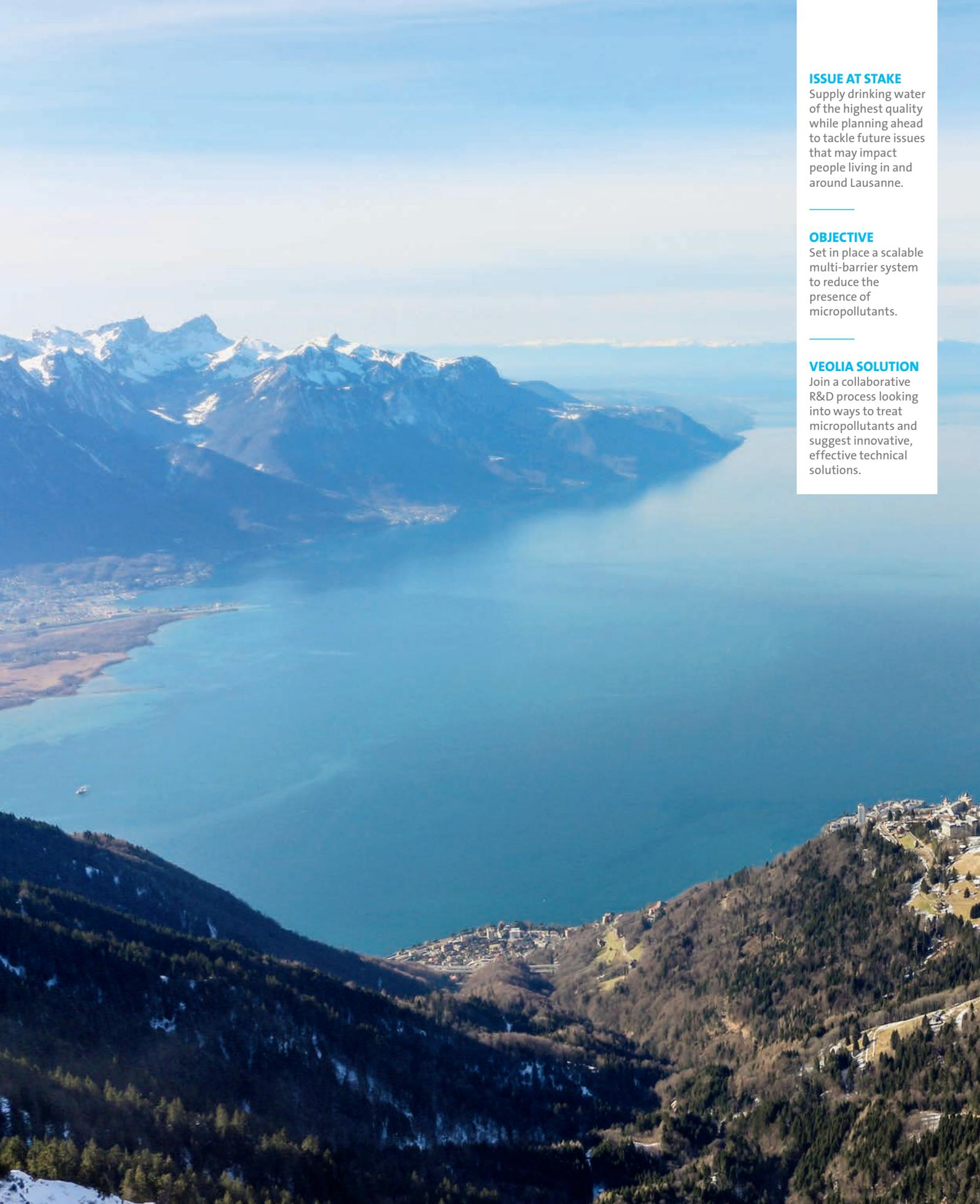
Lake Geneva: micropollutants, new targets for the city of Lausanne

Lake Geneva is the primary source of drinking water for Lausanne and its surrounding area, accounting for 66% of annual production. This reliance on the lake led the city authorities to test various technologies for dealing with micropollutants identified in its water. A project understandably of interest to OTV, a subsidiary of Veolia Water Technologies (VWT).

Whenever the sun comes out, the people of Lausanne flock to the lakeside at Ouchy on Lake Geneva with its

old-time ferries that take tourists out for cruises and its beaches with paddle boats for hire. Lake Geneva is an attraction at any time of year, loved as much by locals as by those who visit simply to take in the sights.

Sometimes called a pocket-sized ocean and extending over an area of 581 square kilometers, more than five times the size of Paris, Lake Geneva attracts countless visitors. But as well as offering leisure activities ▶



ISSUE AT STAKE

Supply drinking water of the highest quality while planning ahead to tackle future issues that may impact people living in and around Lausanne.

OBJECTIVE

Set in place a scalable multi-barrier system to reduce the presence of micropollutants.

VEOLIA SOLUTION

Join a collaborative R&D process looking into ways to treat micropollutants and suggest innovative, effective technical solutions.

KEY FIGURES



70 million cubic meters of drinking water drawn from Lake Geneva every year.

One of the goals of the Lausanne 2030 project is to plan ahead for an additional **30,000 residents** in the coming years.

The current Saint-Sulpice drinking water plant entered service in **1971**.

As part of its battle against micropollutants, the city of Lausanne has launched **11 pilot tests since 2014**.

and transportation, it also plays a vital role in providing water to the surrounding area. Christophe Mechouk, Head of Engineering for the city water services since 2014, explains. "We have countless underground water resources in the vicinity that we draw water from year round. But from mid-spring until early fall, when demand is at its peak, we use the lake as a back-up. As well as Lausanne and its population of around 140,000, we serve a further 350,000 people in the canton of Vaud, a total of over 70 municipalities. Some of these areas have a very high demand for water during good weather." This is additional demand that the lake can provide, once the water passes through drinking water plants at Lutry and Saint-Sulpice. But a problem arose in the years after 2010, with samples taken from

the lake spreading panic across the media and among consumers. The panic was caused by the presence of micropollutants in Lake Geneva's water, minute doses of residues from medicines, herbicides, fungicides and corrosion inhibitors that occur, for example, in water discharged from washing machines. Some of these are known or suspected carcinogens, and there were real questions about the cocktail effect of these products on health and the environment. Clearly, it was time for Lausanne's authorities to act. The issue, already under discussion at city hall, was suddenly a priority.

Scalable industrial ecosystem for multi-barrier treatment

Adsorption, oxidation, membrane

filtration: Christophe Mechouk and his teams ran trials on a number of different technologies. The advantages of a contract divided into lots, a requirement in Switzerland, is that it brought together the finest expertise available to create a complete industrial ecosystem for micropollutant treatment, totally redefining the operational cycle at the Saint-Sulpice drinking water plant. It was at this point, in 2015, that VWT became involved via its OTV subsidiary. "Veolia Group's R&D division and engineers from VWT were tasked by Lausanne's water services with providing a pilot nanofiltration unit. The solution was approved after a year-long collaborative testing process. Then, when the call for tenders for building the plant was issued in 2019, a team of four or five colleagues from OTV worked full-time on the project for several months. We also worked closely with Wabag, a local partner," recalls Cédric Cathelier, Head of Business Development for OTV in Switzerland. It proved to be a winning effort! OTV's solution that uses nanofiltration on 25% of the flow was selected, wrapping up what will be Europe's first multi-barrier plant. "Treatment will start with pre-filtration to 130 microns, followed by an advanced oxidation phase using ozone and hydrogen peroxide, then filtration with granular activated carbon, followed by ultrafiltration, nanofiltration with remineralization and a final disinfection phase," explains Cédric Cathelier.

One to watch...

What happens next? All participants will sign contracts by July 2021, signaling the start of construction on Saint-Sulpice II, a project that will take five years to complete.

VEOLIA, PIONEERING THE IDENTIFICATION AND QUANTIFICATION OF COVID-19 AND ITS VARIANTS IN WASTEWATER

November 2020: as France enters its second national lockdown, Veolia rolled out a brand new area of expertise for the very first time, the result of a rigorous process of research and analysis, begun in March, into ways of combatting the virus. The aim of VIGIE COVID-19 is to alert to the presence of traces of SARS-CoV-2 in wastewater, providing local authorities with indicators to track changes in the epidemic in their regions, and a tool to help them in their decision-making processes. Three months later, Veolia

updated its proposal with assistance from two expert partners. IPMC¹ offers sequencing of the SARS-CoV-2 genome in wastewater to identify variants, and IAGE,² working with medical analysis laboratory Phytocontrol, uses digital PCR to quantify viral loads. With VIGIE COVID-19 PLUS, "we and our partners are taking a further step toward accurately and cost-effectively mapping the circulation of various SARS-CoV-2 variants," explains Philippe Sébérac, Scientific and Technology Director at Veolia. "With these latest

indicators now available to local authorities, VIGIE COVID-19 PLUS becomes an additional decision-making aid when taking protective health measures to combat the spread of the epidemic and the presence of high-risk variants." Veolia has been the first environmental industry player able to identify and quantify the virus and its variants in wastewater.

