

A nighttime photograph of the Hamburg harbor. In the foreground, a large brick clock tower with two illuminated clock faces stands prominently. The harbor is filled with various ships, including a large white sailing ship with multiple masts. In the background, several construction cranes are visible against the dark blue sky, and city lights illuminate the buildings along the waterfront. The overall scene is a blend of modern infrastructure and historical architecture.

**VOITH**

THE MAGAZINE FOR POWER TRANSMISSION

# PERSPECTIVES

#2 | 2012

GERMAN PORT METROPOLIS HAMBURG

## IN CONSTANT FLUX

VOITH STEAMTRAC  
HEAT WITH ADDED VALUE

COMPLETE CONTROL FOR SHIPS  
VOITH ON THE BRIDGE

US HEADQUARTERS YORK  
HOMEBASE WITH HISTORY

Voith moves people, also in  
Hamburg – on the water, on the  
roads and on the rails.

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FUTURE PERSPECTIVES

# FASCINATING TECHNOLOGY

**Dear Readers,** I am very pleased to be able to present you with the latest issue of our customer magazine PERSPECTIVES as the new Chairman of the Management Board of Voith Turbo.

Our main feature looks at Hamburg. The metropolis is constantly changing and, with one of the world's largest container ports, represents an important central hub in a globally networked economy. We are part of this with our drive solutions for ferries, tugs and shunting locomotives.

As far as the future is concerned, we are well prepared with the SteamTrac. A product that utilizes the exhaust heat of diesel and gas motors in order to enhance the efficiency of railcars, ships, sewage and biogas plants at low energy consumption. We also report on our activities in the USA. Our location in York, Pennsylvania, is set to expand the position of Voith Turbo in the important North American market.

Join me on a journey through the fascinating world of Voith Turbo drive solutions. I hope you enjoy the trip. Yours sincerely,

**CARSTEN J. REINHARDT**

Member of the Management Board of Voith GmbH.  
Chairman of the Management Board of Voith Turbo.





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EDITION  
2/2012

DESTINATION  
HAMBURG

PANORAMA  
VOITH TURBO NEWS

EXPEDITION  
STEAMTRAC

PERSPECTIVES  
MULTIMEDIA

**PERSPECTIVES**  
The Magazine for Power Transmission



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**... AND THIS IS HOW IT WORKS**

PERSPECTIVES now also provides multimedia content to be explored by little squares on certain pages – so-called QR codes. With a smartphone and the appropriate program, glossy photographs can now be turned into moving images. Follow the instructions and see for yourself.



**1** Choose a suitable app (QR reader) on your usual platform and download it onto your smartphone (there are free reader apps, for example i-nigma).

**2** Open the application on your smartphone and move the camera directly over the QR code on the magazine page. Many cell phone cameras still lack certain macro functions. This is why the picture may not be sharp. In this case, scan the code from a distance; this often helps.

**3** Once the QR code has been recognized, your smartphone opens the connection to the relevant multimedia content. You can now get started! Please note: You should have a flat rate, otherwise videos might be very expensive.

**FEATURES**

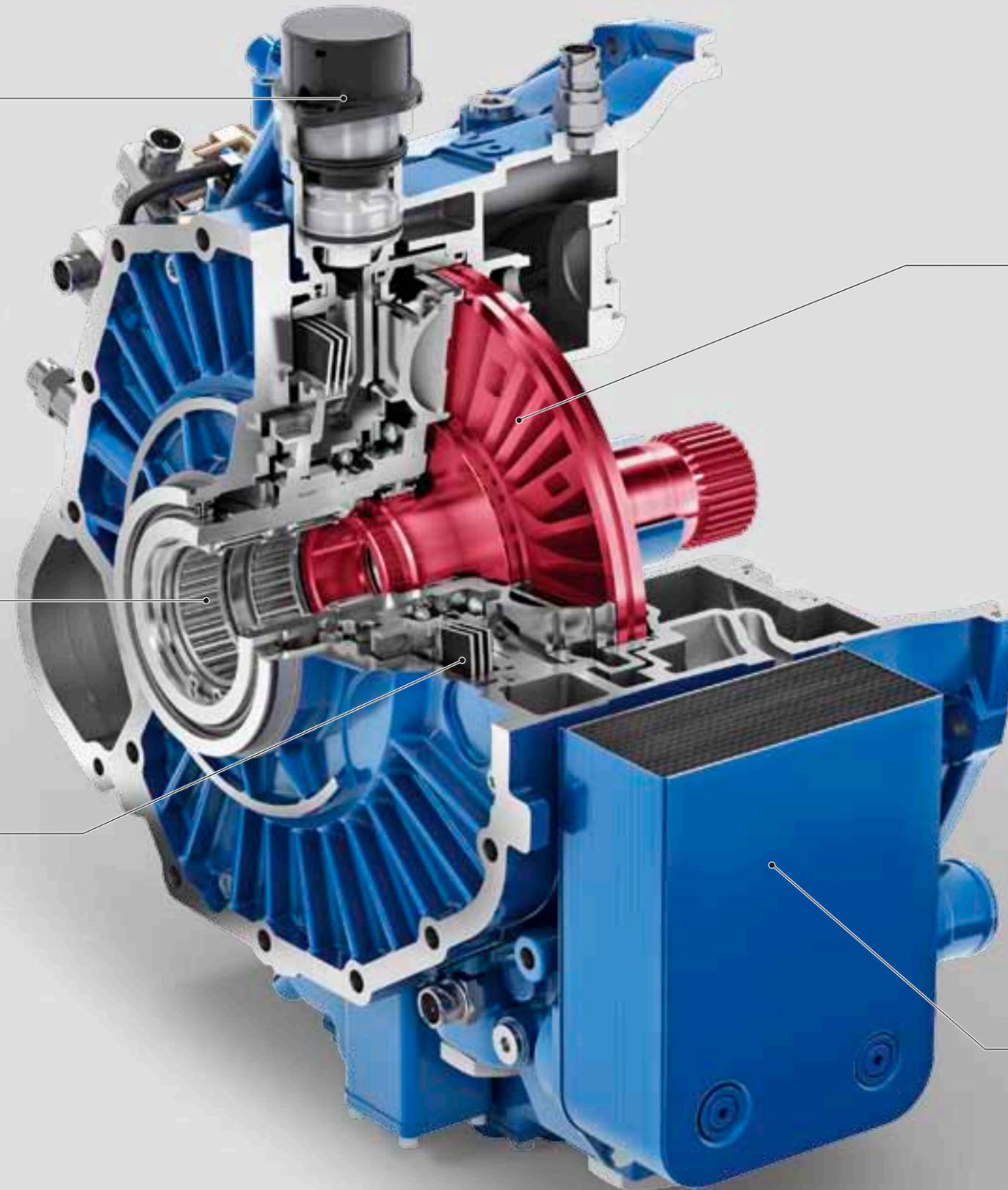
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TURBO COUPLING

# GIANTS WITH FEELING

When the 480 kW (653 hp) engine of the Mercedes-Benz Actros SLT 4165 runs up to its full torque of 3000 Nm, the coupling is under extreme stress. The conventional friction coupling of a normal 40-ton truck would simply end up in smoke on one of these giants of the road weighing up to 250 tons – no chance of transporting the load safely. This is where the fill-controlled VIAB turbo coupling from Voith comes to the rescue. With this system, subtle starting and shunting is possible even with high tonnages. When high tractive efforts are required, the VIAB can also effectively employ the maximum torque of the engine. High speeds are not required. And even during shunting it remains thermally absolutely stable. With its integrated retarder, the VIAB also allows safe braking. And this occurs wear-free. For the driver, this means: Bye-bye stress. ▶

A heavy load for the Mercedes-Benz Actros SLT 4165 with VIAB turbo coupling.



**Profile ventilation**

Allows the turbo coupling to breathe: During filling with oil, air is displaced from the hydrodynamic circuit and flows to the outside via the profile ventilation. When the hydrodynamic circuit is drained, air returns into the turbo coupling.

**Hydrodynamic circuit**

The heart of the VIAB. By varying the oil filling – up to complete drainage – the torque transmitted from the pump wheel to the turbine wheel can be controlled very dynamically but also with extreme subtlety.

**Overrun**

Transmits torque from the turbine wheel to the transmission input shaft during starting. During braking it enables the standstill of the turbine wheel and thus allows braking.

**Turbine brake**

When the turbine brake is switched on, the turbine wheel is stationary at the housing. The hydrodynamic circuit now acts as a retarder.

**Heat exchanger**

During braking, kinetic energy is converted into heat and the oil temperature in the hydrodynamic circuit rises. The heat exchanger dissipates this energy from the oil into the coolant of the vehicle.

▷ “The VIAB turbo coupling allows wear-free starting, shunting and positioning with pinpoint precision”, says Martin Becke. “And all this even at full load, when 250 tons have to be moved in a tough terrain. In addition, the VIAB also acts as a powerful retarder. Thanks to the patented linking structure, the hydrodynamic circuit unites the functions starting and braking in one single component. It could not be more compact. And the drivers are thrilled.” //



**MARTIN BECKE**

The 49-year-old has been heading the Startup Systems Development team at Voith since 2007, and, since 2009, is also in charge of the product line. The engineer and automotive technician joined Voith in 1989.



**System view:** Scan here and see in moving images how the VIAB turbo coupling works. Instructions on how to activate a QR code can be found on page 5.

[voith.com/viab/en](http://voith.com/viab/en)

PORT METROPOLIS

# IN CONSTANT FLUX

Hamburg is the gate to the world. The city in the north of Germany is definitely in business. Because the metropolis on the Elbe never sleeps – and has always allowed room for dreams.

TEXT: VALERIE HÖHNE  
PHOTO: DENNIS WILLIAMSON

Welcome to the Hanseatic City of Hamburg. There's no getting around the landing bridges.

At Hamburg's Burchard Quay, more than 5000 ships are being handled every year.





Insight and outlook:  
construction of the  
Elbphilharmonie behind  
the warehouse district.

**The magic starts** at dawn. When the morning mist dissipates and the sun takes its first peek above the Elbe, the glass front reflects a magic hue of red. Initially quite weak. A faint spark, leaping from window to window, but captured by the east wing within minutes and setting the building aflame. Majestically, dramatically.

A unique spectacle that silences the many moaners at this early hour and accentuates what shines so brightly here: The Elbphilharmonie, Hamburg's concert hall, ungallantly also referred to as "Germany's chaotic construction site" is the city's new landmark. Weighing 200 000 tons, carried by 1 761 concrete pillars and, at a cost of currently EUR 503 million, way over budget, but undoubtedly a resounding architectural feat. And a new building that reflects the soul of this city and its inhabitants like no other structure: old, new, tradition and vision. An old quay warehouse is being crowned with a glass construction that gives the future concert hall wings. Bold. And, if you want, the accumulation of business sense and risk awareness, which has been characterizing Hamburg from time immemorial.

It is the city of ship owners and merchants who have been putting their stamp on architecture, business and society for centuries. No frigidly calculating bean counters, as many might want to believe, but rather liberal-minded adventurers with an infallible sense for a good deal. With their tea clippers they set off to unknown shores 250 years ago and brought Shanghai, Zanzibar and the whole wide world back to Hamburg. Including their goods that filled an entire warehouse district. Trading houses and colonnades were built. Shrines to consumerism

hiding exotic treasures behind their discreet facades – and bringing prosperity to the city.

No doubt, Hamburg was and still is well-off. Even at times when the flow of success at the "Waterkant" seemed to subside – for example during the economic crisis three years ago. "Not much going on on the Elbe. Half-empty freight liners, slow traffic. But I did not worry too much. My boat doesn't sink that fast", says a smiling Gerd Schmehsal. The technician has been looking after the crane systems of the logistics giant Hamburger Hafen und Logistik AG (HHLA) for 38 years. His "boat" is actually the entire harbor. With a surface area of 74.4 square kilometers, the famous "gate to the world" is Europe's second-largest port. And for 823 years the untiring pulse of the city.

Ships are arriving round the clock; over 10 000 of them in 2011. The crisis which Schmehsal remembers has been overcome. The tide of the economy is rising again. 113 ship owners are located here, with a fleet of 1 663 ships and a gross register tonnage of 55 million. In the container business, the Hanseatic city is the world's number one, a hub in the globally networked economy. By 2017, Hamburg will have increased its economic output by nearly 14 percent and therefore pushed the Bavarian boomtown Munich off the top spot.

