



# Download to—ear—th

voith.com  
2019/E

**VOITH**





It can no longer be ignored – something is happening. All around the globe, people want change. Young people everywhere are the primary driving force behind demands aimed at governments, society and industry to move forward in climate protection and use of resources. We see it the same way at Voith: the most urgent issue of the present time is climate change. If we do not unite in embracing change, climate change will alter everything. Because we only have this one Planet Earth.

For more than 150 years, our work has always been in close partnership with the Earth: clean energy from hydropower, paper production from renewable raw materials and drive technology for efficient and environmentally friendly mobility. In this way, our technologies make a contribution to the sustainable development of entire economies.

We are driven by the quest for answers to the great issues of our time. How can we utilize our immense experience to repay the Earth for its contribution to our achievements? What potential is there still to be found in hydropower and paper? What characterizes the mobility of the future, on water and on land? How does an industry with closed circuits operate? Together with our strong partners, we apply our knowledge to find solutions to challenges that are moving entire societies today and will impact them tomorrow.

But more is needed than environmentally friendly products and processes. We need a change in mindset worldwide: in society at large and at an individual level. Throughout our history, there have often been new insights and events that we had to adapt or respond to what we needed in order to acquire new skills. This is the driving force behind progress. The current change in mindset also involves using the opportunities provided by digitalization.

In all these new developments, we always remain true to ourselves – down to earth. In both meanings of the expression. Our values have applied since Voith was founded in 1867 and will remain our keystone in the future. Together, we are shaping change so that our planet will continue to exist.



# Down-to-earth



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# Water – the silent climate saver

Water is the fountainhead of all life on earth and its mainstay. In organisms, it is involved in virtually all metabolic processes, and in all geological and ecological processes on our planet. Water is closely connected to the history, economy and culture of human civilization. It permeates religions, philosophy, science, medicine, art and many other areas of life, and plays the principal role in agriculture, forestry and the energy sector.

# 3



physical states

Water is unique in being the only chemical compound found on earth that exists in nature in all three physical states.



Water is unique in being the only chemical compound found on earth that exists in nature in all three physical states – as a liquid, a solid body (ice) and a gas (water vapor). Voith has always worked with all three, with its power plants on rivers, lakes and in high snow-capped mountain ranges, as well as in drive technology on land and on water.

The fascination with water and its significance knows no limits: without rain there would be no supplies of drinking water, no agriculture, no bodies of water with fish for food, no rivers for transporting freight, no industry. Water is precious and it cannot be taken for granted. From the time nomads started to become settled to the high cultures of antiquity, through the medieval period to modernity, there has been a perennial conflict between too much and too little water. Too much means disastrous flooding, too little triggers life-threatening drought. This danger is nowhere near being eliminated. Although the greater part of the Earth's surface is covered with water (71 percent), only 3.5 percent of that figure is fresh water. Indeed, most of that can be found in the form of ice at the poles, in glaciers and permafrost. This means that it is not readily available as drinking water.

The second challenge of the present day and for the future is humanity's insatiable hunger for energy that is having disastrous consequences for the climate. Renewable energies are one solution. Alongside solar and wind energy, hydropower is by far the largest and oldest, yet most reliable, form of renewable energy generation. All around the world, it makes an indispensable contribution to stable electricity supplies and thus to economic and social progress – in industrial countries and strongly growing regions alike. In addition, hydropower makes a significant contribution to climate-friendly energy production. Ever since the early days of hydropower, Voith has been a leading provider of the necessary technology, constantly implementing refinements. The potential afforded by the properties of water have yet to be fully exploited. New concepts, such as one for a hydrogen economy, are being explored around the world. While, in chemical terms, hydrogen is actually a primary energy source, it practically never occurs in nature in free form, but first has to be extracted by means of other energy sources. Wind energy, photovoltaics and solar thermal power plants could be considered, and experiments are also being conducted with biomass. Is hydrogen the energy carrier of the future that will be fed into the energy cycle?







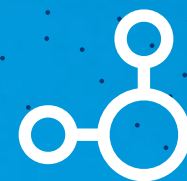
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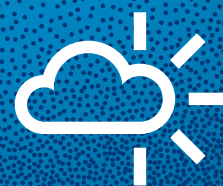
physical states

Water is unique in being the only chemical compound found on earth that exists in nature in all three physical states.



H<sub>2</sub>O

Depending on the isotopic composition of the water molecule, a distinction is made between normal “light water” (two hydrogen atoms (H<sub>2</sub>O)), semi-heavy water (one hydrogen atom and one deuterium atom) and heavy water (two deuterium atoms: D<sub>2</sub>O) and super-heavy water (two tritium atoms).



Water has a decisive influence on our climate and is the basis for virtually all weather phenomena, due to its high mobility and thermal capacity.

The origin of water on the Earth, first and foremost the question as to why significantly more water occurs here than on the other planets, has not been satisfactorily clarified to this day.



Hydrogen – energy source of the future?

The Earth needs a shift in energy and transportation policies. Since the 1980s, many researchers and scientists have seen hydrogen as the energy source of the future. It is used in industry for a wide range of processes. First and foremost in hydrogen fuel cell passenger vehicles. The most important market at the moment is China. A large quantity of hydrogen is required that is stored at high pressure in suitable containers. To meet current market demands, new container concepts, process cycles and material systems have to be developed. Voith Composites and HRC, one of the leading suppliers of fiber composite lightweight solutions, are planning to join forces to work on the next generation of high-pressure hydrogen vessels for fuel-cell electric vehicles (FCEVs). They currently constitute one of the largest cost factors.

71%

The greater part of the Earth's surface is covered by water. Fresh water makes up only 3.5 of this figure.



Completely

# Self-



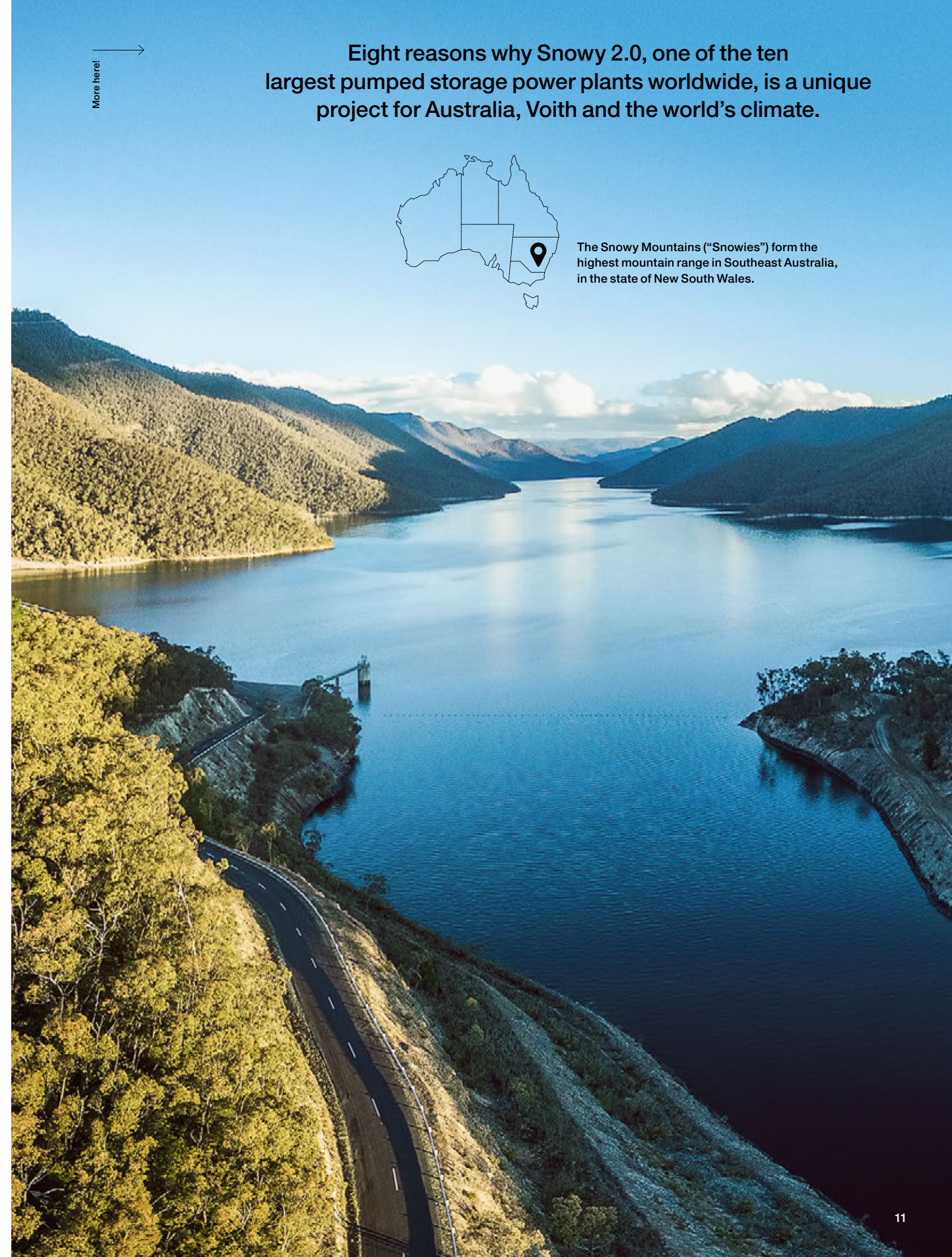
# is sufficient!

More here! →

Eight reasons why Snowy 2.0, one of the ten largest pumped storage power plants worldwide, is a unique project for Australia, Voith and the world's climate.



The Snowy Mountains ("Snowies") form the highest mountain range in Southeast Australia, in the state of New South Wales.



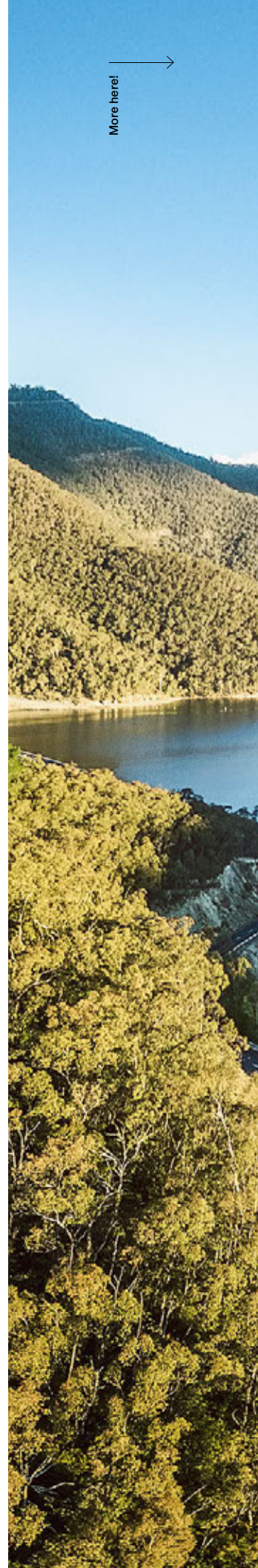


Completely  
self-



Self-sufficient!