¹ Joint research center of the French National Center for Scientific Research (CNRS) and Côte d'Azur University.

² Montpellier-based company specializing in environmental biological analysis



And the design of the drinking water treatment system could well set an example for the future. By 2026, the new plant is forecast to be producing 1.4 cubic meters of very high quality water every second, compared to 1 cubic meter currently. Levels of metformin, a diabetes medication not on the health authority's red list "will, for example, fall from 600 to under 100 nanograms per liter. Other micropollutants, whose levels are already below the limit, will also be lowered. The other target is to produce water that is biologically stable — that doesn't necessarily require chlorine disinfection — within 15 to 20 years," says Christophe Mechouk. This is a new field where Veolia's skills could come into play. Because, in addition to a water treatment plant able to adapt to the city's changing needs, Lausanne is extremely interested in anything that helps make its water cleaner. Patented in December 2020, OPACARB® FL, the latest invention from Veolia's R&D teams, opens the door to treatments for chlorothalonil. First identified by the city water service's laboratory in 2014, this fungicide, used for everything from controlling mold in agriculture to keeping golf greens impeccable, is a suspected carcinogen. Testing the process on a water source near to Lausanne has shown promising results. Further tests are also underway into ways to combat the proliferation of Quagga mussels in drinking water facilities. Although not a threat to human health or drinking water quality, they are a hazard if, for example, they colonize a pipe or water intake. ■

3 QUESTIONS TO CENDRINE CARNEL, R&D PROJECT LEADER, SARP INDUSTRIES

"We aim to transform residual salts into resources"

What is the idea behind the Valosels project?

Cendrine Carnel: Under no circumstances should the fact that we work to benefit the environment prevent us from efforts to reduce our own impact. Quite the opposite, this is an area where we need to be setting an example. A lot of our effort at SARP Industries is focused on the circular economy, reusing the waste we

generate. Valosels is one of these initiatives.

So, what does the project involve?

C.C.: We currently use hydrometallurgical processes to recover and reuse certain metals used in batteries. To isolate them, they have to be first soaked in acid baths so they dissolve; we then add a base to precipitate them as solids. This acid-base mixture used in the

process generates salts. These salts which we produce indirectly are the ones we want to recover, because using our trial process to collect them means they can be recycled back to acid and base. What was waste becomes a resource. What are the risks in the event of accidental spillage into the environment? Increasing the salt content in water courses will, over time, put ecosystems out of

balance and pose problems for living organisms in rivers.

The project pilot phase started in 2018. What are the next steps?

C.C.: We hope to start investing in scaled-up industrial units by 2022. The first sites to be equipped will be those where batteries are processed, but we also need to be thinking about the electric vehicle industry.



The power of crystallization: how an Australian lake produces fertilizers

In Western Australia, the power of the sun will soon be used to extract the essential fertilizer sulphate of potassium (SOP) from the heavily mineralized Lake Way. Salt Lake Potash Limited, known as SO4, is currently commissioning the technology to produce SOP in what is a first for Australia.

In Western Australia, Veolia has been integral to enabling the production of sulphate of potassium (SOP) fertilizer by providing essential crystallization technology. Because of its chemical characteristics, Lake Way is perfectly suited to the production of high-value SOP – a premium potash fertilizer, with potassium one of the three essential nutrients required by most plants. “The main benefit of SOP is

that there is no chloride,” says SO4 Chief Executive and Managing Director Tony Swierczuk. “When you hear about potash, it is typically KCL (potassium chloride) and chloride is not friendly with arid soils such as those found in Australia, the Mediterranean, Africa and Middle East. All of these locations with quite poor soils cannot tolerate chloride put into them. What SOP does is that it introduces a chloride-free source of

potassium. There are particular cash crops such as fruits, berries, nuts and citrus that cannot tolerate chloride at all. It affects the taste and colour.”

A lake rich in potassium

Lake Way has a dry salt surface under which is a quite shallow salt brine aquifer. This brine contains minerals that are taken from the lake’s catchment area that flow into the



ISSUE AT STAKE

Expertise and technology required to crystallize sulphate of potassium.

OBJECTIVE

Crystallize solution into a commercial product.

VEOLIA SOLUTION

Be the technology provider that produces the finished fertilizer.



KEY FIGURES

- **245,000 tonnes** of SOP fertiliser produced per year
- **92%** of production will be exported
- Customers in **60 countries**
- Veolia HPD crystallisation technology used in **30 countries**

crystallizer to grow and purify potassium sulfate crystals, and a second crystallizer to produce secondary Schoenite salts recovered from the recycled SOP mother liquor. These salts are then recycled and combined with Primary Schoenite salts and fed to the SOP crystallizer to maximise potassium yield," indicates Jim Brown, Executive Vice President of Veolia Water Technologies Americas. "Veolia had the expert understanding of the solubility characteristics, dissolution of the salts and all those areas where it has made a name for itself in crystallization," says Tony Swierczuk. "They outperformed competitors with solubility tests in Chicago and determined the process conditions to maximize the product recovery. Veolia did a great job understanding the process flows and really nailed it. HPD is the crystallizer. It is at the heart of the process and is essential to overall production quality. Not getting this right and getting the recoveries right, and the solution management right, we would be in trouble. HPD produces our end product." SO4 is working hard towards being ready for production of SOP by the end of May 2021, with sales of the fertilizer due to begin as soon as possible after. It expects to deliver 245,000 metric tonnes of SOP per annum when in steady state production. SOP is generally considered a higher quality source of potassium, compared to the lower quality KCL – the latter being the largest source of potassium around the world.

Global sales of SOP

Through six distribution partners, it aims to

basin over millions of years – for Lake Way this has meant that it is especially rich in potassium that is ripe for extraction. "The technological process used here involves paleochannel bores that are shallow in the lake and extract brine," adds Tony Swierczuk. "It flows into a trench network that is currently 65km long and will be extended to 95km eventually. The surface layer of the aquifer soaks into those trenches, which are seepage collection channels and also a transportation pathway for bore brine. The water from the lake basically works its way to sumps around the solar evaporation ponds. Those sumps then pump the aquifer brine into the ponds. Over several months after you transport the brine around the ponds and transfer it into downstream cells, under the hot sun, the concentration of brine gets

higher and higher as the water evaporates off." Eventually, a vast majority of the contaminant salts, sodium chloride (NaCl), are removed and this is the plant feedstock. From there, it goes through various phases to remove other contaminant minerals and to beneficiate it, before reaching the crystallization phase. It is at this point that Veolia comes in.

Veolia's crystallization technology

Following a competitive tender process, Veolia was selected by SO4 to provide the crystallization plant. Using Veolia's proprietary HPD crystallisation technology, the SOP solution will be turned into a water-soluble crystal product that is ready for bagging and sale. "To convert the harvest salts to premium grade SOP, Veolia designed an HPD® SOP

ISLAND WATER RECYCLING

Hawaii is a tropical paradise with a diverse and beautiful ecology. But being an archipelago of 137 islands means that water supply is limited. With a growing population, the US state has had to look at water recycling to provide essential water supply.

"Water is limited, obviously, on an island. It's not like we can put in an aqueduct, or pull up an iceberg from the Arctic," says Barry Usagawa, a program administrator at the Honolulu Board of Water Supply. "Recycled water provides that resilience for

us to diversify and extend those limited freshwater supplies even further into the future." In 1998, the City and County of Honolulu entered into a US\$140 million, 20-year agreement for Veolia to design, build and operate Honolulu Water Reclamation Facility. The Honolulu Board of Water Supply purchased the facility from Veolia in 2003, but kept the company on under an operations and maintenance contract. Each day, the plant treats almost 50 million liters of secondary effluent from the city and county to produce almost 45

million litres of recovered water. The water undergoes two different types of treatment depending on its end-use: highly pure water treated using reverse osmosis (RO) is used for industrial purposes, while R1 filtered water is used for irrigation. With eight golf courses within a five mile radius of the facility, in a tropical climate with heavy water demand to keep the greens and fairways lush, this R1 water has limited the need for freshwater supplies for this type of irrigation. Each day, the recycled RO water diverts around eight million liters of fresh

drinking water from industrial use freeing it up for to domestic consumption. The RO water covers around 75% of power generation facility requirements on the island of Oahu.

