

PLANET

#April 2018



**Tomorrow's
world is being
invented
today**

Forum

Food, energy, pollution:
what are the solutions for
the world of 2040?

Frontline

Milwaukee:
Improving
an eco-winner

Outfront

Air quality,
a vital issue

Explainer

Waste on the plate:
insects at the heart
of bioconversion

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Cover photo: SUPERBIEN

THE POST



Antoine Frérot
Chairman and CEO
of Veolia

February 8

Press Day 2018: Tomorrow's world is being invented today.

To mark Veolia's sixth Press Day, we invited 60 journalists on a journey to explore the world of 2040. A world that will be shaped by demographic growth and the explosion of the middle classes, leading to a considerable increase in the demand for food, water, energy and raw materials. A world in which new water, soil and air pollution inherent to economic development will emerge. Our Group has a role to play in the light of these challenges. As a world leader in environmental services, Veolia must pave the way, blaze a trail in its field, and become the benchmark on this market. This is why, as of now, we are coming up with and deploying solutions to meet tomorrow's challenges. There is no reason to be pessimistic when solutions exist or are being invented!

February 22

2017 annual results: An intense and successful year for Veolia.

Revenue up by 4.9%, EBITDA rising by 2.7%, a 7.3% increase in current net income excluding financial gains, cost savings in line with targets: all of Veolia's financial indicators for 2017 are green. This good performance demonstrates the pertinence of our 2016-2019 strategic plan, based on growth and discipline. In my view, the sustained growth of our revenue, which accelerated throughout the financial year due to the renewed commercial drive that began in late 2016, is a major source of satisfaction. In all of

our locations, we have made strong commercial gains, whether with our municipal or industrial clients. The contract signed in Mexico last May is symbolic of the challenges that we help major cities meet: it involves the design, construction and management of the first waste-to-energy facility in Latin America. Last December, we won an important contract in Australia to build and run the new wastewater treatment plant for Springvale mining site. These commercial successes, as much as 2017's performance, give us confidence in the future. As proof, all of the objectives that we set ourselves for 2018 and 2019 have already been confirmed.

March 19

Launch of Veolia's new communication campaign: Welcome to the "Resourcers" community.

"At Veolia, we see the world as it should be and not only as it is." We see waste as a valuable material, wastewater as a new water source, and buildings' wasted energy as new sources of heat. This is our new communication campaign's message. It highlights the distinctive attitude of our 168,800 staff members, whom we have named "Resourcers." What makes our Group stand out is, of course, what we do but also the way we do it. At Veolia, optimism, commitment and collaboration guide our everyday actions, making us bold and creative. This campaign unites us all, fostering a shared mindset to achieve our mission: "Resourcing the world."

CONTRIBUTORS



Editor-in-chief Laurent Obadia

SVP Communications, Veolia

Tomorrow's world is being invented today. The title of this new edition of Planet propels you into 2040. We will face the challenges of exponential growth in food and energy needs and an ever-increasing amount of pollution. Veolia is already getting prepared, as demonstrated by our focus on air quality in the Outfront article. The Forum section presents Antoine Frérot, Bernard Sananès and Angel Gurriá's intersecting perspectives, offering a clear insight into the debates that may arise in this world to come. All the initiatives, whether they are emerging in Europe, Asia or America, represent levers for meeting the challenges of tomorrow's world.

This is my first time as Planet's Editor-in-Chief and I am particularly proud of being involved in this issue. I hope that you will enjoy reading it and that it will inspire new ideas to share in the future!

Also in this issue

Angel Gurriá

Secretary-General of the OECD – Organization for Economic Cooperation and Development

A Mexican economist and diplomat, Angel Gurriá was Mexico's Minister of Foreign Affairs and Minister of Finance and Public Credit before being appointed at the helm of the OECD in 2006. A believer in dialogue, he has worked ever since to reinforce the Organization's role as a discussion forum for economic policy questions. Closely involved in water-related issues, he chaired the international Financing Water for All task force and the World Water Council. He was the first winner of the Globalist of the Year award for his promotion of transnationalism, inclusiveness and a global consciousness.



Bernard Sananès

Founding president of the polling company Elabe

After twenty years in communications, agencies and market research (he headed the polling company CSA for four years), Bernard Sananès launched his own firm Elabe in 2015. A hybrid of three complementary sectors — market research, consultancy and strategic planning, the company particularly looks to offer more strategic and business intelligence-related studies. Boasting a multidisciplinary team of a dozen consultants, Elabe counts CAC 40 and SBF 120 companies, professional institutions and fast-growing medium-sized businesses among its clients.



Kevin Shafer

Executive Director of the Milwaukee Metropolitan Sewerage District (MMSD)

Before joining the MMSD in 2002, he spent ten years with an international engineering group in Chicago and Milwaukee, and then six years with the U.S. Army Corps of Engineers in Fort Worth, Texas. He holds a degree in science and civil engineering with a specialty in water resources from the University of Illinois and a Master's in science and civil engineering from the University of Texas. He served as President of the National Association of Clean Water Agencies and is currently Chair of the U.S. Water Alliance's Leadership Council and Co-Chair of the Water Research Foundation's (WRF) board of directors.



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APRIL 22, 2018

EARTH DAY

"END PLASTIC POLLUTION"

CREATED ON APRIL 22, 1970, INTERNATIONAL MOTHER EARTH DAY IS ONE OF THE MOST FAMOUS ENVIRONMENTAL EVENTS. CELEBRATED BY OVER A BILLION PEOPLE IN SOME 180 COUNTRIES, IT OFFERS CITIZENS AN OPPORTUNITY TO THINK ABOUT THE DAMAGE SUFFERED BY THE PLANET... AND SIMPLE EVERYDAY STEPS TO TAKE TO PRESERVE IT.



WWW.EARTHDAY.ORG/

TRENDS



Exponential growth in the amount of urban waste by 2025

The warning dates back to 2012. In the most recent report* available to date, the World Bank predicts a 70% rise in the volume of municipal waste by 2025. It will primarily come from cities located in areas with high economic growth: South-East Asia, some Eastern European countries, and the Middle East. According to the institution, the production of urban waste will increase faster than urbanization and double by 2025, leaping from 1.3 to 2.2 billion metric tons per year. This trend has already been observed over the past several years, with the estimated average volume of waste produced per capita per day doubling from 0.64 kg to 1.2 kg between 2006 and 2016.

In another report*, the International Solid Waste Association states that the leading waste producers are small and island nations. These include Kuwait, Antigua and Barbuda, Saint Kitts and Nevis, Guyana and Sri Lanka. In countries such as Antigua and Barbuda and Saint Kitts, tourism and its associated activities are the mainstay of the economy but also the main source of waste production, which cannot be handled by the existing facilities. Combined with climate change, the global challenges of managing municipal waste will be huge, despite the efforts made worldwide in terms of recycling and the responsible use of resources. Correctly managing waste is essential in order to build sustainable and livable cities and remains a major concern for many developing countries and cities.

*Sources: World Bank, "What a Waste: A Global Review of Solid Waste Management" report, June 2012 - International Solid Waste Association (ISWA), "Recycling Market & Research" report, September 2014



Some **37%**
of land masses are
dedicated to agriculture
(source: FAO)

815 million
people suffered from hunger in
2016, i.e. 38 million more than
in 2015
(source: 2016 United Nations report)

**2,017
Gigawatts**
of global renewable energy
capacity were produced
worldwide (at the end of 2016);
the 2,000-GW threshold was
crossed for the first time
(source: REN21 international network /
Annual report June 2017)

12.6 million
people die each year from
environment-related diseases
(source: WHO)

The *Plastic Odyssey* prototype: “Around the world powered by plastic”

The crew of the *Plastic Odyssey* catamaran wants to show that plastics are too valuable to end up in our oceans. All set for a three-year expedition, the ship-workshop will set sail from Marseille in November 2019.



Investors embrace sustainability

The Paris Climate Change Conference in December 2015 and the various international initiatives over the past years have persuaded investors to question their role in the fight against global warming. Under mounting pressure to invest sustainably and measure the environmental and social impacts of their portfolio, they can now rely on a responsible decision-making tool, created by scientists from New York (CUNY) and Harvard universities in partnership with UBS bank. According to John Spengler from the Harvard School of Public Health, “We offer a new calculus for sustainable investing. It is unique in that it reframes sustainable development in terms of building our collective natural, human and social capital. To this end, our tool relies on models that help investors assess the efficacy of the actions, products and services undertaken by companies on behalf of the environment and the well-being of society.”

Energy and plastics at the heart of the European Union’s new roadmap

2018 is a key year for Europe in terms of energy and environmental policy. Wrapping up its Clean Energy Package, the European Commission has stated its ambition to support job transformation and new skills acquisition in the sector, along with the economic reconversion of areas concerned by the energy transition. In a renewed electricity market, it is looking to promote a more “flexible” environment that encourages increased participation by the consumer and renewable energy producers. Within the framework of the circular economy transition, the first European strategy on plastics is the year’s other major priority. This emphasis is set to boost the recycled plastics market, as it involves rethinking product design, increasing the volume of plastic waste collected and improving recycling quality. The energy and plastics strategies fall in line with the Sustainable Development Goals, global climate commitments and the European Union’s industrial policy objectives.

Source: www.euractiv.com/section/energy-environment/news/energy-and-environment-in-2018-a-preview/

INSIDE

SPRINGVALE'S AUSTRALIAN CONTRACT IS A MINE OF BENEFITS

In Lithgow, New South Wales, Springvale mine produces the coal used by Mount Piper power station, which provides approximately 15% of the electricity consumed in the state. Veolia's expertise won over Springvale Joint Venture and Energy Australia: the Group was awarded the contract to build and run the water treatment plant for the mine and power station for fifteen years, along with the maintenance of a pipeline connecting the two sites. The construction project, which is set to be completed in 2019, will create a large number of jobs in the region.



VEOLIA'S CSR PERFORMANCE recognized by RobecoSAM

After being included in the benchmark extra-financial rating Dow Jones Sustainability World Index and Dow Jones Sustainability Europe Index in 2017, Veolia was doubly distinguished in RobecoSAM's 2018 Sustainability Yearbook. The Gold Class award is in recognition of top CSR performance in a sector of activity, while the Industry Mover award is attributed for the best improvement in CSR performance per sector. This year, Veolia topped the list of companies in the Multi and water utilities category.

Telex

The Greater Reims urban community is extending Veolia's contract for operating the waste recovery center in Reims (France) for a nine-year period.