More here! →



The Fifth Continent has the potential to cover 100 percent of its energy needs from renewable energy sources. Australia intends to achieve the first 50 percent by 2024. How? With pumped storage technology from Voith.

**1** Need for action identified

The facts are on the table. In 2018, Australia recognized that something had to be done to make sure the lights wouldn't suddenly go out all over the country. The problem: on account of the great distances across a continent of just under eight million square kilometers, different energy systems, increasing consumption and retiring coal-fired power plants, there was an impending energy crisis on the horizon. At that time, the share of renewable energies from wind, solar and hydropower stood at only 17 percent of Australian power generation, according to statistics from the Australian Department of the Environment and Energy. Hydropower already made up the largest share of this figure, at 33.0 percent. Half of this amount was generated by the largest hydropower plant in the country, the Snowy Mountains Hydroelectric Scheme. The lion's share of Australia's power supplies today is coal-based. There is a permanent risk of an unstable power grid inherent in this mix of energy supplies. It is increasingly difficult to maintain a balance between energy generation and consumption. Pumped storage technology is the solution. After all, it is currently the only long-term, technically proven and economically viable form of energy storage.

**“At Snowy, we have a proud history and a strong vision. Snowy Hydro, supercharged by Snowy 2.0, will underpin Australia's renewable energy future and keep the lights on for generations to come.”**

Paul Broad,  
CEO of Snowy Hydro Ltd.

**2** Climate change changes everything

In line with the disconcerting analyses, a change in the mindset among the general public and decision makers also occurred, acknowledging that climate change is threatening life on Planet Earth. The thinly populated continent with around 25.3 million inhabitants (as of April 2019, Australian Bureau of Statistics) is the sixth largest country in the world after Russia, Canada, China, the United States and Brazil. But most of all, this country is one of the most affluent in the world. In 2017, Australia ranked third in the United Nations Development Index, specifically due to its huge mineral deposits. On account of the high amount of fossil fuels extracted, the country is virtually independent of imports of such natural resources. There are no nuclear power plants for electricity generation. The snag: the massive share of fossil fuels leads to huge emissions of greenhouse gases and contributes to global warming. In 1997, Australia was the second to last industrial nation to sign the Kyoto Protocol that came into effect in 2005, the precursor to the Paris Agreement. The declared goal is now to cease wasting the country's own resources, and to use them with more care or find substitutes.

The Paris Agreement (in French: *Accord de Paris*, in German: *Übereinkommen von Paris*) is an agreement between the 197 signatory countries to the United Nations Framework Convention on Climate Change (UNFCCC) with the objective of climate protection. The Convention was signed on December 12, 2015

**3** The right place at the right time

Voith has had operations in Australia and New Zealand for decades. There are more than 80 employees working in Sydney, Brisbane, Perth and Melbourne. Voith opened a branch office in Sydney at the beginning of 2018, with the goal of expanding its local presence in the region. The objective of this new subsidiary is to serve local producers and customers quickly and flexibly, with high-quality products and customized services. Having a representative office in the country helps us understand the geographical conditions, to get a deep insight into the hydropower market and its (legal) peculiarities, and to fulfill the clients' specific needs.

**“Pumped hydroelectricity storage (PHES) is currently the most mature and economically viable form of flexible capacity.”**

From the Australian Energy Resources Assessment (AERA), 2018

**4** A superlative

The Future Generation Joint Venture and Voith signed an agreement with Snowy Hydro Ltd. to build the Snowy 2.0 project in April 2019. The plant will be operated by Snowy Hydro Ltd. Equipped with electrical and mechanical power plant components, Snowy 2.0 is going to be one of the ten largest pumped storage power plants in the world. The gigantic project: the two existing dams in the Snowy Mountains systems with the Tantangara and Talingo lakes are to be connected to each other by subterranean tunnels and a subterranean power plant with pump and electricity generating units. It should be kept in mind that they are 27 kilometers apart and at different altitudes! The entire power plant is almost one kilometer vertically below the mountain peak. The contract covers the delivery of six reversible Francis pump-turbines. The scope of delivery further includes six motor-generators, the auxiliary systems and the entire power plant automation system. The imponderables that could be experienced, however great the effort put into planning, striving for perfection and the most exacting calculations, will be a major challenge. Voith has already successfully managed complex projects of this kind. But in its specific constellation Snowy 2.0 is unique.

**5** Stability and reliability

In the meantime, Australia has more than 120 operational hydropower plants with an installed output of just under 8,800 megawatts. The country's hydropower resources are mainly concentrated in the states of Tasmania, New South Wales (NSW) and Victoria. The Snowy Mountains hydropower plant that covers both NSW and Victoria is Australia's largest hydropower facility. It consists of 16 large dams and nine power plants with a total output of 4,100 megawatts. As investments in renewable energy sources, such as wind and solar power, are constantly on the rise, the demand for pumped storage must increase as a necessary balance to these sources. After all, wind and sunshine are to a certain degree unpredictable. There is at the heart of the innovative pumped storage technology a special asynchronous motor-generator. Its rotational speed is not tied to the line frequency and can be varied. This enables the system to react more quickly and flexibly to active and reactive demands from the electricity grid. Furthermore, it offers additional stability in the event of a drop in voltage.

**6** This is just the beginning

The Australian government is promoting the expansion of pumped storage throughout the country. For instance, Hydro Tasmania has developed – in cooperation with the Australian Renewable Energy Agency – a concept for the new role that Tasmania is to play on the Australian electricity market. Ideas under review include the expansion of existing hydropower plants and the construction of an additional new pumped storage power plant to make the state the “Battery of the Nation”. The country has, however, at least 22,000 locations suitable for new pumped storage power plants. This means that Australia has the potential to become a model country for nationwide use of renewable energy sources. With its experience and its hydropower components, Voith is making an important contribution to this development.

**7** For they know what they do

Voith has been offering everything needed for efficient and pioneering use of hydropower. The portfolio covers all components for large and small-scale hydropower plants as well as pumped storage power plants – from generators, turbines, pumps and automation systems to replacement parts, maintenance and training services, as well as digital solutions for the entire life cycle of the facilities. As long ago as 1937, Voith developed the first single-stage pump-turbine that acted both as a turbine for energy generation and – in reverse – as a pump. Today, almost 200 Voith pump-turbines have been installed worldwide with a total output of more than 25,000 megawatts. At our own locations in Asia, Europe, and in North and South America, we manufacture all components for hydropower ourselves. Furthermore, we are conducting research into tomorrow's means of generating electricity.

**8** Stamina and determination

The Snowy 2.0 project is the second-largest contract ever received by Voith and a nice example of how perseverance pays off. The tender process took almost two years, a test of patience that will bring benefits for all concerned. Especially for the climate.



“I am pleased that Voith, a leading provider of hydropower plant equipment, will be supplying Australia in the future with the necessary electrical and mechanical components for the Australian pumped storage power plant Snowy 2.0. This example of German-Australian cooperation has great potential and is paving the way for large-scale electricity generation from renewable energy sources – in Australia and worldwide.”

Lynette Wood,  
Australia's ambassador in Germany



The Snowy 2.0 project links the two existing dams in the Snowy Mountains system – Tantangara and Talbingo (the photo shows the Talbingo Reservoir) – to each other by means of subterranean tunnels and a subterranean power plant.

# Three questions to...

Lars Meier, a university-qualified engineer specializing in mechanical engineering, Head of Sales at Voith Hydro who spent one year living in Australia with his family over the two-year bidding phase.

# 1

What makes this contract so fascinating for you?

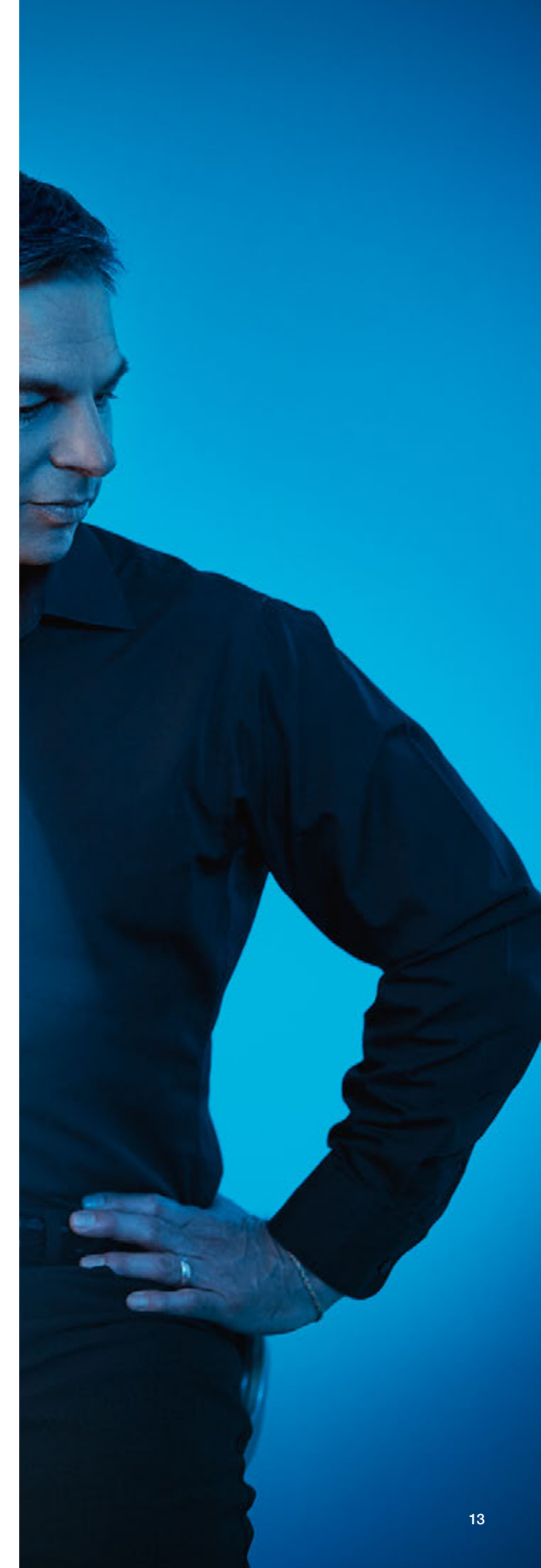
The dimensions of the project are gigantic in every respect; by the time commissioning is completed, hundreds of companies will have been involved, from road construction and mining through to us as hydro-power equipment suppliers.

