

BERYLLS STRATEGY ADVISORS

A BACKSEAT FOR DRIVERS: AUTONOMOUS DRIVING WILL BE THE BACKBONE OF SHARED MOBILITY IN EUROPE

By 2035, autonomous vehicles will make up half of the shared mobility market in Europe, and private car ownership will be in retreat

AGENDA

- **3** Introduction
- **4** Section 1:
Berylls Mobility Model and the future
European urban mobility landscape
- **9** Section 2:
Success factors for AD ride hailing and
pooling companies
- **11** Appendix:
About Our Model

INTRODUCTION

Autonomous driving (AD) has long been seen as the savior of shared mobility, finally making ride hailing and ride pooling services profitable by eliminating the cost of paying the driver.

The original scaling plans of household names such as Uber and Lyft were based on a driverless future, but AD maturity has taken much longer than expected to arrive. Pilot projects are underway across the globe, however the key question remains: when will AD technology, regulation and public acceptance align and reach the point where driverless vehicles start to transform the personal mobility landscape?

To answer this question and quantify the scale of the opportunity for AD to push forward the use of shared mobility services in Europe, we built the Berylls Mobility Model to assess the impact of key drivers including technology, political will and regulatory readiness on driverless urban mobility in 544 European cities across 35 countries ([see About Our Model page 11](#)).

The results of our extensive modeling show a decisive shift toward self-driving ride hailing and ride pooling services over the next decade. The key findings include:

- » AD vehicles will account for **more than 50%** of the distance travelled with ride sharing services (ride hailing and pooling) in Europe by 2035
- » The overall European mobility market will grow by **56% to €802bn** by 2035, but the market share of private cars will shrink to 60%, from 67% in 2022
- » By the end of 2035, we expect that there will be between **500,000 and 1.2 million** AD cars used for ride hailing and pooling

In this report, we will set out in detail our expectations for autonomous driving within the future mobility market in Europe, as well as the success factors that will bring AD into the mainstream. In the coming months, we will publish further findings on the regulatory landscape for autonomous vehicles in Europe, and the routes a range of AD companies are taking into this growth market.

1 | BERYLLS MOBILITY MODEL AND THE FUTURE EUROPEAN URBAN MOBILITY LANDSCAPE

With a large urban population, advanced infrastructure, access to cutting-edge technologies, and progressive public transportation policies, Europe is one of most attractive and dynamic mobility markets in the world. In order to formulate more detailed insights into how this market will develop out to 2035, we developed a mobility model incorporating the impact of a range of factors including major macro trends (economic, political and demographic changes) and country-specific developments (policies, infrastructure and technology).

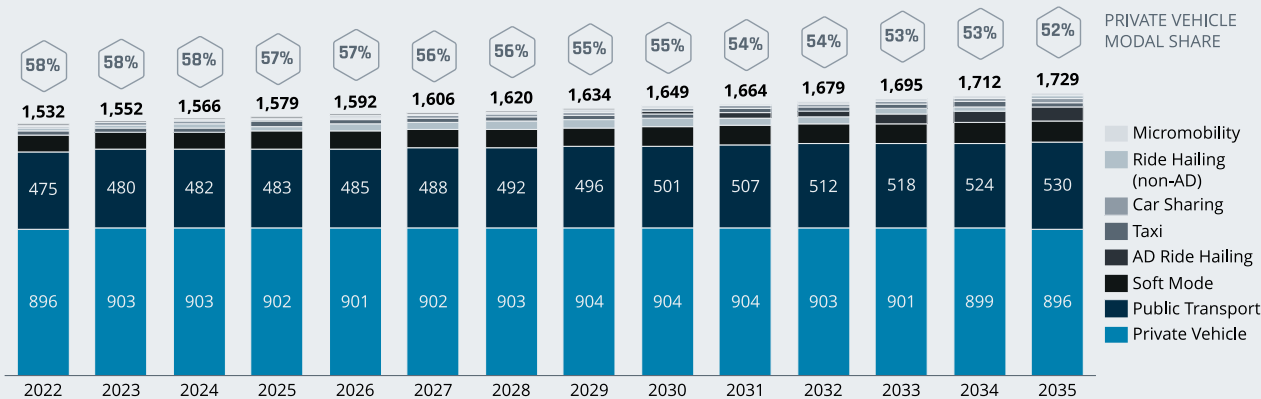
The results allowed us to make a detailed analysis of overall mobility market growth, how various modes of transport will develop, and in particular, the impact of the AD rollout in more than 500 European cities¹.