Entitled "H2027 Future-proofing UK Water," the new report drafted by Veolia in the UK and Ireland presents the latest trends in the British water sector and puts forward innovative solutions to meet the demand and growing needs of the market over the forthcoming decade.

Veolia inaugurated its 19th Hubgrade center in Rueil-Malmaison (France) in the presence of its client, the automobile group PSA. This hypervision and smart metering center improves facilities' energy efficiency and operational performance, supporting Veolia's industrial clients in their strategic vision of the factory of the future 4.0.

IN FRANCE, RENNES METROPOLIS RENEWS ITS WASTE RECOVERY CONTRACT

ValoReizh's waste-to-energy (WtE) facility is part of the "Zero-wastage, zero-waste territories" program that encourages the transformation of waste into green energy. This facility, which Veolia will run for three and a half years, guarantees high performance in terms of green energy production — equivalent to 56,000 metric tons of coal and 44 million liters of fuel avoided — and will help the Rennes metropolis keep its environmental commitments. Over the duration of the new contract, it will treat over 504,000 metric tons of non-recyclable household waste and provide 20,000 households along with the nearby university hospital center with heat.



FIRST PUBLIC-PRIVATE PARTNERSHIP IN JAPAN

This is the first concession contract for a wastewater treatment plant ever signed in the country! At the head of a consortium, of which it holds over 50%, Veolia will be responsible for managing the wastewater treatment plant in Hamamatsu, a coastal town between Tokyo and Osaka, for twenty years. This PPP is undoubtedly the first of many... The Japanese government is strongly encouraging local authorities to turn to delegated management and estimates that almost ¥21,000 billion (€160 billion) worth of contracts of this kind could be signed by 2022.



AN OASIS FOR FEMALE ENTREPRENEURSHIP IN NIGER

In Niger, women are on the frontline, facing environmental issues and the huge challenge of the fight against poverty. To assist them, Empow'Her — an international organization that supports female entrepreneurship — and Veolia inaugurated L'Oasis at the heart of Niamey, in the presence of Dr. Lalla Malika Issoufou, Niger's First Lady and the project's patron. Dedicated to raising public awareness on sustainable development, this incubator encourages women's economic inclusion through entrepreneurship, especially in the areas of maternal health and the environment. The premises were fitted out in an eco-friendly way using recycled and salvaged materials and vegetation.

FOR A NEW PLASTICS ECONOMY

The "For a new plastics economy" seminar, organized in December 2017 in Paris on the initiative of the French Ministry for the Economy and Finance, brought together all of the players in the sector. Antoine Frérot set out Veolia's strategy for plastics recycling and its recommendations for a new plastics economy. The Group aims to generate a fivefold increase in its plastics recycling revenue, with this figure rising from €200 M today to €1 billion in 2025.

Telex

In December 2017, at the Quai d'Orsay in Paris (France), the Minister for Europe and Foreign Affairs and Veolia's CEO renewed the partnership agreement between the ministry's Crisis and Support Center and the Veolia foundation concerning humanitarian aid.



T.PARK in Hong Kong, one of the world's largest sludge treatment facilities, built and run by Veolia, has received three prestigious architecture prizes: architectural sustainability and merit in the Infrastructure and transport category (HKIA institute), along with BEAM Plus New Buildings certification for its environmental commitment, quality and sustainable architectural vision.

A SERIES OF WATER AND WASTEWATER SUCCESSES

In Saint-Pierre on Reunion Island, as well as in the regions of Southern and Northeastern France, Veolia has won several water management contracts worth a total of €170 million. They all represent opportunities for the Group to develop innovations and a service in line with customer expectations in terms of performance, responsiveness, governance and digitalization.

VEOLIA RANKED NUMBER THREE IN THE CAC 40 FOR CLIMATE PERFORMANCE

In its December 2017 report entitled "Performance Climat, où en sont les entreprises du CAC 40 ?" ("How are CAC 40 companies doing in terms of Climate Performance?"), the firm EcoAct analyzes the climate performance and environmental best practices of major French CAC 40 companies worldwide. Veolia comes third in the rankings. It earned this high position especially thanks to the "plastics" solution deployed in Germany, where the Group converts a billion plastic bottles per year into pellets to manufacture new bottles, saving 31,000 metric tons of petroleum.



FRENCH COMPANIES committed to climate change action

On December 12, 2017, the President of the French Republic, the President of the World Bank and the UN Secretary-General organized the One Planet Summit in Paris. Antoine Frérot, Veolia's CEO, took part in the event, highlighting the importance of companies' involvement alongside the public authorities and civil society to win the climate change battle. On the eve of the Summit, 89 French companies including Veolia had signed the French Business Climate Pledge, affirming the need for a collective change of direction to significantly reduce greenhouse gas emissions.

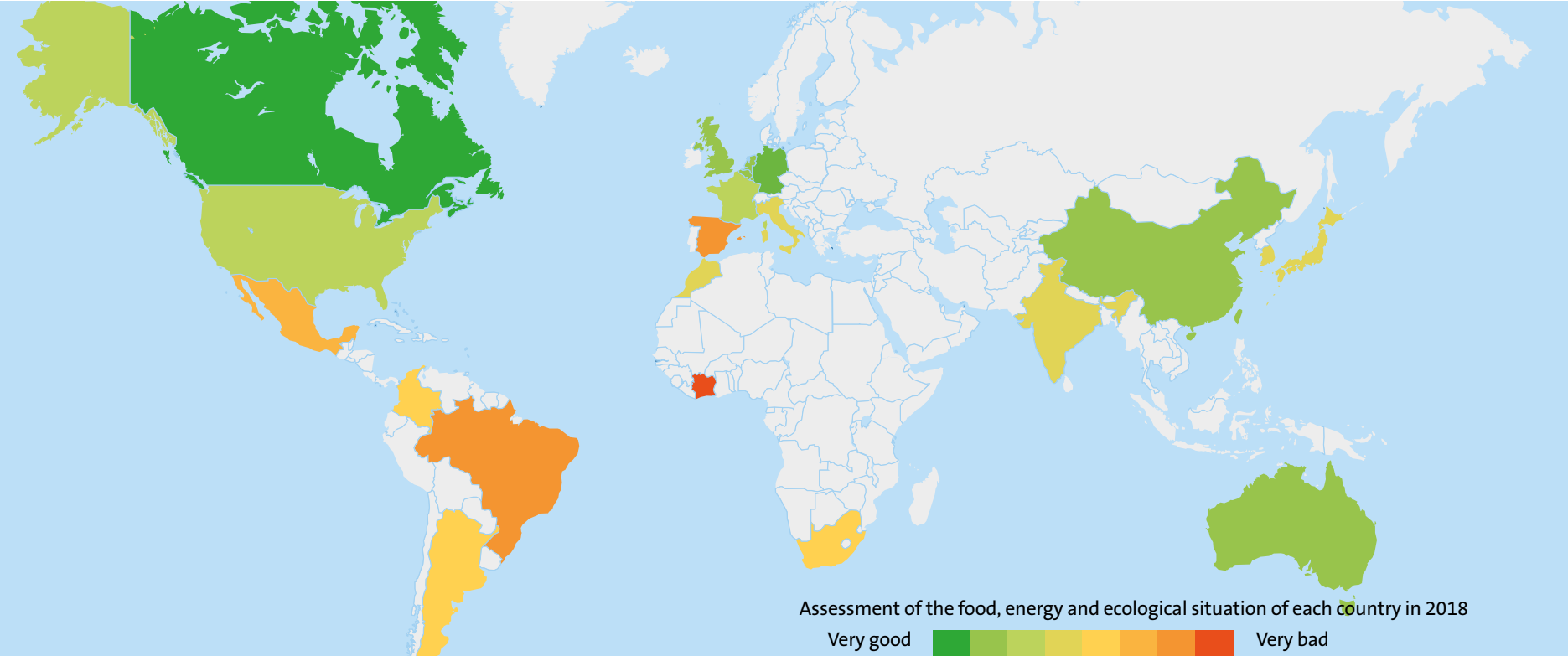
In December 2017, companies, States, and public and philanthropic institutions came together for the One Planet Summit in Paris, reminding us in unison that “We are ONE planet.” An obvious statement that has become a conviction and a global awareness that our destinies are interdependent. This is reflected in the ELABE survey for Veolia conducted in late 2017*. In each of the 28 countries questioned, 84% to 98% of inhabitants state that “our destinies are all linked by the choices that we make today regarding energy, food and fighting pollution.”

THE 5 URGENT ACTION POINTS¹

- 1 DEVELOPING THE RENEWABLES SHARE 6.8/10
- 2 AIR QUALITY 6.7/10
- 3 ACCESS TO HIGH-QUALITY FOOD 6.6/10
- 4 ACCESS TO ENOUGH FOOD 6.6/10
- 5 WATER QUALITY 6.6/10

1- Average urgency of each challenge for the inhabitants of the 28 countries questioned, on a scale of 0 to 10

MEETING THE CHALLENGE OF OUR RESOURCES

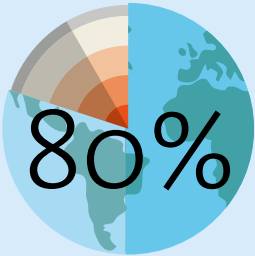


*Methodology

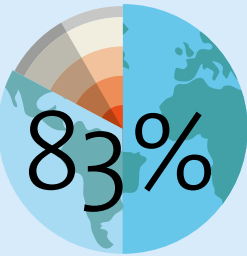
ELABE survey for Veolia, conducted in 28 countries from 11/10 to 12/04/2017 among representative national samples of the resident population aged 18 years and above (500 people questioned in each country, i.e. 14,000 respondents). Representativeness guaranteed by the quota method applied to the variables of sex, age, socio-professional category or equivalent reference per country and region.

THE 4 LEVERS

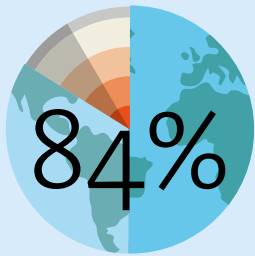
Creativity (technological innovations), individual responsibility (changes in behavior), funding and regulations are seen as comparably important in meeting the challenges of food, energy and fighting pollution. Each of these levers is considered to be important by 75% to 85% of the population in 24 of the 28 countries questioned. The world’s inhabitants as a whole are therefore convinced of the necessary complementarity of these levers to successfully rise to the challenge of our resources.