"Slow traffic" – a thing of the past. By now, Hamburg's 1.8 million inhabitants and nearly five million visitors per year once again marvel at the hectic bustle of barges, freighters and cruise liners, which offer employment to some 150 000 people in the metropolitan region and allow harbor worker Schmehsal to dream happily of his retirement. ▷

## TRADITION AND VISION BELONG TOGETHER

Every year, the city of shipowners and shopkeepers attracts nearly five million visitors to Germany's far north.

▷ The air is filled with a permanent cacophony of tooting, squeaking and humming sounds. And above all this is a hint of seaweed and ship's diesel, the smell of the close North Sea, of freedom, which can enclose the entire city, depending on the weather. A sense of life. A Hamburg promise. The (almost) ubiquitous water also contributes to this sensual illusion.

Not only the Elbe and its canals, but also the river Alster flush maritime wanderlust right through the city. The canals or "fleets" permeate upmarket neighborhoods such as Harvestehude and Uhlenhorst, whose banks are lined by urban villas and glass palaces.

Yet the waterways also cross through working-class districts like Barmbek und Eilbek and revitalize areas with redbrick industrial plants and allotments. Everything seems to be in motion, everything is in flux. A visual mantra that tirelessly enters the Hamburg psyche and keeps driving the city's inhabitants.

2 500 bridges span these countless canals. And this makes – no sailor's yarn – the Nordic boomtown Europe's city with the most bridges, more than Venice, London and Amsterdam together. The most important



View to the Deichtor Square: Hamburg's road network is continuously optimized.

link alongside the Elbtunnel is therefore built on stilts: The new bridges across the Elbe, connecting the southern Elbe region with the city center. Every day, some 140 000 commuters flood into Hamburg. For this reason, the A1 motorway is currently being extended to six lanes. The influx into the city is thus ensured also in the future. And there are other parallels with the Italian "city of canals". Not many people know this: After a catastrophic city fire in 1842 the burghers of Hamburg erected their city hall in the marshes on 4 000 wooden pikes, following the example of St. Mark's Square. Hanseatic lagoon romanticism truly exists.

But the (maritime) romanticism on the Reeperbahn has long been thrown overboard. The times when sailors and rope makers dominated the streets of St. Pauli have long gone. Although the world-famous mile of sin is still an attraction. More than ever. This alluring mix of smutty fantasies and demi-monde rough trade, between Hans Albers, "La Paloma", the FC St. Pauli and the birthplace of the Beatles. All this is concentrated on a stretch of 930 meters. So far. But the unstoppable Hamburg drive has also left some painful scars here. Alongside the red-light district and the harbor inns, luxury hotels and business apartments keep springing up. "Come and visit the Kiez (the nightlife district) while it is still there" shouts one of the bouncers along the Große Freiheit. Haven't we heard this sentence before – in Venice?

Only a few kilometers further down, between Elbe and city center, Hamburg's urge to move on is culminating in a feat of reinvention. This is the place where HafenCity is to be built by 2020, one of the largest urban development projects in Europe. ▷

## 2 500 BRIDGES ACROSS HAMBURG'S CANALS

The Hanseatic City has more bridges than Venice, London and Amsterdam combined.



City of bridges: Hamburg is Europe's number one also in this respect.

Life's a beach – even in the city: For example at the Außenalster.



▷ To the tune of EUR eight billion, land is being reclaimed and 6 000 apartments for 12 000 Hamburgers are jump-started – at square meter prices of up to EUR 10 000. An expensive, extravagant design dorado that will soon contribute to Hamburg's skyline. "Buildings, ships and the water

are so tightly woven together here that no component must be missing in this image to make sure that the appeal never ends", explains Hadi Teherani, the architect who has shaped Hamburg's image in recent decades like no other – and who created the entrée to HafenCity with the Deichtor

Center. With a bit of luck, Hamburg might now also visually become the gate to the world, he says.

Over the last nine years, the old harbor area has seen futuristic glass towers springing up into the sky. Shops, offices, gastro and entertainment complexes to provide jobs for 45 000 people. A mammoth project that presents special challenges because of its insular location. The connections inside the trendy quarter and the city center have to be established via 25 refurbished and new bridges. And the road network also had to

be redesigned – and evokes the first large sea trips of the shipowners.

Here, Shanghai Alley meets Korea Street, there is an Osaka Alley and a Singapore Street. A historically loaded labyrinth of roads, a total work of art from the drawing board that is slowly beginning to fill with life in contrast to the fast-paced building activities.

The citizens of Hamburg react to this torn-up city center in the making with their typical composure. And their confidence in their "nose" for success and good business – ▷

## MAMMOTH PROJECT IN ISLAND POSITION.

45 000 people are to find work in Hamburg's new HafenCity by 2020.

### SHUNTING YARD

# TRACKS IN THE SAND

The shunting yard in Maschen is the largest one in Europe and the second-largest in the world. Every day, the wagons on the tracks are moved around by Gravita locomotives from Voith.

**Nothing but track.** Kilometer after kilometer. Maschen shunting yard is enormous – and literally built on sand. As the area south of Hamburg is situated on peat lands, three million cubic meters of peat had to be cleared away and replaced by ten million cubic meters of sand as a foundation before building work could start.

By now, up to 150 trains with about 3500 wagons are being put together into new formations every day, which then leave the plant on their way to a total of 30 destinations. In the language of the railway people, the labyrinth of tracks is therefore not simply referred to as "station" but as "train formation depot." And in the depot, the traffic rages, controlled by points and signals. Part of the scene are Gravita 10 BB locomotives from Voith (DB series 261), untiring helpers pulling the wagons from A to B. Each locomotive

weighs 80 tons and has a 1 000-kilowatt diesel engine fitted with a modern soot particle filter, which removes 97 percent of the dirt particles from the vehicle emissions. Over the next few years, DB German Railways intends to put 130 Gravita 10 BB locos in service. 20 of them are to operate in Maschen, and another seven will pull freights in Hamburg harbor. The harbor is also the place where the first of the new, fire-red locomotives can actually be seen. In Maschen, loco-viewing calls for binoculars. Because the scene is optically dominated by track. //



**Eco-conscious:** Scan here and view the new locomotives from Voith. Instructions for activating a QR code can be found on page 5.

[voith.com/gravita/en](http://voith.com/gravita/en)



In Maschen near Hamburg, the yard is called "train formation depot".

▷ exercised over centuries. Especially here in HafenCity – with the Elbphilharmonie as its symbolic masthead – the city is opening up. And so do the souls of the Hanseatic residents.

Suit wearer or shipyard worker, be it at a business meeting or a ferry crossing, from the warehouse district to Finkenwerder – the people just let their heads get cleared by the stiff breeze and watch the river flowing. Because, viewed from the banks there are thousands of perspectives for discovering the horizon. Especially one's own. By watching the long-drawn wash of the waves on the Elbe and daydreaming about the massive ships. Or by listening to the crazy laughter of the seagulls, which make you look upwards and evoke the nearby sea. Yes, this is the place where the light is a little bit brighter and the sky a little bit wider than anywhere else in Germany. Anything seems to be possible. And the mind wanders. This is the true secret of success in this city. //

Valerie Höhne lives and works in Hamburg as a writer and journalist.



New residences near the water: The HafenCity is very modern.



One of the tourist attractions: The harbor trip starts at the landing bridges.



From the Goose Market to the Reeperbahn – with the red double-decker.

TOURISM

# GREAT VIEW

Every day, bright-red nostalgic double-decker buses take tourists to Hamburg's most beautiful spots. Ample comfort during the journey is ensured by the Voith DIWA automatic transmission, with which the engines are combined.

**Nostalgia with a view** – if the weather is right. Be it from the jetties to the fish market or during a nighttime tour through the glittering lights of the harbor – whoever approaches Hamburg as a tourist will sooner or later find himself sitting in one of the bright-red double-decker buses offering an exclusive view of Hamburg's landmarks.

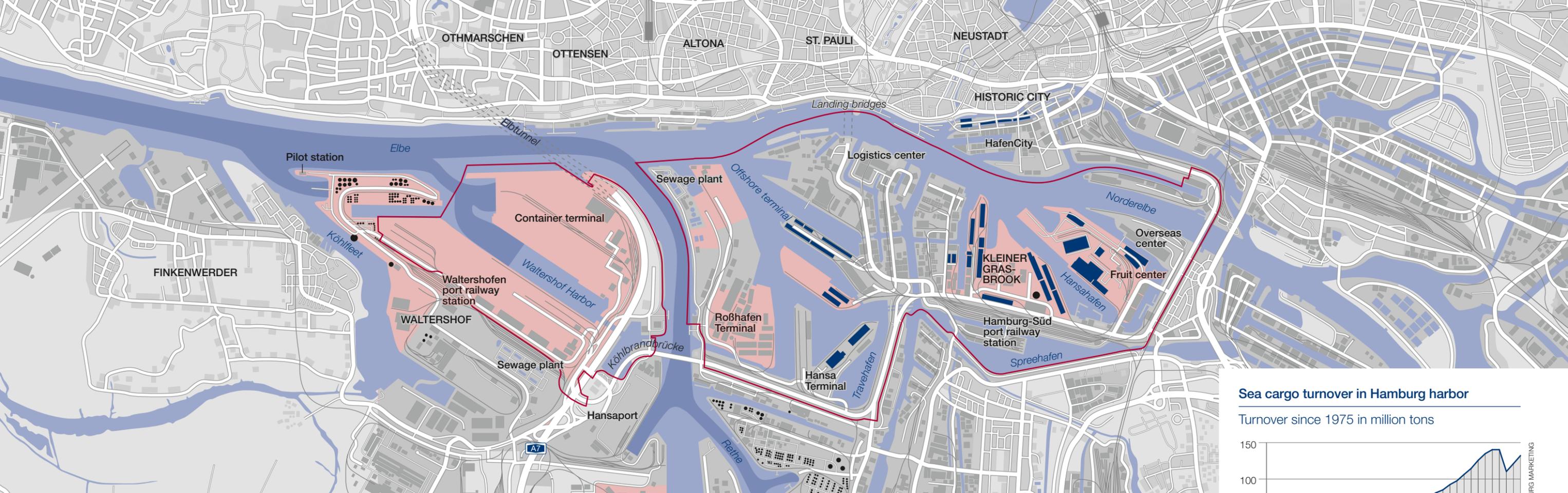
The red buses are meanwhile almost as famous as the sightseeing spots along their routes. Außenalster, Goose Market, Warehouse District, St. Michaelis Church, Jungfernstieg shopping mall or the Reeperbahn – get on board and enjoy a rolling seat with a view.

Yet the trips in the red originals were seriously threatened. The Hamburg authorities no longer wanted to see the buses with their sometimes 30-year-old engines on the roads. The reason was obvious. The elderly vehicles were spitting dirt and had exhaust values that were nowhere near the current limits. The engines were producing big trouble – and not only on the roads. The proprietors of the tour company Hamburger Stadtrundfahrt GmbH decided to invest in the fleet.

Twelve buses are now fitted with modern engines, which, alongside the Euro 5 exhaust norm for commercial vehicles, also

meet the European EEV (Enhanced Environmentally Friendly Vehicle) standard. Reds with a clean bill of health, whose particle emissions have been reduced by 95 percent, while the nitrogen oxide output is now 90 percent lower than before. And, what's more, they use 15 percent less fuel.

The institution has thus been kept alive, and about 250 000 passengers per year can continue to enjoy viewing Hamburg from above. The new engines are combined with Voith DIWA automatic transmissions, capable of almost unnoticeable gearshifts. Which means that the on-board coffee stays firmly in its cup. //



LOGISTICS

# GATE TO THE WORLD

Hamburg is Germany's largest seaport and also one of the world's leading container ports. Its success is not least due to its sophisticated logistics. An overview.

