

Water

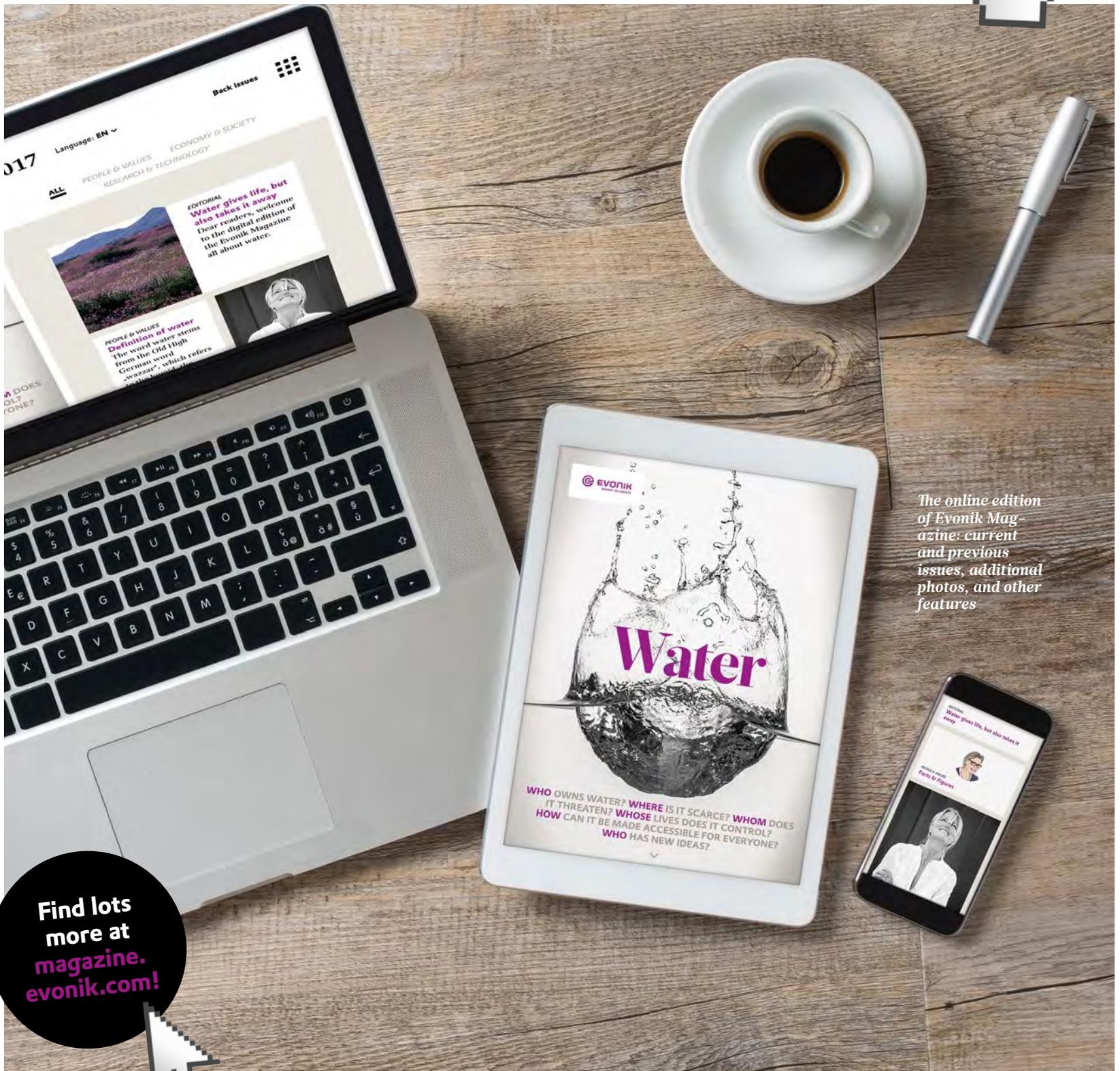
3/2017

WHO OWNS WATER? WHERE IS IT SCARCE? WHOM DOES IT THREATEN? WHOSE LIVES DOES IT CONTROL? HOW CAN IT BE MADE ACCESSIBLE FOR EVERYONE? WHO HAS NEW IDEAS?

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“Water gives life, but it also destroys”



Water can make even the extremely arid Atacama Desert bloom



Dear readers,

Two recently taken photos document the power of water. One of them records destruction, the other reveals growth. In one, we see Hurricane Harvey bringing torrential rain and flooding to Houston, the fourth-largest American city, and causing damage that will cost millions of dollars to repair. In the other, we see the Atacama Desert, one of the most arid landscapes on earth, where decades can pass without a single drop of rain. Suddenly it has come to life with a carpet of purple wildflowers reaching to the foot of the Andes, now that rain has fallen on its stones, sand, and scree.

We have a broad range of associations with the element of water: It gives life, but it also destroys. This breadth is also reflected in the articles of this issue of *Evonik Magazine*. A report from India analyzes two of the country’s crucial problems—water scarcity and water pollution—and points to solutions: methods of obtaining clean water and improving its distribution throughout the land (page 14). The Netherlands have never had to complain about a water shortage—on the contrary. The Dutch have drawn some conclusions from the storm surges and flooding they have experienced over the years. The ideas they’ve developed for living with water sound fascinating or even visionary—but that’s exactly why they often serve as models for other countries (page 36).

Businesses often incur criticism regarding their use of water, and probably no company knows that better than Nestlé. Achim Drewes, the Head of Public Affairs at Nestlé Germany, discusses the question of who owns water with Benjamin Adrion, the founder of the organization Viva con Aqua (page 32). Martin Keulertz, an Assistant Professor at the American University in Beirut, explores the consequences of this issue for global politics. Although the title of his essay, “War over Water?”, sounds provocative, Keulertz believes there is potential for cooperation between nations that have previously had hostile relationships (page 18). Another hopeful development is the research fostered by Manfred Wilhelm, a professor of polymer chemistry at the Karlsruhe Institute of Technology. Together with his students, he is working on new models for using superabsorbers to desalinate seawater and remove heavy metals from wastewater. The driving force behind Wilhelm’s projects is the desire to prove that something can be done (page 46).

To date, Evonik has published two magazines that are mainly directed at people outside the Group. *Elements* primarily reports on the Group’s research and development projects, whereas each issue of *Evonik Magazine* focuses on a single theme from many sides and different perspectives. Starting next year, the best aspects of these two magazines will merge—and create something completely new. This future magazine will keep the established name *Elements*, but it will also include the kinds of features that readers appreciate in *Evonik Magazine*. Be ready for some surprises!

Christof Endruweit, Editor in Chief

Water

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ORIGIN The word “water” is derived from the Old English “wæter,” which is from the Proto-Germanic “watōr”

TYPICAL ASSOCIATIONS Waterfall, drinking water, freshwater, salt water, watercourse, mineral water, wastewater, water pipe, water pollution

SYNONYMS H₂O, spring, well

ANTONYMS Dryness, fire (literary)

USAGE

GENERAL: A colorless and odorless liquid

CHEMISTRY: A chemical compound of the elements oxygen and hydrogen

GEOGRAPHY: The contents of rivers, lakes, and oceans

TRADE: Mineral water



“We aim to use old plastic as a raw material for implementing sustainable solutions for waterborne construction”

The Rotterdam architect Ramon Knoester's innovative ideas exemplify the Netherlands's creative spirit: The country reacts to environmental threats and rising sea levels by coming up with solutions that make its relationship with water positive and practical. From page 30

Standards

- 03 Editorial
- 04 Definition / Masthead
- 06 Facts + Figures: People and Values
- 28 Facts + Figures: Business and Society
- 44 Facts + Figures: Research and Technology
- 54 Point of Contact



RESEARCH AND TECHNOLOGY

- 46 **Science**
Superabsorbers keep babies dry. In the future, they may also make seawater drinkable
- 50 **Report**
Singapore uses rainwater, desalinates seawater, builds dams, and redirects canals—this city-state is a prime example of how to solve the problems of the future



PEOPLE AND VALUES

- 8 **Portraits**
From a beer brewer to a freediver—five examples show that a wide range of relationships with water is possible
- 14 **Case Study**
India's problematic supply of drinking water; the causes and possible solutions of the problem
- 18 **Essay**
Will there be war over water? Martin Keulertz, an Assistant Professor in Beirut, is an expert on this question
- 20 **Photo Gallery**
Sacred swimming and modern technology—fascinating photographs of the source of life



BUSINESS AND SOCIETY

- 30 **Report**
How a tasteless liquid became a cult beverage
- 32 **Debate**
Who owns water? Benjamin Adrion from Viva con Agua and Achim Drewes from Nestlé discuss this question
- 36 **Report**
Rising sea levels are threatening the Netherlands—but the Dutch regard this as an opportunity
- 42 **History**
Ancient Egypt became a world power thanks to the Nile. A modern-day trek along the river

Facts + Figures

3 QUESTIONS FOR

Sigrid Lüber “Everyone Should Contribute”



1 What were the key results of the United Nations Ocean Conference? All of the conference participants demanded better resource management and waste prevention as well as a significant reduction of the use of plastic. In addition, they submitted more than 1,300 voluntary commitments to specific, measurable activities.

2 What will be the main challenge in the years ahead? The biggest challenge is posed by time. Plastic is generally used only once but lasts for all eternity. As a result, the world's oceans might contain more plastic than fish in 2050. That's why immediate and rigorous action is needed with

regard to plastic in particular.

3 How high do you think the chances of success are? The conference could be a game changer, but only if concrete measures are taken and everyone contributes. Governments need to draw up clear action plans, private businesses have to implement mandatory reduction plans, and everyone can do their bit by producing less waste.

Sigrid Lüber is the President of the non-governmental organization Oceancare. She was a special envoy at the first United Nations Ocean Conference, which was held in New York from June 5 to 9, 2017.

22

March is World Water Day, which was formally proposed in Agenda 21 of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro and accepted by the United Nations General Assembly in a resolution passed on December 22, 1992



Water is their most important instrument: Women from the island nation Vanuatu in the South Pacific

The Magical Water Music from Vanuatu

Water plays a key role in the cultural life of the inhabitants of Vanuatu. In this remote island nation in the South Pacific, women have been using water as a percussion instrument for many generations. The inhabitants' more than one thousand years of history are reflected in the women's “magical water music.”

The music deals with the traditional way of life in Vanuatu, which focuses on water. The rhythms and sounds imitate the noise made by swimming fish and the pattering of raindrops. The songs have titles such as “The Sound of Thunder,”

“Waterfall,” and “Waves That Beat Against the Reef.” A key element of this water music is the interplay between the performers' bodies and the water. The women, who wear traditional dresses made of flowers and leaves, stand in the water, which reaches up to their waists. The women use their right hands to set the rhythm and their left hands to strike the surface of the water in time with the beat. The loud splashing, whirling, and spraying of the water creates an impressive soundscape. This *ëtëtung* (“water music” in the Vanuatuan language of Mwelap) is a treat not only

for the ears but also for the eyes, thanks to the lovely way in which the women move through the water and seemingly become one with nature.

Originally *ëtëtung* was an expression of Vanuatuan culture. Today it is primarily a very popular tourist attraction. Since 2008, the Leweton Cultural Village, a local cultural organization, has presented daily live shows of the magical water music on the islands of Mere Lava and Gaua.

Link: www.youtube.com/watch?v=UMFazztDbAI

Clean Water More Widely Available

Substantial rise More and more people are gaining access to clean drinking water worldwide. Even in especially poor countries, the share of people with access to clean water rose from 51 to 69 percent.

Sources: WHO, UNICEF

Developing countries

Population in thousands/percentage with access to water



Least developed countries

Population in thousands/percentage with access to water



THE POWER OF WATER

Devastating
Floods

The second St. Marcellus flood on the North Sea coast In just two days, the storm tide swept away entire villages



Disastrous flooding on the Yellow River (China) in 1887

This catastrophic flood is estimated to have killed between 900,000 and two million people



Disastrous flooding on the Yangtze (China) in 1931 Several waves of floods killed more than one million people



Cyclone and storm surge in East Pakistan in 1970

The disaster killed between 300,000 and 500,000 people



Tsunami in Southeast Asia in 2004 Around 230,000 dead in Indonesia, Thailand, and many other countries

These Ethiopian children are supplied with freshwater from a newly built well

BUILDING
WELLS

Many people in Ethiopia do not have access to clean water and sanitary facilities. The Neven Subotic Foundation is helping to make sure that this will change over the long term

What must it feel like to drink clean water for the first time in one's life? To drink water without having to fear that it will make one ill? And without having to walk six kilometers to a watering hole where animals also go to drink? The Neven Subotic Foundation gives people in Ethiopia this exhilarating feeling. It builds wells in the northern part of the country, especially at schools and in remote villages.

Around 50 million people in Ethiopia—half of the population—don't have access to clean water. That's as if half of the people in Germany would have to drink from rivers or lakes. But that's only part of the problem. The



Africa's water crisis

1
Rapid population growth is boosting water consumption

2
Extensive water pollution, insufficient infrastructure

3
Too little rain and rising temperatures

4
Too much water is used for agriculture

5
Bad government, corrupt water supply companies

other major issue is the lack of sanitary facilities. As a result, 90 percent of feces and waste end up in rivers from which people get the drinking water they need every day.

To address this problem, the foundation is also building toilets. Since 2012, it has built 113 wells (including 57 with adjacent toilets) in cooperation with a local organization. It's a start. The foundation was created by Neven Subotic, a professional soccer player at Borussia Dortmund. He works together with a team of employees and volunteers to raise donations for the foundation. Building a well costs €10,500 and takes 15 months—from the

search for a suitable location to the drilling of a hole and the installation of a pump. Subotic bears all of the administrative and travel costs.

Moreover, he and his team take advantage of every opportunity to pass on their water expertise to others. They invite adults and children to take part in water rallies. An example of such an interactive obstacle course can be found in the Westfalenpark in Dortmund. People who take part in the rally drill wells, pull buckets full of water out of a shaft, and carry 20-liter canisters. In this way, they learn what life is like if you can't simply turn on the tap when you're thirsty.

A black and white photograph of a woman with blonde hair, smiling broadly and looking upwards. A clothespin is clipped to her nose. She is wearing a white button-down shirt, a watch on her left wrist, and rings on her fingers. Her arms are crossed.

**“What draws
me to the sea
again and again
is ultimately
the magic of the
depths”**

LIVING WITH WATER

All of us need water in order to survive. But for some people, water means more—it's a purpose in life that inspires them to accomplish great things. These five outstanding individuals continue to remind us of the importance of water

The Diver

→ Normal diving is not enough for Anna von Boetticher, a freediver who explores the ocean depths.

How long can you hold your breath? Anna von Boetticher's record is six minutes and 12 seconds—underwater. At the age of 47, she is one of the world's best freedivers, or apnea divers. She holds 33 German records and one world champion-

ship. Apnea is defined as the temporary cessation of breathing. Before diving into the water, an apnea diver takes a deep breath that must be sufficient for the entire length of the dive. There's no oxygen tank to rely on—and that poses extreme and

life-threatening challenges for the human body. Ascending too rapidly to the surface can result in paralysis. Anna von Boetticher takes the risks in stride. She made her first dive at the age of 17, supported by scuba equipment. But

she soon decided that she needed a bigger challenge. "I simply wanted to know how much air I'd still have if something went wrong underwater," she said in an interview with the German newspaper *taz* in 2011. Freediving is her passion—but

her profession is quite tame. She owns a bookstore in Berlin. As a sideline, she teaches young frogmen in the German navy how to keep their wits about them while underwater.



“The ocean has opened up huge opportunities for me. I’m very grateful for that”

The Billionaire

→ At the age of 18, Kjell Inge Røkke went off to sea in a fishing cutter. Today he’s one of the richest men in Norway, and his ambition is to free the ocean of plastic particles.

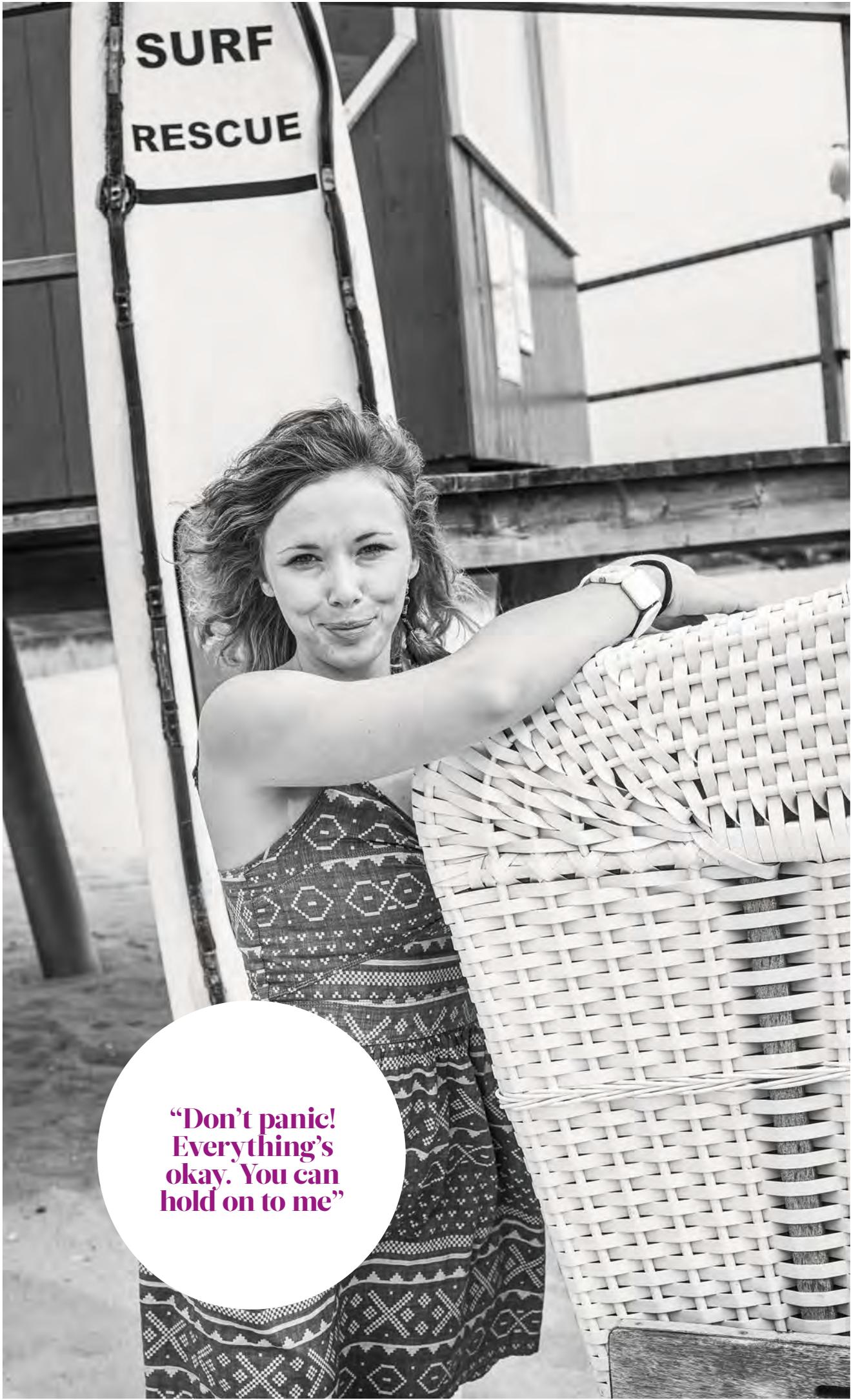
Toward freedom and adventure: Life on the high seas attracts people who want to be free of all constraints. One of these people was Kjell Inge Røkke, who left school in the early 1980s to cast fishing nets from a cutter off the coast of

Alaska. In this environment, Røkke soon developed a talent for business. As soon as he had saved enough money, he bought his own fishing cutter. The risk paid off: He soon became the owner of an entire fishing fleet, and he followed this up

by buying the shipyards where his fishing boats were built. In 1990 Røkke bought a controlling interest in Kværner, which was Norway’s biggest company at that time. The young school dropout who had become a fisherman was now one

of Norway’s wealthiest men. Today he has still not forgotten that he owes his wealth mainly to the sea. That’s why he has commissioned the construction of a 181-meter-long ship that will be able to dive to a depth of 600 meters and remove plastic

waste from the sea. In an interview in the Norwegian newspaper *Aftenposten*, Røkke explained, “I want to give back to society the bulk of what I’ve earned.”