The contract has now been extended to 2038, and in 2019 new technology was installed to improve energy efficiency for the R1 process by 65%. Hawaii has some of the highest electricity costs in the US, but this process has led to significant cost savings for the Honolulu Board of Water Supply.

supply 92% of its product to 60 countries around the globe with the remaining 8% being used for spot and Australian trade. Currently, most seaborne traded SOP comes from Belgium and Germany, but this will provide more supply on the market, with use of SOP growing each year by 3-4%. In particular, South East Asian and Australian customers will have a closer source of SOP than previously. While all of the focus at the moment is on completing the Lake Way project, Tony Swierczuk has ambitions to introduce the technology to other SO4 lakes in the region. He says: "We've got nine lakes in the Goldfields region. I see Goldfields as a multi-lake SOP province. I can see Goldfields in Western Australia being known globally as a provider of high-quality SOP." But in a matter of weeks, SO4 will be producing its high-quality SOP fertilizer from Lake Way, and it is being produced thanks to the assistance of Veolia's technology. As a result, before long, you could be eating tasty fresh citrus fruit, berries or nuts that have been nourished with Lake Way-produced SOP fertilizer. ■

FRESH WATER FROM THE SEA

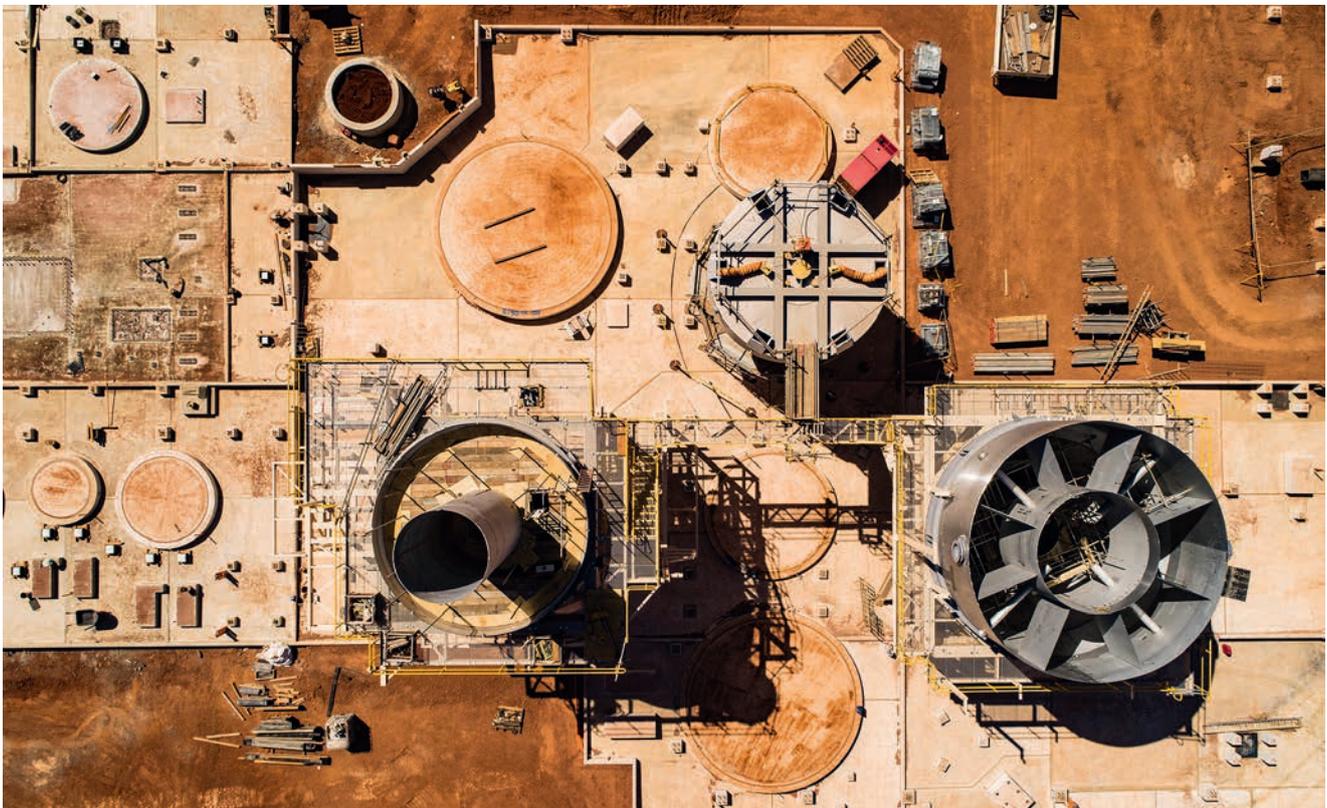
A shortage of freshwater sources on land means that the Spanish region of Almería relies on desalination plants to provide fresh water to inhabitants and agriculture. The Campo de Dalias facility supplies 250,000 people with drinking water as well as 4,600 hectares of irrigation. Built by Veolia, it began operation in November 2015 and is one of the largest desalination plants in Europe.

The project was promoted by the Spanish Ministry of Agriculture, Food and Environment through the public company Acuamed, specialized in water management. Its Project Manager Santiago Lacambra says: "The main objective of the Campo Dalias desalination plant is the

generation of new quality water resources in an area with great scarcity." With a 15-year operation and maintenance contract in place, Veolia extracts seawater and using filtration and reverse osmosis processes produces 97,200 m³ of fresh water per day – this is the equivalent of 1.6 Olympic-sized swimming pools every hour. The process is designed to remove salt and other chemicals from the seawater and produce high-quality drinking water. After treatment, the clean water is distributed by gravity through a 5-km pipeline from the plant and then through a 38-km long network to supply the cities, towns and agricultural needs of western Almería. Effluent created during the process is returned

to the sea, with the 20 diffusers of the underwater outfall carefully positioned to avoid any impact on marine flora and fauna.

Santiago Lacambra adds: "The action also seeks to improve the ecological status of the underground water bodies, eliminating a large part of the deficit of available resources in the area. It is important to mention that during the construction phase and now the plant's operation, all the environmental requirements and conditions in the Environmental Impact Statement have been verified in addition to complying with the requirements stipulated in the Water Framework Directive for all new projects."





SEDIF, the world's first carbon-neutral water service

It is France's largest water service and one of the largest in the world. SEDIF provides water to around 4.6 million people via a public service delegation contract awarded to Veolia in 2011. Working under the control of SEDIF, Veolia Eau Île-de-France is responsible for all aspects of the operational production and distribution of water, as well as for customer relations. Over the past decade, this high-profile contract has delivered a carbon-neutral water service to a region covering 151 municipalities.

Veolia Eau Île-de-France's zero-carbon strategy aligns with SEDIF's climate, water and energy policy to focus on three areas: energy savings, renewable energy, and reforestation to offset unavoidable emissions. The goal is to provide a public service that combines efficiency with

sustainability. The policy provides a formal framework for actions to reduce the impact of the water service on the climate emergency, while also identifying mechanisms to increase its resilience and reduce its vulnerability to climate change. As part of this process, SEDIF makes an active contribution to wider-scale thinking on these

issues, including with its membership of the club for the world's major water services it founded in 2011 at Veolia Eau Île-de-France's suggestion.

A close eye on energy

Veolia Eau Île-de-France's contractual obligations are very much part of a





ISSUE AT STAKE

Major cities increasingly have to face up to their climate emergency responsibilities. The Paris region is no exception and Syndicat des Eaux d'Île-de-France (SEDIF) has tasked Veolia Eau Île-de-France with reducing its carbon footprint.

OBJECTIVE

SEDIF has set itself the target of becoming carbon neutral via a strategy focused on three areas: energy savings, renewable energy, and reforestation.

VEOLIA SOLUTION

The delegated public service contract with Veolia Eau Île-de-France, in force since 2011, ushered in a range of actions designed to cut SEDIF's carbon footprint while guaranteeing good quality water to all its member municipalities.

collective effort to drastically reduce greenhouse gas emissions, as set out in the Paris Climate Agreement. “We originally set ourselves an energy-saving target of 5.5% over 11 years, which we have already exceeded,” says Nathalie Duchevet, Director of Veolia Eau Île-de-France. “That might not seem much, but the final few percentage points are always the hardest, especially when your performance is already excellent. To give you an idea, 5.5% is equivalent to the amount of power used in a year by a town of 20,000 residents.” Among the countless actions put in place to help meet the contract targets, increasing the efficiency of the water network was one of the operations that delivered a reduction in energy use. The pumping systems that carry water from rivers to drinking water plants and then to consumers use large amounts of energy. “The less water we lose, the less energy we use,” is how Nathalie Duchevet describes it. This involves tasks such as keeping efficiency in the 8,700-kilometer network above 90%, compared to a national average of 80%, and upgrading equipment at treatment plants to make them more energy efficient.

