

# PLANET

#november 2015

## Climate Every solution counts



### Forum

Climate policy and growth: are they compatible?

### Gallery

An eye on the climate

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Future scenario

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Methane recovery

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# THE POST



**Antoine Frérot**  
 Chairman and CEO  
 of Veolia

**June 29 Alliance and development in Colombia.** With the signature of an alliance with EPM, a Colombian group specializing in energy production, transport and distribution, Veolia is looking to increase the number of energy efficiency improvement projects among industry, local authorities, hospitals, teaching establishments, etc. If they are able to increase the efficiency of their facilities, they can meet a greater demand for electricity, heat or cooling, while reducing the use of natural resources. In Latin America as on other continents, we are joining forces with first-class partners to roll out these energy-saving solutions more quickly and on a wider scale. In parallel, the municipality of Montería, which now counts over 540,000 inhabitants, has asked us to continue to run its water and wastewater service, which we have been doing for the past 15 years. Past successes - including reducing water losses in pipes to a third of their original level, extending drinking water provision to the entire area, developing access to sanitation for over 80% of inhabitants, and putting in place a social program among 10,000 impoverished residents allowing them to benefit from the water service - have now paved the way for a new ten-year ambition.

**September 10 In Paris, launch of COP21 at the Élysée.** At the invitation of the French President, bringing the "French climate team" together, I was able to explain how by creating a circular economy, we support public and private clients in moving toward a lower-carbon society. This new type of economy, which breaks away from the linear extract-produce-discard production model, plays a key role in the fight against excessive CO<sub>2</sub> emissions. In fact, when you produce new raw materials by recycling waste or wastewater or using the heat lost by industry or cities, you consume much less energy and therefore release much less CO<sub>2</sub> than when you extract virgin materials from

the environment. I also highlighted the need to limit emissions of methane, a short-lived gas with a high greenhouse-warming potential: over the past two decades, this pollutant has contributed just as much to global warming as carbon dioxide, even though the latter is released into the atmosphere in much greater amounts! However, to encourage the spread of solutions to reduce carbon dioxide or methane emissions, the public authorities must set a robust carbon price at a sufficiently high level. Then we will finally put an end to this strange era in which polluting costs nothing, but cleaning up is expensive!

**October 6 ANVIE\* celebrates its 25<sup>th</sup> birthday in Paris.** How can you strengthen cooperation and dialogue between the humanities and companies? This association has been steadfastly tackling this question for 25 years. Twenty-five years of efforts to encourage decision makers from the economic world and researchers from the human and social sciences to meet and work together. Along with 25 years of productive dialogue, fruitful collaboration and repeated success. Which - it has to be said - has been no easy feat! It is an honor for me to serve as president of ANVIE. By turning to sociology, history, psychology, philosophy, etc., companies are constantly looking to better understand their environment in order to take more effective action. A crucial topic at a time when changing production methods are demonstrating that human investment is even more decisive in companies' competitiveness than material investment. Wherever you are, it is people who make the difference, through their talent, commitment and creativity; how then can a company neglect the humanities?

\* French national association for the interdisciplinary promotion of human and social science research among companies.

# CONTRIBUTORS



## Editor-in-chief Marie Riet-Hucheloup

Director of communications France  
& internal communications Veolia Group

"Resourcing the world" is our tagline and it is first and foremost embodied in the everyday actions of almost 200,000 men and women working for our company.

As the Paris Climate Conference (COP21) approaches, more than ever, we must inform and stir consciences regarding this historic issue, raise awareness among as many people as possible and deploy solutions on a broad scale.

We are convinced that action can be taken even now. In this issue, discover our solutions for mitigating greenhouse gas emissions or helping territories adapt to climate change. Enter into the debate between climate policy and growth.

"At decisive moments in history, words are acts," former British Prime Minister Clement Attlee told us. Let's act together as we turn the pages of this magazine.

### Also in this issue

#### Yuriko Koike

Former Japanese cabinet minister. Member of the Veolia Institute's Foresight Committee

When she was Minister of the Environment (2003-2006), she led a campaign to raise public awareness of climate change and promote new technologies. In 2014, she was elected the first Vice President for Asia of GLOBE International, an organization that recommends legal frameworks in favor of sustainable development to public decision makers. A sociology graduate from the University of Cairo (Egypt), Yuriko Koike began her career as an Arab language interpreter and translator before turning to television journalism.



#### Pierre Victoria

Veolia's Sustainable Development Director and Executive Officer of Cercle Français de l'Eau

For twelve years, Pierre Victoria worked as a local and regional councilor before being elected to the French National Assembly from 1991 to 1993, where he replaced Jean-Yves Le Drian, who joined the government. The co-author of the Ministry of European and Foreign Affairs work "La gestion démocratique: un nouveau paradigme pour le développement," and the essay "Entreprise contre la pauvreté," he also coordinated "L'accès à l'eau et à l'énergie: de la vision à l'action." He was awarded the French National Order of Merit. Pierre Victoria is a graduate of Sciences-Po Paris and holds a Masters in Business Law from the University of Paris 10.



#### Valérie Masson-Delmotte

Paleoclimatologist

An engineering graduate from the École Centrale de Paris, she specialized in studying past climates: paleoclimatology. A researcher at the Climate and Environment Sciences Laboratory (LSCE), she is the main author of a report by the IPCC and has coordinated many international climate research projects. She was elected Co-Chair of IPCC Working Group I in early October. She also speaks to the public at large: conferences, schools activities, educational works, etc. She won the Irène Joliot-Curie Woman Scientist of the Year Award in 2013.



# NOVEMBER 9, 2015, PARIS (FRANCE) INTERNATIONAL CONFERENCE WHAT ARE THE SOLUTIONS TO REDUCE METHANE EMISSIONS?

THE VEOLIA INSTITUTE, THE AGENCE FRANÇAISE DE DÉVELOPPEMENT AND THE PRINCE ALBERT II OF MONACO FOUNDATION ARE BRINGING TOGETHER SCIENTIFIC EXPERTS AND PRACTITIONERS TO DEBATE MITIGATION SOLUTIONS AND THEIR DEPLOYMENT. A CONTRIBUTION TO COP21.



WWW.CONFERENCE-METHANE.ORG

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# CURRENTS



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## In Latin America,

### energy efficiency takes priority

Veolia and EPM will be working together to develop low-energy-consuming solutions in the realms of water, transport infrastructures, energy, health and agriculture. On June 29, the Colombian services group EPM and Veolia signed a memorandum of understanding regarding the development of projects and solutions to improve energy efficiency in Latin America. Several months earlier in January 2015, presidents François Hollande and Juan Manuel Santos had launched the Franco-Colombian strategic committee. Chaired by Antoine Frérot, this committee looks to participate in preserving and renewing the available resources, while encouraging sustainable development to the benefit of local populations.



## France adopts an energy transition bill

France now has a legislative framework that determines the major objectives of its green growth and its new energy model. These ambitious goals are in line with those decreed by the European Union. These include reducing greenhouse gas emissions by 40% between 1990 and 2030, with a further 75% reduction by 2050; halving the share of nuclear energy in the energy mix by 2025, i.e. 25% less than at present; halving the total energy consumption in France by 2050, along with a 30% reduction in the fossil energy share and increasing the use of renewable energy in the country's energy consumption to 32%.

## COP21: Civil society, a driver and engine for climate agreements

*While the number of intergovernmental summits and agreements to combat climate change continues to increase, initiatives by civil society are taking off. Local or multinational companies, NGOs and not-for-profits, youth movements, associations, etc. are constantly innovating and getting involved in environmental protection, clean energies, fair trade, sustainable consumption, and more. This is especially seen in the significant presence of these stakeholders on the fringes of the negotiations planned during the Paris Climate 2015 Conference, from November 30 to December 11: half of the 40,000 participants are from civil society. What's more, a "civil society village" is provided for them at the Le Bourget site and the "Agenda of solutions" groups the key initiatives by non-state players. While certain players are positioning themselves as drivers or instigators of change on a local level, others are drawing on their economic weight and international scope to convey policies on a wider scale.*

## Pulling together in the farms of the future

According to Quirin Schiermeier, the German correspondent for the British journal 'Nature,' farmers and scientists must work together for a more resilient agriculture of the future. This is due to the inability on both sides to meet the challenges of adapting to climate change alone. Wildly varying and unpredictable rainfall and temperatures, soil erosion and depletion, an increase in the number of invasive species, etc. are already the most visible effects of this phenomenon. The Agricultural Model Intercomparison and Improvement Project (AgMIP) brings together climatologists, agriculturalists and economists, local farmers, growers and breeders and puts forward farming simulation models. In Australia, a major plan to irrigate the Murray-Darling River Basin was funded to combat severe droughts, taking into account the results of an in-depth study carried out by AgMIP. In the Philippines, the International Rice Research Institute (IRRI) has developed a variety of rice more tolerant to extreme weather conditions (floods, droughts, increased salinity). As a result of discussions and awareness-raising, more and more Nepalese, Indian and Bangladeshi farmers are growing this new variety of rice. Source: Nature, vol. 523, 23 juillet 2015



## Just 12%

This is the worldwide proportion of greenhouse gas emissions subject to pricing, in other words a threefold rise over the past decade.

Source: Les Echos - June 2, 2015

## In Addis Ababa, poor countries speak up

During the third conference on financing for development, which was held from July 13 to 16, many speakers mentioned the long-standing responsibility of developed countries in the global climate crisis. Duly noting the commitment of the Green Climate Fund (\$10 billion raised in 2014), the poorest countries exhorted their OECD and G20 counterparts to define new international tax standards with a particular view to according greater importance to additional funding and the fight against tax fraud and evasion. The summit resulted in an agreement approved by the United Nations' 193 member states: by 2030, \$2,500 billion in additional aid is set to be allocated to sustainable development goals aiming to eradicate extreme poverty worldwide and fight global warming.

## Telex

**Tara expeditions in "Science" magazine** A few months ago, the prestigious scientific journal "Science" dedicated a special edition to the ocean research schooner "Tara" and its research topic: plankton. It published the first scientific results from the two exceptional expeditions, Tara Oceans and Tara Ocean Polar Circle, which between 2009 and 2013 were the first to study plankton on a planetary scale. "Science," May 22, 2015.

## The impact of the circular economy in the United Kingdom

According to the study by Imperial College London conducted with Veolia, the widespread application of the circular economy in the United Kingdom could generate £29 billion a year, in other words the equivalent of 1.8% of Britain's GDP. The institution estimates that 175,000 jobs could be created by putting this economic model in place, especially in the plastics, glass, paper, green waste, aluminum, steel and electronics sectors.

## Energido playing in the big pool at Aix-les-Bains

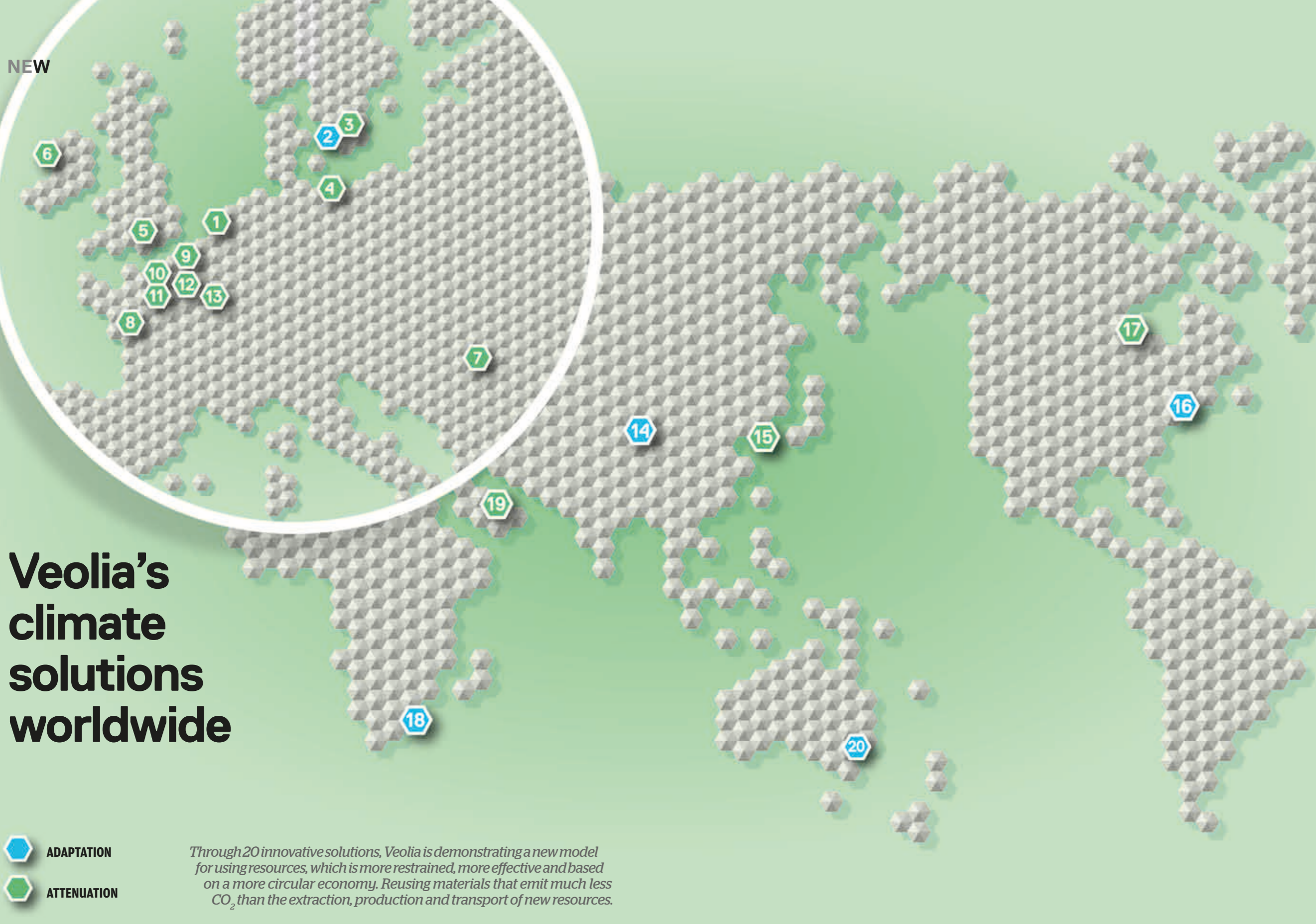
By recovering heat from wastewater that comes from a neighboring wastewater treatment plant, the Energido system (c.f. map page 12) created by Veolia provides 85% of Aix-les-Bains aquatic center's energy needs. A heat pump redistributing the energy produced to all of the pools maintains an optimal water temperature of 27°C, reducing the annual energy bill to a quarter of its original amount.