**SURF
RESCUE**

**“Don’t panic!
Everything’s
okay. You can
hold on to me”**

The Rescuer

→ *Baywatch* is only a movie, but the beach in Hörnum on the island of Sylt is real. This is where 30-year-old Philine Häbich saves lives.

The ocean is beautiful, but it can also be life-threatening. Philine Häbich knows that from her own experience. A few years ago, as she was swimming alone in the North Sea, a current pushed her against a cliff. She managed to save herself with the last ounce of her strength.

Today Häbich is saving other people’s lives. Since 2013, she has been working as a lifeguard on the beach in Hörnum on the North Sea island of Sylt. While others swim for relaxation, she keeps a close watch. She often has to dive into the waves to save swimmers who have gone out too far and underestimated the strength of the current, or elderly vacationers who have a heart attack.

In such cases, a lifeguard has to not only make a supreme physical effort but also calm down the swimmer who is in trouble. “Many swimmers become panicky. I call out to them even before I reach them that everything’s going to be okay and they can hold on to me,” she says.

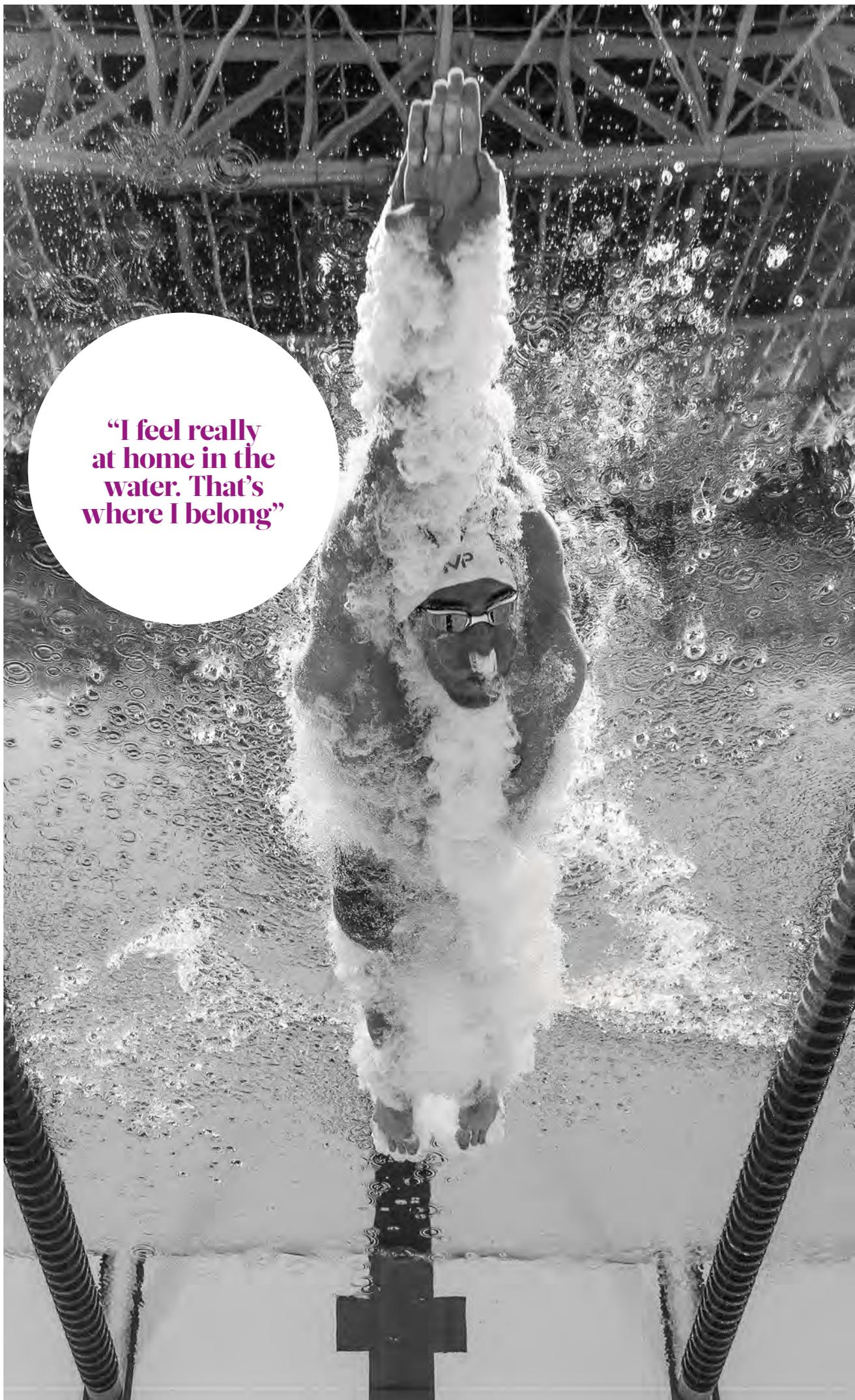
After the end of a two-year break to take care of her young son, she will return to her job next spring. In the winter she works in Berlin as a paramedic, and during the six months of spring and summer she lives in her camper van behind the dunes in Sylt. There the thunder of the waves wakes her every morning to a new day, new vacationers, and new emergencies.

The Athlete

→ Swimming pools are Michael Phelps' natural habitat: This is where he has won a whole series of gold medals.

Every sport has its undisputed champion: Pél  in soccer, Michael Schumacher in Formula 1 auto racing, Roger Federer in tennis—and Michael Phelps in swimming. This 32-year-old US swimmer has won 26 Olympic medals, including 22 in gold, thus setting a lasting record. Such an extraordinary career is possible only through rigorous training. "If I want something, I give it my very best effort, and then I achieve it," said Phelps in an interview in the German newspaper *Die Welt* in 2013. At the peak of his career, Phelps spent six days a week swimming laps. That requires not only discipline and a will of iron but also a passionate love of swimming: plunging into the water and gliding through it, always chasing after the next record. Phelps concluded his career at the Olympic Games in Rio in 2016 after standing on the winners' rostrum one last time—with a gold medal around his neck, of course.

"I feel really at home in the water. That's where I belong"



The Brewer

→ Beer brewing is an art. Susanne Horn uses only the best ingredients for her beer—and that also applies to the water.

The main ingredient of beer is neither hops or malt—it's water, which makes up 80 percent of its volume. As a result, water quality plays a crucial role in brewing, especially if the label on

the beer bottle has an organic seal of approval on it. Susanne Horn, the 43-year-old Managing Director of the Neumarkter Lammsbräu organic brewery,

therefore pays close attention to the source of her brewing water. She uses only water from an organically certified spring that runs 76 meters under the earth. The origin

of the brewing water influences the taste of the beer, she explains: "If we were to move our brewery to another region, our beer would have a different taste." Her predecessor

launched the first organic beer on the market back in the 1980s. Today her company is the most successful organic brewery in Germany.



“To make good beer you need high-quality brewing water. The spring makes all the difference”

THIRSTY INDIA

India's water scarcity is further aggravated by water pollution. But today "water heroes" are emerging all over the country. They want to restore to their fellow Indians a natural resource that the country actually has in abundance



Daily life
in India:
Lining up
for drinking
water

38 billion

liters of sewage are generated daily by India's major cities, according to the country's Central Pollution Control Board

Polluted water
causes skin
lesions



The status quo (1) Water scarcity

Early every morning, Sumathii, a domestic worker who lives in a slum in Mumbai, turns on the solitary faucet in her household

➔ On one of these mornings, she fills a large drum with water. She has only an hour to do this, because the faucet will be dry for the rest of the day. All the same, she's one of the lucky few.

Her neighbors across the road don't even have a water faucet in their homes. There, thirteen families share a public pipeline that provides water only between 11:30 p.m. and 1 a.m. Each resident is allowed to fill ten pots of water a day. But the families don't even have so many pots, so they have to go back and forth several times. Often, the water runs out before everyone has gotten his share. That's why each family gets to go first once in thirteen days. "This idea to form a sequence came about only recently, after years of fighting over water," explains Kaalima, who makes her living by washing dishes in prosperous households where water is always available. Basically, well-off Indians are also affected by the country's water scarcity, but they can deal with the problem by purchasing large quantities of water and storing it in tanks in their homes.

In another slum located 700 kilometers away in Hyderabad, the inhabitants face the same hardships as Kaalima. Here too, women stand in line in the early morning in order to fetch water from a communal supply point. For poor people in rural ar-

reas, the situation is even worse. The documentary film *H2wOe. India's Water Crisis: A Warning to the World* presents the water crisis in the Indian state of Punjab, which was once known for its abundance of water. Today, Punjabi farmers and other rural dwellers are going bankrupt because they can't afford to pay the exorbitant prices that are being demanded for water delivered from other regions. Some farmers are committing suicide in desperation because their crops are drying up and their debts are skyrocketing. According to WaterAid India, the Indian section of the international charitable organization WaterAid, the Indian states of Tamil Nadu and Karnataka are also facing high levels of water stress.

"India is one of the most water-challenged countries in the world, from its deepest aquifers to its largest rivers," says Puneet Srivastava, a Policy Manager at WaterAid India. "Groundwater levels are falling as India's farmers, city residents, and industries drain wells and aquifers. What water is available is often severely polluted. And the future may only be worse, with the national water supply predicted to fall 50 percent below demand by 2030, according to a report published by the McKinsey Global Institute."

The status quo (2) Water pollution

In India, water is already a rare commodity—but even the water that is available is not suitable for drinking

➔ Studies indicate that 80 percent of the country's surface water is contaminated—and that 80 percent of this pollution comes from domestic sewage. A WaterAid report estimates that about 140,000 children die from diarrheal diseases each year after drinking dirty water.

According to UNICEF, 20 administrative districts in India's most populous state, Uttar Pradesh, are affected by arsenic contamination. In the eastern parts of the state, including its capital city, Lucknow, the arsenic content of the groundwater is between 20 and 60 times higher than the permissible limit. The health effects of this pollution can be clearly seen on the skin of many local inhabitants, such as 40-year-old Ramesh Yadav. The palms of his hands are full of lesions caused by severe arsenicosis.

In other parts of the country, the situation is not much better. The Central Pollution Control Board of India has calculated that the country's major cities and towns together generate 38 billion liters of sewage every day. Only 30 percent of it is collected in public sewage systems, and less than 20 percent of this amount is treated by the available sewage plants. The remaining dirty water is invariably emptied into rivers, lakes, and ponds. The holy Ganges River has literally become a stinking sewer. The lack of dilution due to fresh spring water flowing into rivers is raising the degree of pollution even further. In addition, large quantities of fertilizer runoff from farming are entering bodies of water.

30

percent of sewage flows into the sewage system, and only 20 percent of this amount is treated

The causes: Growth and wastefulness

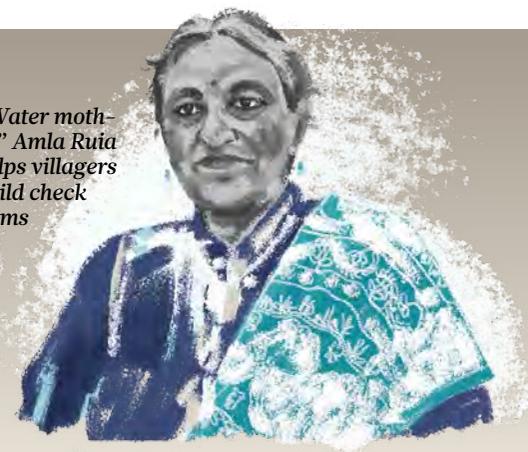
India's water crisis has a lot to do with the country's rapid industrialization—and with failure to use the resources systematically or even at all

→ “India is facing this acute water crisis because of several factors,” says Ayyappa Masagi. “For instance, Indians are not acknowledging that rainwater is our primary source of water.” Masagi, who is popularly known as a “water warrior,” is the founder of the Water Literacy Foundation and the Rain Water Concepts company. “Around 97 percent of rainwater is simply being al-

lowed to flow off into the oceans,” he says. He also cites wasteful water management as another reason for the crisis. “We have been treating water as a commodity and not as a resource,” he points out. Excessive deforestation is one result of this attitude.

T. Raghavendra Rao, the founder and Chairman of the Sustainable Technologies & Environmental Projects Pvt. Ltd. (STEPS) company, explains that even though the total amount of water within the earth's system remains fairly constant, population growth, the uneven distribution of water around the globe, environmental pollution, and the effects of global warming are contributing to water scarcity. “India is also being affected by rapid industrialization,” he says. “Industries such as food processing, power plants, textile mills, and paper and pulp manufacturers require vast quantities of water. The share of water consumed by these industries is so huge that not enough water is available to the populace and agriculture.” India accounts for only four percent of the world's water resources, but it has 16 percent of the world's population.

“Water mother” Amla Ruia helps villagers build check dams



The solutions High tech and mud

“There is hope,” says Rao, pointing out that India is well positioned because of its monsoon rains and the Himalayas

→ “However,” he cautions, “if we do not reduce water consumption by industry without lowering production, we are inviting trouble. Also, if we do not quickly find water-saving methods in agriculture without reducing yields, we will be in danger of scarcity. In short, we have to recycle water and stop the severe evaporative losses and pollution of water reservoirs.”

These goals are already being pursued. WaterAid is working in partnership with the Water Programme of the HSBC Bank to improve the supply of safe water in villages in the state of Uttar Pradesh, where pollution is especially high. Project workers test water quality and install filters to remove arsenic. Ramesh Yadav, the man with severe lesions on his hands, now fetches safe water from a well equipped with such a filter. Project coordinators such as Anand Singh even go to private households to conduct water quality tests.

In Uttar Pradesh, children can now be seen carrying safe water home in buckets. Together with its partner organization Shramik Bharti, WaterAid has repaired hand pumps in one community in the city of Kanpur. Still, it takes several hours for the community dwellers to collect a few buckets of water. The children often have to walk back and forth several times carrying their heavy buckets.

Through his Water Literacy Foundation and his company Rain Water Concepts, the “water warrior” Ayyappa Masagi is striving to restore the hydrological balance of the ecosystem by increasing “water literacy” and promoting efficient and sustainable water management practices. “If we can harness even just 30 or 40 percent of the available rainwater, we can uproot the water crisis that has been plaguing us,” he asserts. To implement his ideas, Indians are building rainwater harvesting systems. This includes digging pits in the earth to collect, filter, and store rainwater for immediate domestic use. The overflow is directed to borewells in order to recharge the groundwater. In Masagi's

97

percent of rainwater flows into the oceans unused, say India's “water warriors”



NGOs are providing children with clean drinking water

“Even if efforts are made by various agencies, it is not enough as long as the public is not involved”

T. Raghavendra Rao,
founder and Chairman of
Sustainable Technologies
& Environmental Projects
(STEPS)

**“Water Man”
Rajendra Singh
explains how to
build dams**



16

percent of the world's population lives in India, but the country has only 4 percent of the world's water resources

opinion, such seemingly simple solutions are more effective than megaprojects such as building huge dams and redirecting rivers. “We have had hundreds of success stories ranging from individual houses and apartments to farms and industrial companies—if they can have success, why can’t the rest of the country?” he asks.

The ambitious goal of this “water warrior” is to make India water-efficient between now and 2020. Although the country is still nowhere close to this goal, Masagi displays a “never say no” attitude as he promotes his vision.

Another such visionary is Rajendra Singh, who is known as the “Water Man of India.” In 2015 he was awarded the Stockholm Water Prize. He is working with villagers in the state of Rajasthan to build mud dams called *johads*—a traditional technique for collecting rainwater in artificial ponds. There are already more

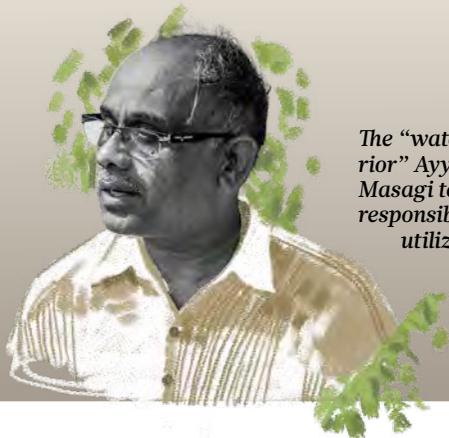
than 8,000 *johads* throughout the state, providing water to over 1,000 villages.

Another “water hero” working in Rajasthan is Amla Ruia, the “Water Mother of India.” She has transformed over 100 villages in the state by helping the villagers to install traditional water harvesting techniques and build check dams called *khadins*. Before her NGO, Aakar Charitable Trust, became active in the region, these villages were arid and dry. The check dams built by the villagers are small masonry structures buttressed by piles of earth. They are inexpensive to build and very effective, especially in hilly terrain.

In addition to this revival of ancient traditions, villagers are also using completely innovative methods, such as recycling “gray water.” Through his STEPS company, T. Raghavendra Rao has developed biological methods of treating wastewater that can be applied primarily

in factories and middle-class apartment complexes. Wastewater can be reused after being purified by means of Rao’s nano-oxidation technology, along with specially formulated bio-media carriers that remove bacteria. Other techniques help to remove contamination from bodies of water, using natural products and specific sound frequency generators that destroy algae and break up phytotoxins. “This non-chemical method improves water quality rapidly,” says Rao. “We also use other methods such as rapid flocculation and rapid oxidation.” Industrial effluents are treated with a combination of biological and chemical methods as well as oxidation.

In addition, there is always a strong focus on changing people’s attitude toward water. “Government agencies won’t accomplish anything if the public is not involved,” says Rao. “As long as people believe that water is free and available in unlimited amounts, nothing will change. Preserving and recycling water costs money, and the government must provide adequate funding. That’s the only way we will have a future.”