I have always seen pumped storage as being the pinnacle of the hydropower business. I am also thrilled that Australia has the opportunity to meet 100 percent of its energy needs with renewable energy. For Voith, it was important to maintain market leadership in this field, in which there is fierce competition. Snowy 2.0 is an important reference project. Furthermore, it will create thousands of new jobs at the contractor companies involved – that's great.



# 2,000 MW

is enough power to supply 200 million LED bulbs with electricity.\*





“I am pleased that Voith, a leading provider of equipment, will be supplying Australia in the electrical and mechanical components for the pumped storage power plant Snowy 2.0. The Australian cooperation has great potential as a way for large-scale electricity generation from sources – in Australia and worldwide.”

Lynette Wood,  
Australia's ambassador in Germany

# 2

## Which of our strengths helped win the project?

Our technological knowledge, our experience, the expertise. But most of all the fact that we were involved from the very outset and supported the client in the development of the project. We felt that it would be opportune to proactively make contact with the construction companies that would receive the lion's share of the overall budget in order to integrate our own equipment into the design of their construction work. At that stage, it became clear to me that individual trips would not be sufficient, I would have to move there. I would have found it very annoying if we had failed to get the contract for that reason. Voith also has all the necessary infrastructure at its branch in Sydney; laptops and smartphones immediately dial into the global Voith network. These were also little pieces of the puzzle leading to success.



# 4,000 pages of DIN A4

paper would have been needed to print out the final version of the bid.

# Some 8,000

sea containers of equipment and material will be needed for Snowy 2.0.\*

# 3

## What was the year in Australia like for your family?

My wife and two daughters joined me in Australia in the second year of tendering. Such a step always contains an element of risk, too. Some things are simply different in an unfamiliar city or don't work out as quickly, and that is when teenagers tend to get impatient. And homesickness is another challenge parents may have to face. But that is something that only a strong family can handle, it creates even closer bonds. We all considered ourselves lucky that Voith, as my employer, gave us the opportunity to live in Australia. There was fantastic support from those colleagues who had been there longer. My family was already familiar with living abroad, as I had held a position as chief engineer at Voith in the United States from 2010 to 2015. All of us loved Australia. The food is great, we lived in Sydney's Olympic Park, around 30 kilometers from the city center, that is fantastic for sightseeing and shopping. My daughters learned how to surf. On Sundays, we liked to hike along the coast and explore the area. At the critical stages of the project, I had to work virtually around the clock, and had to be available on the phone or by e-mail during the day for the Australians and in the evening for my colleagues in Heidenheim.

“It is the second-largest contract in the company's history. That is reassuring because we have done something similar already.”

Lars Meier,  
Head of Sales, Voith Hydro



# 2.2

million meals a year will be served during the period of intense construction work.\*



# 175 hrs

of energy storage will be provided by the new power station. This is enough to supply three million households with electricity for an entire week.\*

\*Source:  
Snowy Hydro Ltd., 2019



“I am pleased that Voith, a leading provider of equipment, will be supplying Australia in the electrical and mechanical components for the pumped storage power plant Snowy 2.0. The Australian cooperation has great potential as a way for large-scale electricity generation from sources – in Australia and worldwide.”

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## Good things come to those who wait

Snowy 2.0 over the course of time

### 2017

March 2017  
Snowy 2.0 project is announced.

December 2017  
The project's feasibility study is completed, showing Snowy 2.0 is technically and financially feasible.

### 2018

December 2018  
Snowy Hydro board approves a final investment decision to proceed with Snowy 2.0.

### 2019

January 2019  
Voith and Future Generation Joint Venture are appointed as preferred tenderers for Snowy 2.0.

April 2019  
Voith and Future Generation Joint Venture are awarded Snowy 2.0 contract.

### 2020

Snowy 2.0 main works begin, subject to planning approvals.

### 2024 2025

Late 2024/2025  
First power from Snowy 2.0, with progressive commissioning of the six units.

Lars Meier,  
Head of Sales, Voith Hydro





# WAVE

Hydropower plants with Voith technology are efficient in themselves. But we are convinced that digitalization can make this already clean means of energy production considerably more efficient and, most importantly, ensure its future viability.

# are all

Even now, hydropower is highly automated. Entire facilities can be controlled by remote access, and many processes run automatically using software. In line with the ongoing progress of digitalization, the next logical step consists of installing a wide range of digital components such as sensors and monitoring systems. Constant data collection using electronic and hydraulic units in the power plants provides the basis for diagnosis and troubleshooting. In this way, plant operators obtain an ever more detailed insight into the current state of their plants. Furthermore, even the smallest of deviations from the ideal values are spotted.

#### The sound of a power plant

Only when anomalies are identified at an early stage is it possible to plan anticipatory maintenance work or draw conclusions on the service life of machines. In order to be able to make predictions of this kind, a sound monitoring system continuously streams acoustic data to data scientists from Voith. They use mathematical models and machine learning to identify anomalies. Even the most experienced hydropower specialist would never be able to keep an eye on everything. Even if he could, detective work of this nature could take days or weeks. A digitalized system, on the other hand, communicates the smallest abnormality to the “control center” and the operator will immediately be given recommendations and instructions for action from the Voith team. In doing so, the team has only one objective: to prevent the customer experiencing expensive downtimes.

This is all the more important as hydropower plants are often located in remote areas and run without human intervention. This means that problems may remain undetected and cause major damage to the facilities as a consequence. Operators are consequently well advised to place their trust in smart, self-learning analysis and monitoring systems to identify possible deviations with potentially dangerous consequences at an early stage. Without such systems, there is a great risk of dangerous operating states. In a worst-case scenario, the plant's failure may lead to the blackout of an entire region.

#### The benefit of digitalized hydropower

Around the world, hydropower plants are maintained mainly on the basis of predefined schedules and empirical values. In this context, however, targeted planning is more efficient and reliable – by means of constant, automated analysis and interpretation of central data such as speed, output or water level. In addition: while global demand for energy is on the rise, careful use of natural resources is becoming ever more important. Wherever there is a reliable source of hydropower, fossil fuels decrease in importance and energy becomes more sustainable. Together with its customers, Voith is continually working on this development.

# SURFED



No business can know everything nor does it need to.  
We need strong partners to address climate change over the long term.  
For this reason, we are constantly expanding our digital network.  
To promote the industrial transformation – not only our own but also  
that of our customers.

# Additions to the family!

## → Innovation Lab

Berlin digital laboratory and place for new ways of thinking, experiments, internal and external further training, and entering into an exchange beyond the walls of the laboratory. The Berlin-based team has been the driving force behind innovations within the Voith Group, such as design thinking, since 2018.

## ← Ray Sono

A partnership for digital transformation and the future: with a 60 percent shareholding, Voith has been the majority shareholder in this agency for digital communication since 2017. Its most striking results so far: OnCumulus, merQbiz and VR applications.

## → Pilotfish

At the beginning of January, Voith acquired a 56 percent shareholding in the provider of digital solutions for public transport. The objective of this cooperation: increased efficiency and new services for customers thanks to digitalized, smart products – across the entire Voith mobility sector.

## → TSP

The joint venture with TSP, one of the leading US providers of services for quality control systems, was founded in April 2019 and bears the name of TSP OnCare Digital Assets Inc. This strengthens Voith's presence in North America in the important field of automation and digital services.

## ← C.H. Robinson

One of the largest logistics groups worldwide, providing transportation solutions and other services for customers from the paper industry. Since 2018, the two companies have been developing integrated logistics solutions for merQbiz, Voith's digital B2B marketplace for wastepaper.

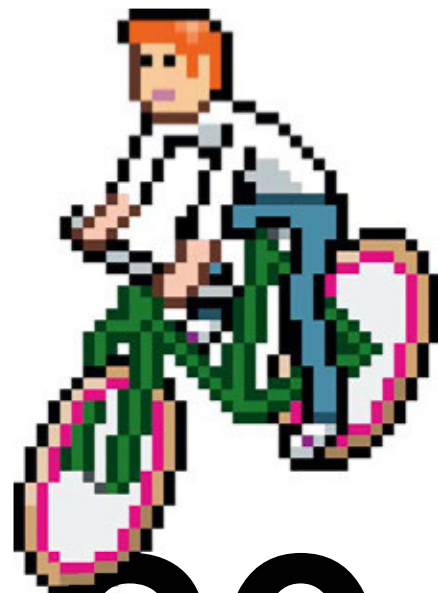




→ 2

# The drive makes the difference

From e-scooters, hybrid and electrified cars and rail systems, to self-driving buses or ferries – municipalities all over the world are working on new, low-emissions, energy-efficient mobility concepts.



# 20%

The 28 EU member states have undertaken a commitment to reduce their greenhouse gas emissions by one-fifth.

Source: German Environment Agency

More here! →

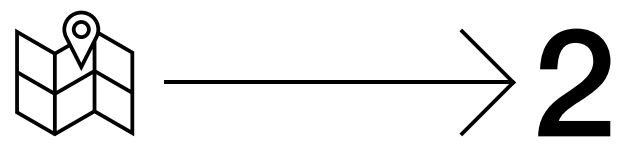
Businesses, consumers and most political decision makers around the world are in agreement that climate protection is now the top priority. The People's Republic of China is leading the field and setting the pace. The rapid shift to electromobility on the road and rail networks in that country is accompanied by prohibitions, new laws and subsidies. The objective is to have at a minimum five million electric cars on China's roads by 2020, while other nations are still talking about charging infrastructure for this alternative drive technology. At least virtually everyone is united in having identified the necessity to develop alternatives to motor traffic. The objective must be to convince people to share the use of public means of transport such as buses and trains. This global stance requires sustainable technologies. That is Voith's strongest driving force. It is part of our DNA: striving to invent new things, inquisitively driving forward new developments, and deploying technological insights for the benefit of mankind. This has been our motivation for more than 150 years. We are shaping the future of mobility, because it is urgently needed and because we have the know-how.