Veolia Eau Île-de-France creates ServO

Veolia Eau Île-de-France created ServO to help optimize operations, energy use in particular, and keep a constant lookout for ways to improve its ecological and financial

performance. This is a centralized tool for managing the entire water service, from rivers through to taps in the home. Every day sees this powerful decision-support tool analyzing millions of lines of data from treatment plants, the network and meters. “Constantly developed and optimized since our mission started, ServO lets us set the best strategy to follow on a day-to-day basis,” explains Nathalie Duchevet. “ServO consolidates and analyzes various parameters, including energy and water quality, using these to give us daily recommendations: real-time instructions to extract water of a higher quality from a

particular river, for example, as this water will require less treatment.” Delivering drinking water to consumers that requires less energy and treatment.

Physically, ServO is a battery of large screens and servers that generate alerts, issue daily reports, produce dashboards, and so on. “ServO lets us leverage all of Veolia Eau Île-de-France’s expertise and know-how. With it, we can locate leaks precisely, or identify the incremental deterioration in equipment at a treatment plant that will need to be replaced.”

Data used by the ServO system comes from thousands of sensors fitted right across the



KEY FIGURES

- Veolia Eau Île-de-France provides a delegated public service to Syndicat des Eaux Île-de-France (151 municipalities)
- 800,000 cubic meters of drinking water produced daily
- 8,700 kilometers of pipe
- 4.6 million consumers

3 QUESTIONS TO FRÉDÉRIC VAN HEEMS, CEO OF VEOLIA’S FRANCE WATER BUSINESS LINE

Water, whether there is too much or not enough, is a bellwether for the climate emergency. With Impact Eau France, part of Veolia’s Impact 2023 strategic plan, Veolia Water France, as a leader and benchmark for water services in France, is leveraging water to accelerate the ecological transformation as it pursues its goal to “create public benefit.”

What are the key features of Impact Eau France?
 F.V.H. : Our new strategic project, following on from Osons 20/20!, is based on three pillars: a solid people-centered organization, green transformation, and an inclusive transformation that mainly involves

sharing challenges and jointly constructing solutions with our clients. During the health crisis, we have been able to draw on the solid foundations we have built to continue supplying our complete range of drinking water and wastewater services to French people, municipalities and industries, while also keeping our teams safe.

What are these foundations?
 F.V.H. : Our public service contract (“CSP” in French) mindset is a perfect example. Unlike the public service delegation model of the past, which in its traditional form no longer delivers what municipalities need, the public service contract mindset allows

us to jointly create and manage services with our clients, drawing on our varied areas of expertise. Our contract with SEDIF is an excellent illustration of this approach, built around a specially designed contract that includes commitments and indicators tailored to each territory.

What commitments does your strategic plan contain?
 F.V.H. : Playing our part in the collective commitment to zero carbon by 2050 means that Veolia has a responsibility to take things to another level, and work alongside the authorities for a successful ecological transformation. This is why we want to produce positive-impact water in

France. To reach this goal, we are committing to a 10% cut in our carbon footprint by 2023, and a 30% increase in our green energy production, using energy recovered from wastewater. Another major commitment is that at least 100 of our sites will have a positive biodiversity project by 2023. Finally, we are raising awareness and giving our teams training in ecological transformation. Our goal is to see at least 90% of our employees making a personal commitment to do something positive for the planet. The idea is to encourage everybody to ask themselves what positive impact they could have at an individual level as part of their day-to-day activities.



network. Buoys on the Marne, Oise and Seine rivers provide data on water levels, Rés'Echo sensors listen to the network to detect leaks, Qualio sensors measure water quality in the network and provide a water traceability capability.

The amount of electricity used by ServO is included in overall energy audit calculations: buildings housing its servers are insulated from solar radiation, external air is used for free cooling, etc. Nathalie Duchevet adds that "heat from the servers is actually used for heating greenhouses. We have now hit our target for cutting energy use by 5.5%, so we're looking into new targets to set ourselves."

Carbon offsetting

As well as energy savings, the contract between Veolia Eau Île-de-France and SEDIF also calls for reforestation campaigns and the use of green energy sources. "Energy savings are a good thing, but we are still an energy-intensive industry. This is why switching to renewables was so important," explains Nathalie Duchevet.

This combination of actions to cut energy use and the switch to 100% renewable energy saves the equivalent of 11,000 metric tons of CO₂ emissions every year. And financial support for reforestation programs in countries such as Mexico, Colombia and Senegal enables us to offset the remaining 45,000 metric tons of CO₂ the water service produces each year.

Additional actions are in place to help meet the targeted 33% cut in greenhouse gas emissions by 2024. For instance, 30% of the light-vehicle fleet has been converted to run

on green fuels, and a low-carbon footprint is a criterion used when selecting products and materials. Finally, for the past two years Veolia Eau Île-de-France has run a campaign among its employees to help identify where further percentage savings can be made.

"Whether it's in biodiversity or energy savings, we're always in discussion with other Veolia entities so that we share good ideas and best practices.

We're pioneers of carbon-neutral water. As an industrial operator, we use energy and chemicals and our vehicles are constantly on the region's roads. We produce greenhouse gases, so it's important that our activities are virtuous. This is completely in line with Veolia's purpose. It applied in 2011 when our mission with SEDIF first began, and applies more than ever today," sums up Nathalie Duchevet. ■

MOBILITY USING HYDROGEN FUEL FROM WASTEWATER

Wastewater treatment plants produce energy — biogas — from fermented wastewater sludge. This green energy gas is then collected and either injected into natural gas networks or fed into cogeneration plants to produce heat and electricity. Veolia is testing a third use, in addition to these two traditional applications: hydrogen as a fuel for use directly in buses and trucks.

"At the wastewater treatment plant in Hyères we're trialing a new sludge recovery solution that produces hydrogen," says Alain le Divenach, Development Manager, Mediterranean Region, Water France. The trial, which runs from April to August 2021, will supply 10 kilos of hydrogen daily, enough to fuel two light commercial vehicles from the fleet belonging to Veolia and its project partner,

the Toulon Provence Méditerranée authority. "Once scaled up, a conventional wastewater treatment plant could produce between 200 and 300 kilos. To give you some idea, a kilo of hydrogen is enough fuel for a light vehicle to travel 100km." During the Hyères trial, methane produced from sludge digestion is transformed into hydrogen and carbon dioxide using a process known as steam reforming, a technique that involves mixing this feedstock with steam heated to 600 degrees Celsius. The two gases produced are then separated, with the hydrogen stored and made available at a fuel distribution point. The carbon dioxide is mixed with more of the gas already produced by the sludge, which is then recovered through growing algae, for example, that is then used in animal feed, fertilizer or biofuel.

"Hydrogen fuel is mostly for use by heavy vehicles, trucks, buses and garbage loaders. Regional mobility plans are needed if hydrogen-fueled fleets are to grow, so that the gas can be used directly at the point it leaves the wastewater treatment plant," he explains. The trial will be used to measure performance and provide real-life feedback on operating costs, helping to identify areas for improvement when scaling up to industrial production. The pilot site at Hyères is already energy self-sufficient as a portion of the gas is used to heat the water for the steam reforming process. "As a complement to existing solutions, hydrogen production becomes particularly attractive in situations where there is no nearby gas network that can absorb the biomethane," explains Alain le Divenach.

The baobab-water tanks of Madagascar, trees of life

Rain is scarce in southern Madagascar. It only falls three or four times a year, but when it does it comes as heavy storms. There are no rivers or lakes on the arid limestone plateaus of the south, and the aquifers are too deep for wells. This means storing water is a matter of survival. The region suffered extreme drought during the 1920s and 1930s, leading to widespread famine. Since then, local people have found a solution: they use baobab trees as water tanks. They noticed that once one of these giant trees was split open by a lightning strike, water would collect in the hollow and remain very pure. This gave them the idea of creating tanks inside the trees, because baobabs are unusual in that they do not immediately die if hollowed out. Thanks to baobab, the iconic tree of Madagascar, the 475 residents of the village of Ampotaka can remain on their ancestral lands.

Photographer: Pascal Maitre



Above. The largest baobab trees are more than 300 years old and can store as much as 14,000 liters of water. One tree can provide an entire family with drinking water for three to four months. These giants make it possible to survive in this land.