The “water warrior” Ayyappa Masagi teaches responsible water utilization



Usha Munshi, a journalist based in Mumbai, lives in a middle-class apartment complex where running water is available around the clock

Consequences for Global Policy

War over Water?

Hollywood has produced a number of films focusing on water in recent decades. In films ranging from *Chinatown* in 1974 to *Erin Brockovich* in 2000, the villains are unscrupulous businessmen who extract profits from this scarce resource or pollute the groundwater. In *Quantum of Solace* in 2008, James Bond fights a criminal syndicate that is buying up the water infrastructure in Bolivia. The dire visions of these movies reflect questions that many people are asking today: What will happen if at some point water is really no longer available in adequate amounts, or if it becomes too contaminated to drink? Will this lead to war?

➔ The International Resource Panel of the United Nations Environment Programme is predicting a gloomy future: By the year 2030, almost half of the global population will be suffering from water stress. In other words, about four billion people will be forced to make do with less than one million liters of water per person per year. That sounds like a lot, but it means that because of the high levels of water consumption for agriculture in many parts of the world, more water will be needed than is available—especially in the hot summer months. What’s more, water quality is sinking.

The water crisis in agriculture

In order to visualize this situation, we need to take a closer look at water. We drink between two and three liters of water every day. A person living in an OECD country uses between 120 and 150 liters of water for cooking, showering, and washing every day. But most of the water we use is in our food. This means an average person actually uses between 2,500 and 5,000 liters of water per day, depending on his or her appetite for meat. This “virtual water consumption” takes place on our dining tables. We also have to consider how much water we actually use. Whereas very little of the water we use for drinking, cooking, and showering evaporates, plants consume water through evapotranspiration. This means that we don’t save any water if we only take quick 30-second showers, because very little water evaporates during this time. Our breakfast bacon has more serious consequences, because the feed we cultivate for farmed animals requires huge amounts of water. As a result, the water crisis is an agricultural issue. About 99 percent of our water resources are consumed by the plants we use to produce food for ourselves and our farmed animals. That’s why countries with a large agricultural sector are especially prone to conflicts. Many analysts believe that water is the new oil. Are they right?

Controversial agreements

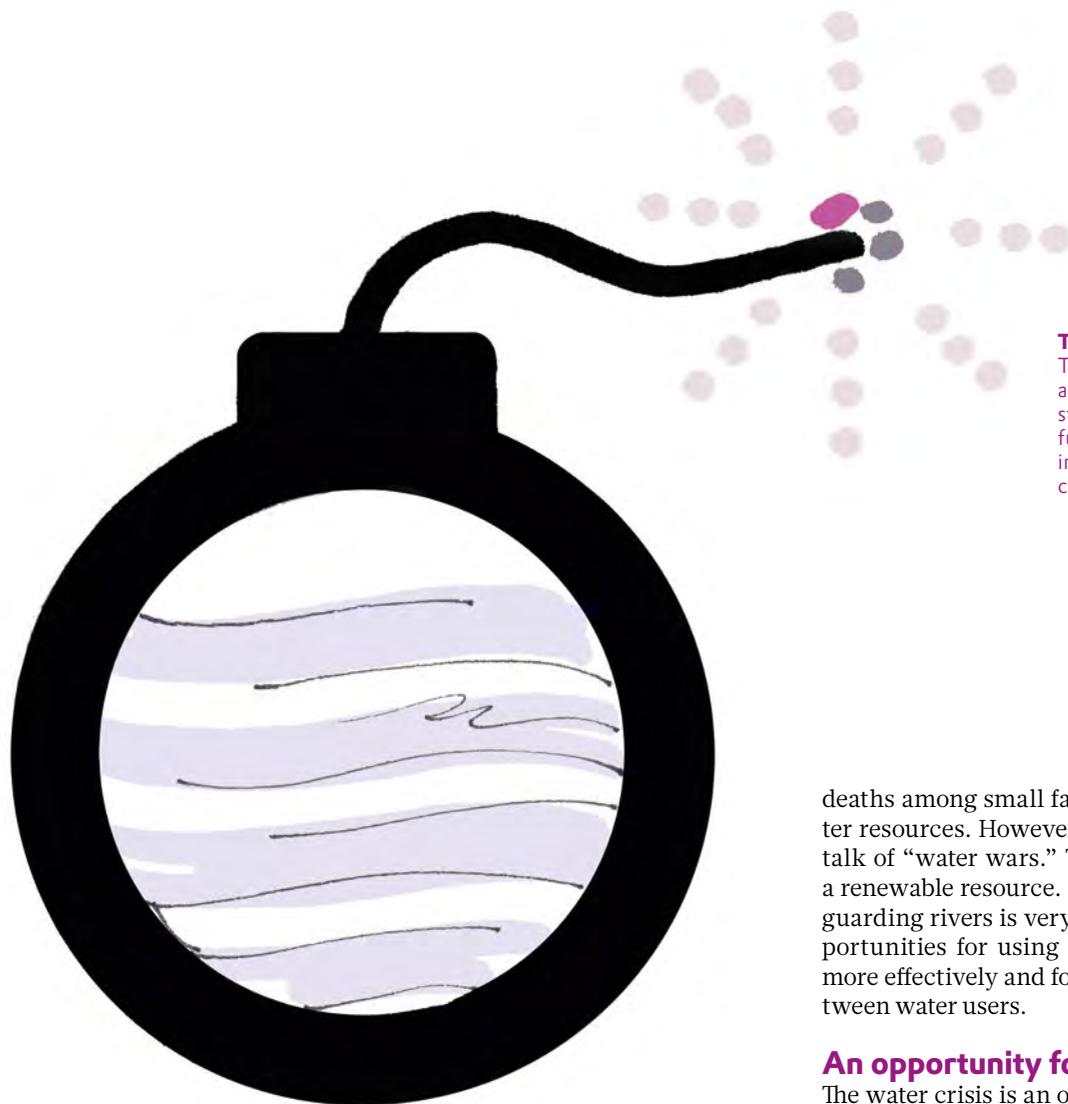
Today we’re already seeing water hotspots all over the world—places where water resources are becoming very scarce. In most of these cases, irrigation farming is playing a crucial role. For example, it affects surface waters such as the Aral Sea in Central Asia, which has almost completely disappeared since the 1970s. The reason

it has dried up is the large-scale cultivation of cotton, which was irrigated by water from the Aral Sea. Another thorny issue is that of surface waters that cross national boundaries. This pertains to rivers in particular. Egypt is one of the countries that are most strongly impacted by this problem. The Nile Delta in northern Egypt, which has been extremely fruitful for thousands of years, is fed by the world’s second-longest river. The 84 billion cubic meters of water that flow down the Nile every year were divided between Egypt and Sudan at a ratio of 80 to 20 by the Nile Waters Agreement of 1959. The reason for this ratio is that the northern part of the Nile Basin has no precipitation, whereas the southern part does. However, this agreement has always been controversial, especially because the countries in which the headwaters are located wanted to safeguard its citizens’ food supply by means of modern irrigation systems. This is why Egypt has declared the Nile to be a strategic resource, for which it would even wage war if necessary.

Climate change—more regional droughts

All over the world, groundwater levels are sinking and increasingly making water a resource in crisis. The global expansion of irrigation agriculture based on the use of groundwater has lowered groundwater levels throughout the world. The best-known examples are in the Punjab region of India and the West and Midwest of the USA. Groundwater levels in Punjab have sunk by as much as 65 percent because hundreds of thousands of small farmers use it to irrigate their water-intensive rice crops. The Ogallala aquifer provides water for irrigation agriculture in the US states of South Dakota, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas. Between 2001 and 2011 its cumulative level sank as much as it had done during the entire 20th century. The groundwater level has risen slightly since 2011, but if the Ogallala aquifer should ever dry up completely, it would take 6,000 years for rainfall to fill it up again through natural processes.

Climate change is a complicating factor. One of its most important consequences will be the higher variability of precipitation. Researchers at the University of Reading in the UK are observing a trend which indicates that humid regions will receive even more precipitation in the future. Other regions that are already very dry, such as the Middle East and the Horn of Africa, will ex-



The water bomb

Today many countries already regard water as a strategic resource. In the future its significance for international relations will continue to grow

perience more droughts due to climate change—along with all the possible consequences regarding migration and internal conflicts.

A further problem is the decline in water quality. In Germany, researchers and ministries are observing high levels of nitrates in groundwater as a result of pollution by fertilizer runoff. But this is a small problem by comparison to China, where 80 percent of the groundwater is so severely contaminated that it can no longer be consumed by human beings without a health risk. This is a challenge even Erin Brockovich couldn't overcome.

Water is becoming scarcer, dirtier, and more fiercely contested. The creators of the James Bond thriller were inspired by the conflicts over water in Bolivia that hit the headlines in 2000. Low levels of precipitation due to climate change and poor management of the water infrastructure were motivating water utility companies there to raise their prices by as much as 300 percent. This had been preceded by the privatization of water networks under pressure from the World Bank, which expected the market to regulate increasingly scarce resources and create a better price structure. The result was months of unrest and several deaths, until the government reversed the privatization of the water infrastructure and invested in the water infrastructure itself.

Will this Bolivian scenario be duplicated in many countries all over the world in the coming decades? It's true that in sub-Saharan Africa there have been many

“Water is growing scarcer and more fiercely contested”



Martin Keulertz is an Assistant Professor at the American University of Beirut. Born in Düsseldorf, he has worked on global and local water issues in the UK, USA, Ethiopia, and Berlin

deaths among small farmers fighting for access to water resources. However, it would be an exaggeration to talk of “water wars.” Thanks to precipitation, water is a renewable resource. That's why the prospect of tanks guarding rivers is very unlikely. Besides, there are opportunities for using our worldwide water resources more effectively and for improving the cooperation between water users.

An opportunity for innovations

The water crisis is an opportunity for collaboration between nations—especially those with less developed diplomatic relations. The countries along the Nile could achieve much more together if they would manage their resources cooperatively. In addition, in countries all over the world—in eastern Europe, northern Asia (Russia), and sub-Saharan Africa—there is enough room to expand agriculture because of high levels of rainfall and fruitful soil. But in order for this to happen, we need free and open agricultural trade so that water-poor regions such as the Near East and expanding economies such as China and India can satisfy their demand for food in spite of their water scarcity. If we are to feed the growing global population in the year 2050, there is no alternative to this “virtual trade in water.”

Besides, the water crisis is an opportunity. In order to manage and conserve our water resources more effectively, we need new technologies such as more drought-resistant seed stocks and computer-controlled precision irrigation of fruit plants. We also need to find alternatives to meat, which is a major consumer of water. About 70 percent of the land area taken up by global agriculture is used for meat production. The production of one kilogram of beef requires 16,000 liters of water. The world is facing a technological race to find alternatives to meat. The success of these technologies would be a blessing for the world's water resources, because the production of plant-based alternatives to meat requires only about one tenth as much water as meat production. Some people regard this as fraud against consumers; others would welcome it as a key innovation for avoiding a worldwide water crisis. ●



Our lives depend on water: We drink it, wash with it, swim and splash in it, conduct scientific studies of it, use it to produce energy and food, and hallow it in rituals

Source of Life



Ama women hold torches as they swim in the water and set off fireworks. “Ama” is the Japanese word for pearl divers, who are usually women. Here they are celebrating the Shirahama Ama festival in Minamibōsō, a city in Chiba Prefecture in the eastern part of Honshu, the main island of Japan



The (partially) living desert. Without irrigation, the entire Imperial Valley would look like the area to the right of the river. There would be no settlements or agriculture, because this valley in southeastern California is basically about as dry as the Sahara Desert. Fortunately, the region's inhabitants hold extensive water rights. During the recent drought period, selling these rights earned the owners more than they would have gained by cultivating the fields themselves



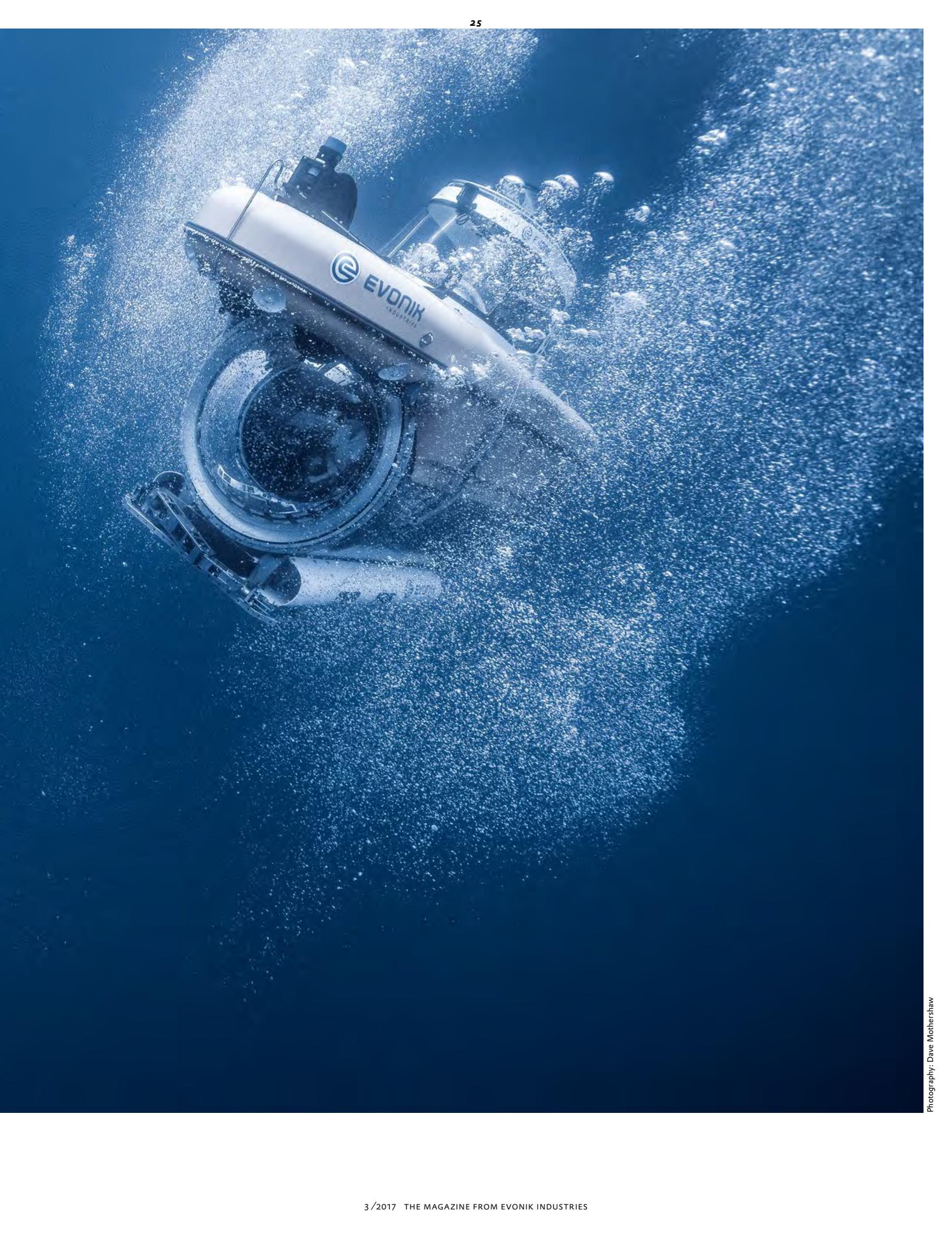
Photography: Edward Burtynsky



This photo by the world-famous photographer Ed Burtynsky is from his book Water, published by Steidl Verlag



*Filming the second part of the BBC documentary **Blue Planet** with the British animal filmmaker and natural scientist Sir David Attenborough. The cameraman can only dive to a depth of 40 meters. By contrast, the LULA 1000 submersible of the Rebikoff-Niggeler Foundation can film at depths of up to 1,000 meters—through a 14-centimeter-thick high vision beacon of PLEXIGLAS made by Evonik*



Photography: Dave Mothershaw





Photography: AP

An archive for water that has turned into ice: At the US National Ice Core Laboratory in Lakewood, Colorado, thousands of ice cores are stored at a temperature of -36°C . They were extracted from the deep layers of ice covering Antarctica and Greenland. At the laboratory they are cut open, photographed, and analyzed. This is how scientists gain information about the earth's ancient history as well as climate change

Facts + Figures

SUPERLATIVE
Perfectly clear



The best tap water In Vienna, the water comes from a mountain spring and is directly channeled to the city's drinking water network through a raised pipe



The costliest mineral water A liter of Rokko No Mizu costs only €1.50 in Japan, where it is produced, but up to €128 in German bars



The cleanest lake Blue Lake in New Zealand is as clear as distilled water, because landslide debris filters out all suspended particles



The freshest seawater It's contained in salt-free "bubbles" on the ocean floor (e.g. off the coast of Australia). Researchers regard these bubbles as reserves of drinking water



Wearing jeans longer to waste less water

Cool jeans are supposed to look old and worn. To achieve this effect, new jeans are given a used look. The chemical processes that are used to create it are extremely detrimental to the environment and require huge amounts of water. It is estimated that every pair of jeans produced in this way consumes up to 11,000 liters of water before it can be sold in a store.

The biggest amount of water is required for the extensive irrigation of the cotton fields and the production

of the associated pesticides. However, the young US textile company Evrnu has developed a solution. On behalf of the Levi's jeans brand, this start-up company from Seattle has come up with a method for producing denim fibers completely from old cotton fabrics. The effect is twofold: Water consumption is reduced by 98 percent, and this prime example of recycling has great potential for widespread use (11 million of the approximately 13.1 million tons of waste textiles in the USA are disposed of every year).

The time-honored Levi's label is the world's first company to take this sustainable approach, which is initially being used for its 511 series. For some time now, small labels such as SEY and Kuyichi have been producing "organic jeans" by means of environmentally compatible processes, for example by avoiding chlorine bleach. Consumers have a choice. The best way to save water is to stop buying "used look" jeans and simply wear a pair of jeans long enough until time wears it out naturally.

