THE AUTONOMOUS FUTURE

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Berylls Report “Autonomous Mobility in the US Automotive Landscape 2030”
By 2030, autonomous mobility technologies will have reached a market volume of $13 billion in the USA alone.

Technological advances and volume benefits will have reduced the technology costs of autonomous driving by 90 percent by 2030.

In 2030, every tenth newly sold private car in the USA will be a self-driving autonomous car (levels 4 and 5).

The Berylls simulation shows that, by 2030, about nine percent of potential vehicle buyers will choose carsharing or carpooling alternatives - and therefore refrain from purchasing new cars.
Many car users have long dreamt of just being able to step into a car, and be whisked to their destination automatically without having to do a thing. Now this vision is becoming reality. In 2019, the first commercial robo-taxis will start operating in public transport; by 2030, experts at Berylls Strategy Advisors expect that autonomously driving cars (levels 4 and 5) will make up 13 percent of new vehicle registrations in the U.S. market. That represents about two million vehicles. However, some 70 percent of them will take to the road as autonomous personal cars; the other 30 percent as robo-taxis, in carpool and car-sharing fleets.

So most U.S. road users will not abandon their cars and switching to robo-taxis. Nevertheless the autonomous car will fundamentally change people’s mobility behavior.

“The next 15 years will usher in a new mobility landscape. Many suppliers are already preparing to handle greater or lesser risks, and seize the opportunities that present themselves,” explains Arthur Kipferler, partner at Berylls Strategy Advisors.

### WILL WE ALL BE TAKING ROBO-TAXIS IN 2030?

### SOME VEHICLE SALES WILL BE CANNIBALIZED

![Graph showing vehicle sales and forecast for 2030](image-url)

**VEHICLE-FREE HOUSEHOLDS IN THE U.S. %**

<table>
<thead>
<tr>
<th>Year</th>
<th>Personal vehicles sold, in millions</th>
<th>12% decrease (2m units)</th>
<th>11% decrease (1.9 m units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>17.1</td>
<td></td>
<td></td>
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<tr>
<td>2025</td>
<td>15.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td>15.2</td>
<td></td>
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</table>

**Forecast sales mix for 2030**

- 2% SHARED AV - REPEAT PURCHASES
- 1% SHARED AV - FIRST PURCHASES
- 10% PRIVATE AV
- 87% CONVENTIONAL PERSONAL VEHICLES
According to Berylls’ analyses, the impact of autonomous cars will become noticeable on the U.S. car market from the middle of the next decade. By 2030, demand for new cars is expected to decline by about two million vehicles - due to shared autonomous vehicles, mainly because they are replacing private vehicles in bigger cities.

The current Berylls report “An Autonomous Future: The Automotive Landscape 2030” analyses the growth of autonomous private transportation in the USA, evaluating the automotive industry’s market potential as manufacturers and mobility providers. At the same time, it takes into account the usage preferences of different target groups and the economic advantages of sharing options with autonomous vehicles.

„The good news is that the train has not yet left the station. Even companies that are not yet taking part in business models involving autonomous driving have the opportunity to jump on the bandwagon. But the window of new opportunities is closing rapidly. It’s high time to act now,” recommends Berylls partner Kipferler.
Autonomous personal transport will grow ever faster in coming years, and represents an important pillar for future business models in the automotive industry. It is forecast that autonomous driving technologies will represent a market worth $13 billion by 2030 in the USA alone - not including the base price of the vehicles. In addition, the fleet business in autonomous vehicles will be worth billions. OEMs, as mobility service providers, will encounter strong competition by tech companies, such as Google’s mobility company Waymo.

Another important aspect for commercial viability is that by making autonomous vehicles freely available for personal use, the automotive industry is opening itself up to new target groups, and turning them into customers.

The speed with which autonomous cars can penetrate the market depends crucially on the future cost development. At present, Berylls experts estimate the extra cost of hardware and software for level 5 autonomy at about $70,000 per vehicle. Currently, only a vanishingly small number of car buyers would be prepared to pay so much for the comfort of autonomous driving in their own car.