The harbor is the heart of Hamburg. It is a major guarantor for prosperity and growth. As a connection to the markets in North, Central and Eastern Europe and a bridge between the continent and overseas, the harbor also represents a vital economic factor. The most important overseas trade partner is North-East Asia. It's always rush hour on the shipping channels, but everything runs in an orderly fashion. In 2011, a total of 10 106 ships arrived here, 5 430 of them container vessels. The sea cargo turn-

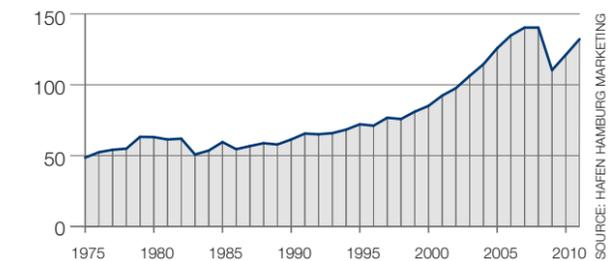
over in Hamburg's universal harbor amounted to nearly 114.4 million tons in 2011. Two-thirds of this volume are bulk goods that are mainly loaded on containers, while one-third consists of mass products. These include coal, ores, mineral oil, grain products and ferti-lizers. Where ships are, there are also people. Hamburg harbor provides some 150 000 jobs. There is an ever growing demand for specialists, needed, for example, to steer the complex container goods-handling procedures via data communication. //

- Shipping lane  
Deepwater level 13.5 m
- Free port border
- Bulk goods/container terminals
- Tank depot
- Quay sheds, warehouses

500 m

### Sea cargo turnover in Hamburg harbor

Turnover since 1975 in million tons



### Largest container harbors in 2011

Turnover in million TEU\*

Shanghai (China)	31.5
Singapore	29.9
Hong Kong (China)	24.4
Shenzhen (China)	22.6
Busan (South Korea)	16.8
Ningbo (China)	14.7
Guangzhou (China)	14.5
Qingdao (China)	13.0
Dubai (UAE)	13.0
Rotterdam (Netherlands)	11.9
Tianjin (China)	11.5
Kaohsiung (Taiwan)	9.6
Port Klang (Malaysia)	9.6
Hamburg (Germany)	9.0
Antwerp (Netherlands)	8.7

\*TEU (Twenty-foot Equivalent Unit) is an international standard unit for containers. One TEU represents the cargo capacity of a standard container: 6 meters long, 2.6 meters high and 2.4 meters wide.

## WORTH KNOWING

### Harbor History

The harbor gets its first mention in the **9th century**. Hamburg has 200 inhabitants.

**7 May 1189** – official birth of the harbor. In a charter, Emperor Friedrich Barbarossa grants the people of Hamburg privileges such as exemption from duty and market rights.

The years **1881–1888** mark the birth of the free harbor and the warehouse district as the world's largest storage area.

**1910** inauguration of the landing bridges on floating pontoons. They can compensate a tidal range of up to four meters.

**1911** sees the opening of the Elbtunnel. The tunnel is 426.5 meters long and features two tiled lanes decorated with reliefs.

In **World War II**, 80 percent of the harbor complex is destroyed.

**1967** marks the start of the container age.

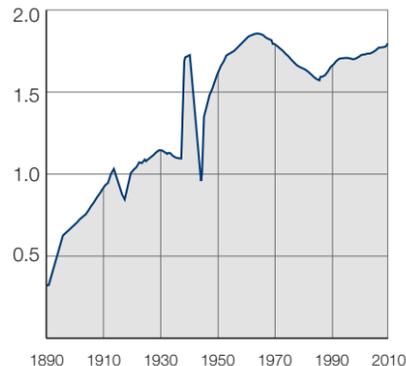
In **2002** the world's most advanced container terminal is opened in Altenwerder.

In **2006** the volume of sea cargo handled reached a new record with nearly 135 million tons.

In **2007** Europe's most modern harbor railway station "Alte Süderelbe" is re-opened. The harbor railway sets a new record in container handling: Some 1.83 million containers.

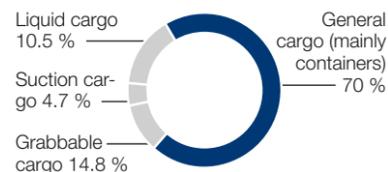
### Hamburg's population

Population development since 1890 in million



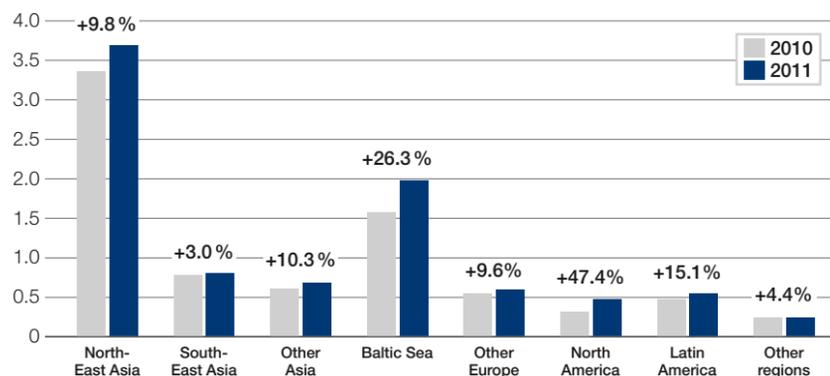
### Sea Cargo Handling 2011

Goods handled in Hamburg harbor, by cargo type



### Hamburg's container trade by destination

Comparison of cargo volume 2010 with 2011 in million tons



### Figures all around the harbor

7 241

hectares is the total area of the harbor, of which 2 987 hectares are covered by water. The actual operative surface of the harbor measures 6 408 hectares. The free harbor takes up 1 542 hectares, i.e. 21 percent of the total harbor zone.

12.80

meters of draught are allowed for ships when they call at the port independent of tides. When utilizing high tide periods, the draught can be as much as 15.10 meters.

320

sea ships can berth in the harbor. 41 kilometers of quay, four large container terminals (Waltershof, Burchardkai, Tollerort, Altenwerder) and eight multipurpose terminals are available for box handling. Hamburg is the home port of half the German fleet.

### Voith Turbo in Germany

The headquarters of Voith are situated in Heidenheim, Swabia.



## INTERVIEW

# GETTING STUCK IN ON SITE

Voith has been active in Hamburg for quite some time. Dr. Martin Füllenbach, Executive Vice President of the Voith Turbo Business Division Marine wants to strengthen the company's activities in the Hanseatic city even further.

### Voith opened a sales office in Hamburg for the Marine Division in spring 2012. What are your expectations for this new subsidiary?

First of all, we want to be closer to our large number of established customers. We have a very solid basis in Hamburg. In the harbor, Voith propulsion systems have been used for decades for the tugboats. From our new office we will be able to visit customers straightaway and react to their requirements much faster. And we would also like to set up a center of competence in Hamburg for all Voith drive systems used in connection with offshore wind parks. I am thinking especially of the design of supply and construction vessels.

### Hamburg harbor is also referred to as the "Gate to the World". Is it also a gate to the markets of tomorrow?

Hamburg is one of the largest harbors in the world and is being monitored by its worldwide competition. For this reason alone we have to be present on site. As for the markets of tomorrow, we have our eyes on the offshore oil and gas market. Apart from propulsion technology for supply and construction vessels, we are focusing mainly on drive systems for drilling vessels and drilling platforms operating at depths of more than 500 meters.

### Why do you focus particularly on these vessels?

Platforms operating at such depths are not firmly connected to the seabed. And we at Voith have high competence in the design of drives that allow so-called dynamic positioning. This means that a freely floating drilling platform can keep its above-ground position even if seas and currents are rough – thanks to Voith technology. For operators this is of course vital.

### Is there also a market closer to Hamburg?

Apart from the harbor, market opportunities lie in the increasing number of ferry systems at the nearby North Sea coast. There are already some first concrete projects that we will handle from Hamburg.

### The Voith presence in Hamburg does not only extend to the water. The famous red city tour double deckers are driving with DIWA automatic transmissions. How do passengers benefit from this?

Above all by more comfort. Our automatic transmissions reduce gear-shifting processes by up to 50 percent. As a result, the bus is much quieter on the road – and the passengers can enjoy the view. //

### DR. MARTIN FÜLLENBACH

The 44-year-old has been working at Voith since 2003. He is a member of the Management Board of Voith Turbo and in charge of the Business Division Marine.





THE FÖTTINGER PRINCIPLE

# THE BIG BANG OF DRIVE TECHNOLOGY

Voith has been using Hermann Föttinger's hydrodynamic findings for more than 80 years for the construction and development of all types of drives. The future of Voith has a basis – the Föttinger principle. Today, the principle is combined with other technologies.

**Modern drive technology** is unthinkable without hydrodynamics. From this aspect, the work of Hermann Föttinger from over 100 years ago was a milestone in the development of Voith. Without the Föttinger principle, without the development of hydrodynamic drives, the technical world would probably look quite different today. Voith has expanded and refined the basic findings of the engineer and scholar, born in Nuremberg in 1877, for over 80 years.

At the beginning of the 20th century, Föttinger looked into the torque conversion of steam turbines for ships. The industry was looking for a transmission capable of converting the high speed of the turbine into a lower speed to comply with the propeller. At the time, it was technically impossible to build mechanical gears big enough for the high output of the turbines. Föttinger came up with the idea of a hydrodynamic converter that would couple the turbine and a pump. The Föttinger principle was thus born, although the new development only functioned satisfactorily when the graduate electric en-

gineer combined the pump and the turbine in a housing. Before that, the flow losses in the lines between turbine and pump were simply too high.

As early as 1906, Föttinger inquired at Voith about the state of technology for water turbines. Yet it would take until 1927 before the Voith engineers and Föttinger finally set out on joint project work. Voith had received an order for the complete hydraulic equipment for a pumped storage power plant in Herdecke. The technical challenge consisted of the construction of the start-up coupling and the clutch for storage operation. Föttinger and his colleagues from Voith decided to use a hydrodynamic coupling. An idea that turned out to be a huge success – for many decades, the pumped storage power plant in Herdecke was the most advanced plant of its kind in Germany and it took until 1994 before it was closed down. How important the Föttinger principle has become for

Voith is demonstrated by an impressive figure. Voith Turbo generates nearly two-thirds of its sales with products featuring a hydrodynamic core component.

But Hermann Föttinger was not only an industrial inventor. His life was primarily dedicated to research. The university was his home and also his fate. In the last days of the war, in the afternoon of 28 April 1945, he insisted on walking to his institute at the Technical University in Berlin Charlottenburg against everybody else's advice. On his way, he was fatally hit by shrapnel. He was 68 years old. //



The primary blade wheel (pump) of the start-up coupling for Herdecke pumped storage power plant.

VOITH TURBO

# WORLDWIDE



INDUSTRY

**28 LIFT ME UP!**  
The boat lift system at a dam in China over-comes 113 meters in height. Voith delivers the joint shafts.

**29 THE HEIGHT OF COOL**  
TurboCool is the name of a new hydrodynamic coupling from Voith.

**29 THE NEW WAY**  
Voith has further developed its WinDrive technology. AeroDrive now proves itself in large wind turbines.

MARINE

**30 VOITH ON THE BRIDGE**  
New software allows propellers to be controlled from the bridge.

**31 STABLE SHIANO**  
Worldwide, there is only one Water Tractor sailing with fully electronic control – in Iwaki.

**31 QUIET IN THE STORM**  
Never before could ships be rotated by 360 degrees as precisely as with the new Voith Inline Thruster.

RAIL

**33 LIGHT-HEADED**  
Galea is the lightest vehicle head ever. It is launched in autumn 2012.

**34 FEATHERWEIGHT**  
This year's Composite Innovation Award goes to Voith – for the new transitional coupler.

**34 ONE-STOP SHOP**  
Voith is the only transmission manufacturer to offer complete wheel-sets for rail vehicles.

ROAD

**36 GASP OF RELIEF**  
ElvoDrive is a promising concept of technology for alternative drive concepts.

**37 1+1+1=SAVE**  
Bus drivers can save fuel, too – with the DIWA.6 automatic transmission.

**38 DEEP BREATH**  
With the LP 725, Voith offers a three-cylinder compressor for high air consumption in alu-light-weight construction.



Gigantic detail: Construction site of the ship lift – and hence the operating site of the Voith universal joint shafts.