As shown in Figure 1, our Mobility Model forecasts overall European urban demand for mobility will increase moderately to 1.73 trillion passenger kilometers travelled by the end of 2035. That represents a compound annual growth rate (CAGR) of around 1%, mainly driven by population growth.

MOBILITY MARKET MODEL

4

FIGURE 1
MOBILITY MARKET DEMAND 2022-2035, BY DISTANCE TRAVELLED
Total distance covered, by mode category 2022-2035 – in bn pkm



Source: Berylls Strategy Advisors ¹The modes of transport include walking and by bicycle, private car, bus, railway, and flights. See About Our Model below for the full methodology.

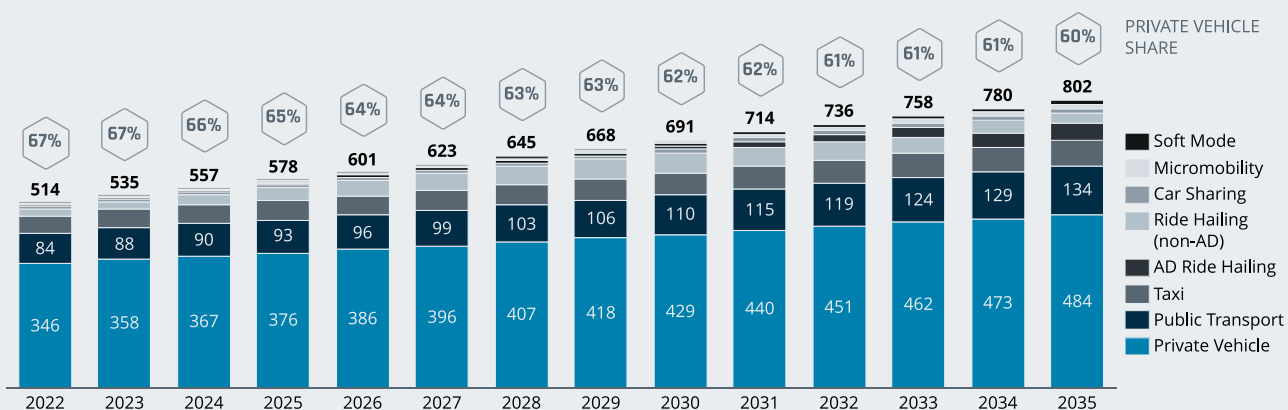
From a market value perspective, the overall European urban mobility market is set to grow by 56% to €802bn by 2035 (CAGR of around 3%), as shown in Figure 2 below. Inflation and a growing

urban population are the reasons the market will grow faster by value than by passenger demand, as measured in kilometers travelled².

FIGURE 2

MOBILITY MARKET VALUE, 2022-2035

Market value, by mode category 2022-2035 – in bn €



Source: Berylls Strategy Advisors

Most importantly for this report, we believe the share of passengers using particular types of transport and the number of journeys they make using the various modes, will also **change fundamentally by 2035**. The most noticeable trend will be the **declining use of private cars**, spurred on by government incentives to switch to lower emission forms of transport, improvements to public transportation systems, and the growing sharing economy.

Our analysis shows that while overall mobility demand will continue to grow, private cars will be used for 52% of the

total distance travelled in European cities by 2035, down from 58% in 2022 (see Figure 1). Private vehicle use will account for 60% of the mobility market by value, down from 67% in 2022 (see Figure 2).

The on-going efforts of cities to cut pollution and congestion by reducing private vehicle usage through policies including tolls and parking fees will be effective. However, to ensure city-dwellers maintain their freedom of movement, transportation authorities must ensure adequate and affordable alternatives.