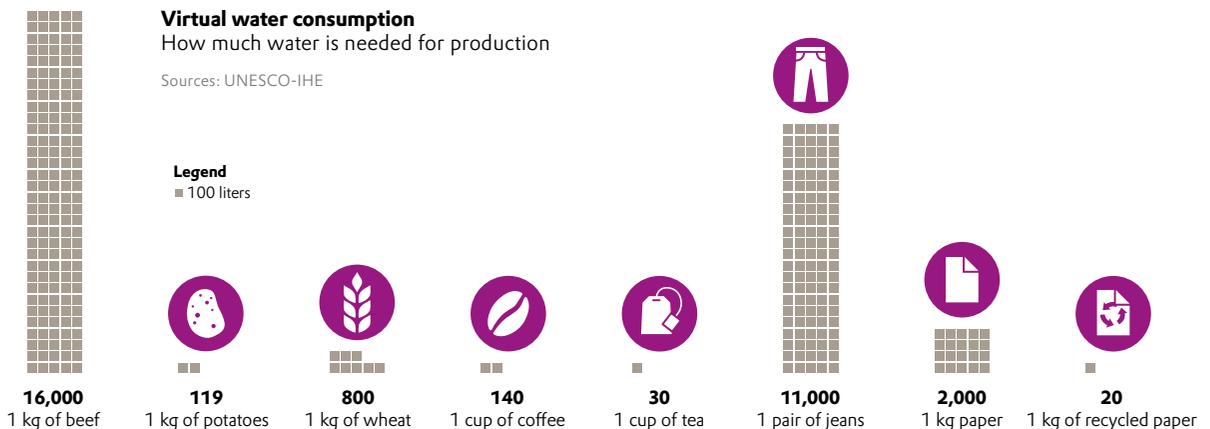


Virtual water consumption

How much water is needed for production

Sources: UNESCO-IHE

Legend
■ 100 liters



Big differences

Water prices in selected cities in 2014
Amounts in US dollars per cubic meter

Sources: Fortune
(Brainstorm Green)



Water is not only vital to life—it's also becoming increasingly valuable. Investors know this very well, and they're making big profits with "blue gold." How does this work?

Water is a scarce resource. Even though around 70 percent of the earth's surface is covered by water, only one percent of this amount is usable freshwater. Moreover, the growing world population is causing global thirst to increase as well. This is making "blue gold" increasingly valuable—not only for consumers but also for investors on the financial market.

Indirect buying
Unlike gold or grain, water can't be directly bought and stored. And unlike crude oil, there is no globally valid price for water. If you want to invest your money in water, you have to do so indirectly—by

buying securities in water businesses ranging from private water suppliers and wastewater treatment facilities to seawater desalination plants, manufacturers of pumps and filters, and mineral water companies. It is estimated that the global water market has had a volume of around €500 billion in recent years. This market is expected to grow by six percent annually. Investors can benefit from this development by buying shares in individual water-related companies or in water funds.

A raw material for everyone
But is it ethically justifiable to make

a profit from a vital resource such as water? For example, what happens if a water supplier offers drinking water at disproportionately high prices? The ESG (Environment, Social, and Governance) criteria provide transparency in this area. Funds that bear this label take into account factors such as environmental sustainability, human rights, and investor protection. These standards can provide orientation for people who would like to invest their money effectively while helping to improve the global supply of water.

3 QUESTIONS FOR

Walter Hirche
"Use wastewater as a source of raw materials"



1 According to a UN survey, almost 80 percent of all the jobs in the world are dependent on water. In your opinion, what are the consequences of this fact?

The increasing scarcity of water requires more investments in the modernization of an aging and inefficient water infrastructure and an increase of trained workers in the water supply sector. We need to transition to a green economy in which water plays a key role.

2 The United Nations World Water Development Report for 2017 focuses on wastewater issues. Why?

If wastewater is not properly treated, it does harm to people, the environment, and the economy. But we have to do more

than just processing wastewater correctly. We also have to use innovative projects to produce energy and raw materials from wastewater.

3 What specific measures and technologies do you recommend?

Let me give you an example. About 22 percent of the phosphorus consumed worldwide today could be extracted from human urine and feces. Phosphorus is a finite resource that is used in fertilizers and has already been greatly depleted. There's considerable development potential here.

Walter Hirche is a member of the Executive Committee of the German Commission for UNESCO and was its President from 2002 to 2014.

6,000
liters of water per second were consumed in Munich during the half-time break of the final game of the 2014 World Cup. Only 2,000 liters were consumed during the playing time

SPARKLING SUCCESS

The triumphal march of mineral water began back in the 1970s with a legendary filmmaker: How clever marketing turned a niche product into a mass phenomenon

→ Orson Welles is notorious for his 1938 radio adaptation of *The War of the Worlds*, a drama about extraterrestrials landing in the USA. And he's famous for his movie *Citizen Kane*, which can still be found today on every serious list of the top ten films of all time. Nonetheless, most people are not aware that Welles also helped to transform mineral water from a niche product into a mass phenomenon.

In the 1970s, this brilliant artist was not doing well financially. He was accepting every job that could earn him a few dollars. That's why he agreed to do a TV commercial for the French mineral water brand Perrier, which was aiming to expand its foothold in the US beverage market. Perrier sales were lagging far behind expectations. In the mid-1970s the brand was selling only about 2.5 million bottles a year. Enter Orson Welles. According to *The Guardian*, his Perrier commercial was "one of the greatest moments in the history of narrative advertising." Welles' rich theatrical voice intoned that only nature can create a product like Perrier: so refreshing and "naturally sparkling, from the center of the earth."

High margins

Thanks to this great but impoverished filmmaker, a huge advertising budget of \$5 million, and sponsorship of events such as the New York Marathon, by the end of the 1970s Perrier was already selling 75 million bottles a year in the USA. Drinking "the Champagne of table waters" was regarded as chic. Whether in the restaurants of New York City or the clubs of Los Angeles, choosing the right bottled water was suddenly almost as important as selecting the perfect wine. The trend soon reached Europe as well. Companies ranging from Coca-Cola to Danone were starting to realize that water was a product like any other—with the crucial difference that the profit margins for water were far higher. Water could be sold in massive quantities by running aggressive marketing campaigns by means of commercials, billboards and, to use a contemporary term, influenc-



Mineral water has become a lifestyle product that is synonymous with health and fitness

ers—famous men and women who were photographed just as they happened to be holding a bottle of expensive mineral water.

In recent decades, no other group of beverages has grown as dynamically worldwide as mineral water. Starting in the 1980s, major food and beverage companies took advantage of this trend, which gained even more momentum through the introduction of the PET bottle. These companies either launched their own brands of mineral water on the market or followed Nestlé's lead by acquiring existing brands such as Perrier. Today Nestlé, the world's biggest food corporation, has annual sales of 7.4 billion Swiss francs from mineral water alone.

149 liters per capita

Many well-known mineral water brands are named after their places of origin, such as Evian, Vittel, Volvic, Selters, and Gerolsteiner. These names are associated with athleticism, health, pristine nature, and purity. And if the producers were forced to get their water from another source, they would have to change the name of their product. Consequently, the producers are helping to protect the landscape around their springs.

For example, Evian water comes from the surroundings of Évian-les-Bains, a small town in Savoy, Europe's highest-altitude region. This is also the region that produces Reblochon de Savoie, a famous cheese made of raw cow's milk. Obviously, cows produce not only milk but also manure. In order to prevent the nitrates in cow manure from contaminating Evian, their premium product, Danone has become proactive and launched the initiative Terragr'Eau. Since the beginning of 2017, the initiative has been operating a center where farmers can bring their manure and have it converted into biogas. In addition, 36,000 tons of organic fertilizer are produced annually, and the nitrates no longer seep into the soil.

In 1970 the per capita consumption of medicinal and mineral waters in Germany was 12.5 liters per year. In 1990 that figure had already increased to almost 83 liters, and today it is about 149 liters, according to the Association of German Mineral Springs (VDM). Wibke Spießbach from the VDM believes that German legislation has been an important growth driver for the industry. "Reductions of the legal blood-alcohol limit for drivers have benefited mineral water. In 1973 the limit was reduced from 1.5 to 0.8



“Tap water isn't something you drink for pleasure”

Arno Steguweit

tenths of a percent, and in 2001 it went down to 0.5 tenths of a percent,” she says. “Mineral water became an accepted drink on social occasions and was no longer associated with self-deprivation.”

Mineral water consumption in the USA also averages out to about 149 liters per capita per year. Last year was the first one in which Americans drank more bottled water than soft drinks such as coke and lemonade. The US market research company Zion predicts that the global mineral water industry will have annual sales of \$280 billion in 2020, compared to about \$170 billion in 2014.

The range of brands is very wide. Discount stores offer mineral water for a few cents per liter, while the brands at premium supermarkets cost a few euros per liter. Consumers can buy water from a spring in their own region, from a Norwegian glacier, or from the Arctic wilderness of Lapland. Water containing vitamin supplements is sold and marketed as a fountain of youth. Water is available in chic plastic bottles, in cans, and even in bejeweled glass flacons. But whether mineral water comes from the local region or from far away, and no matter whether it costs a lot or a little, it's always far more expensive than water from the tap. In Germany, tap water costs about 0.2 cents per liter, and in the USA it costs a bit more.

But is mineral water really better than tap water? “No,” says Arno Steguweit, Germany's first water sommelier, who for many

A tip from the water sommelier Arno Steguweit: “The water should match not your food but your wine”

years recommended the appropriate water for each specific wine at the restaurant of the Adlon Hotel in Berlin. “The prices of mineral water don't correspond to the quality of the product but rather to its origins and its marketing.” All the same, Steguweit doesn't drink tap water. “I use it for cooking,” he says. “It isn't something you drink for pleasure.” The pleasure he refers to is not easy to define. Steguweit points out that because mineral water cannot be smelled or tasted, it has to be felt. “That's why every evaluation is very subjective. There's no right or wrong, and there is no one true table water.”

Steguweit has opened his own online business, which sells not only wine but also water, including exotic brands such as one that comes from the Fiji Islands. “I'm a regionalist, but I also like to try out new things,” he says. Variety and choice are important reasons why people drink mineral water. In addition, it's a source of prestige, because people think it's something special to drink a rare mineral water from Japan. Another important factor is the health aspect, which many companies emphasize in their marketing campaigns. In an article in the newsmagazine *The Week*, John Jewell writes that it was “the marketing trick of the century” to convince consumers that mineral water is the healthy alternative to sweetened soft drinks, even though mineral water is actually competing with tap water. This fact was already confirmed in 2000, when the Vice President of PepsiCo at the time, Robert S. Morrison, declared, “Our biggest enemy is tap water.”

Free of charge in restaurants

Incidentally, tap water fills many of the water bottles that are sold under exotic names for high prices. Almost a quarter of the bottled waters on the market are neither mineral, medicinal nor spring water. And good restaurants in countries such as Sweden, France, Italy, and the USA offer tap water free of charge. However, restaurants in Germany are reluctant to dispense with the additional source of income represented by mineral water. Recently the actor Til Schweiger hit the headlines because of an item he offers in his restaurant in Hamburg: tap water called “Barewater – finely filtered drinking water from Hamburg.” It costs €4.20 per liter, a markup of 210,000 percent. Yet another example of brilliant marketing. ●

Christoph Bauer, Marcus Müntefering

A Commodity or a Human Right?

Who owns water? Benjamin Adrion from Viva con Agua and Achim Drewes from Nestlé discuss one of today's most important issues



Achim Drewes (left) and Benjamin Adrion during the Evonik debate at the headquarters of Nestlé Germany in Frankfurt

➔ **Both of you sell water. Mr. Adrion, you sell water in order to finance the digging of wells and other measures. Mr. Drewes, for Nestlé water is a product that accounts for about seven percent of its total sales. Do the two of you nonetheless have anything in common?**

Drewes: Our aim as a company is to jointly generate added value. That applies to the communities located near our locations and our supply chains and to the relationship we want to have with consumers. Even though one could say that building wells and toilets in remote villages isn't one of the essential tasks of a food manufacturer, we've been doing it for years as part of our location and supply chain programs for years wherever it's necessary. So it's quite possible, Mr. Adrion, that in some areas your activities and ours are having the same results.

Adrion: I completely disagree with you. I won't let you co-opt me that quickly. It's misleading to claim that the basic objectives of Nestlé and Viva con Agua are similar. All of our actions are motivated by the desire to provide everyone with access to clean drinking water and basic sanitary facilities. The difference between our two organizations is that we are using our money to realize our vision of "water for all." Our activities focus on non-governmental organizations that promote water projects all over the world. We are supported by a huge network of volunteers who work with enthusiasm to help us achieve our vision. Like Nestlé, we also sell a brand of mineral water. However, we don't want to extract water in regions where it is scarce. That's another one of the differences between us.

Drewes: That's not quite true. Nestlé doesn't bottle water from areas where it is scarce or where there is drought. It's true that we also operate in countries that suffer from water scarcity to some extent or where access to the public water supply is insufficient. However, our facilities are located in areas where sufficient water is available over the long term. Moreover, we make sure that these facilities don't have any negative effects. We obviously won't build an expensive bottling plant in a drought area or in a location where the plant would have to close down after five years because of a drop in the groundwater level.

Mr. Adrion, you bottle water exclusively in Germany. Could you also imagine bottling water in the countries in which you are active?

Adrion: It's relevant to ask us whether we should supplement our activities in countries such as Ethiopia, Nepal, and Uganda with projects such as bottling a "socially beneficial mineral water." After all, we are more than just an NGO that raises money to build local wells. We are creating an international community of students, musicians, and artists who identify themselves with our vision and our activities and say that they are also part of Viva con Agua. Nonetheless, we wouldn't bottle water in countries such as Ethiopia. One reason for that is the water scarcity in these re-



Achim Drewes and Benjamin Adrion together with Evonik editors Christof Endruweit (right) and Marcus Müntefering

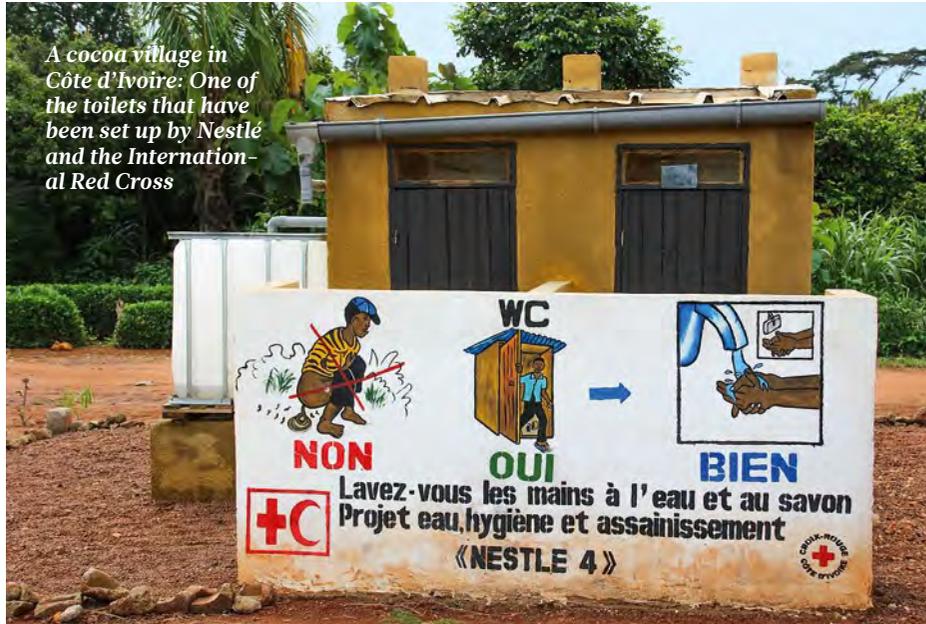
gions. Another reason is that we are clearly saying that there will never be any Viva con Agua plastic bottles in countries that don't have an effective recycling system. Plastic bottles cause a gigantic garbage problem, and we don't want to be part of it.

On principle, we don't want to compete with the basic water supply system of the people in arid regions. And of course the problem isn't just the bottling of water. An even more serious concern is the agricultural sector, which consumes most of the water. This is a sector in which Nestlé, for example, has been active for the past 150 years. During that time, global water consumption has increased dramatically, and today we have reached the limits of our planet's capacity.

Drewes: This is a fascinating topic. Who is responsible for regulating the use of water? Who is creating the framework? What are the resulting requirements? If you want to earn money with water—and that's what Nestlé wants to continue doing—you have to fulfill certain requirements so that you have social permission to do your work. In other words, we have to not only address environmental issues but also make sure that water is available as a human right at all of our locations. If this is not the case, companies should help to reduce this gap, for instance by initiating programs regarding water and sanitary facilities. We're doing that, but of course we always have to ask ourselves whether we've done enough. However, more than anything else we need clear and concise regulations from governments, especially those of developing countries, where there are no water treatment systems and where agriculture and industry are contributing to water pollution. There have to be controls, water usage rights must be clearly organized, and everyone who uses a shared water source has to contribute to the process of finding joint solutions. That includes the agricultural sector, which is the main consumer of water. We are implementing capacity-building measures in many countries, and we're helping farmers to use water, which is a scarce resource, more efficiently and more responsibly. ➔

"All of our actions are motivated by the desire to provide everyone with access to clean drinking water" Benjamin Adrion, Viva con Agua

“If you want to earn money with water, you have to fulfill certain requirements so that you have social permission to do your work” Achim Drewes, Nestlé



A cocoa village in Côte d'Ivoire: One of the toilets that have been set up by Nestlé and the International Red Cross



Achim Drewes is the Head of Public Affairs at Nestlé Germany. Among other things, he is responsible for communications with governments, NGOs, and associations. Nestlé is the world's largest food manufacturer. Its headquarters are in Vevey (Switzerland). In 2016 the company's water business accounted for 7.4 percent of its total sales of €82.4 billion. Nestlé's best-known water brands include S. Pellegrino and Vittel

→ **Adrion:** It's obvious that a company is not directly boosting its own profitability if it implements such measures or fulfills its moral obligation to enable the people living near its facilities to live under humane conditions with regard to water supplies, for example. Don't such activities create a potential conflict with the company's business goals? And couldn't a company be tempted to abandon such minimum social standards in order to gain bigger profits? In that case, the rationale might be "We will only do the minimum that's necessary to safeguard our success in this region and to maintain our good public reputation." I also find it interesting that you say that governments should regulate water use more strictly. Doesn't that run counter to your company's strategic interests, which would benefit from the elimination of trade barriers, the reduction of customs duties, and the liberalization of the market?

Drewes: There's no contradiction here at all. A company such as Nestlé, which is active in many regions, always has an interest in having clear rules that can provide it with orientation. This is the only way we can do reliable planning. For us, it's crucial not to have any erratic fluctuations or interruptions of our trade relations. In this respect, Nestlé is clearly in favor of free trade.

Adrion: I detect an interesting discrepancy between your company's efforts to influence economic policies, on the one hand, and your call for government regulation, on the other.

Drewes: I don't think it's fundamentally wrong for companies to participate in the shaping of economic frameworks. With regard to the regulation of water consumption, all of the users within a water catchment area need to have clear rules concerning how much water they are allowed to extract under what kinds of environmental restrictions. This is necessary in order to make sure that nobody uses more than they are allowed to or more than is sustainable.

Reliable planning and definite rules—are these concepts important for your international activities as well, Mr. Adrion?

Adrion: We operate very much at the level of civil society, and we have comparatively little contact with governments or with local public institutions. The systemic problem that I see with regard to global regulations is that industries, including transnational food companies, exert their influence on these regulations through processes that are not transparent and that serve the interests of the industrialized nations. There is a danger that companies will always be a step ahead of governments and that they will exploit the existing gaps for their own benefit and to the detriment of the local population. This danger is especially great in Africa, where in many cases the competition laws and the local administrations are less developed than they are in Europe.

