

Roland Berger

Focus

April 2019

Making public transport self-sustainable

How public transit companies can operate more profitably with new technology



Management summary

Local public transit in Germany is subsidized from the public purse. Each year, the German state and various public authorities finance public transit to the tune of EUR 3.2 billion,¹ covering not only the costs of running the business but also the costs of environmental protection, providing a basic level of public services and ensuring social participation and quality of life in German cities. Up until now, the fact that these tasks relied on public subsidies seemed unquestionable.

But in recent years, new technology has emerged that could change the face of urban mobility as we know it. Applied correctly, this new technology opens up enormous opportunities for Germany's public transit system.

We set out to discover which new technology – or technologies – public transit companies can make the best use of. We gathered data from our own studies, joint projects with transit companies and discussions with industry experts, and analyzed the trends that emerged. We discussed these trends with representatives of public transit companies, rail travel experts, academics and suppliers of modern mobility solutions. The results? Seven strategies for making public transit in German cities more profitable. Some of these strategies are ready for full implementation now; others should be incorporated into transit companies' planning activities with a view to implementation in the medium term.

We also calculated whether implementing these strategies would boost profitability for three different types of German cities. The results show that in addition to the general economic advantages of public transit, public transit companies can now achieve profitability in their operations thanks to the new technology. This will make it possible to substantially cut subsidies for public transit companies in medium-sized and large cities. Metropolises could even start turning a profit.

To exploit this potential, public transit companies and politicians need to rethink their approach. Where companies today focus on developing new business models, they should think about how they can make use of modern technology instead. That may involve entering into partnerships with private companies. And it is up to politicians to provide them with the financial means for making the necessary investments now, during the transformation phase.

¹ Subsidies for local public transit companies. This figure excludes concession fees for regional rail transportation companies for the provision of urban rail transit and commuter transit.

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1. Gridlocked: The dilemma of public transit

Why public transit is a subsidy business in Germany

Local public transit is a subsidy business in Germany. On average, public transit companies cover only 76 percent of their costs. This is partly because their spending on personnel, energy, infrastructure and vehicles (purchase, maintenance and modernization) is greater than their revenues, and partly because they are legally required to provide a basic level of public services at an affordable price across the entire country, even on routes where this is not economically viable.

The gap in companies' revenues is filled from the public purse. Each year, the state funds municipal public transit companies to the tune of EUR 3.2 billion, which is more than ten percent of the German Ministry of Transport and Digital Infrastructure's annual budget. This money is in addition to the EUR 8.5 billion or so paid in "concession fees", the state subsidies for local

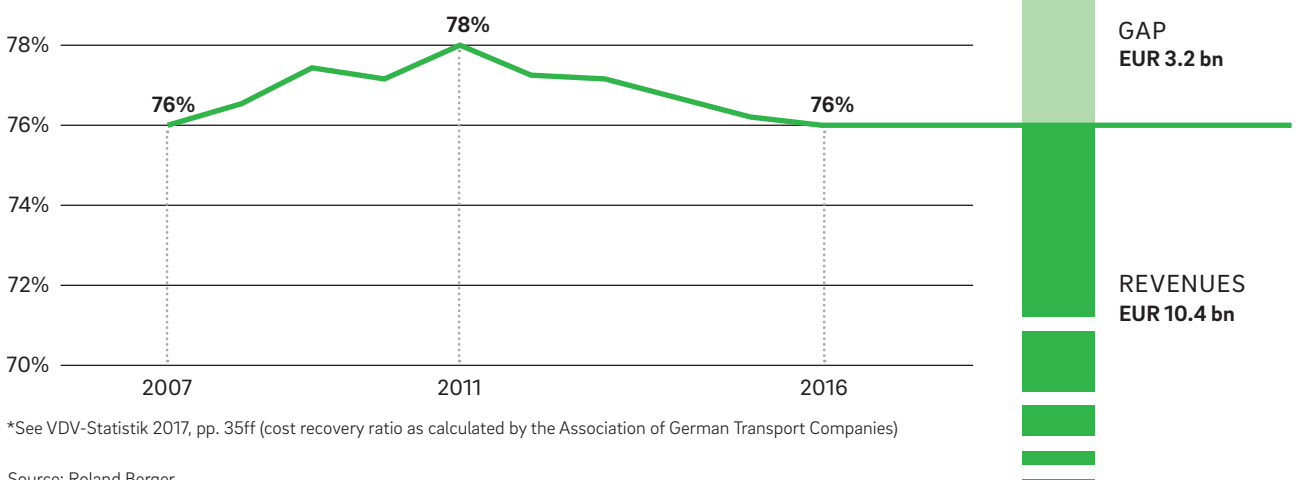
rail transit (including regional, suburban and commuter trains). A proportion of these concession fees – essentially the part covering suburban and commuter trains, plus transfers between railroad stations within cities – can likewise be considered local public transit subsidies.

