Atlas Copco

Industrial ideas

THE ANNUAL MAGAZINE OF THE **ATLAS COPCO GROUP** | 2021-2022

INNOVATING *for a sustainable future*

No waste, low emissions

What if machines could adapt their speed to the current need to save energy?

Perfect vision

Fully autonomous production is no longer an illusion.

Powered up and ready to go

For companies who want to curb or even eliminate their CO_2 emissions, going electric is the obvious choice.

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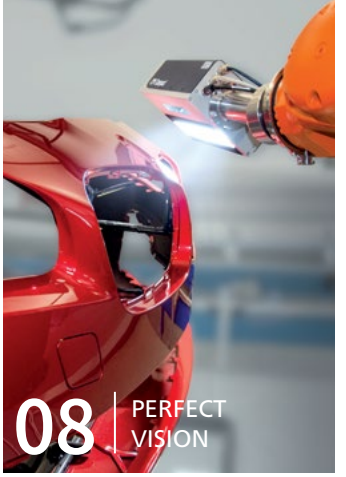

A MAGAZINE FROM THE ATLAS COPCO GROUP

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“OUR IDEAS DRIVE *society forward”*

Unlike many other technology drivers, Atlas Copco is characterized by a very hands-on approach to innovation. We never innovate just for the sake of it, but because we see an opportunity to make a difference. Everything we do is spurred by real challenges. This helps us develop highly efficient and sustainable products that benefit our customers, society and the world.

Our expertise covers many different technologies, and our solutions are used in almost all kinds of industries. Everywhere you look, our products probably had something to do with it. The phone you use was made with our tools and vacuum solutions, the food, clothes or medicine you need were made with the help of our compressors, and the house you sit in may have been built with our power solutions.

When we develop a new product, we always start by looking at a present or future problem that needs to be solved. Our current focus on smart connectivity and remote control is an excellent example of this, as it brings both productivity, safety and environmental benefits. Developing battery-powered machines is another.

We do it together with our customers, who often are leading players in their fields, and we have reached many milestones together. Ergonomics, safety, quality and energy-efficiency are just some areas where we have set new standards throughout the years, and still do. To continuously invest in R&D is a fundamental part of our innovation strategy. We know that this is the best way to remain an industry leader over time.

This publication is a tribute to our spirit of innovation. But having the right ideas is not enough. As you can see, it all comes down to our talented and dedicated people. Here you will meet a few of them, but thousands of colleagues all over the world share the same passion. We believe in giving people a clear responsibility and plenty of freedom to act. Mostly because we know it’s the fastest way to great results, but also because it’s much more fun to work that way, and when you have fun you become bolder and more creative.

This way, we develop industrial ideas that empower our customers to grow and drive society forward. Together, we help create a better tomorrow. ■

Mats Rahmström
President and CEO

MAKING A DIFFEREN

The demand for renewable energy solutions is growing. When making wind turbines, our industrial grinders give the pillars and rotor blades the optimal angle and surface. Our powerful wrenches and tensioners ensure that every bolt is tightened properly to withstand the enormous powers at play. During installation, our generators are used to safely start up the turbines, at land or offshore. And did you know that solar power technology depends on vacuum pumps? They are needed when making the silicon wafers and photovoltaic cells that will capture the sunlight and convert it into energy.

Modern society depends on industrial ideas. Our tools, machines and software solutions are involved in making almost everything you see and use in your daily life.

ICE

If you visit a factory, big or small, there is likely at least one compressor hidden somewhere. These work horses power all kinds of production, and without them the shops would soon be empty. When producing food, for example, high-quality compressed air is critical. Our oil-free compressors and filter purification solutions ensure that the food is not contaminated, and our vacuum solutions come into play when it's time for hygienic sealing and packaging.

Hospitals, dental practices and veterinary labs all rely on a steady supply of oxygen and other medical gases, and our pumps, purifiers and gas distribution systems make it happen. There is no room for failure, and the equipment must be highly reliable, safe and ultra clean. Hospitals must also have stable access to electricity. In case of power cuts, our backup generators ensure that the medical staff can focus on helping their patients, no matter what.

Semiconductors are at the heart of modern technology, and the need just keeps on growing. These components are essential in computers, LED lights, screens, mobile phones and much more. The manufacturing of semiconductors requires pristine working conditions as even the tiniest contamination can destroy the device. Our vacuum pumps create the ultra-clean environment needed, and our abatement systems take care of toxic or global warming by-products to prevent them from harming the environment.

Machine vision systems are able to perform ultra-fast measuring and inspections down to the nano millimeter level. This is extra useful in production flows where surface quality is key, such as bumper inspection, glass, paper and electronic components.

PERFECT VISION

Fully autonomous production is no longer an illusion. Thanks to extremely precise optical sensors boosted by embedded computing power, machines are now able to produce top quality at record speed.

Industrial production is becoming ever faster, more flexible and self-governing. This puts very high demands on reliable item identification and quality inspection. As these tasks must be performed in a split second, it all comes down to smart machines. The human eye is simply not fast or focused enough. Luckily, industrial robots equipped with smart and precise computer vision are ready to take up the challenge.

When quality is key

Machine vision technology has been around for decades, ever since robots and other machines were equipped with cameras. Today, machine vision systems are frequently used in assembly processes, autonomous vehicles, food production, item packaging and logistics – even to enhance medical examinations.

The systems are nowadays digitally advanced with high-resolution lenses, extremely sensitive sensors and fast-switching LED lights. With the help of 3D technology, they can perceive the depth and different angles of an item and detect deviations down to the nano millimeter level. When equipped with infrared radiation functionality, the systems are able to create thermal "heat maps" to scan and identify items. The cameras and sensors are complemented by software solutions that capture data and use it to make decisions and instruct the hardware.

In industrial manufacturing, the systems are often mounted on, or embedded in, robots working on the actual production line. Their visual measuring is extremely quick and precise, even at very high speeds, and instantly detects and classifies scratches, dents, color deviations, or other defects. This is particularly important when

ISRA's sensor systems permits intelligent robot "bin picking", which is a key part of automated manufacturing. Robot vision, special illumination and algorithm-based 3D detection of an object's position and orientation enable highly flexible removal of unsorted components from bulk containers. The sensors offer the highest degree of accuracy, even for large components.

surface quality is key, like in the production of sheet metal, glass, paper, and critical electronic components such as semiconductors.

Besides material inspection, machine vision systems can be used to ensure that pieces are picked and placed correctly and sorted in the right order. This saves time and improves overall production efficiency. The system software also enables self-teaching, and machines can learn how to recognize defects or patterns common for a specific product model, for example, to further improve the production process.

Entering a new field

In 2020, Atlas Copco moved into the field of machine vision to strengthen its industrial assembly expertise and support customers on their journey towards smart productivity. By acquiring Germany-based ISRA VISION, a global leader in machine vision solutions, and Perceptron, a U.S. company with almost 40 years of experience in 3D measurement, a new technology division was established, fully focused on machine vision. The two brands are complemented by QUISS, a technology driver in bead inspection and part of the Atlas Copco Group since 2018.

"Renewable energy is a growing field and we want to be part of this transition. This ambition drives our efforts in developing leading technologies for the solar and photovoltaic industry."

Tomas Lundin
President ,Machine Vision Solutions division.

"Machine vision is a very exciting field for Atlas Copco as it complements our automation and robotic solutions for manufacturing. It is also highly innovative and combines advanced software and hardware technology, which is right up our alley," says Tomas Lundin, President of the new Machine Vision Solutions division. "By acquiring this expertise, we can now provide industrial assembly technologies and machine vision solutions for the same applications, like car manufacturing, and help our customers set up smooth and smart production flows."

Eyes set on renewables

One important customer segment is renewable energy, and solar power in particular. Solar panels must have a flawless surface in order to capture the energy efficiently.

Through ISRA, Atlas Copco develops optical inspection systems for complete quality control of solar panels, from glass production to solar cells and entire modules. The highly precise solutions help producers improve efficiency, performance and throughput – all important steps towards making solar technology more affordable. ■

SMARTER *manufacturing*

Imagine a factory where smart machines operate autonomously and transfer data without any delay. With 5G mobile networks, this will soon be a reality.

With ultra-high speed and reliability, fifth generation (5G) mobile networks will revolutionize industrial manufacturing. The dramatic increase in capacity is a prerequisite for data-consuming technologies like the Internet of Things, intelligent automation, real-time monitoring and machine learning. The network technology is there. The challenge is to optimize it for industrial settings.

Since 2019, the Atlas Copco Airpower factory in Belgium is testing a private 5G network with indoor antennas connecting the shop floor. The goal is to investigate how to best implement 5G and create intelligent manufacturing flows where production data is transferred without delay.

"We are testing how to best connect machines wirelessly and monitor quality and energy consumption in real time, and how to use Automated Guided Vehicles (AGVs) on the shop floor for increased precision and safety," says Wouter Ceulemans, President of Atlas Copco's Airtec division that designs and manufactures advanced compressor parts.

"The really exciting learnings will come from the ultra-low latency. 4G is not fast enough to make real-time control possible. With 5G, the delay drops to a minimum, making truly smart manufacturing a reality," Wouter explains.

"The insights we gain from this test network will naturally benefit our own production flows worldwide, but also help us support our customers. When they get ready to make this big technology leap they will need a partner who understands their challenges, and designs its products accordingly," says Wouter.

Meanwhile, Atlas Copco Industrial Technique has also installed a private 5G network in its integration lab in Stockholm, Sweden. The network is used to develop 5G ready industrial tool solutions for customers worldwide. This is one of the first 5G implementations for industrial purposes in the world and helps put this kind of network solution to the test.

"Today more than 90% of our industrial tools are connected to our customers' systems, most of them through fixed couplings. We also provide many wireless systems based on Bluetooth or Wi-Fi. By installing this 5G network we can design, develop and test new products equipped with integrated 5G modules, and thereby support our customers on their journey toward fully connected manufacturing processes," says Lars Eklöf, President of the Motor Vehicle Industry division. ■

POWERED up and ready to work

One important step toward a carbon-neutral future is power and air supply solutions that curb or even eliminate CO_2 emissions. Going electric is the obvious choice.

Imagine a metropolitan construction site free from noise, harmful fumes, particles and carbon emissions. And imagine being able to store energy in a zero-emission way and supply power to off-grid applications, or to complement a peak in demand. With its electric-powered solutions, Atlas Copco has come a long way toward realizing this vision.

A prime example is the electric-powered E-Air VSD compressor family, designed to be used in the same applications as a standard diesel compressor, but with significantly lower emissions. A prominent member is the plug-and-play, robust H250 VSD compressor that withstands heat, dust, humidity, vibrations and other heavy-duty conditions. Luc Linart and Gill Dhooghe were both part of the development process and know this yellow machine by heart.

"This compressor gives construction companies access to a much broader range of applications. Because it's electric it can be used in low-emission zones and at indoor sites," says Luc Linart, Product Manager at Atlas Copco's Portable Air factory in Antwerp, Belgium. "It also offers a bigger performance in a smaller canopy. And it's easy to move."

"On top of that it's so quiet that the first time we showed it to a customer they said: 'What? Did you turn it on already? Is it running?' You can have a normal conversation right next to it when it's on, unlike old diesel-powered compressors."

Gill Dhooghe, Vice President R&D in Atlas Copco's Portable Air division, explains why this is a crucial step on Atlas Copco's journey to sustainability, a path that he himself feels a personal investment in.

"I'm lucky to be in a position with more possibilities to contribute than some others and it's really my obligation to do so," he says. "This new product family is a vital step toward Atlas Copco's ambition for a sustainable future."

Moving away from diesel

It's clear that the E-Air is a worthy addition to Atlas Copco's canon. Stationary electric air compressors have long been used in hospitals and factories, but portable air compressors have traditionally been diesel powered because outdoor construction and mining sites have not often had electric grid access or the right power outputs.

However, an increased focus on carbon emissions, the rising cost of diesel due to ever-tightening emissions legislations, new regulations on work-site noise levels and the increasing electrification of mines and construction sites mean that diesel power is becoming less and less attractive.

"These combined trends made us see the possibility of moving away from the diesel-driven market and investigate how we as a market leader in portable compressors can lead the way to zero emissions and support our customers in the transition," says Gill.

"And the total cost of operation is unbelievably economical," adds Luc. "While the initial purchase cost is more or less the same, the cost of running an electric machine is about half the price of using a diesel one."

Other major advantages are the compressor's ruggedness for all weather conditions, suiting it for outdoor applications such as geothermal drilling, sand blasting and concrete blasting; its variable speed drive, which improves the energy efficiency; and its intelligent software, which allows it to be plugged

E Air H250 VSD portable compressor

Main feature: Portable, plug-and-play air supply for rough conditions.

Super powers: Tough, silent, portable and emitting 46% less CO_2 compared with a traditional diesel compressor.

Used at: Underground, at construction sites and other places where clean and silent operations are needed.

Luc Linart

Factory Product Manager

How did you end up working for Atlas Copco?

I was working for a pneumatic automation company. Most of the time, the air we were using came from an Atlas Copco machine. I said to myself, 'Darn, those guys are everywhere!' I applied for a job and me and the company clicked straight away. This was what I wanted to do.

Gill Dhooghe

Vice President R&D, Portable Air

What drives you?

To see a big organization going in the direction of sustainable technology is extremely rewarding. We have a lot of successes globally and to work with all those nice, passionate people and create such innovative products that help make the world a better place is fantastic.

into any power output and automatically adjust to the grid and socket available.

Batteries do the work

Another electric milestone is the ZenergiZe battery-powered energy storage system, providing power at off-grid or outdoor events, remote telecoms masts or construction sites. This new system is quieter, smaller and much cleaner than the traditional diesel hulks, and the lithium-ion battery pack can provide over 12 hours of power with a single charge. The system can also work hand in hand with renewable sources, such as solar panels and windmills, and store the energy they provide, in order to be used at a later date.

The battery-powered solution is the result of Atlas Copco's customer-focused, "outside in" approach to R&D, where customer insights are fed back into product development instead of the other way around. Rubén Trevejo and Bárbara Gregorio are two key members of the development team of engineers, marketers and technology innovators.

"We saw the market trends toward clean energy and the reduction of CO_2, especially in Europe, and wanted to meet that need," explains Bárbara Gregorio, Product Marketing Manager in Atlas Copco's Power and Flow division. "Our customers, particularly rental companies and their customers, were starting to think about hybrid systems, especially in metropolitan areas where there are increasing numbers of CO_2 and noise restrictions for the use of machinery."

"I'm proud of the zero emissions, but also of the very good performance," says Rubén Trevejo, Design & Development Manager at Atlas Copco's factory in Zaragoza, Spain. "This technology was completely new to us and that made it a bigger challenge, so we worked on the concept a bit longer than we've done with other projects."

ZenergiZe Energy Storage System

Main feature: Stores and provides energy in a sustainable way.

Super powers: Zero CO_2 emissions, zero noise and virtually zero maintenance needs.

Used at: Construction sites, outdoor events (especially at noise-sensitive locations), solar and wind farms, and telecom applications.

Bárbara Gregorio

Product Marketing Manager

What motivates you?

Sustainability is very important to me and it made me so happy that Atlas Copco has placed its bet on this idea, which seemed a little crazy at the beginning. It was a new technology, customers didn't know about it, but it was the support of our managers that pushed this idea.

Rubén Trevejo

Design & Development Manager

Why did you join Atlas Copco?

I started in 2019, after working for 17 years with another multinational company. It was a difficult decision to change companies, but one of the things that was important to me was Atlas Copco's values, mission and commitment with regard to sustainability. In each engineering department we have a KPI to improve our emissions and carbon footprint in every machine.