NEW

# Veolia's climate solutions worldwide

-  ADAPTATION
-  ATTENUATION

Through 20 innovative solutions, Veolia is demonstrating a new model for using resources, which is more restrained, more effective and based on a more circular economy. Reusing materials that emit much less CO<sub>2</sub> than the extraction, production and transport of new resources.



## EUROPE

### 1/ JOURE, THE NETHERLANDS BIOMASS AND SPENT COFFEE GROUNDS

In 2013, the plant belonging to the coffee roaster Douwe Egberts Master Blenders (DEMB) acquired a biomass boiler, powered using the spent coffee grounds that it produces. Every year, 33,000 metric tons of this process residue are thus repurposed by combustion to produce the enormous amount of steam required to run the plant.

### 2/ COPENHAGEN, DENMARK A FLOOD-RESISTANT CITY

Affected by violent floods in 2011, Copenhagen decided to reduce its vulnerability in the face of extreme meteorological phenomena. Relying on a weather alert system, a tool for controlling the sewer network optimizes rainwater storage, making it possible to reduce annual overflow cases by 90%.

### 3/ BORÅS, SWEDEN STORING ENERGY ALL THE BETTER TO CONSUME IT

The city is able to manage seasonal energy consumption fluctuations by alternating the use of solid fuels — derived from biomass or fossil fuels — and "its Thermos", a 37,000-m<sup>3</sup> hot water reservoir used to store the energy produced.

### 4/ ROSTOCK, GERMANY BOTTLE TO BOTTLE: THE PLASTIC CHALLENGE

Discover the frontline article on page 30.

### 5/ DISTRICT OF SOUTHWARK, LONDON, ENGLAND, UK WASTE-TO-ENERGYSWEEPS IN

An organic waste recovery and treatment plan makes it possible to produce the energy required by Southwark's residents. 2,600 households are supplied with heat and electricity. This pioneering and eco-responsible scheme already guarantees energy sustainability and autonomy.

### 6/ MAYO, IRELAND BIOMASS TAKING ENERGY INDEPENDENCE BY STORM

Producing enough electricity to power the equivalent of 60,000 households by supplying all of the biomass required to run the future Killala plant for 15 years. This is the challenge taken up by Veolia, which is also responsible for operating and maintaining the equipment.

### 7/ PÉCS, HUNGARY HEATING WITH STRAW

85 megawatts is the amount of heat generated by the city of Pécs' two production units, one running on wood, and the other on straw. Since 2004, this city with a population of 150,000 is one of the few in Europe to be heated solely using natural and renewable resources.

## FRANCE

### 8/ SAINT-SYLVAIN-D'ANJOU A SECOND LEASE OF LIFE FOR ELECTRICAL ITEMS

Near Angers, Veolia dismantles, cleans up and reprocesses 35,000 metric tons of electronic waste per year, some of which is highly potentially hazardous (fluids, condensers, batteries). Sorted and then specially recycled, 94% of the materials are repurposed and 80% of this fraction is reused in industrial production.

### 9/ ARRAS ENERGIDO: WASTEWATER TO HEAT SWIMMING POOLS

Thanks to Energido, a system that uses the heat derived from wastewater treatment networks, Arras municipal pool has limited its reliance on fossil fuels for heating. In Aix-les-Bains, Marseille, Toulouse and Roquebrune, other swimming pools have already begun to implement their energy transition and are powered using 100% renewable energy.

### 10/ LE HAVRE CO<sub>2</sub>: A RECYCLABLE GAS!

The pilot CO<sub>2</sub> capture project at the SEDIBEX hazardous waste incinerator will reach completion at the end of 2015. The test phase has been a success: an industrial unit capturing several metric tons of CO<sub>2</sub> per hour has been developed. The production will then be given back to companies using carbon dioxide in their process for manufacturing additives for lubricants.

### 11/ LIMAY BIODIESEL: RESTAURANT OIL IN ENGINES

Veolia recovers used oils from some 20,000 collection points before transforming them into biofuel. With an annual production of 60,000 metric tons, the group powers some of its own fleet of vehicles and supplies local businesses with biodiesel.

### 12/ AMIENS SORTING WASTE WITHOUT TOUCHING IT

At the sorting and collection center, remotely operated sorting systems (via a touch tablet) rely on a technological innovation that ensures the safety of the sorting operators' working conditions and yields a 6% increase in the amount of waste recovered to produce new raw materials.

### 13/ GRAINCOURT-LÉS-HAVRINCOURT TRANSFORMING ORGANIC WASTE INTO ENERGY

From the combustion of the methane derived from the breakdown of organic waste (farming biomass, biological and wastewater sludge, household waste, fat, etc.), the Artois Méthanisation site produces electricity while treating over 25,000 metric tons of waste per year.

## CHINA

### 14/ URUMQI WASTEWATER: A VIRTUOUS SOURCE OF ENERGY

Discover the frontline article on page 22.

### 15/ SHANGHAI LAOGANG WASTE, A REAL BOUNTY OF RENEWABLE ENERGY

Thanks to their system for capturing and treating gas (primarily methane and CO<sub>2</sub>) from waste storage, the Laogang facilities produce entirely green biogas and electricity. Enough to supply their own energy needs and redistribute the surplus to the national grid.

## USA

### 16/ NEW YORK LIGHT IN THE MIDST OF THE BLACKOUT

In 2012, when Hurricane Sandy plunged Manhattan into darkness, most of a university campus in Greenwich Village managed to escape the blackout. The university was able to rely on cogeneration as a source of energy and heat that functions as a more efficient, cost-effective and reliable microgrid that is not only independent from the network but one that greatly reduces CO<sub>2</sub> emissions.

### 17/ MILWAUKEE PRODUCING COMPOST FROM WASTEWATER

50,000 metric tons is the annual amount of Milorganite (Milwaukee Organic Nitrogen) fertilizer produced by Milwaukee's wastewater treatment plant. This compost, which is rich in organic substances as it is produced from sewage sludge, is then used to enrich farmland and keep the region's lawns green.

## AFRICA / MIDDLE EAST

### 18/ DURBAN, SOUTH AFRICA INDUSTRY RUNS ON RECYCLED WATER

In Durban, the treatment plant provides recycled water to the city's industrialists. Sufficiently pure for industrial needs and less expensive, it is used to run the facilities. In a region in which access to drinking water for the population is a priority, 98% of the city's wastewater is recycled.

### 19/ DUBAI, UNITED ARAB EMIRATES ENERGY SAVING: THE EMIRATE'S NEW CHALLENGE

Within the framework of the "Vision 2030" project that looks to reduce Dubai's energy consumption by 30% in the space of 15 years, seven large electric power plants and their energy expenditure are governed by a performance contract. This marks a first step toward expanding the agreement to the 30,000 facilities spread throughout the Emirate.

## AUSTRALIA

### 20/ SYDNEY RECYCLING WATER FOR IMPROVED MANAGEMENT

By recycling all of their wastewater and rainwater, along with the surplus from a nearby sewer, Darling Quarter's two buildings hope to reduce their drinking water consumption by 92%. Produced on site, the water recycled in this way is used to supply the cooling towers, water the gardens and operate the flushing system for the 55,000 m<sup>2</sup> of offices.

Find out more: [www.veolia.com/en/our-solutions](http://www.veolia.com/en/our-solutions)

“Climate change does not respect borders; it does not respect who you are – rich and poor, small and big. Therefore, this is what we call ‘global challenges,’ which require global solidarity.”

Ban Ki-moon,  
Secretary-General of the United Nations, September 21, 2011



10/11

**Biomass comes to Japan**

Veolia has won the contract for running two biomass plants located in the north of the country. The Hirakawa and Hanamaki facilities will convert organic waste into electricity for 22,000 households and allow savings of up to 40,000 metric tons of CO<sub>2</sub> per year. The Group is present on the archipelago since 2002 in partnership with the Takeel group, a major player in industrial waste collection, especially wood residue from the country's forest industries.



**In Paris, environmental consciousness reaches new heights**

On July 21, some 40 religious, spiritual and political authorities from all around the world met in Paris for a “Summit of Conscience for the Climate.” The man behind this initiative was Nicolas Hulot, Special Envoy of the French President for the Protection of the Planet. He lamented the inertia of the negotiations between States, inviting his listeners to “pull the levers of conscience.” The aim was to highlight the cultural dimension of the global climate crisis. The goal of this summit was to spread awareness across the globe. A “call to conscience” is to be sent to the 195 State delegations participating in COP21.

**10 recommendations for reconciling growth and environmental issues**

In 2014, the first report by the Global Commission on the Economy and Climate, “Better Growth, Better Climate,” demonstrated how economic and financial policies could help reduce the impact of climate change. More recently, “Seizing The Global Opportunity,”<sup>1</sup> aimed at political, financial and economic authorities, presented ten recommendations:

- 1 Accelerate low-carbon development in the world's cities
  - 2 Restore and protect agricultural and forest landscapes and increase agricultural productivity
  - 3 Invest at least a trillion dollars a year in clean energy
  - 4 Raise energy efficiency standards to the global best
  - 5 Implement effective carbon pricing by 2020
  - 6 Ensure new infrastructure is climate-smart
  - 7 Galvanize low-carbon innovation
  - 8 Drive low-carbon growth through business and investor action
  - 9 Raise ambition to reduce international aviation and maritime emissions
  - 10 Phase down the use of hydrofluorocarbons (HFCs)
- 1-Source: www.newclimateeconomy.net

**\$140 billion**  
This is the sum that 13 major American companies have pledged to invest in low-carbon projects.  
Source: Le Monde, July 29, 2015

**2015 marked by an increase in extreme events**

Climate change is causing a more frequent number of natural disasters that are taking an ever heavier human and material toll. Since the beginning of the year, more than ten extreme events have occurred across the world: during the winter, torrential rains fell in Indonesia, while Malawi experienced devastating floods. In January, southern Brazil experienced one of most severe droughts in its history. In February, a series of winter storms devastated the north of the United States when tropical storm Chedza hit Madagascar. In the spring, huge fires ravaged the Siberian forests while winter storm Niklas swept across Central Europe and Cyclone Pam hit Vanuatu. India and Pakistan were struck by heat waves all summer long, while California experienced the most severe drought on record. In August, Typhoon Soudelor hit Taiwan and East China while an exceptional monsoon flooded Myanmar.  
Source: www.nature.com/nclimate/index.html

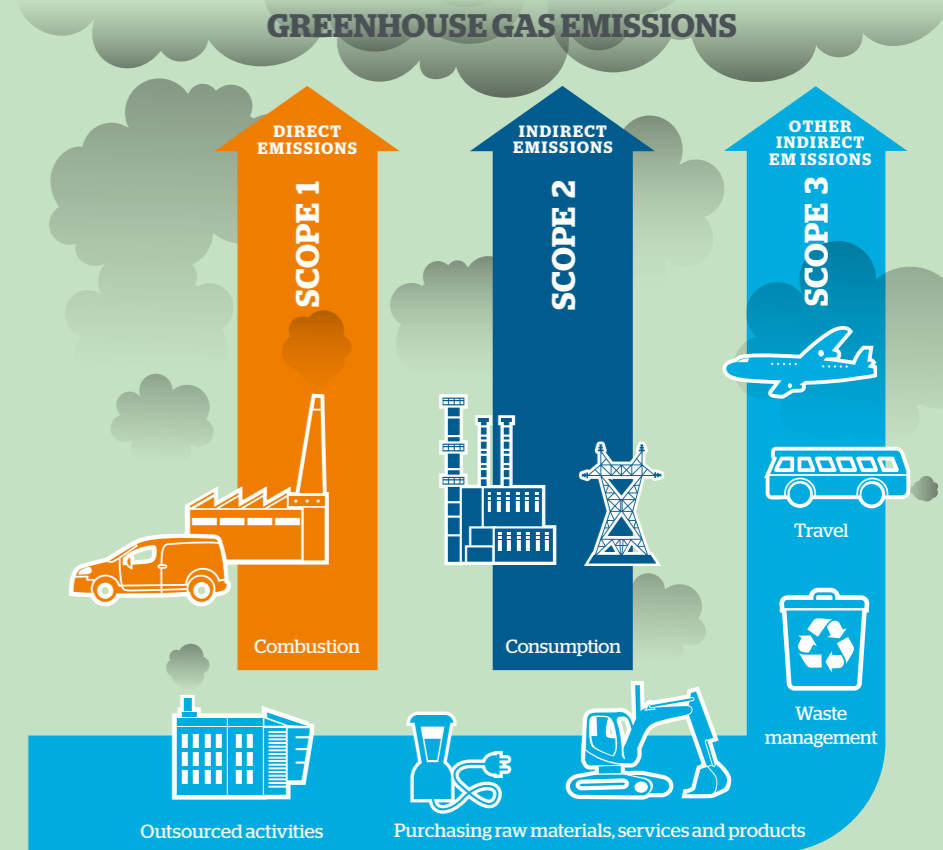
**2015 sets a series of record temperatures**  
On a global scale, according to recent reports from NASA and the UN, the average temperatures over the first six months of 2015 have been the highest ever recorded on the earth's surface: 0.85°C above the 20<sup>th</sup>-century average measured at 15.5°C. June 2015 was the third month this year to beat temperature records, following on from March and May.