HYDRO POWER STATION IN CHINA

# LIFT ME UP!

Voith delivers eight universal joint shafts for the 2000-meter Three Gorges Dam.

**How does one explain size?** Perhaps like this: It really has to be a very clear day if one wants to see from one end of the Three Gorges Dam to the other end of the Chinese prestige object. Being big is the name of the game here. The output of the hydropower station is measured in gigawatt: 18.2, once all the turbines are running. Patience is needed by all who want to overcome the difference in height of 113 meters. The trip through the lock with its five stages takes nearly three and a half

hours. It was therefore decided at an early stage to equip the project with a ship-lifting system. A kind of elevator moves the vessels in a huge trough.

Technically, the plant is an enormous challenge. With its maximum height of 113 meters, the ship lift is about three times as big as the largest project realized so far by German companies. The trough with its usable surface of 120 meters in length, 18 meters in width and a water depth of

3.5 meters weighs some 34 000 tons. In comparison: An Airbus A380, the world's largest passenger plane, accounts for 560 tons. Four 169-meter-high reinforced concrete pillars fixed to a concrete base plate form the foundation of the ship lift.

The trough is suspended between the pillars on 256 finger-thick steel ropes connected to counterweights and driven by electric motors. Eight Voith universal joint shafts transmit the output of the motors to pinions. Theoretically, four shafts would have been enough, but with a lift for passenger ships, the customer wanted to be on the safe side. The decision demonstrates how important quality and reliability are to the operators. There is also technology from Voith for the power generation. Voith has delivered six turbine units for the power station. The final output of these units amounts to 700 megawatts. //

Massive: A universal joint shaft for the Three Gorges Dam.



Economical and reliable: The hydrodynamic coupling.

## THE HEIGHT OF COOL

In the USA, natural gas extraction stations are referred to as "gas plants." Montana and also Wyoming are studded with such plants as these states are rich in gas deposits. In order to make the gas flow through the pipelines, it is pressurized and pre-compressed at special compressor stations located at the start of the transport lines. The heat generated by the compressors is cooled down by huge fans with diameters of up to 3.5 meters.

These fans are usually coupled directly to the motor speed. This means: The motor speed determines the cooling output of the fan. In thinly populated areas, the compressor stations are often situated at remote locations and difficult to reach.

Compared with electric solutions, Voith TurboCool offers enormous advantages in these regions: It can be controlled even without an external power supply.

The hydrodynamic coupling from Voith is installed to an auxiliary drive of the motor. It allows control of the fan speed independently of the motor speed. As a result, the reliability and production output of the plant are improved. The average fan speed can thus be dropped quite drastically. Due to the adapted cooling output, the motor is subject to less load, which saves up to 3.5 percent fuel. And the environment benefits, too. A compressor station with TurboCool emits nearly 500 kilograms of carbon dioxide less, reduces noise emissions – and is therefore much more than just cool. //

## THE NEW WAY

**How can we** utilize wind effectively? Not an easy question. Today, the industry applies two types of transmission concepts. There is the direct drive of rotor to generator. But there are also wind power stations with transmissions and smaller generators. In both cases, frequency inverters are required, which are prone to failures. The Voith WinDrive technology offers a totally new approach. The hydrodynamic transmission allows the conversion of the vari-

able rotor speed into a constant speed for the generator and therefore eliminates the need for a frequency inverter. In cooperation with the Augsburg transmission specialist Renk, Voith developed the AeroDrive as a concept study. In this project, the Renk Aerogear transmission is connected with the Voith WinDrive. Both components are optimally adapted – to each other and also to the special requirements of wind power plants. The reliability of the plant increases and cost-intensive downtimes are thus minimized. The new AeroDrive will

run in offshore turbines with an output of eight megawatt. //



Strong performance: The new AeroDrive.

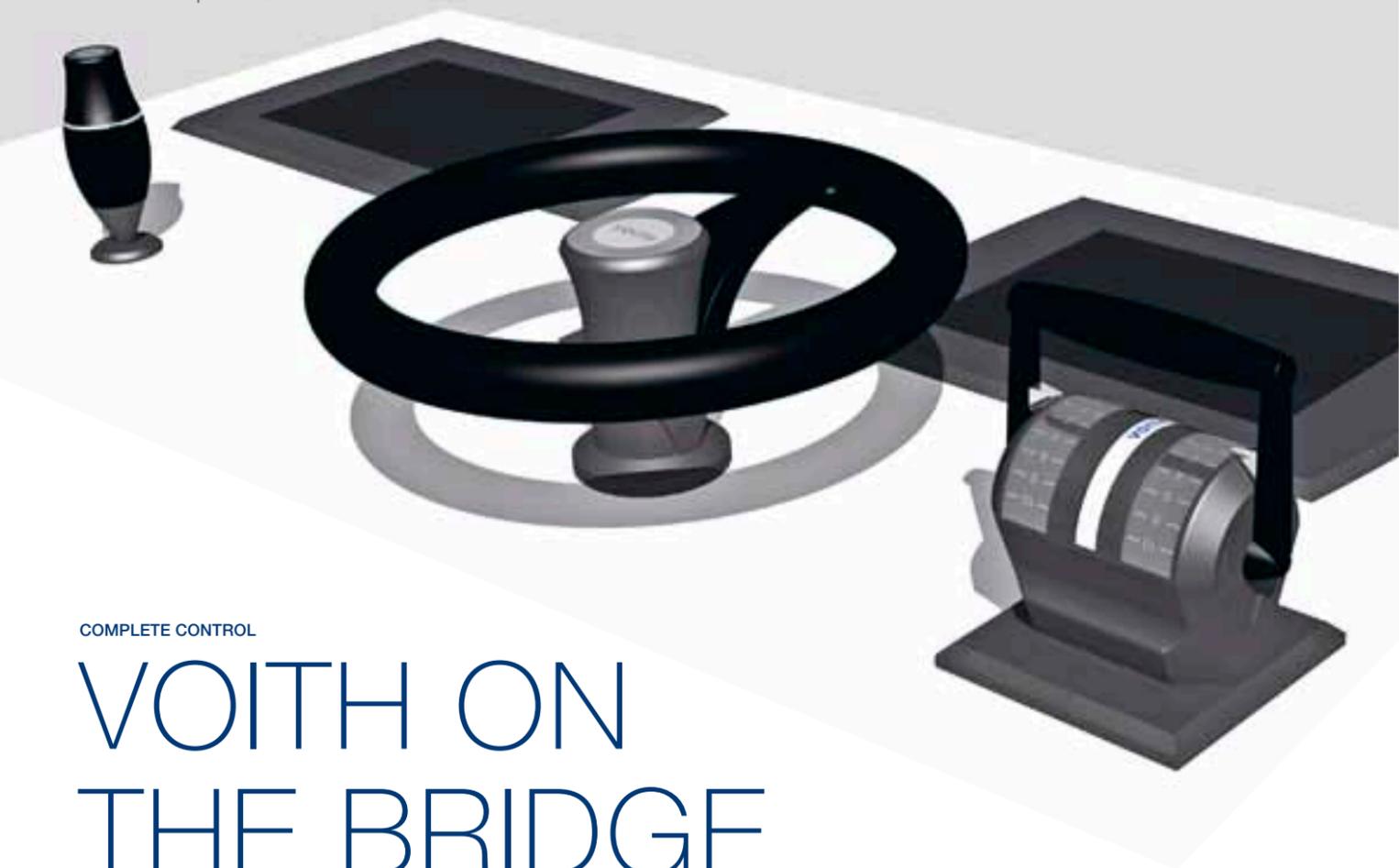
## DUALITY

**Electric motor or gas drive?** No longer is it a case of "either – or". Modern reciprocating compressors in pipelines can be flexibly operated with both energy sources. In the event of a power cut, the system simply switches over to the gas engine.

For SEC Energy Products & Services this is an important argument for the company's patented Dual-Drive technology. The US manufacturer has fitted its Dual-Drive compressor and pump packages with highly flexible couplings and Hy-Grip connecting couplings from Voith.

The Voith components protect the driveline against torque peaks and transient torques. This reduces the risk of damage and increases the reliability of the plant.

Thanks to the Dual-Drive technology it has been possible to prevent up to 99 percent of standstills. //



COMPLETE CONTROL

# VOITH ON THE BRIDGE

The latest addition to the Voith portfolio is a hardware and software architecture for controlling the Voith Schneider Propeller and the Voith Radial Propeller directly from the bridge.

**The bridge is the command center** of a ship. It is the place where the captain decides about course and speed. Exact maneuvering and maximum safety have been the key characteristics of Voith Schneider Propellers for years. Voith Turbo Marine is now offering in-house-developed control and electronics systems for ships with Voith Schneider Propellers (VSP) and Voith Radial Propellers (VRP) – and thus closes a gap in its product portfolio with elegant design and modern electronics.

The new range includes a hardware and software architecture for VSP and VRP. This means that the entire delivery volume will come from one single source in future. In addition, the solution offers numerous

control and assistance functions. The electronics system can, for example, provide specific fuel-saving driving recommendations, which can be signaled to the captain on the bridge on a screen.

The hardware items – such as joystick, steering wheel or controller – were created in cooperation with designers of Stuttgart University under ergonomic and aesthetic aspects. Head of R&D Dr. Dirk Jürgens: “It is important to us that our new remote control on the bridge reflects the image of Voith and conveys our high quality standards. Our propellers cannot be seen under the water. Therefore, the control system is our most important ambassador.” Next year, the Scottish shipyard Caledonian Maritime

Asset Ltd (CMAL) will launch two hybrid ferries with the new Voith control system.

The advantages of this new development are obvious: Voith will be able to react more quickly to customer requirements, and the costs for interface adaptation during commissioning are significantly reduced. The control solution is thus also more efficient.

In addition, there is a monitoring system collecting all relevant drive data. And last but not least, the new control system is also easy on the eye. An aspect that must not be underestimated, because commando systems are in the hands of the captain for many hours. //

## CALM IN THE STORM

**Rough seas, currents and wind:** Keeping a ship in position above ground on the high seas calls for sophisticated technologies. With the Voith Schneider Propeller, the Voith Radial Propeller, the Voith Inline Thruster and the Voith Inline Propulsor (VIP), Voith has a catalogue of propulsion systems that also excel by their outstanding features in terms of dynamic positioning. A new addition is now the VIP Swing-Out Azimuth Thruster. The latter is an internal propeller that can be extended from the vessel hull and rotated through 360°. With this technology, ships can be maneuvered with extreme precision. The system is a so-called RIM Drive, which means that the propeller is driven by a magnetic electric motor without a drive shaft. This shaftless drive concept ensures low vibrations and very quiet running. //



The latter of the VIP Swing-Out Azimuth Thruster can be extended and rotated through 360°.



Ready for service in Japan: The Voith Water Tractor.

JAPAN

## STABLE SHIANO

The harbor of Iwaki near Fukushima is home to the first Voith Water Tractor in Japan – it is also the world’s first VWT with fully electronic control.

**The Land of the Rising Sun** relies on Voith. In Iwaki, 50 kilometers south of Fukushima, the first Voith Water Tractor on the Japanese market has just entered service. The vessel, which was ordered by the shipowner Fukushima Kisen, has been designed specifically for harbor assistance and escort duties – in short for daily port routines. The propulsion system of the vessel consists of two Voith Schneider Propellers.

The overall space requirements for the propulsion system and also the energy requirements were reduced.

The Shiano is also the first Voith Water Tractor with fully electronic control. Due to the direct actuation of the proportional valves, the ship can remain stably in its longitudinal axis. The EC control thus allows effective roll stabilization. //

## ADRIA ON THE RHINE

**Anybody who wants** to get to the “Blaue Adria” from Mannheim has to cross the Rhine. The “Blaue Adria” (Blue Adria) is a vast recreational park south of Ludwigshafen near Altrip. The connection to Mannheim is established by a double-ended ferry, which has been crossing the

river 80 times per day since 1991. Last year, the owner decided to have the ferry thoroughly modernized. For this purpose, the two mid-ship installed Voith Schneider Propellers were overhauled by a specialist team after 120 000 operating hours, while the ferry was extended by 3.5 meters at both ends. Regular customers have high praise to the fact that the ferry now glides

through the water even more smoothly. Due to the extension it can now carry 21 cars, while there was only room for 18 in the past. In addition, the larger distance of the VSP from the ship ends makes mooring and departing significantly more comfortable. This applies especially in the low waters on the Altrip side. Right beside the Blaue Adria. //



The "Sea Installer" is a special vessel for the installation of wind power stations. It is driven by three Voith Schneider Propellers (VSP).