PRIVATE AV USAGE

With a surcharge of $6,400, every tenth purchaser of a new car decides in favor of an AV

AV = autonomous vehicle
Source: Berylls Strategy Advisors
Over the next decade, continuous technological progress and increasing volume benefits will drastically reduce costs, to about $6,400 per vehicle. This was the finding of detailed technology and cost analyses (Berylls Report „An Autonomous Future: Putting Autonomous Vehicles on the Road“). In view of the significant added user benefit, the price for autonomy seems quite reasonable - and will sustainably increase take rates. The study also assesses the cost aspect of a users’ decision to ‘own’ or to ‘share’. Its key finding is that shared autonomous mobility is only more economical than maintaining one’s own vehicle up to a particular mileage.

For an annual mileage of 5,000 miles, Berylls’s simulation models forecast that use of a “shared” autonomous vehicle will cost about $3,300, or $0.67 per mile in 2030. For the same mileage, a car owner faces vehicle costs (“total cost of ownership”) of $5,100 on average, i.e. about a third more. However, the model calculations also show that, from an annual mileage of 7,900, owners of small city cars in 2030 will be able to travel more economically in their own cars than in an autonomous ride-hailing car.

The more expensive the car is to purchase and maintain, the higher is the annual mileage from which an own vehicle represents the more economical solution. In summary, “shared mobility” with autonomous vehicles represents an attractive alternative for people who mainly travel short distances, for example, in city traffic or the area around metropolises, and do not need their own car for other reasons.

**CUSTOMER ACCEPTANCE IS (ALSO) A COST QUESTION**

**SHARED AVS CAN BE MORE ECONOMICAL THAN OWNERSHIP**

**COST COMPARISON**

*Source: Berylls Strategy Advisors*
Who buys, who shares? The answer to this question is fundamental for the industry’s future strategic business models regarding autonomous driving - especially as regards customer marketing and customer retention, as well as for designing offerings. The current study considers four principal target groups for autonomous driving with very different preferences in terms of vehicle possession and vehicle use:

1. **Multi-Car Households**: An autonomous car permits a greater utilization of fewer cars, and will reduce the demand for multi-vehicle ownership.

2. **“Never Boughts”**: The “renouncers”: are particularly open to new technologies and business models and create truly incremental demand.

3. **Convenience- and Cost-Aware Individualists**: Specific lifestyles, priorities and values make private vehicle ownership less attractive and increase readiness to accept sharing offerings with autonomous vehicles.

4. **Millennials and Some of Generation Z**: They are united by a limited vehicle ownership culture. However, they also appreciate individual autonomous mobility - provided that the car is connected.

Almost two thirds of U.S. households are multi-car households with more than one vehicle. On average, the second vehicle is used a third less than the first. We can see this if we compare the annual mileages: The first car travels 11,600 miles per year on average, and the second car only 7,500 miles. If the cars are used by different persons at different times - statistics show that in 80 percent of U.S. households there is no overlapping of journeys - the autonomous car can perform the journeys one after another, like a chauffeur. Thus in 44 percent of U.S. households, an autonomous driving car can make a second car redundant.

### VEHICLES PER HOUSEHOLD %

**AVS CAN GREATLY REDUCE THE DEMAND FOR SECOND AND THIRD CARS**

<table>
<thead>
<tr>
<th></th>
<th>WITHOUT AV</th>
<th>WITH AV</th>
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</thead>
<tbody>
<tr>
<td>Vehicles no longer required</td>
<td>44%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>41%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

Vehicles
The “never boughts”, whether for economic or idealistic reasons, are the most important consumer group for carsharing and ridesharing options with autonomous vehicles. In customer analyses, these “never boughts” are the very consumers who are highly open to new technologies and new business models. This is made clear by the example of Brooklyn: In this New York borough, people who do not own their own car have upped the number of journeys they take with the new ride-hailing providers by threefold within four years. This dynamism shows that there is often a latent demand for mobility in urban areas that can be met with new autonomous options.