The sharp increase in population is causing rapid growth in our cities around the world. According to United Nations statistics, more than two-thirds of the world's population will live in urban areas by 2050. People live in megacities to safeguard their livelihoods and to gain access to education. This presupposes a viable economy. Today's mobility solutions are, however, not able to meet the rising demand for transport caused by urbanization without increasing harmful emissions and traffic jams that waste energy and time. As one of the leading providers of mobility technologies and services, Voith develops reliable resource-saving, low-emissions and smart solutions for sustainable public traffic systems. Voith Turbo has been supplying holistic drive components for rail and commercial vehicles, ships, and for various industrial applications. Many years of experience and a worldwide service and distribution network have enabled the Group Division to acquire unprecedented expertise. The decisive factors in this respect are close cooperation and an exchange of ideas with users, manufacturers and operators all over the world. The development is picking up speed, its momentum can no longer be stopped.



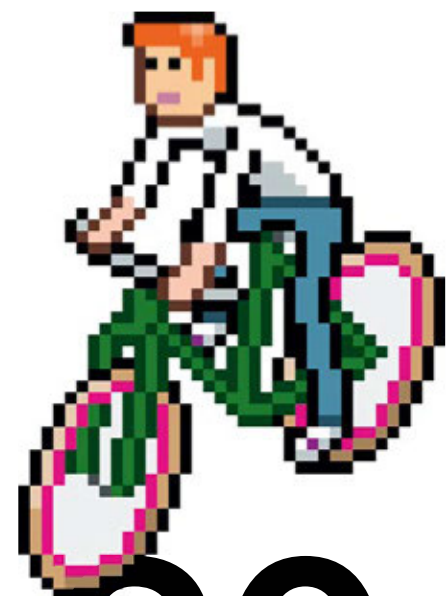
# Mobility





# The drive makes the difference

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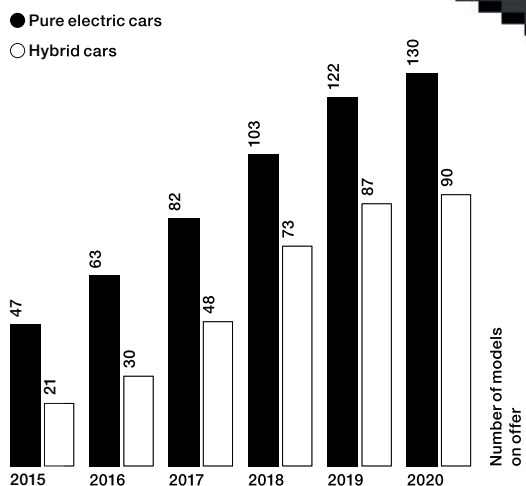


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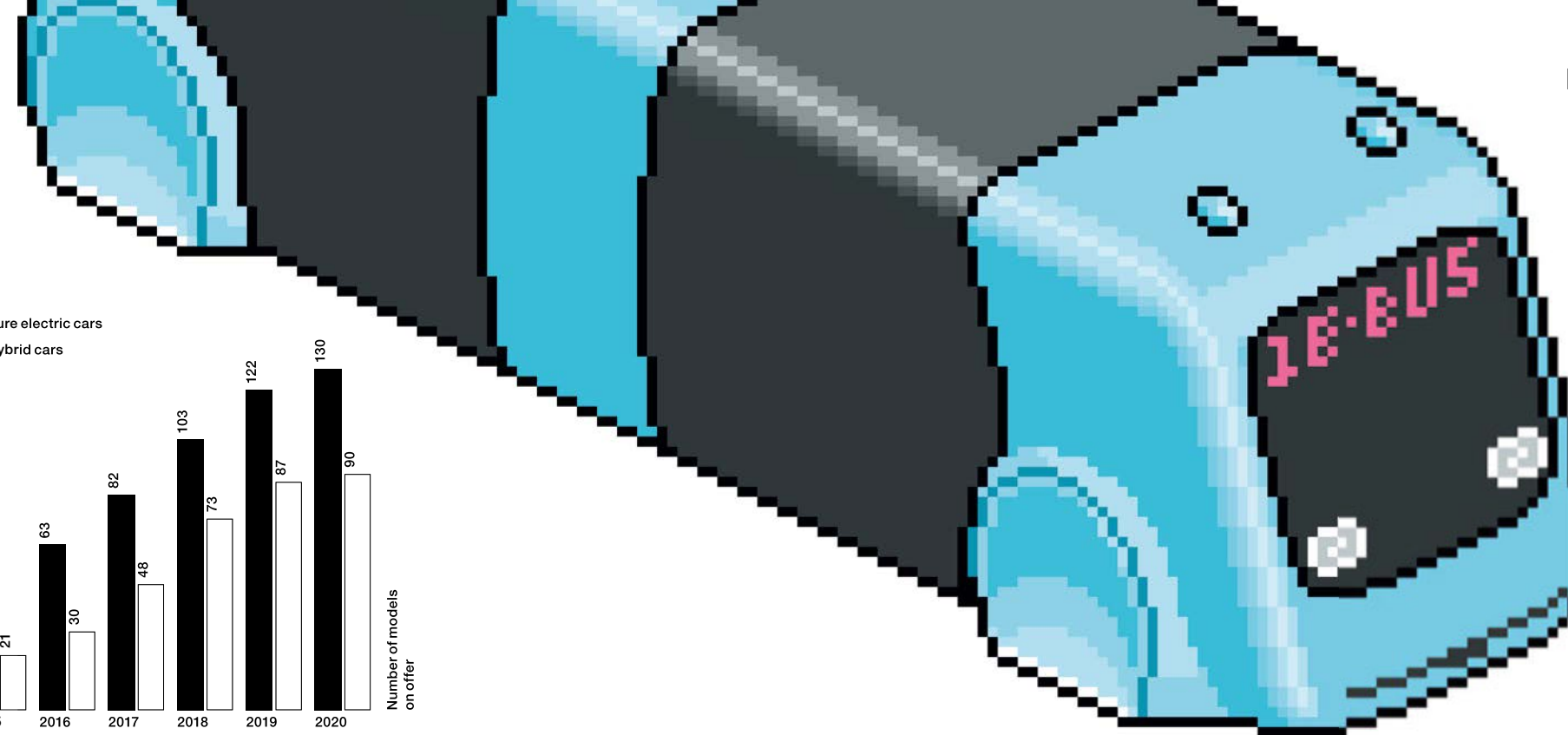
More here! →



## Great selection

There are plans for 130 electric vehicles (EVs) and 90 hybrid models to be on offer worldwide in 2020. In 2015 there were only 47 EVs and 21 hybrid versions.

Source: Statista.com, July 2019



# 421,000

## electric buses

There are currently 421,000 electric buses on the road in China. In the rest of the world, counted together, there are only around 4,000 e-vehicles in operation.

Source: Bloomberg.com, May 15, 2019



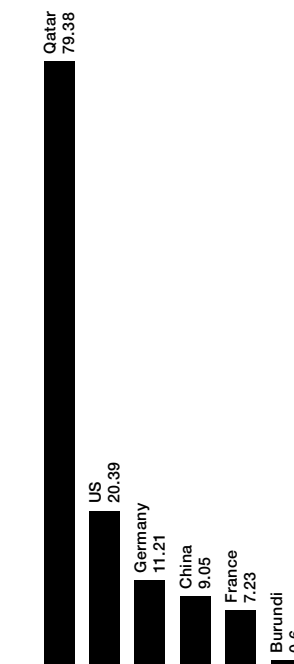
## Europe is on a roll ...

With per capita investments in its rail infrastructure of €365 in 2018, Switzerland took top place. Spain came in last with €29 per inhabitant.

Source: Allianz pro Schiene e.V., 2018

# 79.38

metric tons



That is the world's highest per capita CO<sub>2</sub> emissions figure and belongs to Qatar. In Germany, it is 11.21 metric tons on average. The CO<sub>2</sub> emissions per US American come to 20.39 metric tons, 9.05 in China and 7.23 metric tons in France. The lowest CO<sub>2</sub> per capita emissions can be found in Burundi with only 0.6 metric tons.

Source: Matthias Seidl: „Klima-Status quo: Daten und Fakten zum aktuellen Zustand der CO<sub>2</sub>-Emissionen visualisiert“ (“Climate status quo: data and facts on the current state of CO<sub>2</sub> emissions”)



SN



**Dr. Sigrid Evelyn Nikutta** has been CEO of Germany's largest local transport company, Berliner Verkehrsbetriebe (BVG) since October 2010. Their services were used by passengers more than 1.1 billion times in 2018 alone.

TG



**Tomas Gabinus** is the Executive Director at Pilotfish in Gothenburg, one of Europe's leading providers of IT for public transport; it has branch offices in Sweden, Germany and France.

CW



**Industrial engineer Cornelius Weitzmann** has been CEO Mobility at Voith Turbo in Heidenheim since June 2016, and has been instrumental in advancing the electric drivetrain.

# Mobile world/s

Three experts with the same objective – to play a role in protecting the environment by improving public transportation. A conversation about the mobility of the future.

When you consider the mobility of the future – what do you see as the most pressing issue?

4:00 p.m.

4:00 p.m.

SN

It is beginning right now; today, we are paving the way for the traffic of tomorrow. It must be environmentally friendly and efficient. Only a more robust system of local public transport will allow our towns and cities to remain livable and lovable. We want parks – not car parks!



CW



TG



4:00 p.m.

CW

Precisely. If we want to do something against climate change, we will have to switch from using our own cars to using communal means of transport. Electric ones where possible. For this, we will need powerful infrastructures, however. In addition, use will have to be affordable.

4:01 p.m.

TG

It is a question of how to reduce our global footprint. We have too much individual traffic and we travel too much. Every one of us must give some thought to the means of transport we use and what the consequences are.

The market for e-mobility is currently experiencing rapid growth worldwide – how do you see its development?

4:02 p.m.

4:02 p.m.

TG

I am in favor of electrification, it is far more efficient than burning fuels. There are still issues with storage of the energy and with the batteries. We will resolve them. Electrification is not a trend, it will become the standard. Taxes must be imposed on fuels in line with the environmental damage they cause.

CW



4:03 p.m.

CW

I see it in exactly the same way. We must be able to make the energy available from a technological perspective and it must be affordable. This will only work if there is a significant rise in the volume in these markets. The European Union approved the Clean Vehicle Directive in May 2019. It stipulates that by 2025 up to 45 percent (by 2030: 65 percent) of all urban buses must be clean vehicles, i.e. battery electric, hybrid or hydrogen vehicles. That's a good thing.