"We knew that we needed to create something that could be better for both the environment and cost efficiency," adds Bárbara. "Customers obviously have to take care of their investment in terms of the total cost of operation as well. So, we wanted to combine these things, and we came up with fantastic savings in terms of fuel consumption and noise reduction."

Worth the wait

Since its launch in 2020, the initial customer reactions to ZenergiZe have been worth the longer, more challenging development process. "We knew that we needed a zero emissions portfolio but we didn't know if the market was ready to embrace this," says Bárbara. "However, one of our biggest customers is using it in telecom applications, with fantastic results."

But just because ZenergiZe is out on the market, the product development process is not over, as Rubén explains. "We are learning so much from the customers, who come up with all sorts of ideas for the technology's application. Battery technology will also keep evolving, and that's exciting."

"This is just the beginning," adds Bárbara. "There's the promise of real progress in the future, and everyone in the team was very happy to develop something so new and different. I think we are brave to do so."

Eyes on a sustainable future

The E-Air H250 VSD compressor was also many years in the making, but this gave marketing and R&D time to inspire each other to new heights.

For Gill Dhooghe, one of the most exciting aspects is the sustainable possibilities it opens up for the future. He mentions hybrid solutions, battery power and even hydrogen as being on the horizon for compressors with VSD technology.

"We are certain of the steps we want to follow," he says, "and they're all connected to each other so that we can have the best machines at the end of the process. Our aim is to have an emission-free product for every application that we serve out there."

"We're always thinking ahead," adds Luc. "We want to stay innovative, supplying sustainable solutions and staying ahead of the competition. That's who we are." ■

The ZenergiZe energy storage system can be combined with renewable sources of energy for immediate or later use. It captures the energy and stores it for delivery at any given time. Its intelligent control system then manages the energy offer and demand to increase the efficiency of hybrid power solutions.

NO WASTE
LOW EMISSIONS

Industrial compressors and vacuum pumps consume a lot of power. But what if there was a way to make them use much less energy by adapting their speed to the current production need? This innovative idea has put Atlas Copco at the forefront of energy efficiency.

Most industrial manufacturing processes rely on a steady supply of compressed air to power the tools or robots, or to separate gases and fluids, and more. The compressors producing this air are often hidden at the back of the factory but carry the entire production flow. They are powerful workhorses that keep on going, day in and day out. Consequently, they consume a lot of power, and power use translates into emissions and costs. Industrial companies are therefore constantly looking to maximize their energy efficiency, or put more simply, ways to use less energy to perform the same tasks. Machines that are constantly running will also sooner or later wear out.

Thanks to continuous innovation, Atlas Copco is an industry leader in both performance and energy efficiency. The key enabler of the high energy efficiency is the variable speed drive (VSD) technology. Instead of running at the same speed all the time, this technology enables the motor to adjust and adapt to the current demand.

In 1994, Atlas Copco was the first supplier to integrate this technology into compressors, a game-changing idea that revolutionized the market. About 20 years later, a new industry standard was set with the in-house innovation of VSD+, bringing energy consumption to a record low.

A breath of fresh air

The ZR VSD+ oil-free rotary screw air compressor is one recent example of Atlas Copco's efforts to excel in energy efficiency and performance. This machine provides oil-free air in environments where even the slightest contamination would ruin the product, such as pharmaceutical or electronic component manufacturing. This level of cleanness is also vital in food and beverage production, the textile industry and in car painting processes.

"Reliability and energy efficiency are very important factors for a customer since electric costs represent 75 to 80% of the total cost of ownership over a 10-year period," says Jeroen Hoen, Global

ZR VSD+ COMPRESSOR

Main feature: Delivers clean, oil-free air using flexible speed and minimal energy.

Super powers: Amazingly CO_2 smart, saving 11% compared to compressors with more traditional VSD technology. As much as 90% of the energy can be recovered and used for heating or as steam needed in other industrial processes.

Used at: Food and beverage production, in pharmaceutical industries or at electronics and automotive manufacturers.

John Munck Award

This product was awarded Atlas Copco's prestigious John Munck Award 2020. This award, established in 1988, is presented each year to the person or team having produced the best innovative technical development contribution.

Jeroen Hoen

Global Product Manager

Did something unusual happen in this development project?

Yes, we made a marketing film at the Birra Peroni plant in Italy, which was a lot of fun. Because we were from Atlas Copco, being the specialist in compressed air, we even managed to get permission to visit the Aula Magna at the University of Padua, where Galileo Galilei tried to measure the weight of compressed air more than 400 years ago!

Thomas De Bontridder

Team Leader Engineering

What motivates you?

I love solving technical issues and seeing good ideas being implemented and paying off. Now I can support the team members I lead to bring new products to the market. I've done that myself and I use my experience to advise them. It's great to see people developing within the team, finding their place in the company and getting things done.

Product Manager for oil-free screw compressors, and a 25-year veteran of the company. However, the road to the product's launch was a long one.

"The idea behind it had been with us for quite a long time. It actually goes back to 2006. My first job at Atlas Copco was to test the motors that were meant for this product, but there were technical challenges and it was hard to make it cost-effective, so it was put on hold," says Thomas De Bontridder, previously R&D program leader for the ZR VSD+, and now Team Leader Engineering for oil-free screw compressors.

It wasn't until 2014 that the innovation process started up again. "By that time there'd been new technical developments, so we sat together with people from engineering and brainstormed ideas saying, 'Now we have everything available to make a product that will bring a real benefit to the market,' "says Thomas.

Later, colleagues from various customer centers joined service technicians, production, engineers and marketing as the product was developed. The first units were tested at 10 pilot customer sites, including producers of beer, baby food and medical equipment. The feedback from these initial customers was vital to the refinement of the final product.

"We took a quantum leap with this product," says Jeroen, who remembers the launch as if it was yesterday. "When I was standing there on the stage in front of all the people, that was an enormous thrill. We managed to bring customers a 10% saving on our previous compressor, which for example means savings of almost 10 000 euros a year on a 160 kW compressor."

Money talks all right, but so does sustainability. "Since the launch, we have installed more than 300 units, and every unit saves 40 to 60 tons of CO_2 a year depending on the air demand profile," says Jeroen.

The customer reactions have surpassed expectations, and Jeroen Hoen's and Thomas De Bontridder's work was recognized in 2020 with the prestigious John Munck Award for technical innovation. Their Compressor Technique colleague Dieter Bertels also shares the prize for his vital contribution.

"It is great to receive this award. I'm really proud because we worked so hard to bring it to market," says Thomas. And for Jeroen, the development of the ZR VSD+ still ranks high in his long career. "It makes you proud to work for a company that has the best product in the world. Even now, I still feel very enthusiastic about the product. It's my baby."

Dexter Dai

Senior Development Engineer, Qingdao.

What motivates you at work?

I'm happy that my ideas are encouraged. There's so much freedom here. I helped create a product like this one, and that feels fantastic. Because of this product I also got the chance to visit several countries in northern Europe, India and Australia, and this was really great. To work with people from different countries gives me a true understanding of diversity and it's changed my life in many ways.

Expanding into vacuum

Just like compressors, vacuum pumps are essential in many industrial and scientific processes. They can create controlled environments for processes that need "clean rooms". They can cool and dry or form and shape. They can hold, lift and move products or help to preserve them; and they are also used in distillation and chemical reactions.

Having set a new industry standard for compressors, the logical next step for Atlas Copco was use the same energy-efficient technology in vacuum pumps. One of the people behind the innovative VSD+ technology is

Andries Desiron, then working in Atlas Copco Compressor Technique, today Vice President for the Atlas Copco branded vacuum business.

"The days of switching a vacuum pump on and leaving it to work all day at continuous full load are long gone," says Andries. "There are industry standards which say that companies must actively seek ways to reduce energy consumption. That's becoming more and more important and naturally a very important part of each product development project, not least to meet our own sustainability goals."

One of the key vacuum pump types is the liquid ring vacuum pump. When you go to the supermarket to buy meat, cheese, a bottle of juice or a packet of chips, they've been processed or packaged using vacuum, and somewhere in their production a liquid ring vacuum pump is likely involved.

But these ingenious machines use up lots of energy and water. A more efficient update to a decades-old technology was needed, so in 2019 Atlas Copco introduced the LRP VSD+ pump. It's a much more compact system that offers intelligent vacuum control. The customer can accurately meet their vacuum demand, meanwhile allowing the pump to do its own troubleshooting, protecting itself and providing valuable feedback.

"Everybody in the industry said that it was not possible to speed-control this type of pump. But with our heritage in variable speed drive technology we wanted to prove it could be done," says Andries.

"We saw from the market reaction to another vacuum pump, the GHS VSD+, that customers really benefited from a more intelligent interaction between the pump and their production process," adds Alistair Darroch, Product Manager Liquid Ring Pumps & Sales Tools.

"It's a bit like our homes, where we now have controllable heating systems that are fully regulated depending on the number of people in the house and the

LRP VSD+ vacuum pump

Main feature: Flexible, robust and easy-to-use.

Super powers: Matches the exact vacuum demand and reduces the water consumption thanks to its two intelligent variable speed drives that work in perfect synchronization.

Used at: Humid, steamy and sometimes dirty environments where robust technology is required.

Andries Desiron

Vice President Marketing Atlas Copco branded industrial vacuum solutions

How did you end up working with industrial solutions?

I've always worked with R&D, so when we started up the Industrial Vacuum division I was VP for engineering, but then switched to marketing. I've always liked innovation, and Atlas Copco gives you the freedom to innovate. The idea of achieving something as a team, working together to bring something to life that improves things for our customers is my main motivation.

Alistair Darroch

Product Manager Liquid Ring Pumps & Sales Tools.

What has been your most fun experience at work so far?

The event I've enjoyed most in my career so far was the launch of the LRP VSD+ in Qingdao, China, in October 2019. Over the entire week we as a marketing team were ramping up to prepare for the event and then it came off. It was brilliant.

temperature outside, rather than a system that you just switch on and off."

The LRP VSD+ provides energy savings of up to 40% and uses up to 90% less water than previous "less intelligent" liquid ring pumps. Apart from financial and water savings, this also brings CO_2 reductions.

"Many customers share our passion to address climate change and lower the industrial footprint, but even customers who don't think in those terms still see the benefits, as the energy savings go hand in hand with reduced costs," says Alistair.

So how did this innovation happen? As usual, it all started with a customer need.

"We work closely together with our customers to understand their challenges and how we can address their specific needs," says Alistair.

Once the product management team had identified the needs, it was time for the R&D department to get on board. The three-year development involved a truly international effort, including engineers from China and Belgium, technical input from the U.K. and marketing input drawing on global sources.

Senior Development Engineer Dexter Dai, who's based in Qingdao, China, worked as part of the R&D team and helped to bring the comprehensive expertise needed to develop the LRP VSD+.

"I joined the project as a development and testing engineer and I did a lot of the verification of this product, to validate the idea, together with other engineers," says Dexter. "We also had support from technical service colleagues in India, as well from colleagues on the compressor side who had more experience of the VSD+ technology than we did at first."

"We don't just touch in and out. The interaction between the R&D teams and marketing is 100% integrated," says Alistair. "Even now the same R&D team, including Dexter, is working with me, getting customer feedback for continuous improvement and

GHS VSD+ vacuum pump

Main feature: Smart, energy-saving, plug and play.

Super powers: Considered the best technology platform for central vacuum systems thanks to its large turn-down ratio.

Used at: Glass molding, canning, electronics, food packaging, pasta degassing, clay extrusion, etc.

Pamela Cateland

Senior Product Manager

How did you end up at Atlas Copco?

I'm an Atlas Copco "baby". I joined just after my graduation, starting at a customer center in France and then got the opportunity to move into vacuum, which was a new field for Atlas Copco. It was like a start-up, super-exciting. I've also spent time in China and now Germany. The company offers so many opportunities and I never get bored. For me, it's all about customer satisfaction. Il find satisfaction when we have good feedback from happy customers.

Linda Li

Technical Lead

What is your main motivation?

I really appreciate our corporate culture and commitment to sustainability, for example through the determination to do the best possible for the environment. There's also a good platform here for young talent with good ideas. If you have ideas, you have the freedom to activate them. The most exciting time is when I can solve a difficult problem for the customers. To accomplish this is a great feeling.

optimization of the product, and that continues throughout the product's life cycle."

"The reception has been very good. The customers who specifically requested an intelligent pump have said it's been everything they've hoped for and in some cases even better. But the feedback I enjoy the most is when a customer orders a product, receives it and is blown away by added benefits that they hadn't even considered," says Alistair.

Benefitting from friendly friction

As Alistair Darroch mentions, the GHS VSD+ oil-sealed rotary screw pumps first introduced variable speed drive in vacuum machines. Since the launch in 2015, these products have been bringing their energy-saving, "plug and play" magic to multiple applications, such as the pick and place of electronic items, food packaging, food processing and glass molding, as well as in humid applications such as clay or plastic extrusion.

"It all started back in 2012, when we were still only selling fixed-speed vacuum pumps," says Pamela Cateland, Senior Product Manager in the Industrial Vacuum division.

"We found that a lot of customers were interested in having a centralized vacuum solution instead of using one pump for each individual machine. The beauty with a centralized system is that it can serve several machines and adapt to the actual, current need."

The team looked to the experience already made by colleagues on the compressor side of the company.

"Our market was in the same situation as the compressor market was back in 1994, when the VSD technology was first introduced. So, while our competitors were focusing on fixed-speed machines, we were calling on our internal knowledge, doing the market analysis, meeting customers and developing the first vacuum product with variable speed drive," says Pamela.

Initial production was in Europe, but by 2017 it was clear they also needed to focus on the Far East as the Chinese market is especially strong in IT and electronics.

This is when Linda Li, Technical lead for Oil-Injected Screw products at the product company in Qingdao, China, got involved.

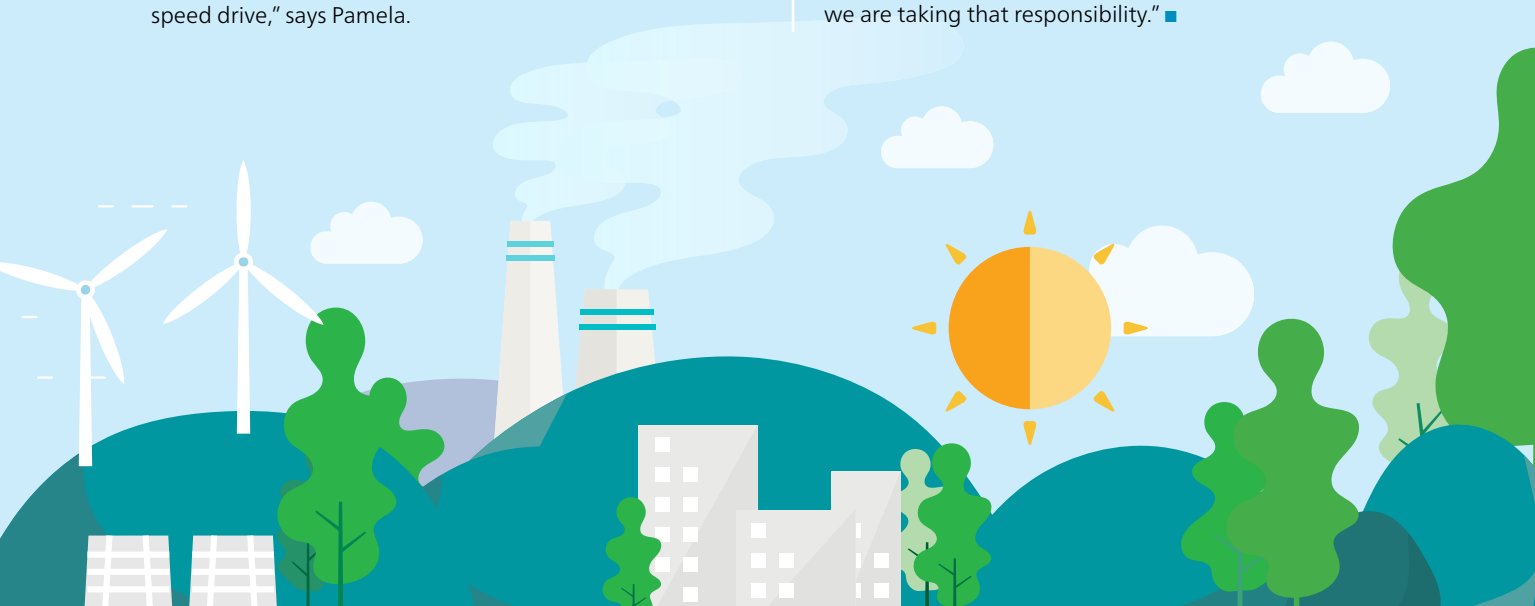
"Our engineering department worked with marketing and across the functions to develop the product specifications," says Linda. "We reviewed and aligned our objectives, manufactured the prototype, and reviewed it together. This is the way we always work. We only launch when the product has been thoroughly tested in the field and when we're all aligned."

