



SOLARIS

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1/2022 (28)



**A good year
for e-mobility**

Review of 2021
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**2000 electric
buses later**

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Market share of over 15%, solid sales results, investments in green solutions for public transport. We invite you to see a summary of 2021 in numbers.

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[2000 electric buses later](#)

Our company could not be prouder today. We have just signed a contract for our 2000th e-bus. Over the last few years, a profound e-mobility revolution has taken place before our very eyes.

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[Hydrogen launch](#)

Solaris is constantly working to optimise its range. So far, there has been only one bus model in Solaris's hydrogen-powered offering, the Solaris Urbino 12 hydrogen bus. Soon, this will change thanks to the 18-metre version of the Urbino hydrogen bus, which will be launched in September.

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As an introduction



Dear Readers, dear Friends,

The first half of 2022 is already over. Time flies unexpectedly fast, all the more so because we have not slowed down our activities. The very titles of the articles we have written especially for you and included in the latest issue of “Solaris Customer Magazine” are proof positive that development and innovation are our constant watchwords.

You will find news about the first deliveries of the Urbino 9 LE electric bus, about development projects we are part of, improved products, and new contracts. Ample space has been devoted to hydrogen technology. What is more, we take a closer look at ESG issues. We have obtained Environmental Product Declarations (EPD) for two bus models and set up a separate team to be in charge of sustainable development in our company. We also report on our educational programme #CityMission. These are just a few of the numerous subjects we proudly cover in the current issue of the Magazine.

In the last few weeks we have signed a contract for our 2000th electric bus. Thank you for entrusting us! A special thanks goes to our employees who every day put a great deal of effort into designing, manufacturing and servicing the Urbino vehicles. As many of you certainly remember, our first electric bus was unveiled in 2011. It has been just a decade since then, but zero-emission Solaris buses have already become a permanent fixture in the landscape of over 100 towns and cities Europe-wide, and every day more and more of them roll out onto Europe's streets. This is a joint achievement of both yours and ours!

A unique event, which marks the culmination of several months' work by many of our company's departments, is the launch of our new model, the Solaris Urbino 18 hydrogen bus, which will expand our hydrogen offering. Along with the first demonstration of our 18-metre hydrogen bus, we are organising the third edition (already!) of our #SolarisTalks conference. This conference, organised by Solaris itself, is dedicated to e-mobility and will present a great opportunity to take a closer look at the changes and challenges our experts have identified in the realm of new battery and hydrogen technologies being applied in public transport.

I hope you will find time to join us at these two remarkable events. Please do not forget: the launch of the Solaris Urbino 18 hydrogen bus & the #SolarisTalks e-mobility conference will take place at 9:00 a.m., Wednesday 14 September. See you then!

I wish you a rewarding second half of the year and hope you enjoy this edition of our "Solaris Customer Magazine".

Kind regards,



Javier Calleja
CEO of Solaris

Solaris electric school buses to conquer the market

➤ The number of Polish municipalities where electric buses will transport students to school is growing. More towns and cities have decided to purchase electric school buses from Solaris.

As part of the “Kangaroo: A Safe and Environmentally Friendly Way to School” programme, Polish communes receive subsidies from the National Fund for Environmental Protection and Water Management for the purchase of zero-emission school buses. The programme has aroused significant interest among local authorities. Four municipalities participated in the first edition, 16 more joined the second. Solaris has submitted the best offer in a total of 11 municipalities. The producer’s orange electrically-powered school buses are already transporting children in Bielany, Godzianów, Gręboszów, Działoszyce and Krasnopol. The remaining buses will soon go to Pałecznica, Przedecz, Rusinowo, Rzeczyca, Skalbmierz and Troszyn. In May, a tender for the purchase of an electric school bus was published by Ożarów Mazowiecki. Soon, Daszyna and Wieniawa will also announce their proceedings.



161 hybrid Solaris buses to go to **Wallonia**

➤ Deliveries of 161 Urbino 12 hybrid to the French-speaking part of Belgium have begun. The contract with the Opérateur de Transport de Wallonie (OTW) also includes an eight-year maintenance service. Once deliveries have been completed, almost 400 Solaris Urbino 12 hybrids will run in Wallonia.



Most of the ordered low-emission hybrid vehicles have already been delivered to the regional operators of the cities of Namur, Liège and Charleroi. The buses are equipped with a modern HybriDrive series hybrid electric propulsion system. By using both a combustion engine and an electric motor, it is possible to significantly reduce fuel consumption and pollutant emissions into the atmosphere. The ordered vehicles also have a Stop-and-Go feature available, which turns off the diesel engine completely when the bus comes to a rest at bus stops and the doors open. The vehicle uses at that moment energy recovered during braking and stored in supercaps. The new Urbino 12 hybrids that are being delivered are also equipped with a monitoring and a passenger counting system.

Solaris makes its debut in a new market in Europe!

➤ The main seaport of Montenegro, the Port of Bar, has decided to select Solaris to supply one Urbino 12 mild hybrid bus. This marks a new, 33rd market on the long list of countries boasting Solaris vehicles. The delivery of this low-emission bus is scheduled for December 2022.

The beginning of May saw the conclusion of a contract with a new client for Solaris – namely with the Port of Bar, the authority in charge of the chief seaport in Montenegro. The contract involves the supply of a low-emission Urbino 12 mild hybrid bus which will be used primarily for the transport of staff and visitors at the port. The purchase is co-financed by the EU as part of the SuMo project (Sustainable Mobility in the Port Cities of the Southern Adriatic Area), funded by the Interreg IPA CBC Italy-Albania-Montenegro programme.

In principle, mild hybrid-type vehicles operate similarly to hybrid buses and offer a range of environmental and economic benefits while ensuring considerable flexibility. The mild hybrid system is based on energy recovery technology, i. e. during braking energy is recovered and stored. See pages 22-23 for more about the Urbino mild hybrid model.



Madrid's **green investment**

➤ Turning 25% of the fleet electric by 2025 and no more diesel engine bus operating in the streets of Madrid as of 2023 – These are the ambitious transport goals that the operator EMT Madrid has set for itself and which it is gradually implementing. In 2021 Solaris secured an order for 250 natural gas-powered buses after winning the tender. This year the city went for an impressive zero-emission investment worth over EUR 30 million – the purchase of a total of 60 Urbino 12 electric buses.

EMT, the public bus operator in the City of Madrid, has commissioned 60 electric buses of Solaris. Madrid has opted for High Energy batteries and pantograph charging which will ensure high operability in all kinds of conditions. The silent and emission-free Urbino 12 electric buses are flagship vehicles of the manufacturer. The electric Solaris vehicles the Madrid operator has opted for will derive energy from state-of-the-art batteries of over 400 kWh, which will ensure an adequate range and operability of the buses for the metropolis.

Solaris has been present in Spain for over 10 years now. More than 500 buses made by Solaris currently ply routes in Spanish cities. Importantly, three quarters of these are vehicles featuring a zero-emission or a low-emission drive.



New Trollinos in Budapest

➤ In a consortium with Škoda Electric, Solaris will deliver another 48 trolleybuses to Budapest as part of a framework agreement concluded in 2014. Additional batteries will allow them to drive without a connection to overhead wires.



Budapest's carrier BKK again extended its order for Solaris trolleybuses. 12 solo Trollino 12 and 36 articulated Trollino 18 vehicles will be delivered to the capital of Hungary in 2022. The latest order for 48 vehicles brings the number up to that foreseen in the framework agreement concluded in 2014. Thanks to this long-term investment, a total of 108 Solaris Trollino trolleybuses will soon be cruising the streets of the Hungarian capital.

These zero-emission vehicles will feature air-conditioning, a video surveillance system and a fire extinguishing system. Thanks to their set of batteries, the Trollino trolleybuses will be able to cover at least four kilometres without being connected to overhead wires.

183 zero-emission Solaris buses to go to Oslo

➤ Unibuss AS, one of the biggest Norwegian carriers, has again opted for Solaris quality. At the beginning of the year, a contract was signed for the delivery of 183 Urbino 18 electric buses to the Norwegian capital. The total value of the contract, concluded as a result of a tender, stands at about €100m. This is a watershed moment in the company's history, never before has there been such a large, one-off order for electric buses.

“Unibuss is extremely happy to have selected Solaris as the supplier of its bus fleet in the biggest tender of this kind so far in Norway. By closely working with Solaris, we will provide Oslo's public transport authority, Ruter, with a high-quality, reliable bus fleet. We have collaborated with Solaris for many years now and we are very happy to be able to develop this partnership even further”, said Øystein Svendsen, CEO of Unibuss.

The buses to run on the streets of Oslo will be fitted with High Energy batteries with a total capacity of over 500 kWh and recharged using a plug-in charger. The drive unit will be an almost 250 kW central motor. The buses will boast modern amenities such as USB charging ports, special ambient lights and two ramps for people with disabilities.

The zero-emission Urbino 18 electric buses will partly replace Urbino 18.75 vehicles that have been plying the streets of Oslo's City Centre till now. The deliveries of newly commissioned vehicles are scheduled for April 2023.



Solaris Urbino 9 LE electric receives the prestigious busplaner Innovation Award 2022 in the category “E-Buses: Intercity Bus”

➤ The Innovation Award competition was held by the German magazine “busplaner” and the winners were determined by readers’ votes. The Solaris Urbino 9 LE electric bus, which can also be type-approved as a class II vehicle, won in the category “E-Buses: Intercity Bus”. The award ceremony took place on 26 April in Berlin at the Bus2Bus conference.



“We are very proud that Solaris has once again been recognised for its contribution to the development of sustainable transport. Our aim is to actively support European towns and cities in their transition to green mobility. We are achieving this by offering zero-emission buses that not only carry passengers in city centres, but also throughout entire conurbations and between towns and cities. The Urbino 9 LE electric bus is an excellent example of this”, said Christian Goll, the Managing Director of Solaris Deutschland GmbH, while accepting the prize.

The first Urbino electric buses on the streets in the Czech Republic

➤ Electric Solaris buses took to the streets of Ostrava after the hand-over ceremony with the participation of Martin Kupka, Minister of Transport of the Czech Republic, Tomáš Macura, mayor of Ostrava, Daniel Morys, CEO of public transport operator DPO, and media representatives.

In 2021, transport operator Dopravní podnik Ostrava (DPO) placed an order with the manufacturer for 24 Urbino 12 electric buses along with the charging infrastructure. Vehicles to join the bus fleet in Ostrava are very quiet and do not give off any harmful emissions, and thus they increase life quality in the city. Each of them can transport 85 passengers, who will benefit from wireless Internet and USB charging ports on-board.

The buses are equipped with Solaris High Power batteries with a total capacity of over 90 kWh. Apart from using a conventional plug-in charging device, the Urbino electric can also be recharged by means of a roof-mounted inverted OppCharge pantograph.

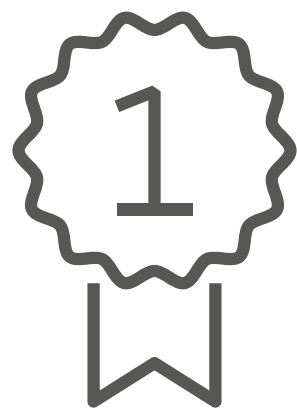


In the photo (from the left): Roman Zdráhal (Director, Solaris Czech), Tomáš Hüner (Head of Smart Infrastructure, Siemens), Daniel Morys (Chairman of the Board and CEO of DPO), Martin Kupka (Minister of Transport of the Czech Republic), Tomáš Macuram (Mayor of Ostrava), Eva Ručková (Managing Director, Solaris Czech), Katarzyna Drgas (Regional Sales Manager, Solaris Bus & Coach).