**Hard work on the high seas:** Steel tubes weighing 500 tons are being rammed into the seabed up to 25 meters deep – for the construction of a wind power station. The work is carried out by gigantic installation vessels. Whatever the weather. And this makes high demands on the maneuver-

ability. The Danish ship owner A2SEA, which specializes in offshore operations, will launch the "Sea Installer", a 132-meter long and 39-meter wide special vessel, over the next few months. It is built by COSCO in Nantong/China and can anchor wind power stations safely up to a depth of 45 meters. The vessel is driven by three VSP, each with an output of 3800 kW. Together with the Voith Inline Thruster (VIT) installed as a transverse propulsion system they ensure safe navigation even if seas are rough. The type VIT 2300-1500 is the world's largest bow thruster in RIM technology. A2SEA has

now ordered a second, nearly identical vessel from COSCO with a crane capacity that has been increased from 800 to 900 tons. The vessel is scheduled to enter service in mid-2014. It also has a Voith propulsion system. //



In action: Scan here and view the installation of the Voith Inline Thruster in moving images. Instructions on how to activate a QR code can be found on page 5.

[voith.com/vip/en](http://voith.com/vip/en)

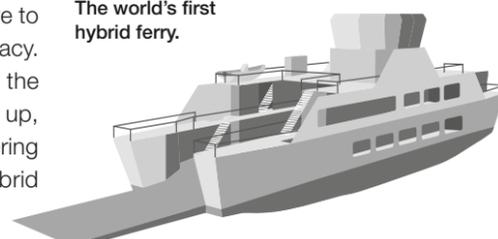
## FAIR FERRY

**A ferry getting its power** from a socket? Not yet, but such a vessel is currently under construction and will enter service in 2013. The Scottish shipowner Caledonian Maritime Asset Ltd (CMAL) plans to launch the world's first hybrid ferries next year. The two double-ended ferries will be able to transport up to 150 passengers and 23 cars. They will be the first ferries worldwide combining a conventional diesel drive with lithium battery technology. CMAL

would like to use this system to reduce CO<sub>2</sub> emissions by up to 20 percent. The ferries are expected to use less diesel fuel and to be much quieter, especially when berthing and casting off. The batteries are recharged overnight. Scotland has a rough climate; strong winds can make the waters quite turbulent, so that the ferries have to be maneuvered with maximum accuracy. As the vessels often dock straight at the concrete ramps without being roped up, the demands on propulsion and steering are very high. For this reason the hybrid

ferries are driven and controlled by two diagonally arranged Voith Schneider Propellers, each rated at 375 kW. As a result, the fair ferries can cross the waters fast and safely even if seas are rough. //

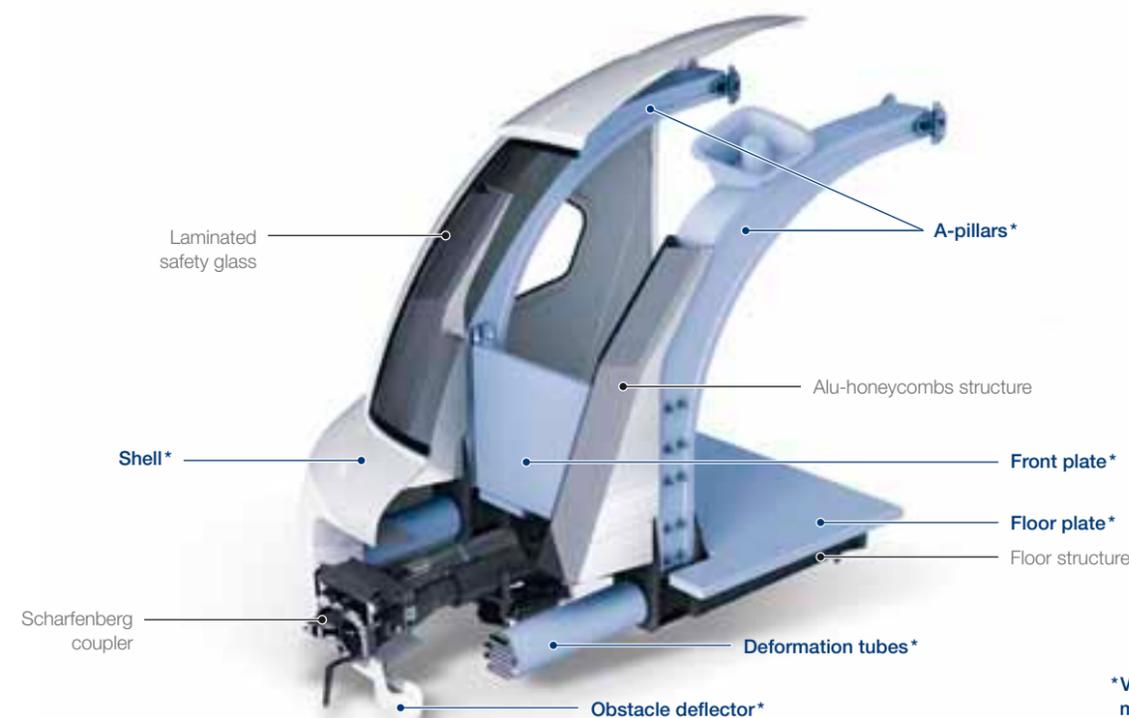
**Planned for 2013:**  
The world's first hybrid ferry.



## PRODUCT INNOVATION

# NOT JUST A PRETTY HEAD

The new Galea vehicle head from Voith Turbo Scharfenberg is considerably lighter than previous versions. It consists almost completely of fiber composite materials which make the train even safer.



**Smooth train journeys** at high speeds. Voith has been developing light, aerodynamic and safe vehicle heads for many years. In autumn 2012, Voith Turbo Scharfenberg will be presenting the Galea vehicle head, which consists almost completely of fiber composite materials. The development also draws on the experience of the Voith specialists for crash energy systems. Galea is interesting for smaller manufacturers who cannot fall back on large research departments.

The new vehicle head is significantly lighter than all previous steel constructions. This reduces energy consumption and increases economy. And the environment is protected, too. In fact, fiber composite materials absorb the energy generated during a collision even better than steel constructions. All fiber compound components can also be used individually if required. The special structural and energy absorption elements designed by the Voith experts increase passive safety for driver and passengers. Galea is also ex-

emplary in terms of fire protection, as well as noise and heat insulation.

Galea is suitable for trains with maximum speeds of up to 200 km/h. The lightweight construction allows individual designs also in smaller quantities. The applied glass-fiber reinforced materials can be easily shaped, making even complex geometries and freeform designs possible. Smaller operators can thus retain their identity and differ optically from their competitors. //

## NEW TASKS

**Ulf Klaua** is the new Manager of the Department Marketing and Sales of Voith Turbo Lokomotivtechnik GmbH & Co. KG. Before his appointment, the 43-year-old was in charge of the Department Construction and Prototype Design and also instrumental in building strategic partnerships as a Sales Engineer. The father of two children studied rail engineering at Dresden Technical University. Over the last two years, he also completed an extra-occupational MBA degree at Steinbeis University Berlin. Prior to joining Voith, the passionate volleyball player worked for a number of other companies in the rail industry. //



**ULF KLAUA**  
The 43-year-old has been put in charge of the Department Marketing and Sales of Voith Turbo Lokomotivtechnik GmbH & Co. KG.



Handy-sized prize-winner: The new transitional coupler.

## LIGHT BUT STURDY

**A train breaks down** between stations and has to be towed. A case for a new Voith-developed transitional coupler between Type 10 and draw-hook. Its special feature: The coupler is made from carbonfiber-reinforced plastics (CFK) and weighs only 23 kilograms – 50 percent less than previous steel solutions. It can be mounted by just one person. The concept also convinced the jury of the cov-

eted “Composite Innovation Award”, which was presented to Voith in June 2012 at the international CFK Valley Convention in Stade/Germany. Major criteria for the evaluation were the technological degree of innovation, the commercial potential as well as the benefits for industry and environment. The coupler, which was developed in cooperation with TU Chemnitz and the company East4D asserted itself against countless rivals in front of a jury of 420 experts. //

## PRESS UNDER PRESSURE

**One step less** is sometimes a step forward: During the production of complete wheelsets for rail vehicles Voith now combines two previously separate manufacturing stages and is thus the only transmission company capable of offering complete wheelsets for rail vehicles. The new wheelset press, which joins the wheels to the wheelset shaft applying up to 315 tons of pressure, makes it possible. In the past, the pressing procedure had to be outsourced. Now the wheel sides are consecutively joined together, and, after a period of rest, tested and measured. And that’s it. For the customer, this means shorter delivery times, and the concept is definitely popular. Voith delivers a total of 522 complete



Complete wheelset for South-Korean Railways.

wheelsets to the vehicle manufacturer Hyundai-Rotem, who is currently building 87 six-axle locomotives for South-Korean State Railways. The plant in Heidenheim-Mergelstetten also produces 272 complete wheelsets for the BEML-built Delhi metro trains. For the metro in Jaipur, BEML has ordered another 87 complete wheelsets. Quite a lot of pressure for the new press. //



Coating on nano basis: Locomotives of Schalker Eisenhütte.

## COOLING COATING SYSTEM

**2 400 kilometers** of subterranean tunnels, shafts and galleries distributed over 14 floors so far. 25 are planned: “El Te-

niente”, the world’s largest underground copper ore mine, is situated right in the middle of the Chilean Andes. In the up to 15-meter-high shafts, diesel-electric locomotives pull wagons with the precious cargo out of the mountains.

The locomotives and especially their cooling systems are exposed to high stresses in the dusty and hot air in the mine, for example because the air flow to the cooling systems is obstructed by steel wire grids protecting the vehicles against rockfall.

Voith delivers the cooling systems for the locomotives built by Schalker Eisenhütte. The systems cool the diesel engine, the drive motors, the inverters and the brake resistors of the locos. All aluminum cooling elements are supplied by Voith with an external coating system on a nano basis.

This offers four advantages: The nano coating ensures outstanding protection against corrosion. As the surfaces are dirt-repellent, maintenance intervals are longer and smaller, allowing the installation of smaller and lighter units. This reduces the total weight and hence the fuel consumption. The overall eco-balance is also better, as Voith nano paints emit less CO<sub>2</sub> than conventional lacquers, both during production and in operation. Nano paints also require fewer solvents and additives. //

## RATHER SPORTY

**Huge sports events** are often the motor for infrastructural developments. This is also the case in Shenyang in China, which got a new tram just in time for the 12th National Games. The National Games are some kind of inner-Chinese Olympics. Sporty ambitions also apply to Shenyang’s new city transport system: The new electric tram built by Changchun Railway Vehicles is meant to cover the up to 700-meter long route without overhead wires. The technology is supplied by Voith. Four traction motors, two traction

inverters and four energy storage units (Supercaps) are installed in each of the five-car trains. Voith also delivers 80 KSH-330 gear units for the project. Supercaps are Voith-developed high-performance

condensers to be charged by the braking energy of the railcar. This energy can be used for accelerating – or for bridging up to 700-meter long non-electrified track sections. //



Simulated reality of tomorrow: Electric tram in Shenyang.

INTERVIEW

# CITIES CAN BREATHE AGAIN

The share of alternative drive concepts in public transport is continuously rising. Voith reacts to this development with the ElvoDrive technology concept.

**DR. CHRISTIAN JAUFMANN**  
The 47-year-old has been heading the Voith Product Group Bus Drives in the Business Division Road since 2010.

**Dr. Jaufmann, what is the basic idea behind the ElvoDrive?**

Initially, it is the same as for all hybrid drives: Storing braking energy and releasing it again during acceleration. This helps to save fuel and reduces the emission of harmful carbon dioxide. Yet the ElvoDrive takes one step further, because it is configured as a series hybrid. The combustion engine can be operated at the so-called point of lowest specific consumption, which saves even more fuel. In addition, our ElvoDrive has a modular design. In later stages, this offers a huge bandwidth from pure fuel savings to emission-free driving.