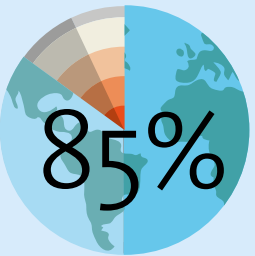
REGULATIONS



FUNDING



CHANGES IN INDIVIDUAL BEHAVIOR



TECHNOLOGICAL INNOVATIONS

INNOVATE AND EXPLAIN

While they are confident about future innovations, the world’s citizens are nonetheless cautious about their country’s capacity to implement them widely over the next two decades. A considerable challenge lies ahead of companies and public players: they must continue along the path of environmental innovation, educate about disruptive solutions that come up against the difficulty of imagining what currently remains unknown, deliver the capacity to deploy them, and demonstrate their efficacy and performance.

THE SOLUTIONS



Dedicate more urban space to agriculture.



Feed livestock and cultivated fish on insect larvae rather than grain.



Capture CO₂ from the atmosphere to store and/or reuse it.



Refurbish former industrial sites for farming use.



Generalize wastewater treatment.



Generalize waste recycling.



Transform organic (food, green, farming) waste into fertilizer.



Generalize renewable energy production.

FROM THE LEAST PROBABLE TO THE MOST PROBABLE

Food, energy, pollution: what are the solutions for the world of 2040?

We meet Antoine Frérot,
Angel Gurría and
Bernard Sananès.

12/13



Antoine Frérot,
Chairman and CEO of Veolia



Angel Gurría,
Secretary-General
of the OECD
(Organization for Economic
Cooperation and Development)



Bernard Sananès,
Founding President of Elabe

Demographic growth, galloping urbanization, climate change, increasingly scarce resources, an explosion in energy and food demands, increasing pollution... Looking forward to the world of 2040 may seem worrisome. Yet, although the challenges may be huge, solutions already exist and others will appear, giving us cause for hope and optimism.

Feeding nine billion humans, meeting the strongly growing energy demand, and fighting air, water and soil pollution. Why do you identify these three challenges as a priority for 2040?

Angel Gurría: The challenges that you mention – food security, energy security and reduced exposure to pollution risks – contribute to the sustainable and inclusive growth championed by the OECD. Failing in one of them would compromise the international community’s capacity to achieve the Sustainable Development Goals it has set itself for 2030. However, as the capacity to meet them is very unequally distributed across countries and within the same country, stumbling over one of these goals could more broadly compromise other balances. I’m particularly thinking of increased inequality and mass migration.

Antoine Frérot: These three challenges are naturally at the heart of our concerns, as they are major economic and social issues over the next decades that affect every country. The demographic explosion, galloping urbanization, increasing scarcity of resources and their impact on food and energy chains, as well as ecosystems, are closely linked to the issues of water, energy

and waste management. As a global benchmark in optimized resource management, Veolia is therefore a key player in providing concrete solutions in the light of these challenges.

Bernard Sananès: The survey that Elabe conducted for Veolia in late 2017 reflects this feeling of urgency. Across the five continents, the majority of inhabitants we have questioned believe that it is necessary to act rapidly to meet these ecological, energy and food challenges. Five priority issues have been identified:

- the development of the renewables share in their country’s energy sources,
- air quality,
- access to high-quality and healthy food,
- access to enough food to meet each person’s needs,
- water quality.

To what extent are these three challenges interdependent?

A. F.: Water is needed to produce energy and develop agriculture, just like energy is needed to treat water and produce food. Healthy and available soils are also needed for agriculture, which in turn will provide biofuels, i.e. energy.

“As a global benchmark in optimized resource management, Veolia is a key player in providing concrete solutions in the light of these challenges.”

Antoine Frérot

...

... Only an actor like Veolia, which is able to oversee the combined management of water, energy and waste, can deliver effective solutions to meet these three challenges. This also implies creating virtuous circles between those involved in the same area – local authorities, industries, citizens – where one person’s waste becomes another’s resources. This is why it is crucial to accelerate the transition to a more circular economic model.

“Private companies are governments’ partners in tackling these challenges with civil society.”

Angel Gurría

What levers will enable us to meet these challenges?

A. G.: Tensions require coordinated responses: of course, responses on a national level are essential, but they are not enough. Multilateralism is part of the solution. International discussions can contribute to food security by reducing pressure on resources in countries where arable land or water is rare; international investment is required to allocate financial resources where they produce the best impact; the spread of innovation is also globally beneficial as long as inventors’ interests are protected.

B. S.: Public opinion unanimously believes in our collective ability to improve the world of tomorrow, over and above national situations and cultural differences. More specifically, the levers most widely identified by the 14,000 people that we questioned are creativity, which is a source of technological innovation, and changes in behavior. Followed by funding and regulations.

“Public opinion unanimously believes in our collective ability to improve the world of tomorrow, over and above national situations and cultural differences.”

Bernard Sananès

A. F.: Innovation, creativity and a sense of collective responsibility, which are part of Veolia’s DNA, are essential assets in coming up with the new solutions that the world needs. The issue is not so much changing scale as changing perspective. Turning our attention in new directions, exploring what is possible, pushing back the limits of what is not. We are going to continue to expand and enlarge our traditional areas of expertise, but we are also going to have to create new ones and explore other territories. To this end, our long-standing integrator culture will be decisive. It will allow us to bring together all of the ideas and expertise required to invent the most effective and innovative solutions.

What concrete solutions could be developed to meet the challenges of food, energy and pollution?

A. G.: On a national level, green and inclusive growth strategies are going in the right direction. Europe and the European Commission are paving the way: they combine a kind of energy and carbon temperance, a common agricultural policy that encourages more environmentally friendly farming practices, and a framework directive that promotes a better environmental status of water resources. The countries that deliberately engage in international climate initiatives, the fair trade of foodstuffs and the diffusion of clean technologies are pioneers. I would like to see the entire international community follow their lead. And the sooner, the better.

A. F.: At Veolia, we already have a host of solutions and we are striving every day to come up with new ones. For instance, in the area of food, we transform biowaste into organic fertilizers and recycle wastewater to irrigate crops. In Malaysia and France, we are even working on pilot projects that consist in producing animal protein from insect larvae bred on biowaste! As for our energy clients, we have long been supporting them with ...





- ... their energy transition, especially via our energy efficiency or waste heat recovery solutions. We are also experimenting in the realm of CO₂ capture and recycling. To combat pollution, we are currently developing processes to eradicate drug residues from wastewater. We are also testing promising solutions to address air quality, especially inside buildings.

What will be the main obstacles to overcome in deploying these solutions on a large scale?

A. F.: To meet the challenges of the future, we are going to have to mobilize all of those involved at every level. Over and above concrete actions that companies such as Veolia can devise and implement, the public authorities' commitment

“To meet the challenges of the future, we are going to have to mobilize all of those involved at every level.”

Antoine Frérot

will be decisive in their large-scale deployment. In the area of air quality, for example, where we are starting virtually from scratch, clear and tailored governance must first of all be put in place, and then effective regulations adopted, accompanied by public awareness-raising measures. At present, Veolia is testing a new generation of sensors and equipment for dynamically controlling the air quality inside buildings. We want to be ready when regulations emerge.

B. S.: The world's citizens remain cautious about their countries' ability to widely roll out certain solutions over the next two decades. Most of them believe in generalizing renewable energy production, recycling all waste to recover all materials, transforming organic waste into fertilizer and treating wastewater. However, they are more cautious when it comes to their countries' ability to generalize urban farming, use insect larvae as a staple food for livestock, or capture CO₂ from the atmosphere for storage or reuse. It is up to companies and public players to demonstrate their feasibility, usefulness and performance.

A. G.: No one is suggesting that private companies should replace governments. That is not my opinion. I think that they are governments' partners in tackling these challenges with civil society. Private companies will find incentives in public policies to help resolve the abovementioned challenges. Their ability to innovate, develop, and — for some of them — invest are important channels for public action. This partnership will be all the more effective if companies are working toward a common good. We share this conviction with Antoine Frérot. This change is behind major reforms in France and a number of OECD countries regarding the status of the company and its governance. Even if they don't seem related to what we are talking about, these reforms are also part of the solution. ■

MAY 2-4, 2018 — FAO ROME - ITALY

GLOBAL SYMPOSIUM ON SOIL POLLUTION

"BE THE SOLUTION TO SOIL POLLUTION"

THIS DISCUSSION FORUM BRINGS TOGETHER THE INTERGOVERNMENTAL TECHNICAL PANEL ON SOILS, THE SECRETARIATS OF THE BASEL, ROTTERDAM AND STOCKHOLM CONVENTIONS, UN ENVIRONMENT AND THE WORLD HEALTH ORGANIZATION. IT REPRESENTS A FIRST STEP TOWARD THE APPLICATION OF THE VOLUNTARY GUIDELINES ON SUSTAINABLE SOIL MANAGEMENT, IN LINE WITH THE SUSTAINABLE DEVELOPMENT GOALS.



WWW.FAO.ORG/GLOBAL-SOIL-PARTNERSHIP/FR/

In France, Loïc is looking for new models of urban agriculture. In The Netherlands, Thierry is developing biological remediation and green energy solutions. They are both inventing the world of tomorrow.

Above and beyond

Meeting Veolia employees from all over the world.

Loïc Couttelle

Project Director
2EI Veolia
France

At the helm, along with his wife, of a farm spanning some forty hectares in the peri-urban area of Lille, Loïc Couttelle has been putting his passion for agriculture to good use in his new position at Veolia as of January 1, 2018. After spending 24 years in Veolia's Waste Solutions business line in France as regional Director of Operations, Loïc has just been appointed Project Director at 2EI Veolia, in charge of the Urban Farming project. "Veolia could play a role in this emerging sector... It's my job to explore this possibility!" he says happily. "What was originally a personal step now perfectly complements my new professional role."

"Urban agriculture offers real opportunities in terms of the circular economy, which we find in our areas of expertise: recycling water for irrigation, organic matter for fertilization and, in certain cases, energy management. It can also create jobs for local communities via integration programs. A point that raises real expectations among the local authorities and economic players alike," he continues.

Which goes to show it's much more than a fad. "Being able to create robust and duplicable production systems, as well as pass on knowledge, build skills and expertise... This is our added value," he explains. Veolia is launching two projects in 2018. One is inspired by nature: a pilot urban farm under construction in Lille will implement bio-intensive micro-market gardening techniques, following the principles of biomimetic permaculture. The other will focus on the roof of a shopping mall in Brussels: on the basis of aquaponics, it combines fish breeding with vegetable growing.