"And we constantly challenge each other. We have different perspectives, and a bit of friendly friction drives the development. It's always focused on the product and making it better."

The solution is definitely innovative. More than 7,500 GHS VSD+ vacuum pumps have been sold worldwide, with customers appreciating that it's easy to install, easy to use, easy to service and has great energy-saving potential. It's also compatible with different needs for different markets, big and small.

"It has a very large turndown ratio. You can decrease the rotor speed and the flow is proportional due to the technology. And the technology's power consumption is also proportional. So, if you are only running at 5% of the flow, you're also consuming only 5% of the power," says Pamela.

"The VSD+ control is a big achievement compared with older products," adds Linda. "It's an intelligent technology and there's more control intelligence on the way. Different countries already have different targets to achieve zero emissions, and with a product like this Atlas Copco is already a step ahead of other companies. I'm proud that we are taking that responsibility." ■



passionate people

Tapping into the GREEN ENERGY MARKET

Process Engineer and Market Manager Rasmus Rubycz loves turning problems upside down to find smart solutions.

What opportunities does the growing demand for green energy bring?

For the first time, the environmental, political and business worlds share the same ambition and need. This is a game changer and major business driver. Renewable energy is still a young research field with many unsolved problems, for example, how to recover and store the energy generated. This is a Gordian knot everyone is trying to untie. The race is on, and Atlas Copco has the expertise and innovation power needed to take a leading position.

Why is energy storage such a hot topic?

In order to establish completely renewable energy flows that are fully carbon free, you must be able to store the energy you generate. You can put up as many wind turbines as you like – it won't make a difference if you still have to rely on less environmentally friendly power sources on days that are less windy.

You are also focusing on industrial heat pumps, Why?

Unlike the power market, the heat market is yet to be decarbonized. Energy producers have come a long way in producing electricity from renewable sources, but heat is still largely generated through coal or natural gas. Our large-scale heat pump technology could build the missing bridge between the energy and heat production processes and complete the circle.

So, how does heat recovery work?

It's about generating power from heat. Take the fridge in your kitchen, for example. To stay cool, it pumps out all heat out of the backside by using an electric motor. If you would heat up the backside, cool the inside and swap the motor against a generator, you would have a heat recovery system that can generate electricity. In a similar way, energy-consuming industrial processes that generate a lot of waste heat can use our huge turbines to turn that heat into electricity.

Are there any challenges?

We were among the first players entering this field and found that the market was not ready at the time. But the maturity level is increasing fast. It's now up to us to keep innovating for the future.

Rasmus Rubycz
Market Manager New Energy, Gas and Process division, Germany.

Rasmus Rubycz joined Atlas Copco Energas in 2012 as Project Engineer, working with solutions used in floating gas production. In 2015 he moved on to focus on energy recovery solutions, and eventually took on the role of Market Manager for the New Energy segment.

CONTRIBUTIONS THAT COUNT

Going full circle

Atlas Copco takes a life-cycle approach to innovation. In 2020, we adopted a Group standard for calculating a product's carbon footprint during the design phase. The Product Carbon Foot Printing tool includes the carbon impact of all aspects of the product's life cycle, from choice of materials to product use, recycling and disposal.

Funding the future

Every year, Atlas Copco makes large investments in pension funds. We have for many years avoided any funds dealing with weapons, drugs and gambling, for example, but as of 2020 the pension investments are made in line with The United Nations' Principles for Responsible Banking. This means that instead of avoiding certain funds you favor the ones that help drive sustainable development for both people, society and the environment, like new renewable energy solutions or battery technology.

Hello HVO

Our Power Technique production facilities in Antwerp now use renewable HVO oil (hydrotreated vegetable oil) for endurance testing of prototypes, when making compressors for mobile compressed air applications. A fossil-free fuel produced from waste fats, residues and vegetable oils, HVO has 90% lower CO_2 emissions than diesel.

Powered by the sun

Atlas Copco in Antwerp, Belgium, and Rock Hill, U.S., have both installed solar energy to help power the plants. In Antwerp, energy production started in October 2019, and has so far resulted in savings of about 460 tonnes CO_2. In Rock Hill, savings amounted to just over 500 tonnes of CO_2 emissions in 2020.

Since 2018, our production plant in Chakan, India, is also powered with solar cells covering about a third of the factory roof. About 80% of the energy used now comes from this renewable source, reducing the carbon dioxide emissions by 600 tons annually.

Cutting our emissions

Atlas Copco's goal is to reduce our CO_2 emissions from energy consumption in operations and transport of goods by 50% by 2030, in relation to cost of sales and with 2018 as a baseline. So far, we have achieved a reduction of 28%. Actions taken include buying renewable electricity, installing solar panels, switching to biofuels in portable compressor testing, and implementing energy conservation measures, logistics planning improvements as well as switching to more environmentally friendly transport.

SMART TOOLS FOR MODERN LIFE

Industrial tools transform the world. Without them, daily life would not be the same.

Thanks to smart, efficient and connected industrial solutions, we can now fly in lighter airplanes that emit less CO_2. Home appliances can be designed in new ways to use less energy, and agricultural machines can be better equipped for more sustainable food production. Industrial tools are also critical when making electric vehicles, and in the move toward renewable energy. Likewise, computers, mobile phones and even car electronic devices are assembled with our solutions, and then disassembled when it's time to recycle the materials. And the list goes on. If you can use it, we were probably there.

Tight for TAKEOFF

In a smart assembly environment, you need smart tools. With an integrated controller, advanced ergonomics and sustainable battery power, the Tensor IxB tightening tools are all that and more.

Connectivity is making the world of manufacturing digital, flexible and more sustainable, but for automotive or aerospace assembly plants, it's a double-edged sword. Increasing consumer demands, tougher sustainability regulations and constant technical updates mean car manufacturers must regularly reconfigure or "rebalance" parts of their assembly lines. A single assembly station can easily take nine hours to rebalance. When you consider that manufacturers can have hundreds of stations, that's a lot of time and money.

The aerospace industry must respond to its own technical, consumer and regulatory demands. Tightening deviations, often stemming from the tendency to use cheaper air or battery-powered basic clutch tools, can have implications on both safety and cost control. If tightening errors are missed, the cost of reworking can be tens of thousands of euros. And the use of more advanced tools can be hindered by their lack of ergonomics and stable wire connection in cramped, hard-to-reach parts of the aircraft.

But Atlas Copco's Tensor IxB cordless tools are about to turn the tightening tool market upside down. "We saw several years ago that there was a need for increased flexibility" says Jonas Mann,

Vice President R&D for tools and assembly systems. "It is labor-intensive to rebalance a line and move a controller box from one station to another. You must unscrew it from a rack, move it physically and draw new cables to make network drops and connect it to the system. You basically have to stop the line or incur the expense of doing it over a weekend. But with a Tensor IxB tool you can do it almost 'on the fly.'"

"Tensor IxB is a range of tightening tools that fits really well with the smart factory concept," says Tim Mann, Global Product Manager for the Tensor IxB Family (who is not related to Jonas). "We have made things much more flexible because we've done away with the controller box hardware and built the controller functionality into the tool itself. By having the tools directly integrated to their production system, manufacturers can now easily make production line changes and collect and report all the necessary data."

Tensor IxB Family

Main feature: User-friendly, ergonomic and lightweight battery nutrunners, offering powerful performance and accuracy.

Used at: Automotive, aerospace and general industries around the world. Especially suitable for narrow production areas where a perfect result is crucial.

The new tool is also cordless and battery-powered, but still has a cable-tool level of productivity. It's ideal for tight spaces, and the battery use cuts the overall energy consumption still further. The four-and-a-half-year development process has also improved the tool's ergonomics, making it much easier to use for operators.

But it's fair to say that the powerful in-built, integrated controller is the star of the show. So much so that it dazzled some customers who saw prototypes. It has also been awarded the prestigious Red Dot Design Award for 2021.

"When we presented the idea of having the controller inside, some people said 'No, you cannot do that. The tool will be too heavy'," says Tim. "And some customers who saw the first prototype

said the controller couldn't possibly be in there and was hidden somewhere!"

Such profound innovations take time and effort, but Tim and Jonas say all the teams involved – in Stockholm and customer centers worldwide – have been utterly committed to this "leap of faith."

"This was probably the most complex product development process that we have ever entered into, both in terms of the technical challenges and the actual scale of it," says Jonas. "It's a complete program with different tools, a completely new software concept, new connectivity modes and a new battery platform."

For those customers who still require wired connections, the controller box will continue to live for years to come, but the new technology is truly groundbreaking.

"It's a historical transformation," says Tim. "In a sense we're now adding an option for our customers that's the equivalent of changing from a fixed telephone line to a cell phone. It's a new platform that will only keep growing in the future." ■

reddot winner 2021

The Red Dot Award is an international competition for product design, ranging from robot technology to vehicles and household aids. Each year, the award appraises the best products created in roughly 50 categories.

Jonas Mann

Vice President R&D, Tools & Assembly Systems

Please describe the product in three words.

Industry 4.0 ready.

What motivates you?

To work with dedicated and competent colleagues and work in cross-functional teams to create customer benefits that no one could do alone.

Tim Mann

Global Product Manager – Tensor IxB Family

When and why did you join Atlas Copco?

I joined three years ago. I was previously a management consultant within modularization and I worked for other industrial companies. Atlas Copco has a great reputation, and I'd heard from some friends that you can be very creative and effectively an entrepreneur at work here. You can really drive your ideas without needing to follow a load of micromanaged processes.

passionate people

"ERGONOMICS IS KEY"

What happens when powerful handheld tightening tools are used repeatedly at high torque? Ava Mazaheri is investigating the force exposures and how to turn the learnings into great product design.

Why did you choose to study the reaction force exposure related to handheld tightening tools?

These tools are used to fasten screws, nuts and bolts to certain torque levels, and the tool handle then undergoes a forceful displacement which we refer to as reaction force. The user must counteract the reaction through muscular force. As assembly work by nature is highly repetitive, this can lead to disorders or injuries that take a very long time to heal. My mission is to find ways to avoid that, or at least minimize the risks.

How is this linked to Atlas Copco?

We develop and evaluate all our handheld tools from various ergonomics perspectives, such as handle design, noise, vibrations and temperature. Customers have for a long time asked for recommendations from tool manufacturers regarding reaction force exposure. Neither the scientific community nor our competitors have had well-grounded answers to provide, so we'll be the first ones to do this. Ergonomics is key to us and makes us stand out from the crowd.

And what are you looking to find?

The hypothesis is that our highly dynamic tightening program, which runs with very high tool speed, is more ergonomic than traditional programs. Due to its ballistic fashion, a great deal of the reaction force is absorbed by the tool itself, instead of by the operator. However, although force is reduced, the tool motion is still jerky. The challenge lies in understanding which levels of these exposures could increase the risk of musculoskeletal disorders. It's about finding the right balance.

You are researching "on the job." How is Atlas Copco supporting you in this?

Apart from providing facilities and resources, I have continuous access to expertise and input from the company, as well as from our broad network of customers. This means that I can ground my approach in real industry needs.

Have you had any "aha" moment so far?

Yes! A gray Thursday afternoon in November 2020, with probably enough caffeine in my blood to power a small car, I discovered a way to quantitatively explain what we had previously only been able to observe and describe subjectively. I would claim this to be a, in this context, new way of measuring discomfort.

Ava Mazaheri
Atlas Copco Industrial Technique, Sweden.

Ava Mazaheri first joined Atlas Copco as a summer intern in the Industrial Technique business area in Sickla, Sweden. She then pursued her master's thesis project in biomedical engineering with the company, focusing on new ways of evaluating tools from an ergonomics perspective. This developed into a larger research project with the Industrial Design and Human Factors team, in collaboration with the Royal Institute of Technology in Sweden, with Ava as a PhD student.

“Joint development is the

BEST WAY FORWARD”

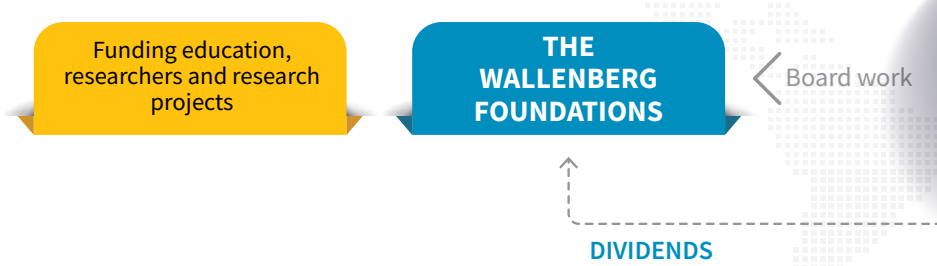
Atlas Copco is part of the "Wallenberg Ecosystem," set up to push scientific boundaries. The dividends we generate contribute to a flow where billions of SEK are granted to research and education, resulting in new insights for the benefit of people and industrial development. In this interview, Peter Wallenberg Jr. explains how it all works.

Since Atlas Copco was first founded in the early 1870s, our development has been tightly linked to the Wallenberg family. André Oscar Wallenberg was one of our founding fathers, and the family foundations remain our largest shareholder through their holding in Investor AB.

The Wallenberg family has held a prominent place in Swedish business and industrial development since the establishment of the country's first private branch bank in 1856. The bank supported companies emerging during the first and second industrial revolutions – many of them becoming global industry leaders in their respective fields. By making long-term investments in these companies and then granting a majority of the dividends to research and education, an ecosystem of innovation was created, built to last for generations. This system, and the successes of each company contributing to it, now enables annual research and education grants of around SEK 2.4 billion (2020).

The system is based on a group of private, nonprofit foundations that are sole owners of the holding company FAM and majority owner of the industrial holding company Investor AB, who in turn are lead shareholders of many successful companies. The oldest and largest foundation is the Knut and Alice Wallenberg Foundation, KAW, established in 1917. It is one of the largest private funders of scientific research in Europe and primarily supports research in medicine, technology and the natural sciences.

We asked Peter Wallenberg Jr., Chair of KAW, Member of Atlas Copco's Board of Directors and one of the senior representatives of the fifth generation of



of the Wallenberg family, to explain Atlas Copco's role in this ecosystem and the greater value it brings.