A good year for e-mobility

Review of 2021

Solaris is Europe's biggest manufacturer of electric and hydrogen buses



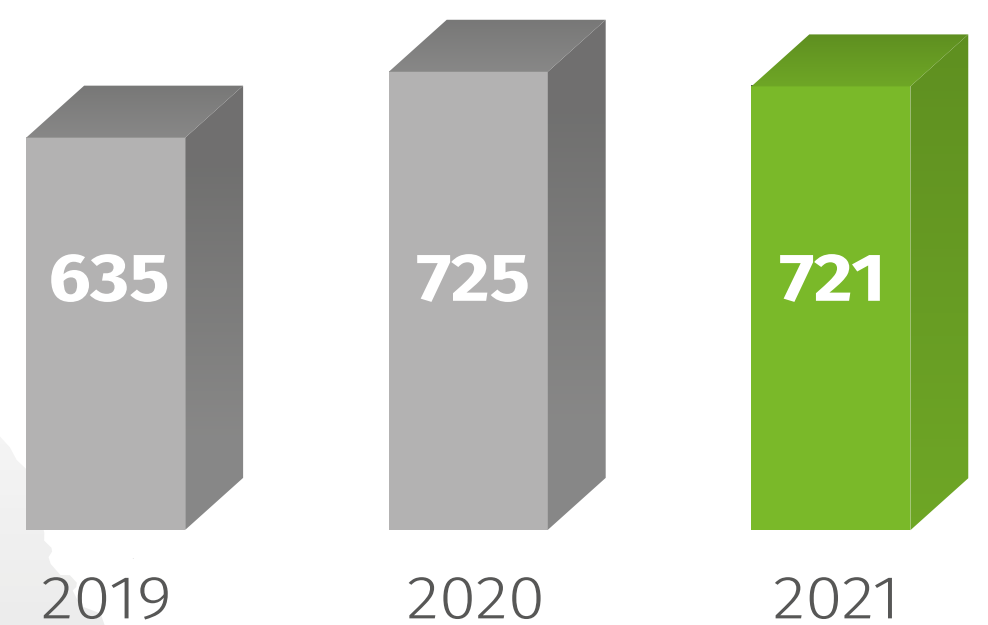
market share of 15% in 2021

in newly registered zero-emission buses in Europe, excl. GB and Ireland

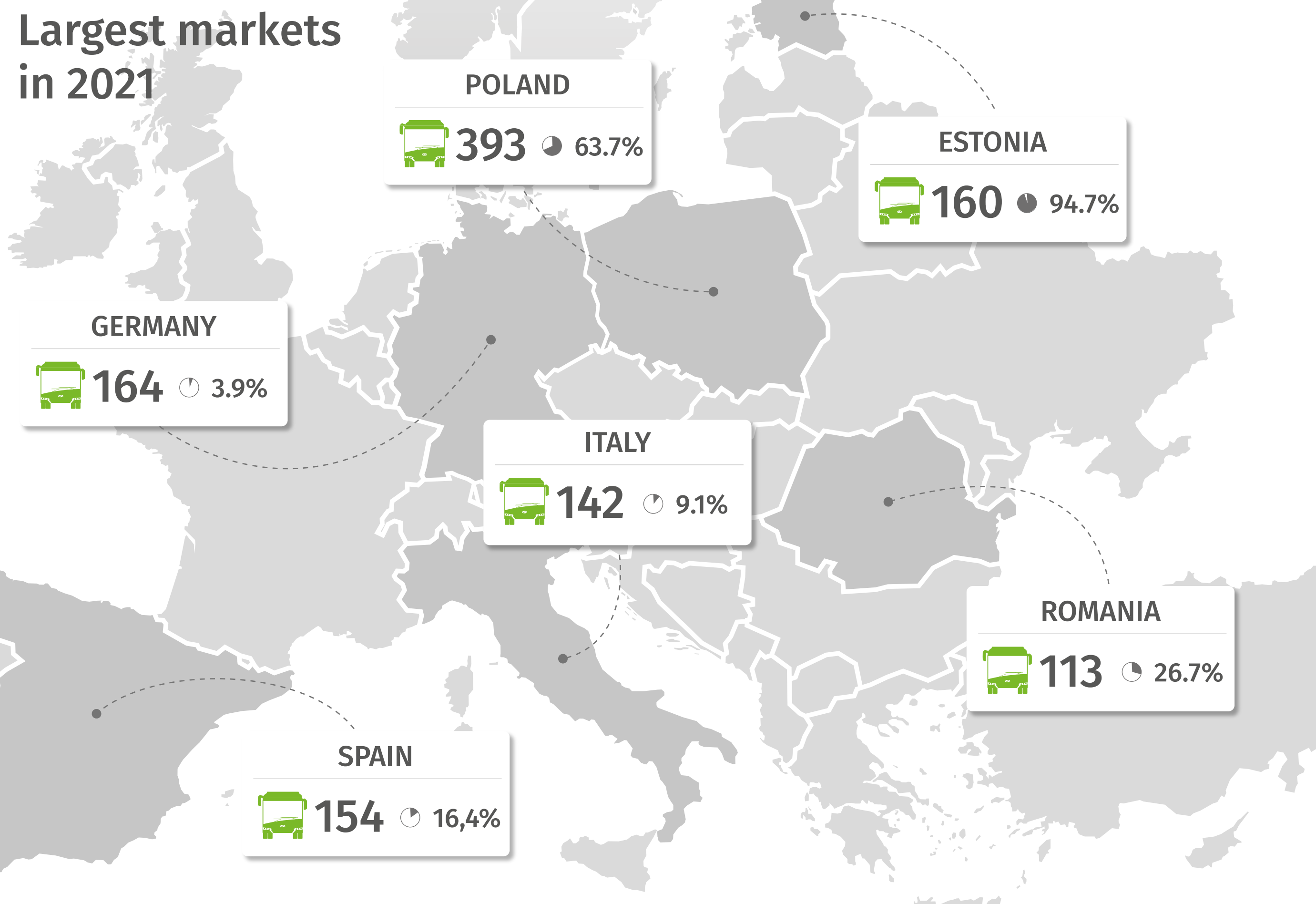
15%

Despite the ongoing pandemic in 2021, Solaris **reported solid sales and financial results.**

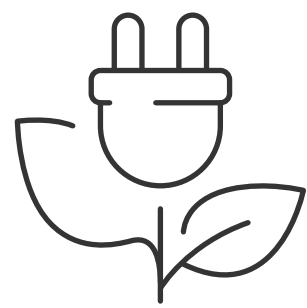
Solaris revenues in 2019 - 2021 in EUR million



Largest markets in 2021



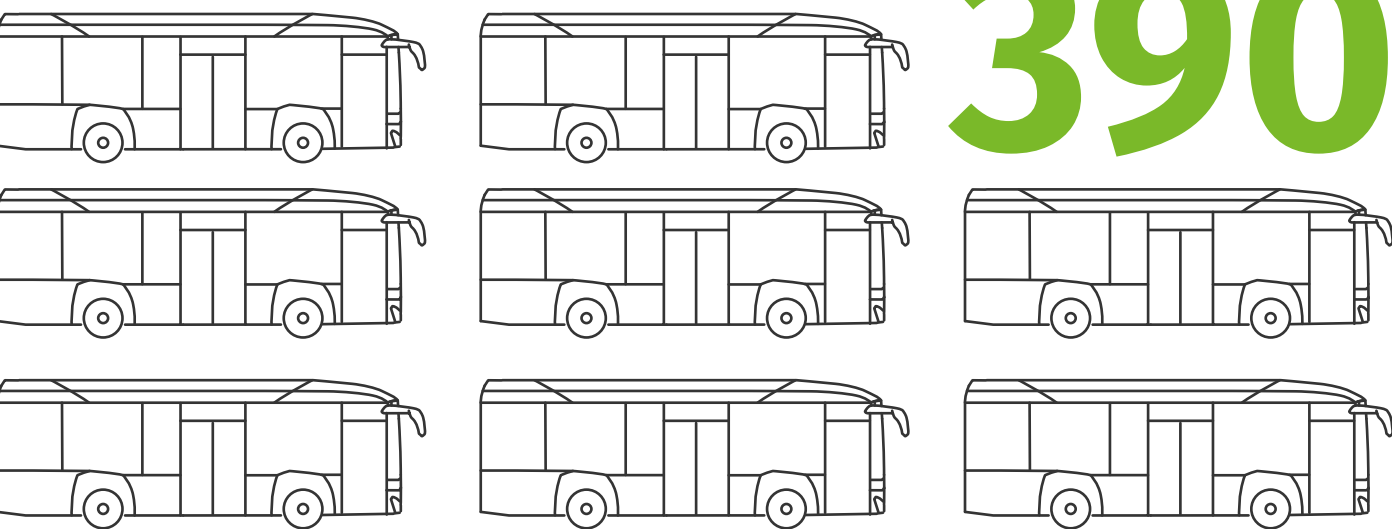
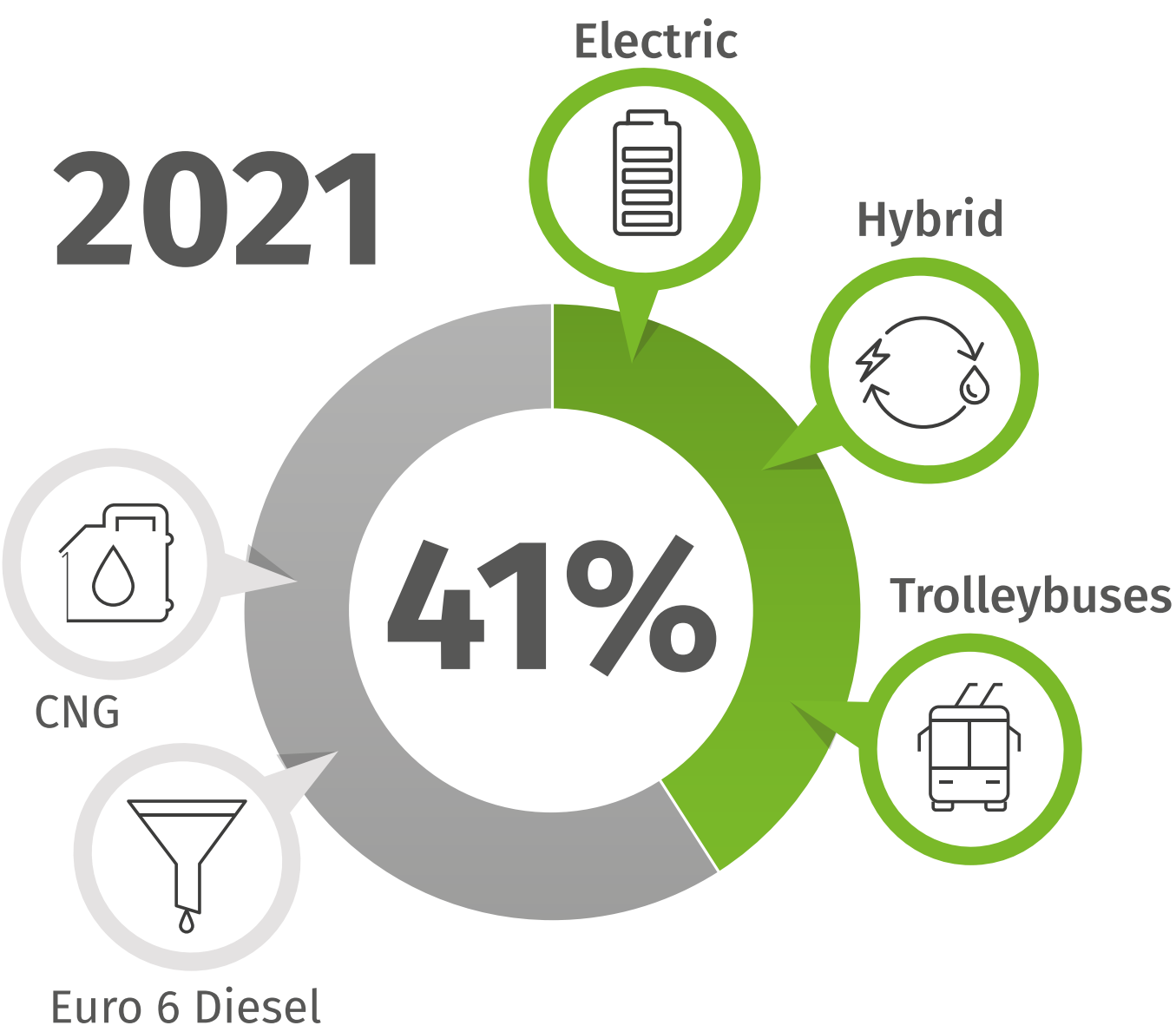
We are investing in green solutions for public transport.



In 2021, we sold a total of

1492 buses and trolleybuses,

41% featured environmentally-friendly alternative drives

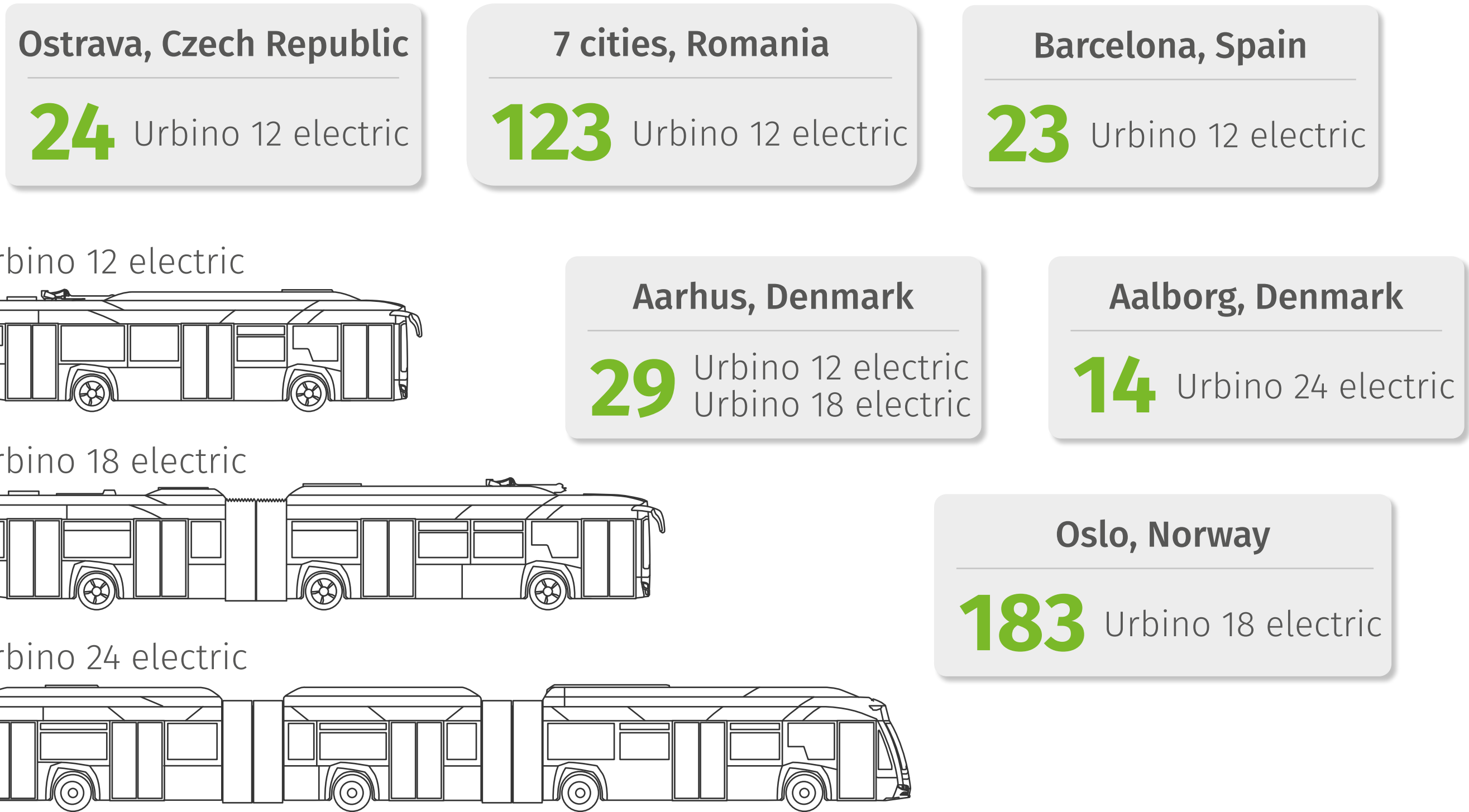


of the e-buses sold to European towns and cities are Solaris vehicles. **This is the biggest share among all producers.**

European market **share of 12%**

New orders for Solaris e-buses are currently being executed

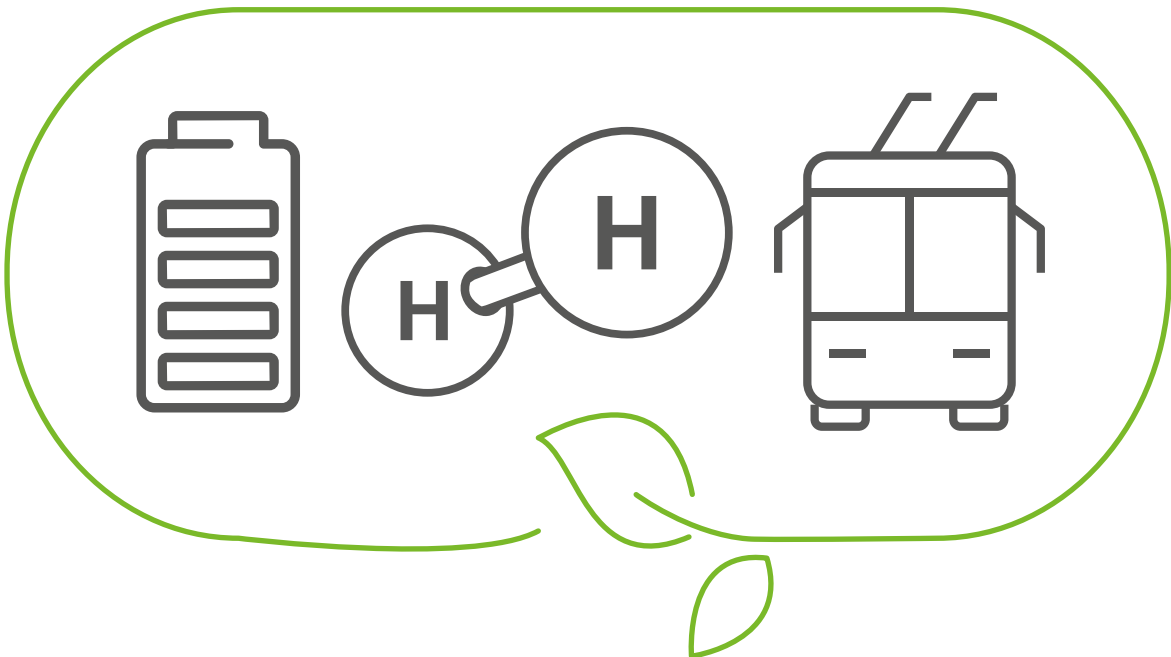
Biggest contracts for e-buses in 2021



E-mobility has many faces

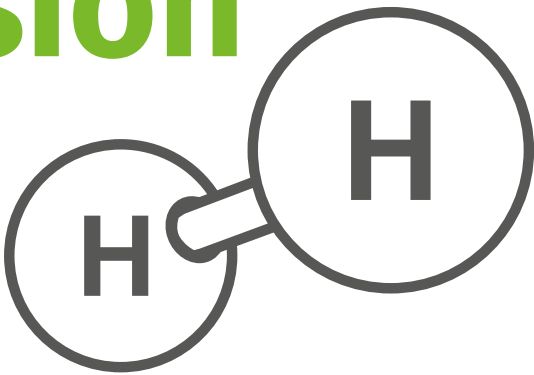
We are investing in various zero-emission technologies as we believe that responses to the challenges of green public transport should be as different as the towns and cities and their residents are.