Back on his land, this environmental enthusiast is planning to make his 40 hectares another demonstration: transforming a cereal monoculture peri-urban farm into a diversified agro-ecological system designed to supply the city with food. ■





Thierry Arnaud

Managing Director
of Biothane
Veolia Water Technologies
Techno Center
Delft, The Netherlands

Anaerobic digestion holds no secrets for Thierry Arnaud... It was the subject of his doctoral thesis and he has gained expertise over many years with Veolia in this area. He had therefore no hesitation in agreeing over a year ago to head up Biothane, the world leader in the biological treatment of industrial wastewater via anaerobic digestion. “A technology of the future that must become more widespread in response to the growing energy demand and the fight against pollution,” he explains. Biothane provides all of the Group’s subsidiaries with some of the most highly developed and competitive anaerobic digestion solutions on the international market. Anaerobic granular sludge reactors for paper mills in Spain, Finland and Australia, anaerobic membrane bioreactors for the dairy industry in Greece, the United Kingdom and South Africa, and even anaerobic reactors dedicated to the petrochemical industry in China. Thierry is constantly undertaking innovative projects to meet the energy transition challenge and fulfill customer expectations. “Since I arrived, I have filed three patents, not counting those developed or updated by my colleagues. And that’s only the beginning!” Thierry is a manager who fosters team spirit, working alongside his team to tackle the challenges awaiting him. “We work in a kind of virtuous spiral that drives us to come up with original technologies and stay competitive... With the invaluable ingredient of diversity — every country in the world is represented in our teams — which at the end of the day makes for an excellent fermenter!” A champion of resources for all, Thierry likes to use his expertise on behalf of the less fortunate. “In our sector, we deliver solutions to those who need them most. With the Veolia foundation, I sponsored an association from my village, Premiers Pas, to build manually drilled boreholes in Togo,” he concludes, happy to make his desire to get involved a reality. ■



USA

Milwaukee

Improving an eco-winner

Milwaukee, Wisconsin: in addition to its fame as an American brewery capital, the city is home to one of the oldest branded fertilizers on the U.S. market. Milorganite® pellets are produced through a process that mimics nature, with microbes that digest organic matter in wastewater. An idea from Veolia has helped cut the production's fossil fuel use and further reduce its environmental footprint.

Located on the western shore of Lake Michigan in the U.S. Midwest, the city of Milwaukee takes its name from a Native American term meaning “gathering place by the water.” A description perfectly in line with the exemplary process implemented in the city for treating and recycling wastewater, eliminating and recovering waste, and reducing the amount of energy consumed by all of these operations.

Developed by the Milwaukee Metropolitan Sewerage District (MMSD) and marketed since 1926, the process produces a pelletized fertilizer recovered from wastewater from the metropolitan area, including the breweries — important for their nutritional content, as it turns out. The resulting product is composed of heat-dried microbes that have digested the nutrients in the wastewater. Known as Milorganite® (for Milwaukee Organic Nitrogen), the product is sold across the



Issue at stake

➤ Reduce the energy consumption linked to the production of “Milorganite®,” a fertilizer produced from wastewater sludge.

Objective

➤ Produce a 100% organic amendment for sustainable farming.

Veolia solution

➤ Replace some of the fossil fuel consumed by the water reclamation facility with biogas from a landfill site.

The Milorganite® recipe for success

The technological journey toward the finished product begins with collection in interceptor sewers of wastewater and preliminary treatment to remove solid materials. Microbes are then added to the water — the activation process — to digest the nutrients in the water. Binding agents are added to the water, causing the microbes to clump together and settle to the bottom of the undisturbed water in sedimentation tanks. After settling,

the cleaned water is returned to nearby Lake Michigan. The microbe clumps are sent to the city’s Jones Island water reclamation facility where the material is dewatered and dried to 95% solids in one of twelve rotary kiln driers. The now-pelletized material is then sent by rail car or truck to the adjacent port of Milwaukee for packaging and shipment to commercial and retail customers in bags ranging from five pounds to one ton.



••• U.S., Canada and the Caribbean. Milorganite®’s production fits with a broad sustainability strategy co-developed between MMSD and its partner Veolia. The twofold aim is to ensure environmental compliance — wastewater recovery, carbon footprint reduction — and develop a range of innovative technical programs. Other strengths have a socially responsible dimension, including successful Small/Women/Minority Business Enterprise (SWMBE) purchasing programs and utilizing a collaborative process control framework aimed at controlling potential wet-weather overflows.

Brewing up a commercial success

Milorganite® is produced at a rate of approximately 48,000 metric tons per year. Sales, which have been steadily increasing (topping \$10 million in 2017), benefit from a special ingredient according to MMSD Executive Director, Kevin Shafer. “Other cities are producing similar fertilizers but our quality is higher due to good BOD (biological oxygen demand) content that comes from the brewery streams.” Sales of Milorganite® are mainly for golf courses, green spaces and retail sales. Its appeal, says Kevin Shafer, is that

“Milorganite® is from a natural source so it dissolves more slowly and soaks into the ground more efficiently than synthetic fertilizers produced from mined phosphorous — which is also a finite resource.” In 2008, MMSD entered into a public-private partnership with Veolia. Under the contract, which was renewed in 2016, the Group operates and maintains the city’s two water reclamation facilities, Jones Island and South Shore, a 320-mile collection system, biosolids production and a “Deep Tunnel” sewage sludge storage system. Early in the partnership, Veolia approached MMSD with a proposal to reduce the amount of energy consumed at Jones Island by utilizing biogas. This gas comes from the anaerobic digestion of waste from a landfill operated by Veolia 17 miles away, with the methane recovered being piped in. Completed in 2017, the project has halved the amount of natural gas consumed on the site, saving 1.5 million dekatherms per year. A new biogas plant is set to open soon, increasing the proportion of operations powered by biogas to almost 85%. “Veolia’s energy recovery idea enabled us to reduce fossil fuel usage, reduce our carbon footprint and save money for our ratepayers,” says Kevin Shafer. “They’ve truly provided added value and been a good partner for us and the city of Milwaukee.” ■



Key figures

- 1.1 million people benefit from wastewater services in 28 municipalities
- Operation and maintenance of a 320-mile system of interceptor and main sewers
- Two wastewater treatment facilities with a combined peak capacity of 630 million gallons
- Management of a 28-mile-long, 521-million-gallon Deep Tunnel storage system
- 3,000 miles of household laterals and 3,000 miles of sanitary sewers
 - Annual production of 48,000 metric tons of MMSD’s renowned Milorganite® biosolids fertilizer
 - 2017 Milorganite® sales > \$10 million
- 1.5 million dekatherms of energy saved annually

Recognized expertise

The excellence of the MMSD-Veolia partnership has been recognized through multiple prestigious honors, including: U.S. Water Prize from the Clean Water Alliance; Platinum Awards from the National Association of Clean Water Agencies; Distinguished Service Award from the National

Council for Public-Private Partnerships. In addition, the Jones Island facility consistently ranks as one of Historic Milwaukee’s most popular “Doors Open” tour attractions, drawing more than 4,000 visitors in 2017. In 2016, MMSD awarded Veolia a 10-year contract extension, two years ahead of schedule, based on its performance. Scott Royer,

VP and General Manager of the project for Veolia, attributes this success to the Group’s sustainability commitment. “With MMSD’s vision to achieve 80% renewable energy for their wastewater treatment operations and Veolia’s long-standing commitment to recycling, we know that this is a win-win partnership.”





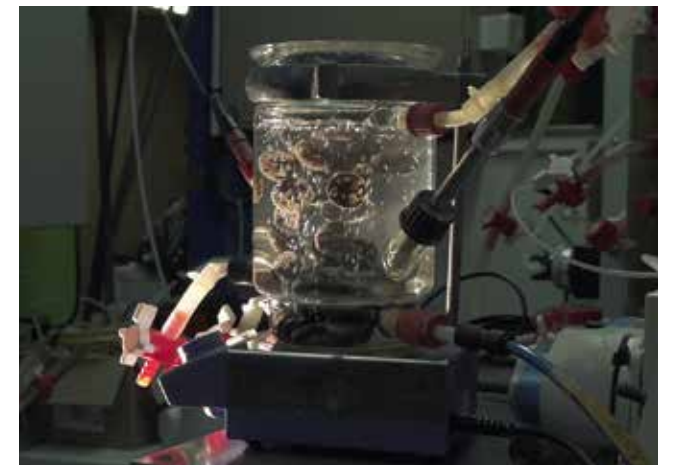
Aarhus

DENMARK

Eliminating drug residues in municipal wastewater

Certain drugs that we consume are found in small amounts in wastewater in the form of residues. Untouched by traditional wastewater treatments, they subsequently end up in nature. To address this problem, biological treatment technologies have been successfully tested in Denmark. Through the MERMISS project, Veolia and its local subsidiary Krüger are stakeholders in an experimental concept that is being followed by the European Union.

The municipality of Aarhus, Denmark's second-largest city, decided to tackle the drug residues found in wastewater when planning the city's new university hospital. This move led to the creation of a consortium consisting of Aarhus University Hospital, Herning and Aarhus water utility companies, the Danish Technical Institute, Krüger, the Technical University of Denmark, Aarhus University and Air Liquide. It was tasked with identifying the most efficient and environmentally friendly way to remove pharmaceuticals ...



Issue at stake

➤ Meet the challenge of pharmaceutical pollution.

Objective

➤ Measure and eliminate pharmaceutical residues in municipal wastewater.

Veolia solution

➤ An effective and economical technology for the biological removal of drug residues, known as MBBR, supplemented by an ozone treatment.

Drugs in our wastewater

Some of the drugs that we consume are discharged into the municipal wastewater via our urine. The European Commission has drawn up a list of 4,000 active pharmaceutical ingredients that are likely to end up in wastewater: contraceptives, antidepressants, antibiotics, anti-inflammatories, anticancer drugs, contrast agents used in medical imaging, etc. Some of them have an impact on the environment, especially fish and amphibian reproduction. This is particularly true of endocrine disruptors, which influence our hormonal system. However, in most countries there are currently no regulations regarding the treatment of these drug residues. One of the components of the MERMISS project consists in establishing and drawing up a vigilance list for the most toxic pharmaceutical residues on a European scale. This will allow innovation efforts to concentrate on treating these substances.



technology relies on micro-organisms that grow on plastic media. Due to the project's configuration, they will develop specific "skills" for treating pollution that is not readily biodegradable. "Unlike traditional activated sludge, this technology facilitates the degradation of complex organic matter using slow-growing bacteria," states Christina Sund, Business Development Director at Krüger.