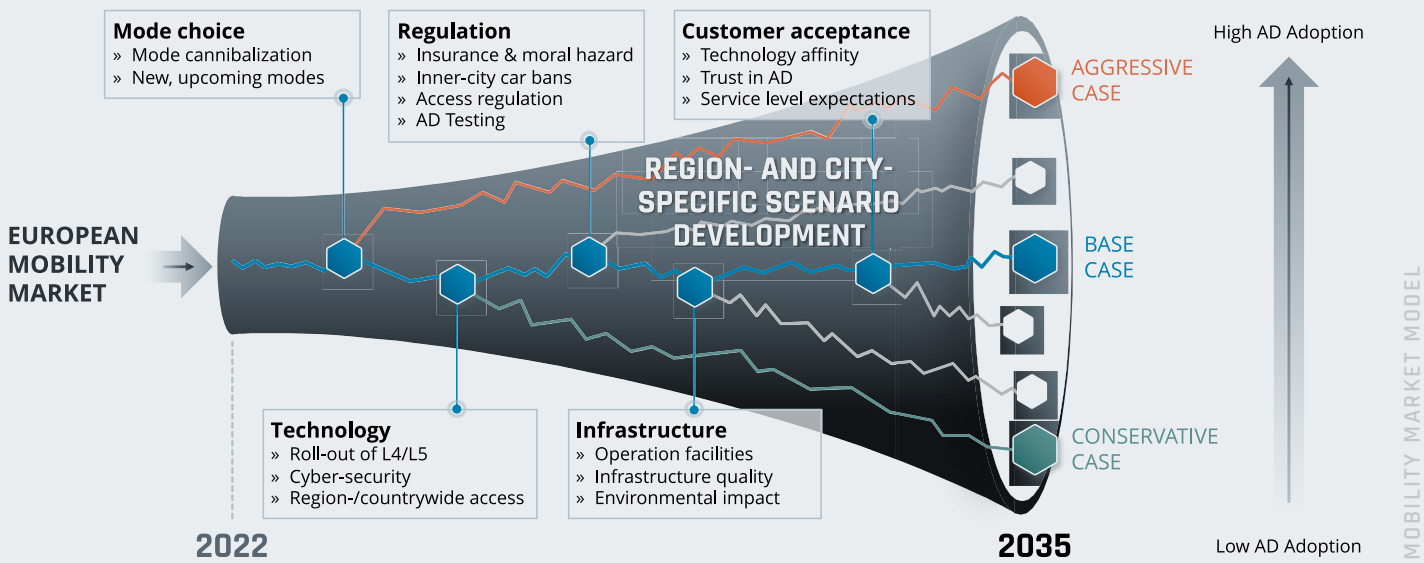
² Our model was based on the inflation data in March 2022, which might deviate from the current level.

AD in focus

We used our model to assess three scenarios of AD development in shared mobility, based on a range of technological progress, business development

and government policy support. Varying the assumptions on these input factors resulted in a **conservative case**, a **base case**, and an **aggressive case**, as shown in Figure 3:

FIGURE 3
SCENARIO DEVELOPMENT FOR EUROPEAN MOBILITY MARKET OUTLOOK



Source: Berylls Strategy Advisors

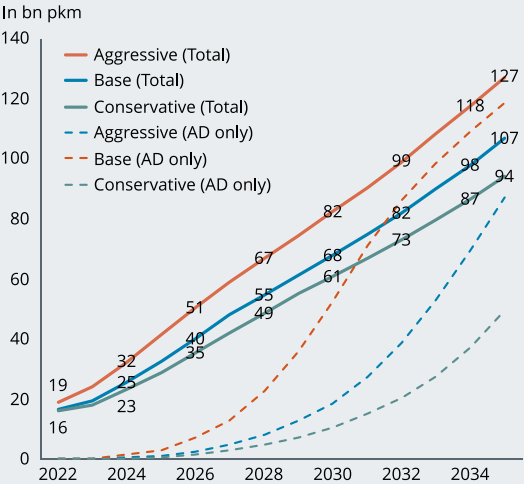
In the **base case** scenario, we expect AD to be rolled out commercially in the next five years and increase to account for approximately 50% of all vehicles used for shared mobility by 2035. For the **aggressive scenario**, our model assumes governments roll out more progressive policies toward AD and more restrictive policies against private car usage in cities, companies speed up the rollout of high-level AD technology, and the customers show higher acceptance of AD vehicles. For the **conservative scenario**, the reverse of each of these factors is assumed. (Please also

[refer to the appendix for a detailed explanation of our key assumptions.](#))

Shared mobility in the form of ride hailing and pooling has already gained strong momentum as part of cities' strategies to strike a balance between individual mobility (using private cars) and ensuring the cars on the road are used more efficiently. As Figure 4 below shows, we expect significant growth in all forms of ride hailing and pooling, accelerating after 2026 when AD vehicles come on stream, in all three scenarios (aggressive, base and conservative).