Drewes: I would like to differentiate that a bit. Civil society has very high expectations about the extent to which companies can help to solve global problems. I think that companies such as Nestlé definitely have the means at their disposal to make global challenges smaller and that it is our duty to make a visible and transparent contribution to the way specific issues are addressed. Moreover, when we develop a new plant site we adhere to high environmental standards.

Adrion: By that you mean Nestlé's own standards...

Drewes: Yes. We regard them as minimum standards that are just as binding as legal requirements. More specifically, this means that we don't release untreated water into the environment, for example. We build our own sewage treatment facilities, if necessary. Doing so can also have a positive impact on the surrounding region.

How do you assess such measures, Mr. Adrion? What do you think should be done?

Adrion: The creation of a sustainable world is the most important task that future generations will have to accomplish. And there's still a great deal to be done. We are living beyond our means when it comes to the consumption of our resources, and that especially applies to water. If things continue the way they are going now, we won't be able to avoid disaster for very long. Today we would already need the natural resources of four planets in order to meet our current demands. Do people really believe that increased growth is still the answer?

Drewes: We agree on one point. We are in a situation where consumption and agricultural production patterns are not sustainable. Although the Sustainable Development Goals are by no means perfect, they provide us with a framework that actually should help to get industry, civil society, and, last but not least, governments—which continue to have the most responsibility for development policies—to commit themselves to shared goals.

Adrion: I'm astonished to see the way you are now transferring the responsibility to governments. It would be wonderful if a company like Nestlé were to focus on these shared goals simply on its own initia-



A well in Nepal, where Viva con Agua started a project in 2014. The focus is on schoolchildren

tive. In the final analysis, are you saying that you're merely selling whatever customers want?

Drewes: No. Governments are clearly responsible for setting the goals of development policies, but everyone else, including industry, has to contribute to the achievement of these goals. The Sustainable Development Goals provide us with a shared set of objectives that is also widely accepted by the business community—which you are demonizing here. And this is an opportunity to achieve something together.

Adrion: I'm not demonizing the business community. I don't want to make sweeping statements, but I do want to ask some questions. How did we get ourselves into this situation? And what do we have to do in order to improve this process in some way? How can we structure our economy in such a way that it becomes "fit for our grandchildren," as Richard David Precht has put it? In this regard, I have my doubts whether global companies, which are ultimately controlled by anonymous shareholders, are sufficiently able to fully take the consequences of their actions into account. At the end of the day, they give their highest priority to their annual business results.

Mr. Drewes, in 2010 the United Nations recognized that water is a human right. The number of people who have access to clean water has increased significantly since then. Would you call that a success?

Drewes: Yes, even though it's probably more the result



Benjamin Adrion, a former soccer pro, founded Viva con Agua de Sankt Pauli in 2006. The organization's vision is a world where everyone has access to clean water and basic sanitary facilities. To realize this vision, it collects donations in creative ways. For example, it has been bottling and selling a "socially beneficial mineral water" since 2010. Viva con Agua has so far helped two million people worldwide through its water projects

of development processes than of the formal recognition that water is a human right. But it was a logical step to give the human right to water a special status, because it increases public awareness of this issue. However, this measure does not impose any specific obligations on the various players. We are trying to break down these obligations into specifics for our own activities. We do this by implementing community-based programs near our facilities or by having plants that are located in regions suffering from water stress certified according to the new standard of the Alliance for Water Stewardship.

Adrion: On the one hand, it's a fact that the number of people who do not have access to clean water has been cut in half over the past ten or 15 years. But on the other hand, nobody knows how the overall climatic conditions will develop and what consequences these developments will have. Climate change is already having massive effects on the availability of water all over the world. We are already reaching the limits of our planet's total carrying capacity, especially with regard to the water that is being used by agriculture and industry. "Virtual water"—in other words, the water that is consumed in the process of manufacturing products—plays an important role in this respect. We are currently not managing to use water sustainably within the overall framework of our consumption. In the future, this can definitely cause the number of people who have access to clean drinking water to decline once again, and it can also have many other negative consequences.

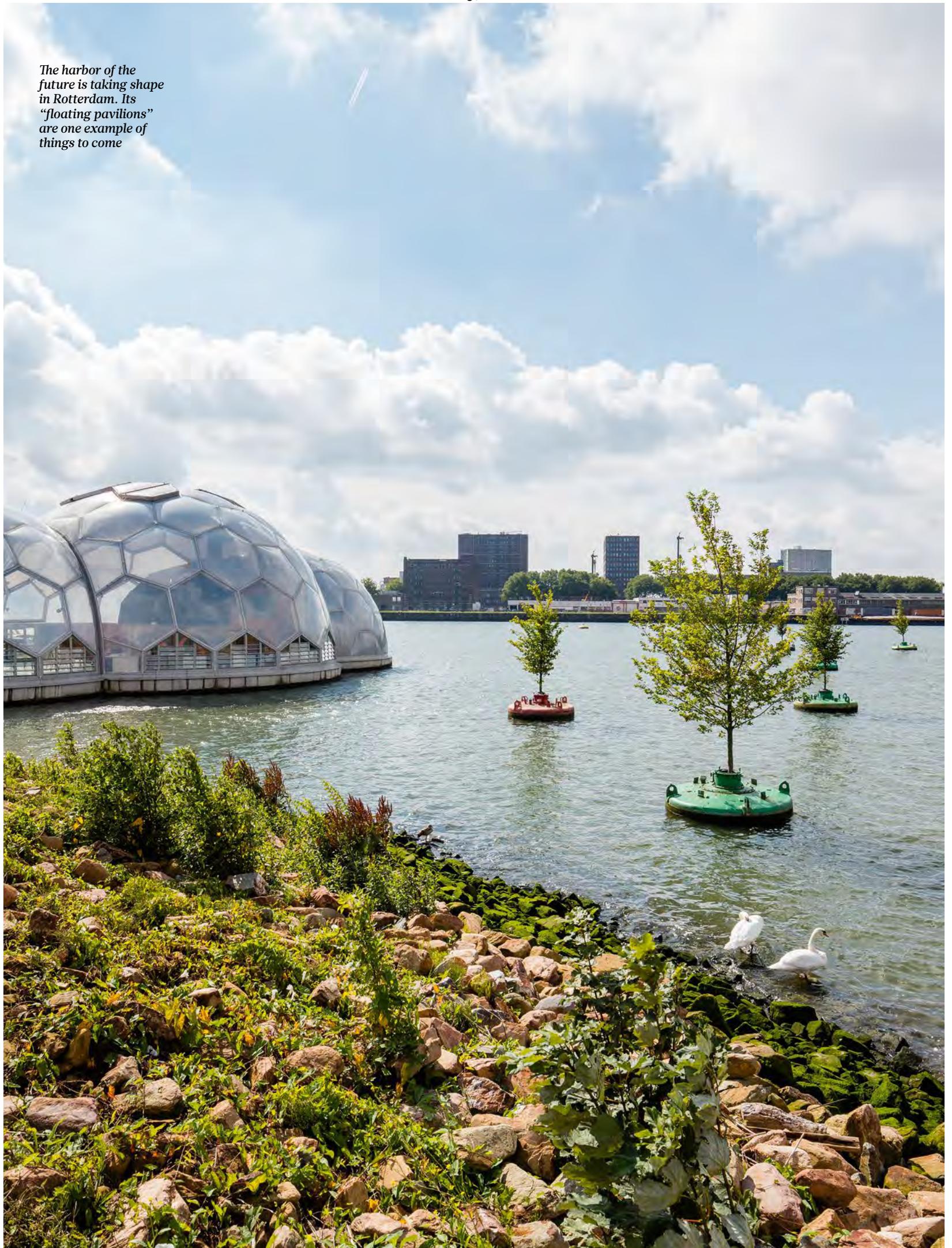
Mr. Drewes, does the Nestlé company, which is often subject to criticism as the main representative of its industry, believe that it has a special responsibility in this regard?

Drewes: Because Nestlé is the world's largest food manufacturer, it's always automatically the first target. As a result, we have to be able to deal with criticism. We have to find the right answers and make corrections whenever we do something that hasn't turned out too well. In addition, we have to engage in a dialogue and partnership with civil society whenever there are difficulties. We've become pretty good at that by now.

Adrion: This is a step in the right direction, but it can only be a start. Major course corrections will be needed in order to create a sustainable world, and I fear that the pace of this change is not fast enough. For major companies, the primary concerns are ultimately to safeguard their supply chains, make profits, and generate further growth. And they can't do that without gigantic amounts of resources. The responsibility for changing the situation is borne to a very large extent by the companies. We can only succeed if we work together with you. I'm optimistic that more and more companies will move into the forefront of this development. A major reason for that will be the pressure from us, the consumers. Another important reason will be the healthy common sense of the executives of the major corporations.

Hosts: Christof Endruweit and Marcus Müntefering

The harbor of the future is taking shape in Rotterdam. Its "floating pavilions" are one example of things to come



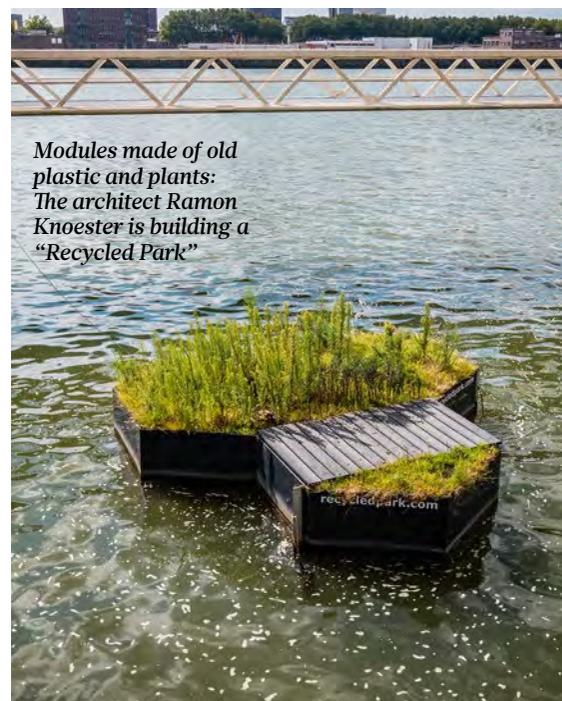
A NATIONWIDE WATER LAB

One fourth of the Netherlands lies below sea level. The country's inhabitants have learned how to defy the forces of nature—and even how to make floods and storms useful. In this age of climate change and environmental pollution, the Netherlands are once again playing a leading role. Projects that include water as part of a new quality of life are springing up all over the country

➔ Ramon Knoester holds up a bag whose contents—a colorful mix of blue, red, white, and gray pebbles of different shapes—any child would love to spill out and play with right away. The pebbles are made of plastic. Nowadays Knoester, an architect whose firm is near Rotterdam's central railroad station, considers them his main construction material. That's because these tiny particles will be processed to form a firm dark mass for constructing building foundations that will eventually float in the water, overgrown with plants. "My five-year-old son proudly told the kids at his childcare center that his father builds plastic islands," says Knoester with a broad smile.

Creating new land from the recycled waste of our prosperous society—this is a new dimension for the Dutch, who have always been very imaginative when it comes to exploiting the potential of their special circumstances.

In the broad water basin of Europe's biggest seaport with its ultramodern skyline of skyscrapers, people like Ramon Knoester are thinking ahead about the harbor's future. For the past four years Knoester, the founder of the architects' firm WHIM, has worked mainly in the harbor delta of Rotterdam, where the Rhine, Meuse, and Scheldt Rivers flow into the North Sea, bringing with them tons of plastic waste from all over Europe. Knoester would like to gather it up before it's washed out into the open sea. The first filter units have already been installed. "As an architect, I believe I bear social responsibility. Our project aims to use old plastic as a raw material for implementing sustainable solutions for waterborne construction," he says.



Modules made of old plastic and plants: The architect Ramon Knoester is building a "Recycled Park"

"We want to reduce the amount of plastic in the sea and use it for sustainable construction solutions along the water"

Ramon Knoester: The architect from WHIM who founded the "Recycled Park," which is now being tested in the harbor of Rotterdam

A blue-green testing ground

The project has already taken on shape. From the Wilhelminapier you can see the "floating pavilions"—three domes on a floating foundation that look like space stations. A century ago, oceangoing steamships carrying immigrants to North America would depart from this peninsula. The pavilions that are floating here today serve as event locations and exhibition venues. They symbolize the new era of Rotterdam. That's why this was the ideal place for Knoester to dock the prototype of his "Recycled Park." Each of the ➔



“We are putting in plants on roof areas and also changing the city’s water balance”

Eveline Bronsdijk works for the city of Rotterdam, where she has been conducting climate protection measures for the past decade

→ three modules is 2.40 meters wide. The rough underside enables water plants to take root, and the upper surface has been planted with thick grasses. On other platforms resembling buoys, trees sway in the water like sculptures. Platforms in flexible sizes ranging up to thousands of square meters are also conceivable. The city government recently included the “Recycled Park” in its urban development concept, which calls for additional green zones to be created in the harbor in the near future.

Rotterdam has become an extensive blue-green testing ground. That becomes evident if you climb up to the roofs of the city. Eveline Bronsdijk does that almost every day. “In the past ten years we’ve put in plants on about 250,000 square meters of roof area,” says Bronsdijk, who is responsible for Sustainability and Communication at the city’s urban development department. While she drinks tea in the “Op Het Dak” outdoor café, a few meters away a guide explains to a group of visitors how the automatic irrigation of tomato plants in the roof garden works. The eighth floor of a 1960s office complex between the railroad sta-



The Timmerhuis: The roof garden of this 14-story residential and commercial building is part of Rotterdam’s sustainable water management system. The building also houses the urban development department

tion and City Hall is a flourishing landscape consisting of quiet zones, wildflowers, and garden plots. “Many of the buildings in this area were regarded as derelict,” explains Bronsdijk. “But now an entirely new sense of neighborliness has developed in this former social flashpoint. And we collect rainwater for far more uses than just watering flowerbeds.”

80 percent below sea level

The roof terrace offers an excellent view of the “Water Square Benthemplein,” where children are playing and skaters are practicing their fancy moves on the steps. On very rainy days, the square is transformed into an urban lake. It’s a typically Dutch solution: a rainwater retention basin that relieves the

pressure on the city’s sewers and at the same time serves as a place for communication. In Rotterdam, which was almost completely rebuilt starting in 1945 after a series of devastating bombing attacks, periodic self-reinvention has become a habit.

It’s the second-largest city of the Netherlands, with a population of about 630,000, and 80 percent of it lies below sea level—in some places, as much as six meters below. Flooded streets would seem to be inevitable. To prevent this from happening, a protective network of dikes, high-water locks, and pumps has been installed along the country’s southern coast. The steadily rising sea level resulting from climate change has intensified the external pressure on this system. And not only the sea but also the in-



Photography: Miquel Gonzalez (2), Ullsteinbild

creasing volumes of river water and rainfall have to be managed. Rotterdam has created its own climate protection department, which is working hard to create new water circuits through a dialogue with scientists, architects, and environmental engineers.

Buildings that float in the water

“For decades, we’ve done everything we can to keep the water away. Now we have to learn how to make better use of it for ourselves,” says Koen Olthuis from the Waterstudio architects’ firm in nearby Rijswijk. Olthuis is an architect, but like many of his colleagues he also does interdisciplinary work. He calls himself a visionary in the realm of “floating cities.” Examples of what he means can be seen in the newly created urban district of

IJburg in the east of Amsterdam. Here, along the IJsselmeer, Olthuis’ team has created the Waterwoningen project, a settlement of about 60 buildings ranging from bungalows to three-story apartment houses. Even the buildings that are 18 meters high float securely in the water and resist storms with a wind speed of 12. The construction, which is similar to a massive drilling platform, shows that it’s possible to build large-scale settlements on the water. “People like to associate Holland with picturesque houseboats,” says Olthuis, “but we want to think further ahead and create new kinds of urban living.”

Treating water not as an enemy but as a friend by nature—this approach is increasingly gaining ground in the Dutch mindset. Koen Olthuis, who regularly receives dele-



Storm surge in 1953: Pumping water out of cellars

The Netherlands Stormproof and inventive

The Dutch people have been living with water for centuries. During their eventful history they have constantly faced new challenges

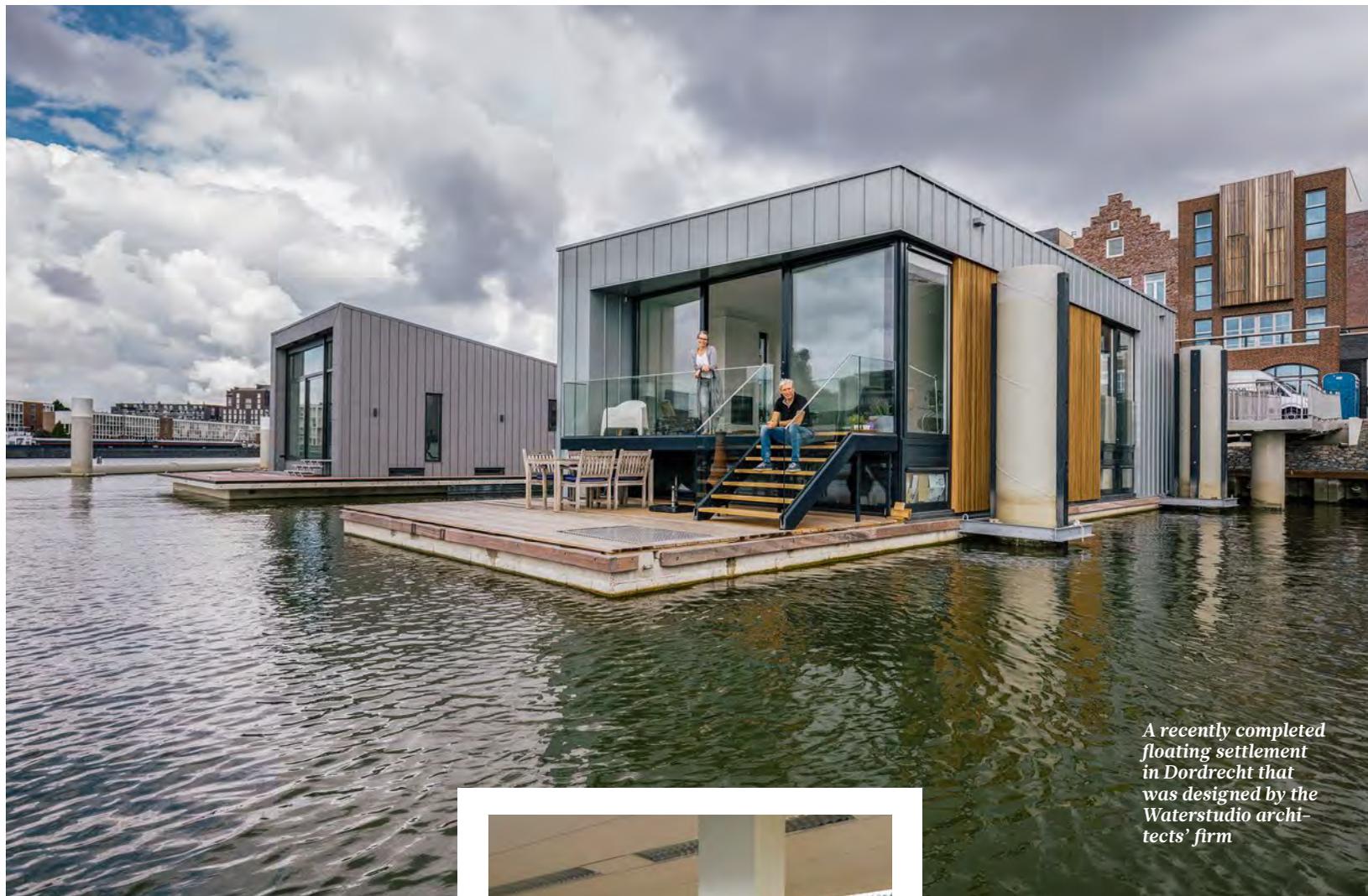
Disaster alert: In 1953 the southern part of the Netherlands experienced the strongest storm surge of modern times, which killed 1,835 people and more than 200,000 animals. The Dutch government subsequently created the “Delta Plan” to improve coastal protection and began to implement it in 1958.