GALLERY



Top. Baobabs are filled by hand, with buckets lifted up one at a time. A pool is dug close to each tree to harvest water during heavy rains. The opening in the trunk is then closed off to prevent theft.
Bottom. Baobabs must be hollowed out sufficiently to provide good storage capacity, but not enough to weaken them. After hollowing out, a six-month wait is needed for the scar to heal — for bark to grow on the inside and create a waterproof layer — before they are filled with water.





Top. Buckets of water, purchased from the town during the dry season when the baobabs are empty, are used to carry water up into the trunk. Cattle get their water from edible cacti with a high water content. **Bottom.** Before drawing water from the tree, this man is removing branches used to prevent birds and other animals from falling into the water tank inside the baobab and polluting the water.



PASCAL MAITRE Documenting lives

It was in 1996, while working in southern Madagascar for the magazine GEO France, that Pascal Maitre first saw people pouring buckets of water into baobab trees at the side of the road. It was an image that stayed with him until his next visit, this time for National Geographic to report on the plundering of natural resources. During this visit he met Pascal Danthu, a scientist with the French Agricultural Research Centre for International Development in Madagascar, whose work focuses on baobabs. "I quickly grasped the extraordinary relationship between local people and this tree," he recalls. "It was

something that nobody had previously documented." He worked with fixers he already knew from his previous thirty or more trips to Madagascar to arrange the necessary contacts. It is important to choose the right seasons. You have to go when it rains so that you can photograph people filling the trunks, then again six months later to watch them hollowing out the trees. Making this report involved two 10-day stays.

He takes most of his photos in the morning or evening. Mostly because it's too hot by day to hollow out a tree, but also because that's when everything appears at its best. "The January light in the southern hemisphere, after the rains, is a wonderful thing," he says. Pascal Maitre is a photographer who loves

color and is a big fan of Matisse, Gauguin and the Fauvism style of painting. This story about people and baobab trees is something very close to his heart. "I handled it as a reporter, I'm a photojournalist first and foremost. What I love best is to tell a tale, telling the story of people's lives through my photos."

Photography is also a way to help improve people's living conditions, and Pascal has made several reports documenting the lack of access to electricity in Africa. As he sees it, "it's not something that will change overnight, but it does help to kick-start a process. That's the power of reporting." And it's a career he intends to continue for as long as there are tales to tell. "Every story is unique, and people are so fascinating."

BIOGRAPHY

Pascal Maitre was born in 1955 and, like every photographer of his generation, he is self-taught. He turned to photography after studying psychology, but concluding it was not for him. His desire to leave his native France and travel the world, combined with his love of photography, led him to forge a career as a photojournalist. He started out at Jeune Afrique magazine, where he learned the trade. He then joined the Gamma agency before setting up his own agency, Odyssey Images. Now represented by MYOP, Pascal returns to Africa again and again, but he has also reported from Afghanistan, where he covered the Russian invasion, and South America.



Top. Water is stored inside the tree for six months before use. Soil in the water has time to settle and water is filtered by fibers in the baobab, emerging clear and pure. This purity makes it highly valued during childbirth to minimize risks of infection.
Bottom. Because water is so precious it is never used near the baobab where it is stored, to avoid the temptation to waste it. People carry it back to their homes with great care, then use it very sparingly.

New ways of thinking about sustainable water management





Securing access to water and wastewater services, optimizing how they are managed and ensuring continuity of service: these are the watchwords guiding Veolia's strategy in this area. Against the background of converging worldwide crises that call into question 200 years of progress in water provision, Veolia is today designing the water services of tomorrow.

Population growth, rampant urban growth, increasing volumes of water withdrawals for farming and industry: demand for water is growing rapidly around the world, at a time when a third of the largest groundwater resources are already over-exploited.¹ And there are also new threats to face: waterways, treatment plants and networks have become potential targets for cyber or terrorist attack, and extreme weather events are occurring with increasing frequency. Against this background, Veolia works to ensure secure access to water and to deliver the quality and quantity demanded. The Group also works hard to optimize the management of infrastructure and networks using digital tools, and to ensure continuity of service to its industrial and municipal customers thanks to a range of new modular offers. Going far beyond the infrastructure alone, Veolia is reinventing how water is managed. We take a look at the changes underway.

Driving progress in complementary solutions

As part of its efforts to ensure access in sufficient quantity, Veolia remains a pioneer of seawater desalination with a 50-year track record in the field. "In some parts of the world, the Gulf countries for example, where there are few if any freshwater resources, desalination cannot be thought of as simply an add-on to water from surface and underground sources. In these places it is the only source of drinking water," points out Vincent Caillaud, CEO of Veolia Water Technologies (VWT). "Given this reality, the reliability of our service is

mandatory, strictly non-negotiable." Its SIDEM subsidiary is currently busy with three major projects either in the construction or commissioning phase, in the United Arab Emirates, Bahrain and Saudi Arabia. Dating back over 50 years, Veolia continues to assert its presence in the desalination sector, with the market in the Middle East currently growing by an annual average of 8%.

VWT offers a new product that increases the safety of the high-pressure reverse osmosis system needed for desalination: The Barrel (see page 52), an encapsulation system for the technology. Its smaller footprint with enhanced operator safety and real-time digital monitoring of treatment process parameters, etc., are just some of the advantages already attracting clients seeking technologies that are reliable, robust and cost-effective. The Barrel is also one of a package of technologies for reusing treated wastewater, an activity where Veolia is perfecting its expertise in France and internationally. The types of clients won over by water reuse are as varied as the uses they make of it. Chinese oil refiner Sinopec uses it at its Yanshan petrochemical plant to increase the volume of process water available without drawing additional freshwater; in the Namibian capital Windhoek, it is used to provide residents with drinking water; and in the Milan region, in Italy, it is used for irrigating crops. According to Geneviève Leboucher, Senior Vice-President, Access to Water and Sanitation at Veolia, "looking ahead, reuse is an obvious choice for protecting water resources as a complement to optimizing use and combating waste." ▶



“Analysis and reactivity are critical to dealing with cyber risks.”

Jean-Louis Fiamenghi

SUPPLY CONTINUITY: KNOW-HOW FROM VEOLIA WATER TECHNOLOGIES

A compact technology with plug-and-play connections delivering water of a predetermined quality: these are the core features of our Mobile Water Services (MWS) solution. This is a flexible temporary alternative that allows industrial customers to maintain process continuity under all circumstances. We hear from the world leader in sustainable mobility.

The Michelin factory at Bassens, near Bordeaux in France, is one of three in the world that produces synthetic rubber for tires. Two on-site demineralization units provide the constant supply of demineralized steam the production process requires. “We run two units because demineralization also involves times spent regenerating resins in the ion exchangers that are needed to produce demineralized water in sufficient volume”, explains Victorine Chailan, an energy and fluids engineer with Michelin. “As soon as one unit starts its regeneration cycle, the other one takes over production.”

In September 2020, Michelin needed to carry out maintenance on one of the units, so it ordered an MWS solution rather than cutting back its steam production. With an hourly capacity of 100 cubic meters of demineralized water, the on-site fleet of VWT trucks quickly delivered the 600 cubic meters needed at the plant every day. François Shamber, the Energy Progress coordinator at the Michelin Bassens plant, talks about his experience: “Thanks to MWS, we had all the steam we needed and maintenance went ahead without a hitch. We’d absolutely use MWS again.” With the necessary information to hand, the MWS trailers can be readied at a moment’s notice.

Digital acceleration cannot happen without a cybersecurity culture

Digital technologies are key to providing exemplary management of water resources on behalf of municipalities and industry. Geneviève Leboucher explains, “our Hubgrade digital offer leverages artificial intelligence, our data pool and our expertise. It uses algorithms to process data and continually optimizes the performances of our clients’ installations. This enables it to calibrate energy and consumable costs as a function of variations in the quality of water entering treatment plants, at the same time as guaranteeing the quality of water exiting a plant. Our aim is to increase stability of plants, making them cheaper to run and more robust over the longer term.”