**What are the advantages for bus operators and local authorities?**

A town or city with a high quality of living needs an environment that stands out by high air quality and low noise pollution. Both can be achieved with the ElvoDrive. Here is a configuration example for the ElvoDrive: In the city center, the bus drives purely electrically and gets its energy from the battery. Once the bus is on a suburban route, the diesel generator can be started and recharge the energy storage unit, so that the bus

can once again drive without emissions when back in the city. In five years' time, this scenario might be the norm.

**Are there any other development potentials for the ElvoDrive?**

A possible option are electric buses with fuel cells or batteries operating entirely without a diesel generator. They are charged overnight at the bus depot or at stations along the route. On the drive side we have already demonstrated what we can do in this respect.

**How does the ElvoDrive work in an inner city bus with a high-performance battery?**

In its drive configuration as a 100-percent electric bus, the ElvoDrive has the following components: The traction unit, consisting of an e-machine with storage system, automated gearbox and a power converter. The concept of the ElvoDrive ensures that the bus can be operated with minimum losses in the driveline. As a result, the battery is fully utilized. However, as yet there are no batteries with sufficient capacity for a city bus to run for a whole day.

**Which other applications are thinkable for the ElvoDrive?**

The drive might be an idea for refuse vehicles or distribution trucks driving through the cities every day. Any conversion to the ElvoDrive will help the environment. //



The Mercedes-Benz Citaro already drives with the new DIWA.6 automatic.

**1+1+1= SAVE**

**Saving fuel is simple** – just take the foot of the gas. In theory this might be true, but everyday life is different. For example for bus drivers: Starting, rolling for a few meters, stopping. About three times per kilometer. Bus drivers often apply the un-subtle method of full throttle followed by full brake. But money and energy can be saved even in this case. Voith now offers its new DIWA.6 automatic transmission combined with the topography-dependent SensoTop gear-shifting program and the SmartNet

telemetric system as a complete solution. The goal: Five percent less consumption and higher availability thanks to preventive maintenance.

Five percent may be ambitious, but the DIWA.6 features a few innovations to make it possible. Measurements have shown that city buses are driven at full gas for only ten percent of the time. Until recently, the transmission was run at its full operating pressure of 8.5 to 10 bar, a value that is only required at full load. With DIWA.6, the operating pressure is reduced to about 5

bar for most of the time. This measure alone can save up to three percent fuel. And then there is the optimization of the periods when the transmission is idling and does not have to be moved by the engine. DIWA.6 saves about two seconds of load operation per stop, which really adds up over a year in the permanent stop-start scenario of inner city traffic. About 100 extra hours in idling can thus be achieved – another energy saver. Just like the SensoTop gear-shifting program, which – combined with a new torsional vibration damper – shifts gears at even lower speeds and thus cuts down on consumption. At the bottom line this amounts to up to five percent less fuel. But bus operators can save costs not only by lower fuel consumption. As long as the bus runs, it earns money. Is it in the workshop, it costs money. In order to minimize downtimes, Voith relies on the SmartNet telemetric system: The operating data of the bus are transmitted to a server via GPRS. In the event of a transmission failure, the operator is informed and can react instantly. This form of preventive maintenance keeps buses on the road for longer and cuts down on workshop stops. //

**CLOSE CONTACT**

**The times when** we drove to the filling station with a smile are long gone. Fuel prices are rising incessantly. For bus operators with heavy schedules, three percent less

diesel consumption of the fleet would mean a considerable saving: For 50 buses, each driving 50 000 kilometers per year and using on average 45 liters per 100 kilometers, this amounts to nearly 34 000 liters. With the DIWA automatic transmission and the SensoTop gear-shifting program, Voith has been supplying reliable and energy-efficient drive components for many years. Under the name DIWA Excellence, Voith also offers a service and maintenance program, which reduces costs and increases vehicle availability. The goal: Being close to the customer – be it through preventive maintenance, repairs, fuel optimization or service agree-

ments. Voith utilizes its worldwide presence even more intensively in order to develop individual DIWA Excellence solutions with its customers. For buses that take passengers to their destination day and night – and bring back a smile when it's time to refill the tank. //



Dialogue with customers: Service is the key.



**In Action:** Scan here and experience the world of DIWA automatic transmissions in moving images. Instructions on how to activate a QR code can be found on page 5.

[voith.com/diwa-excellence/de](http://voith.com/diwa-excellence/de)

## TAKE A DEEP BREATH

With a gentle hiss, the bus kneels towards the curbside. The doors open. People comfortably get off, others shove their way in. The sliding doors close, the bus is lifted back into driving position and moves on to the next stop. City buses need air, lots of air. Not only for the doors and the “kneeling” – the little bow to the curbstone – but also for the pneumatic suspension and the brakes. Voith has been supplying two-stage compressors for many years, which ensure sufficient pressure in the air system. Compared to single-stage compressors, Voith

compressors have a higher specific delivery volume and reach their desired final pressure at lower compression temperatures thanks to interstage cooling.

With the LP 725 Voith now offers its three-cylinder compressor also in alu-lightweight construction. The previous grey cast iron LP 700 air compressor has been installed in the Mercedes-Benz CapaCity articulated bus since 2008. With up to four doors, this bus uses enormous amounts of air. From 2013, the LP 725 is intended for the new generation of Euro-6 engines in the Citaro articulated bus (also Mercedes-Benz). //



Made for high air consumption:  
The LP 725 three-cylinder compressor. //



The LP 725 will be on the roads from 2013.

## NEW AT THE TOP

**CHRISTIAN NYKIEL**  
The 51-year-old has been heading the Business Division Road since 1 September 2012.

**Christian Nykiel** is the new Executive Vice President of the Business Division Road. The 51-year-old, who previously worked as Commercial Manager at Voith Turbo Aufladungssysteme in Gommern near Magdeburg, took over the Division per 1 September. Christian Nykiel has been with Voith since May 2011. Before that, the graduate business administrator held various functions at ABB in Germany and

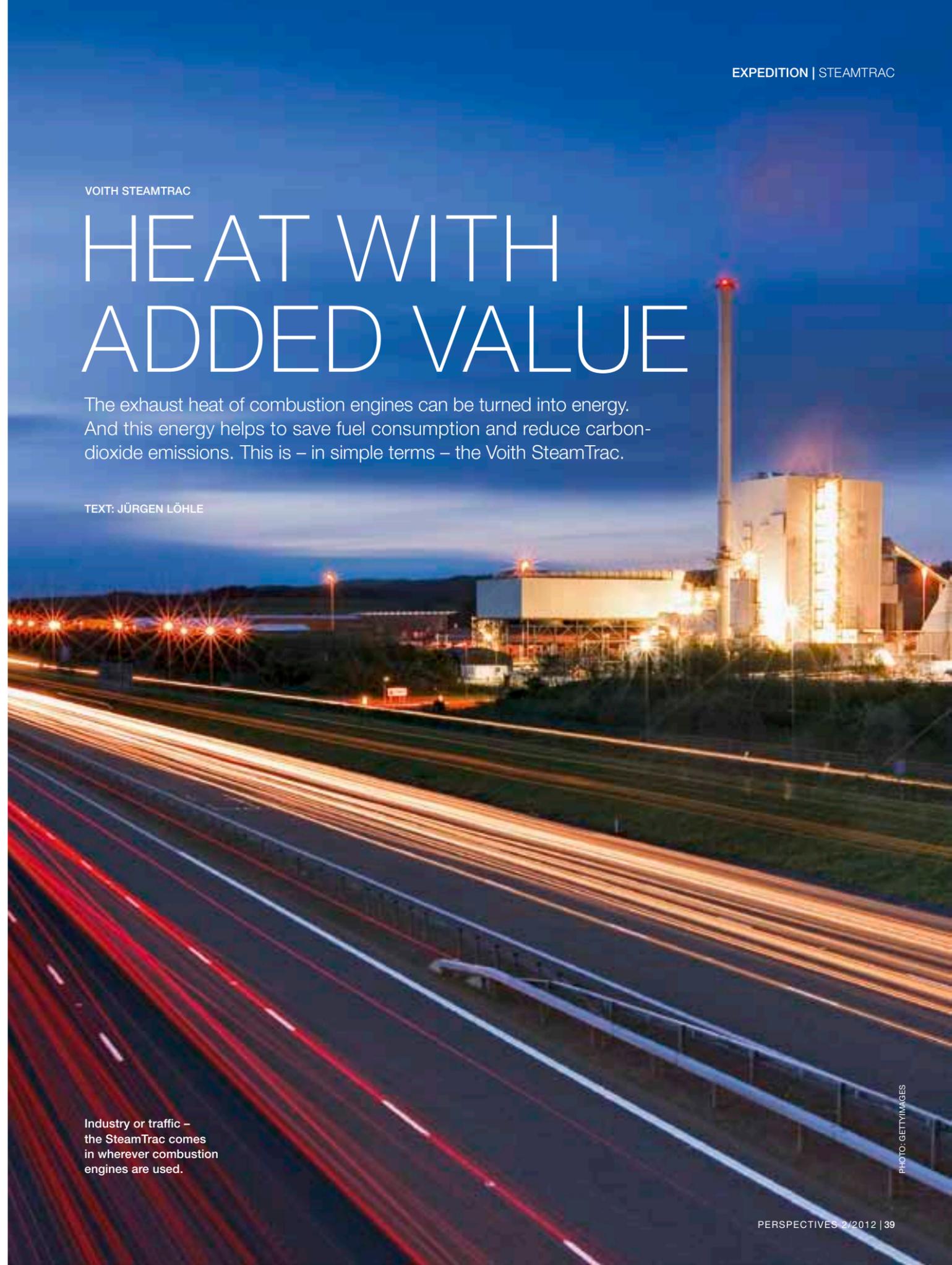
Switzerland, as well as at Peguform GmbH. At Peguform, he worked as Divisional Manager and was in charge of the optimization of business processes in all areas and also IT. As Executive Vice President of the Division Road, Nykiel will be responsible for drive and braking systems for buses, trucks and agricultural machinery. This includes automatic bus transmissions, retarders, torsional vibration dampers and air compressors. Nykiel is married and has three children. //

VOITH STEAMTRAC

# HEAT WITH ADDED VALUE

The exhaust heat of combustion engines can be turned into energy. And this energy helps to save fuel consumption and reduce carbon-dioxide emissions. This is – in simple terms – the Voith SteamTrac.

TEXT: JÜRGEN LÖHLE



Industry or traffic – the SteamTrac comes in wherever combustion engines are used.