What is the purpose of this ecosystem, and has it always been the same?

Our Foundation's stated purpose is to benefit Sweden by supporting basic scientific research and education. Although slightly changed in the 1920s, the direction was established already by Knut and Alice Wallenberg, who were very engaged in public development and in promoting Swedish science, trade and industry. To ensure their work could continue over time they set up a foundation that would manage the funds and hand out the grants. Over time, additional foundations have been added by, or in honor of, other family members, all in the same spirit but focused on different fields.

Today, "betterment of Sweden" (*landsgagneligt* in Swedish) is not restricted to geographical borders. On the contrary. The research we fund, albeit at Swedish universities, will in many cases benefit the entire world, and the science teams often consist of experts from many different countries. The results are openly shared and can be used as stepping-stones for future scientific breakthroughs. We want to help Swedish companies and science institutions get a head start, but it's really about global collaboration for the greater good.

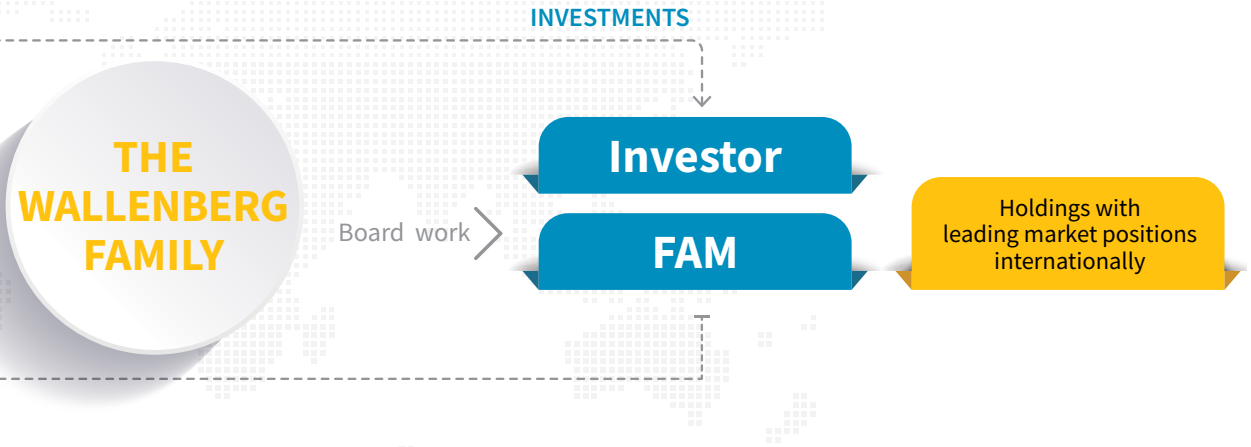
So how does the ecosystem work?

It is based on the performance of the companies in the foundations' investment portfolios, Atlas Copco being one of them. The higher dividends they generate, the more money goes back to the foundations, and the more goes into R&D that drives scientific development for decades to come. All parts of the system depend on each other. The foundations grant 80% of their received dividends and reinvest 20% in the existing or new holdings.

Some of "your" researchers have been awarded the Nobel Prize, like the recent Chemistry Laureate Emmanuelle Charpentier. Is there a common trait that unites researchers who take science to the next level?

On the contrary, I would say that they are all very good at being different. What unites them is that they have the courage to follow their inner passion, and they do it with persistence. Needless to say, they are also extremely bright and talented.

We want to enable these researchers to explore pet projects they otherwise would have a hard time funding. When gifted people are allowed to follow their true passion, real breakthroughs can happen.



We work together with the universities to find and promote excellent researchers with unique viewpoints and ideas. We give researchers the freedom to pursue some pretty mind-boggling projects.

Increased diversity is an important aspect of this. We have a special program to support young researchers, work to increase the number of women in natural sciences, and we fund projects enabling highly educated international researchers to pursue a career in their expert fields. The university world is often based on hierarchies and established power structures. We try to rock that world a bit to ensure a continuous flow of fresh perspectives to bring out the best ideas.

You receive thousands of applications each year. How do you decide which ones to support?

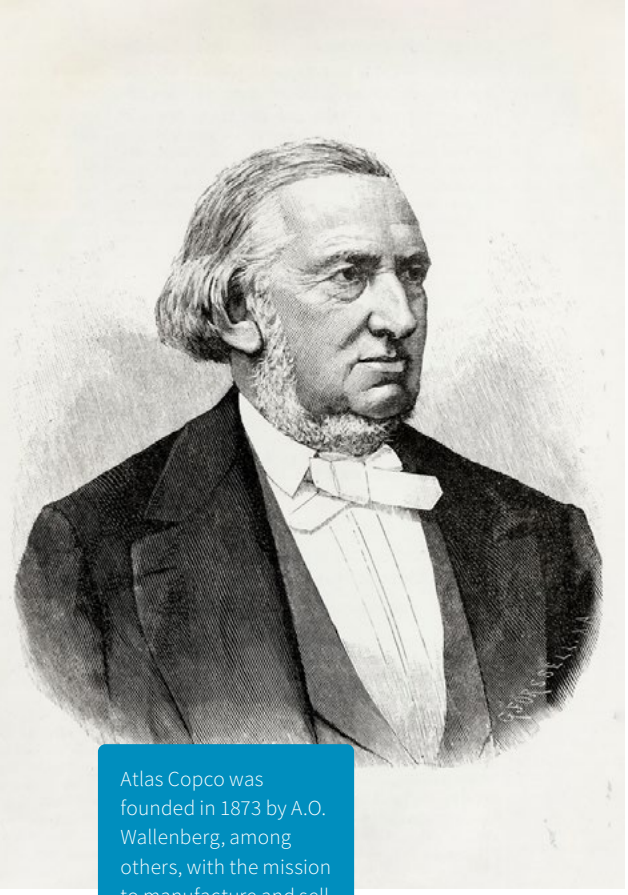
As for KAW, the largest foundation, the application always comes from the individual researchers, but their university has to nominate the candidate. We then ask a team of experts to review it to ensure the project is thought through and of high potential. The most interesting applications are then sent for peer review by several leading international experts. A basic requirement is that the research should be excellent and unique. We don't premiere "more of the same."

Which are the most exciting projects right now?

There are so many, but if I must pick a few I would highlight the recently launched SEK 3.7 billion investment in data-driven life science. When combined with innovations in data processing and artificial intelligence, this research field will impact all fields in medicine and natural sciences. This is particularly important to ensure a better preparedness against future pandemics. Related to that, we have also granted in total SEK 180 million for Covid-19 related initiatives this year.

Another example is the so-called Wallenberg AI, Autonomous Systems and Software Program, WASP, which Atlas Copco is part of. When this kicked off in 2015, Sweden was falling behind in these areas. By bringing academia and industry together in this program, things have moved forward fast and Sweden is now one of the leading nations, attracting international experts who want to be part of this development. This proves that collaboration always is the most efficient way.

Personally, I am also very fascinated by the work done at the Wallenberg Wood Science Center that explores how to develop new materials from trees. This is a highly



Atlas Copco was founded in 1873 by A.O. Wallenberg, among others, with the mission to manufacture and sell materials for railroad construction and operation. During the decades that followed, technical innovations and competition pulled the company in different directions and new technology fields, such as compressed air and power solutions. Atlas Copco has continued to grow through strategic acquisitions.

1890/1900

advanced field and the research covers nanocellulose and nanostructured wood fibers, for example.

What opportunities do you see for Atlas Copco in relation to autonomous systems and the Internet of Things?

The ongoing industrial revolution is of course a game changer that brings obvious opportunities for tech-savvy and innovation-driven companies like Atlas Copco. But it's not only about digitizing products and solutions or implementing new technology. This development will have a profound impact on people, and people are without a doubt a company's most valuable asset.

Companies will have to reshape the way they work, reskill their teams and make sure people are on board. This will bring about a behavioral change affecting all of us, including your customers. Atlas Copco is very good at incorporating acquired companies, and that skill can be applied to this as well. Change management will be key.

Replacing plastics with wood is one example of innovation for a more sustainable world. Are your foundations specifically targeting sustainability projects?

Not specifically, but as it turns out a large number of the projects we support have a direct impact on sustainability areas. This only shows that sustainability is incorporated in all aspects of society today and not a separate issue. In the same way, successful companies take sustainability into account in everything they do. Atlas Copco has always been good at constantly improving, not least driven by customer requirements, and I see sustainability as a natural part of this.

We call ourselves "The Home of Industrial Ideas." Do you think this is an accurate description?

About a year ago, I was invited to an open house activity at the Atlas Copco headquarters in Sickla, where teams from different parts of the Group showcased some of their most innovative R&D projects. The solutions and the turnout were just incredible. This kind of culture, where employees on all levels are allowed to explore ideas even if they are a bit "off

1920s

1950s

the charts" and not linked to existing product portfolios, is extremely valuable and something I would like to see in many other companies. It's also much more fun to work like that and this makes you more attractive as an employer.

Atlas Copco is in many ways a classic, traditional engineering company but the key to your success is your ability to keep up with the times and continuously develop what you do and how you do it. A current example is the move from diesel to electric. Since I visit different parts of the organization, I know that this is the case wherever you go. It is a profound part of who you are.

Do you see any room for improvement?

Like all large organizations you are struggling with speed, and that challenge will only grow with the technology revolution mentioned earlier. Linked to this, I would say that it's very important that you establish alternative career paths to provide a steady inflow of new perspectives. If years of employment or certain job titles are basic requirements for senior positions you automatically exclude talents who joined later in life or chose to follow different career paths. Also, younger generations expect to move forward fast and they are not likely to stay in the company if they first have to put in 20 years before being considered for higher positions. Hiring and promotion processes could be more flexible and offer multiple ways to develop the individual. This will also help you increase the level of diversity.

What would be your wish for the future?

The most fun part of this job is when I get the chance to visit all the smart and passionate researchers, to hear their thoughts and learn about what they have found so far. Being able to support them in their quest for innovation is extremely inspiring and rewarding. From the foundations' perspective, it's about unlocking the potential of tomorrow. My wish would be that the entire world unites in respecting and understanding the long-term value of research. Joint development is the best way forward. ■

KEEPING IT DRY

A 10-year development process resulted in an innovation that changes everything. This groundbreaking dryer is ideal for pharmaceuticals and other sensitive production environments.

To electronics, food and beverage and pharmaceutical industries, dry production environments are a must.

"There's always a certain amount of moisture in the air and when you compress it there's a risk of condensation, which can affect the quality of the end product, and also damage the equipment downstream," says Nuri Köse, General Manager of Atlas Copco Turkey. "In mining or construction this is not a big deal, but in a lot of production flows you don't want water anywhere near the product."

This moisture can be removed by a desiccant dryer. The principle behind this technology is simple: the moist air flows over a hygroscopic material that attracts water, a "desiccant," and is thereby dried.

Atlas Copco's Cerades™ desiccant is now transforming the art of drying, and Nuri Köse was part of the team making it happen. Even by Atlas Copco's high standards of innovation, this desiccant is truly groundbreaking. It replaces the traditional silica beads with an absorbent block that's more robust, longer-lasting and much, much better at drying.

"We first said over 10 years ago that we needed something different, because with

a better desiccant, we would have a better dryers. That was the start of this innovation journey," explains Yves Goister, Vice President of Engineering for air and gas treatment.

A dryer's performance is to a large extent determined by the desiccant material, and since everybody is using the same core material from the same suppliers, it's very difficult to make a better product.

The beauty of the Cerades™ desiccant is that while the water-absorbent material is similar to what's gone before, it is fixed in a ceramic honeycomb structure similar to what's used for catalysts in cars. The structure is coated with a relatively thin but very effective layer of active desiccant, which makes the dryers using this technology perform much better than anything else on the market.

Now all that may sound like a simple concept (genius ideas often are), but in reality it's the result of a decade of development, several iterations and the close cooperation between R&D and Marketing. "It's been a push-pull process. The pull came from the marketing side and the push from the R&D side. I don't think 10 years ago any sales staff thought this solution would come, but they really shaped the product for the market," says Yves.

"That's the secret recipe of Atlas Copco," adds Nuri. "Our engineers have a business sense and our marketers have an engineering sense – no one wants to go to market with ordinary products that everyone else makes too. The recipe for success is that each of us understands how the other works."

The potential rewards of this innovation are huge, and it was awarded the company's prestigious John Munck Award for 2021.

"This is a half a billion euro market, so we saw the differentiation as crucial to our success," says Nuri. "And when you listen to the customers, it's not that they need a dryer as such; it's that they need dry compressed air. Cerades™ works in our dryers to answer that need in a way that the competition cannot." ■

Cerades™ desiccant dryer

Main feature: energy efficient and extremely reliable.

Used at: industries such as food and beverage, pharmaceutical, and semiconductor production.

John Munck Award

This product was awarded Atlas Copco's prestigious John Munck Award 2021. This award, established in 1988, is presented each year to the person or team having produced the best innovative technical development contribution.

Nuri Köse

General Manager of Atlas Copco Compressor Technique Turkey

What do you appreciate most about your job?

I'm proud to work for a company where our salespeople have the opportunity to offer the most innovative solutions to every industrial application; making them more productive, profitable and sustainable. And the diversity in our potential customer base makes life fun!

Yves Goister

Vice President of Engineering, Atlas Copco Industrial Air Division.

Describe Cerades™ in three words.

Leading differentiated technology.

What motivates you?

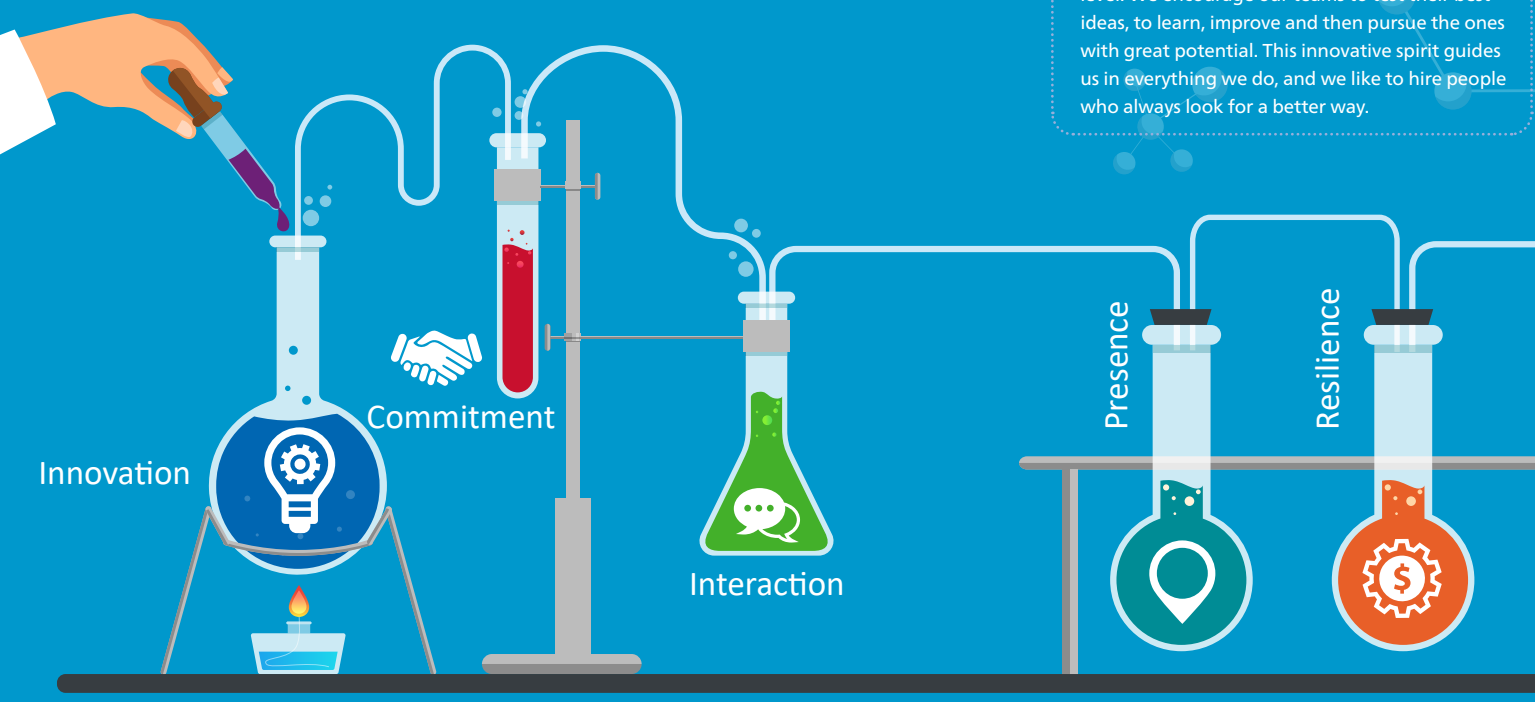
We have the people and the teams with the right attitude and the company wants to invest in the kinds of projects that make a real difference. With the right people, the right teams and the company's innovation culture, we are successful. It's really rewarding.