Adopted in 2019 by the Italian public service company Metropolitana Milanese SpA for its Nosedo wastewater treatment plant, the largest plant in Europe where final effluent is used in agriculture, our Hubgrade Performance service delivered a 20% saving in energy costs for biological treatments in just six months, as well as a 60 to 80% reduction in the use of precipitation chemicals such as ferric chloride. Vincent Caillaud says, “with Hubgrade Performance it becomes possible to automatically adjust

the equipment’s operational parameters to reflect the input flow rate. This optimizes their operation while cutting the plant’s environmental footprint and running costs.” The forecasted annual savings at Nosedo are considerable, around €500,000 a year. Jean-Louis Fiamenghi, Director of Security at Veolia points out that “digital innovations involve not just physical protection for installations, they also need virtual protection against cyberattack.” Security, which was previously outsourced, was taken back in-house in 2012 under the close control of Veolia’s Chairman and CEO Antoine Frérot. A well-resourced team of experts was created under the robust management of Jean-Louis Fiamenghi. The team keeps a constant watch on the fight against all manner of risks to the Group’s employees, clients and facilities. The true worth of this close oversight has been highlighted since the outbreak of the COVID-19 pandemic. The rapid rise in working from home and the resultant requirement to manage certain operations remotely have seen the emergence of new risks to services. “Given the ever-growing inventiveness of pirates, and the major risk that an interruption to service entails, it is vital that we identify every component

that is critical to our cybersecurity,” says Jean-Louis Fiamenghi. “All our facilities are fitted with systems that trigger an alarm if there is a significant variation in a critical parameter. This means that any unwelcome intrusion into a computer system, like the recent event at the drinking water plant in Tampa, Florida, will be identified and halted immediately.” And because cyberattacks are becoming more targeted as well as more effective, many countries now require operators that provide essential services, such as water and wastewater, to protect their facilities. Geneviève Leboucher points out, “as well as meeting all regulatory requirements, we also follow all the recommendations of the EU’s Network and Information System Security Directive² on cybersecurity.” And because municipal facilities are very often owned by local authorities, Veolia is tasked with establishing cybersecurity procedures needed to keep equipment and facilities

secure. “Analysis and reactivity are critical to dealing with cyber risks,” says Jean-Louis Fiamenghi, whose teams regularly foil attempted break-ins. Its wealth of acquired experience means that Veolia, alongside France’s leading computer security specialists, will be an administrator and the first non-IT company involved in the future Campus Cyber, opening in La Défense, the Paris business district, in the fall of 2021. This is an initiative led by the French National Cybersecurity Agency (ANSSI). But the COVID-19 pandemic has also led to the emergence of a new risk factor that operators never had to take into account previously: emotional risks. “In an increasingly uncertain world, we need to be aware of behavioral risks and the human element in crises,” explains Jean-Louis Fiamenghi, who is increasingly training employees to “keep thinking rationally even when it seems everything is becoming irrational.”

Digital for service continuity

If digital technologies make it possible to manage water resources more sustainably, they also help ensure it is available 24/7. Vital for drinking water and municipal sanitation, service continuity is also often essential to industry so that manufacturing can continue without interruption. Vincent Caillaud explains, “Hubgrade means we can remotely check that our technologies are working as they should, adjust process parameters, and even advise or troubleshoot for our clients. That’s the magic of digital: our experts are networked and can intervene wherever the client is located.” Augmented reality opens the door to new forms of remote operations, helping with commissioning, maintenance, troubleshooting and emergency support. As Geneviève Leboucher says, “when the COVID-19 pandemic started, we trained 100 people in Asia to use connected glasses. This was a boost for regional central support services which were able to continue ▶



“In certain regions, the reliability of our desalination service is strictly non-negotiable.”

Vincent Caillaud

providing their expertise as close to the ground as possible.” There is no question about it, the health crisis has demonstrated the usefulness of digital solutions and heightened clients’ interest in them. The requirement to ensure resilience is greater than ever.

Forecast the unpredictable, anticipate the urgent

In today’s uncertain times, Veolia’s highly experienced teams try to head off the unexpected by offering to work with their municipal and industrial clients to secure water and sanitation services, and with manufacturing companies for their value chain. In these situations, Veolia is the specifier when it comes to business continuity plans for clients whose core activities do not involve water treatment. For industrial clients, the goal is to avoid any impacts on production in the event of a fault in water treatment systems. “We analyze different scenarios and the criticality of

operations so that we can secure their supplies of power and reagent,” explains Geneviève Leboucher. “We then suggest and install sensors, and recommend items of critical equipment where redundant capacity is needed.” VWT has created a Mobile Water Services (MWS) fleet of modular mobile water treatment units to safely deal with emergency situations or temporary needs for stable quality water (see box page 46).

VWT is going all-out to maximize its ability to respond rapidly to keep its industrial clients’ activities in operation, even in an emergency. It has just invested €20 million in a regeneration plant for resins used in the production of the high-purity water needed by manufacturing industries, which will also serve as a base for additional mobile water treatment units. Strategically located in Heinsberg, Germany, at the heart of a heavily industrialized region of Europe, the plant will be fully operational as of mid-2021 and will boost VWT’s ability to respond

quickly in support of Veolia’s clients. And although 95% of clients for MWS are industrial companies, it has also been invaluable to municipalities facing a crisis. “Think back to October 7, 2020. In a few short hours, five municipalities in the Roya valley of southern France were devastated by torrential rains. The damage was extensive. Assets belonging to the local public water service for drinking water production and distribution were destroyed, as was a portion of the publically-managed wastewater network,” recalls Geneviève Leboucher. MWS trailers were quickly deployed to provide locals with a supply of drinking water. Jean-Louis Fiamenghi adds, “being efficient at crisis management is above all a matter of training.” At sites where it works, Veolia is constantly identifying crisis scenarios and preparing action plans. Regular drills are held to train teams to respond to emergencies as fast as possible. “These drills are sometimes run in collaboration with state services, like in 2016 when teams from Veolia Eau Île-de-France joined an exercise simulating a 100-year flood on the River Seine, designed to test the abilities of strategic operators to respond.” Veolia teams are tightly knit and socially engaged, as shown by the Veoliaforce network of 500-odd volunteers, a team of emergency logisticians coordinated by the Veolia Foundation who provide their professional expertise in challenging situations worldwide. For Geneviève Leboucher, “it’s an opportunity for Veolia employees to develop know-how they can then apply in other situations, not necessarily only during an emergency.”

Anticipating uncertainties: extending the scope of our involvement

Aside from emergency responses and the more incremental changes resulting from global warming, the operation of wastewater networks is changing too. The Group’s advances in how it manages extreme climate events mean it has also improved its control over events that are recurrent and more frequent, limiting their impact on the environment. Geneviève Leboucher adds, “to limit the footprint of wastewater systems on receptor environments that are already highly fragile, we are increasingly using infrastructure designed for extreme events. We’ve been using this form of proactive management ▶





SUSTAINABLE WATER MANAGEMENT IS ESSENTIAL TO DELIVERING THE UN 2030 AGENDA

To speed up implementation of the 17 Sustainable Development Goals (SDG) by 2030, the United Nations has issued guidance frameworks for each goal. And the Sustainable Development Network¹ recommends a synergy approach for putting them into practice, as used by Veolia Water Technologies (VWT). Its projects, although specifically targeting SDG6,² also create synergies with other SDGs. Here is a quick round-up of three examples.

At Cagnes-sur-Mer in southern France, VWT subsidiary OTV has put the first of a new generation of energy-positive wastewater

treatment plants into operation. It's about more than self-sufficiency. The plant, which has been treating wastewater from 160,000 residents since 2019, produces more energy than it uses. It does this by treating sludge at low temperatures, reducing overall energy use, recovering energy from all possible sources (solar, heat pumps, etc.) and producing biomethane, which injects enough gas into the network to cover the consumption of 1,000 households. This is an outstanding example that works to "substantially increase the share of renewable energy in the global energy mix," while also

delivering an "improvement in energy efficiency." (SDG7). Another innovation is in aquaculture, at a time when overfishing is threatening the oceans as demand for fish and seafood continues to rise. Operational since January 2020, the Fredrikstad Seafoods salmon farm is Norway's first onshore salmon farm. Using RAS2020 (Recirculating Aquaculture System) technology to provide stable water temperatures for optimum fish growth and survival rates, the site can produce up to 1,500 metric tons of salmon each year. A solution that helps to "maintain marine biodiversity"

(SDG14) as well as helping to provide access to "safe and nutritious food" (SDG2).

There are many similar examples, a reminder that sustainable water management and the protection of water resources are essential drivers on the road to achieving all the SDGs.

¹The UN Sustainable Development Solutions Network was set up by the UN Secretary General to mobilize practical solutions for delivering the SDGs.

²"Ensure availability and sustainable management of water and sanitation for all".

OUTFRONT

for at least 20 years. We also encourage clients to look at the bigger picture in terms of how existing wastewater networks operate. These networks were designed a long time ago when the climate was different and there were fewer users to serve. The truth is that the largest single reason for networks to overflow is because earlier urban planning policies failed to take enough account of the effect of increased soil sealing on how these systems would function.”