All “electric” paths are right – electric buses, hydrogen buses and trolleybuses.



We delivered our first hydrogen buses in 2021

54 zero-emission hydrogen buses



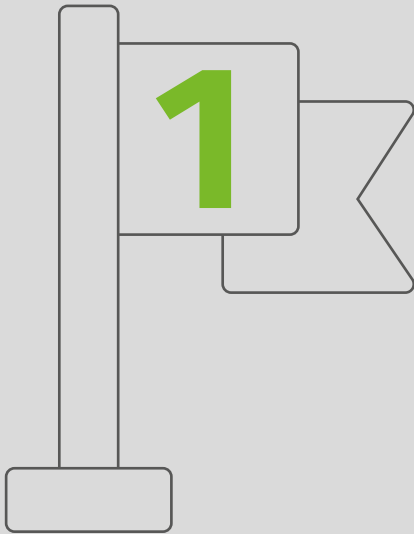
made their way to clients from Italy, Germany, the Netherlands and Sweden.

European Clean Hydrogen Alliance



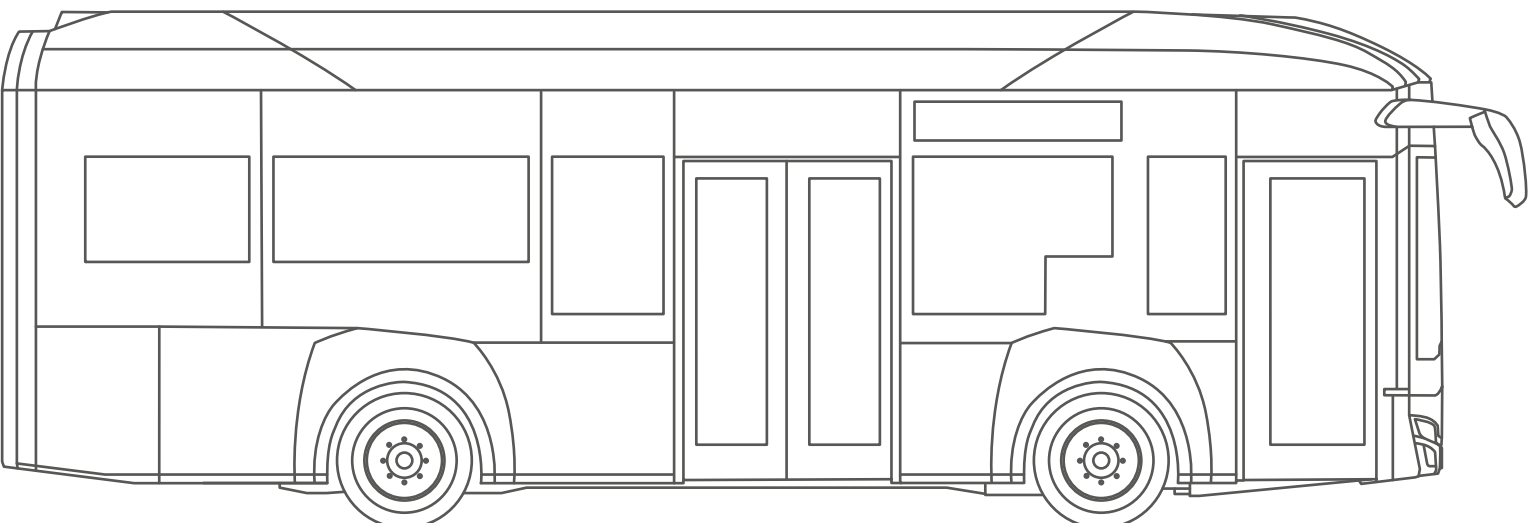
In 2021, we joined the **European Clean Hydrogen Alliance** to boost the development of this technology in Europe.

We are the largest European supplier of trolleybuses



In 2021, **119 Solaris Trollino trolleybuses** made their way to operators in Germany, France, Czech Republic, Romania, Poland and Hungary.

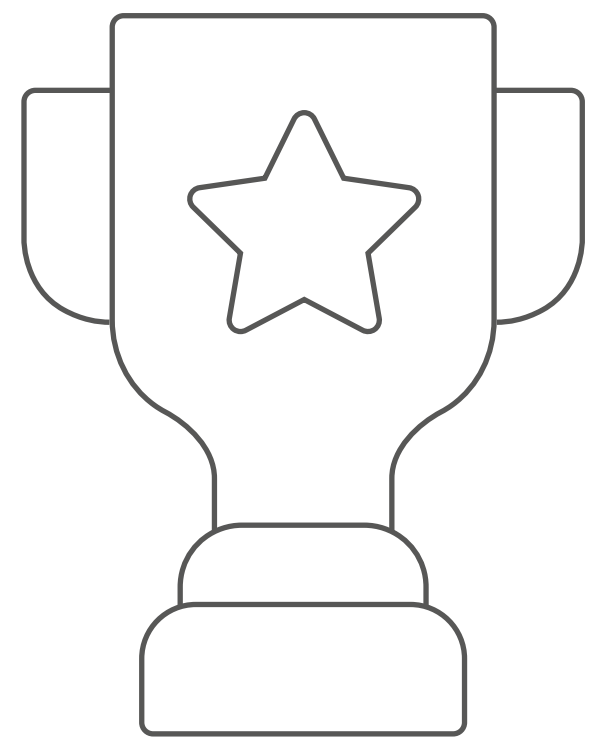
Urbino 9 LE electric **NOVELTY!**



2021 saw the launch of another electric intercity bus, i. e. the Urbino 9 LE electric bus. Since then, we have landed orders for **28 units** of this model.

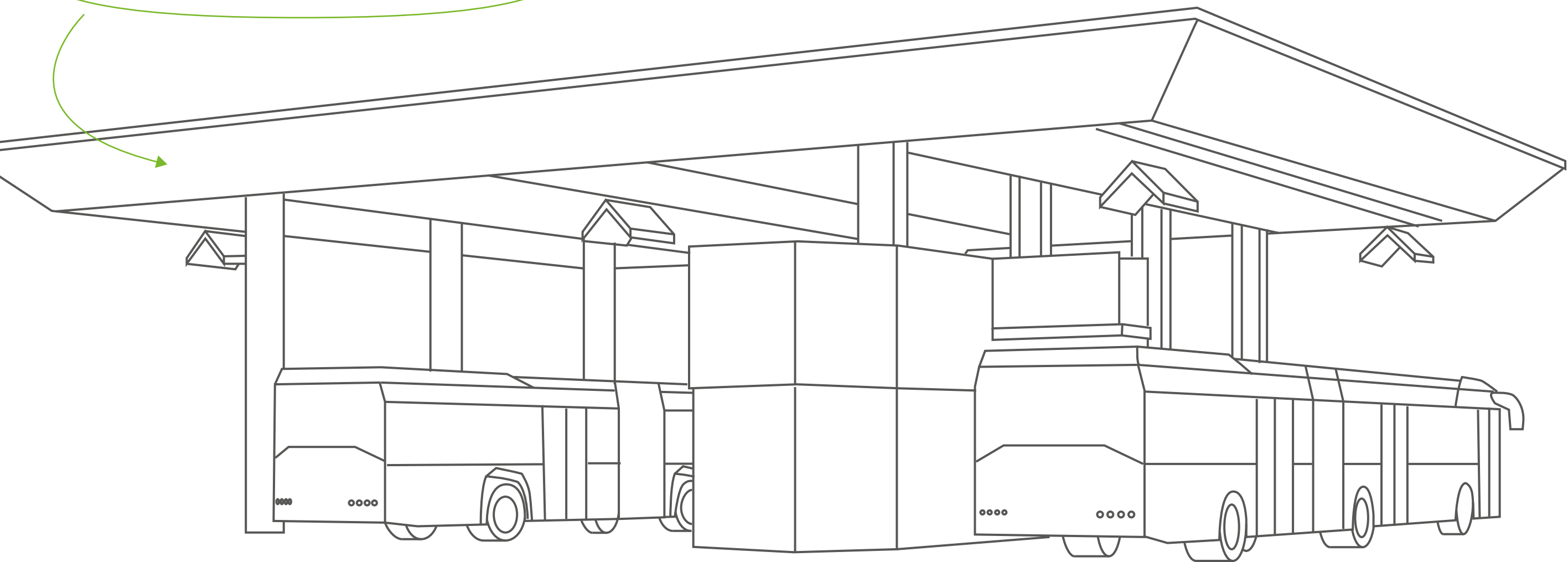
First Sustainability Report

Our Sustainability Report was awarded a prize for the best debut at the Sustainability Reports competition for “a report that contains a multitude of well-prepared information, with a clear layout, a concrete set of ESG actions and an interesting description of the company's role in the ‘zero-emission’ future”.



We invest in infrastructure development

- Own innovative Charging Park in Bolechowo
- New main warehouse in Bolechowo



Industry events

Transexpo trade fair 2021, Kielce

27-29.10.2021

We displayed:

- Urbino 9 LE electric bus,
 - Urbino 15 LE electric bus,
 - Urbino 12 hydrogen bus.
- ↳ (medal at the Targi Kielce Fair for the best product in the Bus category)

Czechbus, Prague

23-25.11.2021

We displayed:

- Urbino 12 hydrogen,
- Urbino 9 LE electric.

Tampere Local Public Transport Days, Finland

23-24.11.2021

We displayed:

- Urbino 15 LE electric.

#SolarisTalks

7.10.2021

Industry meetings focusing on swapping experiences and discussions about the future of urban mobility.



2000 electric buses later

Our company could not be prouder today. We have just signed a contract for our 2000th e-bus. Over the last few years, a profound e-mobility revolution has taken place before our very eyes. In 2021, every fourth newly registered bus in Western Europe was an electric bus!

2,000 zero-emission Urbino electric vehicles have been chosen by city carriers in over 140 cities in 21 European countries. More than 1,300 of these have already bolstered public transport, while the remaining 700 vehicles are currently being manufactured. Battery Urbino buses enhance modern, environmentally friendly transport in Berlin, Bolzano, Brussels, Cluj-Napoca, Cracow, Landshut, Madrid, Milan, Oslo, Paris, Venice... to name but a few. The odometer showing these electric kilometres cannot be stopped.

”

“We have been investing in e-mobility for a long time: we are designing new models of electric buses, developing electric drive technologies and supporting initiatives aimed at transitioning to zero-emission transport. From the very beginning we have emphasised that this is the right direction for the development of modern urban transport systems. Today, electric buses made by Solaris are part and parcel of the everyday life of residents in more than 100 European towns and cities, and this makes us extremely proud. We would like to thank you for each of these 2000 orders, and also thank our employees for the work they put into designing, manufacturing and servicing the vehicles.”

Javier Calleja,
CEO of Solaris Bus & Coach

”

Starting with the first cuts of steel profiles which initiate the welding process of a body frame, to insulating, assembling the bodywork, painting, fitting windows, installing electrical, hydraulic and pneumatic systems, mounting seats, equipping the bus with air-conditioning, doors, the driver's cab, and finally with the engine and batteries, followed by the starting-up process, the test drive, up to our meticulous quality control and the customer's acceptance – the entire manufacturing process of an electric bus is highly customised.

Solaris embarked on its zero-emission, battery-powered journey in 2011, when the first 8.9-metre Urbino electric bus was launched. The Urbino 12 electric bus has been offered since 2012. A year later, the articulated Urbino 18 electric was unveiled, and in 2020 the Urbino 15 LE electric followed, the first intercity bus in Solaris's electric range. In 2021, 10 years after the launch of its predecessor, our latest electric bus was presented to the public: the Urbino 9 LE electric. The manufacturer also landed its first ever order for bi-articulated Urbino 24 electric vehicles. Electric Solaris buses are state-of-the-art, boasting innovative safety systems and the latest battery types. Yet, the last word has not yet been spoken when it comes to Solaris's efforts to develop reliable and clean urban transport. In parallel to

these e-buses, our company has been strengthening its position as a manufacturer of hydrogen buses, by actively promoting and developing this cutting-edge technology.

Today, the company manufactures 1500 buses annually, with nearly half of these featuring electric drives. The share of alternative drives in the company's offering, which has been growing for several years, is a clear symbol of changes related to the transition to the zero-emission path by more and more towns and cities. A few years ago, only a few opted to electrify their municipal bus fleets. The vast majority of bus routes were operated by buses with conventional drives. In 2012, only 15 electric buses rolled out onto the streets of European cities. Just nine years later, in 2021, as many as 3282 new e-buses started regular service in towns and cities in Western Europe and Poland, with every tenth having been manufactured by Solaris. Last year, the share of e-buses in the number of newly registered buses in Western Europe and Poland amounted to 24.5%! This paradigm shift in the transport sector has become reality, and 2000 sold Solaris e-buses is perfect proof of this.







Hydrogen launch

So far, there has been only one bus model in Solaris's hydrogen-powered offering, the Solaris Urbino 12 hydrogen bus. Soon, this will change thanks to the 18-metre version of the Urbino hydrogen bus, which will be launched in September.

Solaris is constantly working to optimise its range. At the launch, announced for September, the manufacturer will unveil its 18-metre bus with hydrogen as the main power source. The vehicle will join the Urbino 12 hydrogen in the hydrogen offering of the bus maker.