More bacteria, less ozone

This technology can also be used as a post-treatment step for effluent polishing, after the "conventional" wastewater decontamination process. For complete treatment, e.g. for hospital wastewater (cf. above), the system consists of six MBBR reactors in series. The post-treatment concept harnesses three reactors using

the same technology, supplemented by ozone oxidation to remove all target pharmaceuticals to PNEC (predicted no-effect concentrations) level. The more effective the biological treatment, the less ozone needs to be added – a more expensive and energy-consuming process. The results of the experiment are extremely conclusive. Up to 90% of the pharmaceutical residues found in the municipal wastewater have been removed. Which opens up a world of opportunities! "We are just about to launch a new project to test this purely biological elimination technology on a larger scale," states Thomas Møller. "As MBBR technology is so inexpensive, it becomes relatively cost-effective to eliminate pharmaceuticals from wastewater, even in municipal wastewater treatment plants. Krüger's technology can be a game-changer, allowing us to meet the challenge of pharmaceutical pollution in wastewater." ■

... from wastewater: the MERMISS project (Environmentally friendly treatment of highly potent pharmaceuticals in hospital wastewater). Initial tests began at Aarhus University Hospital with wastewater from the oncology department. The scope was then expanded to include Herning's municipal wastewater, and finally effluent from the municipal WWTP in Aarhus was polished. The aim was to draw up a suitable treatment framework.

Diffuse pollution

The question was as follows: should they treat the wastewater at the hospital's own treatment plant or send it for treatment at the municipal level? With the growing popularity of outpatient care, the number of patients monitored at home by Aarhus University Hospital rose by 34% on average between 2007 and 2015. As a direct consequence, pharmaceutical pollution is no longer limited to the hospital's wastewater. To make the right decision, Aarhus University Hospital's Environmental Coordinator, Thomas Møller, studied patients' medical data. Only 4% of the total prescribed pharmaceuticals are consumed in hospitals. The results are indisputable: to limit the environmental impact, the municipal water must be treated.

Biological efficacy

"We chose to work with Krüger because they offer technical solutions to eliminate drug residues that are effective and economical in one," states Thomas Møller. Aarhus hospital and Krüger decided on MBBR (Moving Bed Biofilm Reactor) technology. This biological treatment



Unprecedented water treatment at the new hospital

In the Danish city of Herning, where the ambitious hospital complex of Gødstrup is being built to serve western Jutland from 2020 onward, the question of treating drug residues is key. "We are very keen to provide high-quality drinking water both now and in the future, and therefore not discharge drug residues into the environment," highlights Niels Møller Jensen, CEO of Herning Vand, the city's water utility company. "Yet 95% of this residue is discharged by people

outside the hospital. We must therefore treat the water in the municipal plants." Herning Vand and Krüger worked together to find an effective and affordable solution to this problem. Once again, the solution chosen was MBBR (Moving Bed Biofilm Reactor) technology. "We discovered that nature was much more efficient than we thought: with MBBR technology, we will be able to eliminate drug residues in all the city's wastewater," concludes Niels Møller Jensen.



Ellesmere Port UNITED KINGDOM

At its Ellesmere Port site in the UK, Veolia is experimenting with energy storage in lithium-ion batteries. The idea is to improve the energy and environmental performance of its hazardous waste High Temperature Incinerator. This facility is not only the largest of its kind in the country, but also one of the most technologically advanced in Europe.

The flexicurity of battery energy

Heavy industry

dominates the town of Ellesmere Port in the otherwise leafy county of Cheshire. Not far from the city of Liverpool, it is home to a major car factory, chemical facilities and one of the UK's main oil refineries. Along with a major shopping outlet and a significant number of homes, these large energy users all put stress on the local electricity network, part of the UK's National Grid. Veolia also contributes to the energy



Issue at stake

► Ease the pressure on the National Grid in the Ellesmere Port region.

Objective

► Optimize the use of the energy resources available at Veolia's local plant.

Veolia solution

► Lithium-ion batteries to better control energy use.

... picture with its High Temperature Incinerator (HTI) in the town. Treating 100,000 metric tons of hazardous waste at 1,200°C, it securely disposes of everything from laboratory waste through contaminated electrical equipment to all sorts of liquids and gases. But this comes at the cost of high energy use, potentially placing a further burden on local electricity resources.

Saving costs and securing the grid

Veolia realized that by introducing lithium-ion battery technology on the site, it could not only reduce the pressure on the local network, but also lower the plant’s operating costs by buying energy at cheaper times and storing it. “We are able to buy low-cost electricity at off-peak times and store it for use at peak times,” says Veolia UK Chief Technology and Innovation Officer, Richard Kirkman. “The advantage of this is that we are able to use it later when energy costs are more expensive. Bear in mind that a single battery is the size of a small family car but is capable of storing the equivalent of the energy use of 1,000 homes or 100,000 AA batteries!”

Frequency control: a source of revenue

“We are also able to sell our storage capacity to National Grid to help it balance the system frequency. It has an obligation to control the frequency of the grid at 50 Hz, plus or minus 1%. It needs to manage the circumstances that could lead to frequency variations in UK supply, which disrupt the balance between production and consumption and therefore the stability of the grid. The battery is able to help it do this, along with lots of other suppliers. Additionally, there are times



Richard Kirkman
Chief Technology and Innovation Officer, Veolia UK and Ireland

Veolia supports the UK’s vision of a decentralized grid

“We learned a lot about how to connect to the National Grid, particularly behind the meter. Our top priority was to not destabilize the grid. We had to install new protection to safeguard the grid in case of any unexpected circumstances. Increasingly, because more and more renewable energy is being used in the UK, the National Grid is transforming into a connected and decentralized platform. We knew that we had an asset in Ellesmere Port with our High Temperature Incinerator. For us and our supply chain of electricians and other service providers, this has been a learning experience that has helped us develop expertise that will be crucial as the UK relies on more renewable energy on a decentralized grid.”

KEY DATA

- A lithium-ion battery is capable of generating **400 kW/385 kWh**.
- This is equivalent to the energy required to power **1,000 homes** or **100,000** AA batteries.
- The HTI facility must operate at **1,200°C** to securely dispose of hazardous materials.
- The battery provides around **1 hour of back-up** in the event of a power outage allowing safe power-down of the HTI.

when we can sell electricity back to the grid, but helping it meet its frequency obligations is a more likely source of revenue.” In the future, the rise of renewable energy will further boost the potential of this solution. The British government has recently committed to phasing out coal power by 2025. Inherently more intermittent than fossil fuels, renewables require much more complex grid control systems. April 2017 saw the UK’s first day without

coal power since the industrial revolution, with wind power now replacing the fossil fuel on 75% of days last year. The UK is home to the highest number of offshore wind projects in the world and singlehandedly installed 53% of Europe’s offshore wind capacity in 2017, according to WindEurope. “When the wind is blowing and the UK is generating lots of wind energy, we are able to buy this energy and store it,” says Richard Kirkman. “So there is also the carbon benefit of not using power generated by coal or natural gas.” ■



Energy storage: the lucrative hospital sector

Hospitals still rely on fossil fuel generators to ensure continuance of care in the most sensitive departments. However, they have three disadvantages:

- they take a few seconds to kick in,
- they are expensive to operate and maintain,
- they are environmentally unfriendly.

On the contrary, battery storage technology, offers several advantages:

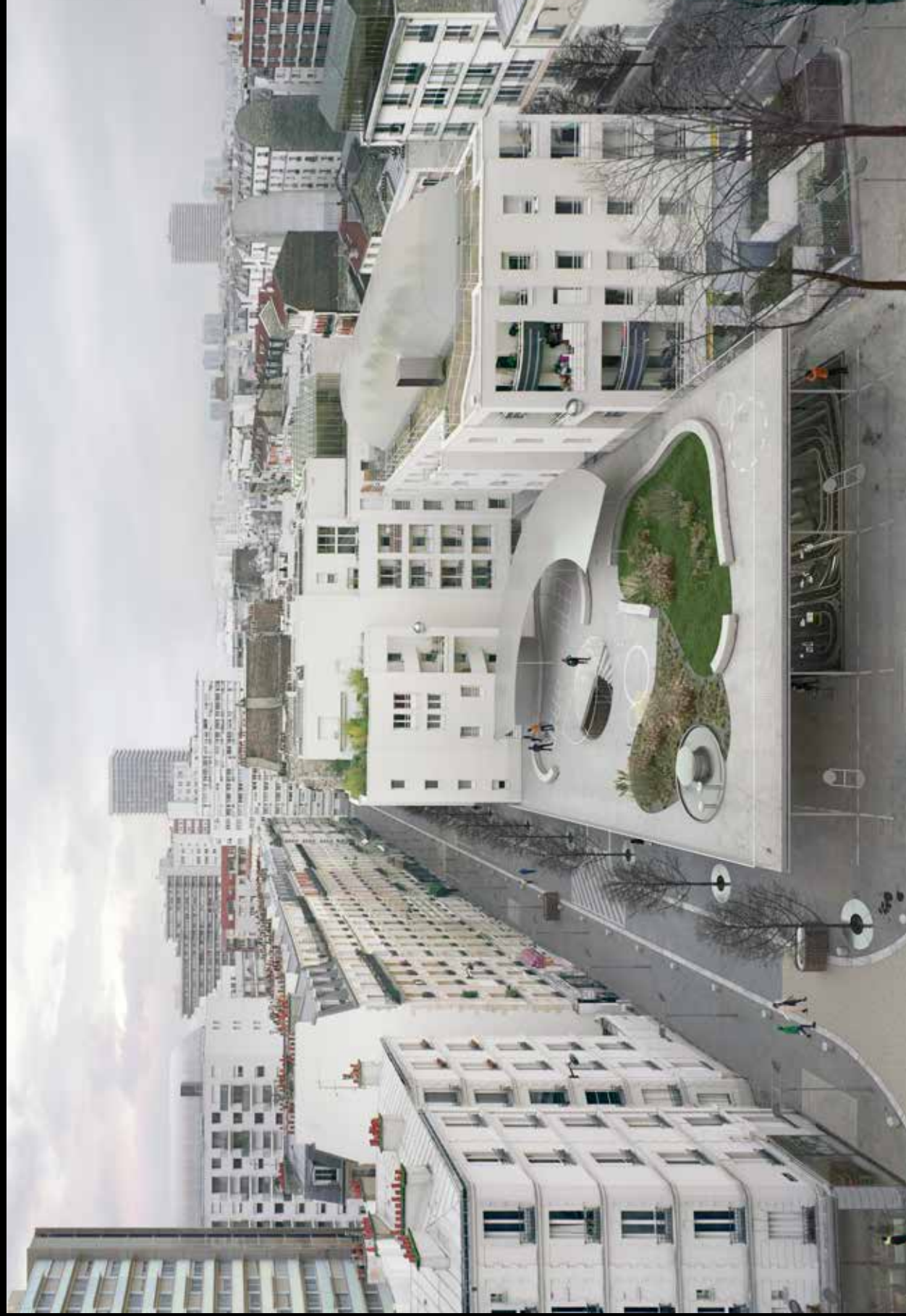
- it operates instantaneously,
- it is less expensive as electricity can be bought off-peak,
- energy storage can be combined with renewable energy sources.