This global approach to how systems operate requires a change of mindset, abandoning the concept of separate business lines to

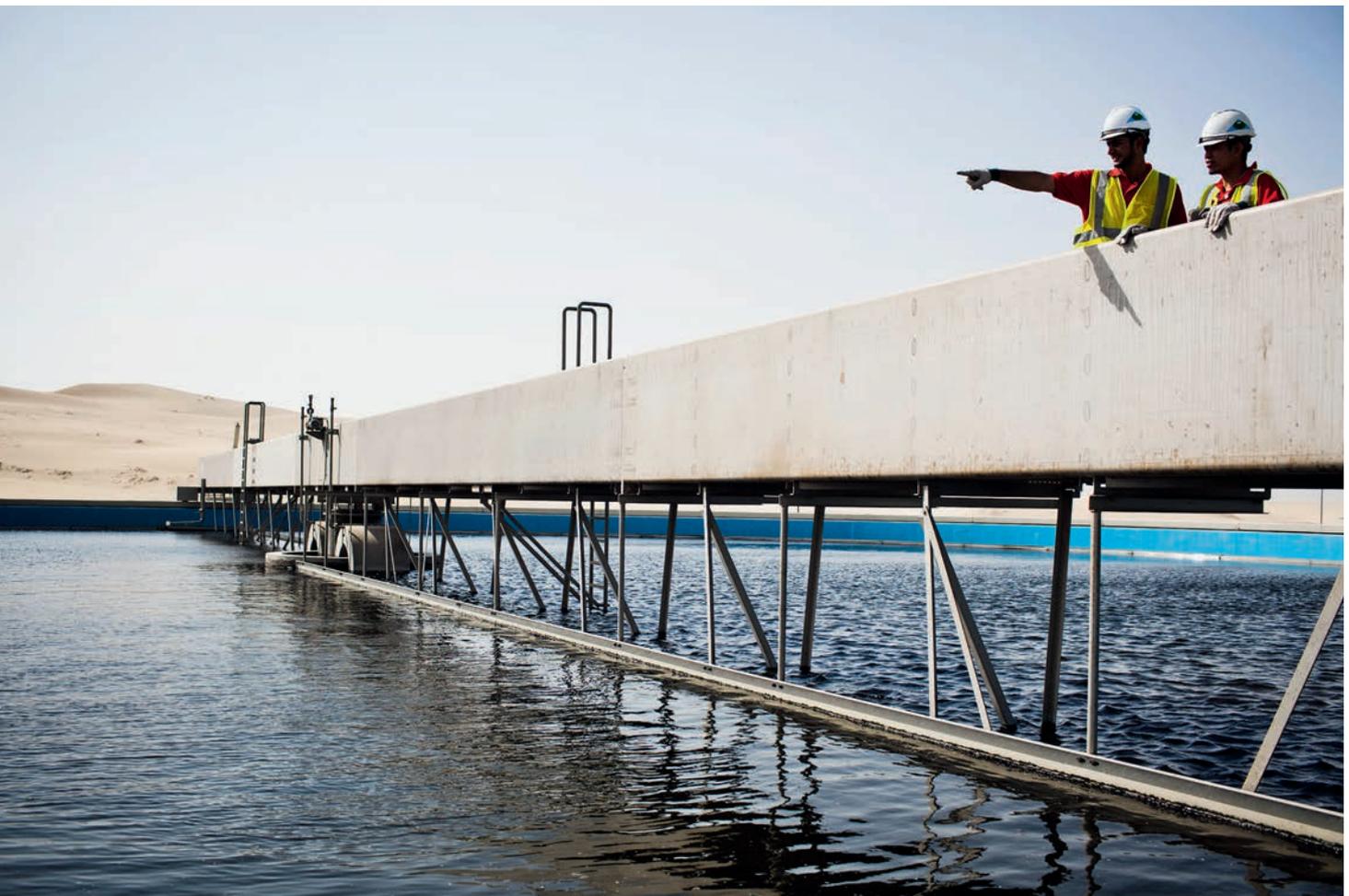
manage networks and treatment. Veolia also encourages local authorities to stop thinking of water distribution networks and wastewater treatment plants as separate entities. In addition to its operating services, the Group also offers services for identifying and mitigating vulnerabilities in wastewater systems. These can, for example, anticipate, alert and react in the event of flooding. According to Geneviève Leboucher, “the large number of issues raised by the water cycle — health quality, protection of the environment and water resources — leads us to look beyond our historical missions, which focused above all on collecting and

treating wastewater and piping drinking water to consumers’ taps.” Improving the quality of natural environments, preventing the spread of micropollutants, identifying new water resources, tracking the health of the general population by tracing viral and bacterial loads in wastewater, reinforcing infrastructure to limit the impacts of major crises, creating cooling islands in cities, guaranteeing sufficient water pressure for fire safety, and so on: all these services require significant investments that perhaps should not be directly charged to consumers’ water bills. We have reached the limits of the water-pays-for-water model, and Veolia works tirelessly with municipalities and local authorities to design alternative economic models that reflect the full value of these new services. “A complete model for us to invent with our clients,” is how Geneviève Leboucher describes it. ■

“The large number of issues raised by the water cycle leads us to look beyond our historical missions.”

Geneviève Leboucher

¹ <https://www.unwater.org/water-facts/scarcity/>
² <https://www.ssi.gouv.fr/entreprise/reglementation/directive-nis/>



MIDEWA: Planning ahead for emergency supplies

MIDEWA, a joint venture between Veolia and 62 local councils in the central German state of Saxony-Anhalt, teamed up with a local market garden company to create a solution for distributing five-liter packs of drinking water in the event of a temporary disruption in the supply. The idea is clever and socially positive.



Obsthof Müller is a company passionate about provenance. The market gardener based in Querfurt, a town of around 10,000 residents, sells direct from the farm and places a strong emphasis on its local roots. Fruits and vegetables harvested on the doorstep share shelf-space, sometimes as juices, liquors or jams, with produce from other local producers: everything here is from Saxony-Anhalt, a state that lies between Hanover and Berlin. And MIDEWA was looking for a local solution to mitigate the consequences of supply failures and broken mains pipes in its network, situations where it usually has to deploy water trailers. "Trailers are cumbersome as well as being tricky for



householders. And since Obsthof Müller already had apple juice packing facilities that are totally suited to water without any alteration to the process, it was natural to turn to them when we wanted to set up a system for bottling drinking water," explains Karina Wasmund, head of relations with local councils at MIDEWA. So MIDEWA launched its Mobile Drinking Water program, as back-up to its trailer fleet. The concept: 5-liter water packs, similar to wine boxes, that people can pick up or have home-delivered, for those who live somewhere remote or are unable

to travel themselves, if their local water supply is cut off. "The cardboard packs have a 100%-recyclable plastic liner. This was central to our objectives: finding a solution that was local, rapid and easier to transport, with impeccable health standards and, critically, more environmentally friendly than plastic bottles." Mobile Drinking Water is a concept that has already been well received by MIDEWA's customers (householders, children's daycare centers, care homes, etc.) and could also be used for humanitarian aid in a crisis.

IN BRIEF

► It took the operations team at MIDEWA just four months to create and launch Mobile Drinking Water.

► To make sure they can react quickly in the event of a problem in the network, where it is unusual for

water supplies to be cut off for longer than a few hours, the stock of packs is stored at seven different locations.