As with the shorter bus version, at the heart of the bus sit cutting-edge fuel cells that act as a miniature hydrogen power plant on board the vehicle. Thanks to this technology, and an increased number of new, light hydrogen tanks, the bus will be able to cover long distances on a single refill.

The longer version of the Solaris hydrogen bus will also carry more passengers, in particular as regards the number seated.

These articulated vehicles, equipped with a hydrogen fuel cell, are nothing new in the Solaris offering. Manufactured for Hamburg in



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World launch

Solaris Urbino 18 hydrogen

#SolarisTalks

E-mobility conference

14 / 09 / 22

Watch it online at solarisbus.com

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2014, our 18.75 m electric Solaris Urbino buses featured a hydrogen range extender. First and foremost, the device was designed to increase the bus's range and functioned as a complement to the battery, which was the main energy source on board. This was also the case for the Solaris Trollino 18.75 trolleybuses which made their way to Riga in 2018-2019.

The articulated Solaris Urbino 18 hydrogen bus will be presented to the public for the first time on 14 September 2022. Deliveries, in turn, will be able to start in the second quarter of 2023. Taking into account clients' needs, the manufacturer has decided to unify this vehicle with other Solaris buses to the maximum extent possible. Clients will also have a possibility to customise the bus to individual preferences, e. g. the Urbino 18 hydrogen bus will be available with various door arrangements and, what is more, it will be equipped with numerous ADAS (Advanced Drivers Assistance Systems) solutions, i. e. automated assistance systems for the driver, including such features as MirrorEye and MobilEye Shield+.

With the new 18-metre hydrogen bus, the manufacturer is responding to the growing market interest in hydrogen technology. Undoubtedly, this has been stimulated by the continuously growing network of hydrogen refuelling stations around Europe, as well as by subsidies from the European Union to boost the development of zero-emission public transport.

As you may recall, the launch of the 12-metre version of the Solaris Urbino hydrogen took place in 2019. Since then, hydrogen buses have been delivered, among other places, to Bolzano in Italy, Cologne and Wuppertal in Germany, as well as to our clients in the Netherlands and in Sweden. 54 Urbino hydrogen units in total were sold last year. Nearly another 100 units have been ordered for this year. The new Urbino 18 hydrogen bus will most certainly satisfy the needs of carriers in the articulated hydrogen bus segment, and the company will soon be able to announce even more orders placed for this new zero-emission vehicle.

First deliveries of the Urbino 9 LE electric bus



There's good news for everyone wishing to change to the Urbino 9 LE electric bus! The youngest member of the zero-emission Solaris Urbino family will soon be in regular use in several European towns and cities. The first deliveries have already been made.

At the end of April 2022, the Solaris Urbino 9 LE electric bus received the Innovation Award in the category "Intercity Bus". The prize was awarded by the German magazine "busplaner", one of the leading opinion-forming trade magazines in Europe. This distinction, earned for its "intercity character," highlights even more clearly the versatility of this model. The possibility to type-approve the vehicle as class I and class II makes it perfectly suited to be delivered both to huge

and small urban centres. This low-entry vehicle is easy to customise and thus can be tailored to individual clients' needs.

Residents of Polish towns and cities will be among the first to benefit from the latest electric Solaris bus. A total of 9 Urbino 9 LE electric buses will make their way to the towns of Zawiercie, Cieszyn and Żyrardów in this summer. By the end of 2022 this group will be joined by the town of Bielsko Biała, which will receive two units. Public transport in towns with 30,000 to 40,000 inhabitants greatly facilitates commuting to work or school every day. Demand for public transport in such areas is quite unusual, as there is a need for buses running frequently on individual routes, however, with fewer passengers on board. Compact zero-emission Urbino buses will perform excellently in these conditions. All the more so because the spacious, widened interior will ensure a comfortable ride just as well on longer routes, e. g. from nearby smaller towns to a larger town or city.

The 9-metre electric Solaris bus is a versatile vehicle in all respects. Thanks to its compact dimensions it will perform excellently in cramped city spaces and on narrow streets amongst buildings. Thus, it will easily master the busy urban traffic in large conurbations.





Those who are planning to visit South Tyrol will have a good chance of visiting the city of Bolzano on a zero-emission Urbino 9 LE electric bus, just like those visiting Spanish Madrid and Barcelona.

The latest, highly manoeuvrable electric Solaris bus will cope excellently on steep climbs and tight mountain bends. A powerful motor and a relatively low weight allow it to go over hills smoothly. Therefore, it is an ideal means of transport for those living in mountainous areas. Our Austrian friends are of the same opinion. According to a framework agreement signed at the beginning of this year with Austrian carrier Österreichische Postbus AG, Solaris will supply them with up to 24 Urbino 9 LE electric vehicles by the end of 2025. The vehicles can be deployed across the whole country.

The Urbino 9 LE electric bus will allow zero-emission mobility to venture beyond just city centres. Through their actions, carriers from Italy, Austria, Spain and Poland are demonstrating that they are committed to the development of environmentally friendly public transport.



Zero-emission mobility...

on poles

Trolleybuses were the first Solaris vehicles to boast an electric drive. The experience the company gained during their manufacture has significantly contributed to the later e-mobility revolution. Trollino vehicles are quiet and generate no emissions, and our offering is constantly being expanded.

The first Solaris trolleybus was handed over to the city of Gdynia back in 2001. Since then, Solaris has supplied “the city of sea and dreams”, as Gdynia is often called, with nearly 100 trolleybuses. Today, the residents of this coastal city can take advantage of the most technologically advanced 12-metre and 18-metre Trollino vehicles, boasting capacious traction batteries. These vehicles combine functions typical for trolleybuses and e-buses and thus are able to drive effortlessly even without being connected to overhead wires.



Solaris's Trollino vehicles are operated on the streets of, among other cities, Riga, Ostrava, Rome, Bergen, Vilnius, Lublin and Tallinn. All in all, over 1800 vehicles of this type have been manufactured to date! After gaining some initial experience operating Solaris trolleybuses, numerous carriers, e. g. from Braşov, Milan and Budapest, have decided to order even more of these zero-emission vehicles.

Trolleybuses are a vital component of sustainable, modern and environmentally- and resident-friendly public transport. That is why Solaris is constantly expanding its range of models. Carriers may opt, among other models, for Trollino vehicles sporting the novel MetroStyle design or the bi-articulated 24-metre layout. What is more, super-trolleybuses that boast batteries similar to those in electric buses (in addition to the conventional trolleybus drive) are enjoying great popularity. Featuring traction batteries, Trollino vehicles can also drive without any external power supply. By pressing one single button the driver is able to switch from the overhead line to the traction battery mode.

In May this year, the local carrier in the Polish city of Tychy (TLT Tychy) put six such super-trolleybuses into operation. The vehicles are type-approved both as trolleybuses and electric buses. They can be recharged when driving via the overhead line and during a

stopover using a plug-in connector. Driving without a connection to the overhead wires is possible due to the In Motion Charging system. The remarkable 24-metre trolleybuses will, in turn, relieve passenger traffic in the capital of the Czech Republic. Operator Dopravní podnik hlavního města Prahy (DPP) has ordered 20 Trollino 24 vehicles. This model, which can carry 179 passengers at one time, is Solaris's response to increasing passenger capacities on the most heavily used routes in congested towns and cities.

Another capital with heavy passenger traffic is Bratislava. The fleet of the local carrier Dopravný Podnik Bratislava [DPB] will be expanded via the addition of 16 bi-articulated trolleybuses. Earlier, in 2020, operator DPB tested the 24-metre trolleybus in urban traffic, on all its routes. Due to year-on-year increases in passenger numbers, the carrier was faced with the need to increase passenger capacity on some of them. This capacious trolleybus has turned out to be a perfect solution for metropolises with increased passenger traffic.

Trollino is a family of low-floor trolleybuses that are extremely popular all over Europe. Their marginal environmental impact, tried and tested technology, lower infrastructure development costs, as well as a quiet and comfortable ride provide versatile possibilities for the deployment of trolleybuses, and Solaris's extensive offering allows tailor-made solutions to be provided to carriers.





Mild hybrid

A stop on the way to e-mobility

Hybrid buses are a noteworthy solution for carriers that plan to gradually forgo diesel vehicles. They offer a bunch of environmental and economic benefits while providing a considerable degree of flexibility at the same time. By closely monitoring the public transport sector's needs, a while ago Solaris expanded its range of low-emission vehicles via the addition of a new model: the Urbino mild hybrid bus.

Hybrid buses are nothing new in the Solaris offering. The first Urbino hybrid was displayed in 2006. Back then, Solaris was the first European producer to offer a serially produced bus with a hybrid drive. Their later generations have been part and parcel of the manufacturer's range to date.

However, the mild hybrid is a novel solution. The design of this vehicle resembles that of a typical hybrid, yet it features an electric machine with less power. Therefore, this is a more attractive proposition in terms of its cost-effectiveness, which allows the hybrid drive's benefits to be partly retained. Commonly known as a mild hybrid on the market, this solution marks a natural evolution of the energy recovery technology in buses - a technology that uses

energy generated during braking. Thanks to it, the vehicle releases fewer pollutants and is more environmentally friendly than required according to the restrictive EURO 6 emissions standards for diesel engines.

This is a response to the needs of operators and carriers offering public transport services when it comes to innovative urban transport vehicles which minimise the impact of such transport on the natural environment, while at the same time allowing them to generate savings and to reduce fuel consumption.

The system applied in the Urbino mild hybrid bus consists of an internal combustion engine supported by an electric machine working as a power generator. It takes the strain off the combustion engine, which results in fuel savings and lower exhaust emissions. The mild hybrid solution is based on energy recovery technology. It is used especially during two driving activities: acceleration and braking. In particular it is during regenerative braking that energy is recovered and stored in an energy storage device. It is then used when the engine is under greater strain, i. e. during acceleration. At that moment, the machine acts as an electric motor. As a result, mild hybrids release fewer pollutants and are more environmentally friendly.

The mild hybrid solution enjoys great popularity among our clients. Until now, Solaris has landed orders for almost 70 units in total. The most interesting contracts include 16 Urbino mild hybrids to be delivered to Hanau (Germany) and 29 units of this kind for Łódź (Poland).

The mild hybrid drive has enriched Solaris' existing portfolio when it comes to low-emission vehicles encompassing the Urbino hybrid and the Urbino CNG buses. These are low-emission vehicles that stand out on account of their great operability, and at the same time their economical operation. Although hybrid buses are no match for electric and hydrogen buses in certain key aspects, they are still an excellent bridge solution when it comes to the transition to fully zero-emission public transport. When, due to a variety of factors, full electrification of a fleet is not possible in a given town or city, mild hybrid buses come to the rescue.



A hydrogen-powered future

- new orders from Austria, Czech Republic and Germany

The green change in public transport is truly under way. More and more European carriers are opting for state-of-the-art solutions and purchasing zero-emission hydrogen buses.

Soon, the residents of Austrian towns and cities will see the benefits of hydrogen-powered journeys for themselves. Austria's biggest carrier, Österreichische Postbus AG, has signed another framework agreement with Solaris for, among other things, the delivery of up to 82 zero-emission Urbino 12 hydrogen buses. The order is to be fulfilled in the years 2022-2025 with an option to prolong this period until 2028. It is the largest contract for hydrogen-fuelled vehicles landed by Solaris so far.

However, this is far from the beginning of our hydrogen-based collaboration with Austria. A series of tests of the Urbino 12 hydrogen took place in May last year for the benefit of Austrian public transport

operators. A few months later, bus company Österreichische Postbus concluded a contract with Solaris for the supply of up to 40 hydrogen buses to Carinthia. The first five buses will make their way to Villach, a picturesque town in the mountains, as early as this autumn. The presence of the Urbino 12 hydrogen bus in South Austria is related to a broader strategy being implemented by the local authorities. The aim of the H2 Carinthia project, which is part of this strategy, is to create a model hydrogen region using hydrogen-derived energy in public transport and industry.

Hydrogen Solaris buses will also be seen rolling along the streets of the Czech town of Ústí nad Labem. The Urbino 12 hydrogen units, commissioned by carrier Dopravní podnik města Ústí nad Labem, will be the first Solaris hydrogen-fuelled buses in the Czech Republic. A framework agreement, signed at the end of 2021, stipulates a delivery of up to 20 units over the next 8 years.

The latest orders landed by Solaris for zero-emission hydrogen-fuelled buses have been placed by clients from Germany. By spring 2023, the regions of Glonn and Hofolding in Upper Bavaria will have received a total of 10 Urbino 12 hydrogen vehicles. Five units have been ordered by the carrier Busreisen Ettenhuber GmbH, and another 5 units will head to the bus company Martin Geldhauser GmbH & Co. KG. In July this year, the carrier RVK placed an order with Solaris Bus & Coach for 20 Urbino 12 hydrogen buses. After the deliveries have been completed, the city of Cologne will boast a fleet of 35 hydrogen Solaris buses in total. Thus, Cologne will boast the biggest fleet of hydrogen Solaris buses in Europe.





The Urbino 12 hydrogen bus is the most technologically-advanced vehicle made by Solaris. Thanks to the technology featured in it, it can cover around 350 km on a single refill, regardless of weather and road conditions. So far, Solaris has delivered as many as 60 units of this vehicle type, and another 70 buses are to be manufactured and supplied in 2022-2024. In September 2022, the hydrogen-powered offering of the manufacturer will be extended by the addition of an articulated Urbino 18 hydrogen bus (more on page 16).

Investments in hydrogen-fuelled vehicles are becoming increasingly popular in other European countries, too. This is the result of the strategy of the European Union, which has opted for hydrogen as the main means to achieve climate neutrality. In addition to investing in research to develop the technology and subsidising solutions involving the use of hydrogen fuel, the regulation establishing the European Partnership for Clean Hydrogen (2021) contains indicators for reducing the costs of producing pure hydrogen to as little as €1.5-3 per kg, and of distribution, to less than €1 per kg. Hence, the coming years look very optimistic for all European cities that are planning to develop zero-emission urban transport based on this fuel of the future.

In 2021, Solaris delivered nearly 400 zero-emission (electric and hydrogen-fuelled buses) to its clients. Considering the cumulative numbers for the years 2012-2021, Solaris is currently Europe's largest supplier of zero-emission city buses.

Milan opts for clean air

The largest city in northern Italy has pledged to become an agglomeration with a zero-emission public transport system within less than a decade. It is also with the contribution of Solaris that Milan, for a few years now, has been consistently implementing its strategy to transform ATM's whole fleet to a zero-emission one by the end of 2030.

Clean air and no tiresome noise on the streets is a vision that the second largest Italian city, Milan, is striving to bring about. A new Low Emission Zone was established there in 2019. As part of endeavours to reduce traffic jams and air pollution, the city has restricted access by diesel vehicles to an even greater extent. Low-Emission Area B covers about 75% of the whole metropolitan area,





inhabited by 97.6% of Milan’s residents, i. e. almost 1.4 million people. The emissions standards that vehicles must meet to enter this zone will progressively increase. The transformation is to culminate in 2030, by which time all diesel vehicles will be banned. In line with projections, over the next few years the PM10 and NOx emission levels in Milan will be slashed by more than 50% and air quality in the city will improve considerably.