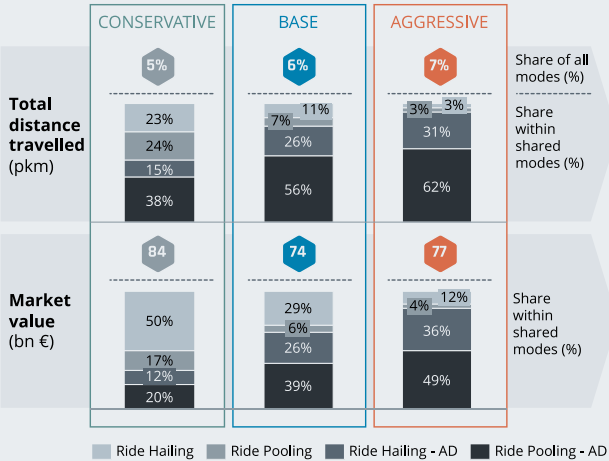
FIGURE 4
GROWTH IN DEMAND FOR SHARED MOBILITY, 2022 - 2035

SCENARIO OVERVIEW: RIDE HAILING / POOLING



Source: Berylls Strategy Advisors

SCENARIO COMPARISON "SHARED MODES" 2035



Taking into account new regulations such as urban vehicle access regulations, ride hailing and pooling regulation, technology trends including mobility-as-a-service (MaaS) and the digitization

of taxi services, our model shows shared mobility demand will be between six and 10 times higher in just over a decade (see Figure 4).



The pace of growth in the market will create a strong opportunity for the mass rollout of **AD-enabled shared mobility**. Due to the cost advantage of operating AD vehicle fleets with no driver costs, AD shared mobility is cheaper for passengers and can also cover more demand because vehicles can operate 24/7.

In the aggressive case shown in Figure 4 above (in which more shared mobility vehicles are replaced by AD versions), shared modes have a market value of €77bn in 2035 and cover 7% of total mobility demand. Yet in the conservative case, with fewer AD vehicles, customers are expected to spend €84bn but shared mobility will cover 5% of total mobility demand.



Due to the lower cost per kilometer, AD shared vehicles can therefore address a larger share of mobility demand at a lower cost for their users.

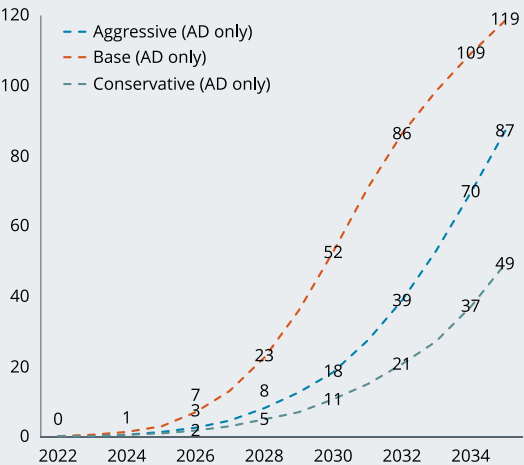
As a consequence of AD shared mobility growth, we will witness the roll-out of massive AD vehicle fleets. By the end of 2035, we expect between 500,000 and 1.2 million AD cars to be used for ride hailing and pooling (see Figure 5 below), more than estimated 300,000 taxis today.

Due to the greater efficiency of ride pooling at comparable service quality levels, European cities will favor this approach over individual ride hailing.

We expect lawmakers to establish governance schemes that support this, including the integration of ride pooling into existing public transit offerings and pricing schemes. As Figure 5 shows, by 2035 AD ride pooling will cover more distance travelled than ride hailing (67% vs. 33% in the aggressive scenario) with fewer vehicles (43% of the shared AD vehicle fleet vs. 57% for ride hailing), making ride pooling a substantial and widely available part of cities' future mobility offering.