CW



4:04 p.m.

SN

The electrification of our bus fleet is in full swing, serial deliveries are in progress and some of our bus routes in Berlin are already being served entirely by electric-powered vehicles.

TG



How soon can implementation of new technologies across the board be expected?

4:05 p.m.

4:05 p.m.

CW

Nationwide or Europe-wide implementation is conceivable, but it will take years or perhaps even decades. We should not forget that there are other technological developments. Once fuel cell technology has become a standard product, the process might pick up much more speed.





Decades are too long ...

4:05 p.m.



4:06 p.m.

CW

I see that differently. Public transportation can change dramatically within ten years. With regard to cars, offers such as car sharing have an immediate effect. We shouldn't vilify diesel engines, either – with regard to limiting climate warming, they have significantly lower carbon emissions than gasoline engines. At Voith, we decided to develop an electric drive concept three decades ago. The first field tests are currently underway in Schwäbisch Hall with three buses. This will subsequently evolve into a standard product that we intend to put on the market in 2020. We are also working on a hybrid solution that will come onto the market in 2021.

4:08 p.m.

SN

We are currently in a transitional period. It won't work without new diesel buses. Our car fleet is already completely electric. By 2030 at the very latest, our buses will also be running completely emissions-free at a local level. Urban traffic systems are complex structures. With bus fleets, people think of the vehicles, but the infrastructure has to be adapted: depots, charging stations, electricity grids ...

4:10 p.m.

TG

I am nevertheless certain that electrification of mobility will move quickly. Faster than we think. If you have a look at the countries around the world, they currently have the cash to make these investments. Inventions such as the e-scooter are a positive example.

TG



Is Sweden further down the road than other countries?

4:12 p.m.

4:12 p.m.

TG

I do think that with regard to environmental awareness Sweden is ahead of Germany, as an example. But the German government is quite progressive in terms of speed, for example with investments in solar technology and transitioning to electrified public transport.

4:14 p.m.

SN

Such comparisons are tricky. There are cities in China with more than 15,000 e-buses. These are impressive figures. That said, the quality and environmental standards there are quite different compared to the situation here.



What is the role of digitalization in all this?

4:17 p.m.

4:17 p.m.

TG

Digitalization brings about a radical improvement in the design of public transport, rendering it more efficient – in terms of logistics, staffing and with regard to maintenance. Passengers benefit from information that is always up to date.

CW



4:18 p.m.

CW

One fantastic aspect is that the young generation is specifically embracing change. In earlier times, everyone wanted a car at 18. Nowadays, youngsters use services such as Uber and other apps for travel. If young people change their behavior, this will have the greatest impact on the transformation of transportation.

There is, nevertheless, the phenomenon that the automotive industry is currently generating most sales with SUVs ...

4:19 p.m.

4:20 p.m.

CW

This is true. But VW, the world's largest carmaker, is now putting enormous efforts into electrification, and other automotive manufacturers, too. I hope that the consumers will ultimately also buy electric cars.

4:21 p.m.

SN

SUV drivers like to point out the greater comfort in comparison to compact cars. This means that we will also have to become more comfortable. New buses and trains are making a contribution to this, as is, for instance, our mobility platform Jelbi, which combines local public transport and sharing.

So how do you envision the mobility of the future?

4:22 p.m.

4:22 p.m.

CW

I am optimistic. For me, the most important thing is for public transportation to be people's first choice.

4:23 p.m.

SN

With BVG, two-thirds of passengers are already traveling on electric-powered vehicles. On subways and streetcars or with our solar ferries. Hopefully, as many municipalities as possible will follow our example.

4:24 p.m.

TG

I hope that we are helping to promote these developments. And keep our promises for the next generation.

SN



CW





In line with the population growth of our planet, there is increasing demand for transportation. At the same time, an improvement in the local and global CO<sub>2</sub> balance is desired. A dilemma. We do not think in terms of problems, we think in terms of solutions. Some examples:

### A fleet of clean buses

**The task:** CO<sub>2</sub> emissions in towns and cities have to decrease significantly.

**The solution:** Electrification is one of the central “adjusting screws” in the system. For this reason, more operators of local public transport systems are turning to the use of completely electrically powered buses. Especially since at least 15 percent of buses must have an alternative drive system for public service contracts from 2025 onwards. As of 2030, the share will then rise to 30 percent. This is a requirement of a directive issued by the European Parliament in April 2019. There are similar objectives in place outside of Europe. Whether the drive is based on electricity, hydrogen, natural gas, biomethane or LPG – clean local public transport is the goal. The transition is not only sensible but also much simpler than previously assumed, with the Voith Electrical Drive System (VEDS) for example. It is completely emissions-free, compatible with all battery systems and was developed for use in single-decker, double-decker and heavy articulated buses as well as in barrier-free low-floor buses. It has a groundbreaking integrated self-learning energy management system. Voith’s hometown of Heidenheim has already taken on a pioneering role and is moving in the right direction. As of December 2019, electric buses with VEDS, which guarantees a range of up to 200 kilometers, will be seen on its streets.



### As a reward

The coveted 2019 international sustainability prize presented by the “busplaner” journal (published by HUSS-Verlag) was awarded to VEDS in the “components” category in March 2019. That was confirmation for Voith that it is moving in exactly the right direction with regard to e-mobility.

### Horst is already on the way

**The task:** Firstly, ferry operations must become safer and more reliable, and secondly, the fuel costs need to be reduced.

**The solution:** In the Akoon pilot project on the Rhine river, various research institutes and businesses are using the Horst ferry to test autonomous ferry operations on inland waterways in Germany between Oestrich-Winkel in Hessen and Ingelheim in Rhineland-Palatinate. Voith is providing four Voith Schneider Propellers (VSPs) for drive and steering. This reduces fuel consumption. In addition, a smart route planner acts to increase efficiency and thus conserve resources. Incidentally, Horst carries 600,000 people and 300,000 vehicles each year.



### Safely towed along

**The task:** The risk for humans and the environment emanating from the tugboats used for large freight barges all around the world is to be eliminated.

**The solution:** The international autonomous tugs joint project. The parties involved include the German Research Ministry (BMWi) as sponsor, the Federal Waterways Engineering and Research Institute and the Fraunhofer Society. In a first step of the FernSAMS project (runs until 2020), project coordinator Voith developed the study content for remote-controlled tugs.

This involves the captain standing on the riverbank rather than on the bridge of the tugboat. In the future, autonomous tugs could be able to operate without any crew at all on board. This would eliminate the risk to human life from fire, capsizing or collision. As the cockpit and crew quarters would no longer be required and a lighter design would be possible, the energy needs of these support boats would decrease dramatically. In addition, a diesel-electric drive concept would make them considerably more environmentally friendly.

A welcome side effect is a significant cost reduction for tugboat owners and ports. Voith also intends to be on board for unmanned shipping.



### Leading the way

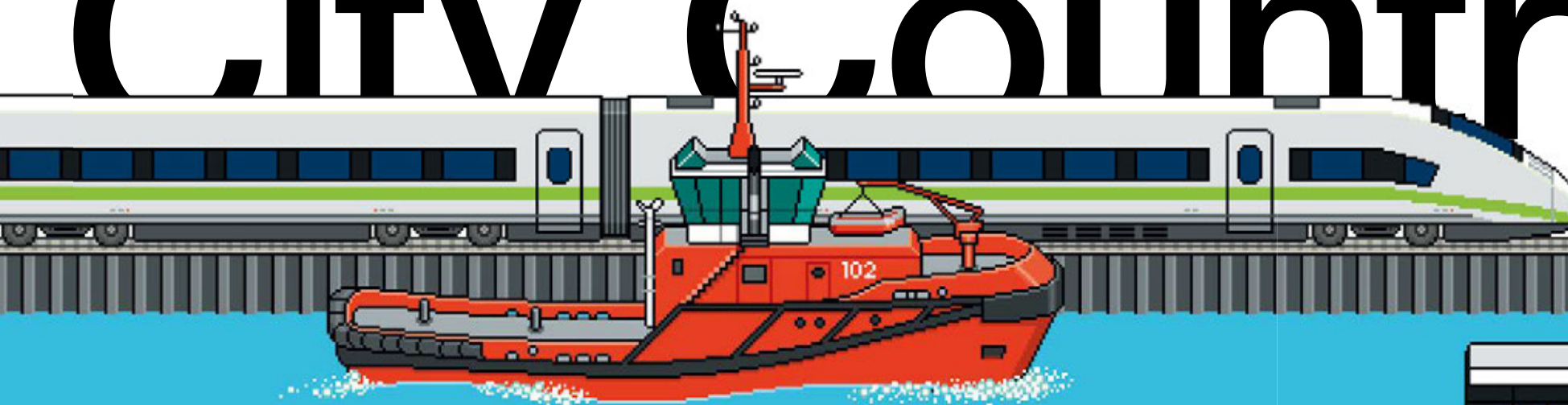
Because the technology offers increased safety, reliability and a higher degree of automation in logistics and in combined transport, the semi-automatic coupler Voith CargoFlex Type Scharfenberg was awarded the 2018/2019 Innovation Prize of the Bahn-Media publishing house. The jury, made up of rail experts from all over Europe, was impressed by the light but robust system for automatically decoupling or signal transmission that can be flexibly incorporated into existing equipment.

### Alliance with CRRC for the mobility of tomorrow

**The task:** To improve the climate footprint in traffic and transportation at a global level.

**The solution:** More sustainability in local, long-distance and goods traffic. This is the declared objective of a strategic partnership that Voith entered into in September 2019 with the signing of a memorandum of understanding with the China Railway Rolling Stock Corporation (CRRC), the world’s largest rail vehicle manufacturer. The two corporate groups want to accelerate research and development in the field of electric drive systems. The intention is to deploy their combined expertise not only to improve the climate footprint in the traffic and transportation sector but also to expand the business for commercial vehicles and to further strengthen the groups’ respective position on the rail vehicle and industrial markets. This is not the first cooperation agreement between Voith and the gargantuan vehicle manufacturer from China: we had already founded two joint ventures at the beginning of the year that focus not only on research and development but also the manufacture, distribution and maintenance of rail products. China remains the world’s major driving force in the field of electromobility. For this reason, the cooperation with the most important vehicle manufacturer in the People’s Republic promises a great deal of progress in this field. The fact that the agreement on the current cooperation arrangement was signed in the presence of the heads of government of both countries during federal chancellor Angela Merkel’s trip to China, underlines the magnitude of this important step in the direction of greener mobility. A step that can only succeed shoulder to shoulder with strong partners. We are already making progress.