► 30,800 liters of water, a total of 6,160 packs, or 44 pallets, are pre-positioned at

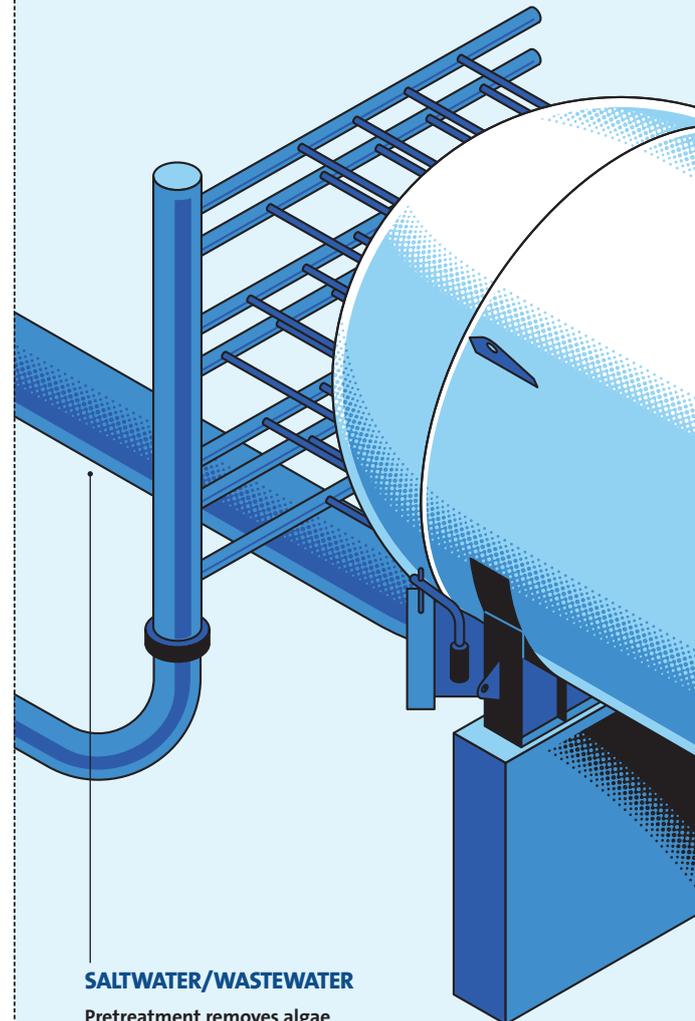
MIDEWA agencies, ready to be distributed to local people when needed.

EXPLAINER

Enclosing the water treatment process

This innovation is a game-changer for desalination and reuse. The Barrel was designed by Veolia to pave the way to a plug & play approach to reverse osmosis water treatment. Each vessel can house as many as 200 membranes, each with its own sensor. Units have a small footprint and can be installed indoors or in the open air.

The market is increasingly turning to ever-larger treatment plants as it seeks to meet growing demand for drinking water, requiring land that is not always available. "This is what drove us to invent The Barrel: a self-contained vessel housing all the membranes and that can be scaled as needed," explains Vincent Baujat, Executive Vice-President, Techno Hub at Veolia Water Technologies. Delivered as a ready-to-install module, The Barrel connects directly to the production site. According to Vincent Baujat, "on-site construction needs are very simple. Since we first showed it in Dubai in 2019, and despite the delays caused by COVID-19, this compact modular system has attracted a lot of interest from around the world, for desalination as well as other low pressure osmosis applications." Another advantage for Gulf countries like Oman, that are looking to expand their industrial base, is that The Barrel will be built locally. "Veolia will prepare and deliver the tubes, which will be enclosed in a locally fabricated pressure vessel." In France, The Barrel would be well suited to treating micropollutants at the outlets of a drinking water plant. Vincent Baujat says, "this will soon become a regulatory requirement. However, not all drinking water plants have enough land for a new building." Vendée Eau, a regional public water authority, didn't wait for the new regulations and chose The Barrel for its test unit at Sables-d'Olonne (see below). With a 25% smaller footprint for the same process, it looks like the perfect solution.



SALTWATER/WASTEWATER

Pretreatment removes algae and large pollutants before water for processing is fed into The Barrel. Water passes through a number of membranes inside The Barrel.

THE JOURDAIN PROJECT

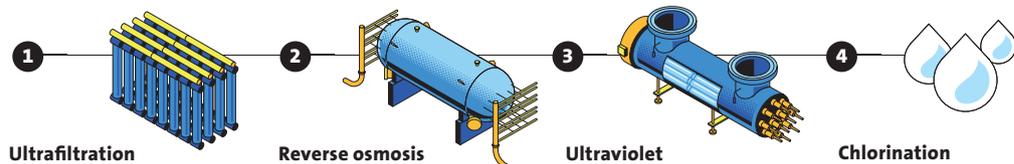
To tackle water shortages that become critical during the summer months, Vendée Eau is running trials on water reuse as part of its Jourdain project.

The idea is unlike anything else in Europe, reusing treated wastewater by pumping it into waterways upstream of dams in areas that suffer from water shortages. Currently under construction, testing at the demonstrator will start in the next couple of years, with full production scheduled for 2026.

The Jourdain treatment plant will remove bacteria and viruses, as well as medical and chemical pollutants and chloride. "We approached Veolia because of its great reputation and research capabilities," explains Jacky Dallet, President of Vendée Eau. "The Barrel was the right choice for us: water of sufficient purity from a process capable of delivering as much as 160 cubic meters an hour with low energy use." Another advantage is its small footprint, because the Jourdain demonstrator

is designed to be rolled out in zones with limited available land. Treated wastewater is already used by the food industry and for the production of drinking water in Israel and Spain. Jacky Dallet sums up, explaining, "there are no regulations in France for reusing wastewater that is fed into a reservoir used to produce drinking water. The Jourdain project is a testbed for the technology and for the regulations we will help to draft."

MULTI-BARRIERS FOR THE JOURDAIN PROJECT



THE BARREL, A PLUG & PLAY SYSTEM

With no need for a building, The Barrel can house any type of spiral membrane, depending on the water treatment required.



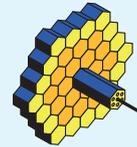
SMART CONNECTORS

Test the conductivity of water in permeate tubes. In the event of a leak, these can detect the exact origin of the problem thanks to the difference in conductivity between saltwater and permeate.



TECHNOLOGY CONNECTION

Data from smart connectors sent to the cloud before analysis by Veolia's engineers provides clients with accurate and comprehensive reports (leakage, lower yields, etc.).



MEMBRANES

Separate pure water (permeate) from the rest, allowing only H₂O molecules to pass into the small tubes surrounded by the membranes.

PERMEATE

Inner tubes are connected to deliver the permeate (pure water). For desalination plants, this water will require remineralization and chlorination before being fed into the drinking water network.

CONCENTRATE

Untreated water that did not pass through the membranes exits as concentrate. At desalination plants, this brine is piped offshore to avoid disturbing local ecosystems.

PRESSURE

Forces water through tiny pores in the membranes. The smaller the pores, the greater the pressure needed. For desalination, a pressure of 80 bar for membranes with 10⁻¹⁰ m pores.



Treatment plants in the modular era

Invented by the Veolia Water Technologies subsidiary OTV with assistance from the Design Centre¹, these new-style facilities meet an emerging market trend. This upscale move opens the field of possibilities for users in search of even more agility.



“There is a movement in construction, a sector where an increasing number of players are looking for more malleable, lighter and less risky facilities. Our offer aligns with this demand.” François Enguehard, Director of the Veolia Technologies and Contracting (VTC) Design Centre, knows only too well that agility is now the name of the game for small and medium-sized waste treatment plants (covering up to 50,000 inhabitants). “We have switched to a product-focused approach with solutions that can be transportable and then installed and connected in a few days,” he says. Veolia has jumped on board this new train with the creation of modular plants that can accommodate several types of sludge treatment technologies. The result is a plug and play alternative that adapts to changing

needs and can be upgraded over time by, for instance, installing new parts. Another advantage of this standardization is its extreme adaptability. “Clients with more conventional — and therefore more rigid — structures can run into complications when it comes to complying with new standards. Our modules remain extremely upgradeable,” confirms Pierre Chevreuil, Regional Director at OTV. Yet another argument to convince clients, who will be able to benefit from the modular treatment plant solution this year.

Collaborative work and eco-design

To make the idea of modular treatment plants a reality, the Design Centre questioned both the stakeholders (key academics, design offices, local authorities and their partners) and clients

of Veolia’s France Water business line. This pulse-taking exercise influenced the chosen direction, combining modularity and sludge recovery, all with the best possible energy performance. And where does design come into it all? “We were guided by the client’s voice,” underlines François Enguehard, referring to the needs and feedback expressed on the subject. “Choices still need to be made in terms of materials, the aim being to maintain a sustainable, circular economy approach.” This environment/economy compromise will also be solved from a construction point of view, as certain elements can be locally produced.

¹ Veolia’s Design Centre draws on different experts in the Group (research and innovation, design and engineering, etc.) with a view to accelerating the development of new technological concepts.

JUNE 7, 2021
WORLD FOOD SAFETY DAY



FOOD SAFETY CONCERNS EVERYONE

THE WORLD HEALTH ORGANIZATION (WHO), IN COLLABORATION WITH THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO), IS INVITING ALL THOSE INVOLVED IN THE FOOD CHAIN TO ACT TO PREVENT, DETECT AND MANAGE FOOD RISKS.

WWW.FAO.ORG/FAO-WHO-CODEXALIMENTARIUS/WORLD-FOOD-SAFETY-DAY/



NEW FILM



How and why, at a glance

Reuse of treated wastewater



YouTube
Veolia group
channel