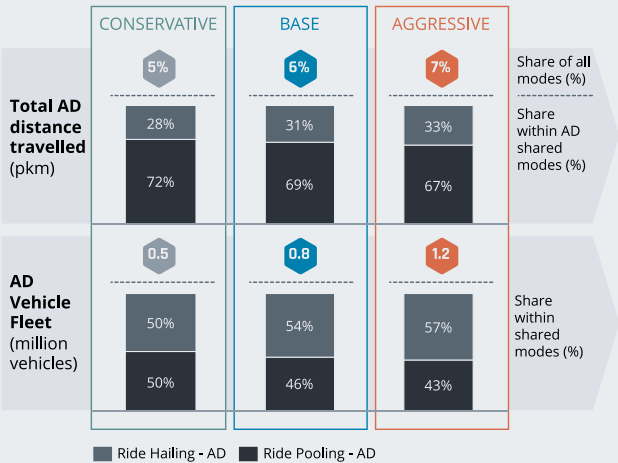
FIGURE 5
GROWTH IN DEMAND FOR AD-SHARED MOBILITY AND AD-VEHICLE FLEET, 2022 - 2035

SCENARIO OVERVIEW: AD RIDE HAILING / POOLING
In bn pkm



Source: Berylls Strategy Advisors

VEHICLE FLEET: SCENARIO COMPARISON 2035



2 | SUCCESS FACTORS FOR AD RIDE HAILING AND POOLING COMPANIES

So how can governments and the mobility industry make these projected growth rates a reality? The following key success factors will have the strongest impact on the viability, scalability and sustainability of AD ride hailing and pooling business models:

Key Success Factor 1: Autonomous driving technology maturity

Bringing autonomous driving technologies to maturity has probably been the biggest bottleneck preventing the mass deployment of self-driving vehicles. The

extremely high complexity of real-life road conditions requires very advanced technology to cope with all different situations a car may face, especially in crowded European cities.

However, AD operators such as Cruise and Waymo in the US, and Baidu, Pony.ai and WeRide in China are now on the road, and from recent announcements such as the partnership between Mobileye and Sixt in Germany, we can expect to see AD pilot projects in European cities over the next 12 months.

Key Success Factor 2: E2E customer centricity

Not only do shared AD vehicles need to master driving in complex urban environments, they must also provide all the customer service currently given by the driver. This goes far beyond an intuitive customer app: shared mobility companies are responsible for providing a high-quality customer experience end-to-end, which includes clean, hygienic vehicles, support for disabled passengers, a service for returning customers' lost belongings, and much more.

Key Success Factor 3: Scalable operations

To scale their business in a viable way, AD companies should start their shared mobility operations serving routes with high potential demand and limited existing public transport options. These may include commuting routes, commonly used roads to and from shopping areas, and airport transfers. Each city will have a different scaling pattern, depending on its traffic congestion issues, local public transport and taxi prices.

Key Success Factor 4: Regulation and local infrastructure

Progressive urban transportation policies will support the introduction of new shared forms of mobility by adjusting their governance measures, such as granting toll discounts, reserving priority stops in congested areas, and introducing public transport coupons for ride hailing and pooling users. Allowing AD testing on public roads will also be a must for a timely route to market. Some countries including Germany and the UK have already defined AD-related liabilities and created AD regulation road maps³, and in our next report, we will look in detail at how supportive regulatory frameworks are in the major European countries.

Well-developed transport and technology infrastructure also provide the basics for the successful application of AD technology and operational safety. 5G network coverage and well-maintained roads are essential for the introduction of shared AD mobility services.

To discuss our mobility model and executing the four success factors in greater depth, please contact us. We look forward to sharing our insights.

³The Gesetzes zur Änderung des Straßenverkehrsgesetzes und des Pflichtversicherungsgesetzes – Gesetz zum autonomen Fahren 2021 from Germany and the Automated and Electric Vehicles Act 2018/ Roadmap to Enable Remote Operation of CAVs by 2035, from the UK.



APPENDIX: ABOUT OUR MODEL

We developed the Berylls Mobility Model to simulate the total individual distance travelled, modal share and market volume for 16 different modes of transport in 544 cities with a population over 100,000 across 35 European countries.

To forecast overall mobility demand, we factored in metrics including the urban population, population growth, number

of individual trips and average distance travelled per mode of transport. In addition, we quantified the impact on the mobility market of major macroeconomic trends, public policy, technology development, consumer behavior including working from home and pandemic restrictions, private car restrictions by cities, and Mobility-as-a-Service platforms, and included these in the model too.