Solaris has been actively participating in the transformation of Milan’s fleet over the last few years. Since 2014, the manufacturer has delivered 320 vehicles to the city, including 165 electric buses and 30 trolleybuses. The effectiveness of the electrification process in Milan deserves special recognition. The Urbino electric and Trollino vehicles, plying the streets in the capital of Lombardy, account for over half of the zero-emission Solaris vehicles delivered to the Italian market. The very first Solaris buses made it to Milan in 2018. A year later, they were joined by the first Trollino vehicles. One milestone was the launch of a huge tender for the supply of up to 250 e-buses to Milanese operator ATM, which is still one of the biggest tenders won by Solaris to date. What is more, one of the 140 buses delivered as part of this contract so far was the thousandth Urbino electric bus manufactured by the bus maker.

Milan is not giving up in its efforts to create a pollution- and noise-free



future for public transport. At the beginning of 2022, the City Council of Milan decided to earmark further funds for the renewal of the fleet of the local public transport operator ATM Milano. Along with the funds granted earlier, almost €450m have been allocated for the development of sustainable mobility so far. Over the next four years, these funds will allow another 350 zero-emission public transport vehicles to be purchased. Thanks to this, over 500 out of the 1200 vehicles in ATM's fleet will be zero-emission by 2026. What is more, all buses in Milan are to be electric by 2030!

Solaris is actively supporting the attaining of these ambitious objectives. In mid-November 2021, the carrier signed a contract with the manufacturer for the supply of 50 18-metre trolleybuses, and in April 2022 it opted for the purchase of another 75 Solaris e-buses. The newly commissioned vehicles will hit the streets of Milan in the second half of 2022. By then, 320 zero-emission Solaris buses in total will be cruising the streets of this Italian city.



Testing e-mobility

Solaris has consistently, for years, been a leader among European manufacturers of public transport vehicles. The company has secured itself this unique position in the market due to its constant development and continuous extension of its product range via the addition of new zero-emission buses. The company's clients are able to acquaint themselves with the range of Solaris buses before making any purchase plans. To a large extent this is possible thanks to our large fleet of demo buses.

The transition to sustainable transport has been a guiding idea for Solaris for decades. We want to promote the idea of clean, safe and modern public transport among public transport operators in European towns and cities as well as among their residents and drivers. The company's clients can learn what kind of benefits the shift towards e-mobility may bring towns and cities by testing demo buses. Positive experiences operating electric or hydrogen buses, promising operability parameters, quiet and smooth engine operation, but, above all, satisfaction of drivers and passengers - are the best recommendations for e-mobility.

Solaris's clients eagerly try out the functionalities of buses before purchasing them. They can discover new vehicles from the company's offering, get to know their potential and the cutting-edge technologies

applied in them, both via the demonstration and trials in urban traffic. In the latter case, the demo buses become part of the transporting system of the carriers, and are tested in real conditions, taking into account the specifics of a given location and individual needs.

In 2021 alone, a few dozen demonstrations of Solaris e-buses took place in a dozen or so European countries.

The Urbino hydrogen tour in Poland

At the beginning of 2021, a series of demonstrations of the Solaris Urbino 12 hydrogen bus was organised in Poland. Starting on 27 January 2021, representatives of public transport operators and authorities from Jaworzno, Cracow, Konin, Włocławek and Poznań were able to gain an insight into the possibilities offered by this hydrogen vehicle and go for a test drive. All these towns and cities have always been at the forefront when it comes to the implementation of zero-emission solutions in their bus fleets.



Hydrogen Carinthia

Our hydrogen-fuelled demo bus also had its day in the picturesque city of Villach, in south-east Austria, thanks to the H2 Carinthia project which aims to direct the development of this Austrian region towards the use of hydrogen energy in the transport sector. The demonstration that took place on 20-21 May 2021 allowed us to show representatives of the local authorities and transport operators all

the assets of the Solaris hydrogen bus and benefits arising from the use of vehicles applying hydrogen technology. The event in Villach inaugurated a series of trials of the hydrogen vehicle in Austria that lasted until the end of May.



The Urbino 15 LE electric bus in Scandinavia

Moving on to northern Europe, it is worth mentioning tests of the zero-emission Urbino 15 LE electric bus. This possibility was offered to carriers and residents of the cities of Oslo and Kristiansand. Thanks to the tests which took place on regular bus routes with the participation of passengers, they were able to see the advantages of the vehicle operating in city traffic for themselves. The Solaris Urbino 15 LE electric bus performs excellently both on city and intercity routes. For good measure, it easily mastered the extreme Scandinavian conditions, providing carriers and passengers with comfort and safety.



An impressive bi-articulated vehicle

The Solaris range includes also a Metrostyle vehicle. Its unique design is a response to the needs of the public transport market when it comes to BRT routes (Bus Rapid Transit). It was exactly this vehicle that was trialled by TLT Tallinn, the largest public transport operator in Estonia, at the end of last year. TLT particularly appreciated its unusual passenger capacity. One Trollino 24 vehicle can fit up to 200 passengers. What is more, it doesn't require any advanced charging infrastructure. The vehicle features batteries that are charged using overhead wires, which allows for great freedom of operation.



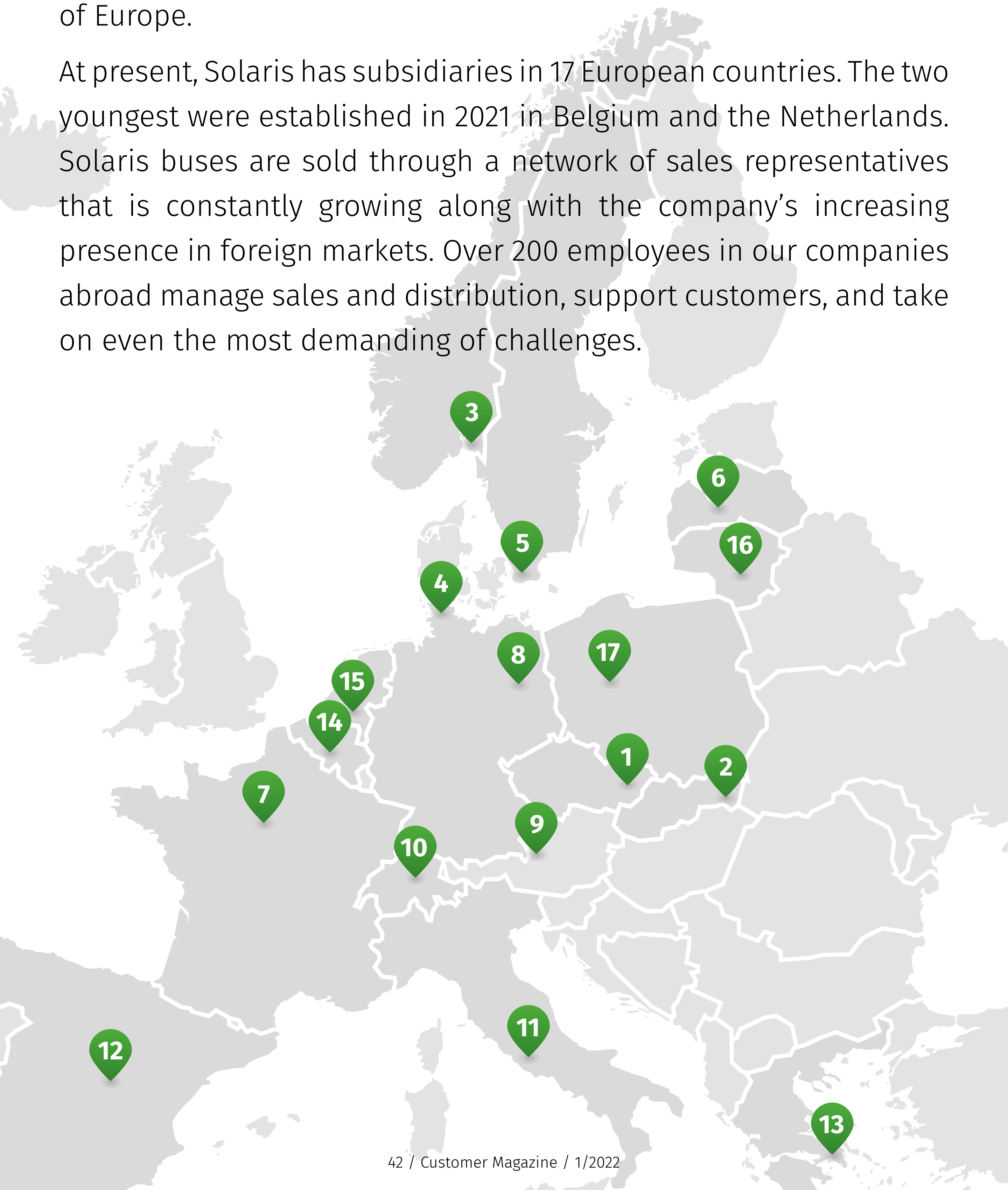
The favourite one – the Solaris Urbino 12 electric

As for tests in Poland, it was the Solaris Urbino 12 electric that enjoyed the most popularity. The 12-metre electric bus performs outstandingly both in large and small towns and cities. Last year, this model was tested by almost 20 clients from various corners of Poland. Its parameters and technologies were demonstrated, for example, for carriers in the towns of Czechowice-Dziedzice, Wieliczka, Giżycko, Opoczno and Stalowa Wola.

International presence

The heart of our company beats in Poland, where all Solaris buses are developed, from concept to design and finally to the manufacturing phase. However, a successful and well-oiled sales and service network located Europe-wide would not be possible without support, on site, in individual countries. Our international network of subsidiaries is enabling us to transform the image of public transport in nearly all of Europe.

At present, Solaris has subsidiaries in 17 European countries. The two youngest were established in 2021 in Belgium and the Netherlands. Solaris buses are sold through a network of sales representatives that is constantly growing along with the company's increasing presence in foreign markets. Over 200 employees in our companies abroad manage sales and distribution, support customers, and take on even the most demanding of challenges.



<div> <div>1. Solaris Czech spol. s r.o.</div> <div>Czech Republic, Ostrava</div> </div> <hr/> <div> <div>Managing Director</div> <div>Roman Zdráhal</div> </div> <div> <div>Additional Info</div> <div>20th anniversary in 2021</div> </div>	<div> <div>2. Solaris Slovakia s.r.o.</div> <div>Slovakia, Košice</div> </div> <hr/> <div> <div>Managing Director</div> <div>Ing. Lubomír Melichar</div> </div>	<div> <div>3. Solaris Norge AS</div> <div>Norway, Oslo</div> </div> <hr/> <div> <div>Managing Director</div> <div>Sverre Skaar</div> </div>
<div> <div>4. Solaris Denmark Bus A/S</div> <div>Denmark, Padborg</div> </div> <hr/> <div> <div>Managing Director</div> <div>Vagn Erik Hvid</div> </div>	<div> <div>5. Solaris Sverige AB</div> <div>Sweden, Malmö</div> </div> <hr/> <div> <div>Managing Director</div> <div>Robert Schneider</div> </div> <div> <div>Additional Info</div> <div>new CEO</div> </div>	<div> <div>6. Solaris Bus & Coach Latvia SIA</div> <div>Latvia, Riga</div> </div> <hr/> <div> <div>Managing Director</div> <div>Rolands Katkevics</div> </div>
<div> <div>7. Solaris France SARL</div> <div>France, Ennery</div> </div> <hr/> <div> <div>Managing Director</div> <div>Olivier Michard</div> </div> <div> <div>Additional Info</div> <div>new CEO</div> </div>	<div> <div>8. Solaris Deutschland GmbH</div> <div>Germany, Berlin</div> </div> <hr/> <div> <div>Managing Director</div> <div>Christian Goll</div> </div>	<div> <div>9. Solaris Austria GmbH</div> <div>Austria, Salzburg</div> </div> <hr/> <div> <div>Managing Director</div> <div>Anna Mejer</div> </div>
<div> <div>10. Solaris Schweiz GmbH</div> <div>Switzerland, Villmergen</div> </div> <hr/> <div> <div>Managing Director</div> <div>Stefan Siegfried</div> </div>	<div> <div>11. Solaris Italia S.R.L.</div> <div>Italy, Rome</div> </div> <hr/> <div> <div>Managing Director</div> <div>Alberto Fiore</div> </div>	<div> <div>12. Solaris Bus Ibérica, S.L</div> <div>Spain, Madrid</div> </div> <hr/> <div> <div>Managing Director</div> <div>Kepa Mendikute</div> </div>
<div> <div>13. Solaris Hellas S.A</div> <div>Greece, Athens</div> </div> <hr/> <div> <div>Managing Director</div> <div>Theodore Hadjipanayotou</div> </div>	<div> <div>14. Solaris Netherlands BV</div> <div>Netherlands, Riethoven</div> </div> <hr/> <div> <div>Managing Director</div> <div>Wil Willems</div> </div> <div> <div>Additional Info</div> <div>the youngest subsidiary</div> </div>	<div> <div>15. Solaris Belgium SARL</div> <div>Belgium, Brussels</div> </div> <hr/> <div> <div>Managing Director</div> <div>Marek Krawiec</div> </div> <div> <div>Additional Info</div> <div>the youngest subsidiary</div> </div>
<div> <div>16. Solaris LT</div> <div>Lithuania, Kaunas</div> </div> <hr/> <div> <div>Managing Director</div> <div>Donatas Mačiulis</div> </div>	<div> <div>17. Solaris Bus & Coach sp. z.o.o.</div> <div>Poland, Bolechowo</div> </div> <hr/> <div> <div>Managing Director</div> <div>Andrzej Sienkiewicz</div> </div> <div> <div>Additional Info</div> <div>HEADQUARTERS</div> </div>	



The hydrogen industry is already prepared to play its key role

We talk to Jorgo Chatzimarkakis, CEO of Hydrogen Europe, about the European hydrogen landscape, the technological challenges of the fuel of the future, and how to effectively address them.

Solaris Customer Magazine: What is Hydrogen Europe about?

Jorgo Chatzimarkakis: Hydrogen Europe is a trade association that aims to accelerate the development of the European hydrogen industry and thus propel global carbon neutrality. Our members are like-minded European organisations who support the delivery of hydrogen and fuel cells technologies. We do this to enable the adoption of abundant and reliable energy which efficiently fuels Europe’s low carbon economy.

SCM: Could you tell us briefly about the strategic aims of your organization?

JCh: Hydrogen has a strong potential to become an agent of climate mitigation and help decarbonise almost every sector of economy: heavy industry, transport, buildings, and energy. Our objective is to make sure that the European hydrogen industry delivers on the EU’s energy transition and its ambitious carbon neutrality goals in all these sectors.

SCM: What needs to happen to achieve this goal?