Recipe for
SUCCESS

Atlas Copco has remained a technology leader for almost 150 years thanks to a refined recipe for long-term performance. Here are the key ingredients.

INNOVATION

Atlas Copco was first founded to make products for the emerging national railroads, and ever since, we have developed solutions that drive society forward. We continuously invest in research and development to secure a steady flow of new solutions that take our customers, and the business they operate in, to the next level. We encourage our teams to test their best ideas, to learn, improve and then pursue the ones with great potential. This innovative spirit guides us in everything we do, and we like to hire people who always look for a better way.



PRESENCE

Atlas Copco is a global Group with operations in more than 180 countries and R&D, manufacturing and sourcing capacity in the Americas, Europe and Asia. This means that we can adapt our production and serve customers even in times of market restraints. We are also present in most industry segments, and our product portfolio covers many different brands to meet a wide variety of customer preferences and needs. We continuously acquire new companies that strengthen our technologies and local markets. All in all, this makes us less vulnerable and protects our business over time.

RESILIENCE

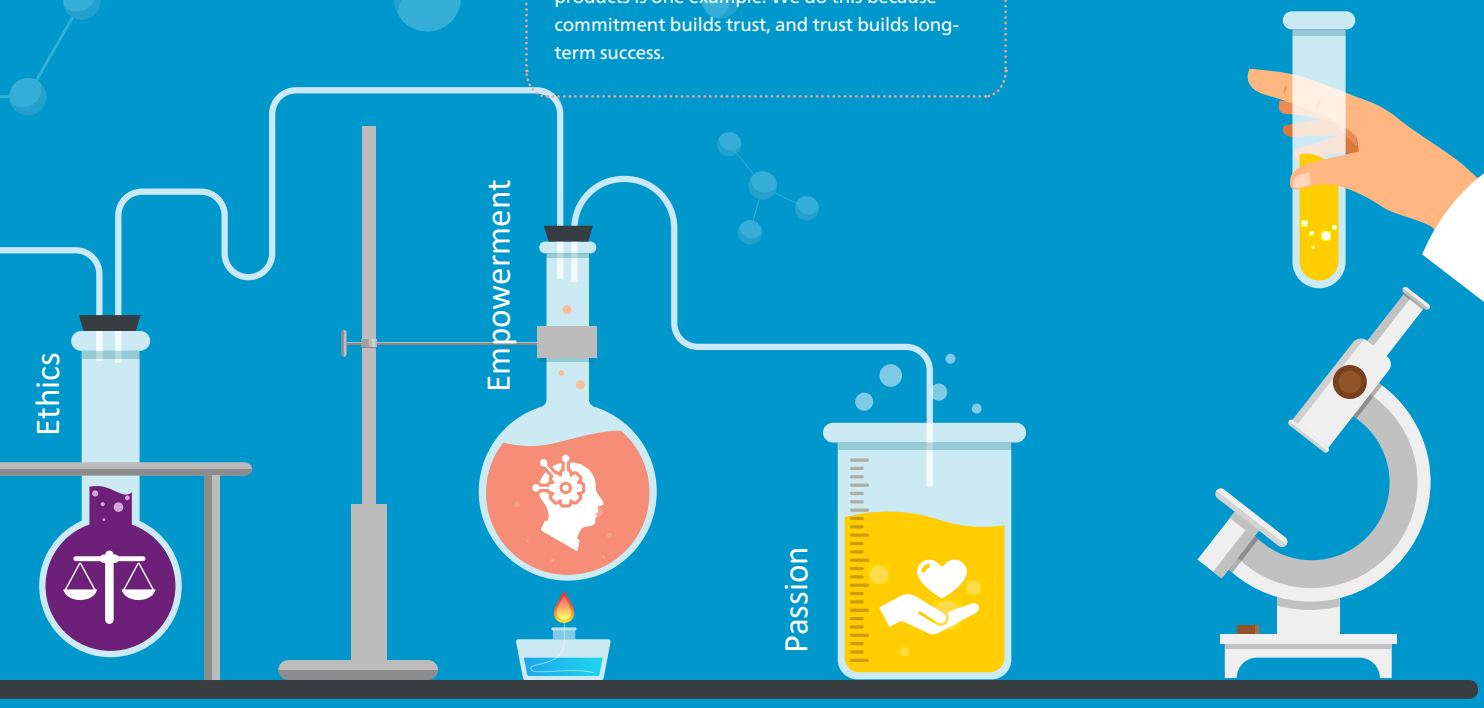
Our business model is very flexible, and therefore resilient to almost any challenge. We can rapidly reduce our variable costs and working capital to adjust to new market conditions. Thanks to our asset-light manufacturing structure we have low fixed costs, and on top of this we have a solid service business that serve as a cushion in down-turns. This allows us to continuously invest in innovation and competence, and also keep up speed in tougher times.

INTERACTION

In our experience, close collaboration is the best way forward. By listening to customers, suppliers, distributors and our industrial peers, we gain insights that spark new ideas and help us improve. Understanding our customers' reality and future needs is also the core of our product development. We never innovate just for the sake of it. Everything we do is spurred by real challenges. And we do it by teaming up with our many colleagues all over the world. At Atlas Copco, support and a fresh perspective are only an email away.

COMMITMENT

Our products are most often critical parts of our customers' processes, and this brings a great responsibility. We work very closely together with customers to find the best solutions, and always strive to exceed their expectations. To ensure everything runs smoothly, we also provide service expertise in all the countries and markets we serve. As a technology driver and a global industrial player, we are also committed to finding solutions that benefit society and the environment. Limiting the footprint from our products is one example. We do this because commitment builds trust, and trust builds long-term success.



ETHICS

We stand for integrity, fairness and respect and have zero tolerance for corruption and human rights abuses. This is a reflection of our core values and our commitment to the highest ethical behavior. We always follow the laws and regulations in the countries where we operate and ask our employees and business partners to act according to our high business standards. And if they fail to do so, we take action.

EMPOWERMENT

We work in a decentralized setup. This means that the person who is closest to an opportunity or a problem has the authority to act on it. Empowerment is key to us, and when you join us you will soon realize that no one will tell you exactly how to do things. We pair this freedom to act with clear goals and a high level of accountability. When you take on a task, you also get the responsibility that comes with it. This doesn't mean that you must always succeed. You are welcome to try and fail, as long as you learn from it and do better next time.

PASSION

Innovation is our core, but it's our dedicated and talented teams who make it happen. Working here means being surrounded by very ambitious people who share a strong drive to make a difference – to customers, society and each other. We recruit people with the right mindset, help them grow and develop, and then trust them to find the best ways forward. If you are up for a challenge, our internal job market offers almost endless opportunities.

A RENTAL

When building offshore wind energy mills, marine life must be protected from being disturbed by noise and vibrations. The solution is to create a protective curtain of small air bubbles. With the help of an Atlas Copco compressor, air is pushed through a perforated hose, forming a bubble ring around the construction site.

STATE OF MIND

In an uncertain world where needs can change overnight, renting equipment is a safe bet. Flexible air, nitrogen, power and flow solutions will get the job done in all conditions.

How can a power plant quickly handle a machine breakdown that could shut down the electricity supply to an entire city? How can a brewery speed up production during seasonal peaks? And how can a contractor manage construction projects in remote locations with no access to a power grid? The answer is quite simple: rental solutions.

"Our rental solutions are designed to help our customers excel through agility. We are here to provide them with what they need, when they need it, in a quick and hassle-free way," says Janne Scheepmans, Sales Excellence Manager in Atlas Copco's Specialty Rental division.

"We team up with our customers to provide a total solution that suits their particular industry. Our experts know exactly how to best unburden any given situation, and how to set up the equipment in the best way. That means our customers can relax and concentrate on their core business," she adds.

"We team up with our customers to provide a total solution that suits their particular industry. Our experts know exactly how to best unburden any given situation, and how to set up the equipment in the best way."

A flexible complement

Atlas Copco's Specialty Rental division typically provides mobile air compressors and dryers, light towers and generators. Recently, nitrogen generators, boosters, steam boilers, pumps and battery packs were added to the equipment range. Most of the division's customers operate in the manufacturing industry (including aviation), oil and gas, mining and drilling or power and energy.

"Rental services are a complement to the customer's existing machine park or fleet," says Janne. "In some cases, ownership is the better option, but in other cases rental makes most sense. It's not an either/or situation. Our customers often buy machinery to cover a certain baseload and then rent equipment for more temporary needs."

One example of this flexible approach is when two 180-meter offshore wind turbines were built near the U.S. city of Virginia Beach in July 2020. Clean energy projects like this one are increasing around the world, but the construction phase can harm marine life. The solution here was to bring in an Atlas Copco compressor that produced a temporary bubble curtain around the site to protect the sea mammals. The compressor released small air bubbles from a perforated hose, creating a noise-reducing screen.

This kind of bubble curtain, from the seabed to the surface, can reduce noise levels by more than 90%, and thus prevent sea mammals from experiencing sonic disturbances that can result in them becoming disoriented or even deaf.

Scaling up solutions

Rental solutions often also come into play when a customer identifies the need for a higher level of capacity and wants to quickly scale up production without expanding their regular machine park. When a Russian company making glass containers for food and beverages experienced an unexpected peak demand one summer, an electric, 100% oil-free air solution was brought in to

keep the production going. Atlas Copco's service engineer also worked on-site, making sure that everything ran smoothly.

In case of emergency

Another situation could be if a breakdown occurs in a factory and there is an urgent need to keep production going.

"Instead of having to shut down the entire facility, a rental solution can maintain the part of the flow that is unaffected to prevent downtime," says Janne.

A less common but significant application is providing solutions in case of emergencies like floods, power outages or urgent healthcare. The installation of an Atlas Copco electric air compressor at an emergency hospital in Milan, Italy, created 400 extra intensive care units during a critical phase of the Covid-19 pandemic.

Resource-efficient, and also sustainable

According to Janne Scheepmans, there is a global trend to not focus on the cost of ownership as much as the cost of "usership". After all, idle equipment does not add much value. According to this increasingly common trend, optimal usage becomes crucial.

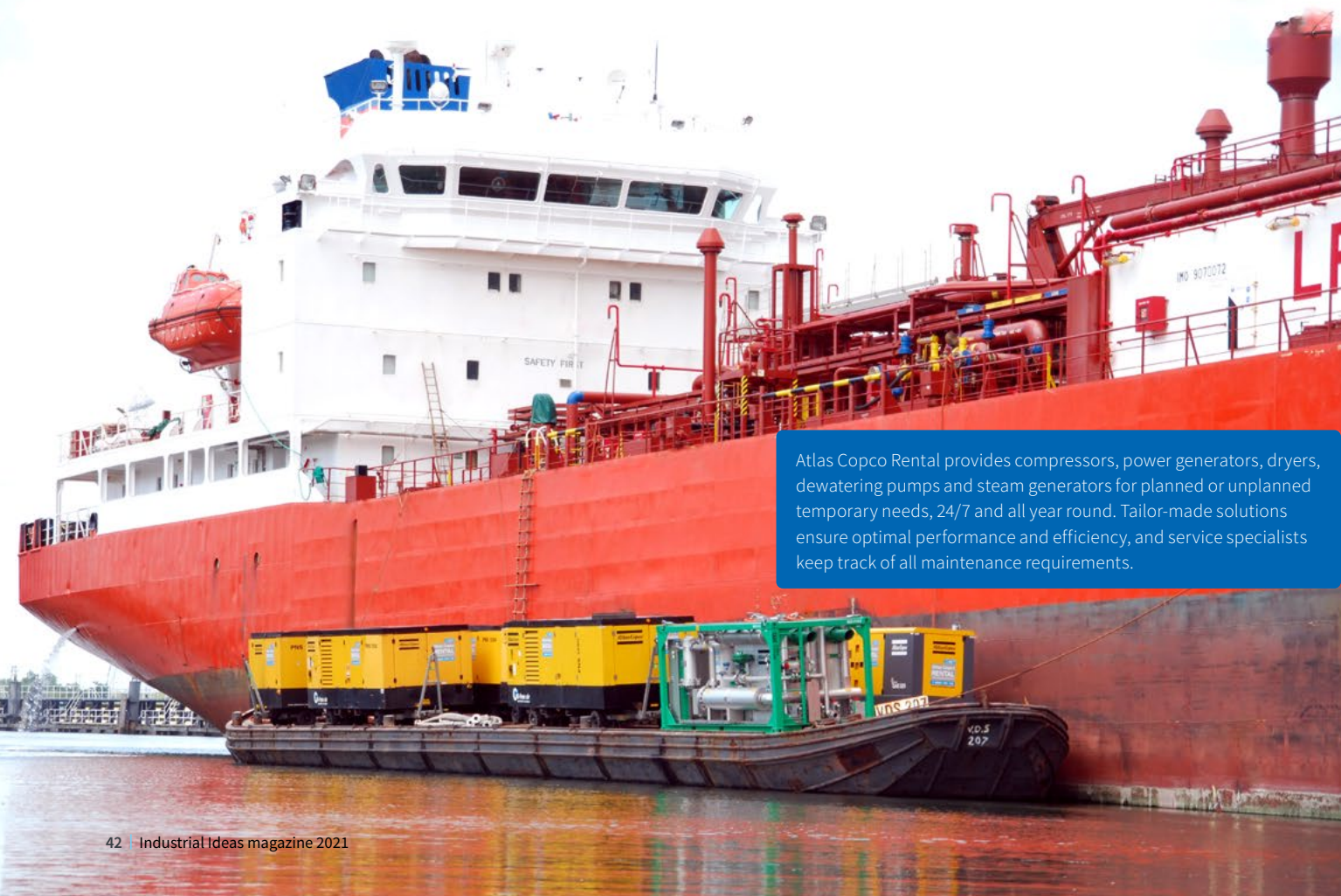
"Here, renting could be an important key for sustainable operations, as it helps you optimize your resources. You only use the equipment when you need it, and it can then be put to use somewhere else. This way, the equipment is always used in the most efficient way possible," she says.

Janne adds that rental solutions can also contribute to greener operations, as the equipment is often newer and more energy efficient than companies' existing machines.

"This is a result of the fact that we use the newest, most innovative and clean technology, such as diesel compressors that conform with the latest emissions legislation."