The pathway to... 2040

To embrace the challenges that the world will have to face in 2040, Veolia set up its Press Day on February 8, 2018 in the French design school ENSCI (Ecole nationale supérieure de création industrielle). Guillaume André, Quentin Didierjean and Thélonious Goupil — three young designers who graduated from this prestigious school — took the opportunity to present a personal and realistic vision of water,

energy and waste treatment in the city of the future. For four months, the trio worked closely with Veolia's experts to draw up a tangible scenario. Then they collaborated with the architectural photographer Maxime Delvaux and a team of 3D integrators to depict it in images. The exhibition "The pathway to" is organized around five windows, opening to 2040. The staging is based on a series of photos

and objects created especially for the event: "the street, the urban space," "the 'central waste plant' in the city," "the new neighborhoods," "the city's new boundaries," and "housing and food." These iconic urban settings — from the private sphere through the city center to the outskirts — offer a host of innovative perspectives on the city of the future. We take a guided tour.



The street, the urban space In 2040, town planning has found a lofty solution to urban sprawl. People get around on foot or use low-emission personal transportation or mass transit. A new type of urban furniture has appeared; it improves sensory comfort in the urban area. These objects are managed by a "municipal employee," whose job it is to make sure they are adapted to specific local needs and uses.

The “central waste plant” in the city. In addition to traditional facilities to treat waste and wastewater still required on the urban fringe, a network of micro-plants has been installed in the city center. This relocation has reduced carbon emissions from trucks.



The new neighborhoods. Population growth and increasingly efficient transportation have increased the attraction of outer-urban areas. This phenomenon has led to the transformation of the landscape in areas that were previously neglected. Vertical agriculture produces fruit and vegetables in all seasons thanks to hydroponics. An ecosystem has been created between houses, offices and factories, all of which produce and consume energy.

The city's new boundaries. On the outskirts of the city, small fields are used to produce a variety of fruit and vegetables. Small farming lots are irrigated by artificial watercourses, created using the city's recycled wastewater. Houses are built using recycled and local materials. Energy comes from small renewable energy production units installed in gardens.



Housing and food. New technologies, new codes and new practices have appeared. The most recent buildings are crisscrossed with technical ducts that serve as a structure. In the kitchen, there is a great variety of vegetables and local produce.

On the way...

Joint interview with Guillaume André, Quentin Didierjean and Thelonious Goupil

Working on a collaborative project demands intelligence, diplomacy, open-mindedness and the ability to compromise. Not forgetting organizational and methodical skills if you want to achieve a realistic end result. Each in their own way, the three young ENSCI graduates tell their story, taking us behind the scenes of an unprecedented partnership with Veolia. An interview from three points of view.

It all started with a question posed by Veolia: what solutions must be developed over the next twenty years to meet the exponential rise in food and energy needs and combat pollution? “Veolia pushed us out of our comfort zone!” explains Quentin. “We had to be able to come up with a well-argued and eloquent project, in terms of both content and images. In our job, it’s rare to find yourself taking such a global approach as ‘thinking about society.’



Quentin
“What made my relationship with Veolia all the more interesting was that I was able to see how a large company takes an eco-friendly approach with its profitability constraints and growth imperatives.”



Thelonious
“Being on the same skill level, I had to accept my co-workers’ different visions. This was what was so difficult yet enriching about this project, which had an exciting dynamic and tension.”

So it was very important to me that we agreed about sufficiently robust and detailed elements. This gave rise to intense discussions and debates!”

They then had to develop ideas in line with precise specifications, shaping a shared vision. “We spontaneously wanted to work together, all three of us aligned around the same vision,” states Guillaume. “We made it a point of honor. And the basis of this collective vision was a carefully chosen and ambitious iconographic selection.” This is where they came into contact with a number of Veolia’s experts. “While we were chosen for our personal vision of the subject, it was incredibly enriching for us to discover the vast expertise in the Group, along with the wealth of pilot projects underway,” adds Quentin. “Thanks to the close relationship that formed over the course of our exchanges and the rich discussions, we were able to draw up a highly developed scenario. All we had to do was come up with tangible schemes that could be illustrated.” A wealth of futures is no bad thing! But between anxiety-

inducing and unmistakably idyllic scenarios, the trio chose the vision of a plausible (at least in the medium term), realistic, moderate and above all optimistic tomorrow. “Our city offers gradations depending on how you look at it. It requires us to get involved at every level, from the city center to the fringes to the outer ring,” states Guillaume. “For we wanted to show that there are multiple solutions. We made the creative decision to take the photos with a large-format camera. Its main advantage being the fact that we could develop the large prints on display, into which we gradually incorporated the designed objects. As if, during the twenty years separating us from 2040, we had continued to create things.”

“The architectural photographer Maxime Delvaux’s work was incredibly rich,” says an enthusiastic Thelonious. “He quickly formed his own opinion about our project and naturally became the fourth musketeer! The keenness and intelligence of his eye were invaluable to us from an esthetic point of view and our search for the best

possible landscape. As we brought on board new forms of expertise — especially 3D integration — each made a new contribution. Everyone has ideas about these future cities. It was incredibly stimulating to have the space, time and comfort to think about them,” he concludes.

On the strength of this collaboration, their future prospects have been confirmed and subtly altered. This thinking will accompany our three designers as they move forward. Working with Veolia and collaborating with professionals with sometimes over thirty years’ know-how has enriched Guillaume, Quentin and Thelonious’ experience: they have learned to translate their thinking in different sectors of activity. For, in the future, engineers and designers will increasingly find themselves working together on forward-looking questions.



Guillaume
“I was used to working with multidisciplinary teams, less with designers with similar skills. The exciting thing about this project is that together we managed to put forward the future that we want.”

Guillaume André, object mastery
During his seven years of studies, he explored design from every angle to gain a global perspective. His successive internships with the agency NoDesign and the French Alternative Energies and Atomic Energy Commission (CEA), followed by his experience at the Centre Michel Serres, led him to specialize in innovation, research and new technologies. He pays particular attention to manufacturing methods and social and environmental issues. His specialty is understanding everyday objects and repairing them. Handling these objects with a history encourages exploration and reappropriation.
Graduated from ENSCI in July 2017

Bio

Quentin Didierjean, bio-inspired
Following an in-depth exploration of different worlds — cabinetwork at Robert Goudoin, augmented reality at Levels3D, product and set design at the Constance Guisset Studio, Quentin became interested in eco-design. For his degree, he created an array of accessories, equipment and recipes for producing your own objects based on everyday biodegradable materials. His dissertation *Controlled disappearance* describes the concept and uses of bio-inspiration for practicing sustainable design.
Graduated from ENSCI in April 2017

Bio

Thelonious Goupil, in praise of ordinary objects
His degree in hand, he spent six months with Ransmeier Inc. in New York and then a year with the Jasper Morrison agency in Paris. Two professional experiences that reinforced his industrial design sensibilities and understanding of ordinary objects. In July 2016, his Seaside Bench project won the Hyères-Toulon Design Parade jury prize. He was subsequently offered a one-year residency at the Villa Noailles, during which he developed personal projects in collaboration with local businesses. An independent designer since July 2017, Thelonious Goupil looks to create objects designed according to their context and the techniques governing their implementation, while ensuring the projects’ economic viability.
Graduated from ENSCI with distinction in March 2016

Bio

ENSCI, the school of every design

The *École nationale supérieure de création industrielle—Les Ateliers* (ENSCI—Les Ateliers), placed under the joint authority of the Ministries for Culture and Industry, was founded in 1982 under the patronage of Jean Prouvé and Charlotte Perriand. Ranked as the best design school in the world by Red Dot Design in 2011, it is the leading French higher education establishment exclusively devoted to design and industrial design. Adopting an innovative approach, it unites the fields of industrial and product design with digital, spatial, communication and service design.

Air is a public good whose deteriorating quality impacts public health and contributes to global climate change. In response, tightening regulations are imposing tough new requirements on states and industries.

AIR QUALITY, A VITAL ISSUE

The quality of the air

we breathe is worsening in many parts of the world. While some improvements have been achieved in recent years, progress has been sporadic and overall pollution levels are still increasing. The public stakes of dirty air are staggering. Air pollution currently causes the premature death of 6.5 million people worldwide and — with the rapid urbanization and industrialization of the planet — is on track to claim 7.5 million lives by 2040. Of these, 4.5 million would be as a result of ambient air pollution and 3 million from indoor air pollution. Beyond the impact on humans, poor air quality carries enormous economic consequences. The OECD recently estimated the costs of air pollution, considering effects such as productivity at work, healthcare spending and agricultural impacts. The finding: a 1% increase in economic costs to global GDP — i.e. almost 2,600 billion dollars per year — by 2060.