Following years of research initiated by the world of industry and the public authorities, the international community has agreed to quantify greenhouse gas (GHG) emissions according to now-standardized principles. Each method undoubtedly has its limits, especially the precise and equivalent counting of direct and indirect emissions. But the more the “Measure, Report and Verify” approach is shared by everyone, the more this will further progress in international climate negotiations.

**CALCULATING GHG EMISSIONS**

**3 distinct categories (or scopes) of GHG emissions**

- **Direct emissions/scope 1** are linked to the combustion of fossil fuels from resources owned or controlled by the company/local authority.  
For example: emissions from combustion.
- **Indirect emissions linked to energy/scope 2** come from the production of electricity, heat or steam imported and consumed by the company/local authority for its activities.  
For example: electricity consumption.
- **Other indirect emissions/scope 3** go from upstream to downstream, from the most extensive supply chain to the transport of goods and persons. This may represent the largest share of emissions.



**THE SIX GREENHOUSE GASES TO TAKE INTO ACCOUNT**

<b>CO<sub>2</sub></b> Carbon dioxide GWP= 1	<b>CH<sub>4</sub></b> Methane GWP= 28	<b>N<sub>2</sub>O</b> Nitrous oxide GWP= 265	<b>PFC</b> Perfluoro-carbons GWP= 7,910 PFC51-14	<b>HFC</b> Hydrofluoro-carbons GWP= 12,400 HFC-23	<b>SF<sub>6</sub></b> Sulfur hexafluoride GWP= 23,500
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CO<sub>2</sub> being the benchmark index, its GWP is equal to 1.  
Sources: IPCC 4<sup>th</sup> and 5<sup>th</sup> Assessment Reports/Kyoto Protocol

**What is the GWP?**

The global warming potential (GWP) is the index that compares a greenhouse gas' contribution to global warming compared to CO<sub>2</sub> over a given period. As CO<sub>2</sub> is the benchmark index, its GWP is equal to 1. **The GWP values make it possible to convert greenhouse gas emissions into CO<sub>2</sub> equivalent.**

**The GWP index is established according to three criteria:**

- time (100-year period),
- the reference 1 for CO<sub>2</sub>,
- regular revision by the IPCC

Source: The Greenhouse Gas Protocol - WRI-WBCSD Corporate Standard. ISO 14064/ISO 14069.

**THE THREE STEPS IN THE INTERNATIONAL STANDARD**

**1 Collecting activity data for each of the three scopes**



Collecting activity data (number of km traveled, metric tons consumed and kWh consumed).

**2 Looking for emission factors**

Finding the right conversion factor makes it possible to estimate the amount of GHGs emitted from an activity data

**3 Converting data into emissions**

**ACTIVITY DATA AMOUNT X EMISSION FACTOR = CO<sub>2</sub> EQUIVALENT**



**Yuriko Koike,**  
Former Japanese Minister  
of the Environment



**Antoine Frérot,**  
CEO of Veolia

# Is an ambitious climate policy compatible with growth?

## The debate.

### Yuriko Koike / Antoine Frérot

*From the political to the industrial world, a consensus finally seems to be emerging to take action on climate change. However, the consequences of an offensive climate policy on growth are causing concern. Can you really tackle climate change without harming the economy? Two experts share their viewpoints.*

A growing number of companies, including Veolia, are now publicly calling for a significant cost to be levied on greenhouse gas emissions. Why?

**Antoine Frérot /** Quite simply because the principle of putting a cost on pollution has proven that it is rapidly effective in a wide variety of sectors, such as industrial waste or wastewater. Hence the interest of finally applying it to greenhouse gases (GHGs). In order to do so, two conditions must be fulfilled. First, polluting must...

... become more expensive than cleaning up. A price of 30 or 40 euros per metric ton of CO<sub>2</sub> would make it possible to give sufficient economic incentives, in terms of demand, promoting energy efficiency measures and, in terms of supply, encouraging fossil fuels to be replaced by renewable energies. Secondly, the sums collected by taxing pollution must serve to fund clean-up actions. If we want to stabilize the amount of carbon found in the atmosphere, there is no alternative to putting a price on CO<sub>2</sub>.

**Yuriko Koike** / I would add that this kind of scheme saves energy and boosts innovation, thereby opening up economic opportunities for companies. This can increase their financial worth and improve their social reputation. Provided, of course, that a fair and simple scheme is found.

**Regarding the idea of a significant cost linked to GHG emissions, what does past experience tell us about the form that this cost should take: tax, emissions permits market, other measures?**

**Y. K.** / Directly taxing carbon involves everyone in the effort and has the advantage of appearing fair and simple. The disadvantage is that you don't know in advance what emissions reductions will result from a given level of taxation. However, if the level is too low, the effects are zero, as Antoine has just said. But if it is too high, it can be detrimental to international competitiveness! This is why Japan chose to introduce low taxation, combined with complementary measures. On the contrary, the "carbon market" offers good visibility on the reduction in emissions generated, as you decide beforehand on the volume of emissions to be distributed between the players. However, it is difficult to reach a consensus on this distribution in advance! Finally, let's not forget that a third option exists: the regulatory route. This is potentially highly effective for major emitters, as demonstrated by the American Clean Air Act. These measures can be combined in different ways, for example exempting participants in the emissions permits market from carbon tax. However, making the system more complicated raises the administrative costs.

**A. F.** / Organizing a global market for CO<sub>2</sub> emissions permits in the short term is unrealistic, as this solution requires global governance. The European experience has proven that it is not easy to put this kind of system in place: it is the most sophisticated economic mechanism ever invented to combat climate change, but it is sending derisory tariff signals, between €5 and 7 per metric ton of carbon, which does not encourage companies to drastically reduce their greenhouse gas emissions. It is much easier to set a fee on greenhouse gas emissions, establishing it over a sufficiently vast initial territory, for example the size of the European Union. I use the word 'fee' and not 'tax' because the sums charged in proportion to CO<sub>2</sub> emissions would serve to fund emission reduction measures.

**How do you bring about the necessary changes to our energy system without "killing the economy," as some people fear?**

**A. F.** / There is no conflict between energy transition and economic growth! For example, for a new car covering 15,000 kilometers a year, a fee of 30 euros per metric ton of CO<sub>2</sub> represents an annual expenditure of 60 euros, which remains reasonable. To those who persist in objecting that protecting the atmosphere is too expensive, I ask: how much will its destruction cost? The low-carbon economy also has a high potential for job creation. Over and above the extensive use of fossil energies, climate change is the result of a linear economic "extract-produce-discard" model that ever increasingly draws on energies and raw materials from nature. As a result, the fight against greenhouse gas emissions requires the implementation of a model that is more restrained and efficient in terms of natural resource use, based on the principles of the circular economy. Europe could create up to three million jobs with this new economy that transforms waste into resources.

**Y. K.** / In a certain respect, it is also possible to reduce the impact on the economy by reallocating the revenue from a carbon tax: for example, even though it is not what Antoine recommends, by using it to reduce other taxes – on companies, on income, social security contributions, VAT, etc. Which would counteract the current trend for companies to invest to gain short-

**“Directly taxing carbon involves everyone in the effort and has the advantage of appearing fair and simple.”**

Yuriko Koike

**“It is easier to set a fee on greenhouse gas emissions, establishing it over a sufficiently vast initial territory...”**

Antoine Frérot





...  
term profit, without investing in the environment. What's more, the carbon price is not the be-all and end-all: we also obtain results by raising professional awareness, improving technologies, etc.

#### How can you avoid penalizing companies that will be the first to be subject to a carbon fee?

**A. F. /** Predictability and fairness are companies' two main requirements. Predictability, by setting the carbon price for at least a decade in order to secure companies' planned anti-CO<sub>2</sub> investments. Fairness, to prevent distorted competition between the economic players on whom a CO<sub>2</sub> price is imposed and the others: the only way of ensuring fair treatment would be to establish—on entering territories that want to do more in the fight against CO<sub>2</sub>—a tax on products manufactured in countries that are less active.

**Y. K. /** The World Bank, the OECD, the G7, etc. are currently working on coordinating the implementation of a carbon cost in different regions—including Japan. Continuing these regional efforts is the key to putting in place a fair carbon price, i.e. one that does not inflict an unreasonable burden on companies on the global market.

#### What will be the main obstacles to overcome to put in place this new system on a global scale?

**Y. K. /** The problem is that neither shareholders nor the markets really reward the efforts of companies looking to reduce their emissions. In the absence of a global framework, the fear of a decline in competitiveness for those who act first lingers. In Japan, there is a culture of respecting voluntary initiatives taken by companies. A tradition that is worth re-examining as it has produced good results.

**A. F. /** Aiming for a restrictive global agreement seems unrealistic nowadays. Although they are aware of the climate challenges, neither China nor the United States will relinquish any of their sovereignty to address them. And for the past 20 years, climate negotiations have stumbled over a single carbon price: in the absence of massive financial transfers, the price suitable for the North will always be too high for the South, while the price suitable for the South will prove too low for the North. Today, the essential thing is not to wrest a signature from the 195 members of the United Nations, but to reach an agreement that can be accepted by the countries representing

80% of greenhouse gas emissions. To date, some 40 countries and 20 regions, as Yuriko has mentioned, have systems that attribute a carbon price. Despite the imperfections of these "climate clubs," it would be preferable to promote them and then organize their future convergence. Much remains to be done to apply the "polluter pays" principle to carbon dioxide: carbon pricing covers barely 12% of worldwide emissions. ■

For the 11<sup>th</sup> consecutive year, in May 2015 the Japanese government launched its "Cool Biz" campaign, which encourages employees to swap their tie and jacket for a shirt in order to reduce air conditioning in offices and save energy. The aim is to maintain the conditioned air temperature at 28°C. Yuriko Koike (left), during the 2014 launch in Tokyo.



#### GLOBE International in favor of climate legislation

> Yuriko Koike was the Japanese Minister of the Environment for three years, as well as Minister of Defense of the Liberal Democratic Party (LDP). A member of the House of Representatives for a district in Tokyo, since 2014 she has been the Vice President for Asia of GLOBE international, an association of parliamentarians from over 80 countries. Their mission is to work beyond borders and ideologies to promote environmental governance, biodiversity and climate protection, to the benefit of sustainable development. This public-spirited commitment, admits Yuriko Koike, results from the conviction that a well-considered and effective legislative framework is essential in order to protect the planet: in her view, the world's legislators must learn from each others' successes and failures, especially so as to prevent developing countries from repeating the mistakes of richer nations. Convinced of the importance of exporting the most advanced technologies to reduce greenhouse gas emissions, she nonetheless highlights the need to protect the intellectual property associated with their development.

GLOBE International is sponsoring the fifth edition of the "Global climate legislation study," alongside its partner, the Grantham Research Institute on Climate Change and the Environment, and the London School of Economics and Political Science.

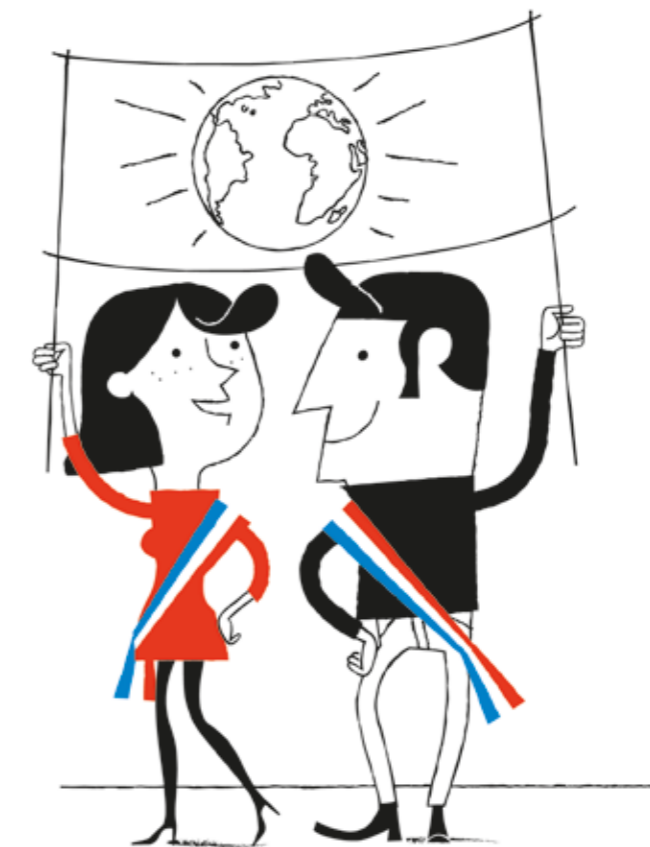
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*What do helping the disadvantaged return to work and the long road to improving female representation in a sector have in common? Roz and H el ene's boundless enthusiasm!*

# Above and beyond

Meeting Veolia employees from all over the world.

## Roz Belhrous

Contact Center Manager, Veolia, Haringey (Greater London), United Kingdom

**Roz Belhrous** is definitely community-oriented and she uses it to... get jobs for others. At the North London call center she has run since 2011, this member of staff, with her forthright personality, has implemented an exemplary vocational rehabilitation system. Roz offers job seekers suffering from exclusion or who have a language barrier to join her team for an unpaid work experience of two or three months. She believes that "a call center is the right place to learn the basics in administration." Therefore, it is here that recruits learn how to advise customers on household waste and manage complaints. To help these volunteers, Roz spends her lunch hour tutoring those who need to improve their English, giving a helping hand to write a CV, etc., in return for personal investment and unfaltering motivation: "From day one, I have to feel that they have a real desire to come to work, rain or shine," she explains.