Mobility modes:

MODE CATEGORIES	MOBILITY MODES
Soft mode	Walking, Bike
Micromobility	Bike sharing, Moped sharing, eScooter sharing
Private Vehicle	Private car, Motorcycle
Taxi	Taxi
Car sharing	Car sharing (free-float & station-based), Car rental
Ride Sharing	Ride hailing (w/ AD), Ride pooling (w/ AD)
Public Transport	Rail, Bus





AD mobility scenarios:

Below are the key assumptions of the three scenarios we developed to simulate the possible degree of AD development in shared mobility, including technology development, customer acceptance, and regulation:

CRITERIA FOR THREE AD SHARED MOBILITY SCENARIOS 2023-2035

Key Assumptions	Conservative case	Base case	Aggressive case
Hailing/Pooling: Regulation impact	<ul style="list-style-type: none"> » Taxi, car and oil/energy lobby uses power to keep current status of private cars and taxis 	<ul style="list-style-type: none"> » Integration of hailing and pooling services into the public transport system » Lower entry barriers for new mobility modes and players » Greater adoption of MaaS 	<ul style="list-style-type: none"> » Cities enforce more measures to decrease private car usage (e.g. inner-city car bans) » Restrictions on hailing and pooling services are lifted
AD: Regulation & technology readiness	<ul style="list-style-type: none"> » High safety concerns regarding AD due to issues linked to accidents and reliability » Political resistance to shared AD services 	<ul style="list-style-type: none"> » Common, Europe-wide roll-out and scaling of AD approvals » Fast and countrywide deployment of AD hailing and pooling services 	<ul style="list-style-type: none"> » Fast roll out of high-level AD technology (Level 5) » Integration of shared autonomous vehicles into existing mobility ecosystem
AD: Customer acceptance	<ul style="list-style-type: none"> » High skepticism against AD vehicles » Private cars remain a status symbol » AD vehicle services perceived as alternative to public transport, not to private cars 	<ul style="list-style-type: none"> » Common acceptance of AD vehicles due to lower pricing and reliability » AD hailing/pooling services being used on a regular basis, replacing private car trips 	<ul style="list-style-type: none"> » Wide acceptance of AD vehicles, either due to own will (pricing, reliability) or as a result of regulatory changes » AD services are fully integrated into the mobility ecosystem
Summary	<p>Slow adoption of regulations to support hailing/pooling services and a slow pace of AD technology development leads to a less significant shift away from private car usage</p>	<p>Announced regulations will be implemented and AD technology will develop as expected, leading customers to switch from private car usage to AD hailing/pooling adoption</p>	<p>Regulatory approval leads to high AD hailing/pooling adoption by consumers, impacting the use of private cars. AD hailing/pooling becomes an everyday part of inner-city mobility.</p>

Source: Berylls Strategy Advisors



THE BERYLLS GROUP'S SERVICES are fully dedicated to the automotive industry. Our experts in Germany, China, Great Britain, South Korea, North America and Switzerland understand the industry's key challenges and are developing ways to achieve sustainable success in the automobility eco system. They use advanced digital strategies and other innovative approaches. Our professionals are networking across our four specialised units to offer our clients end-to-end support, from strategy development to the implementation. We call this network our Berylls Quartet:

Berylls Strategy Advisors - The expertise of our top management consultants extends across the complete value chain of automobility - from long-term strategic planning to operational performance improvements. Based on our automobility thought leadership Berylls Strategy Advisors stand out with their broad experience, their profound industry knowledge, their innovative problem-solving competence and, last but not least, their entrepreneurial thinking.

Berylls Digital Ventures - The development and operation of digital products or the implementation of new business models are increasingly required to drive the realization of our clients' strategic concepts. The Berylls Digital Ventures team takes up this challenge - working together with our clients end-to-end. Furthermore we invest in promising startups and bring digital solutions to market, turn-key ready for our clients. Always with a keen focus on automobility.

Berylls Mad Media - The radical digitalisation of the customer interface undermines the boundaries in the automotive sales model. Our Berylls Mad Media experts develop and operate tailored solutions, including data-driven marketing, integrated service designs, and including the agile realisation of integrated process and IT architectures. We strengthen customer loyalty, market exploitation, and profitability - taking vehicles and services to market digitally.

Berylls Equity Partners - is a private investment company, supported by strong anchor investors and pursuing an entrepreneurial approach. We carefully select, acquire, and improve operationally, companies with value potential in the mobility industry - with a long-term strategic direction.

The automotive industry is currently facing fundamental challenges. We have made it our mission to support industry players in accomplishing an effective and future-proof change process. The unique value we bring to the table is based on digitisation, technological innovation, market insights and renowned partnerships. The Berylls Quartet is your high-performance engine to succeed on this exciting road.

The future will be, but different.



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