# City Country, River





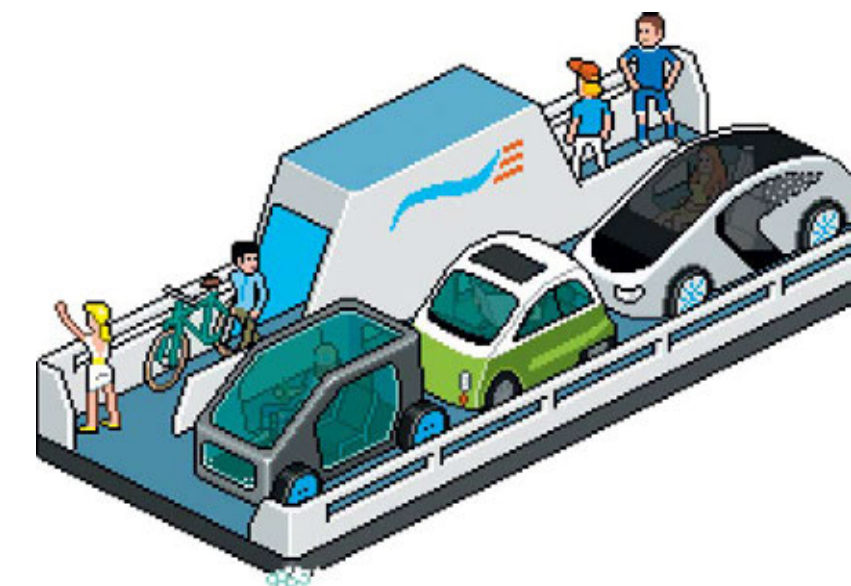


←  
More here!

# The ecosystem of a city in the near future

1. **Autonomous ferry**  
Automated ferries will make it possible for foot passengers and vehicles to be carried from one riverbank to the other and through shipping traffic without there being a captain on board. A Voith pilot project.
2. **Helicopter taxi**  
As a means of emissions-free individual transportation, the electrically powered and pilotless aircraft takes passengers to their destination. It is pleasantly quiet and ideal for urban traffic for that reason.
3. **E-bus for everyone**  
Electric buses will replace the existing local public transport fleets with energy-efficient alternatives. The digitally controlled drive system VEDS developed by Voith is currently undergoing testing in several German cities.
4. **Water taxi**  
With modern, emissions-free hovercraft, water can be used as a transport route and take passenger traffic away from the roads. As in Venice since time immemorial.
5. **Higher quality of life**  
Water for recreational activities significantly increases the quality of life of city dwellers.

Tomorrow's urban life is characterized by two megatrends: technology and sustainability. From small municipalities to megacities, mobility is changing because it has to and because there are ever more solutions for resource-saving transportation. At the same time, city dwellers have an increasing desire for more nature in courbations and thus for a higher quality of life. Our graph shows what there is already, what will be coming in the near future and in which areas Voith is making a contribution.







# Tomorrow's urban life

protects the climate and improves the quality of life.

6. **Fully autonomous cars**  
Self-driving motor vehicles without human operators are seen as the means of transport of the future when it comes to individual traffic.
7. **Electric suburban and long-distance trains**  
Suburban and long-distance trains of the new generation are electric-powered, which means they keep their environmental footprint to a minimum as they travel. Subterranean or elevated tracks allow the limited space in a municipality to be used to the fullest. Often with a Voith drive all over the world.
8. **Urban gardening**  
Green roof areas, cultivated balconies and greenhouses represent a sustainable lifestyle and the ecological movement.
9. **Fast scooters**  
The e-scooters that have been taking road traffic by storm since 2019 are suitable for short trips in the city. No need to look for a parking space.
10. **Small electric cars**  
Economical in use, quiet and low in emissions, electromobiles dart around the cities. The number of downtown charging stations is constantly on the rise.
11. **Drone mail**  
The flying devices are more flexible, quieter and more environmentally friendly than trucks for delivering small parcels. Voith is carrying out research into suitable packaging material.
12. **Natural green areas**  
A city's extended green lungs improves the climate and well-being of its inhabitants.





# Knowledge and skills – the most important resources for climate protection

The world is changing at a rapid pace. Not just in the areas of climate. The megatrends prevailing at a global level are, firstly, the population explosion and, secondly, the demographic transition.

# Know

More here! →

Alongside, the rapid technological development demands new expert knowledge and new job descriptions that are currently coming into being everywhere. The pressure on industrial companies around the world to constantly keep up with (or even set the pace for) the environment that is changing on so many levels and to be quicker in terms of innovation than in the past can only be countered with willingness to continually adapt. The decisive source of answers to the pressing issues of the present day is human resourcefulness. It has always been that way. But never before in the history of humankind have knowledge, participation and innovation been so closely linked to each other.

Anyone or any organization that wishes to (continue to) exist and be successful must engage in constant learning. Every day. Alone, with each other, from and with others. For this reason, we attach great importance to a culture of knowledge transfer. Our ambition is to be the technology leader and to shape the future – our own, and that of our customers and partners. Pioneering technologies and services are a good approach. But they are based on many different specialized skills. If we want to find the best technologically and most sustainable solution for our Earth, we must pass on our knowledge, so that it can expand.

Many societies around the globe are still at the very beginning and can benefit from our know-how. To be able to help them in this way in their ecological and economic development is one of the greatest tasks in the global world.

# Know





# Knowledge and skills – the most important resources for climate protection

The world is changing at a rapid pace. Not just in the areas of climate. The megatrends prevailing at a global level are, firstly, the population explosion and, secondly, the demographic transition.

# KNOW

More here! →



## €33.5 billion

was the amount spent by German businesses in 2016 on further training for their employees.

Source: Confederation of German Employers' Associations, March 2017



## US \$20 billion

is the amount of revenue projected for the North American e-learning market in 2019. Europe and Asia take second and third place with US \$9.3 billion and US \$8.3 billion, respectively.

Source: Ambient Insight, The 2016–2021 Worldwide Self-paced eLearning Market, 2016

# KNOW





“Thanks to the Internet and social networks, it is nowadays quite easy to acquire new knowledge. Generic learning methods are consequently becoming ever more popular. I engage in context-based learning, through practical applications, in interaction with colleagues, flexibly, quickly and effectively. I pass on useful information through digital channels, and sometimes we also meet up – physically at meetings or virtually in an online conference in order to discuss the topics. Our transfer of knowledge has an important function, because no organization is able to grow without a good platform for the exchange of knowledge. The more we share, the more we learn. Voith has launched many initiatives aimed at developing this new way of exchanging knowledge and promoting community thinking.”

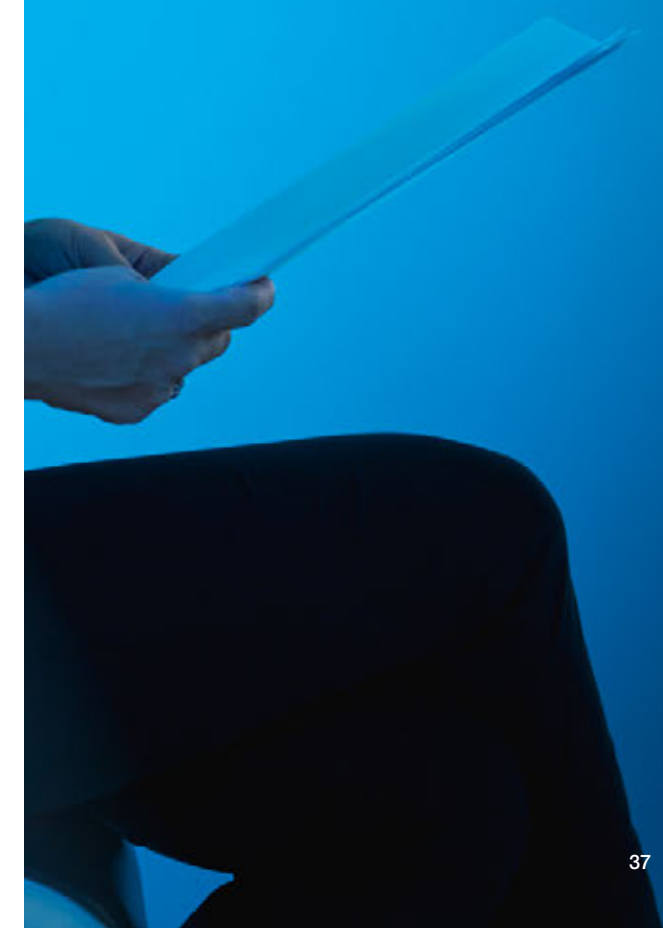
Siddhartha Mishra,  
Director Digital Projects Platforms and Services at Voith, and played a decisive role in the development of DRIVE.

# You don't forget what you've learned

Voith is convinced that lifelong learning on the part of every individual, internal knowledge transfer and the sharing of insights in the regions where the company operates are decisive factors in sustainable development. For itself, the individual and society. Consequently, we offer our workforce a wide range of qualification and advanced training programs. Of course, employee preferences vary with regard to how they acquire new knowledge. At Voith, there is something suitable offered for everyone with the freedom to adapt it to their particular needs.

... shouldn't serve to provide an advantage to an individual or a certain group, but everyone in a company or a society. ... can learn a lot from the experiences of others. Under the ... D&I initiative we exchange ideas and information mainly ... in online meetings and through SharePoint. For practical ... internal and external networks like Women&Voith and the ... managers at other corporate groups provide assistance.”

Elisa Wang-Rührnößl,  
Corporate Manager Diversity & Inclusion, is responsible for  
the D&I program at Voith.







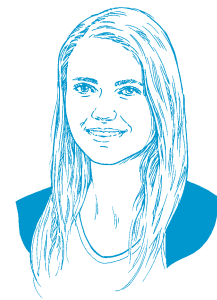
“Thanks to the Internet and social networks, it is nowadays easier to acquire new knowledge. Generic learning methods are becoming ever more popular. I engage in context-based learning, through applications, in interaction with colleagues, flexibly, quickly. I pass on useful information through digital channels, and I also meet up – physically at meetings or virtually in an online forum – to discuss the topics. Our transfer of knowledge has an impact because no organization is able to grow without a good pool of knowledge. The more we share, the more we learn. Voith has many initiatives aimed at developing this new way of exchanging and promoting community thinking.”