Another plus for rental solutions is that they can facilitate the journey toward electrification and other new technologies. Renting equipment is a way for companies to minimize their risks by testing out new equipment and making sure it fits their needs.

"It speeds up innovation," says Janne. "If our team has implemented a new and innovative solution successfully for customer A, customer B can immediately take advantage of it as well. Not every customer has to innovate on their own. Instead, they can rely on us to provide an innovative and proven solution. ■



Atlas Copco Rental provides compressors, power generators, dryers, dewatering pumps and steam generators for planned or unplanned temporary needs, 24/7 and all year round. Tailor-made solutions ensure optimal performance and efficiency, and service specialists keep track of all maintenance requirements.

passionate people

AT YOUR SERVICE

Service Specialist Tomasz Bugaj knows how to keep business and society running, at all times.

You work in the rental business, serving customers who quickly need flexible solutions installed. Can you tell us about some exciting projects you have participated in?

Since our customers are in various sectors, I've had many exciting experiences on and offshore. One of the most interesting international projects I did, and something I will remember for the rest of my life, was when undertaking a high-pressure testing of a pipeline in Siberia during winter. It was - 57C˚ when we arrived. We were somewhere in the woods in the middle of nowhere an eight-hour drive from civilization and had to keep our equipment operational around the clock.

Another memorable experience was an assignment in an offshore construction project. The ship was loaded with compressors that would create a bubble curtain in the water. While the customer was building offshore platforms and windmills, these class zero, oil-free air compressors were used for noise mitigation on the vessel in order to protect the wildlife. As a service technician, my team and I did all the installations, testing, operating and maintenance on board.

What key skills are needed when working in service?

You need to have a great sense of empathy for your fellow technicians, and technical experience is an absolute must. You should also have a "can-do" mentality and ability to find solutions on the spot. People skills are also very important. When you talk to a customer who's experiencing a breakdown you need to give them that instant feeling of trust. Regardless of what happens, he or she should know that you will help them solve the problem as soon as possible.

We are there to support and give our best to guarantee that customers can run their business smoothly, and to provide tailor-made solutions. And we are always ready to help, through physical visits, our remote assist tool or by telephone.

And what is most fun?

The best part of the job is that I get to work in an international environment with all types of people. I work with state-of-the-art machines and on interesting applications in various industries. I feel like I get the opportunity to develop my skills every day. My managers also give me a lot of opportunities to challenge myself and go outside my comfort zone.

Atlas Copco is the home of industrial ideas – what does this mean to you?

That we are a company that always finds the most innovative solutions and brings added value to our customers. And that we do it in a safe and responsible way.

Tomasz Bugaj
EU Service Specialist, Atlas Copco Rental Europe.

Tomasz joined Atlas Copco in 2012 as a Service Engineer, taking care of machine maintenance, commissioning and decommissioning, as well as troubleshooting of breakdowns. In 2018 he embarked on a new opportunity as EU Service Specialist, specializing in different product groups and also training other service technicians.

EXPERTS IN THE FIELD

To ensure that all customers get on-site support, Atlas Copco works with local dealers and service suppliers in most parts of the world.

Merredin, 200 kilometers east of Perth, is in the heart of Australia's "wheat belt." This region faces extremely hot and dry weather in summer, and fires during harvesting are extremely common. A fire can start either in the crops near the paddock being harvested or inside the machinery itself – often while in operation. This can lead to not only physical damage but business interruptions, such as sourcing a replacement piece of equipment mid-season, which can be time-consuming and expensive.

When two brothers owning a large wheat and sheep farm required compressed air to clean their farming vehicles, Atlas Copco's local dealer, Atlas CEA, went on-site to observe the farmers' operations. The primary purpose of the compressor was blow-cleaning of harvesting equipment such as tractors, headers and balers, to prevent any buildup of fine particles and straw around the moving parts within the machines. Apart from keeping the valuable equipment in good shape, this maintenance prevents a serious fire hazard in the hot summer months.

After evaluating the farmers' needs, the Atlas CEA representative recommended a U190 PACE compressor as the best fit for the job. Even though this "utility compressor" is not fitted with wheels, it is a highly mobile, easy-to-move compressor. It is lightweight, tough and compact, and can be serviced in less than an hour. It also comes with PACE technology, which enables the operator to adjust the pressure to match different job tasks. This means that the same compressor can be used for various applications on and around the farm, such as blasting or powering handheld tools. ■

U190 PACE compressor

Main feature: Lightweight and compact with excellent fuel efficiency. Stackable up to three levels high. Also available with PACE, an electronic adjustable pressure system, and an integrated generator.

Used at: Mostly integrated into utility trucks, but also service and construction vehicles.

Gateway to GROWTH

With a continuing focus on construction, connectivity and green energy, the future looks promising for Atlas Copco in China, the world's second-largest economy.

In the 1920s, when Atlas Copco products were first imported and sold in China, the country was poor and underdeveloped. A hundred years later, the country is an economic powerhouse.

In nominal terms, China's GDP was 66 percent that of the United States in 2018, which made it the second-largest economy in the world. It became the largest trading nation in goods in 2013 and the world's largest economy in purchasing-power-parity terms in 2014; as of 2020 it has 124 of the Global Fortune 500 companies (for the first time more than the U.S. with 121); and it is one of the world's top two countries for receiving and being the source of foreign direct investment (FDI).

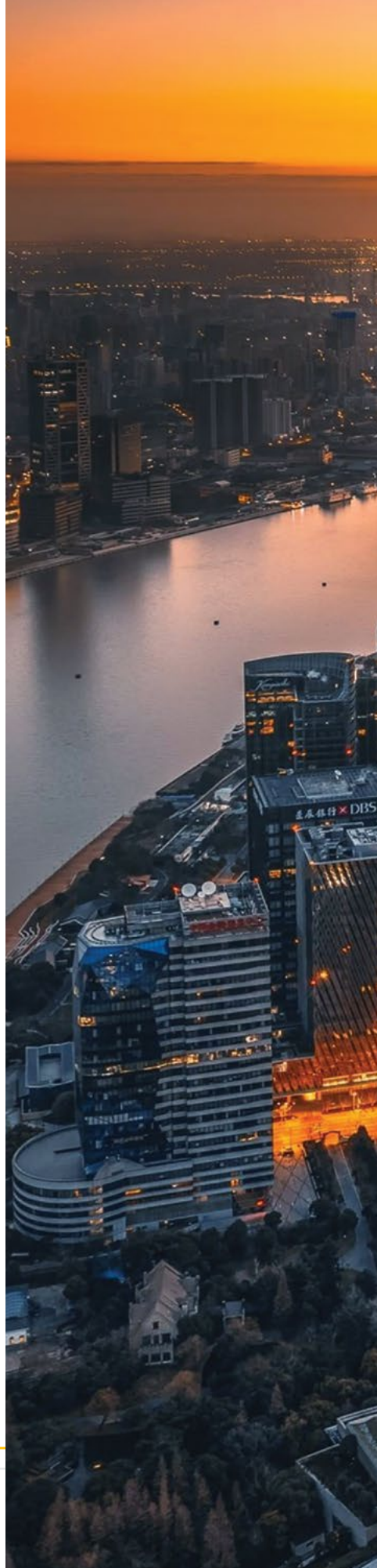
"It's all happening at the speed of light," says Francis Liekens, Vice President for Atlas Copco Holding Greater China.

A new phase

At the end of the last century, China went through an economic miracle where it became the "factory of the world." During that time, Atlas Copco's operations expanded substantially from modest beginnings so that today, China is the company's second-biggest market.

It's just 35 years since the opening of its first representative office in Beijing in 1985, yet Atlas Copco now has seven manufacturing facilities, a high-tech R&D center and a nationwide sales and service organization in the Greater China region. The operations employ more than 5 500 people.

Urbanization, increased domestic consumption and continued technical advancements for better air, water and living conditions are all underlying trends which drive the demand for Atlas Copco's solutions in the entire region.



"The main engine for the economy is no longer production but domestic consumption," says Francis. "We see an expanding middle class with rising disposable income and higher demand for everything from healthcare to travel and tourism."

Apart from private consumption, other major economic drivers include the huge initiatives the Chinese government has introduced to boost innovation, new technology and a cleaner environment. Today, China is the world's second-largest spender on domestic R&D, and the country accounts for close to half of the world's investment in renewable energy.

"The increased focus on the environment has resulted in rising demand for environmentally friendly, quality products, which is beneficial for us as this has already been our focus for many years. Companies are now ready to pay a premium price for energy-efficient products and solutions," Francis explains.

Infrastructure investments create opportunities

A prominent government initiative is the Belt and Road initiative, the enormous global infrastructure project launched by China along ancient global trade routes from east to west.

"These contractors have a global presence and tend to prefer working with suppliers like us – companies that have a global presence with a consistent offer in products and services," says Erik Sparby, Regional General Manager for Atlas Copco Power Technique.

He adds that after the downturn in the economy during the first quarter of 2020, there is now a surge in demand for new equipment and services, especially in the water well and "drill and blast" segments. Looking to the future, his view is that traditional infrastructure developments will continue.

"We will see an increased demand for repair and maintenance of existing buildings and structures as many of them are 20 years of age or more and need upgrading. There is also growing demand for more environmentally friendly products. One example is that China is shifting to the stage IV diesel emissions legislation for off-road equipment, and we have a range of both on-site and mobile machines that offer reduced or even zero tailpipe emissions."

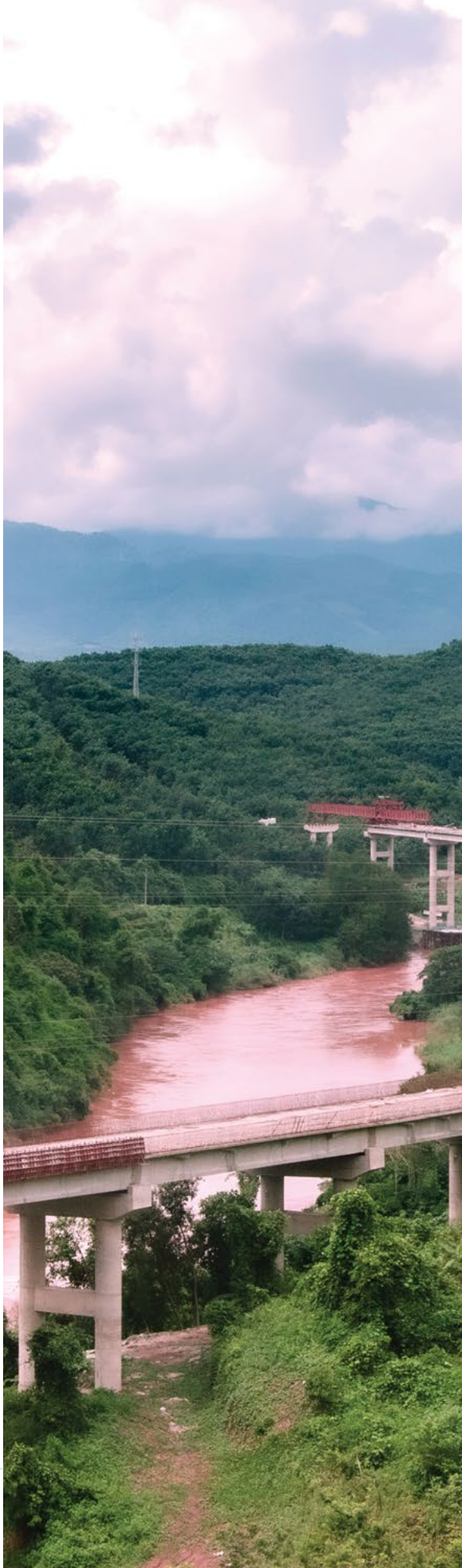
Reflecting the increasing activity in the construction sector, the demand for heavy trucks and off-road machinery is growing. In addition to this, several domestic construction brands are investing heavily in automation and digitalization. This suits Industrial Technique. "Our smart assembly offer is a very good match, and we support customers with customized, smart and connected tooling, as well as quality assurance solutions that improve their entire production flow," says Justin Zhou. General Manager for Atlas Copco Industrial Technique, China.

Taking the lead in high-end production

China has launched its 14th five-year strategic plan to develop the manufacturing sector from being "the world's factory" to producing high-end products in 10 key industries, including

The main engine for the country's economy is no longer production but domestic consumption."

Francis Liekens
Vice President
Atlas Copco
Greater China



Infrastructure investments like the Belt and Road Initiative, increased connectivity and the electric transformation of the automotive industry are some of the main growth drivers for Atlas Copco in China.

11%

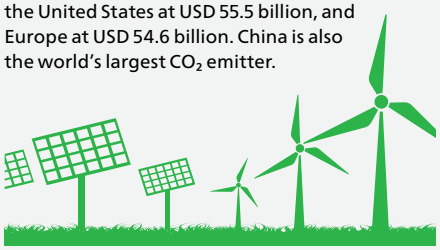
China is by far the largest electric vehicle market in the world, with 1.2 million units sold in 2019, as compared to 600,000 in Europe and 300,000 in the United States. The EV market share in China is expected to grow from 5% in 2019 to at least 11% in 2022.

378 BILLION

With USD 378 billion spent in 2020, China is the second-largest R&D investor in the world. In 2019, China became the world's top filer of international patents.

83.4 billion

In 2019, China invested USD 83.4 billion in renewable energy capacity. This means China tops the global list, followed by the United States at USD 55.5 billion, and Europe at USD 54.6 billion. China is also the world's largest CO_2 emitter.



USD 10,261

The Chinese GDP per capita was USD 10,261 in 2019. In 1985 the figure was USD 294.

1.4 BILLION

China has a population of 1.4 billion people. That is equivalent to 18% of the total world population.

Sources: McKinsey; World Bank; WHO; IMF World Economic Outlook, UN Environment Programme, and China's National Bureau of Statistics.

IT, robotics, aerospace, rail, green energy and green vehicles, and healthcare and medical equipment.

"As a large and highly reputable supplier we are able to deliver in areas that are becoming more and more important for Chinese companies, including energy efficiency, environmental protection and social responsibility," says Frank Liu, General Manager for Atlas Copco Compressor Technique, Shanghai. He also notes a trend toward consolidation in the market. "Manufacturers and companies are becoming bigger, more sophisticated and more demanding – all of which are competitive advantages for us."

The electric transformation of the automotive industry and China's rapid development in digitalization, automation and smart manufacturing also play into the hands of Atlas Copco Industrial Technique.

"Electric vehicles, off-road equipment, electronics, high-speed rail and wind energy are all business drivers," says Justin Zhou. "One reason is that the authorities are stimulating domestic manufacturing and investing in strategic areas for the future, including 5G, artificial intelligence, electric vehicle charging, high-speed rail and inner-city rail transit."

Connectivity is a main driver

Another important trend in the entire region is connectivity. An increasing number of customers are interested in the production advantages that connectivity offers.

"We support our customers in optimizing their production performance by monitoring and collecting real-time data from each compressor to minimize downtime, predict maintenance needs and suggest energy-saving measures," says Frank Liu.

"An increasing number of our power technique customers now utilize the potential of connected machinery, where uptime is in focus. We can predict maintenance needs via wireless data, and support customers by servicing their equipment remotely," adds Erik Sparby.

Justin Zhou expects the digitalization trend to continue, as China takes its first steps toward fully 5G-connected manufacturing plants. "We will see more and more complete solutions in smart manufacturing, with more automation, more robots and cobots, as well as more machine vision solutions and more data-driven services," he says.