The "Roz method" has proved itself, as some 60 trainees have worked for her over the past five years, with some still working there, but as employees now, and others who have moved on to other departments encouraged by this step toward employment. What has become Roz's preferred recruitment method is also a formidable asset for the call center as the cultural diversity of the trainees – they come from Pakistan, Nigeria, Turkey, Russia, Spain, etc. – mirrors the very cosmopolitan population of Haringey. "We reflect the profile of our customers," confirms Roz, who is also very committed to the company's social and inclusive values. "It seems natural to locally support employment in exchange for the services for which we are paid. This is also a way of resourcing the world," she adds, calling on the other sites in Greater London to build on her initiative. ■



## SPOTLIGHT



20/21

### **Hélène Guize**

Sales representative  
Ambassador for  
the feminization of waste  
management services  
Veolia, Ile-de-France, France

**Hélène Guize openly admits** that in her field of construction waste contract management, being a woman is an asset when managing contractual and sales relations. “In the predominantly male environment of construction, being a woman helps keep discussions calm and courteous,” she says. Hélène realized her gender was an asset as soon as she joined Veolia almost 20 years ago in the field of industrial waste management and later in construction waste management. As a sales representative, Hélène plays a role in developing a sector in which Veolia would like to specialize. She has since experienced the boom of the recovery and recycling industry by assisting her customers, which are major names in construction, in concluding and monitoring their recycling contracts. Even though this activity, which is today very competitive, requires you to be persistent to win new contracts, Hélène, who enjoys working in the field and who is an expert negotiator, loves her job.

It was therefore no surprise that she immediately agreed to become an ambassador for the feminization of waste management services. This is a representative and advisory role supporting Veolia’s commitments promoting gender equality at work that she enthusiastically took on. “Through recruitment and internal communication campaigns, we are helping to increase the number of women working in waste management services and show that we are just as good as men at our jobs!” Her presence at student job fairs is also an opportunity to talk about “an exciting job which,” she admits, “is not always a spontaneous choice for a woman.” For this mother of four, these are all opportunities to refute a few stereotypes about women on the way. ■



# Urumqi

China

22/23

*As China ramps up development of the Silk Road Economic Belt, the “beautiful pastures” of Urumqi<sup>1</sup> are under intense ecological pressure. An advanced biogas recovery project gives some angular momentum to the circular economy in the remote Xinjiang province.*

## Wastewater: a virtuous source of energy

**For a son of** Brittany's rugged coast, Veolia engineer Alexandre Quinton is a long way from the ocean. In fact, his new home town of Urumqi, the capital of China's largest province Xinjiang, is listed as the most remote city from any sea according to the *Guinness Book of Records*. Alexandre moved to Urumqi in 2014 as Technical Manager for Urumqi Hedong Veolia Water Co. Ltd, a wastewater joint venture which houses one of the most advanced biogas recovery projects in China, possibly in Asia. The project is a landmark in ecological conservation and the deploy-

ment of the circular economy in this unique part of the world.

### Challenge for Urumqi

Xinjiang is remote country: more might be known of the mountains of Pluto than the geology of the provincial heartland's Tarim Basin, one of the driest places on earth and ...

1. In Junggar Mongolian (north-west China), *urumqi* means “beautiful pastures.”



#### Issue at stake

> Urumqi is a critical hub on China's new Silk Road Economic Belt – but water scarcity will challenge its growth.

#### Objectives

> Introduce the circular economy to Xinjiang's sensitive and self-contained ecosystem.  
> Save energy and reduce stress on the water cycle.

#### Veolia solution

> An advanced biogas solution recovers valuable fuel and fertiliser from wastewater sludge and reaps economic and environmental benefits.  
> Biogas produced per month: 985,318 m<sup>3</sup>

**CLIMATE** Reduction in carbon emissions: 80%

... thought to be one the last places in Asia to become inhabited. Yet for its remoteness and mystery, Xinjiang is no wilderness. Urumqi itself has been a vibrant Silk Road trade center for thousands of years and will be a vital hub of China's new One Belt, One Road development initiative, a modern day Silk Road which connects much of central Asia through trade agreements and China's newly formed Asian Infrastructure Investment Bank (AIIB). The challenge for Urumqi's growth is therefore neither location nor economic prospects but environment. The whole Xinjiang region is a unique and self-contained ecosystem and its hydrological balance is proving sensitive to human touch. Indeed, Urumqi was blacklisted in 2008 by the central government as one of the most polluted cities in China, with both severe air pollution and low quality, scarce water.

## Scarcity drives the circular economy

If necessity is the mother of invention, then scarcity is the father of the circular economy. Driven by a need to run wastewater operations at maximum efficiency, Veolia and partner Urumqi KUNLUN Environment Protection Group Co Limited worked to implement an advanced biogas production system for the Hedong wastewater treatment plant, not only reducing sludge stress on the water cycle downstream but also extracting biogas from a resource previously regarded as waste. Through Urumqi Hedong Veolia Water Co. Ltd, Veolia now recovers sufficient fuel from its sludge digesters to run the air blowers required by the wastewater treatment plant and, through cogeneration, to produce 50% of the plant's own electricity needs. The

## Veolia expertise in Hedong

When Veolia's joint venture first approached the Urumqi Hedong Veolia Water Co. Ltd joint venture and the Hedong wastewater treatment plant, the existing digesters and gas blowers had been inactive since 1996, due to unstable performance and low gas yield. "They had been abandoned," explains Alexandre Quinton. Veolia made a full renovation and restoration to restore and improve biogas operations and has since made many enhancements, including the addition of the Alizair™ odor recovery system and introduction of SCADA systems across the plant for real-time control. With the Hedong biogas system operating well, the day-to-day challenge for Veolia engineers today is keeping the equipment in top shape. One critical area is the gas-powered blowers, which run on biogas and supply warm air across the wastewater treatment plant for essential biological processes. "This equipment has already been running for six or seven years, and of course it is aging, so we are now trying to reinforce the maintenance system and fully implement the preventive maintenance to support this very accurate technology," states Alexandre. Veolia's latest work involves a full implementation of the GAMA maintenance system - Global Assets Management and Analysis. GAMA had been used in some areas of the plant already, but due to connectivity issues its full power had not been realized. GAMA experts from France have visited the plant to support the full implementation with the maintenance managers. "We really need preventive maintenance for this equipment to guarantee we can continuously operate and get savings on the air production and electricity consumption," says Alexandre. Aside from the GAMA initiative, Veolia is working on a new project to harmonize the two digester lines into one. "It will give us more flexibility in future," concludes Alexandre.

amount of sludge remaining after digestion is reduced by a considerable percentage too.

### A tricky exercise

Extracting biogas from wastewater sludge is not easy - to start with, the rendered fuel is pure methane, a highly explosive odorless gas. "It is quite dangerous, and as an operator we must pay very careful attention to health and safety, to be very careful with this kind of work," explains Alexandre Quinton. Aside from safety, the digesters require a deft touch to operate. As with any living biological process, the technology is sensitive, requiring

precise and reactive control. "We need to be very accurate in the way we use the digesters, in terms of the process, the way we operate and maintain the machines. Every day we have to follow up on a lot of parameters to ensure the biological process inside the digester is good," says Quinton. Today, with a culture of constant improvement, Veolia has built the plant into a world-leading example of advanced digestion and biogas production. The wastewater plant now serves 15 million people in Urumqi, while reducing its impact on the environment through this advanced renewable energy project. ■

### Urumqi Hedong Veolia Water Co. Ltd

Joint venture contract signed **2005**  
Contract duration **23 years**

### Contract landmarks

Joint venture company established	July 2006
Phase I operation and Phase II expansion construction begins	November 2006
Biogas project begun	2008
2014 treatment capacity	400,000 m <sup>3</sup> /day
2014 population served	1.5 million inhabitants

### Biogas project

Daily digester inlet sludge flow treatment capacity	2,700 m <sup>3</sup>
Digester technology	Mesophilic anaerobic digestion
Biogas produced per month	985,318 m <sup>3</sup>
Carbon emissions reduced	80%
Site's electricity needs covered	50%



## Driving Xinjiang's circular economy

"There is a Chinese saying, 'city born of water, booming by water,'" says Xu Mei, Urumqi Hedong Veolia Water Co. Ltd General Manager, explaining the importance of water resources in the desert oases of Xinjiang's major cities. "Water could attract people and retain people. Water is the foundation for developing. So the Urumqi government really pays attention to water reserving and saving." By creating value from wastewater, the plant not only manages to minimize its dependence on fossil resources, but also to decrease the volume of sludge. It thus reduces its carbon footprint, with 80% CO<sub>2</sub> emission savings in 2014. Xu sees the Hedong plant as taking a leading role in the local circular economy. First, the plant is quite unique in its multiple biogas reuse strategy. According to Xu, few operators in China have used biogas simultaneously for three different purposes: heating, electricity production and air blower operation. Second, the 'waste' itself, compacted sludge, is still put to good use. "All the sludge produced by the plant is sent to a composting unit accommodating our capacity, which allows us to create fertilizers for local landscaping." In Xinjiang the soil is quite poor and lacks nourishment. One of the environmental tasks in Xinjiang is 'opening up waste land' and planting trees and grass - so the compost made by sludge could be used for feeding the poor soil. These developments are vital as the region undergoes further urbanization and more people are attracted to this central Asian hub. "As Xinjiang will be the bridgehead of the Silk Road Economic Belt, the region will become more proactive in promoting cooperation with other countries. And Urumqi, Xinjiang's capital, is expected to become the administrative hub," explains Xu.



# Bouqueval

France

26/27

## When waste produces energy

*Bouqueval waste storage center recovers the biogas produced by the waste to transform it into electricity and heat. It is the largest biogas recovery unit in France, commissioned in 2013, known as Électr'Od. A report on an exemplary site.*

### What is striking

on arriving at the site of Veolia's non hazardous waste storage facilities in Bouqueval, to the north of Paris, is the size of the premises. 350 hectares, i.e. equivalent to almost 500 soccer fields! The cleanliness and order that prevail there are also surprising. Trucks arrive on the platform-type scale, then discharge

their load and leave empty in a well-oiled choreography. This storage center, which has been running since the seventies and will continue to do so until 2027, can receive over one million metric tons of "ultimate" (non recyclable, non hazardous) waste. Waste is stored in sealed containers, in areas spanning 7 to 8 hectares dug and

...

### Issues at stake

> Waste produces methane, a greenhouse gas 28 times more powerful than CO<sub>2</sub>. Preventing it from being released into the atmosphere is therefore crucial.  
> This methane can be repurposed to produce renewable energy in the form of electricity and heat.

### Objectives

> Best reuse the methane produced at Bouqueval storage center, by putting in place the most high-performance and reliable equipment.  
> Demonstrate the performance of these methane recovery systems in order to deploy them in other waste storage centers, and even other applications.

### Veolia solution

> Commissioning of Électr'Od, a unit that produces heat and electricity from biogas, with a processing capacity of 100 million cubic meters of gas each year. An effective (40% yield) and flexible solution, thanks to ten engines operating independently.

**CLIMATE** 140 GWh of electricity/year



**Gwenaël Le Fournis,**

Biogas Energy Manager, Waste Recycling and Recovery, Veolia

**“Électr’Od is also suitable for methanization”****What is the outlook for developing Électr’Od in France?**

Biogas recovery systems really developed from 2001 onward. Today, these facilities are aging and need to be replaced by higher-performance units such as Électr’Od. It is also in waste authorities’ interests: their tax on polluting activities is reduced if they recover biogas. Électr’Od can also be installed on methanization units, which will develop on a large scale: when you are able to recover a “difficult” biogas like that from the storage centers, with a host of pollutants, you can recover any biogas.

**And in the world?**

Biogas recovery cannot compete with cheap fossil fuels. States must therefore put in place financial support mechanisms to allow the sector to develop. This is the case in Western and Northern European countries, but it is still in its infancy in Eastern Europe, Africa and South America. If the carbon credits market were to start up again, that could also benefit the sector.



... made impermeable with a six-meter layer of clay and an airtight membrane,” states Gwenaël Le Fournis, Veolia’s Biogas Energy Manager, Waste Recycling and Recovery. “They are then filled with a layer of waste to a height of 25 meters, before being covered with earth.”

When it breaks down, fermentable waste produces a mixture of gas, known as biogas, which is rich in methane. No fewer than 9,000 cubic meters of biogas are recovered every hour at the Bouqueval site. However, this methane is a greenhouse gas 28 times more powerful than CO<sub>2</sub> (in other words, one liter of methane produces the same greenhouse effect as 28 liters of CO<sub>2</sub>). For this reason, it is important to avoid releasing this methane into the atmosphere. Burning

it in flare towers would be a waste. It is therefore smarter to repurpose it: when methane becomes a city gas, it heats housing, powers stoves and allows you to take hot showers (see page 48).

## Technological progress

This repurposing is nothing new: the storage center has been producing electricity from biogas since the nineties. But with limited results. “Between 1998 and 2013, our boilers were producing steam that turned a turbine,” explains Gwenaël Le Fournis. “But the electrical efficiency was only 20%, i.e. an energy loss of 80% as the heat wasn’t used.”

Meanwhile, gas engines, which up to that point had been too fragile to be used for biogas, had become much more reliable. In 2010, Veolia therefore decided to replace its previous turbines with engines. These work on the same principle as car engines: rid of its pollutants, biogas enters a combustion chamber with air where it is set alight. The explosion moves the pistons that pull a camshaft, whose movement produces electricity via an alternator. The Électr’Od biogas recovery unit is today the largest in France. Commissioned in June 2013, it cuts a fine figure with its ten engines – four 2.7-megawatt (MW) and six 1.1-MW – impeccably aligned and connected by pipes that shine in the sun. Depending on the amount of biogas produced, which varies especially with the

weather, each engine is turned on or off separately from the others to ensure flexible production. “We produce 140 gigawatt hours (GWh) of electricity a year, compared to 80 with the previous turbines,” says a delighted Gwenaël Le Fournis. “This is equivalent to the production of 40 average wind turbines, or the consumption of 41,000 households, excluding heating. We also recover the heat produced by these engines.” This is used on the Veolia site, for example to treat wastewater (leachate) from the waste. It also serves to heat the neighboring village of Le Plessis-Gassot (*read interview opposite*). Veolia also plans to connect the town of Goussainville, located 5 km away, to put the heat to even better use. The total (electricity and heat) efficiency for repurposing the biogas would then reach 60%. ■

**Didier Guével,**

Mayor of Le Plessis-Gassot

**“The whole village is connected to the heating system”****How did the idea of heating your village with biogas come about?**

I had been looking for a renewable energy for the village for a long time. In 2011, when Veolia filed for planning permission for the thermal engines, I asked them to study the feasibility of recovering the cooling water to heat the village. A consulting firm demonstrated that the idea was a good one, so the project was launched. We built a heating system from Veolia’s site to the village, along with the connections, for a cost of 1.15 million euros.