**Siddhartha Mishra,**  
Director Digital Projects Platforms and Services at Voith, and played a decisive role in the development of DRIVE.



**“I prefer to obtain new knowledge in personal talks and discussions; I like to use the office grapevine for smaller details. In order to stay up-to-date with current trends, I regularly attend Voith Tech Talk, for example. This is a place where internal and external specialists present pioneering technologies. There is no way in which knowledge transfer could be more direct.”**

**Philipp d'Heureuse,**  
international trainee at Voith Paper who has been participating in the Global Graduate Program since last year.



**“Any knowledge that has been learned must be passed on so that it can be used sustainably and in a useful manner. I consider this to be a cornerstone of living together in any form of society and its development. Many departments at Voith exchange ideas and information digitally using programs such as “SharePoint”. For me, the most valuable means of imparting knowledge is the spoken word.”**

**Franziska Frauenauer**  
is an industrial clerk and commenced her cooperative study program of business administration in October 2019.

**“Knowledge shouldn’t serve to provide an advantage to an individual or a certain group, but everyone in a company or a society. We can learn a lot from the experiences of others. Under the umbrella of the D&I initiative we exchange ideas and information mainly in online meetings and through SharePoint. For practical knowledge, internal and external networks like Women&Voith and the D&I managers at other corporate groups provide assistance.”**

**Elisa Wang-Rührnößl,**  
Corporate Manager Diversity & Inclusion, is responsible for the D&I program at Voith.





“I use different ways of acquiring knowledge, from e-learning courses and classroom training to internal workshops. Each concept has its own strength, but as an engineer I still learn most quickly through day-to-day practical work. I communicate new information through our Manuals, these are a kind of operating instructions for everyone. Furthermore, a weekly workshop is held in our department where we pass on information or there is also the monthly Lunch & Learn event with other teams. Voith offers very good further training and knowledge-sharing platforms to maintain and strengthen our competitiveness.”

Ying Huang  
works as a design engineer at Voith Paper.

# How exactly does AI learn ?

**In order to acquire and pass on knowledge, humans use various digital and analog channels. But how do machines achieve the same? This is explained by Jens Haag, Director of R&D Advanced Analytics and Controls at Voith Digital Ventures.**

The immense growth in performance in recent years enables computers to perform the sophisticated calculations very quickly. In this respect, they outperform human abilities by far. The most famous example of this was the triumph of the AlphaGo computer program over one of the world's best players of the complex board game Go in 2016. This play level was achieved using what is known as “reinforcement learning”, where the computer plays through a vast number of games and evaluates them, thus refining its game strategy further.

#### **Emulating humans**

To use a simplified generalization, artificial intelligence stands for an imitation of human learning ability, in most cases in connection with a decision derived from the use of computer software. For this purpose, the corresponding models are generated from data and evaluated for other specific situations. In turn, machine learning addresses such creation of models that puts the data available into context. In this respect, a distinction is made between supervised learning and unsupervised learning. In the case of unsupervised learning, the computer searches for patterns and similarities in the data available and collates the same. With supervised learning, in contrast, artificial intelligence attempts to make exact predictions by simulating general rules.

#### **A blank sheet**

Artificial intelligence has made a great leap forward with neural networks, which are also referred to using the term “deep learning”. These networks are inspired by the working of the human brain and, in technical terms, correspond to a mesh of numerous mathematical functions in a large number of layers (that's where the expression deep learning comes from) enabling the software to learn independently. At the beginning, this neural network is a blank sheet waiting for data. Only when training with real data commences does an empty neural network become a powerful algorithm. There are, however, pre-trained networks that are adapted to specific applications.

#### **AI is good for the climate**

Artificial intelligence will continue to significantly gain in importance, and in many areas will lead to an improvement in the quality of decision-making. Smart electricity grids already use models of weather patterns and energy demand to coordinate electricity production and distribution in a highly efficient manner. In the mechanical and plant engineering industry there is always scope for increasing the efficiency of a production facility and the quality of its product. Anomalies or errors in the process or in plant components can be identified at an early stage, which allows maintenance work to be planned and carried out in due time. This provides Voith with great potential for cost savings and improvements in the quality of the machines and plants sold, which is a competitive advantage. Most of all, however, this in turn makes a contribution to boosting sustainability through the optimum use of resources such as energy, raw materials and water – in line with our goal of closing cycles as far as possible.





→ 4

# Paper develops its potential

Climate protection took on a new level of urgency over the past year. In the aftermath of alarming studies, people used the European elections in May 2019 as a call to politicians to take immediate and decisive action. Papermakers must also find solutions because the demand for sustainable paper is constantly on the rise.

## 79 billion kilograms

of household and hygienic tissue was sold world-wide in 2018. In 2023, this figure is expected to rise to 87.5 billion kilograms.

Source:  
Statista.com, 2019



Currently, it is no longer possible to get away from the current ecological, societal and social issues. Paper made of wood is a good example of the paradoxical situation in which humankind is currently facing at a global level. Paper is manufactured from pulp which, in turn, is extracted from wood. It is a fact that wood is a natural and renewable material that consumes CO<sub>2</sub> from the atmosphere during its growth and continues to store carbon for its entire life cycle. It is also a fact that the paper still needs a lot of resources. How can sustainability work within such a contradiction in terms? What role can be played by paper in a world that urgently needs alternatives to plastic?

There are always two factors: finding uses of paper as an alternative material and recycling. Well, recycling really is nothing new. It is the underlying principle of nature that knows no waste. Waste is a human concept. What a circulatory system can look like is only just becoming apparent. In the future, Voith machines will, for example, be able to produce baby wet wipes that dissolve in water, in contrast to conventional wet wipes. There are great opportunities for deployment. They only have to be researched and implemented in an efficient or cost-saving manner. This requires ideas and courage. Quickly, in fact. Research must find the ways and means – also with the help of digitalization. Voith's heart has always been beating for paper as a versatile raw material, for its production and its ongoing refinement. The fact that paper has a reason for being even in an increasingly digitalized world is undisputed. But the shape that the paper production of the future will take has yet to be elaborated by the various partners around the world. After all, one thing is certain: paper has yet to develop its full potential. But it is definitely suitable for green, sustainable applications.





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Source: Statista.com, 2019

## 113,275,000 metric tons

The country with the highest consumption of paper, board and card in 2017 was the People's Republic of China, followed by the United States (70,388,000 metric tons) and Japan (26,415,000 metric tons). Germany took fourth place with 20,614,000 metric tons.

Source: VDP via Statista.com, 2019

## 420 million metric tons

The global consumption of paper, board and card amounted to 420 million metric tons in 2017. Ten years previously it had only been 394 metric tons.

Source: VDP via Statista.com, 2019

## 71.6%

That was the recycling rate of wastepaper in Europe in 2018. In 1991, it was only 40.3 percent.

Source: CEPI via Statista.com, 2019



“Nowadays sustainable business management is vital for meeting the demands of all stakeholders.”

Markus Schönberger,  
Head of Sustainability Office Voith



# 7

## pieces of good news

Newspapers, magazines, books, packaging of all kinds, postal matter of all sizes and thickness, tissue products, paper cups – the list could fill entire magazine pages. Paper does, however, have one issue. Although made from the regenerative raw material wood, production is energy-intensive. Paper is nevertheless celebrating its revival as products made of it can contribute to holding back the flood of plastic endangering nature. We will, however, need sustainable paper production in the future. There are newsworthy ways and means already available. For a start, sustainability manager Markus Schönberger, Head of Sustainability Office Voith, has seven pieces of good news for us.

Umka or:

e's no  
ed for  
thing  
to be  
new  
#1



**All-around talent:**  
The demand for packaging material made of paper is constantly on the rise worldwide.



“Nowadays sustainable business management is vital for meeting the demands of all stakeholders.”

Markus Schönberger,  
Head of Sustainability Office Voith

“Our strategy: we are implementing sustainability along the entire value-added chain and the processes involved.”

Markus Schönberger,  
Head of Sustainability Office Voith

“Our mission: we contribute a quantifiable added benefit to the sustainable development of the company, society and the environment.”

Markus Schönberger,  
Head of Sustainability Office Voith

Umka or:

there's no  
need for  
everything  
to be  
new  
#1

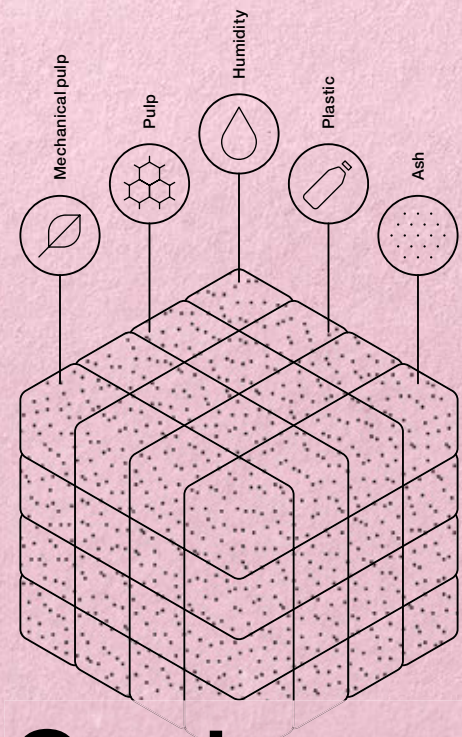
Umka or:  
there's no need for everything to be new

Great changes often start out with something small and with the right ideas even small things can make a big difference. Like the Umka paper factory in Serbia. It has been producing board since 1939 and today – just like the entire industry – it faces the task of producing quality products although its feedstock, wastepaper, is constantly deteriorating. Umka made wise investments in order to maintain the existing level and to increase production volume. Within the scope of a conversion project, it called on Voith's assistance in modernizing its stock preparation so that it can effectively clean even highly contaminated wastepaper. By doing so, this Serbian company not only improved the quality but are also optimized their operating costs and created the basis for further growth: instead of 105,000 metric tons of board per year, Umka now wants to produce more than 200,000 metric tons and thus enter new markets, beyond those European countries it has previously supplied. Voith paved the way and gave the Serbia-based company the tools necessary for their drive towards international expansion.

All-around talent:

The demand for packaging material made of paper is constantly on the rise worldwide.





**In-depth analysis:** As part of the minimally invasive quality control, BaleVision drills a sensor probe into the paper bale and measures its components.