A thriving vacuum business

Increased connectivity means a growing demand for semiconductors, and

large volumes of chips for the global electronics industry are produced in the Greater China area. On top of this, flat panel display production, LED lights, battery manufacturing, solar panels and scientific research equipment are the main drivers for the Group's vacuum business in Greater China.

"The more electrified and digitalized the world gets, the more it depends on semiconductors," Eric Lin, General Manager for Edwards Taiwan, explains. "The Atlas Copco Group has a strong position in the expanding semiconductor industry, and the expertise and capacity required to meet the steadily growing demand linked to the development of 5G, artificial intelligence, Internet of Things and cloud-based services," he says.

Erik Sparby
Regional General Manager, Atlas Copco Power Technique China

Justin Zhou
General Manager for Atlas Copco Industrial Technique, Shanghai Trading

Eric Lin
General Manager Edwards, Taiwan

Frank Liu
General Manager, Atlas Copco Compressor Technique, Shanghai Trading

Janet Ren
General Manager Leybold, China

Janet Ren, General Manager for Leybold in China, also part of the Group, highlights the expansion of the country's already world-leading battery, 5G and solar energy industries, and their technology upgrades.

"Leybold is a leader in integrated vacuum solutions for these segments, and we continuously invest in R&D to maintain this position," she says. "Moreover, China keeps increasing investment in technical upgrade, new technology and scientific research to boost the national innovation capacity, and the trend will continue in the years ahead."

Tackling challenges

As China's industrial companies continue to develop at a rapid pace, they also face challenges related to increasing compliance pressure in areas like taxes, the environment, cybersecurity and protection of intellectual property.

"The country is clearly stepping up its actions in these areas," says Francis Liekens. "This is a big advantage for Atlas Copco, as we are already compliant with all regulations and don't need to make the big investment that some of our local competitors now need to do. We are also known for following very high ethical standards, and this is something we see a business differentiator on all markets."

Though Francis has a highly positive outlook on Greater China's economic prospects and the opportunities ahead, he doesn't ignore the challenges.

"The market is changing fast. Trade disputes could lead to a market slowdown. We must also always keep a close eye on business ethics aspects. But overall, I think the opportunities clearly outweigh the challenges. This is the place to be." ■

Setting THE TONE

Jimi Hendrix, iconic rock figure of the 60s, was one of the most renowned and innovative guitarists of his day. His innovation was made possible by the development of the guitar amp.

In fact, the progression of rock music as a whole was enabled by production of the valve amp, and Edwards, now part of the Atlas Copco Group, was already involved in producing valves in the 1930s. Valves, or vacuum tubes, were by far the dominant active electronic component in most instrument amplifier applications until the 1970s, when solid-state semiconductors (transistors) started taking over.

Jimi Hendrix loved the depth and warmth that transistor-based amps couldn't deliver. In fact, nothing screams audiophile authority like a valve (or tube) amp, and even today there is a niche of purists who continue to specialize in building them.

CLEARLY SUPERIOR

When making glass containers, the vacuum pumps needed can consume a lot of energy. Choosing the most efficient one will have a positive impact on costs, performance and the environment.

Phoenicia Glass Works, established in Haifa in 1934, is one of Israel's oldest manufacturers and distributors of glass containers. It specializes in glass containers for the domestic and international food and beverage industry. The company produces approximately 200 bottles per minute and nearly one million glass containers every day.

As part of their production process, Phoenicia Glass Works was using five older models of rotary vane vacuum pumps for glass molding applications. This installation required a high level of maintenance and offered poor energy efficiency. The company therefore decided to invest in an improved and stable vacuum level while meeting their environmental goals.

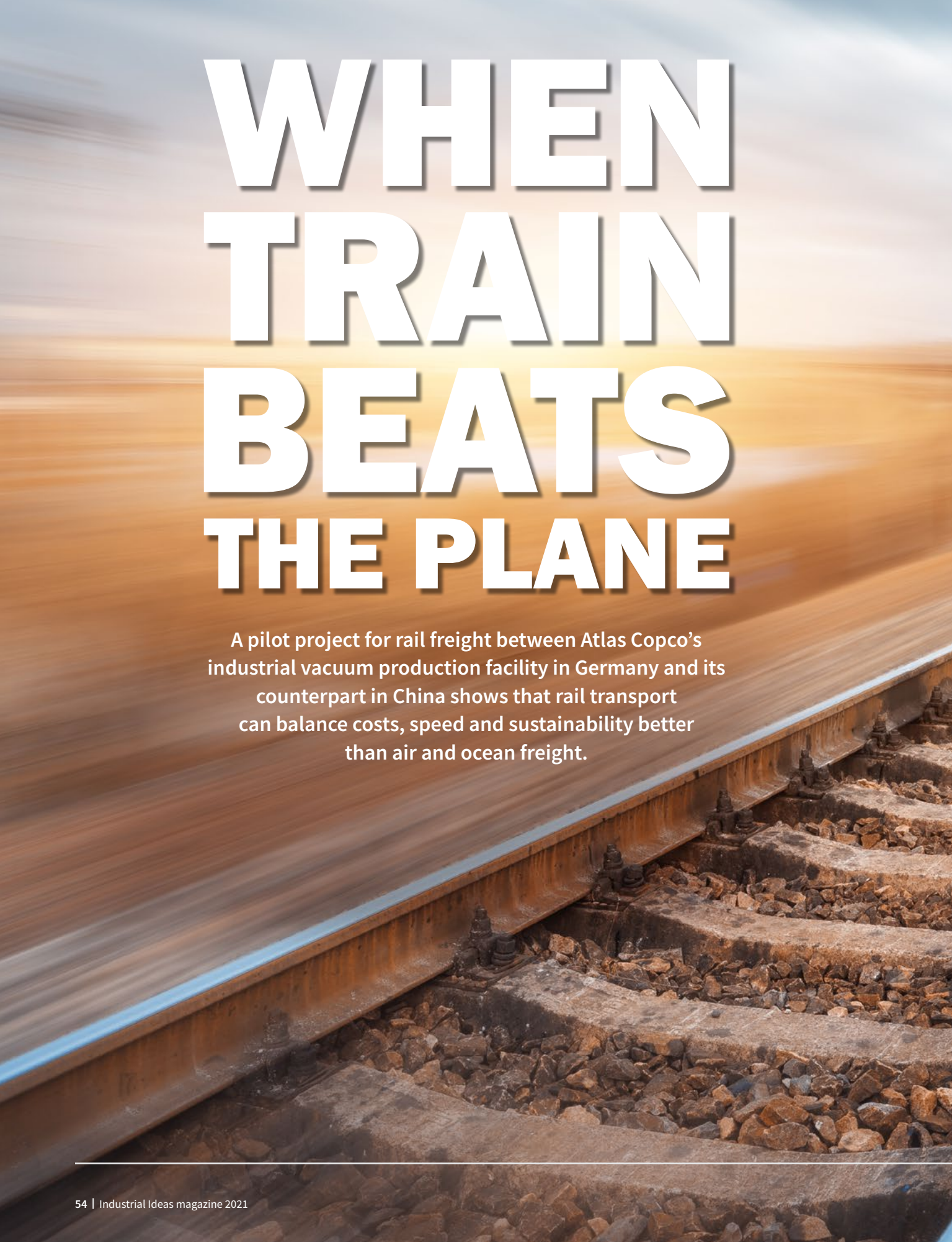
After meeting with Atlas Copco, who thoroughly analyzed their needs, Phoenicia was convinced of the benefits of the GHS 1900 VSD+ oil-sealed screw vacuum pump equipped with variable speed drive.

Phoenicia decided to install a centralized vacuum solution including six pump units and a central controller. The top-of-the-line central controller allows Phoenicia to monitor and control the six GHS VSD+ vacuum pumps simultaneously to optimize the power consumption.

The new installation has resulted in a 43% energy savings for Phoenicia Glass Works. Maintenance costs have also been reduced, thanks to longer service intervals which significantly lower the system's overall life cycle cost. Additional peace of mind comes from knowing that in case of emergencies, Atlas Copco's international network of dedicated service technicians are on hand to help. ■

WHEN TRAIN BEATS THE PLANE

A pilot project for rail freight between Atlas Copco's industrial vacuum production facility in Germany and its counterpart in China shows that rail transport can balance costs, speed and sustainability better than air and ocean freight.



Atlas Copco's commitment to growing in the right way underpins the green logistics strategy of the Group's Industrial Vacuum division. But there's always a challenge to balance fast deliveries, transportation costs and minimal environmental impact.

Leybold, a leading vacuum producer based in Cologne, Germany, sends heavy pumps weighing more than 150 kilograms, plus semi-finished parts such as components and rotors, to Tianjin, China, for local production and distribution. Although air cargo transports are quickest, at 10 days or less, the growing volumes to the Far East meant planes had become unsustainable, as Alexander Irchin, Logistics Manager, Atlas Copco Vacuum Technique, explains.

"We wanted to move away from using air freight as rail transportation is more economical. We were also concerned about the high levels of CO_2 emissions produced through air transportation."

Finding a new way

China's heavy investment in the Belt and Road infrastructure project across Asia, and in the German port of Duisburg, has been a game changer for rail travel between China and Europe. Leybold therefore decided to make a rail freight pilot.

The "Lighthouse project" began in mid-2019, when 20 full container loads were sent by rail nearly 8 000 kilometers from Germany to China. In 2020, Leybold sent 74 containers of Rail cargo to Shanghai and Tianjin. The flow is arranged so that the full container load first

goes to the production facility, where the team unloads the relevant goods before dispatching a truck onward to the customer center.

The benefits of train transports are clear. On this particular route, rail freight is 75% less costly than air freight, while the train's carbon emissions are 90% lower. Compared to ocean freight, the train is 50% quicker as the distance by rail is 8 000 kilometers compared to more than 23 000 kilometers by ocean.

Securing the load

During the pilot, all Leybold's transports were put in ocean freight packaging to avoid corrosion, while reducing the amount of plywood and completely eliminating the need for polyurethane foam. The transports were monitored via GPS tracker and the cargo's temperature, humidity and load shocks were measured.

There can be significant temperature and humidity fluctuations, and load vibrations, but no significant damage was reported. This data prompted a decision to switch to rail for all but the heaviest of cargoes, which still go by container ship.

When distances are long, the planning time is important to ensure local market expectations can be met. Supply chain strategies focusing on planning delivery times, covering manufacturing and transport, are key to managing the right level of inventory for local markets and "just in time" refilling.

Another Europe-to-China rail route is now running in Edwards, also part of the Atlas Copco Group. Its distribution center in Czech Slavonin has started to ship products to destinations in Shanghai and Qingdao, via Poland. "We have also establishes rail shipments from China to European customers from our manufacturing center in Qingdao," Alexander says. "In addition to saving time and money, this also brings a reduction in CO_2 emissions and on top of that improves customer satisfaction."

Alexander Irchin
Logistics Manager, Atlas Copco Vacuum Technique

Rena An
Order Management and Planning Manager, Leybold China

Jiri Polasek
European Distribution Center Manager, Edwards Czech Republic

Our strategy to switch to rail is driven by environmental and cost optimization needs, but it is also based on customer requirements."

Alexander Irchin

"Our strategy to switch to rail is driven by environmental and cost optimization needs, but it is also based on a strong focus on customer requirements. We wanted to establish a method that would get products to them without undue delay. It also proved to be a wise choice from a flexibility point of view. When we initiated this project we had no idea a global pandemic would hit, with logistics constraints and restrictions to follow. By using alternative and reliable transport modes like rail we were able to maintain supply and customer support in a very challenging time," Alexander Irchin concludes. ■

passionate people

MAKING THE CONNECTION

Logistics Manager Katey Kim plays an important part in securing the vacuum solutions needed for the making of semiconductors and other electrical devices.

You work in a division that provides vacuum solutions for the world's semiconductor manufacturers. Why is vacuum needed there, and where are semiconductors used?

Let me start with the semiconductor part. These highly advanced connectors are crucial for all kinds of electrical devices and digital communication, such as smartphones, computers and televisions. Increased demands from video streaming and simple notification services also require semiconductors, as does big data, artificial intelligence, Internet of Things and autonomous cars.

When you manufacture semiconductors, the surrounding environment needs to be absolutely clean, and this is where our vacuum solutions come in. Without them, micro-sized contaminations such as dust could destroy the whole product.

What is your role?

My mission is to lead and develop the global supply chain for the Semiconductor division by focusing on optimization of the supply network, inventory level and transportation mode. All these activities ultimately improve our customers' satisfaction. It's great fun as it's challenging but at the same time very clear how important your job is and how much you contribute. I also get to talk to a lot of people in a lot of different places.

I am also encouraged by my managers to keep learning and taking on new challenges. A few years ago, I was selected for an annual Global Mentoring Program, and our Divisional President mentored me. This was a good experience. I have also been part of an international management program with people from the Atlas Copco Group and some other big Swedish companies. This training, in a way, really changed my life. It was focused on self-awareness and it helped me think about my interaction and behavior toward others.

What is on top of your mind right now?

One of Atlas Copco's sustainability goals is to reduce our carbon footprint. From a logistics point of view, we can contribute and at the same time increase customer satisfaction in our deliveries. We are currently exploring the options of more sophisticated planning and demand tools which could help us set the right amount of stock at the right time, with short lead times. We are also investigating more environmentally friendly modes of transportation, for example international railroads. I really hope that these measures will contribute to a sustainable future.

Katey Kim
Semiconductor Logistics Manager, Edwards Korea.

Katey joined Edwards in 2013 as Service Supply Chain Planner in Korea, responsible for demand forecasting and supply chain projects. She then moved into a global forecast and planning manager role. In 2020 she took up a newly created role as Semiconductor Divisional Logistics Manager, taking care of vacuum brands serving the semiconductor market.

CHIPPING IN FOR SAFETY

When a South Korean education center for semiconductor production experienced two severe explosions linked to nitrogen, they decided to replace their current machines with on-site nitrogen supply solutions from Atlas Copco.

Semiconductors make up the heart of modern-day electronics, and South Korea is at the heart of this industry. The world-leading semiconductor producers located here are constantly looking for highly skilled employees, and to meet this need, the Korea University of Technology and Education (Korea Tech) has established a top-notch education center in the city of Cheonan.

Each year, roughly 10,000 students pass through this Semiconductor Equipment Technology Education Center, as they are trained in semiconductor and solar cell production. The majority are undergraduate students, but the center also welcomes external trainees, researchers, teachers and people working at semiconductor manufacturing companies. The education center is rated number one in Korea, in terms of know-how and facilities.

As the trainings run all year round, the center must have 24/7 access to compressed air and nitrogen. Nitrogen plays a central role in the manufacturing of semiconductors. It is a very dangerous gas that can lead to asphyxiation. On top of this, it is highly explosive and it must be handled very carefully.

"Many schools and smaller research institutes use liquid nitrogen for cost reasons, but liquefied nitrogen is risky to handle. We prefer to have our own nitrogen generator on-site, and we believe it's more cost-efficient as well," says Cheolho Im, Technical Support Team Manager.

"We experienced two severe explosions in our lab. Fortunately, there were no casualties, but significant machine parts had to be replaced. Needless to say, safety and reliability are top priorities to us, so we decided to look for a new provider. While searching I found out that Atlas Copco not only provides air compressors but nitrogen generators as well. As we already had a very positive experience of their air compressors, we felt reliability was guaranteed," says Cheolho Im.

In December 2019, the center installed an Atlas Copco nitrogen generator and a nitrogen supply compressor. In conjunction with the Atlas Copco oil-free air compressors already in use, the solution now provides nitrogen and compressed air to the ultra-clean semiconductor production rooms.