**How was the project received by the residents?**

At the first public meeting, 40% of the population was present. At the second, almost 80%. And when we announced the costs, everyone was in agreement. It has to be said that the village covered the installation costs, thanks to the tax on waste paid by Veolia, which I had been putting aside for seven years. We signed an agreement with the operator concerning the connection, operation and maintenance of its equipment and the costs inherent in the consumables used on its facilities for the village, as well as the purchase price for hot water. We also signed an agreement with each resident: we sell them the energy at the price at which we bought it from Veolia, i.e. 10 euros per MWh excluding tax. 60% of the houses in the village are currently supplied by the system. In 2017, all of them will be. Many people didn’t believe in the project, but it is working today. The neighboring town of Goussainville is studying this solution for its municipal buildings and I have just hosted a Chinese delegation from a city with over a million inhabitants, which is extremely interested in this type of project.



# Ros tock

Germany

30/31

## Bottle to bottle: the plastic challenge

*When someone buys water somewhere in Europe, there is a very strong chance that the bottle will have been manufactured using recycled plastic, polyethylene terephthalate, commonly known as PET. Veolia is at the center of this process in Germany and other countries.*

**Every year** we drink hundreds of liters of tap or bottled water. Looking back in history we would have collected our water to drink in a bucket from a well or water pump, until the glass bottle and mass production of them was developed in Britain in the late 19<sup>th</sup> century. But once a glass bottle or container broke, it had to be thrown away, and was heavy to carry. Although polyethylene terephthalate (PET) was first patented in 1941 in England, it wasn't until 1973 that the PET bottle was patented.

Production of plastic bottles for soft drinks followed soon after and the first bottle was recycled in 1977. Then in the early 1990s, Coca-Cola became the first company to use food-grade recycled PET (known as rPET) in its packaging. It took a while to get going, but since the early years of this century, the amount of food-grade



### Issue at stake

> Developing a bigger industry for recycled PET bottles.

### Objective

> To increase the amount of food-grade recycled PET used in European countries.

### Veolia solution

> Building and operating the infrastructure to help develop food-grade recycling.  
> 1 billion bottles recycled per year

**CLIMATE** 1 metric ton of PET bottles recycled = approximately 1.5 metric tons of CO<sub>2</sub>eq avoided



**Stephan Bockmühl**

Managing Director Veolia Umweltservice PET Recycling GmbH

**How many plastic bottles do you recycle annually?**

"In Germany we have recycled approximately 1 billion plastic bottles. Additionally, our plants in Switzerland and Sweden support the success in producing food-grade rPET, closing the packaging loops.

Food-grade recycling of PET is not rocket science anymore. The market and its mechanisms have matured; therefore we have the know-how built up internally, as well as cooperation on several levels with our customers. But a minor challenge is the recycling line itself.

**You're talking about a "minor challenge," could you be more specific?**

You can buy a system to recycle PET out of the box that will give you sufficient quality. Yet the key to it is to get continuously good feedstock and accordingly yield, as you have to be efficient in what you do to get the best quality material out of the system. The way it works is that we collect post-consumer beverage bottles from retailers in Germany, and about 25% of these are colored bottles that we need to separate out as they contaminate the transparent, main material bottle stream. We grind the bottles and wash them before putting them

in a swim sink operation, where the PET sinks to the bottom and the high-density polyethylene from the caps floats to the top. The hot-washed PET flake goes into a mechanical process originally designed by United Resource Recovery Corporation, where the material is treated with caustic soda. In a second step the outer layer of the PET flake where most of the contamination can be found is removed. After sending all of the material through a rotary kiln which operates under vacuum, several sorting steps purify the end product. Finally, every bag of rPET flake is tested to ensure it meets the quality requirements.

**Would it be possible to develop closed loop models on a larger scale in Europe?**

At Rostock we take approximately 42,000 metric tons of material each year, of which around 32,000 metric tons is transparent bottles to be recycled. From this we get about 24,000 metric tons of flake that can close the packaging loop when it is manufactured into a bottle again. It is very important that we have a closed loop operation in Europe for environmental reasons: we need to keep our essential resources in the place we are using them. But if we export bottles or low-quality flakes, we are also exporting the jobs that go with it. This isn't just the jobs at recycling plants, but the electricians, the drivers and other subcontractors that benefit from us."

... recycled packaging has steadily increased. And in some countries, we are now getting to the stage where there is an rPET cycle just like there is a water cycle, where the plastic is used over and over again.

**From PET recycling to food-grade use**

The first food-grade recycling plant in Europe was opened in Switzerland in 2000 and was closely followed by another in Germany in 2002. In 2006 a third line was taken into operation close to Stockholm, Sweden. These

**Key figures**

**1 billion** PET bottles recycled in Germany by Veolia each year

**32,000 metric tons** of bottles recycled  
**24,000 metric tons** of rPET flake produced  
**55 employees** at Veolia rPET plant in Rostock, Germany

Recycling **1 kg** of PET saves **2.5 kg** of CO<sub>2</sub> compared to using 1 kg of virgin material

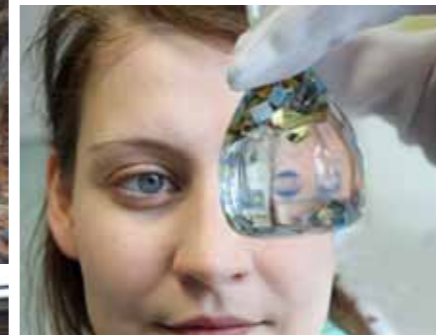
plants were bought by Veolia in 2007 when it purchased a company called Sulo. Germany continues to be a pioneer in food-grade PET recycling and partnership between the different parts of the supply chain is essential to making this a success. One example is the relationship Veolia has with a water company called Hansa-Heemann, which has its own bottling plant to bottle its own water. Its water is used either in its own products in Germany such as *hella* or it provides own brands for supermarkets. It also manufactures a range of soft drinks, sports drinks and energy drinks. "Sustainability is in our DNA," says Hansa-Heemann Head of Corporate

Purchasing Andreas Normann. "In Germany, packaging for our products used to be glass that needed to be refilled, but was also easily breakable. In early 2002, we moved into PET. The advantages of it are that it is light, unbreakable and so it is good for the customer as it is easy to carry. Eventually, we moved into more recycled content, and now we are at the stage

with our brands where we have a typical rPET content of 55%." This 55% is exceedingly high and among the world's best for mainstream brands, when an average of around 25% would be more typical. Although some companies are using 100% rPET bottles around the world for smaller brands, this doesn't tend to be widespread because of the difficulty of getting enough feedstock. To

**Andreas Normann, Head of Corporate Purchasing, Hansa-Heemann**

"Hansa-Heemann is primarily a spring water bottling company and one of the leading producers in Germany. We bottle for supermarkets, but also have our own brands and other soft drinks products. One big difference to other companies is that we are a water company, but we also manufacture our own bottles. We have four main plants in Germany in the north, middle and south. The company employs around 600 people and is a privately owned company. Our focus is on Germany, but also Austria, Switzerland, Denmark and Poland. With sustainability being so important for the company because spring water is a limited resource, the management wants to continue that tradition of managing our resources sustainably. We led the way by creating our own packaging production in 2008, and I have represented the company as part of the RAL Quality Assurance Association PET Beverage Packaging in Germany. This institute seeks to promote the sustainable development of PET bottles and make a positive contribution to resource efficiency and environmental and climate protection. The proposed Circular Economy Package from the European Union that is due to be revealed later this year is very important for helping closed loop models like ours to develop. If we can get collaboration across Europe, then we can ensure that more food-grade plastic is used in bottles time after time. If we just leave it to the free market, then that material will go wherever the price is best, which could be anywhere in the world."



get to this high level of 55%, and to create this prime example of the circular economy in action, takes a lot of logistical organization.

**No room for mistakes**

Not only is Veolia in Germany collecting the materials, but it is also sorting the bottles, removing the colored ones that contaminate the natural bottles, putting them through the

hot wash and mechanical-chemical treatment, and turning them into a food-grade flake ready to be processed into bottles again. "The main point is, when you have a closed loop, to know where the material is coming from," adds Andreas Normann. "We need a consistent material flow as we must be able to rely on it whenever it is required to optimize the business processes. But we also need the rPET flake to meet our product specifications, as we prefer transparent material as that is

easiest to recycle. And the most important thing is that it is safe for customers." At the food-grade end of recycling, there is no room for mistakes. "We have worked with Veolia for a long time, and have developed the capabilities of doing business together, especially the technical aspects and ensuring the quality is maintained. Veolia is very well organized and has a great reputation, and our partnership with the company works very well to meet the standards we require." ■

# View from above

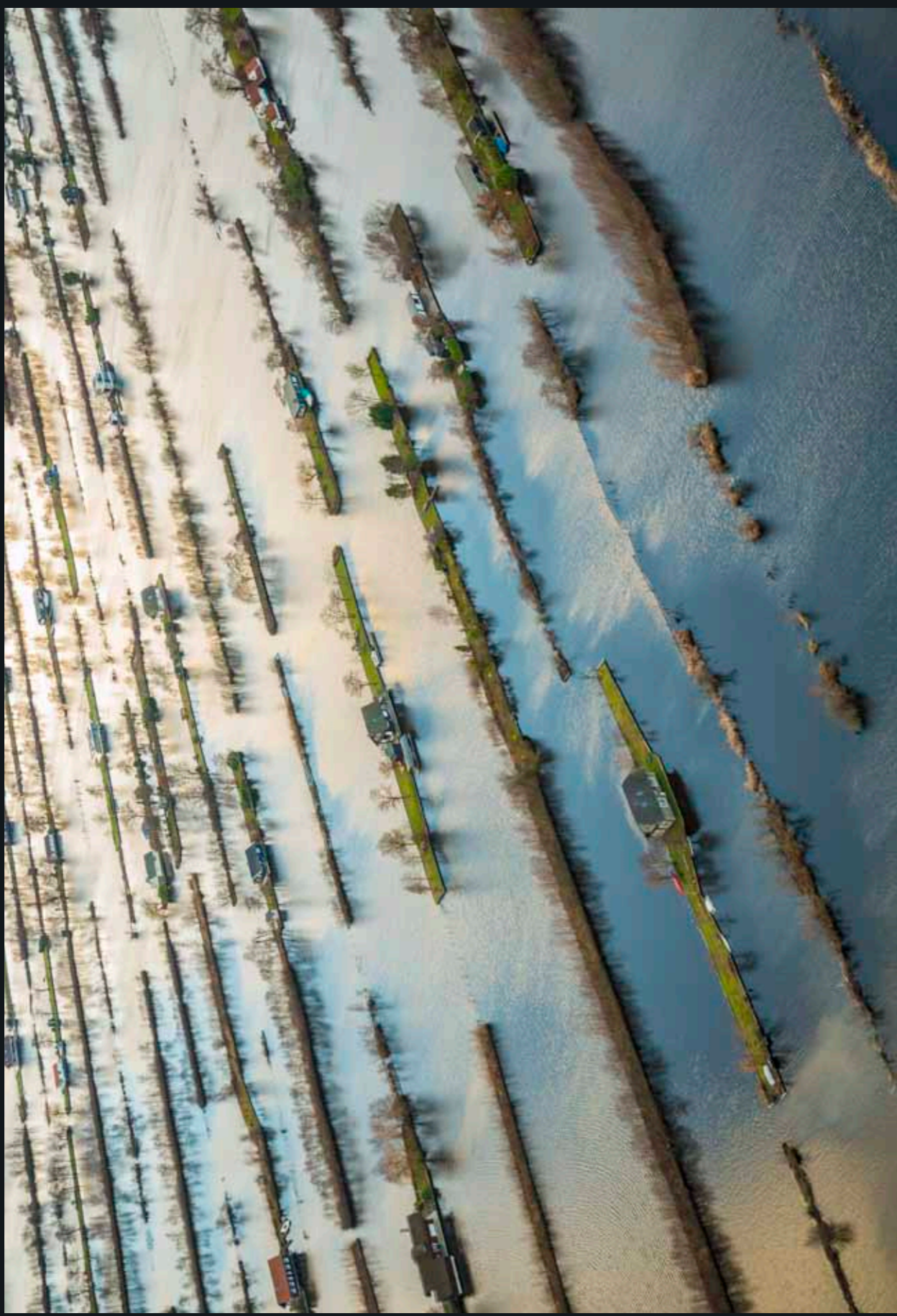
The rising level of the oceans, due to their warming and the melting of terrestrial glaciers, is a direct consequence of the increase in greenhouse gas emissions. Rising by over 3 mm each year, water levels could increase by over a meter by the end of the century, according to predictions that are constantly being adjusted

upward. Small insular states in the Pacific and Indian oceans, such as the Maldives, would be the first to disappear. However, all over the world, populations living in often overexploited coastal regions are also threatened by erosion, storms and floods. At National Geographic's request, George Steinmetz traveled to the