In big cities and urban regions with a good public transport infrastructure, increasing numbers of people will do without their own car in future. There are a number of reasons for this: they no longer want to drive a car and don’t want the expense and time consumed for parking and caring for the vehicle; they place less value on material possessions and want to reduce their environmental footprint. The convenience and cost-oriented individualists are an important target group for sharing concepts with autonomous cars. There is a correlation between traffic volume and car possession: in New York City, for example, cars only manage an average speed of 17.6 mph, at the same time, the city has the highest share of no-car households in the USA (54 percent). Increasing numbers of 20 to 25 year olds in the USA do not possess a driving license. Many of them consider a car too expensive, or they live in big cities where the car is more of a burden than a joy. The limited culture of possession of the “Millennials and some of Generation Z” is also increasingly leading them to do without dedicated vehicles. They conduct their lives in social media, not on the road in their own cars. But they can be won over by shared car services with autonomous vehicles, for example in order to get to individual leisure destinations lying outside the public transport infrastructure. Connected in the robo-taxi? Awesome!

MONTHLY TRIPS IN NEW YORK DISTRICTS, IN THOUSANDS

MOBILITY MODELS CAN CREATE NEW DEMAND

<table>
<thead>
<tr>
<th>District</th>
<th>2013</th>
<th>2017</th>
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<tbody>
<tr>
<td>Manhattan</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Brooklyn</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Taxis

New mobility models
The operation and management of sharing and carpool options with autonomous vehicles will generate around $4.8 billion dollars annual revenue in the USA by 2030. To win market share fleet operators must demonstrate their user friendliness by offering attractive prices, short waiting times and a reliable supply, even during peak demand. Berylls’ simulation model allows suppliers to perform an analysis of the prerequisites and possible measures, geared to the respective local circumstances. It allows fleet operators to assess the opportunities and risks, as well as profitability. With this as a basis, they can plan and optimize their fleets and the utilization specifically for every city in the USA.

Taxi services and mobility providers who have already built up a very strong market position with conventional vehicles will automatically benefit from the move to autonomous mobility. They must build up new competencies, for example for vehicle maintenance, central routing and fleet management. One way of further expanding their market presence is by cooperating with cities and local authorities, and agreeing partnerships with them. Profitability can be further increased with additional offerings outside their core business, such as package delivery, in-car entertainment or floating services.
FRESH THINKING - AND ACTING!

Berylls’ scenarios show that, if the automotive manufacturers want to succeed against the competition, they must rapidly establish a presence with autonomous cars in the new applications - and very likely with new partners, too. The supplier industry must recognize that differentiation is growing strongly in the field of digital systems. As a result, profit pools are shifting. This is irreversible. New business fields must be acquired or built up. However, old and new world areas should be consciously managed as two companies under one roof, with one oriented to efficiency and the other to innovation.

Local authorities, cities and municipalities currently often do not yet fully recognize the economic impact of autonomous mobility. There is thus a lack of understanding of the possibilities of the technology. Cities and municipalities, as elementary components of the new autonomous mobility, should therefore also provide political support and actively help to mitigate the skepticism that many citizens hold against the new mobility offerings. After all, they are the future.
EVERY ACTOR NEEDS A ROLE IN THE CHANGEOVER ON AUTONOMOUS MOBILITY

1. Regulators shall be the arbitrators of progress.

2. OEMs must work out their own position.

3. Mobility providers should use their position effectively.

4. Cities should orchestrate their own change.

5. Suppliers will need to reposition their portfolios.
Berylls Strategy Advisors is a top management consulting firm specialized in the automotive industry, with offices in Munich and Berlin, in China, in Great Britain, in South Korea, in Switzerland and in the USA. Together with automotive manufacturers, automotive suppliers, engineering and mobility service providers, equipment suppliers and investors, its strategy advisors and associated network of experts work to deliver answers to the central challenges of the automotive industry.

The focus is on highly innovative and high growth strategies, assisting in mergers & acquisitions, organization development and transformation, and measures to improve performance along the entire value chain.

In addition, the experts at Berylls Digital Ventures work with clients on solutions for digitalizing and transforming the business models of OEMS, suppliers and automotive service providers.

Berylls’ consulting teams are known for their extensive and relevant experience, solid knowledge, innovative creativity and entrepreneurial outlook.

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