## Such ideas change the world #2

### Such ideas change the world

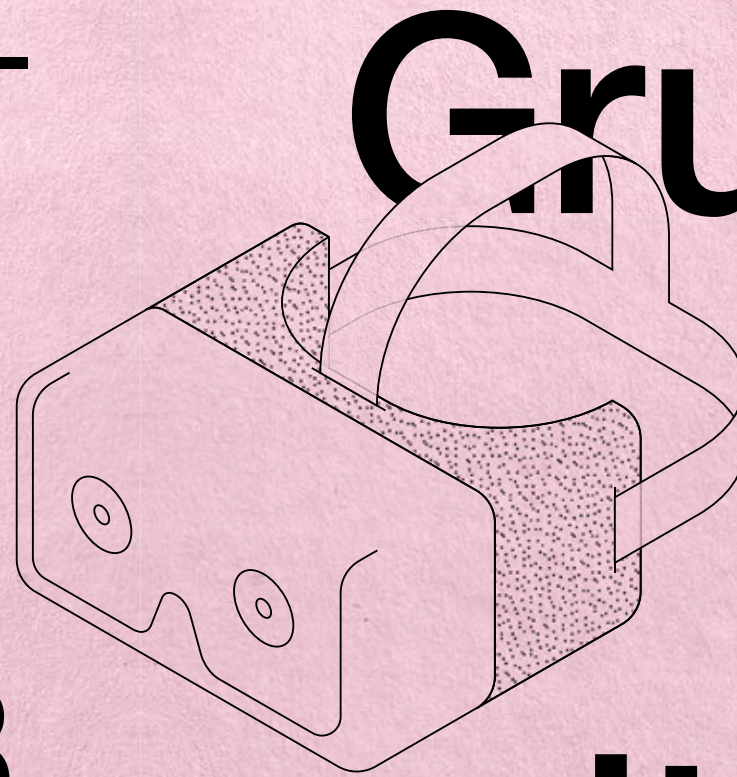
Recycling is one of the central aspects of the circular economy. Wastepaper is an important basis for the manufacture of new paper products. In the past, its quality could only be determined using cumbersome methods such as breaking open the paper bales. In order to be able to analyze the quality of wastepaper, the California-based company merQbiz – a joint venture with Voith – developed the BaleVision solution for the North American market. It combines a device that drills a sensor probe into the paper bale with software that uses the measured values to calculate information on the share of wood and pulp, humidity, and contaminants. This not only makes it possible to examine more bales but also to derive more specific statements on their quality.

## Paper-making 4.0 or: the solution for full control #3

### Papermaking 4.0 or: the solution for full control

The pressure is rising. Papermakers must become more efficient and more sustainable in their production. The encouraging piece of news: both can be combined using industry-specific software concepts. For this, Voith coined the expression “Papermaking 4.0”, which describes the digitalization of the paper industry and already supplies a software concept that increases the effectiveness and economic efficiency of production facilities, while product quality remains constant. How is this achieved? The software receives measured values from virtual sensors. It uses statistical methods and artificial intelligence (AI) to make forecasts of the paper’s strength properties and calculates how these can be achieved using the smallest amount of fibers. Processes and the use of resources are optimized on an ongoing basis as the body of data increases. However, paper producers face a further challenge – following on from the first: they have to provide their existing staff with the necessary skills and train new employees on an ongoing basis. Retaining skills and transfer of knowledge are a decisive competitive factor nowadays. In this context, the Voith PaperSchool provides a wide range of internal and external training courses covering the entire spectrum from basic training to an advanced level, and is held at the Voith Training Center in Heidenheim, Germany, or in Kunshan, China, directly at the customer’s premises or online. Practical training offers the opportunity to learn under real-life conditions in the paper production building.

This includes virtual-reality training where trainees explore the paper factory and practice scenarios while production continues. With e-Learning, continuous tests and revision ensure successful learning.



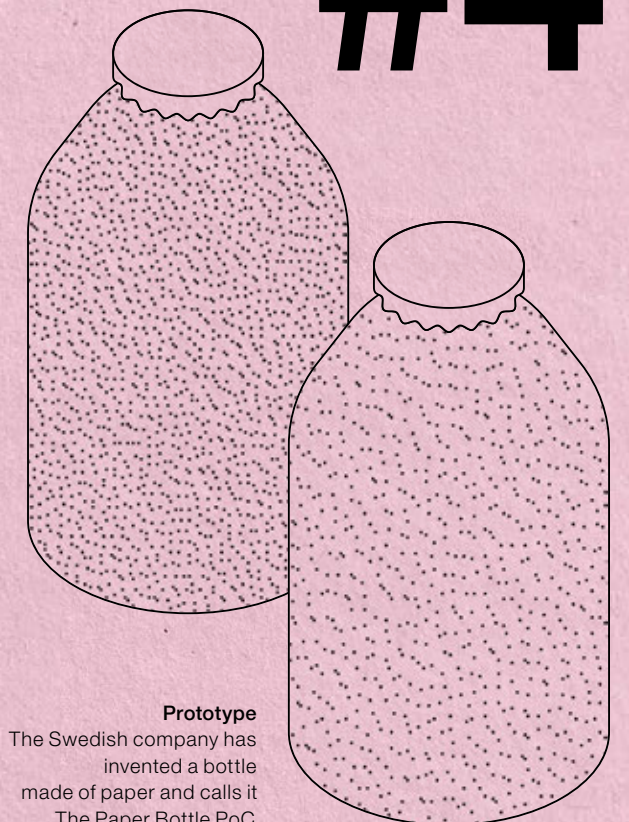
**Method of learning:** VR technology allows customers to look into the internal workings of the paper machine.

### Gruvön or: paper shows its talent

All around the globe, the paper industry is working towards reducing its ecological footprint. One particularly impressive example of its progress can be found in the provincial area of southern Sweden.

There, in Gruvön on the banks of the huge Vänern lake, stands the world’s most modern board machine. Operated by paper producer Billerud-Körsnäs and built by Voith, the KM7 is setting new standards. Equipped with networked high-tech components and digitally controlled, it provides not only efficient but also resource-saving and low-emissions operations. Each day it produces a quantity of board for the global market equivalent to 100 million one-liter milk cartons. Billerud-Körsnäs wants to transfer this expertise into a bottle made of paper. Recyclable, biodegradable and suitable even for carbonated beverages, it is intended to be a sustainable alternative to plastic bottles. The group joined up with industrial partners in 2015 to research solutions for mass production. Pilot production is now on the horizon. The paper bottle will then be able to demonstrate its potential as a replacement for plastic.

# Gruvön or: paper shows its talent #4



**Prototype** The Swedish company has invented a bottle made of paper and calls it The Paper Bottle PoC.



Sustainable production or:

# benefit for customers

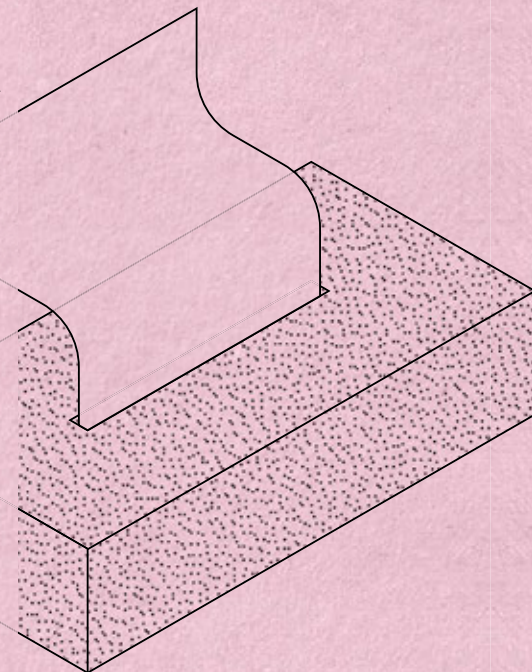
## #6



**Trophy:**  
Sustainable ideas are rewarded.

**Sustainable production or:  
benefit for customers**

Sustainability is deeply anchored in the consciousness of papermakers. No modernization, no new building can dispense with technology that uses efficiency gains to make a contribution to reducing resource requirements and, most of all, CO<sub>2</sub> emissions. Alongside ecological benefits, the economic advantages that can be achieved by sustainable business management become more specific. Legal requirements are increasing, which means that demonstrable sustainable management can strengthen a company's position towards a customer when a contract is being awarded. For example, Voith was awarded Gold Status by EcoVadis, an independent rating agency, and thus ranks among the best five percent of 60,000 businesses examined.



**Superstar:**  
Demand for tissue products is constantly on the rise.

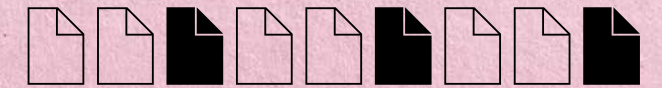
# Tissue or: the rise of the gentle star

## #5

**Tissue or:  
the rise of the gentle star**

A day without paper? Without kitchen roll or toilet paper, without paper handkerchiefs, cleaning cloths and towels? With no other grade of paper do we come into so much direct contact as hygiene and household tissue. Tissue products are omnipresent, not only in the private sphere but also in the fields of industry and medicine. Even today, tissue paper is a grade of paper for which there is no technical replacement that really works. Demand is constantly on the increase, especially in China. A total of around 79 billion kilograms of household and hygiene tissue was sold worldwide in 2019. By 2023, this figure is expected to rise to 87.5 billion kilograms (forecast: Statista.com, August 2019). Sales are expected to increase by an average of 2.8 percent each year and come to a total of €251 billion by 2023 – a rise of just under 12 percent on 2019. Tissue is the gentle star among the grades of paper. Requirements increase in line with growth. Demands are placed on the paper industry to meet the increasing demand with products that are more sustainable than in the past and are manufactured with fewer resources. For this, Voith contributes its extensive knowledge of paper and combines it with sophisticated technical solutions and digital control equipment. Smaller energy and water requirements help to reduce the ecological footprint of production.

# Every third sheet of paper in the world comes from a Voith machine!



# Paper Foresight Project or: the future of paper

## #7

**Paper Foresight Project or:  
the future of paper**

Which new trends and technologies will change society and business – and the paper segment, too? The Paper Foresight Project provides answers. Voith joined forces with more than 50 experts from the fields of industry and research to analyze tendencies and develop scenarios that provide a concrete outlook until the year 2040. The most important insight: many things will remain the same but different due to digitalization. The number of grades of paper will be similar to today but paper will replace certain types of plastic.



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