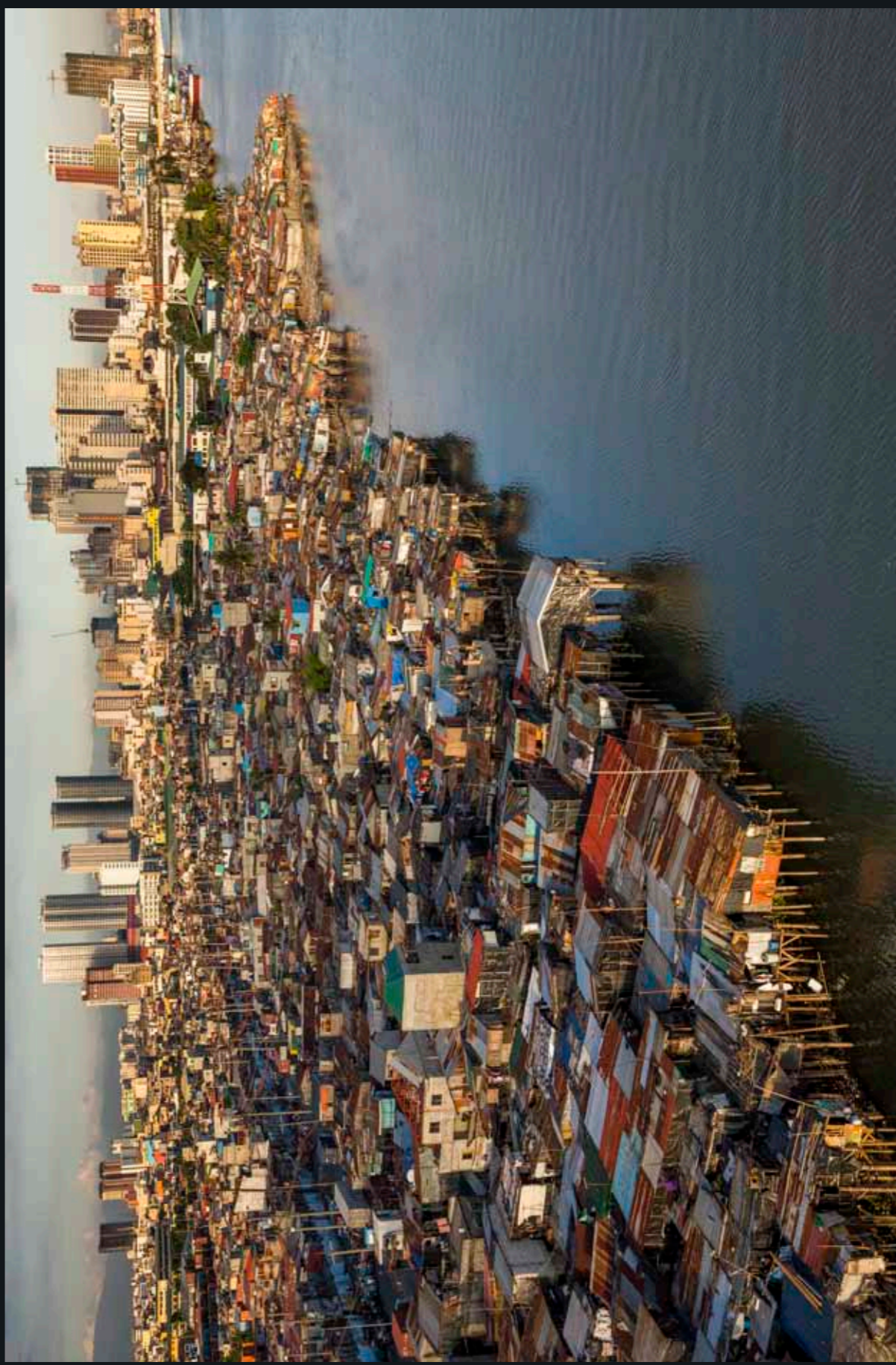
most sensitive areas to bear witness to the inexorability of this global phenomenon and the means deployed to adapt to it. His photography offers an invitation to take a step back, all the better to measure the effects of climate change.



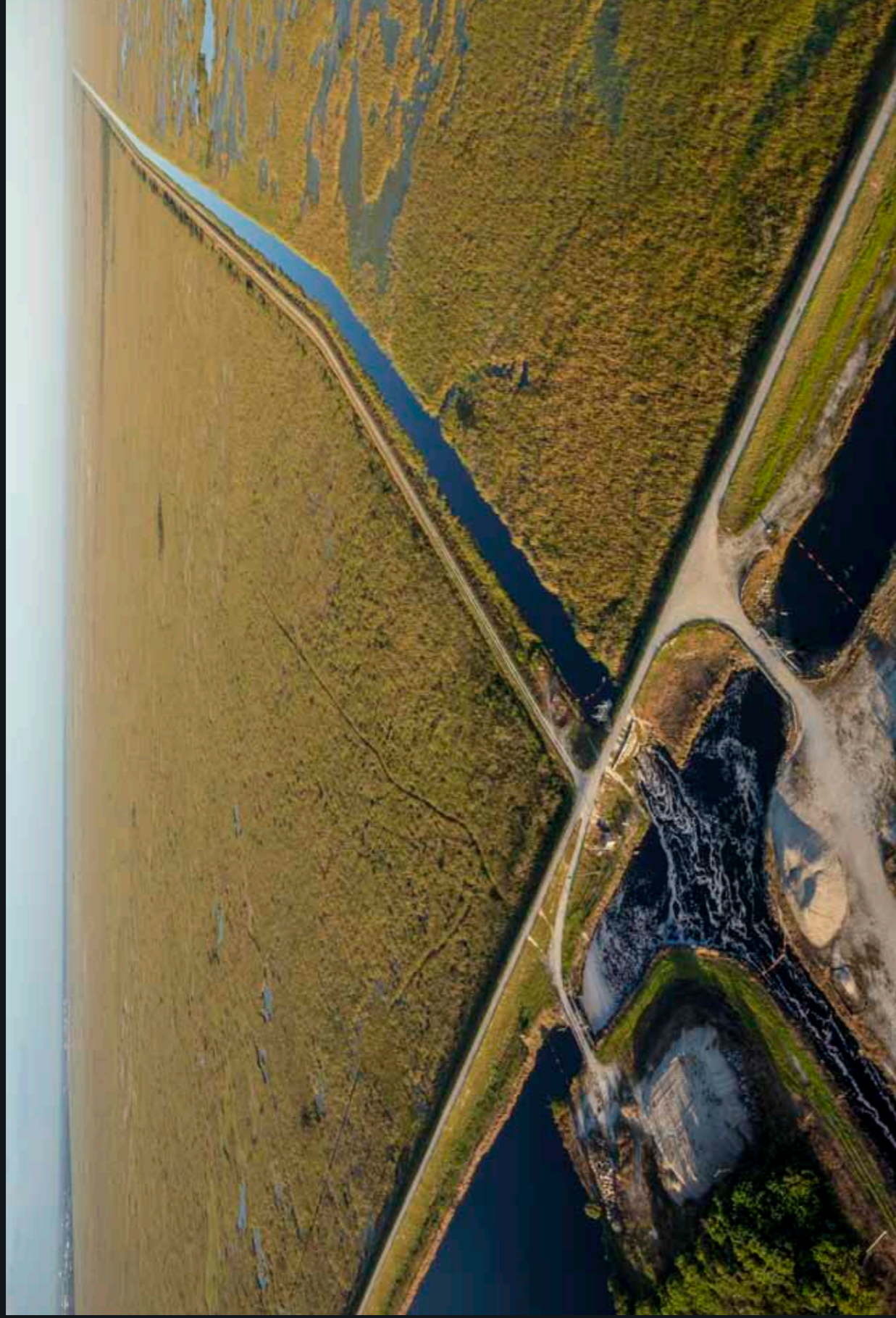
**Vulnerable capital** With over 150,000 inhabitants over a surface area of 5.8 km<sup>2</sup>, Malé, the capital of the Maldives, is one of the most densely populated cities in the world. The island, surrounded by concrete battered by the waves, only rises one meter above the Indian Ocean.



**Short-term investments** Water has reclaimed this former peat bog in the Netherlands, where holidaymakers now live... three meters below sea level! - while these luxury summer houses in Miami, built on artificial islands at the water's edge, do not seem particularly bothered by the rising oceans.



A suspended sentence for the coast. Manila's shoreline is one of the few affordable spots for the poorest inhabitants, who are nonetheless aware of the risks they run. Situated between river and sea, their huts on stilts form a paltry defense against the typhoons that regularly assail the coast of the Philippines.



## George Steinmetz, an aerial view

Crisscrossing the globe for over thirty years, George Steinmetz knows just how fragile it is.

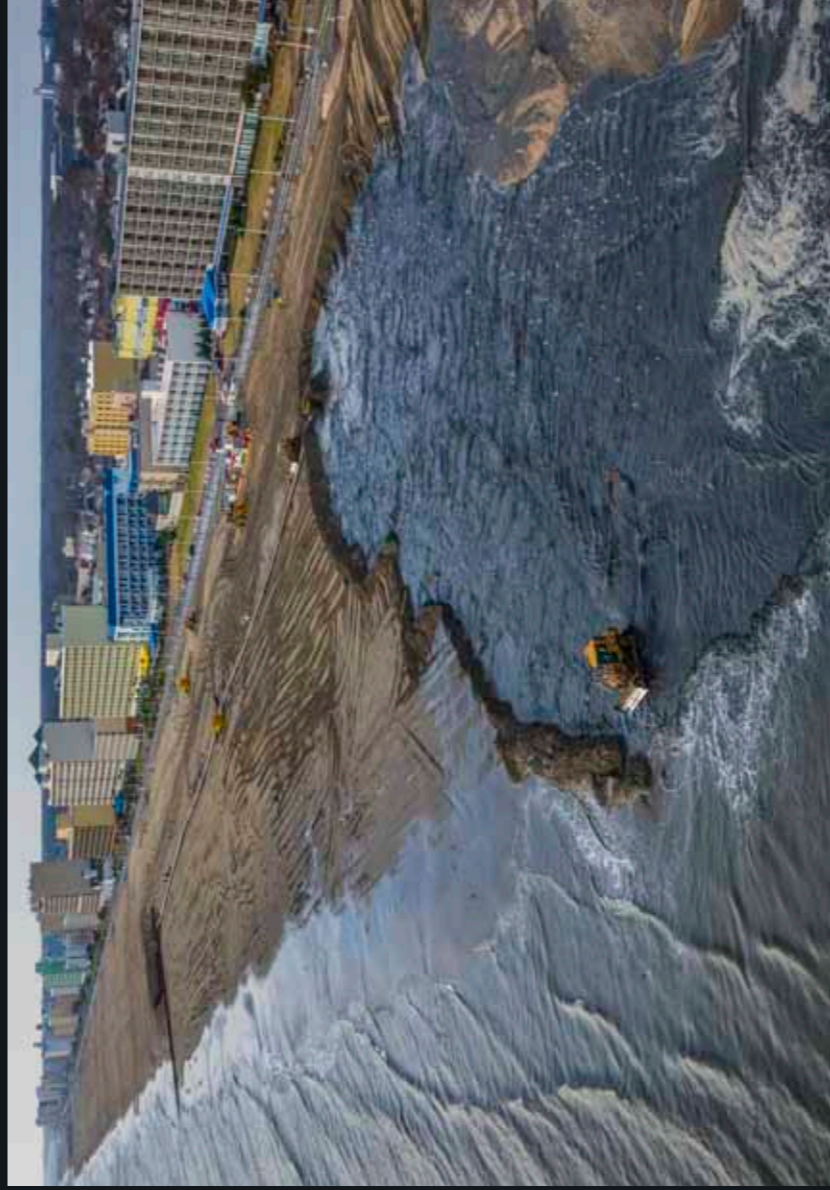
While the American photographer is particularly fond of flying over breathtaking landscapes on the hunt for unique angles for his shots, he is also keen to reveal their ephemeral or threatened nature. “Most of the phenomena that affect our environment are not visible

from the ground, while the reality of them leaps out from above,” he reminds us. No stranger to heights, it was for this reason that he decided to focus his attention on rising sea levels. In short, gaining a higher perspective to see things more clearly. The reports for which he was commissioned between 2013 and 2014 took him from the Netherlands to the archipelagos of Asia Pacific, through Russia and the East Coast of the United States. From one place to the next, George Steinmetz’s views reveal

the diversity of the initiatives undertaken to attempt to control rising water levels... or worse, ignore them in favor of short-term economic interests, as is the case in Florida. “It is disturbing to observe a continued lack of reaction – or even denial – in the face of the phenomenon,” laments the photographer. There is no doubt that his current topic of interest – the ever growing food needs of humanity, another problem on a global scale – will raise questions in its turn.

## Bio

In the late seventies, while he was a geophysics student at Stanford, George Steinmetz broke away from the comfort of his native California to hitchhike across Africa, camera in hand. Ever since, this regular contributor to National Geographic and Geo and winner of two World Press Photo awards has been traveling non-stop to the most hidden corners of the globe. He is particularly passionate about arid environments, which he has photographed for fifteen years from his paramotor.



Not all countries are equal in the light of **climate change**: some are much more vulnerable than others. There is still time to **change course**, as long as we reduce our **greenhouse gas** emissions.

# Future scenario

## The climate is changing:

scientists from the Intergovernmental Panel on Climate Change (IPCC) have proven it. "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, the sea level has risen, and the concentrations of greenhouse gases have increased," confirm climatologists in the summary of 2013's report on scientific elements<sup>1</sup>. What is the cause of this warming? Contrary to what climate skeptics may say, human responsibility plays a big part: we emit too many greenhouse gases. "The atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. There has been a 40% increase in carbon dioxide concentrations since preindustrial times," highlight scientists. The verdict is irrevocable: "human influence on the climate system is clear."