A shifting landscape

Why the setbacks to cleaner air? One reason is a lack of sufficiently stringent fiscal and incentivizing regulations to force the development and implementation of new technologies and attract the capital to fund this negative externality. Air quality is also a complex and fluctuating problem with many sources, making it difficult both to address and to show a clear return on investment to each stakeholder. However, the market’s ability to attract investors — and therefore capital — would be a key driver in encouraging decision-makers to

commit to achieving more ambitious air quality goals. Now, however, the political paralysis may be showing signs of ending as a result of rising public concerns over the health effects of dirty air. According to the Elabe survey for Veolia conducted in late 2017 in 28 countries (cf. page 10), air quality is citizens’ second most important concern. An increasing number of public demonstrations in India, China and Europe are encouraging governments to take action. And every day, new cities are taking steps to restrict air emissions to combat local pollution. In response to civic and other pressures, government regulations are evolving quickly, with increasingly stringent limits on ambient air emissions of pollutants such as nitrogen oxides (NOx) and particulate matter. Similar regulatory drivers are developing on indoor air. In France, air quality monitoring is now mandatory for all elementary schools and day-care centers, a requirement to be extended to all schools by 2020 and all public buildings by 2023.

Positioned to act

When it comes to combating air pollution, Veolia has a lot to offer. “We have a host of skills in this area, which are already being utilized in the Group’s entities. They have simply not yet been fully deployed. It is up to us to promote them better, with a view to providing solutions to our clients’ air quality needs,” states Veolia OFIS Executive Vice President, Sabine Fauquez-Avon. On the strength of its building management and maintenance experience, the Group offers its clients dedicated indoor air quality solutions. “This involves guaranteeing the health and

Innovation to accelerate progress

Veolia is a founding partner of Airlab, the innovation platform developed by AirParif, an air quality monitoring network in the Paris region. Airlab brings together start-ups, small and large businesses, research institutes, local authorities, governmental bodies and citizens. Drawing on this open innovation approach, Veolia has joined with the property management company Icade to launch a project to test a new generation of sensors designed by the start-ups to continuously measure air quality in office buildings. The aim is to control ventilation, recycle indoor air, measure air hygrometry and reduce emissions of CO₂, fine particles and volatile organic compounds. The first tests are scheduled for the summer of 2018. “This joint experiment will allow us to offer our commercial and industrial customers a combined solution, integrating energy efficiency and health security in buildings,” says Veolia OFIS Executive Vice President, Sabine Fauquez-Avon.



A matter of will

“There are many places around the world where people are breathing air that is totally contaminated. They think it’s normal that the sky is gray and not blue. It’s entirely possible to have intelligent solutions to totally eliminate toxic and carbon emissions in our cities. It can be done if companies like Veolia keep on applying their creativity and accelerating their capabilities to develop technologies that will influence consumers in the right direction. If we succeed in putting effective air pollution control measures in place, we can save thousands of lives per year. It’s not just a question of technology. It’s also a question of will, public policy and the determination of people to live in a world that is sustainable and in an environment that does not negatively affect our health.”

Maria Neira
Director of the Department of Public Health,
Environmental and Social Determinants of Health
World Health Organization (WHO)





Key figures on air pollution

- 4th leading cause of death in the world
- 7.5 million premature deaths in 2040 of which 4.5 million from ambient air pollution and 3 million from indoor air pollution

integrate digital air quality information platforms via mobile apps for citizens, keeping them informed in real time about air quality and the mitigation measures underway. This offer will also rely on data collected by other entities in the city within a partnership framework.

Overcoming hurdles

Veolia is developing pilot projects at several customer sites around the world, explains Sabine Fauquez-Avon. “On internal air quality, we are working closely with Baxter Laboratory in Belgium and the Sheraton Hotel in Dubai. We are also conducting an experiment at Le V, the building that houses our head office in France, controlling the office ventilation to optimize occupant comfort.” Other pilot projects concern the ambient air quality in cities and local authorities: one involves pollen monitoring in Nice (France), while another concerns the recovery of mercury from incinerator fumes, detection of air pollution sources and identification of response strategies in Manila (the Philippines). “It will take time to implement the political, regulatory, technological, social and financial solutions to combat air pollution and the health and economic risks it creates,” underlines Jean-Christophe Taret. Veolia plans to put this time to good use to deliver solutions commensurate to the challenge. ■

••• comfort of the buildings’ users while managing the energy consumption of doing so,” explains Sabine Fauquez-Avon. In terms of ambient air quality, Veolia plays more of a service integrator role. In this respect, it can help municipalities develop a global strategy to combat air pollution. As a water, waste and energy expert, the Group has several “bricks” of expertise with which to build to meet the challenge of air quality. These include:

- hazardous waste incineration technologies and expertise in controlling emissions, including toxic pollutants such as mercury;
- solutions for controlling odors from wastewater treatment plants;
- operating experience in building energy services and HVAC systems that are directly linked to indoor air quality norms;
- centers for remotely controlling

water and energy systems (Hub-grade), which now incorporate air quality control;

- proven audit, diagnostic and measuring capabilities developed for air and water quality in buildings.

Integrated solutions for existing customers

“We are targeting offers to meeting the needs of customers in existing high growth potential markets in the short and medium term,” says Veolia Strategy Director, Jean-Christophe Taret. For indoor air quality, Veolia is targeting the tertiary sector (offices, hospitals, commercial buildings) with an integrated air quality management approach

that leverages analytics, data processing and knowledge of onsite operations. “As it already operates the energy utility for customers, Veolia possesses an insider’s knowledge of the installations, from design to operation, down to measuring air quality in real time,” explains Jean-Christophe Taret. This knowledge allows it to identify deterioration, recommend layout changes and implement corrective actions. For ambient air, the primary initial targets are medium to large cities in Europe and North America. The value proposition includes decision-making tools (measuring, modeling and predicting air quality in the city), offering recommendations for acting on sources of pollution and implementing mitigation actions (for example, closure of a highway to reduce peak pollution). These tools could

Community

Each year in France, 10 million metric tons of food — worth 16 billion euros — are thrown away without being eaten. This food waste also produces 15.55 million metric tons of CO₂. This is equivalent to 3% of France’s total greenhouse gas emissions, and five times higher than emissions from domestic flights... At the same time, 4 million people rely on food aid. A paradox that has led Veolia and the food banks in Northeastern France to develop an original idea: the bike blender.



Pedaling against food waste

Based on an idea by Geneviève Pupil, Director of Meurthe-et-Moselle’s Food Bank, the bike blender appeared in Nancy in 2016. Made from materials salvaged from waste drop-off centers, it works in the same way as the smartphone charging stations found especially in railway stations, offering users the opportunity to recharge their cell phone as they pedal. In the case of the bike blender, simply pedaling activates a blender and mixes its contents... Slightly overripe fruit and vegetables are thus transformed into delicious juices, soups and smoothies. The bike blender has proved to be a fun and attractive way to raise awareness about food wastage and the best practices to avoid it. It shows that you can make good and tasty use of food that would otherwise end up in the trash.

Its kilometer reader tells users the distance that they have covered and the number of foodstuffs reused... before they enjoy the fruit of their labor! This approach is winning over the younger generation. “They are very much involved in sustainability and combating food waste. They now come of their own accord to ask us a host of questions. In return, it’s easier to tell them about our program,” states Geneviève Pupil. Success is on the cards. Rolled out in the Meurthe-et-Moselle, Bas-Rhin and Moselle areas, bike blenders are continuing their tour of France... and joining Veolia in the regions. For, given the large amount of edible food waste thrown out, the Group is very much engaged in awareness-raising actions — soup workshops, food donation assistance, etc. — among its staff members and citizens throughout France.

4 million people rely on food aid

Food banks
Emerging in the eighties, the first food support network in France was inspired by the American food bank model.

- The 79 food banks and 23 branches across France actively combat food waste and come to the aid of over two million people.
- 1 in 2 food aid beneficiaries received food collected by food banks, i.e. the equivalent of 210 million meals.
- In Europe, food banks have developed in 22 countries.

EXPLAINER

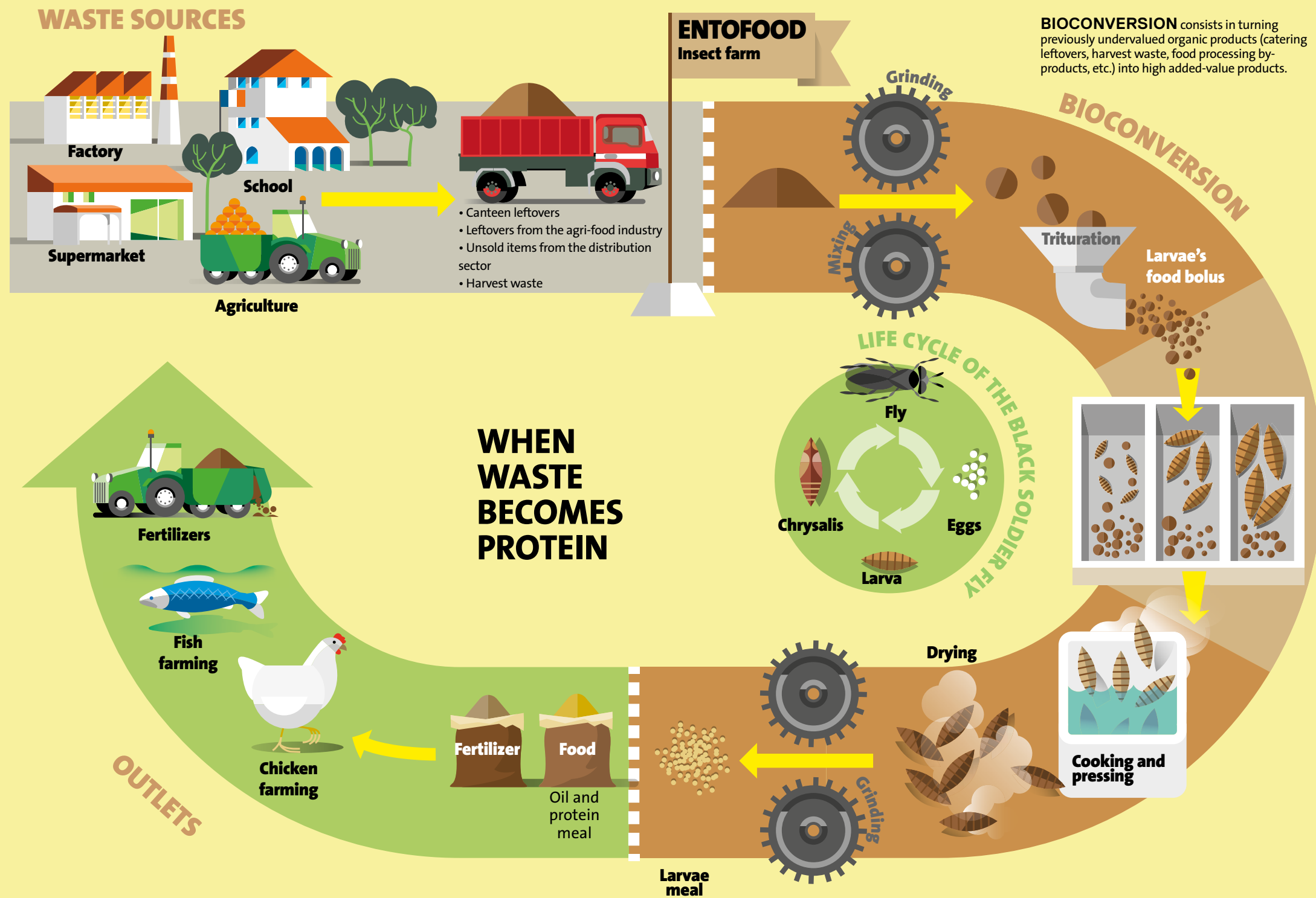
Waste on the plate: insects at the heart of bioconversion

What if our food waste could be used to feed insects and these insects could be used to feed farm animals? The start-up Entofood is developing this very idea at its pilot farm in Malaysia in partnership with Veolia.