JCh: It is crucial that the energy transition is accomplished with as much industry endorsement and public support as possible. To this end, the aim of Hydrogen Europe is to foster dialogue and cooperation with all stakeholders: policy makers in Brussels and across the EU, industries, civil society, media, but also our peers within the hydrogen sector. Only by speaking to each other, will we be able to develop a robust hydrogen industry for the benefit of the EU and its citizens.

SCM: How does it look today?

JCh: Hydrogen saw an unprecedented development in 2020. From an innovative niche technology, it is fast becoming a systemic element

in the European Union's efforts to transition to a climate neutral society by 2050. This was proved by the publication of the EU Hydrogen Strategy in 2020 and a set of legislative proposals laid out in the Fit for 55 Package in 2021. At the end of 2021, the European Commission published its Hydrogen and Decarbonised Gas Market Package. The mere fact that this file contains hydrogen in its name is a recognition of its potential.

SCM: What are the main challenges for hydrogen technologies?

JCh: Today, hydrogen represents a modest fraction of the global and EU energy mix and is still largely produced from fossil fuels. For hydrogen and hydrogen technologies to contribute to climate neutrality, it needs to achieve a far larger scale and its production must become fully decarbonised.

As the EU institutions further shape these initiatives, they should bear in mind one factor: no initiative must create regulatory barriers to the creation of a net-zero economy.

SCM: How can we overcome these barriers effectively?

JCh: With an appropriate hydrogen framework in place, 1 million tons of clean hydrogen per year can be produced and at least 6GW of electrolyser capacity will have been installed by 2025 already.

Significantly higher volumes can be achieved with the development of the hydrogen market, which will include blending with natural gas, building hydrogen valleys and stimulating hydrogen production. By 2050, a mature and deep hydrogen market will be in place ensuring a fully decarbonised economy.

SCM: What can accelerate the development of hydrogen as part of the energy mix?

JCh: Along with ramping up hydrogen production, the EU should build on existing assets, such as an extensive infrastructure. Its 20,000 km of well-developed gas grid can be converted to accommodate hydrogen at a minimal cost. Additionally, offshore pipelines and depleted oil and gas fields can be used on the one hand to transport renewable hydrogen produced directly offshore and, on the other hand, to store hydrogen.

The hydrogen industry is ready to do its part, but the EU decision-makers have to begin putting into place a concrete and fit for purpose framework for the development of a clean hydrogen economy.

SCM: It seems that hydrogen has become or might become a more popular source of energy not only in public transport but also in other industrial applications.



JCh: Hydrogen will play a role in all applications, especially in sectors that cannot be easily electrified, such as heavy-duty, air and maritime transport. The transport sector is likely to be the biggest user of hydrogen in 2050, with more than 50 million tonnes used either directly in fuel cells, or as part of synthetic fuels.

Keeping and developing European industrial leadership in these sectors will be crucial to maintaining jobs and generating growth in Europe.

SCM: What is the main focus for Hydrogen Europe at the moment to accelerate hydrogen technologies and deploy them on a large scale?

JCh: At Hydrogen Europe, we are working on making sure regulatory policies at the European level are favourable to the development of hydrogen mobility, such as the Energy Taxation Directive or the Taxonomy Regulation.

Investment in the use of clean hydrogen as a fuel is a crucial driver to ensure the competitiveness of clean hydrogen in gaseous or liquid form to decarbonise the mobility sector. Hydrogen Europe's team is in close touch with European stakeholders to develop EU standards and regulations that are required to support the use of clean hydrogen and hydrogen-based fuels, including an ambitious review of the Renewable Energy Directive.

SCM: We mainly talk about the future. But what is the situation today?

JCh: Hydrogen ambitions are already reflected in a number of national and regional hydrogen plans. For example, France plans to have up to 50,000 light-duty vehicles and up to 2,000 heavy-duty vehicles on its roads by 2028. The Dutch strategy forecasts a 300,000 light-duty

hydrogen vehicles fleet as well as a minimum blending rate of 14% of sustainable aviation fuel (SAF) by 2030. The German region of North-Rhine-Westphalia foresees about 500 buses by 2025.

We already see the change happening: the world's first passenger train powered by a hydrogen fuel cell is already in commercial operation in Austria and Germany, further tests are being conducted on French and Swedish railways. The world's first zero-emission hydrogen-electric passenger train commercial operation is slated for 2024. At the recent COP26 summit in Glasgow, hydrogen buses took participants to the key conference sites.

SCM: What would be your main message to those Public Transport Authorities which consider hydrogen as the potential fuel of the future but are not yet convinced if this is the right direction?

JCh: All of this is to say that technology is rapidly becoming an end users' favourite to decarbonize public transport operations; public transport operators are commissioning, or have already commissioned, hydrogen-powered city buses and related hydrogen refuelling stations.

Long-distance bus and coach operators can rely on the implementation of the Alternative Fuels Infrastructure Regulation, which mandates targets for hydrogen refuelling stations on the TEN-T networks and in urban nodes. Hydrogen Europe very much supports this approach, as binding geographical targets for road transport refuelling is an essential means of showing public confidence for the hydrogen road mobility.

The technology is becoming both cheaper and more efficient, and the higher the demand, the faster the transition to zero-emission public transport will be.

This is yet another proof that the time to bet on hydrogen is now.



Solaris buses **now with EPDs!**

Solaris has obtained the Environmental Product Declarations (EPD) for its two bus models, the Solaris Urbino 18 electric and the Solaris Urbino 12 hybrid.

An Environmental Product Declaration is an international eco-label that provides clients with solid data on the whole life-cycle environmental impact of a given product.

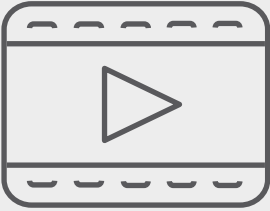
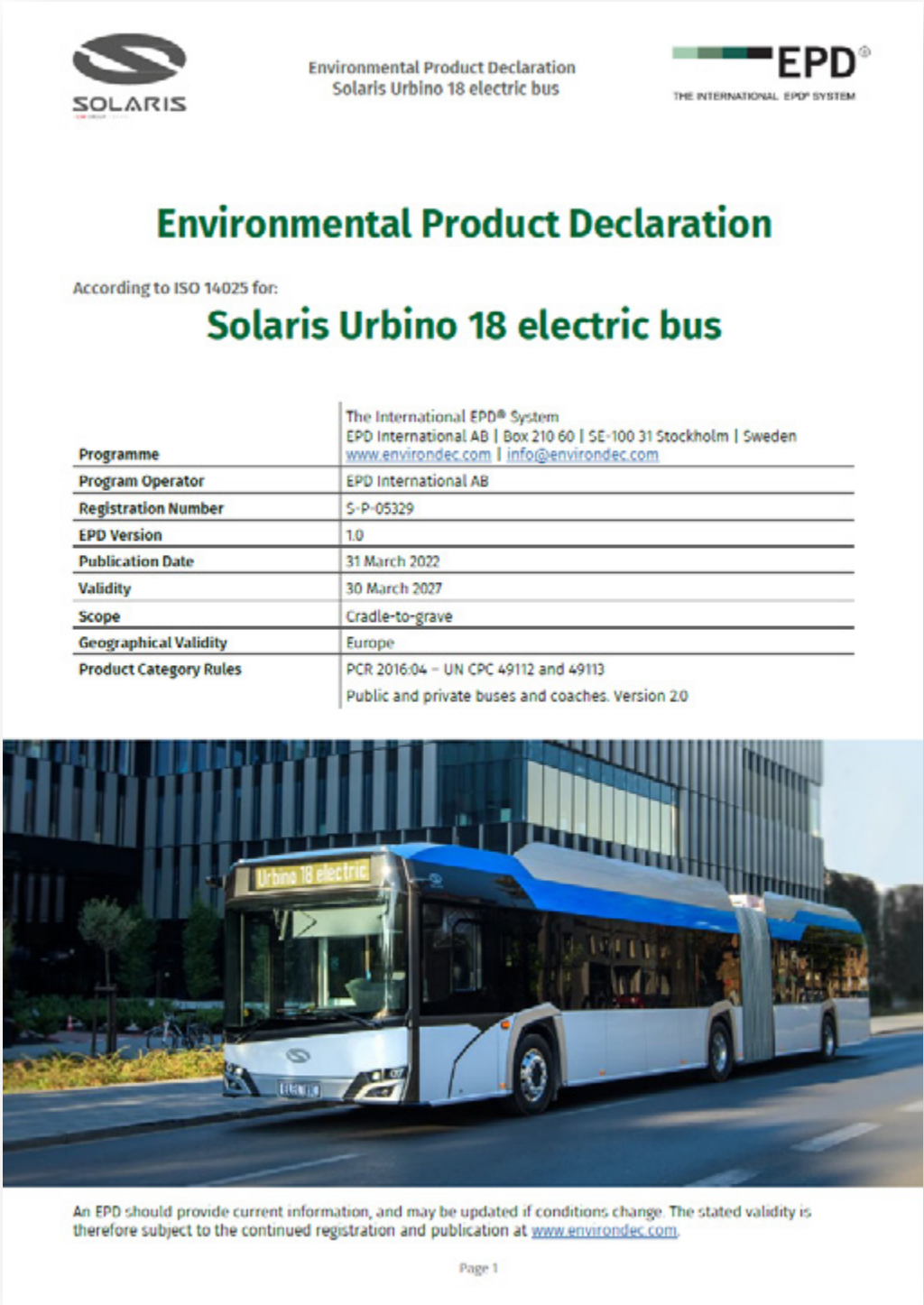
EPDs are a recognised and reliable source of information on the environmental profile of products. They are drawn up on the basis of an LCA (Life Cycle Assessment) study. The environmental impact assessment process takes into account all stages of the product's life cycle: from the extraction and transportation of raw materials, through the production of components and the bus, and the transport of the finished product to the customer, to the operation, maintenance and disposal of the bus at the end of its life cycle.

Thanks to the detailed LCA calculations, manufacturers acquire a lot of vital information on the environmental impact of their product throughout its entire life cycle. On the basis of this data, they can identify areas in their value chains where there is still potential for minimising negative environmental impacts. LCA calculations show, for instance, how crucial the place where e-vehicles are operated is for assessing their ecological profile. The same e-bus operated in

Sweden or France leaves a much lower environmental footprint, due to the energy mix in these countries, than, for example, in Poland. In the global EPD database it is possible to check the products of various manufacturers from many industries.

“EPDs confirm the manufacturer’s commitment to measuring and reducing the environmental impact of their products and allow them to report this impact in a very transparent way. This allows our end customers, i.e. public transport operators, to be guided, when making their purchasing decisions, not only by the price, the vehicle’s technical parameters or warranty and servicing conditions, but also by the impact of the product on the natural environment. Thus, the Environmental Product Declaration supports informed environmental choices and motivates manufacturers to manage their supply chains and production processes in an even more responsible way”.

Javier Calleja,
CEO of Solaris Bus & Coach



[EPDs are publicly available here \[LINK\]](#)



Towards sustainable mobility

The idea of sustainable development has guided Solaris from its very beginning. It is not only an inherent part of our daily tasks, but also the basis for Solaris' greatest aspiration: to change the image of public transport.

While implementing this idea, we have been engaging in a number of real activities such as developing new technologies, implementing innovations and initiating projects aimed at fostering the green transformation in public transport and reducing the impact of the company and its key suppliers on the environment. We know that stepping up actions geared towards sustainable mobility is also one of the priorities of the European Green Deal, and its implementation is bringing us closer to reaching climate neutrality for Europe by 2050.



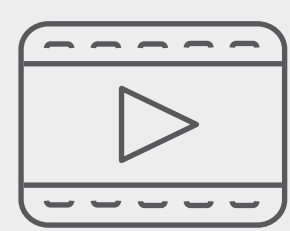
We manufacture state-of-the-art vehicles equipped with low- and zero-emission drives and continuously develop innovative solutions for sustainable public transport. In 2021 alone, we initiated numerous projects to help accomplish related objectives. The most interesting ones include:

- **Drawing up of a REACH Certificate of Compliance.** As part of this initiative, and in collaboration with our suppliers, we gathered data on the presence of substances of very high concern (SVHC) in components used in our vehicles.
- **Conducting an assessment of an electric and a hybrid vehicle's impact on the natural environment (Life Cycle Assessment, LCA) and securing an Environmental Product Declaration (EPD).**
- **Initiating an air quality assessment of the bus interior related to the emissions of volatile organic compounds.**

In order to efficiently implement new initiatives and attain our objectives, the ESG Department was established within Solaris's organisational structure. The Department is in charge of ensuring compliance with all environmental, social and governance standards.

Its objective is to implement sustainable development activities throughout the life cycle of our vehicles. The responsibilities of the department include, among other things, assessing the supply chain and liaising with suppliers, monitoring working, production and raw material sourcing conditions, as well as ensuring good relations with local communities.

We report our impact on the external environment in accordance with the international GRI (Global Reporting Initiative) standard which enables companies worldwide to report their impact on the environment in a transparent, comparable and structured way. Following the guidelines of the standard, our company analyses data on ESG issues and presents it in a comprehensive manner in the form of an annual sustainability report. On the basis of the gathered data, we then define specific objectives that allow us to devise the right strategy for the years to come.



[Solaris’s Sustainability Report for 2020 is available here \[LINK\].](#)





Virtual-FCS

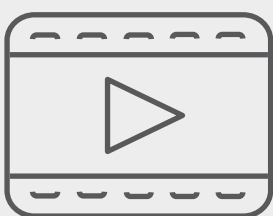
How can you make the process of designing hybrid fuel cell and battery systems easier, cheaper and faster? This is the main task faced by the participants in the consortium implementing the Virtual-FCS project.

Fuel cells have a wide variety of applications in the transport sector, ranging from hydrogen-powered drones to ocean-going vessels and large-scale power production. However, as an advanced technology, fuel cells require specialised knowledge to integrate into existing devices and systems. For companies without any experience in fuel cell technologies, this may constitute a huge obstacle that prevents such activities from being undertaken. The Virtual-FCS project has

been developed to address these needs, and thus it is accelerating the market deployment of environmentally friendly fuel cell technology. The project brings together stakeholders operating in the area of hydrogen and battery technologies. The main objective of the initiative is to support the development, optimisation and design of hybrid hydrogen fuel cell and battery systems for various applications. The project is coordinated by SINTEF AS (Norway) and includes the following partners: Solaris Bus & Coach (Poland), Banke ApS (Denmark), Universite Bourgogne Fanche - Comte/FC Lab (France), Ballard Power Systems Europe AS (Denmark), Westcon Power and Automation AS (Norway) and Vivarail Ltd. (UK).

As a result of the project's activities, the participants are striving to allow for better hybridisation and control strategies for every application of fuel cells. The aim is also to accurately predict the lifetime, reliability, and performance of fuel cell systems with battery systems, which, in turn, is intended to reduce costs. In the longer term, it is planned to continuously develop and widely adopt a toolkit, which comprises a software and hardware platform. This tool is intended to be free of charge and entirely open-source, allowing everybody to benefit from modules for designing and optimising fuel cell power systems for a diverse array of applications. The Virtual-FCS library is available to download on GitHub and can be used together with the free modelling environment OpenModelica. Tutorials for this tool can be found on YouTube.