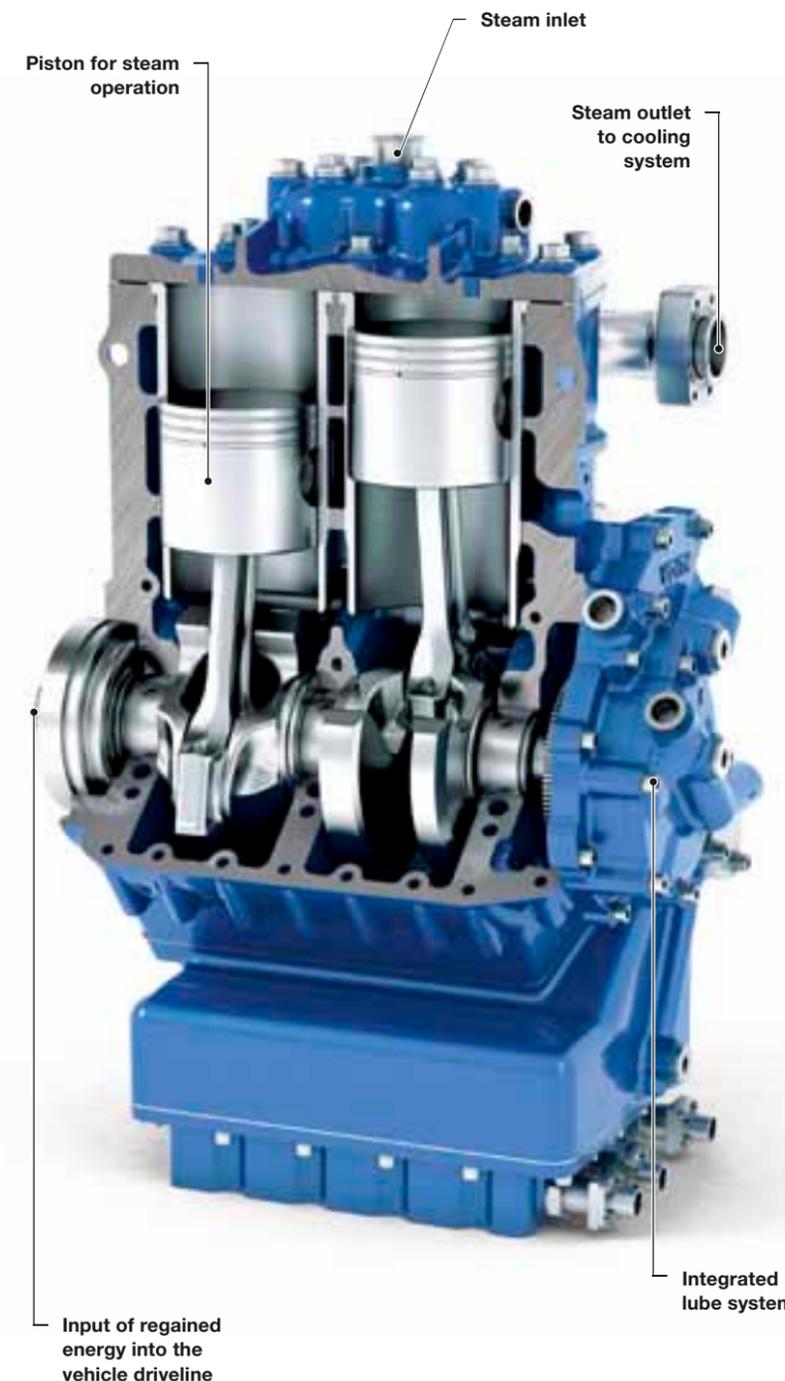
Full steam ahead: The Veerhaven takes six barges to their destination with the help of the SteamTrac.

Traveling with SteamTrac: Ne 81 railcar of Südwestdeutsche Verkehrs-Aktiengesellschaft in Lahr.



### Expander R2/800

The expander is the heart of the SteamTrac. In simple terms, it is a “steam engine.”



**JÜRGEN BERGER**  
The 40-year-old engineer is the Manager SteamTrac at Voith Turbo.

**Small vessel – big job:** The push boat Veerhaven is on its way from Duisburg to Rotterdam. It has to push six barges in front of it. Huge diesel engines rumble in the belly of the ship. “The boat really has to struggle”, says a man on the riverbank looking at the Veerhaven with its load at the front. True, but the floating workhorse needs less diesel than assumed. A lot less.

Until recently, energy in the form of fossil fuel was just there. In abundance and affordable. Twenty years ago, a liter of super cost DM 1.30, heating oil was about 20 pfennigs per liter. But these days are long gone and especially oil has become very expensive, while the associated CO<sub>2</sub> emissions are among the worst culprits of climate change.

### EXHAUST AS AN ENERGY SOURCE

The heat from the exhaust warms up an operating medium – usually distilled water.

For design engineers, this scenario is a challenge to squeeze as much usable energy as possible from every drop of fossil fuel. Especially from combustion engines, where 60 percent of the total energy still blows out in the form of heat. But heat can also be turned into new energy – a fact to which Voith takes a practical approach. The idea of power from heat is not new, but first of all it is necessary to develop a concept and then a product that is suitable, practical and commercially beneficial for the customer. “In the past it simply was not worth it to think for too long about waste heat recovery”, says Jürgen Berger, Manager SteamTrac at Voith.

A situation that has drastically changed in recent years. Incessantly rising costs for fossil

fuels, their finiteness plus rising eco-awareness acted as some kind of initial spark for a more intensive look at the energy efficiency of combustion engines.

It was in 2006 when Voith set up its first “mini steam power plant that made waste heat reusable” (Berger). Voith has had complete locomotive drive systems in its portfolio for a long time and was now wondering how these drives could be made more energy-efficient. “We threw virtually anything on the test stand”, explains Berger, “and in the end, to say it quite plainly, we got stuck with the hot exhaust”.

But the findings are actually far from plain. Of course the combustion heat warms up the cooling water, which can then be used for heating in winter. But while the heating system keeps us warm, there is still a huge quantity of heat that escapes from the exhaust unused.

This is where the Voith SteamTrac comes in: The exhaust heat is used for heating up an >

▷ operating medium. This is usually distilled water, but in cold regions it may also be alcohol or a mixture. The heat from the exhaust then evaporates the water in a heat exchanger. This steam then drives a motor, cools down again, liquidizes and flows back into a tank. From there, the operating medium is pumped back into the heat exchanger. Energy recuperation in a closed system. If the Voith steam engine is coupled to the motor and utilizes its exhaust heat, the system is referred to as Voith SteamTrac. This means that energy gained from heat is directly used for forward propulsion or tractive effort.

In cases where this is not possible, for example in a power station where a stationary engine is installed too close to a wall or where the steam engine cannot be coupled to the combustion unit for other reasons, the “steam engine” drives a fan or a generator to produce electricity – becoming the Voith SteamDrive. “Free energy” (Berger) for higher efficiency. But why did nobody think of this earlier? “The fundamental question was – is the world ready for such ideas?” says Jürgen Berger, who is in charge of the development together with his 14-strong team. And his spontaneous answer is: “It is

now.” The company thus hopes to attract a great deal of interest in Swabian energy-saving technology à la Voith. In all applications with combustion engines, be it in the belly of a ship, in a diesel locomotive, a truck, a biogas plant or in a combined-cycle power station. In terms of function it does not matter whether the engine is stationary or mobile. In practice there is also a two-cylinder SteamTrac for flanging to combustion engines rated from 300 to 500 kilowatt while generating 40 kilowatt by it-self. The operating medium is heated up to 400 degrees and directed to the engines at a maximum pressure of 60 bar. “We started with a power class that allows different applications”, explains Jürgen Berger. “Combustion engines with an output of up to 500 kilowatt can, for example, be found in the railcars of regional trains and in trucks or, like here, in vessels such as the Veerhaven.”

A six-cylinder with an output of 140 kilowatt is under development for larger engines. And what are the benefits of the technology? Eight percent more output at unchanged energy consumption are certainly an argument. An even more tangible result is the cut-down on fuel without negative impact on performance. In the Veerhaven push boat, the SteamTrac reduces the annual diesel consumption by 40 000 liters per engine and the carbon dioxide emissions by 106 tons. “With this technology”, so Jürgen Berger. “Voith is also making a contribution to the energy shift.” //

## TECHNOLOGY AS ENERGY SAVER

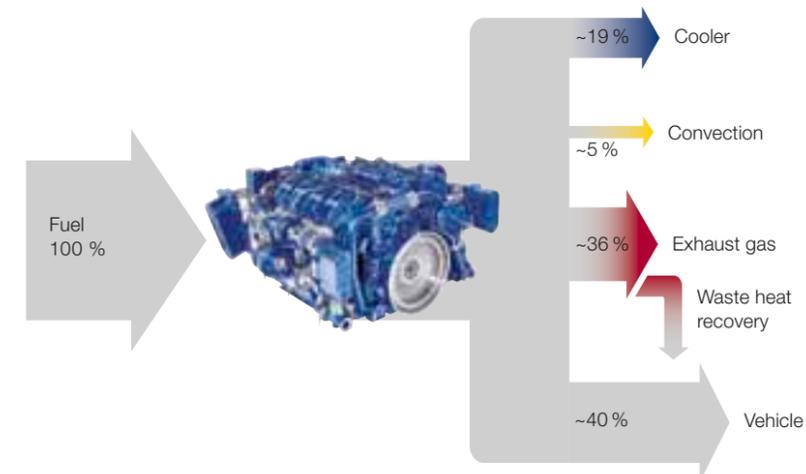
And the actual benefits of the SteamTrac? Eight percent more output at unchanged energy use are an impressive argument.



**Utilizing waste heat:** Scan here and learn more about the Voith SteamTrac and its function. Instructions on how to activate a QR code can be found on page 5.

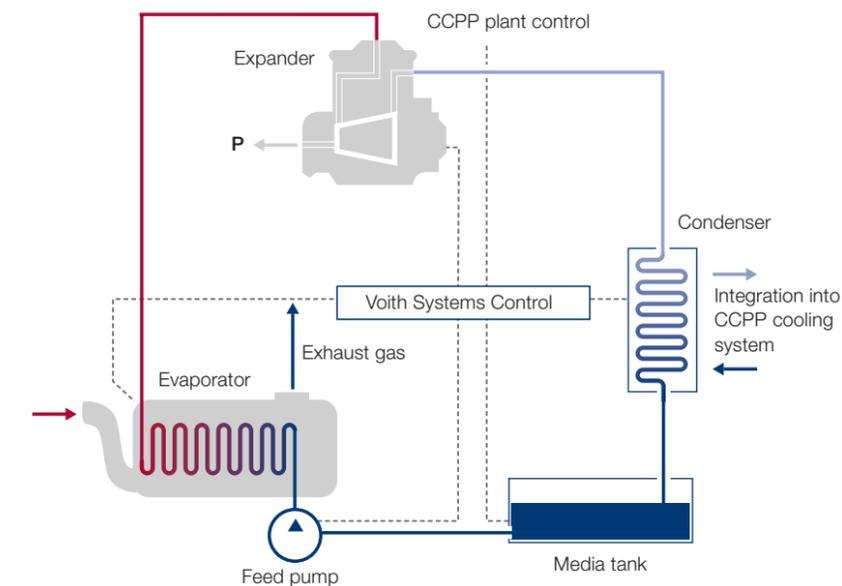
[voith.com/steamtrac/en](http://voith.com/steamtrac/en)

## Energy flow of a combustion engine



The efficiency of modern combustion engines is a mere 40 percent. Sixty percent of the energy thus remains unused. It dissipates either as exhaust heat or via the cooling water. Some of this energy can be recuperated with the Voith-developed waste heat recovery system.

## Function of the SteamTrac system



The operating medium is pressurized by a pump and forwarded into an evaporator (heat exchanger). This evaporator is a component of the silencer and thus integrated in the exhaust line. The operating medium is superheated by the exhaust gases of the combustion engine until it evaporates. The superheated steam is then decompressed in the piston expansion machine. Energy contained in the steam is converted into mechanical energy and forwarded to the engine drive shaft or the gearbox drive. The operating medium is liquidized in the condensation heat exchanger and then stored in the media tank.



Totally natural: The Voith SteamTrac can also be used in biogas plants.

PHOTO: FOTOLIA

VOITH STEAMTRAC

# GREEN ENERGY FROM THE SEWAGE PLANT



SteamTrac in practice: Sewage plant in Mergelstetten.

PHOTO: SIGFRIED GEYER

the rails. A push boat with a SteamTrac operates on the Rhine between Rotterdam and Duisburg (see pages 39–45). And at the Kaiserstuhl, a rail bus is currently being tested after getting approval for passenger traffic by the Federal Office for Railways. On the road, the innovative technology can be used in trucks and reduces consumption, an interesting aspect in times of high fuel prices. Jens Grieser is out and about a lot on these summer days. When he is not in Mergelstetten, he can often be found on a farm in his home community Söhnstetten. Here, a farmer has been running a biogas plant since last year – with the Voith SteamTrac. This plant was also launched by Grieser. //

#### JENS GRIESER

The 31-year-old works at Voith in the department Development, Application and Sales of SteamTrac/SteamDrive.



Prototype in the sewage plant: The Voith SteamTrac is utilized in Mergelstetten to reduce energy costs with its eco-friendly technology.

**A sewage plant** in the country, surrounded by fields and forests – welcome to Mergelstetten. Hot sunshine and a cloudless sky. The thermometer already shows 30 degrees at nine in the morning on this day in July. Inside the engine room it is even a few degrees hotter than outside. Since May, Mergelstetten has a new combined-cycle power plant fitted with the Voith SteamTrac.