From a general economic point of view, these subsidies are a good thing: They guarantee high-quality transportation infrastructure and limit the "external costs" of individual transportation. But pressure is growing on public transit to offer cheaper or even free local transportation, following the example set by cities such as Vienna, where annual tickets for public transit cost just EUR 365, or Luxembourg, whose residents will be able to use the entire public transit system free of charge from the year 2020. → [A](#)

A: A subsidy business

Cost recovery ratio of German public transit companies

COST RECOVERY RATIO*



*See VDV-Statistik 2017, pp. 35ff (cost recovery ratio as calculated by the Association of German Transport Companies)

2. Technology shows the way

Urban mobility is transforming

Urban life has changed dramatically in recent years. This transformation has been driven by new technology, alongside economic, environmental, social and political developments – developments that are also set to radically change local transportation in German cities. To identify the key trends affecting today's mobility sector, we analyzed data from projects that we have carried out with municipal public transit companies, other studies and discussions with experts. The following changes stood out:

TECHNOLOGICAL CHANGE

Modern mobility solutions are developing faster than ever. They include self-driving and networked vehicles, vehicles powered by non-fossil fuels and the use of real-time data.

ECONOMIC CHANGE

Companies providing innovative mobility solutions and business models are now competing with municipal public transit companies for customers and control of the customer interface.

ENVIRONMENTAL CHANGE

Climate change is forcing us to find environmentally friendly solutions to congestion and emissions.

SOCIAL CHANGE

People's expectations of mobility are changing fundamentally. They are increasingly calling for integrated systems that combine different modes of transportation in a coordinated manner and allow them to switch from one mode to another at specific points or "hubs". They also increasingly want to share vehicles and access transportation as and when they need it, not when the timetables dictate – in other words, they want mobility on demand.

POLITICAL CHANGE

The negative impacts of transportation such as road congestion, air pollution and increasing scarcity of space are upping the pressure on politicians to take action, for example, in the form of driving bans. Additional pressure is coming from new market participants and mobility concepts, some of which are already influencing legislation (such as the German Car-Sharing Law).

We discussed these trends and their possible impacts with representatives of municipal public transit companies, experts from the rail and mobility industries, and leading academics. Based on these discussions we derived seven key strategies – actions that will enable public transit companies to achieve their goal of profitability.

People's expectations of mobility are changing fundamentally. They are increasingly calling for integrated systems.

3. The road to profitability

Seven strategies for public transit companies

The seven strategies presented below relate to three distinct areas of public transit companies' value chain: vehicle procurement, operations/traffic control, and sales and marketing. It should be noted that they cannot all be implemented in full right now: In particular, self-driving vehicles remain something for the medium term, while other levers can be applied immediately. → **B**

All seven strategies have an impact on the profitability of local public transit; however, that impact varies depending on the type of city and the size of its population. For the purpose of our calculations we distinguish between three types of cities:

Metropolises: cities with populations of over a million (e.g., Berlin, Hamburg)

Large cities: cities with populations of between 200,000 and a million (e.g., Dusseldorf, Wiesbaden)

Medium-sized cities: cities with populations of under 200,000 (e.g., Regensburg, Giessen).

For each of the three types of cities, we drew up a profit and loss statement. We included municipal public transit companies and, proportionally, regional rail transit (insofar as it plays a significant role in commuter and urban transit in the type of city in question).