## Adapting to risks

Those who feel the cold might be only too glad if the weather were warmer! However, this temperature increase would have serious social, economic and environmental consequences. We are beginning to feel its effects: more frequent and more violent storms and hurricanes, heatwaves, pre-

cipitation variations, rising sea levels, etc. The fifth IPCC<sup>2</sup> report describes the risks according to the different greenhouse gas emission scenarios and draws up the sorry list of the expected impacts: "alteration of ecosystems, disruption of food production and water supply, damage to infrastructure and settlements, morbidity and mortality, and consequences for mental health and human well-being." No country is prepared to face up to the consequences of climate change! It goes without saying that the vulnerability of each country to these changes depends on its geography – we may think, for example, of islands on the frontline when it comes to the risk of rising water levels – but this is not all. The way in which the country's ability to cope with changes is also a key factor. In 2013, the British risk analysis firm Maplecroft published a climate change vulnerability atlas<sup>3</sup> (see map page 45). Its ranking takes into account rising water levels, changes in temperature and precipitation, and populations' sensitivity to these changes in terms of health, education, agriculture dependence and the country's adaptability, along with its ability to deal with the impacts of climate change (economic factors, R&D, resource security and the effectiveness of government, etc.). It is worth noting that the countries most affected by risks linked to global warming have themselves contributed very little to

contd. on page 46



**Pierre Victoria**

Veolia's Sustainable Development Director

### COP21's success depends on the involvement of all players

#### Do companies have a role to play in the fight against climate change?

Of course. Both by limiting their own greenhouse gas emissions and above all by developing low-carbon services and solutions. In fact, there are already a great many solutions that are up and running in certain areas, with good tools and mechanisms able to create the conditions for a local low-carbon ecosystem. The issue at stake today is to create the necessary conditions so that these initiatives are not just remarkable best practices, but an obvious move for all, as was true of the effective treatment of wastewater or waste to promote the health and progress of our societies. However, companies do not hold all the keys: global policies are required to implement solutions. In this respect, it is for example essential that a robust and predictable carbon price is set. We also recommend the principle of a carbon fee, along the "polluter pays" model.

#### What makes Veolia stand out?

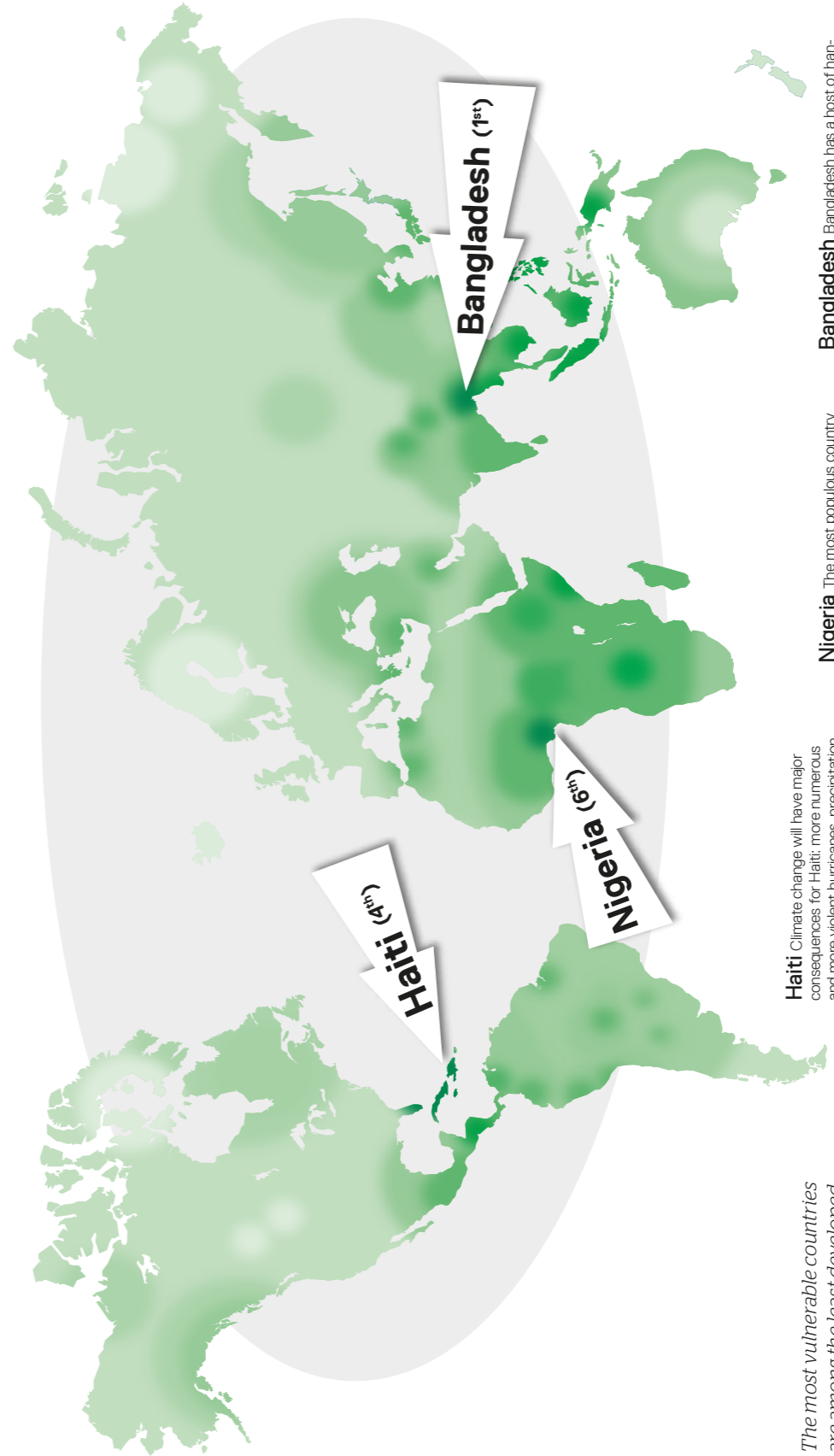
Our conviction that we must change the way resources are used. Moving from a linear, extremely high energy-consuming "extract-produce-discard" approach to a more restrained model for low-carbon resilient development based on the circular economy, in which one person's waste becomes another person's resources. These solutions are at the heart of our partnerships with municipalities and companies. Accordingly, we will deliver essential services to an ever-growing population, drawing less on natural resources. To achieve this, innovation is a must. We are already able to recover and repurpose many sources of energy, produce biogas in our waste storage centers, recover calories from wastewater, etc.

#### What would be a successful COP21?

This success does not solely depend on the signature of a global and restrictive agreement on GHG emissions, following on from the Kyoto protocol. It will be measured by the yardstick of the commitment of each country, along with non-state players, including companies. Finally, we must not forget the question of Green Climate Fund financing (see Currents, page 7) aimed at helping vulnerable countries to adapt.

# The vulnerability atlas

This map shows countries' vulnerability to climate change. This vulnerability depends on geographic and climatic criteria, along with each country's degree of development, infrastructure and governance. The greater the increase in temperature, the more serious the impacts on these countries, with incalculable consequences on populations.



The most vulnerable countries are among the least developed, almost all of which are found in Asia and Africa, as highlighted by the ranking drawn up by Maplecroft. Haiti is in 4<sup>th</sup> place and Nigeria in 6<sup>th</sup>, while Bangladesh comes first.



**Haiti** Climate change will have major consequences for Haiti: more numerous and more violent hurricanes, precipitation variation (more episodes of drought in the dry season, and flooding in the rainy season), coastal erosion, etc. This will aggravate an already delicate situation, as Haiti is extremely deforested, agriculture dependent, and experiencing governance problems. Close to the country in terms of geography, Florida (United States) is exposed to the same climate hazards, but is much better equipped to withstand them. This is why it does not feature among the most vulnerable countries.

**Nigeria** The most populous country in Africa, Nigeria is particularly sensitive to changes in rainfall patterns, along with rising sea levels and erosion. Climate catastrophes can have a huge impact on its economy, which is highly dependent on oil: in 2012, serious flooding led to losses of 500,000 barrels of oil a day. It also suffers from underdeveloped infrastructures and institutions that remain weak.

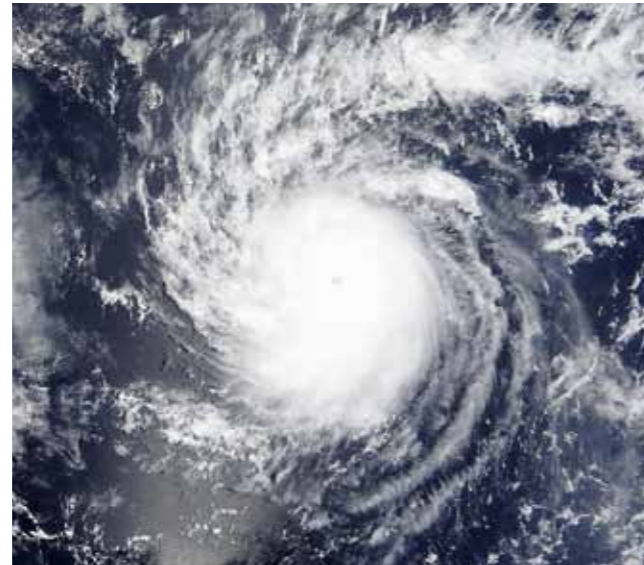
**Bangladesh** Bangladesh has a host of handicaps that make it the most vulnerable country to climate change. Extremely sensitive to rising water levels (two thirds of its land comes to less than five meters above sea level), it is also subject to frequent cyclones. Its lack of infrastructure and high dependence on agriculture, along with its high population density, are also risk factors.

Source British risk analysis firm Maplecroft, 2013 report. maplecroft.com/about/news/ccvi\_2013.html

... greenhouse gas emissions: those who pollute are not the ones who pay! On the contrary, developed countries, which are the main emitters, are among the least vulnerable.

## 2°C: a major challenge

Luckily it is not too late to react. In fact, "we can reduce the global risks of climate change by limiting the pace and scale of this change." In 2009, politicians at the Copenhagen summit decided that limiting this change means keeping the increase in temperature below 2°C. An ambitious target: "To date, we have released over 2,000 billion metric tons of CO<sub>2</sub>," states climatologist Valérie Masson-Delmotte. "However, to limit global warming to 2°C, we must not exceed 3,200 billion



metric tons, i.e. a 70% reduction in global emissions by 2050. This shows the extent of the challenge!" Certain economic scenarios drawn up by the IFCC show that this aim is achievable, provided that we especially reduce our dependence on fossil fuels (coal, oil and gas) and leave 80% of these resources in the sub-soil. It will take more than paltry

efforts to enable us to meet the climate change challenge; "substantial cuts in anthropogenic GHG emissions by mid-century through large-scale changes in energy systems and potentially land use" are required, according to the summary of the IPCC report on mitigating climate change<sup>1</sup>. Greenhouse gas emissions in 2050 must be 40 to 70% lower than in 2010. And they

must be virtually non-existent by 2100! This is only possible by combining all the means of reduction: energy saving, energy efficiency, renewable energy, etc. The IPCC has thus sent packing those who are happy to act, but later: "delaying mitigation efforts through 2030 is estimated to substantially increase the difficulty of the transition to low emissions levels," it underlines. This report concludes by highlighting the key role that companies will play in the fight against climate change. ■

1. [www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5\\_Summary-Volume\\_FINAL.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Summary-Volume_FINAL.pdf)
2. [www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5\\_wg2\\_spm\\_en.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/ar5_wg2_spm_en.pdf)
3. [www.maplecroft.com/portfolio/new-analysis/2013/10/30/31-global-economic-output-forecast-face-high-or-extreme-climate-change-risks-2025-maplecroft-risk-atlas/](http://www.maplecroft.com/portfolio/new-analysis/2013/10/30/31-global-economic-output-forecast-face-high-or-extreme-climate-change-risks-2025-maplecroft-risk-atlas/)
4. [www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc\\_wg3\\_ar5\\_summary-for-policymakers.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf)

Valérie Masson-Delmotte, a climatologist at the Climate and Environment Sciences Laboratory, Co-Chair of IPCC Working Group I

## "The IPCC is compiling an invaluable inventory of climate knowledge"

*Climate knowledge is a long scientific path, which began in the 19th century and is today driven by 25,000 researchers.*

"From the mid-nineteenth century, scientists such as the Frenchman Joseph Fourier or the Swede Svante Arrhenius understood how the climate works: radiation exchanges between the Earth and space, the role of the greenhouse effect, etc. They also identified how the climate had varied in the past, particularly with ice ages. However, it was in 1979 that the first in-depth study of the climate's response to an increase in the concentration of CO<sub>2</sub> in the atmosphere was published. The intuitions of the seventies and eighties were then refined by satellite measurements, especially in difficult-to-reach areas, which supplemented over 150 years of oceanographic and meteorological measurements. Finally, climate modeling and studying other planets in the solar system along with past climates have completed this knowledge. 25,000 scientists are currently working on the climate worldwide! The Intergovernmental Panel on Climate Change (IPCC) was formed following the Rio conference in 1992. The IPCC does not carry out research, but compiles an inventory of climate knowledge on the basis of scientific literature. A few hundred authors and several thousand proofreaders are involved in each report. The IPCC studies three aspects: climate physics, the impact and vulnerability of climate change, and finally mitigation strategies. It serves to provide a decision aid for politicians, but does not decide anything itself."



To raise the general public's awareness of the need to act to counter climate change, the Parisian establishment la REcyclerie has set up a program of activities promoting everyday eco-responsibility. As a founding partner, Veolia is supporting these novel events.