Delta works: This system of 13 storm surge barriers along the North Sea coast is a unique technical monument that was continuously expanded. The Eastern Scheldt barrier alone is three kilometers long. The project was completed in 1997 with the Maeslantwehr in Zuid-Holland province.

The future: Even after the completion of the coastal protection network, the government’s Delta Commission has continued to invest €1.2 billion annually in research projects and flood protection measures.

gations of experts from all over the world, advocates a fundamental change of perspective. He believes that the water from the polders—the areas surrounded by dikes that are so characteristic of the “Land of Tulips”—does not have to be pumped back into the sea. In the future, flooded regions could be settled—through the use of flexible amphibian platforms. “Such platforms adapt themselves to the water and could even be pushed around so that they could dock in other locations,” Olthuis explains.

This paradigm shift is taking place on a broad front throughout the Netherlands. It’s not only port cities that are receiving support from the authorities. In recent years the general public has realized that the network of rivers in the interior is a crucial →



A recently completed floating settlement in Dordrecht that was designed by the Waterstudio architects' firm

→ component of the country's sensitive ecosystem. It has also become obvious that land reclamation and the straightening of watercourses have magnified the risk of flooding rather than decreasing it. This is a problem that many countries are struggling with. Ten years ago, the Dutch launched a government program based on the principle of creating "Room for Rivers." The effects of this program are now visible to everyone, for example along the Waal River near the city of Nijmegen.

Three youngsters are having fun swimming near the riverbank. On the opposite bank an elderly lady and her grandchild are walking their dog. Joggers run over the new bridges. Andrea Voskens, an architect, takes in the view of the Waal. "This program has totally changed our concept of the river," she says. "Formerly there wasn't very much going on here; now it's a real leisure paradise." In the catchment area of Nijmegen, which has 170,000 inhabitants, water sports are now possible. They used to be inconceivable because of the river's current and its shipping traffic.

The reconstruction of the Waal, the southern arm of the Rhine in its river delta, was one of the 30 measures of a coun-



"Instead of keeping water away with dikes, we should use it to create new ways of living"

Koen Olthuis: The head of the Waterstudio architects' firm designs floating environments for living and working

try-wide flood-control project. Voskens supervised the local implementation of the "Room for Rivers" project as a stakeholder manager for the Nijmegen city council. In Nijmegen the Waal takes a 90-degree turn and its width narrows from 1,500 to 450 meters. This bottleneck was the cause of high water and severe flooding in the Nijmegen region and in southern areas along the river in 1993 and 1995, with 250,000 people having to be evacuated. This experience led to a rethinking of the problem: Instead of building ever higher dikes, it was decided to give the rivers more room.

A model for New York

In Nijmegen, a side canal three and a half kilometers long was built and the original dike was relocated. This resulted in the formation of an island. Houses that were previously situated in the floodplains now stand on this island. On the site of today's side canal, 50 houses had to be demolished. "When the project started there was a lot of protest," Voskens recalls. People in Lent, the affected part of the city, didn't want to leave their houses or feared that the dike relocation would cause a rise of the groundwater level that could damage their houses. But their



“Formerly there wasn’t very much going on along the river; now it’s a real leisure paradise”

Andrea Voskens: This architect coordinated the “Room for Rivers” landscaping project for the city of Nijmegen

attitude changed in the course of the project. In the end, everyone moved willingly and sacrificed their homes for the greater good.

Until a couple of years ago, Lent was a village. Even before the start of the project, the growing city of Nijmegen had planned that Lent, separated by the Waal from the city center, would in the future be part of the city. So “Room for Rivers” also promoted urban development in addition to being a flood-control project. The citizens of Lent are now proud of the results. “We involved everyone right from the start,” says Andrea Voskens. She was always available to the people affected by the project, helping them solve many technical problems and search for new accommodation. She was also there for the families as they took a final look at their old homes, always mindful of the fact that they were losing their past. That was what drove her to find satisfactory solutions for their future—a task that gave this previously technically-minded architect great satisfaction. “The best thing in the entire project was the trust that people placed in me,” she says.

The project’s open atmosphere and practical approach are also attracting lots of attention abroad. The *New York Times* reporter Michael Kimmelmann is impressed by its innovative strength and regards it as a model for water-rich major cities in the USA, such as New York and New Orleans. “In this small



The Waalbrug in Nijmegen connects a newly created island with the mainland. The landscape was restructured in order to prevent the Waal River from overflowing

water-soaked country, climate change is regarded not as a problem but as an opportunity,” he says. In Rotterdam he experienced urban diversity on the water, including the city’s latest project, which combines two core areas of Dutch expertise: seafaring and agriculture. The architects’ firm Beladon is creating a floating farm called Merve4Heaven in the harbor. Soon cows will be grazing here on three levels, fed by a closed organic circuit of solar energy, rainwater, and animal feed. “We’re bringing agriculture into the city and fresh milk closer to the consumers, thus shortening transport routes and saving energy,” says the head of Beladon, Peter van Wingerden. Thanks to the popular urban farming movement, this kind of water-based cultivation should also be possible for another traditional Dutch prod-

uct: greenhouse tomatoes. Peter van Wingerden is convinced that his pilot project will have many imitators. “Cities will continue to grow, and most conurbations are located along rivers and other bodies of water. Why shouldn’t we take advantage of that?”



Ursula Jäger, Managing Editor of Evonik’s employee magazine *Folio*, has traveled along the Dutch coast more than once



Uwe Killing, a Berlin-based journalist, used to dream of a hippie houseboat, but gave up this cliché after visiting Rotterdam

THE POWER OF THE NILE

Probably no other river in the world has received as much veneration as the Nile. The Greek traveler and “granddaddy of journalism” Herodotus declared that Egypt was the “gift of the Nile.” He himself traveled along the river all the way to the island of Elephantine. Join us as we follow in Herodotus’ footsteps 2,500 years later

→ The *Mirage 1* of the South Sinai Nile Cruises company sluggishly steams up the Nile. The ship is a floating hotel, complete with a ballroom, a gym, and a jeweler. Up on the sundeck, only a handful of Canadian tourists loll about on deckchairs and watch the palm-lined banks of the legendary river pass by. They sip coke or whisky on the rocks that is served by uniformed waiters. Now and then, the bikini-clad tourists jump into the swimming pool to cool off from the hot temperatures, which can quickly rise to over 45 degrees Celsius at this time of year.

The luxury cruise ship is a self-contained world of its own. The children on the banks of the river sometimes get a glimpse of the foreigners in their swimwear, laugh and wave to the tourists before disappearing into their mud huts. As was the case thousands of years ago, these huts are made from the silt of the mighty stream. Civilization began here with the building of houses made of mud bricks.

The deadly expanse of the desert begins just behind the houses, the palms, and the lush green meadows that line the banks of the river. The scenery lets one sense what may have moved the Sudanese writer Tayeb Salih to write that the Nile winds its way through the country like the sacred snake of ancient Egyptian deities. Salih’s florid prose has the Nile’s chest swelling with wrath, while the flat, thirst-slaked land extends as far as the eye can see. Salih writes that the calm and moist soil harbors a mystery and that the earth is like a hot-blooded woman who longs for her spouse. There would be no life here without the Nile.

5,000 kilometers to Egypt

Egypt has been tormented by Islamic terrorism in recent years. However, the Canadian tourists on board the ship seem unconcerned. They are looking forward to seeing Abu Simbel and its huge statues of Ramses II. The complex is located in the far south of the country, only 36 kilometers from the Sudanese border. Like gigantic sentinels, the statues guard the border between Egypt and “Black Africa.” They stand at the beginning of a unique civilization, which arose here more than 4,000 years ago—a civilization that would have been unthinkable without the great river flowing from the interior of Africa.



Thilo Thielke worked as an Africa correspondent for *Der Spiegel* for many years. He spent most of his time near the sources of the Nile, around Lake Victoria. He has now fulfilled his dream of following the course of the Egyptian Nile for three weeks, from Abu Simbel to the delta

“Lord of fish, that makes the waterfowl to go up-stream”

The poet **Khety** is credited with praising the Nile as the basis of all life 4,000 years ago.

The Nile has already traveled more than 5,000 kilometers by the time it reaches the “Land of the Pharaohs.” The source of the White Nile, the Ruvironza, arises in the mountains of Burundi in the heart of Africa. The Ruvironza flows into the Kagera, which eventually discharges its waters into Lake Victoria. The White Nile begins its trek north near Jinja in Uganda. It flows through part of the Congo at Lake Albert before proceeding through South Sudan and Sudan until merging with the Blue Nile next to the Sudanese capital of Khartoum.

The Blue Nile has its origins in Lake Tana in Ethiopia, from where it makes its way to Sudan. Although the Blue Nile is only about 1,500 kilometers long in total, the vast amounts of water that make the desert bloom in Egypt largely come from the rain that falls in the Ethiopian highlands.

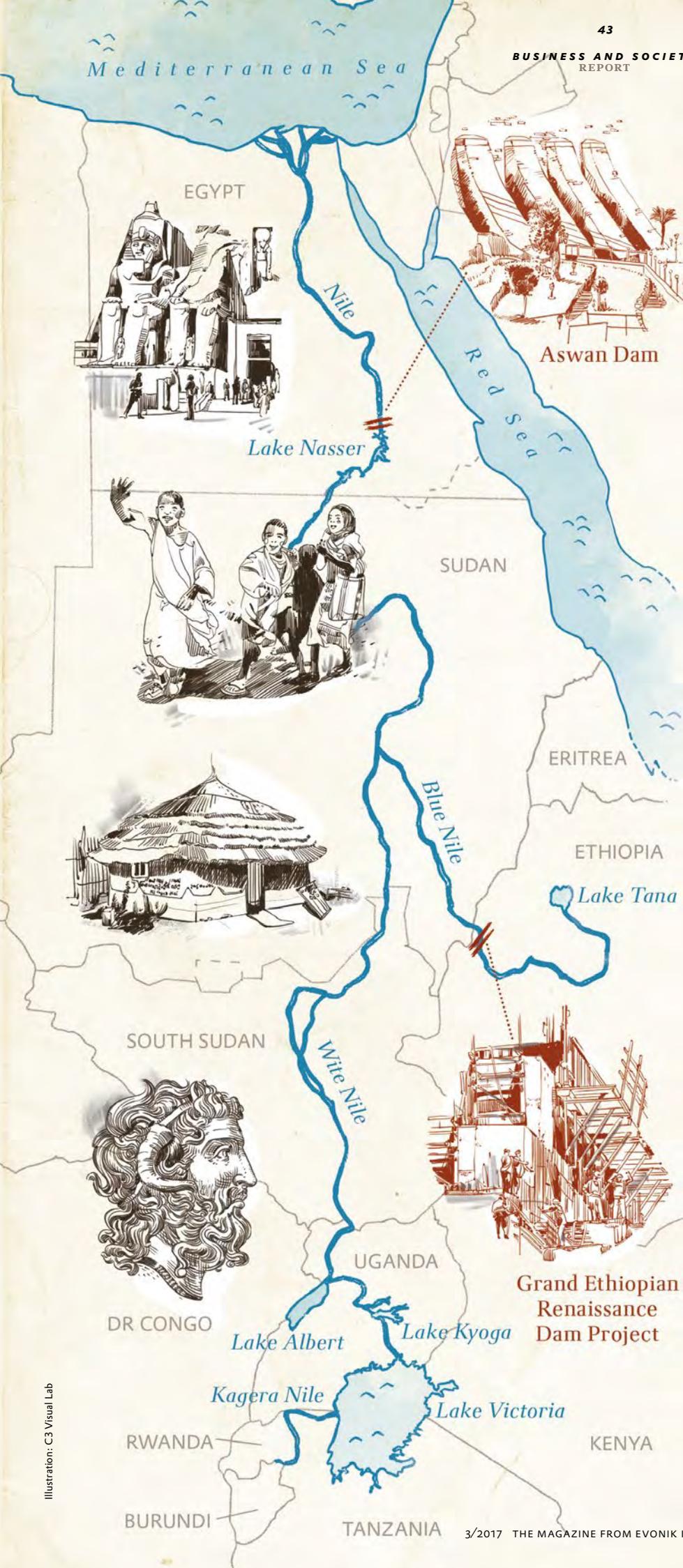
The Romans searched for the source of the Nile in vain

“Praise to you, O Nile, that issues from the earth, and comes to nourish Egypt,” says a 4,000-year-old hymn that is attributed to Khety. “Lord of fish, that makes the waterfowl to go upstream ... that makes barley and creates beans. Flow, O Nile! We sacrifice to you. Come to Egypt! Come, Hidden One! Who nourishes man and animals with his fruits of the field.”

In his book about the race to find the sources of the Nile, the Swiss author Georg Brunold wrote that Alexander the Great is said to have asked Ammon, Egypt’s highest god, about the sources of the Nile. Caesar supposedly expressed his readiness to give up his warring ways in exchange for the secrets of the Nile if they could be wrested from the river. The Nile outwitted even gods and demigods, causing Dionysus and Hercules to wander through the Egyptian hinterland in vain.

As a result, *caput Nili quaerere* (“searching for the sources of the Nile”) became a metaphor for insoluble problems even back in ancient Rome. For centuries, the divine river kept its secrets. Great explorers such as Stanley and Livingstone, Bruce and Burton—all failed to solve this mystery. Instead, the eager young British officer John Hanning Speke eventually found out that the Nile arose in Lake Victoria near Jinja.

The river was finally brought to heel by the Egyptian officer and then president Gamal Abdel Nasser. Although



his plan to create a pan-Arabic state that would extend from the Atlantic to the Persian Gulf failed miserably, he managed to tame the Nile by building the Aswan High Dam. Construction began in 1960. Many Nubian villages and temples disappeared beneath the floods, and 100,000 people had to be relocated. The Soviets were greatly involved in the building of the 3,800-meter-long dam, which is 111 meters high and causes the waters of the Nile to back up into a 500-kilometer-long lake that stretches deep into Sudan.

International dam disputes

Was Nasser's taming of the mighty river so that it would only flow like a sluggish canal tantamount to sacrilege? Perhaps an expression of megalomania? Not at all, says the noted hydrologist Mohamed Nasr Eldin Allam from Cairo University. He claims that Nasser's achievement was a blessing for the country. "In the past, agriculture suffered when no water came. In such crises, the people practically ate each other up. They were unable to plant or harvest anything and searched desperately for groundwater. That changed completely after the building of the Aswan Dam. It's true that the Nile suddenly became like a canal, but we can now regulate the water level. We have a controlled river and are no longer completely dependent on the rainfall in Ethiopia."

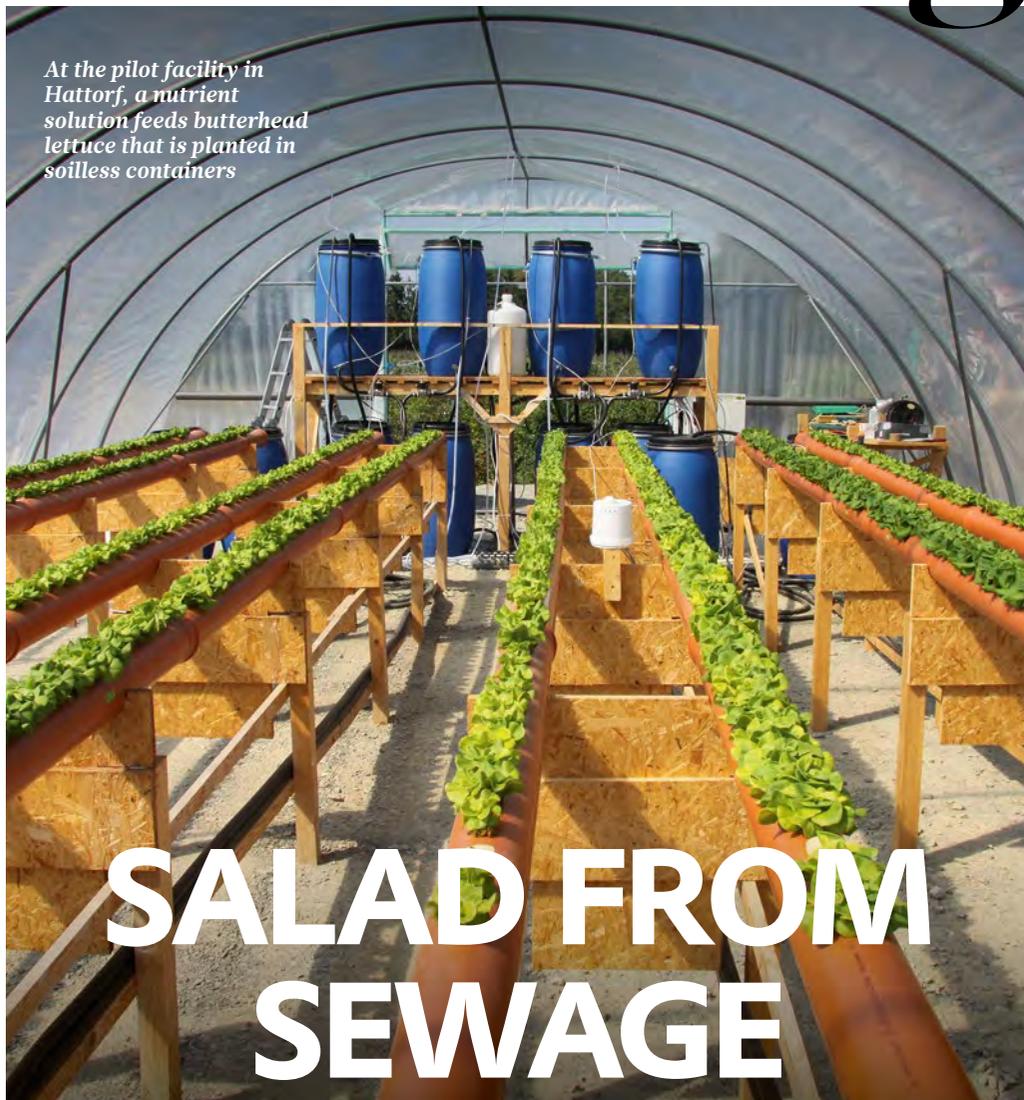
Eldin Allam has an office in the center of Cairo. In addition to teaching at the university, he works as a consultant and delivers expert opinions. He knows very well how important the river's water is for Egypt and he looks with concern at Ethiopia, which has been feverishly building the Grand Renaissance Dam since 2011. This megaproject will rival the Aswan Dam in scope.