We then analyzed how the seven strategies would affect the profit and loss statement for each type of city, particularly in terms of investments, running costs and potential additional revenue. Here, we focused on the financial impact of new technology. Note that the strategies are intended to be used alongside traditional actions such as organizational change and cost optimization. → **C**

Vehicle procurement

STRATEGY 1: FLEET AUTOMATION

The first strategy we propose is automating the existing bus fleet. The idea is that the public transit company replaces its buses with autonomous vehicles without altering the routes covered. Ultimately, these vehicles function as "feeders" for high-frequency routes, which continue to be covered by subway trains. Conventional streetcars can also be replaced by self-driving models, while subway trains are often already driverless today. To counter passengers' reservations about driverless vehicles, they could initially have conductors on them. In the future, it might also be worth considering reducing the size of vehicles to reflect the requirements of the route.

Fleet automation would mean that public transit companies could not only save on staff numbers but also control their operating procedures, such as refueling and washing vehicles, more efficiently and hence more cost-effectively. Moreover, autonomous vehicles cause fewer accidents and consume less energy thanks to their optimized driving style.

The impact of this strategy – like the two following strategies in the area of vehicle procurement – is seen first and foremost in operations; however, the underlying decision and the biggest investments need to take place in the procurement phase. It goes without saying that the full impact of this strategy will only materialize in the medium term. But that requires the conceptual foundations to be laid today.

Requirements and impact

- > Large-scale investment in new vehicles and necessary infrastructure. However, vehicles can be replaced successively once they reach the end of their useful life
- > Savings on labor expenses and cost efficiencies from

tighter control of operating procedures, lower maintenance costs, more energy-efficient driving and fewer accidents. Additional costs for recruiting specialized personnel

- > No new revenues
- > Cost recovery ratio increase of three to five percentage points for all types of cities. Larger increases in metropolises and large cities than in medium-sized cities due to scaling effects

**STRATEGY 2:
ELECTRIC BUSES**

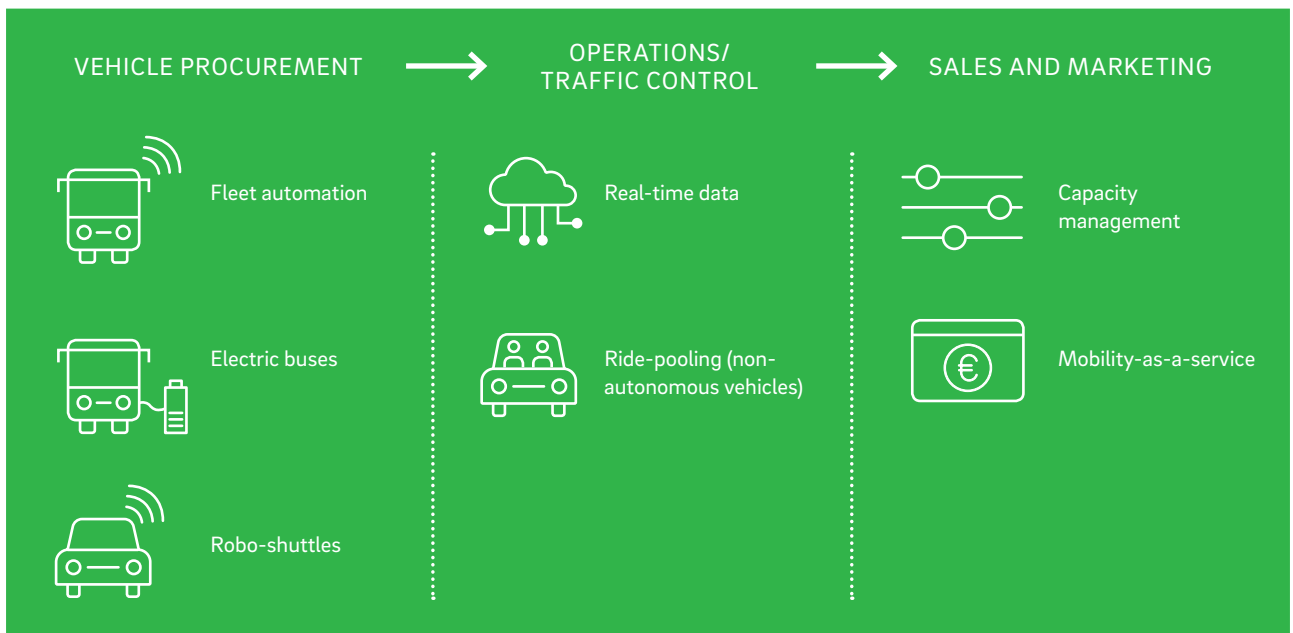
Public transit companies replace their buses with electric vehicles and build the required charging infrastructure. They can also replace buses with vehicles that run on other non-fossil fuels, such as hydrogen.