## Greening up the everyday

Passing on a few useful steps for the planet every month: this is the challenge that la REcyclerie has set itself, inviting its visitors to share in a fun yet educational program. Destination COP21, as it is known, was inaugurated in this new third space<sup>1</sup> on the edge of Paris, echoing the recommendations of the international climate conference to encourage ordinary people to get involved. Carried out in partnership with the student collective WARNI<sup>2</sup> and Veolia, "the project highlights the best practices that everyone, whatever their age, can adopt to reduce their impact on the climate," summarizes Claire Ruszniewski, the venue's events manager. This ambitious and eclectic initiative offers the public the opportunity to grasp the main issues at stake for COP21 by exploring all the dimensions of eco-responsibility. Since February, forums and encounters have been organized every month

based on a climate-related topic: Consumption & Collaboration, Finance & Responsibility, Food & Farming, etc. The discussions are accompanied by a host of practical workshops to gain an introduction to recycling, compose an anti-waste menu, create your own vegetable garden or make your own compost. Combining positive questioning and role plays, la REcyclerie's initiative stands out through its effectiveness in promoting concrete solutions among a varied, urban population with differing degrees of awareness of sustainable development concerns. For Veolia, a partner and financial supporter, "it is also an opportunity to communicate in a different way about social responsibility issues, by taking part during conferences or providing educational material," adds Fanny Demulier, Veolia's CSR Communications officer. Which should encourage la REcyclerie to continue to green up its visitors' everyday lives beyond COP21.



**A unique venue** Having opened in June 2014 in a former railway station on the edge of Paris, this space dedicated to "new everyday practices" has received the COP21 label and is run by some 15 permanent staff. Along with its canteen and greengrocery, it features a repair workshop and an urban farm. It is also an events venue, hosting a succession of get-togethers, thrift stores and workshops.

**Destination COP21, a success with the public** Over the first months of the program, la REcyclerie organized 21 workshops and 17 meet-ups involving over 1,500 participants and welcoming almost 9,000 visitors.

**For more details about the program until December 2015:** [www.larecyclerie.com](http://www.larecyclerie.com)

1- An emerging social environment model encouraging sharing, innovation and entrepreneurship.  
2- We Are Ready Now! is a national community movement to raise young people's awareness of climate imbalance concerns.



# Methane: climate pollutant, green energy

Reducing the amount of methane that we release into the atmosphere allows us to fight climate change. The technologies exist and are being deployed by industry.

48/49

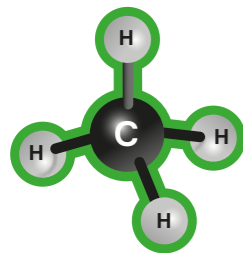
Combating climate change is above all about taking action on CO<sub>2</sub>. However, other greenhouse gases exist, especially methane. "Reducing methane emissions goes hand in hand with actions to combat CO<sub>2</sub>, and has an instant positive impact," highlights Gary Crawford from Veolia's International Affairs Department. "The technologies now exist, so it is possible to act." For this reason, more and more companies and local authorities are tackling their

methane emissions. Methane represents 30% of Veolia's greenhouse gas emissions<sup>1</sup>. "We have the ambitious aim of capturing over 60% of the methane that we release by 2020," states Gary Crawford. "We are also keen to repurpose it." In fact, recovering and repurposing methane presents a double advantage: not only is a climate-damaging gas prevented from being released into nature, but recourse to fossil energy sources is also avoided by using this renewable gas. ■

1- In terms of "CO<sub>2</sub> equivalent."

## WHAT'S METHANE?

This greenhouse gas comes primarily from the fermentation of organic products. 40% is generated by nature (swamps, termite activity, etc.) and 60% by humans (agriculture, animal husbandry, fossil fuel use, etc.). Its greenhouse-warming potential is 28 times that of CO<sub>2</sub> over one hundred years, and 80 times greater over twenty years. All the more reason to recover and repurpose it.



## 4 INJECTION INTO THE NATURAL GAS NETWORK

The other solution for recovering methane consists in separating it from other gases (steam, CO<sub>2</sub>), purifying it, and then injecting it into the natural gas network. It will subsequently heat homes, offices and industries instead of fossil methane.

## 3 HEAT AND ELECTRICITY PRODUCTION

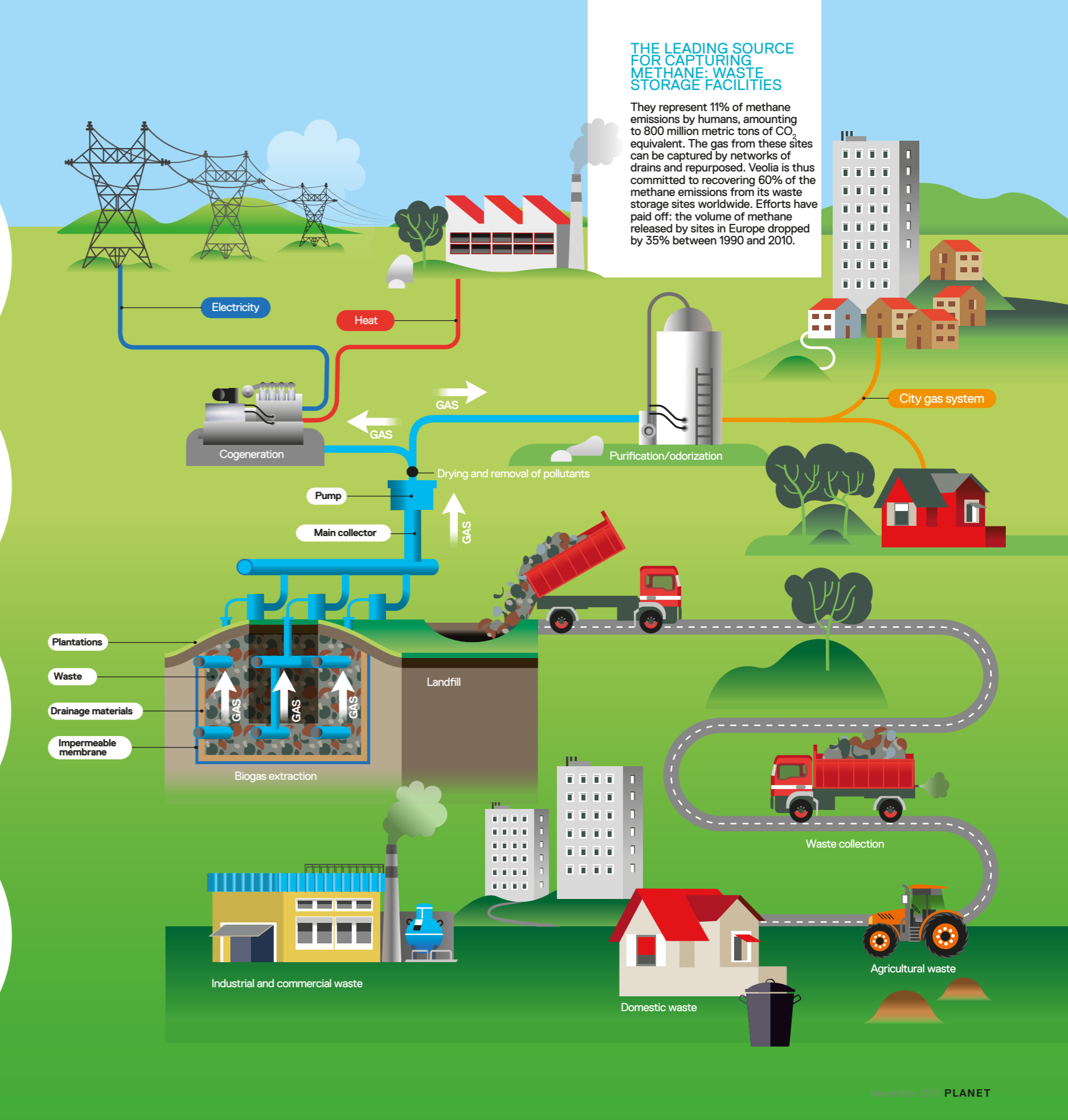
After drying and removing pollutants, methane can be burned in a gas turbine or a generator engine, in order to produce electricity and/or heat. The electricity is injected into the system, while the heat is used on site, by a neighboring factory, or in a heating system.

## 2 CAPTURE

Methane (or biogas) from waste storage facilities is captured via a network of vertical and horizontal drains, and then collected and transported via pipes to be repurposed.

## 1 A GAS TO BE RECOVERED

The methane derived from the organic waste from storage facilities or sludge from wastewater treatment plants can be recovered so as not to be released into the atmosphere. It is also a source of renewable energy, which prevents the use of fossil energies.



THE LEADING SOURCE FOR CAPTURING METHANE: WASTE STORAGE FACILITIES

They represent 11% of methane emissions by humans, amounting to 800 million metric tons of CO<sub>2</sub> equivalent. The gas from these sites can be captured by networks of drains and repurposed. Veolia is thus committed to recovering 60% of the methane emissions from its waste storage sites worldwide. Efforts have paid off: the volume of methane released by sites in Europe dropped by 35% between 1990 and 2010.



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## Eco-storage with the Groundfridge

At first glance, this strange spherical den doesn't seem to have much in common with our grandparents' larder. And yet the basements in old houses were the direct inspiration for the Groundfridge cellar, which keeps up to 500 kg of food cool without using a single kilowatt. This autonomous and sustainable conservation system actually takes

advantage of the earth's thermal stability to guarantee a constant temperature of between 7 and 15°C (depending on outside temperatures ranging from -10 to +35°C). Like a standard refrigerator, the Groundfridge can therefore store vegetables, fruit, cheese or wine in its ingeniously laid-out sealed chamber. The

idea budded a few years ago in the brain of Floris Schoonderbeek, a Dutch designer keen to respond to the craze for growing your own organic food, which has taken the Netherlands by storm. "The emergence of alternative consumption modes is leading to the development of alternative storage modes," he explains. Hence, also, the

Groundfridge's original design, which has been devised more as an item of equipment rather than an architectural feature: with its lightweight laminated polyester structure (300 kg) and compact diameter (2.3 m), this low-tech invention is transportable and suitable for most soils. Once the cellar is buried and covered with the earth that

has been excavated, you need simply walk down a few integrated steps to access and enjoy its contents... Presented last April at the Milan World's Fair and nominated for the Dutch Design Awards, the Groundfridge has garnered fans before even reaching the market: two of the three prototypes finalized to date have already found a taker.

Find out more at [www.weltevree.nl](http://www.weltevree.nl).

DECEMBER 4-10, 2015, GRAND PALAIS, PARIS (FRANCE)

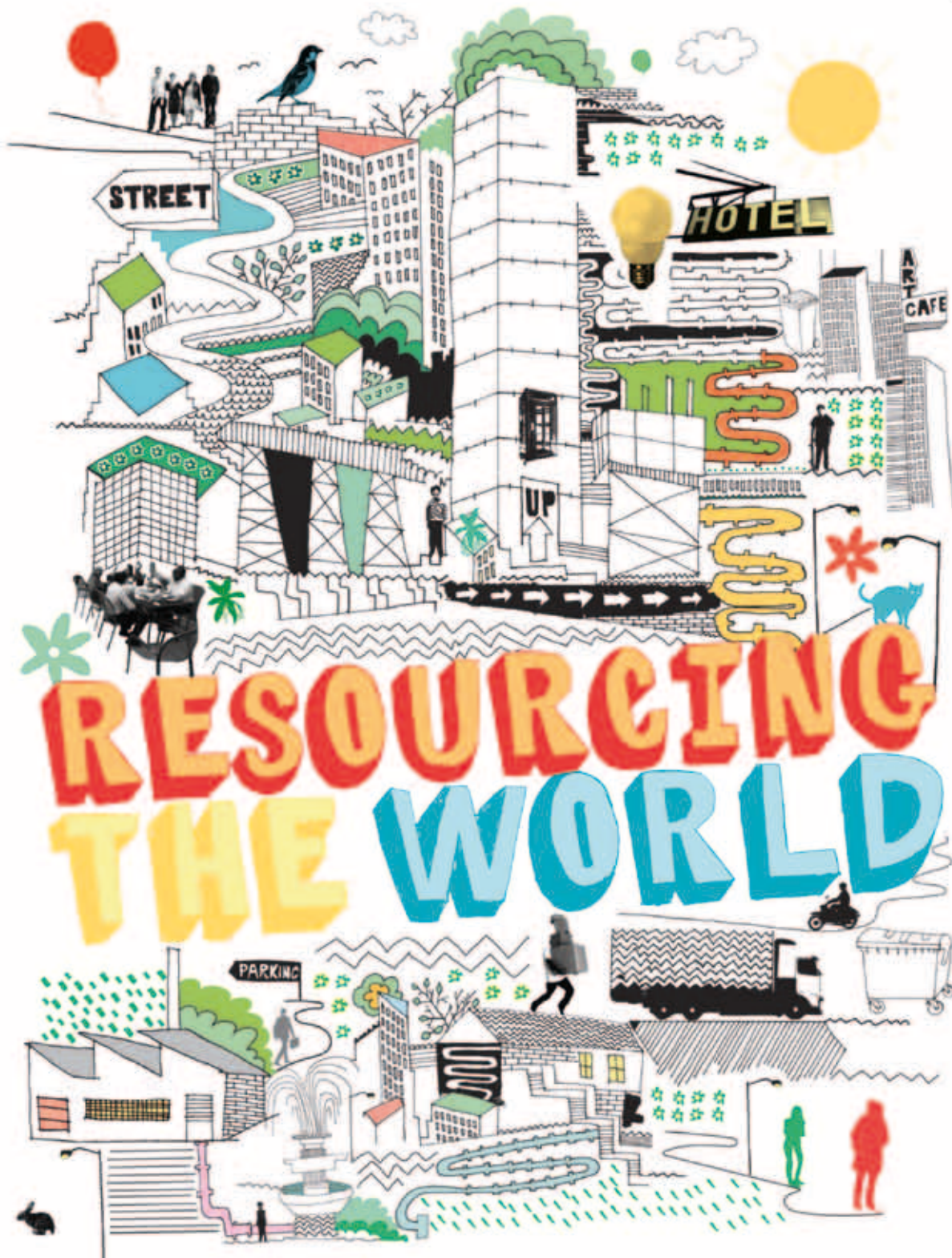
COP21 SOLUTIONS EXHIBITION

## PROLONG THE CLIMATE EXPERIENCE

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Resourcing the world