Will flies allow us to feed the world better? If you're averse to a diet of insects, fear not: today we're only talking about growing their larvae and using them as food for farm animals. Especially those requiring protein, such as fish, poultry or pigs. This is the aim of Entofood, a French start-up established in Malaysia. Its idea is simple: transforming the problem of managing unused or undervalued organic waste into a solution to the growing need for protein for animal food. With Veolia's help, Entofood is developing high added-value products based on black soldier fly larvae (*Hermetia illucens*). This is a non-invasive insect that is harmless to humans and feeds on food waste: the ideal candidate for this method of converting waste into protein,

known as bioconversion. Entofood produces oil, protein-rich meal and organic fertilizers from these larvae. A real circular economy is therefore established. The prospects are promising: aquaculture provides half of the fish consumed worldwide. Bioconversion will mean that cultivated fish do not have to be fed with other fish or any protein grown to the detriment of food crops or forests. Entofood and Veolia have complementary know-how: the first has the technology required for this new form of recovery; the second has the knowledge and expertise regarding the organic source on a global scale. This partnership could make the difference in a world where the issues of food safety, self-sufficiency and greenhouse gas reduction are critical. ■

Veolia is also partnering the start-up Mutatec, established in the Bouches-du-Rhône region in France, which also uses the black soldier fly as food for aquaculture and poultry farming. The fly larva has a high potential: in July 2017, the European Commission authorized the use of processed animal protein derived from insects for aquaculture.



WHY ASIA?

There are two main reasons for choosing Asia:

- the "black soldier" fly (*Hermetia illucens*) is native to the tropical belt, hence Entofood's decision to reproduce it in its region of origin;
- the region represents over 80% of aquaculture worldwide.

10 kg of plant protein produces **1 kg** of beef protein, but **10 kg** of insect protein.

50% of fish consumed worldwide come from farms (since 2014).

1 kg of eggs from the black soldier fly, fed on waste, produces **6 metric tons** of protein in **10 days**.

There are only **10 to 12 days** between the black soldier fly eggs hatching and larvae harvesting.

10% of the protein market could come from insects by 2040 (analyst estimate).



> How does 3D food printing work?
The process is based on three elements:
• the software element, with 3D modeling files, sometimes known as computer-aided design (CAD);
• the physical element, the machine itself, which can use different 3D printing techniques (depositing successive, more or less dense layers of a food product);
• the material used, in other words the food to be printed.

> The three most common uses
• **Fun, playful and design-forward cuisine:** decorating dishes, cakes, candies, etc.; writing in specific fonts; complex-shaped objects (sugar decorations, chocolate in paste form, foams, purées, chewing gum, etc.).
• **Mass catering for seniors:** cuisine and food with tailored textures, improvement in the nutritional value of meals.
• **Experimentation by NASA and the Massachusetts Institute of Technology's laboratories:** food in space and under extreme conditions.

> An added ecological argument
• 3D food printing offers the possibility of reducing food wastage and waste.

3D food printing is coming to our kitchens

“3D Food Valley” is emerging in Brittany, France’s leading food and drink region. Heading the charge is the Centre Culinaire Contemporain, a laboratory dedicated to the food of tomorrow open to researchers, chefs and gastronomes. It is here that 3D culinary printing is taking shape. Crepes in the shape of the Eiffel

Tower have become a classic. “We can create culinary items made of chocolate or sugar,” states co-founder Freddy Thiburce. “Our machines — the byFlow and PancakeBot — work with powder, liquid and even purée.” But the Center wants to go even further. With the Brittany region, nine industrialists and three academic partners, it

has been running the Manger 4D program since 2016. Drawing on applied research on 3D food printing and the many opportunities for innovation that it offers, disciplines can be integrated and endless combinations identified: human and social sciences, food chemistry, new technologies and the Internet of Things. A clever cocktail that

paves the way for three major avenues of exploration. Customized cuisine, for the elderly or the allergic, would make it possible to adapt dishes to specific dietary requirements. Fast home cooking, for consumers with no interest in the culinary arts, would make it easier to prepare everyday meals. And last but not least,

culinary design and industrial prototyping for the food and beverage industries. “The microwave and food processor are appliances that used to be seen as gadgets and were accepted in the end. We are convinced of 3D food printing’s potential for use in the factory, restaurant or home.”

Centre Culinaire Contemporain*

Created in Rennes in 2013 and given a government-approved label, it is a forerunner of the living lab model tailored to the food sector.
*Contemporary Culinary Center

A shared innovation platform, the Center brings together a consortium of companies from the food sector along with public players, based on

a collaborative, international and use-focused approach.

JUNE 5, 2018

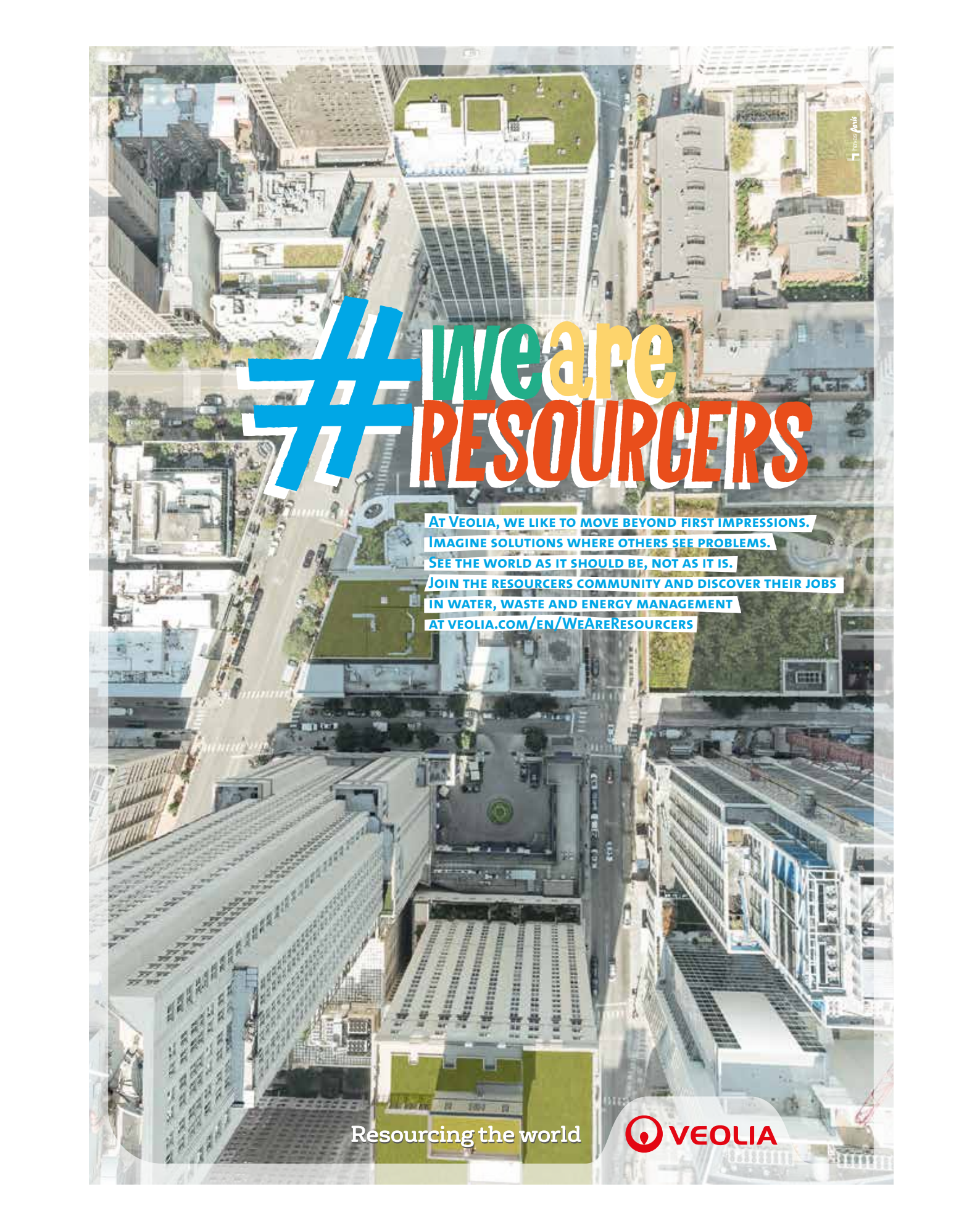
WORLD ENVIRONMENT DAY

BEAT PLASTIC POLLUTION

GOVERNMENTS, INDUSTRIALISTS, LOCAL AUTHORITIES AND PRIVATE CITIZENS MUST TOGETHER EXPLORE SUSTAINABLE ALTERNATIVES TO REDUCE THE EXCESSIVE PRODUCTION AND USE OF SINGLE-USE PLASTICS. ON THIS DAY OF INTERNATIONAL ACTION, ATTENTION WILL BE PARTICULARLY FOCUSED ON SAFEGUARDING THE OCEANS AND THE PLANET.



WORLDENVIRONMENTDAY.GLOBAL/FR



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IMAGINE SOLUTIONS WHERE OTHERS SEE PROBLEMS.

SEE THE WORLD AS IT SHOULD BE, NOT AS IT IS.

JOIN THE RESOURCERS COMMUNITY AND DISCOVER THEIR JOBS

IN WATER, WASTE AND ENERGY MANAGEMENT

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