At the back of the room, Andreas Bosch sits at a small desk. The Voith engineer has opened his laptop and monitors the processes in the power station. For the last few days, the staff of the sewage plant have reported a whistling noise. Yet everything runs smoothly this morning while the cause of the sound has not been found. But nobody gets into a sweat about it. “The SteamTrac is a highly innovative technology”, says Jens Grieser, who participated in the development and implementation of the system. He steps behind his colleague and looks at the screen. “There are still a few birth pangs, but we are very proud of our baby.”

The baby referred to by the graduate engineer is two months old and a lot louder

than a normal infant: The Voith-developed SteamTrac is a heat recovery system coupled to a combustion engine in the sewage plant. The exhaust heat of the plant is used for generating electricity. “The system has been running continuously for about two weeks”, says Torsten Lonsinger, Plant Manager in Mergelstetten.

The plant clarifies the waste water of seven neighboring communities. In the interest of water conservation, several smaller sewage plants in the adjacent villages have meanwhile been closed down. Together with Jens Grieser, Lonsinger intently monitors the practical progress of the new technology. And in this case, there is even an extra level of excitement: “The sewage plant in

Mergelstetten is currently the only plant in Germany where the Voith technology is being used. In fact, there is no other sewage plant in the world with a SteamTrac”, says Grieser. Mergelstetten is the prototype. The 31-year-old speaks of a flagship project for Heidenheim. The engine of the combined-cycle power station of the sewage plant is driven by digester gas and has an output of 235 kilowatt. The Voith SteamTrac adds another 16 kilowatt. The system heats water in a heat exchanger, evaporates it and superheats it. The steam is directed to an expander with two pistons, and the energy generated in the process can be fed into the grid. “It is our goal to cover a large proportion of our energy requirements from our own sources”, says Lonsinger. This helps

to save energy and reduces the operating costs of the plant. “Today we are up to 50 percent self-sufficient, in the past this figure amounted to only 40 percent.”

The new technology also offers another advantage: It is eco-friendly and non-toxic. “Our operating medium is water”, says Grieser. “Just like with the good old steam engine.” The Mergelstetten plant produces electricity with the SteamTrac to the tune of EUR 1 000 per day, calculates the engineer. This green technology is subsidized by the State of Baden-Württemberg. The sewage plant is not the only place where the SteamTrac can be used. The technology has also proven itself in practical applications on the water and on

The historic center of York, the first capital of the USA, is inviting for a stroll.

PHOTO: YORK COUNTY CONVENTION & VISITORS BUREAU



Keeping a keen eye: Ron Wilhelm (left) and Lee Myers are two of the 123 employees of Voith in York.

VOITH IN YORK

# HOMEBASE WITH HISTORY

Voith Turbo has ambitious goals in the United States. 123 employees in York make sure that they become reality. US CEO Normand Boisvert also wants to score with sustainability themes.

**Chicago, Philadelphia,** or perhaps Washington D.C.? Normand Boisvert gracefully declines. “Many people might like to live in large cities”, says the CEO of Voith Turbo in the United States. “But just as many – me included – appreciate the atmosphere in a small town.” A small town like York with its population of about 45 000.

This is the location of the US headquarters of Voith Turbo. Boisvert and his wife have been living in York for five years and enjoy the pleasant climate, the special flair of the trade center and last but not least the historic heritage. “The people are particularly proud of the history of this town”, states the Voith

Manager. Because: York is also known as the first capital of the USA.

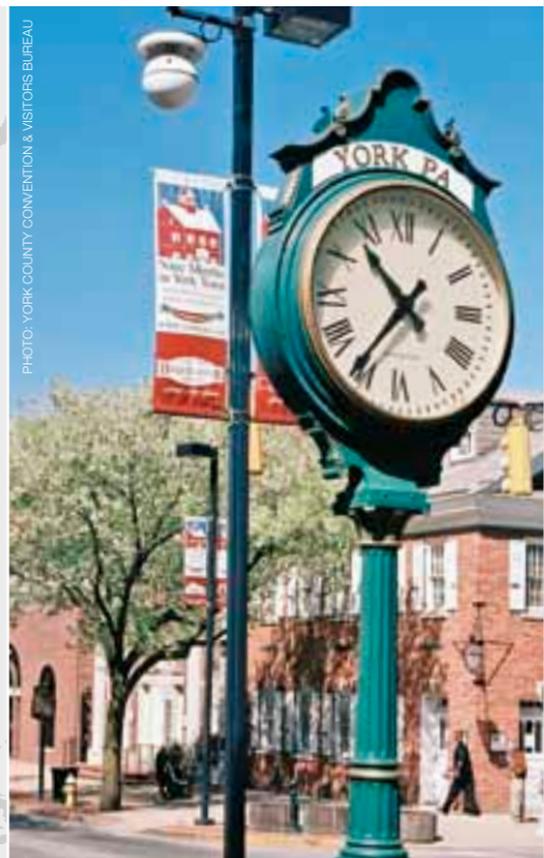
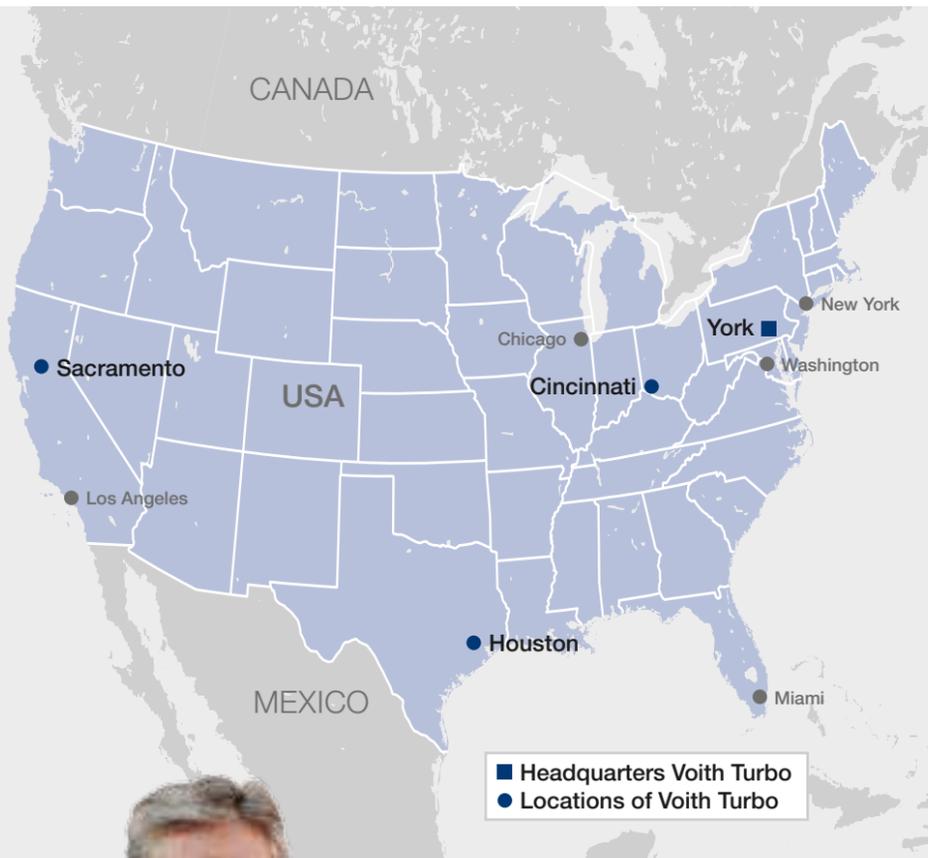
From September 1777 to June 1778 the heart of the founding state Pennsylvania was the temporary seat of the “Continental Congress”. During this time the North American colonies referred to themselves for the first time as “United States of America”. York is also the venue of the oldest exposition in the USA. The York Fair has been running for 247 years.

But at Voith in York it is not only the past that is worth looking at. On the contrary. The company chief has ambitious goals for the future. In 2011 Boisvert announced at

the Voith head offices: “Over the next five years we want to grow by 100 percent in the USA.” And the chances that this plan will materialize are quite good. “2011/2012 was an excellent year for us”, he says. “We are on the right track to make our vision come true.” As always, the performance of the workforce is a key element for success. 170 men and women work at Voith Turbo in the USA, 123 of them in York.

In total, Voith Turbo is represented in the United States at four other locations apart from York. The colleagues in the distribution centers Sacramento, Cincinnati and Houston ensure that the entire catalogue

of Voith products – from Vorecon planetary gears and DIWA automatic transmissions to Voith Schneider Propellers – gets to the customers fast and reliably. The three distribution centers supply customers across the entire continent – from Oregon to Maine, from Texas to North Dakota. With its new development center for hybrid technology in San Diego, Voith also wants to take technological progress outside the US borders. “We have assembled some of the best engineers in the USA in this center”, explains Normand Boisvert. This team will work together with colleagues from the German headquarters on the development of superlative Voith products. >



York's historic charm.



▷ A topic for the future, which Boisvert will handle from York, is sustainability. He has launched a number of programs to boost in-house initiatives that are dedicated to this subject. Not too long ago, a team of employees presented best-practice examples for sustainability at a symposium for health, safety and environment in York.

**NORMAND BOISVERT**  
The 61-year-old has been CEO of Voith Turbo Inc. since 2007 and responsible for the US market.

Normand Boisvert and his colleagues in York have their fingers firmly on the pulse of time. And this pulse can sometimes beat quite strongly. After all, the legendary motorbike maker Harley-Davidson is also based in York. Another brand with a rich history, founded in 1903. A works tour at Harley-Davidson is an absolute must on the to-do list of every self-respecting tourist. And, should anybody be suddenly overcome by a longing for metropolitan flair, a well-established network of highways offers fast connections to various large cities. "In many of these cities you'll soon come across products from Voith", says Boisvert. Voith experiences particularly strong growth in the market for passenger trains. //

WORTH KNOWING

# SUCCESS FIGURES

With its four divisions, Voith offers a broad spectrum of products and services – all around the globe. All divisions operate with the aim of acting successfully and eco-friendly.

# 860

... gigawatt hours of electricity are generated on average by the Piva hydropower plant in the north of Montenegro. Voith has modernized the high-voltage switchgear, which ensures that the generated power is reliably fed into the grid. The new unit includes the control system and the protective gear, the equipment of the central control room, as well as the modernization of the direct current and emergency power supply systems. The rehabilitation project will be completed in 2013. Voith Hydro is also currently rehabilitating Saratov hydroelectric plant in Russia. Alongside the rebuild of the Kaplan turbines, which was ordered last autumn, Voith Hydro will also carry out the design, production and assembly of the Kaplan unit configured as a residual water turbine. The modernization is undertaken for the plant owner RusHydro, the largest electricity company in Russia and the second-largest in the world.

# 3 000

... London underground trains drive with Wedgelock couplers from Voith Turbo. During the Olympic Summer Games with 800 000 visitors per day and the subsequent Paralympics, there were also 1 500 double deckers with DIWA transmissions on the road. Since last year, Voith Industrial Services has been in charge of the availability and maintenance of 600 buses of the transport operator London United. And there is more: Three Thames ferries in London's southern district of Woolwich are driven by Voith Schneider Propellers.

# 80

... paint shops in the automotive industry are being looked after by Voith Industrial Services worldwide. This makes the company one of the international leaders in this area. All large automobile manufacturers are on the customer list. The services on offer range from technical cleaning and maintenance to the full operation of the plants. Voith Industrial Services is continually expanding its service portfolio and its own processes.

# 1

... million tons of fine paper per year are now being produced by the South Korean Moorim Paper Group on the company's new production line DongHae PM1 from Voith Paper at the location Bulsan, as well as on two other paper machines. This makes the company the largest producer of fine paper in South Korea. DongHae is the first non-stop production line in the country and also excels by resource-sparing operation. The PM1 mainly uses short fiber pulp, which is produced on site. This material does not require drying but can be pumped to the paper machine directly in liquid form. This saves huge amounts of energy normally required for dewatering the pulp. The close cooperation between the South Korean Moorim Paper Group and Voith Paper continues in the form of service agreements.

# 300

... new long-distance trains of DB German Railways are gradually to replace the old Intercitys and Eurocitys from 2016. For the first lot of 130 trains, Voith Turbo delivers 260 front ends with roof, 260 automatic couplers and 2 000 semi-automatic couplers.