"With the new machine setup, even small amounts of compressed air show almost perfect purity," says Chief Researcher Seokil Yoon. "It's essential that oil and dust are filtered out properly. Any contamination can make the nitrogen generator and the connected pipeline explode. And if the lines leading to the semiconductor production are contaminated, all equipment must be replaced, which is both costly and time-consuming. With our new solution, this is no longer a problem." ■

Turning apples into APPLESAUCE

Compressed air is a prerequisite for most of the products, services and tools we need throughout life. And it all starts with small jars of baby food.

The Gerber Products Company was founded in 1927 as one of the first producers of canned baby food. Since then, it has fed generations of young Americans. The company is nowadays a subsidiary of Nestlé, but Gerber remains a leading baby food brand on the U.S. market. It even has its "own" baby, featured on all product packaging.

Gerber's production plant in Fremont, Michigan, makes purees of carrots, sweet potatoes, apples and other fruits and vegetables. As the food is served to infants, quality and safety are top priorities. There must not be any risk of the product having incidental contact with oil, which is frequently present in industrial settings, and food producers therefore go for oil-free air compressors. Gerber's production process already relied on oil-free compressors from Atlas Copco, so when the time came to take energy-performance up a notch, they didn't have to look far to find what they needed. After consulting their local Atlas Copco expert, their choice fell on a ZR 90-160 VSD+ compressor, complemented by an MD dryer.

"The reason this compressor is so appealing to us is that we need a guaranteed dew point and guaranteed pressure performance," says Geoff Martin from the Néstle Gerber Maintenance team.

"And we cannot afford to have downtime. With the provided **SMART**LINK connectivity system our air compressors are monitored 24/7 by Atlas Copco's maintenance experts as well as ourselves. I can now talk to a service guy sitting 100 miles away and ask him to look at the same performance data I see on-site," Geoff continues.

The factory used to have five air compressors serving the entire plant, but by switching to a much more efficient compressor, they were able to trim out three of the older compressors and now only use two machines, the ZR 90 being one of them. Since it's equipped with the most sophisticated variable speed drive technology, it brings substantial energy savings, which means reduced costs and less environmental impact.

"The energy efficiency gain we see is around 30-40%, as we were able to shut down desiccant dryers and other machines that would be running for hours on end. This machine does everything we ask it to do, and more," Geoff concludes. ■

Clean water CHANGES LIVES

Our Water for All initiative supports communities with limited access to clean water, to prevent acute health risks and help people build a better future.

Water for All, Atlas Copco's main community engagement initiative, was founded in 1984 by a group of employees who wanted to help a community in Peru drill for water to survive a serious drought. Since then the initiative has grown and there are now more than 50 local Water for All teams who volunteer to support projects ranging from small wells to sewer systems for entire villages.

The funding is based on employee donations and the company contributes twice that amount. So far, Water for All has helped more than two million people get access to clean water and hygiene facilities. Here you meet two of the many dedicated supporters.

Women and young girls are particularly affected by water scarcity as they often must walk long distances to fetch clean water for their families every day. If the village gets a local well or water supply system, these girls can instead go to school or spend their time establishing a thriving business. This has a positive effect on the entire community.

Italy

Manuela Stagnati, Marketing Administrator in Atlas Copco's Oil-free Air division, has been President of Water for All Italy since 2014.

"Our projects focus on Kenya, Ethiopia, South Sudan and Uganda, in cooperation with Amref Health Africa. They cover wells, protection of natural spring water, pipelines and water tanks. Training in hygiene and sanitation is another important aspect," says Manuela.

Many projects also support schools with water tanks and water sanitation kiosks. If a school does not have proper toilets, girls often drop out once they reach puberty.

"We follow our projects step by step, from start to finish, to see the benefits reaped in the communities. Meeting the beneficiaries in the field is the most amazing and motivating part of my voluntary work. I'm a very proud ambassador," says Manuela.

The most recent projects have been establishing wells, ventilated latrines and a fish breeding tank in counties in the Republic of South Sudan.

"South Sudan gained independence in 2011. In addition to the water emergency, the many years of conflicts and civil war has made the situation even more difficult, and help was needed more than ever. Despite the critical circumstances, and COVID-19, we were able to implement all water installations on time," says Manuela.

Manuela Stagnati
Marketing Administrator in Atlas Copco's Oil-free Air division

Taki Suzuki
Senior Corporate Communications Manager

Japan

Water for All in Japan was started in 2014 by Taki Suzuki, Senior Corporate Communications Manager. Today it engages more than 120 volunteering employees who run projects focused on water, sanitation and health, primarily in Asia.

"We have grown steadily and see a growing engagement especially among our younger employees. They want to contribute to society and not just work toward traditional performance-related goals. Being engaged in Water for All is a rewarding way to change people's lives for the better, and you also learn a lot," says Taki.

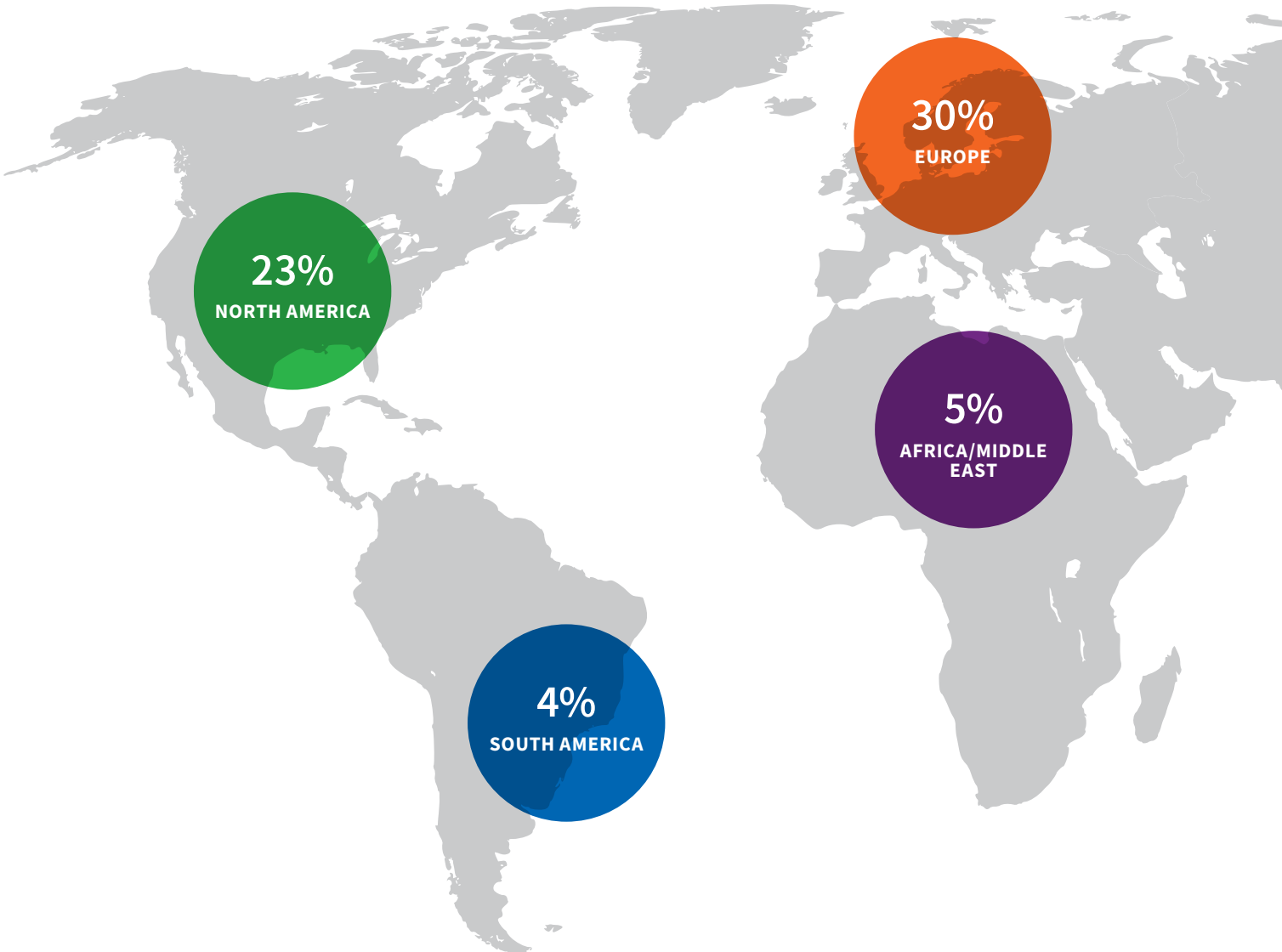
In 2018 Water for All Japan partnered with the NGO Water Aid Japan to cooperate in a two-year project in East Timor. In this Southeast Asian island country, access to clean water and the possibility to maintain sanitation and hygiene is poor, especially in rural areas.

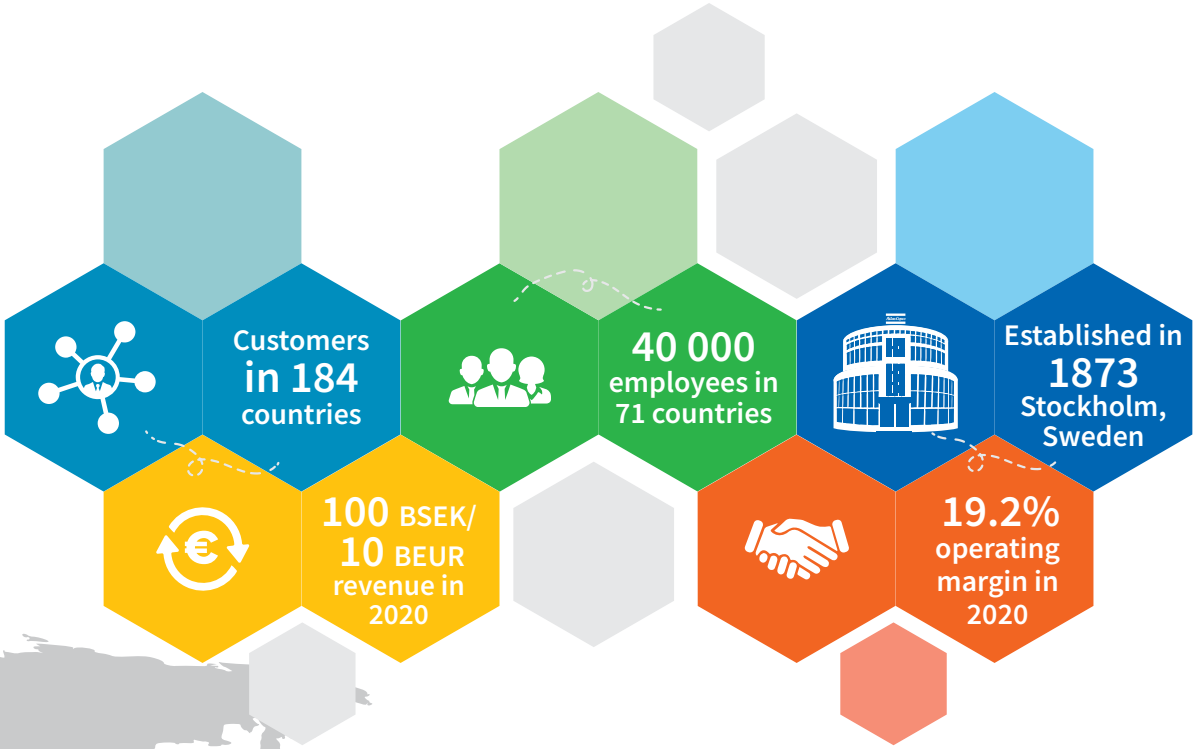
To improve the water, sanitation and hygiene (WASH) situation, one of the projects focused on trainings for municipality officials that included data analysis of WASH services, finance, planning and monitoring. The participants also learned about the standards of WASH facilities in households, schools and healthcare facilities.

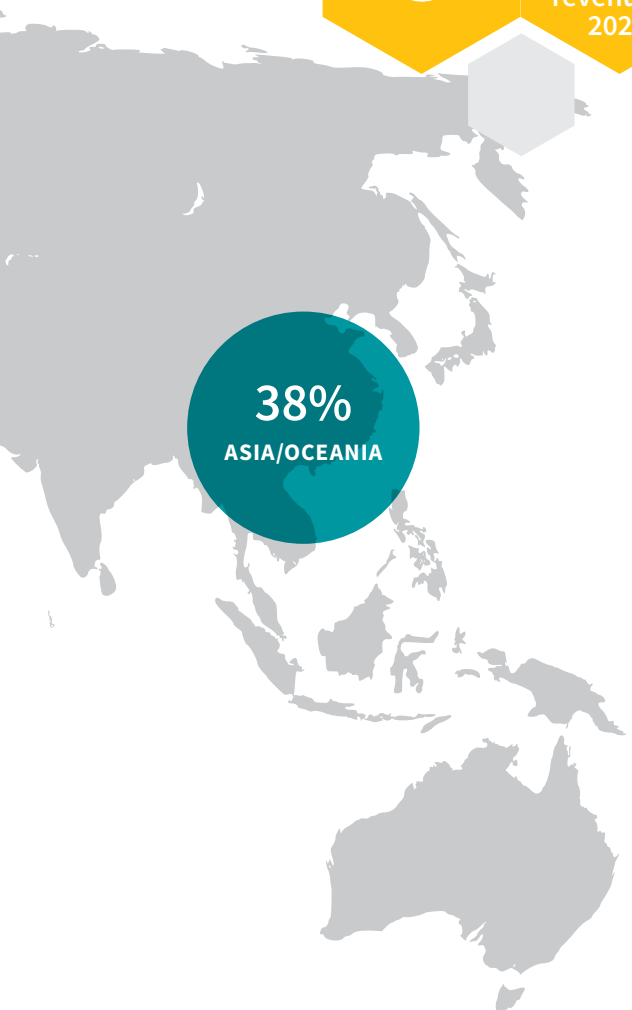
"The two communities in East Timor are now all set to continue their work toward their goal of clean water, decent toilets and good hygiene being a part of everyday life," says Taki. ■

THIS IS **ATLAS COPCO**

Atlas Copco is a global company with customers in more than 180 countries. We develop leading compressors, vacuum solutions, generators, pumps, power tools and assembly systems and serve almost every industry.







Working for a sustainable future

We are committed to being part of the solution for a better tomorrow. An integrated sustainability strategy, backed by ambitious goals, helps us deliver greater value to all stakeholders in a way that is economically, environmentally and socially responsible.

Read more about our goals and results on our Group website atlascopcogroup.com.

For more information
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ENABLING THE SHIFT

Atlas Copco's industrial solutions are at the heart of the electric car revolution.

The car manufacturing industry is currently undergoing a major shift toward battery power and weight reduction. Yearly sales for electric vehicles are expected to reach 26 million vehicles in 2030, which would represent 28% of the global car sales.

This shift brings new challenges for car and battery manufacturers. To stay competitive, they must be ready to quickly scale their production and constantly reduce the time to market. Adding to that, the batteries used in electric vehicles are heavy, and the heavier the car, the more energy it will consume. To compensate, manufacturers are using new light-weight materials, which in turn bring new requirements and a demand for new techniques.

To meet this growing need, Atlas Copco innovates together with the world's leading car and battery manufacturers. Together we develop new and future-proof technologies that make vehicles as light as possible, while improving their capacity range and environmental performance.

This continuous focus on R&D leads to new solutions and technologies for bonding, potting, tightening, machine vision, process control, quality inspection and data-driven service. The end result is a steadily growing portfolio of smart and unique products that support and revolutionize car and battery manufacturing processes in a sustainable way. ■