The Virtual-FCS project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (now the Clean Hydrogen Partnership) as part of Grant Agreement No. 875087. This Joint Undertaking receives support from the EU's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe Research.



[More information about the project can be found here \[LINK\]](#)



Fot. Kiepe Electric

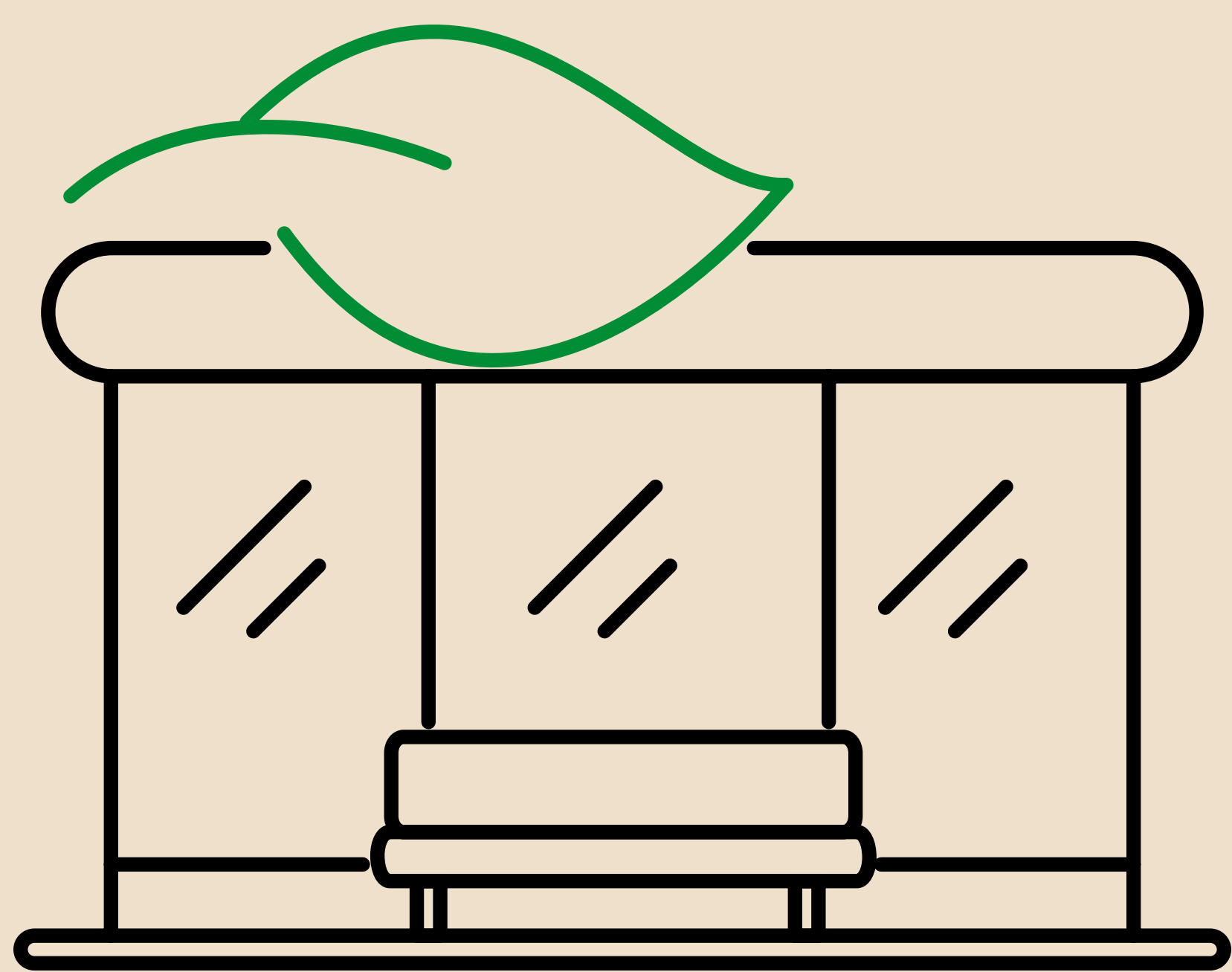
Autonomous Trollino

Solaris is taking part in a research and development project in Milan that involves testing innovative solutions that support assisted driving in a Solaris Trollino 18 trolleybus.

The Technical University of Milan (Politecnico di Milano), the municipality of Milan, and the local carrier ATM are implementing an innovative project called Tech Bus, carried out as part of the Joint Research Lab for the Urban Mobile (JRL) programme. The project aims to create a green and smart city that is resident-friendly. As the first steps towards implementing autonomous transport on the streets of Milan, the Solaris Trollino 18, a vehicle from the ATM fleet, is being tested on trolleybus route 90/91.

The first project phase focuses on three aspects: the priority of traffic lights, management of crossroads and information on road traffic, as well as bus stop monitoring. By providing the driver with information on the status of traffic lights along the bus route and recommending an appropriate speed, the vehicle may adjust its speed to follow a green wave of traffic lights. The development of a dynamic traffic light control system based on the 5G network is also envisaged. This would allow public transport to be treated as priority, e.g. during peak hours or in the event of a delay in the schedule. The continuous exchange of information between the vehicle on the route and the traffic lights and road infrastructure is possible due to on-board smart sensors that use V2I (Vehicle to Infrastructure) communication. Algorithms processing camera images and data gathered in real time make it possible to inform the driver of obstacles along the route and even of the presence of people approaching the next pedestrian crossing. Technology installed at bus shelters is designed to send information to the vehicle, e. g. the number of passengers waiting at a given bus stop, data on whether the area around the bus stop is fully accessible or the flow of passengers getting on and off the vehicle.

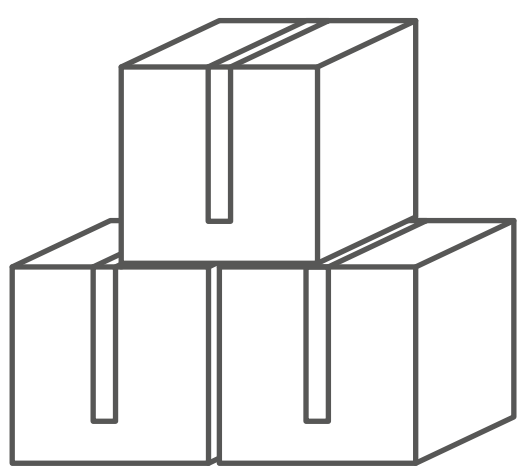
In addition to Solaris and the Milanese institutions mentioned above, the project also involves the following firms and institutions: IBM, Vodafone, the Foundation of the Technical University of Milan, the Milan Chamber of Commerce, Brembo, Enel X, Pirelli and ST Microelectronics.



2021

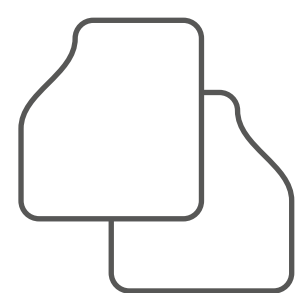
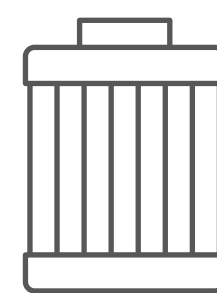
at the Solaris Logistics Center

Every year, more and more Solaris buses join the passenger bus fleets plying Europe's streets. Rolling out of the gate of our Bolechowo factory is just the first leg of their journey. The thousands of kilometres covered every day by our vehicles means parts end up needing to be replaced, at least the consumable ones. So what was it like servicing our vehicles when it came to spare parts? Well, 2021 was indeed hectic!



51 273

shipments were dispatched by the Central Warehouse

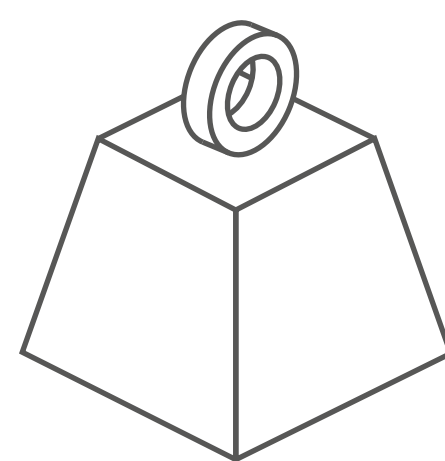
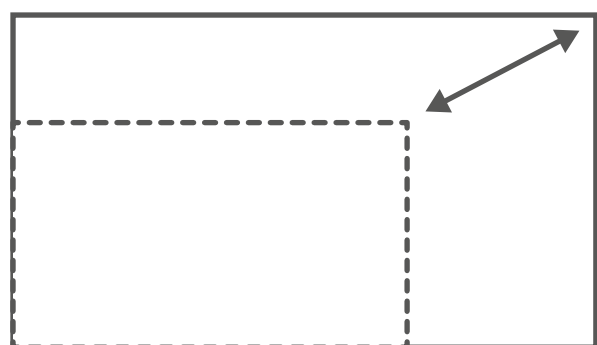


17 722

various types of spare parts were delivered to our clients in 2021

To cope with servicing the growing fleet, the central warehouse at the Solaris Logistics Center has increased in area

2x

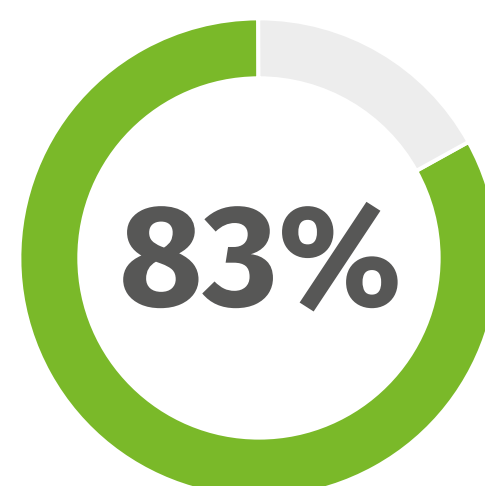


1 754

tonnes of goods were dispatched by the Solaris Logistics Center

25

countries' clients received Solaris spare parts in 2021



This is Optiline brake pads' share of all the brake pads sold by Solaris in 2021



Original
Solaris parts

Optiline
SOLARIS



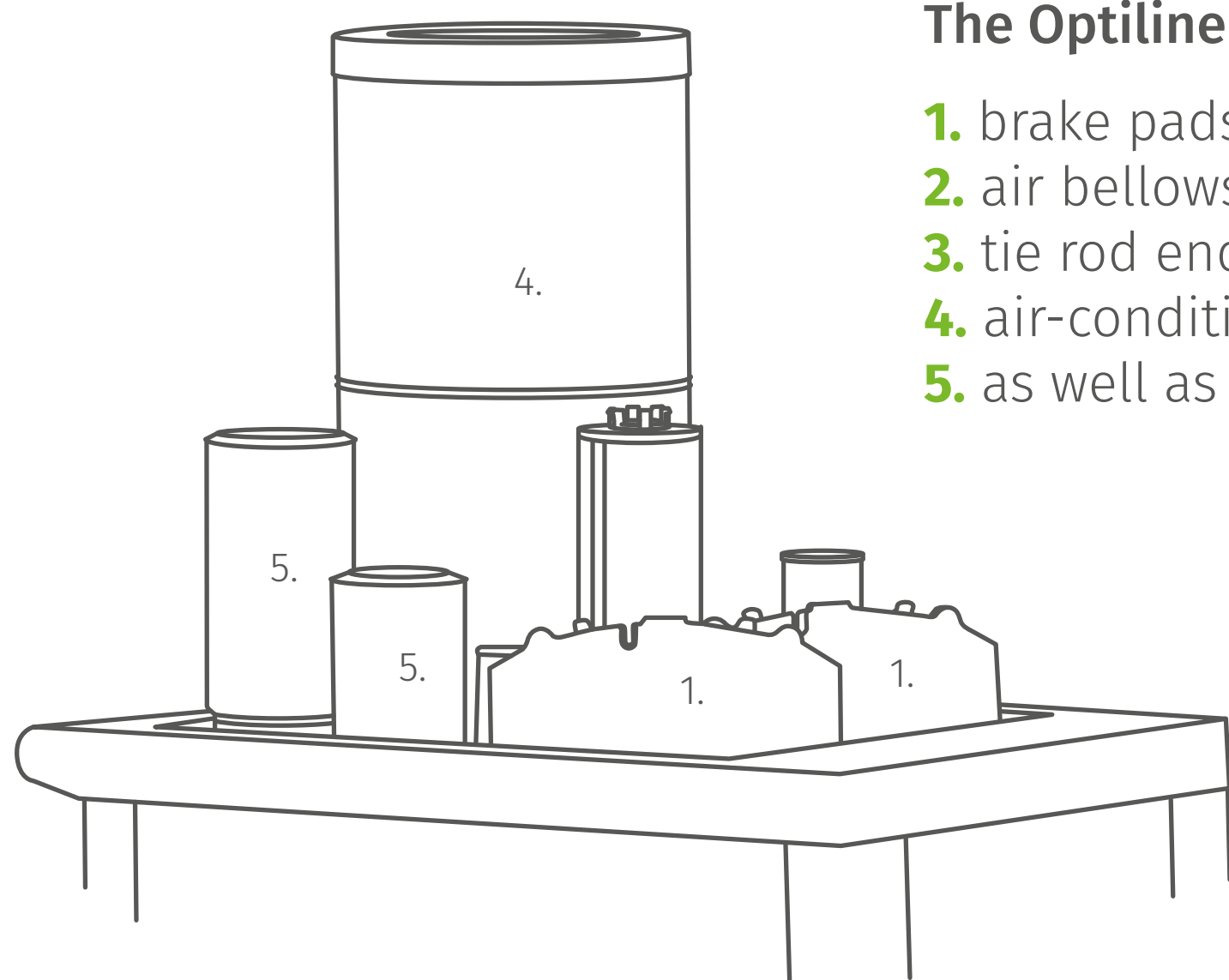
Would you like to know more about our spare parts line?
The Optiline products are presented in the videos by Julo Szalek.