Once the dam is completed, which is expected to occur in the near future, it will consist of a 145-meter high and 1,800-meter-long roller-compacted concrete wall that cost around \$5 billion to build. Allam is convinced that the dam poses a threat to Egypt. What's more, he thinks it's unnecessary, because "Ethiopia has heavy rainfall along the Nile basin, ranging from 900 millimeters per year to over 2,200 millimeters per year in some areas. Egypt, by contrast, only gets 20 millimeters. That's practically nothing, we are veritably drying out." Allam also points out that "the water from the Blue Nile, which would otherwise flow through Sudan and then through Egypt, would have to be diverted for more than one and a half years for the reservoir to fill up."

In 2013 the Egyptian government threatened to take military action if Ethiopia refused to give up its dam project. For now, however, the governments in Cairo and Addis Ababa have come to an agreement in cooperation with the administration in Khartoum. Previously, the government in Cairo always invoked treaties that guaranteed Egypt and Sudan 87 percent of the water of the Nile. These treaties were signed in 1929 and 1959 and enable Cairo to veto the building of new dams. However, Egypt's president, Abdel Fattah el-Sisi, seems to have given in. In fact, the electricity produced by the new dam might even benefit Egypt.

But this doesn't really reassure Mohamed Nasr Eldin Allam. "The dam in Ethiopia will control the water, and control over the water means power," he says. No other river in the world has demonstrated this fact as clearly as the Nile, which enabled mankind to create its first civilization. However, if the river should fail, it would also mean the end of all life. ●

Facts + Figures



At the pilot facility in Hattorf, a nutrient solution feeds butterhead lettuce that is planted in soilless containers

SALAD FROM SEWAGE

Huge amounts of freshwater are needed for agriculture worldwide. A team of researchers wants to change that by growing vegetables in treated wastewater

After numerous tests, it was determined that butterhead lettuce was the vegetable that was best suited for trials of a potentially revolutionary technique: hydroponic gardening with treated wastewater.

In hydroponics, plants grow not in soil but in containers, where they are supplied with nutrients. Vertical farming projects such as Aero-Farms in Newark (USA) use freshwater for this purpose. The research project HypoWave is taking a different approach. "Wastewater con-

tains many nutrients as a matter of course. Our technique could make these nutrients usable for food production and at the same time significantly reduce the huge amount of water that is consumed in agriculture," says the project's manager, Thomas Dockhorn from the Institute of Sanitary and Environmental Engineering at the Technical University of Braunschweig.

However, many questions still need to be clarified before then. As a result, the research team has created a pilot

facility at a sewage treatment plant in Hattorf near Wolfsburg. "Here, we want to find out how we can optimally adapt wastewater treatment to the plants' nutrient needs," says Dockhorn. The researchers are also investigating the technique's profitability and marketability.

A total of twelve partners are involved in the HypoWave project, which is being coordinated by the independent Institute for Social-Ecological Research (ISOE) in Frankfurt am Main.

3 QUESTIONS FOR

Torsten C. Schmidt
"We've Obviously Struck a Chord"



1 The University of Duisburg-Essen has been offering a degree program in water since 2001. What exactly does it involve?

We combine chemistry, microbiology, and process engineering. It's without parallel in Germany. At the end of the program, graduates can help to optimally use and protect water as a precious resource.

2 Has the program met with a good response?

We've had about 60 to 100 students begin this bachelor degree program every year since it was launched. We've obviously struck a chord with our interdisciplinary approach and the program's strong environmental component.

3 How can the graduates help to improve the water supply?

They can do this by inspecting the hygienic and chemical quality of drinking water in developing countries, for example, and by making sure it meets the requisite standards. Such expertise is also important in western Europe, because we can't be sure that climate change will leave us with sufficient amounts of clean drinking water. in the future.

Torsten C. Schmidt is a professor at the University of Duisburg-Essen and Director of the Center for Water and Environmental Research.

69

percent of the freshwater consumed worldwide is needed for agriculture. Industry consumes 19 percent and 12 percent is used by communities and private households



These Vietnamese farmers use the SoDis method to purify their drinking water themselves

THE POWER OF THE SUN

A simple water purification method could save millions of lives. However, there are problems in its use and acceptance

Two actors in a street theater performance bend forward to suggest a stomach ache, while a bacterium dances behind them to show that it is the cause of their suffering. The sun then suddenly appears, carrying a PET bottle full of water in its arms. The bacteria twists and turns as it dies. The two actors drink from the PET bottle and immediately feel better.

This performance in Bolivia advertises the solar disinfection (SoDis) method, which uses UV radiation and heat to purify drinking water. SoDis kills off harmful microbes in contaminated water. It was developed by the Swiss research facility Eawag, which has been struggling to

introduce the method worldwide since 1999. It works as follows: Contaminated water is filled into a one or two-liter PET bottle which is left to lie up to six hours in the sun. After this period, the water is drinkable, without requiring any boiling or chemicals.

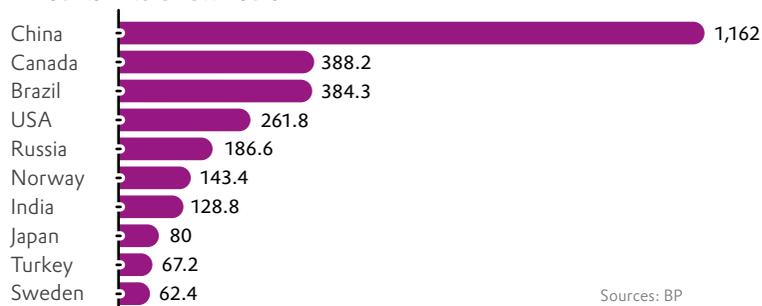
According to the World Health Organization (WHO), SoDis can save the lives of millions of people who die every year from diarrhea. Not only is the method simple, it costs almost nothing to carry it out. SoDis works perfectly in the lab, where it thoroughly purifies water. However, it is often improperly implemented in practice, despite the efforts of many aid organizations.

"It takes a lot of time to change people's habits and their daily routines," says Valérie Cavin, a water expert at the Swiss development aid organization Helvetas, who has been working on the SoDis project for the last five years. "They often forget to put the freshly filled bottles out into the sun in the morning or they drink the water before it has been completely disinfected." That's because the water needs to be outside for two whole days when the sky is overcast. Another problem is that some people don't think the method is effective. It seems too easy to them, even though simple solutions are sometimes the best.

An Inexhaustible Source of Energy

Water has been an important supplier of energy for centuries. According to the BP Statistical Review of World Energy, hydroelectric power covered 6.9 percent of global primary energy needs in 2016. China is the world's leading consumer of such energy. Last year the country consumed 1,162 terawatt-hours of hydroelectricity. Germany ranked 24th, at 21 terawatt-hours.

Top 10: consumption of hydroelectricity in 2016
Amounts in terawatt-hours



Sources: BP

WATER PIONEERS

To New Shores



Fernando Magellan He set off on the first circumnavigation of the globe in 1519. He was killed a year before the expedition's return in 1522



Francisco de Orellana Between 1541 and 1542, he was the first European to travel down the Amazon from west to east



Gertrud Ederle In 1926 this US native became the first woman to swim across the English Channel—in two hours less than the previously fastest man

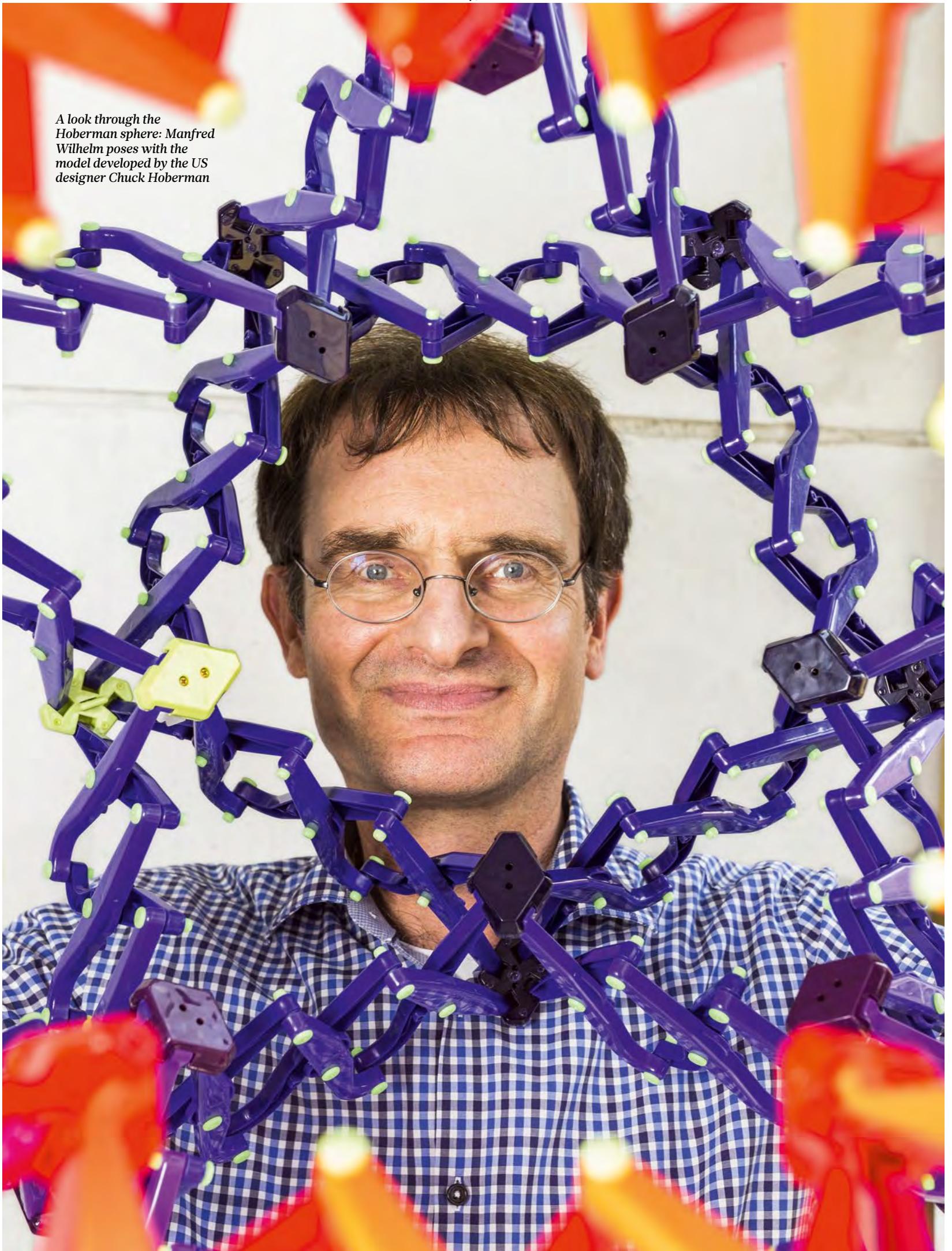


William Beebe Together with Otis Barton, he built the first bathysphere in 1929. In 1930 they became the first people to reach the deep sea



Maud Fontenay In 2003 this French sailor became the first woman to cross the Atlantic from west to east. It took her 117 days to perform this feat

*A look through the
Hoberman sphere: Manfred
Wilhelm poses with the
model developed by the US
designer Chuck Hoberman*



YES, WE CAN!

Manfred Wilhelm, a scientist at the Karlsruhe Institute of Technology, has a dream: going where no one has been before. Today he's using the superabsorbers that are normally inside baby diapers to make polluted water drinkable—and potentially change the world

Keeping babies dry: Superabsorbers are used mainly in baby diapers



→ When Manfred Wilhelm needs time to himself, he goes down to the basement. He has three teenage daughters and holds a professorship at an internationally renowned university, so he rarely has uninterrupted time for his work. In his house near Karlsruhe, he writes expert opinions, edits scientific articles, and thinks about his specialist field, polymer chemistry. He jots down his best ideas for research projects on a whiteboard behind his desk at the Karlsruhe Institute of Technology (KIT), where he has taught and researched polymer materials for the past 11 years. Laypeople would simply call them plastics.

Students looking for topics for their bachelor's, master's, or doctoral theses often

find what they're looking for on Wilhelm's whiteboard. Three theses are currently devoted to the topic of water. Depending on their conclusions, they might be able to

“Science is the power of anticipation. I want to create something that still hasn't been created”

Manfred Wilhelm teaches and researches at the Institute for Chemical Technology and Polymer Chemistry at the Karlsruhe Institute of Technology (KIT)

change the world—with a type of plastic that so far has mainly been used as a toilet.

Superabsorbers are plastics that can absorb huge volumes of liquid. Industrial companies primarily use this white granulate to make baby diapers. The first Pampers were lined with superabsorbers in 1987. Since then, practically all modern baby diapers use superabsorbers, which can easily soak up 500 times their own volume of water and retain it securely. Drier baby bottoms, happier infants, and free-spending parents are the three pillars of the diaper business.

“I actually had a brainstorm while changing a diaper,” says Wilhelm, who is now 51. During a family vacation on the Baltic Sea he noticed how fast his young →



A constant stream: The prototype of an osmosis motor

→ daughter's diapers also swelled up as she played in the salt water. He had previously been reading up on polyelectrolytes for his inaugural lecture at the university, and a few years before that he had worked at the renowned Weizman Institute in Israel, commuting between the Max Planck Institute in Mainz and the Rehovot research Institute south of Tel Aviv. "I still remembered Israel's difficulty with securing freshwater," he says. "Every day there was something in *The Jerusalem Post* about the current level of water in the Sea of Galilee." All of these thoughts and memories coalesced one day at the changing table. Wouldn't it be possible to use superabsorbers to desalinate seawater? The answer is yes, as Wilhelm's student Lukas Arens is demonstrating in his doctoral thesis. All the same, it's not very easy.

A question of energy

To understand why not, we first have to know how superabsorbers soak up water. Wilhelm explains the process by having visitors stir a teaspoon of grainy white superabsorber powder into a beaker of water. Within seconds, it forms a tough gel that can't be removed by tipping or shaking the beaker. The secret lies in the powder's molecular structure. "This is a polymer—a long molecular chain of acrylic acids that forms

a three-dimensional network that acts like a molecular sponge," Wilhelm explains. He jumps up and grabs from a shelf a brightly colored plastic ball that could have come from a toy store. It's a Hoberman sphere, which can be pulled in every direction via clever hinges to form ever larger spheres. "The superabsorber polymer can do this even better. In contact with water, it grows a thousandfold," says Wilhelm. "It packs the water molecules into the interior of its web of cross-links and holds them there by means of ionic interactions." The tighter the meshes of the cross-links—that is, the greater the degree of cross-linking—the more firmly the superabsorber holds the water, and the less it swells up.

"The problem of desalination has basically been solved, but we want to prove that there's another way to do it"

Lukas Arens, a doctoral candidate at KIT, is developing systems to make desalination by means of superabsorbers measurable

For his thesis, Arens is now exploiting the fact that freshwater is quickly soaked up by the superabsorber, whereas salt and salt water take longer. "And vice versa," he says, meaning that when he presses a superabsorber that is full of salt water, the salt water comes out first, followed by the freshwater. "By applying the necessary pressure, we can separate freshwater from salt water," he concludes. In a long series of trials at the laboratory in Karlsruhe, he is using a specially made press to find out how effective and efficient this method is, how much energy it requires, and how strongly cross-linked it has to be.

It's ultimately a question of energy. "Theoretically, the smallest amount of energy needed for desalination is one kilowatt-hour per cubic meter of the resulting freshwater," says Wilhelm. "Present-day facilities need around ten times that much energy. We're already in the same order of magnitude." He's thinking of the huge desalination plants in Saudi Arabia and the United Arab Emirates, where gigantic power plants produce hundreds of millions of liters of drinking water every day, partly by turning the seawater to steam and partly through reverse osmosis, in which water is pressed through special membranes. "Just the fact that we're in effect using a three-dimensional mem-

brane in our superabsorber offers this process advantages,” says Wilhelm.

Demonstrating potential

Two rooms over, the bachelor's degree candidate Ilona Wagner is exploiting another selective behavior of superabsorbers. “Depending on the degree of cross-linking, superabsorbers also soak up water polluted with different metals at different rates,” she explains. She is experimenting with arsenic, cadmium, lead, and chromium—extremely toxic metals that are present in untreated industrial wastewater. Unfortunately, in underdeveloped countries and emerging markets they end up in the drinking water of millions of people. “There are processes for removing these toxins from the water, but they are complicated and very expensive,” says Wagner. Her initial experiments have shown that carcinogenic chromium salts, which are used in the tanning industry in India and Bangladesh, for example, can soon be removed from water by superabsorbers at rates as high as 99 percent. Because chromium salts are colorful, even laypeople can see this effect. In Wagner's beakers, the superabsorber flocculates steadily, causing the greenish color of the chromium to disappear from the overlying water. Wagner's idea is that even very small businesses could put fleeces containing superabsorbers, which are merely oversized diapers, into their tanning brew to remove the chromium and dispose of it separately. However, the road from her bachelor's thesis to the implementation of her idea will be a long one.

The implementation of another one of Wilhelm's ideas, the “osmosis motor,” seems even further away. In this device, the osmotic pressure of a swelling superabsorber is used to transform energy. The basic principle has been demonstrated in the KIT laboratory, where various devices and weights constantly move up and down, driven by the differing salt content in the water. Christopher Pfeifer is finishing up his doctoral thesis on this topic. Things are looking good, he says: “Now we just have to optimize the energy yield by finding the right degree of cross-linking in the superabsorbers.”

Will the superabsorber ideas on Wilhelm's whiteboard ever be able to replace established processes? Wilhelm himself is skeptical. It's true that he has already commercialized about a dozen of his ideas, because his institute specializes in developing new measuring methods and innovative measuring devices that help plastics manufacturers understand their polymers better. However, he concedes that “the industry is basically resistant to innovation.” He adds that this isn't so bad: “The resistance against completely new technologies also generates pressure to continue improving the tech-

1,000,000

liters per second

was the global capacity for producing drinking water by desalination in 2015. About one percent of the world's drinking water is produced via desalination, but this figure is increasing rapidly.

2

main technical processes

are used today for desalination: distillation and membranes. Energy-intensive distillation dominates only in the Mideast, where almost half of the world's desalination for drinking water takes place. Cheap petroleum makes that possible.

3 kWh

per 1,000 liters

is today a very good rate for the energy needed for reverse-osmosis desalination. Distillation requires around three times as much energy. Prof. Wilhelm believes his method requires even less.



Tom Rademacher

is regularly amazed by the absorptive power of today's diapers, now that he has children of his own. He lives, works, and changes diapers in Cologne

nologies that already exist.” The research done at KIT is part of this effort. Wilhelm's graduates are entering the industry to teach plastics new tricks such as powering innovative soles for athletic shoes at Nike. “If my devices are used and my graduates get good jobs, that's success enough for me,” Wilhelm says. He was the first member of his family

of winegrowers to go to college, so he knows how far one can get with education, brains, and good ideas. But he also knows the limits of his craft. “Our task as researchers is not to put living men on the moon,” he says. “Engineers are better at doing that. We want to be the first to come up with these new ideas.”



Lukas Arens generates energy from salt water



Makes drinking water from brackish water: a press



Ilona Wagner extracts heavy metals from wastewater

"WE USE EVERY DROP"

Singapore has no springs or reserves of drinking water worth mentioning, and it used to depend on its neighbors for water. Today this Asian city-state is a prime example of how the water problems of the future can be solved



The Marina Barrage has transformed the bay into an inland lake



➔ “Turn their water off! Turn their water off!” chanted the crowd. If one had to choose the moment that clearly demonstrated to the people of Singapore that at some point they could be left high and dry, it would have to be a certain day in the fall of 1998. Shortly after the onset of the Asian financial crisis, Singapore’s neighbor Malaysia was facing financial collapse. The Singapore government had agreed to provide a rescue package, but in exchange it wanted to extract major concessions from Malaysia’s Prime Minister at that time, Mahathir Mohamad.

The city’s authorities demanded a virtually unlimited extension of the treaty of 1962, in which Malaysia had committed itself to supplying Singapore with water for 99 years at a special price. “There are limits to our friendly treatment of our neighbor,” Mahathir roared, and the crowd chanted, “Turn their water off!”

It’s not only their shared colonial history that connects the 5.8 million inhabitants of the Southeast Asian island state of Singapore with the 31 million Malaysians on the mainland. In geographic terms, they’re bound together by the Causeway, a connecting dam that is 1,056 meters long and 18 meters wide. Since 1923, goods have been rolling along the four lanes of the Causeway into and out of the city. In addition, drinking water from the Linggiu Reservoir in southern Malaysia is pumped to Singapore through gigantic pipes running along the Causeway.

Water treaties registered at the UN

In 1998, 70 percent of Singapore’s water still came from Malaysia. Today Malaysia covers only half of Singapore’s daily water consumption of 400 million gallons (1.5 million cubic meters). “Mahathir’s threatening gesture was a wake-up call for Singapore,” says Cecilia Tortajada. “It

warned us never to become complacent.” Together with more than 50 other water experts, she does research at the Institute of Water Policy at the Lee Kuan Yew School of Public Policy, which is located in the midst of Singapore’s Botanic Gardens, a UNESCO World Heritage Site. Tortajada is a leading expert in the field of urban water management. As a young scientist in her home town, Mexico City, she had found out about Singapore and decided that South America—and in fact the whole planet—needed to learn from this “small town in Asia.”

Why? “Because here every inhabitant can drink water directly from the tap,” she replies. A European might take this for granted, but in Asia, except for Singapore and Japan, it can’t be done without risking one’s health. Tortajada, who has a doctorate in biology, points out that people all over the world are aware of the huge political impact of water issues, “but only the Singaporeans indulge in the luxury of planning 50 or 100 years ahead.”

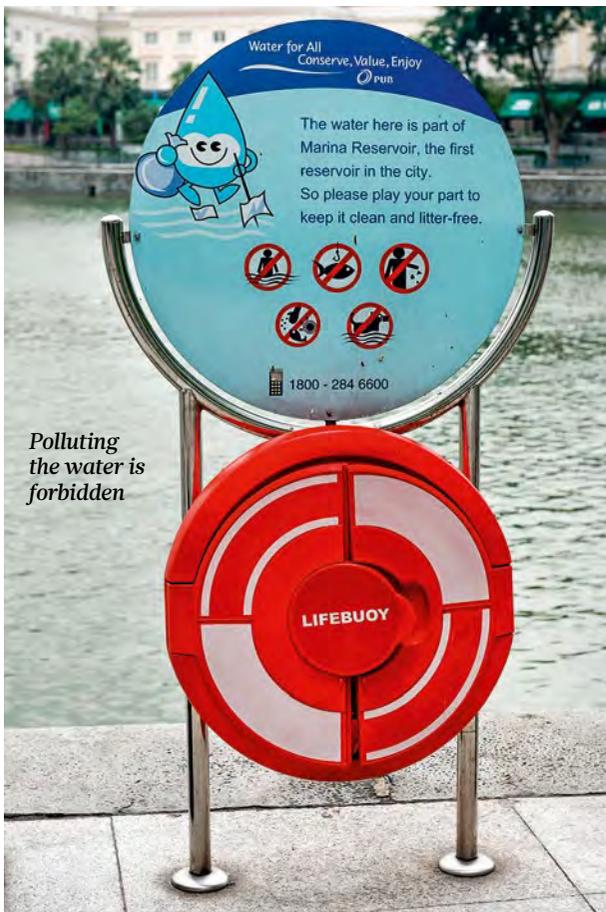
In this high-tech and banking hub, this circumstance is closely connected with a single person: the creator of the independent Singapore, Lee Kuan Yew. When the federation of Singapore and the sultanates of Malaysia became independent from Great Britain in 1957, Singapore’s 900,000 inhabitants were supplied with all of their drinking water by the mainland. Lee not only insisted that the water supply contracts that were signed in 1962 cover almost a century—he also made sure they were registered at the United Nations as an international law.

This move turned out to be absolutely right. On August 9, 1965, when Singapore under Lee Kuan Yew declared its independence, Malaysia’s Prime Minister Abdul Rahmat announced that he could turn off Singapore’s water supply at any time if he didn’t like its policies. Lee regarded this as an incentive rather than ➔

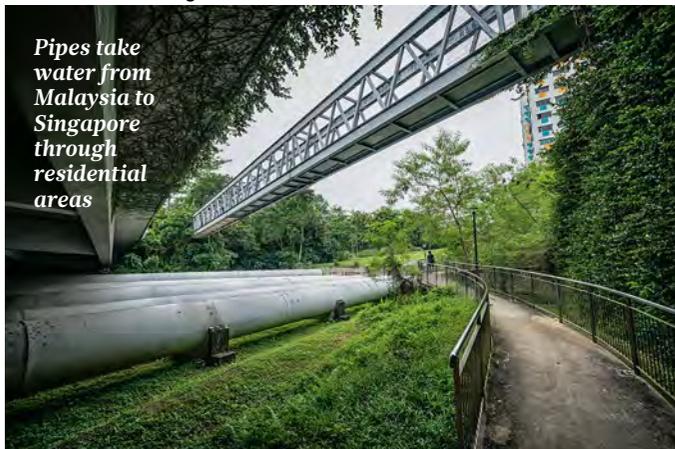
On the street or at home, in Singapore you can drink water straight from the tap. In Asia, that’s a rarity

“We indulge in the luxury of planning 50 or 100 years ahead”

Cecilia Tortajada, a Mexican biologist who works at the Institute of Water Policy in Singapore, explains how the city-state deals with water



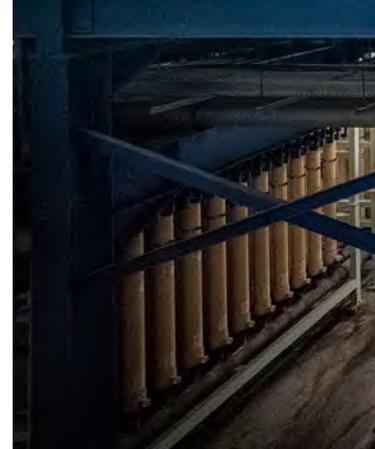
Polluting the water is forbidden



Pipes take water from Malaysia to Singapore through residential areas



School groups visit the waterworks to see how water is recycled



→ as a threat. As early as 1971, the newly created Public Utilities Board (PUB) drafted the first meticulously detailed plan for safeguarding the city’s supply of drinking water. Three years later, the engineers at the PUB tried to build a desalination system. The only reason why the project failed is that back then the world still had no affordable technology for this process.

The engineers then decided to channel the water that Singapore has in abundance: tropical rainfall. Singapore has an average annual precipitation volume of 2,500 millimeters—150 percent more than London. Wastewater pipes were now laid in all residential areas, along the main traffic arteries, and even along the edges of the few remaining virgin forests. As a result, Singapore was no longer prone to the devastating floods that follow monsoon rains and are typical of the tropics. In

other major cities in Southeast Asia, such floods are still a recurring problem. The rainwater collected by the pipes now flowed into gigantic retention basins and reservoirs. Today Singapore has 17 of these artificial lakes, which serve as the centers of local recreation areas.

Barrages and a desalination plant

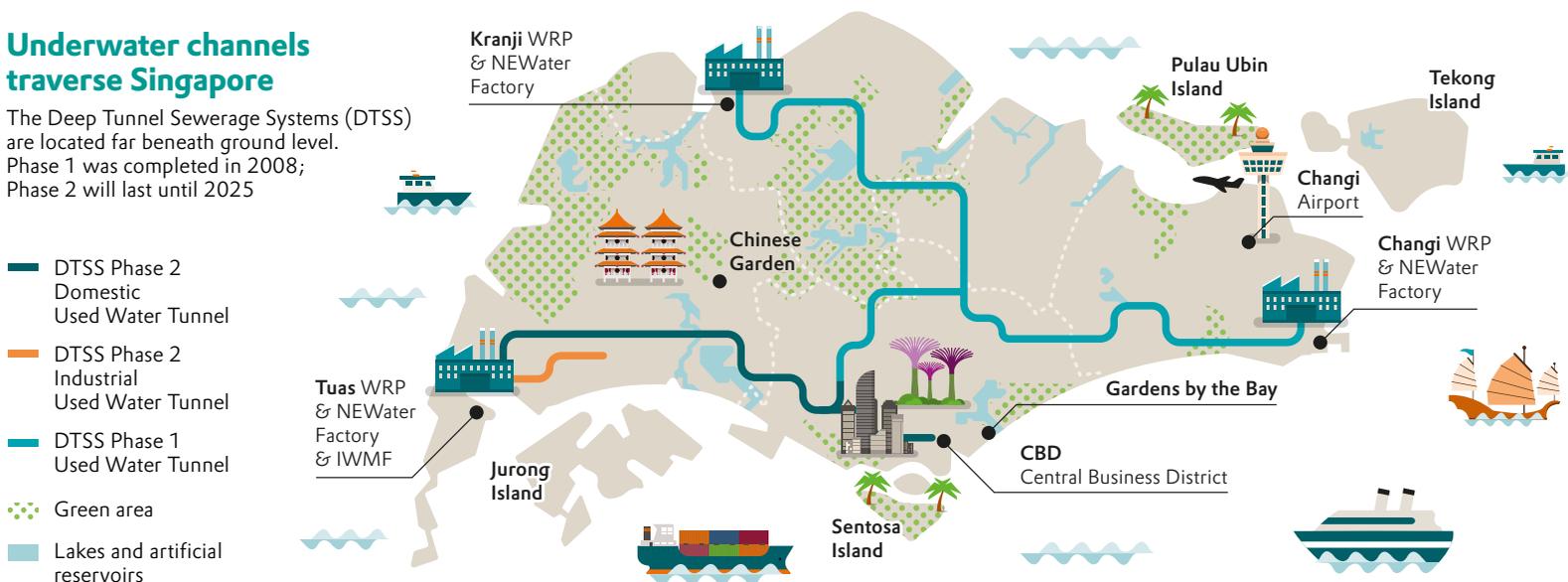
At other points, the coastline was straightened by means of dikes so that freshwater could accumulate in artificial lakes. This has had the positive side effect of enlarging the city’s territory by about 120 square kilometers to a present total of 719 square kilometers. “The only problem is that we would have to flood the entire city with water in order to cover our needs with rainwater alone,” says Tortajada. Mahathir’s threat had played right into the Singapore leaders’ hands. They reacted by implementing

“One of the biggest water reservoirs is you yourselves”

Nallini, a tour guide at the waterworks in the Changi district, urges visitors to save water

Underwater channels traverse Singapore

The Deep Tunnel Sewerage Systems (DTSS) are located far beneath ground level. Phase 1 was completed in 2008; Phase 2 will last until 2025





A drinking water production facility that is operated by the Public Utilities Board (PUB)



Cecilia Tortajada is a leading expert in the field of municipal water management

the Four Taps master plan for water. Taps One and Two were the reservoirs in Malaysia and the collected monsoon rainfall. To create Taps Three and Four, the government invested the equivalent of €2 billion.

Since 2000, the PUB has created a network of drinking water production facilities throughout this island-state as part of the New Water project. Gigantic drilling machines were used to bore tunnels that are as high as houses through this tropical island's rocky foundation at depths of more than 50 meters. Such drilling machines are also used to bore tunnels through the Alps. The purpose of these tunnels, which are several hundred kilometers long, is to collect all of the city's wastewater. New Water, which can even be bought in bottles, is actually wastewater that has been purified to form drinking water that fulfills the EU standard.

Five new waterworks have been built at the end of the network of surface and underground channels, which now has a total length of 8,000 kilometers. In addition, there are three desalination plants, which will soon be joined by a fourth.

The biggest single project, the Marina Barrage, is a 350-meter-long retaining wall that has transformed the entire bay into an inland lake. Today the face of Singapore is the skyline around the Marina Bay Sands casino hotel, which is located next to the Formula 1 circuit. These structures stand on a horseshoe-shaped headland that was wrested from the sea through the construction of the Marina Bay Reservoir.

The retaining wall is part of a desalination plant that has transformed the former bay into a freshwater lake covering 10,000 hectares. At the plant's inauguration ceremony, Yaacob Ibrahim, who was then the Minister for the Environment and Water Resources, declared, "Except for the bottle of New Water that you might take with you as you fly home, I can guarantee that from now on we will reuse every drop of water in Singapore." The inauguration in 2008 came at exactly the right time, for

in the years since then all of Southeast Asia has been plagued by devastating periods of drought. And the situation isn't getting any better. The years 2014, 2015, and 2016 were so dry that the Linggiu Reservoir (Tap One) in Malaysia was in danger of drying up.

Fear of terrorist attacks

Because of the fear of terrorist attacks—Islamists have threatened to poison Singapore's drinking water—none of the facilities in the PUB's water network may be visited. The only exception is the waterworks in the Changi district. Every day, school groups are led past glass walls behind which engineers and technicians are monitoring water circuits.

"One of the biggest water reservoirs is you yourselves," the tour guide Nallini explains as she leads a boisterous group of schoolchildren through the labyrinth of display boards, hands-on exhibits, and water pipes. On average, every inhabitant of Singapore consumes 149 liters of water every day. That's much less than the Saudis, for example, who consume 1,000 liters of water daily—but the citizens of Hamburg manage to get by on 120 liters per day. And that's why Nallini explains to the children how they can help to make Singapore "a First World water city."

"How many of you leave the tap on when you brush your teeth in the morning and in the evening?" she asks. Nearly all the children hold their hands up. "Use a toothbrush tumbler from now on, starting tonight," she tells them in a no-nonsense governess voice. "That way you can save eleven liters of water every day."

The children definitely look impressed as they leave the visitors' center. It's obvious that today the city government has taken another big step forward in its campaign to increase its water supply. In the future, Tap Five will consist of educational campaigns to show people how to save water. Plans call for Singapore to cover all of its water needs itself starting in 2061.



Jürgen Kremb

A former correspondent for *Der Spiegel*, he moved to Singapore in 1998, where he advises companies and political institutions on their Asia strategy. After living in Beijing for eight years, he was looking forward to drinking water in Singapore from the tap without any adverse health effects

“You Don’t Have to Be a Grownup to Make a Difference”

A small kid with a big vision: At the age of six, Ryan Hreljac formed his commitment to fight the global water crisis. Today, twenty years later, a global organization has grown out of his enthusiasm: the Ryan’s Well Foundation



Mr. Hreljac, where does your desire to solve the water crisis come from?

It all started with a school project in the first grade. Our teacher said: Many people are dying because they don’t have clean water. For me as a six-year-old this was unimaginable, because all I had to do was to open the tap. Then she added that girls could not go to school because they had to travel long distances to carry heavy canisters full of water to their villages. A well costs around 70 dollars. So I went to my parents and asked them for the money.

How did your parents react?

At first they said I shouldn’t worry about such serious issues, as I was too young for that. But I didn’t let go. Finally, they let me earn the 70 dollars with jobs around the house. It took me two months to earn the money.

What did you do with the money?

My mother took me to an organization that runs water projects in Africa. But my 70 dollars weren’t enough, they told me, a well costs several thousand dollars. So I held a talk at my school in front of all my classmates to collect more money. I was very nervous. A year and many talks later I finally raised enough money and a well could be drilled in a school in Uganda.

What happened next?

When the community in Uganda found out that a child had raised the money, they wanted to get to know me. My neighbors donated their collected air miles so that my family and I could travel to Uganda. The people there were so grateful that they even introduced a “Ryan’s Day” at school. This was incredible, but it motivated me to continue. I was just an average kid who played far too many video games, but I wanted to make a difference.

Anyone can do that. You only have to find something you are passionate about and share your enthusiasm with as many people as possible. This is the reason why the Ryan’s Well Foundation exists, because we receive a lot of help from volunteers all around the world.

To date, the Ryan’s Well Foundation has collected over ten million dollars and built 1,166 wells in 16 countries. What are the greatest challenges involved in bringing water to developing countries?

To make our work sustainable. It is not enough to drill a well, people have to know how to maintain it and deal with the water meaningfully. It’s also very important to educate the people about diseases like cholera and typhus, which are transmitted by contaminated water. That’s why we offer hygiene workshops and educational programs. Over one billion people have no access to sanitation facilities. 88 per cent of all diseases are caused by poor hygiene. In addition to the wells, we have built over 1,000 latrines.

What are the future projects of the Ryan’s Well Foundation?

We are currently collecting funds for various projects in Kenya, Burkina Faso, Uganda, Haiti, and Ghana. This year we will drill seven wells in the Amansie district of Ghana. They will supply six villages and a maternity clinic with water. This will allow us to improve the lives of 4,500 people.

When you look back at your almost life-long commitment, what have you learned during this time?

That you don’t have to be a grownup to make a difference. A kid can make a huge impact too, because kids don’t overthink too much. My innocent naivety and stubbornness as a child helped me to get started, and luckily I still haven’t stopped.

Interview: Eva Bolthofer



The Ryan’s Well Foundation
website is at:
www.ryanswell.ca

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you can't improve it.

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**“Science is the power
of anticipation. I want to
create something that
still hasn’t been created”**

Manfred Wilhelm teaches and researches at the Institute for Chemical Technology
and Polymer Chemistry at the Karlsruhe Institute of Technology (KIT)