Watch on:  SolarisBuspl  solaris-bus-&-coach



Optiline goes from strength to strength

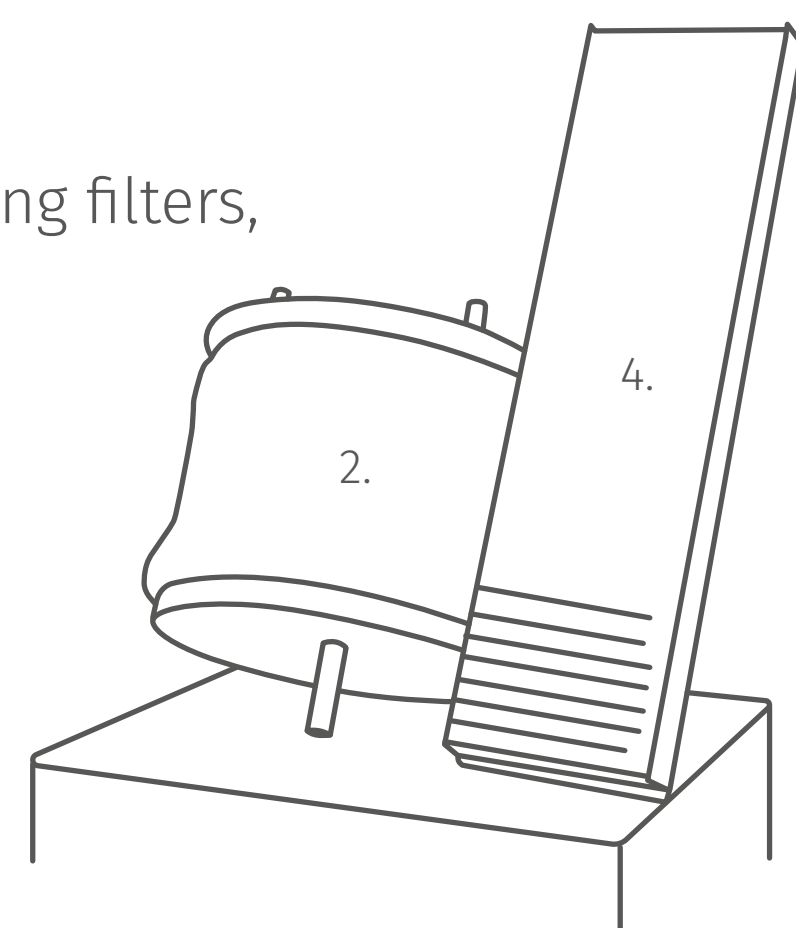
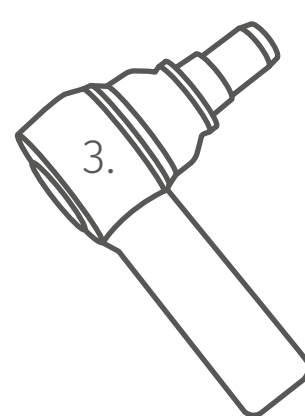
Original spare parts made by Solaris have been continuously strength-ening their position in the market. The Optiline brand already enjoys widespread recognition in many European countries. It is trusted both by small bus companies and large operators that provide transport services in the largest metropolises. How has our brand been developing? Let's have a look at the most interesting facts and figures concerning our thriving spare parts brand Optiline.



The Optiline range encompasses:



- 1. brake pads,
- 2. air bellows,
- 3. tie rod ends,
- 4. air-conditioning and heating filters,
- 5. as well as motor filters.



So far, the best performance of Optiline brake pads has been recorded



in Włocławek

where they, having been in operation over a distance of

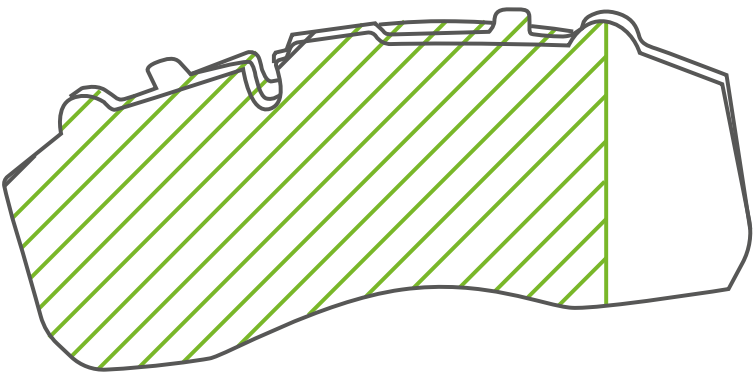
186,000 km

still do not need replacing.

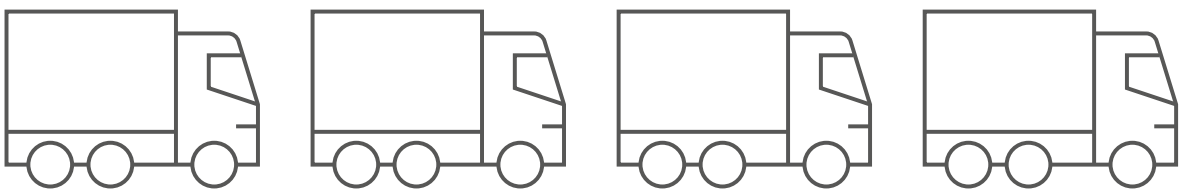
Optiline brake pads, Optiline air bellows, Optiline tie rod ends and Optiline air-conditioning and heating filters can also be used **during the vehicle warranty period.**



Optiline brake pads made up a whopping **83% of all brake pads sold by Solaris in 2021.**



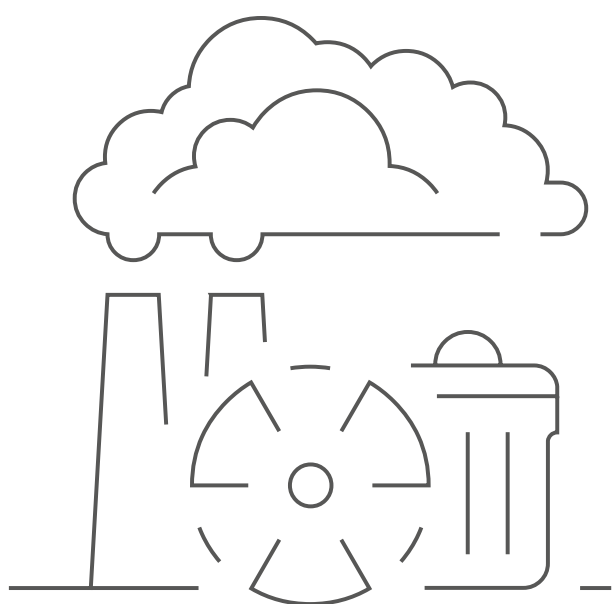
Optiline brake components are not limited to use in Solaris buses. They can be installed **in buses made by other brands, as well as in trucks!**



Optiline air bellows may last up to **900,000 km.** This has been proven in laboratory tests in which the air bellows have completed **9 million cycles of fatigue tests, equivalent to 900,000 km of on-road use.**



900,000 km



Optiline air-conditioning filters trap up to



99.9%

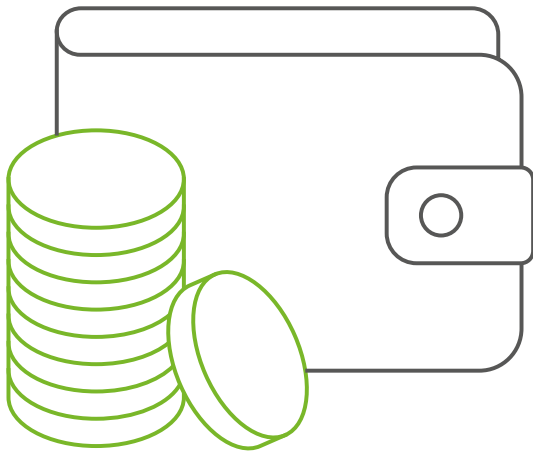
of all pollutants in the air that enters the bus. **Air purified in this way ensures even greater comfort for passengers.**

Optiline parts are delivered to



23 countries

- mainly to Europe but also to Israel and the **United Arab Emirates.** This is the perfect proof that the materials used in their production **perform excellently in various weather and road conditions.**



Purchasing Optiline parts **reduces costs.** Our products not only guarantee a competitive purchase price, **but their quality and long service life also end up protecting other components in the vehicle.**

Modern cities are green cities

European capitals are turning to nature, and their activities are highly inventive. Paris's municipal authorities plan to resurrect the long-buried Bièvre river to combat high temperatures. Tallin has a 13-kilometre green corridor for pedestrians, which is, at the same time ... a highway for insects. Barcelona, on the other hand, is implementing various innovative urban planning solutions for cleaner air.

“The time is long gone when the protection of nature and progress were opposites”, said Mihhail Kõlvart, Mayor of Tallinn, when receiving the European Green Capital Award. The changes that have taken place, not only in the Estonian capital but also in other European towns and cities, are ample proof of that. Looking at individual solutions, one would like to say “Finally! It is possible after all!”

Paris

Paris has set itself the goal of becoming one of the greenest capitals in Europe by 2030, and of reducing emissions by 75% by 2050. These



objectives are very ambitious, but Anne Hidalgo, the city's mayor, is proving with her policies that it is possible to attain them. Through consistent implementation of car traffic restrictions and expansion of the cycle network, air quality in the city has been significantly improved. In addition to the existing 1,000 km of cycle paths, 130 km of new routes will be available to the city's residents by 2026! Paris's green strategy also includes significant changes to its most famous locations. For example, there are plans to redevelop the Champs Elysees, which by 2024 are set to resemble a large garden rather than a congested thoroughfare.

Turning towards a river, and rivers in general, is also a vital component of a green strategy. Apart from closing streets running directly along the Seine to road traffic, there are also plans to uncover its tributary, the Bièvre river. It was buried in 1912 due to pollution. A first section running through Paris is to be restored as early as in 2026. This will help reduce the urban heat island effect, which can make the city centre experience temperatures 8°C higher than in outlying areas.

Tallinn

The Estonian capital has been setting trends in green development for years now. Various activities undertaken by Estonians have been recognised by the European Commission, with Tallinn being awarded the title of European Green Capital for 2023. Solutions implemented in the city attract attention not only due to their effectiveness but also their originality. One example is a 13 km long green corridor running through six city districts. It was created not only for pedestrians, but also for insects, which in such a space have just the right conditions to pollinate plants and move around freely. It is also for the sake of these pollinators that a strategy of letting parks, conservation areas and gardens grow wild has been introduced. Also worthy of note is the fact that protected green areas make up almost 20% of Tallinn's total area. Public transport in the city has been free of charge for almost 10 years, and traffic regulations encourage daily



cycling by giving cyclists priority over car drivers. Moreover, the city authorities aim for 11% of all journeys to be made by bike by the year 2027. Interestingly, on the outskirts of the capital Tallinn, in the Paljassaare conservation area, you can stumble upon herds of Scottish Highland cows. They were brought there to boost species biodiversity in the country. This shows how seriously environmental issues are taken in Tallinn and how hard people work to ensure environmental protection is an integral part of the development of this modern city.

Barcelona

Barcelona is another European metropolis whose authorities have committed to significantly improving the relationship between urban spaces and nature. The urban planning solutions introduced in the city have become world-famous and an inspiration for other metropolises struggling with the problem of air pollution. We are of course talking about the so-called superblocks, i.e. neighbourhoods consisting of nine apartment buildings, within which motorised traffic is completely banned. Between the buildings of the superblock only pedestrians and cyclists can move. Thus, air and noise pollution are reduced and city dwellers are naturally encouraged to ditch their

cars. Moreover, the car-free spaces are turned into parks, squares and flowerbeds, thus increasing the share of greenery in the local landscape. The solution was first introduced in 2016 in the city centre, where thanks to the regular structure of buildings it was possible to section off such zones. Next, it is also planned to create a network of superblocks connected by green corridors. There is also an ambitious plan to introduce a rule that residents should be no further than 200 metres from the nearest green space. Ada Calou, the city's mayor, has announced that by 2026 every street in the main district, Eixample, will be at least 80% shaded by trees and 20% unpaved. These ambitious plans reflect a significant change in the approach to respecting the environment and responding to the effects of climate change.

The above-mentioned examples prove that a change in attitude towards environmental protection in urban spaces is no mere fad. The consequences of climate change, which are increasingly being felt, are prompting city authorities to implement long-term changes. One of the most visible trends is the shift towards greenery and replacing hitherto ubiquitous concrete with green areas.





#CityMission by Solaris

– an educational project with a green goal
under the surface

A creative competition, educational workshops, an urban game for the whole family and green initiatives for schools – these attractions awaited the participants in the pilot edition of an educational project called #CityMission by Solaris (MiastoMisja Solaris). Most of the project activities are already over, and the official end of the project is slated for September 2022. CityMission by Solaris will be one of the company's main educational initiatives in the area of corporate social responsibility in the years to come.

Mission: City



This spring, Solaris launched an educational project devised for pupils in grades 1 to 3 of primary schools. Its aim is to enhance environmental awareness among young children and to encourage them to use public transport as it is the most environmentally-friendly solution. As a leading manufacturer of state-of-the-art zero-emission vehicles, Solaris has decided to pursue these objectives by inviting children to live in a world that is closest to its heart, i. e. to one full of cutting-edge technologies. Another issue addressed

in the project is the city and its future. That is how #CityMission by Solaris, an educational initiative with a green goal under the surface, emerged.

Education through Play

The main part of the first edition of the project was a creative contest for teams of pupils led by their teachers. The task was to design a cutting-edge bus that would help to make our towns and cities greener. Its appearance, features and the way it moves were solely the outcome of the children’s imagination and creativity. Entries could be submitted as a video or a presentation. Next, ten finalists were picked from all of the entries during an online vote by the public. This was by no means an easy task: many original, interesting and inspiring works were entered into the competition. Finally, a jury selected three winning designs: “Eko 19tka” from Primary School No. 19 Stanisław Staszic in Poznań, “Krejzolki Konstruktor” from the School and Kindergarten Complex No. 1 in Poznań and “Π-wna 1” from the Polish-English Bilingual Primary School in Poznań. The main prizes in the contest are unusual green initiatives for schools - breathing murals and vertical gardens.

Additionally, to develop the theme of #CityMission, educational workshops were organised by science enthusiasts. The first 15 schools to submit entries were invited to take part. During the workshops, the children could learn why public transport is of such importance for environmental protection. Moreover, the pupils took part in experiments to show them how zero-emission buses operate and together they discussed what measures could be undertaken right now to ensure a bright future for cities.

Zero-emission game

In parallel to the above-mentioned activities, an urban game was organised in Poznań. It was designed to allow children, together with their parents and siblings, to learn more about the benefits of zero-emission public transport. The game was based on a map, available

online and in print. The participants were asked to travel around the city using e-buses. When reaching the stops marked on the map, children could learn interesting facts about green urban transport and solve puzzles. For the first 50 to finish, fun gifts awaited them at a designated point in the Old Market Square in Poznań.

Green initiatives

The final phase of the project, the installation of the prizes, still lies ahead of us. By the end of September, breathing murals and air-purifying vertical gardens will have been installed at the three winning schools. Thus, the project will bring a long-term benefit to the schools, to the pupils no less, who will be able to breathe cleaner air. We also would like to invite pupils from the winning schools to participate in installing the garden or mural, thus creating an opportunity for joint action.

This year's pilot edition of #CityMission by Solaris was carried out in Poznań and the surrounding areas. Ultimately, we want to broaden the territorial scope of the project participants, aiming to reach as many young people as possible and to explain to them the role played by public transport in environmental protection and the development of our towns and cities.





SOLARIS

A CAF GROUP COMPANY



E-MOBILITY

We are changing the image
of public transport