Requirements and impact

- > Using electric vehicles reduces energy consumption and makes it possible to plan service and maintenance

B: Potential savings in all areas

Seven strategies for boosting the profitability of public transit companies' operations



nance intervals more effectively. Electric vehicles also emit fewer pollutants and make less noise than conventionally powered vehicles

- > Large-scale investment in building the charging infrastructure, involving the laying of new electric lines and investment in substations. Electric buses currently cost more to buy than conventional-drive vehicles, and have shorter ranges and running times. However, it is assumed that the costs, range and running times of both types of vehicle will converge in the future. For it to be possible to gradually replace conventional buses with electric vehicles, significant investment subsidies will be required, especially for building the charging infrastructure
- > Ultimately, lower running costs thanks to significantly reduced energy costs during vehicle operation and lower costs for maintenance and servicing
- > No new revenues
- > Cost recovery ratio increase of up to two percentage points for all types of cities

STRATEGY 3: ROBO-SHUTTLES

Public transit companies introduce "robo-shuttles" – self-driving taxi-vans. These vehicles are used for "ride-pooling": with the help of an app, the company brings together different customers who are going in the same direction. Robo-shuttles can supplement bus services on heavily congested routes, or replace them completely on routes with low levels of traffic. The service is integrated into the local public transit system and has a fare structure designed with the users of public transit in mind.

Using robo-shuttles for ride-pooling makes it possible to cut the number of buses and make better use of those that remain. Labor, maintenance and repair costs are also lower.

Requirements and impact

- > Large-scale investment in new vehicles and technology
- > Lower labor costs as no drivers needed. Further savings from fleet reduction and lower maintenance and repair costs. Additional costs for specialized personnel and/or technology, such as apps
- > Minor increase in revenues as robo-shuttles feed high-traffic routes
- > Cost recovery ratio increase of four to five percentage points for all types of cities

Operations/traffic control

STRATEGY 4: REAL-TIME DATA

Vehicles transmit data in real time to the public transit companies. The biggest financial lever here is predictive maintenance, whereby technical data is collected and used for spotting early on when components are becoming worn out or could soon need replacing. This helps avoid repairs and optimizes the planning of maintenance intervals and new vehicle purchases. It also reduces repair costs as worn-out components are identified and replaced before they malfunction.

Data recorded in real time can also include journey-related data such as the number of passengers, or any delays on the route. This allows transit companies to match timetables more closely to demand. Initially, they use the data simply to improve timetables; in the longer term, however, they can adapt timetables in real time, rerouting buses if there are traffic jams, say. Real-time data also makes it possible to plan bus routes optimally so that existing vehicles are used as efficiently as possible.

Requirements and impact

- > Investments in new technology, integrating technology

into vehicles, and software for reading and transferring data

- > Savings on repairs and extended working life of vehicles thanks to predictive maintenance. Also, lower energy costs due to optimized timetables. Additional costs for hiring specialized staff
- > Optimized timetables make more journeys possible, generating additional revenues
- > Cost recovery ratio increase of up to seven percentage points in metropolises, four points in large cities and one point in medium-sized cities

STRATEGY 5:

RIDE-POOLING (NON-AUTONOMOUS VEHICLES)

Public transit companies are already using ride-pooling with non-autonomous taxi-vans such as the "BerlKönig" in Berlin. The taxi-vans, which have drivers, help connect new areas to the transit network and replace bus routes with low utilization. By running services on demand only, public transit companies can make better use of their fleets and reduce their operating costs. They can also serve areas that were previously ignored by the local transit network because it was not worth offering regular services there – rural regions, for instance.

Requirements and impact

- > Investments in ride-pooling technology (apps, software). The number of buses needed falls as underutilized routes are served on demand only
- > Lower maintenance costs. Higher labor costs, despite fewer buses, due to the need for additional drivers for taxi-vans
- > New revenues thanks to more customers and new routes
- > Cost recovery ratio increase of less than one percentage point in metropolises, no change in large and medium-sized cities. Despite the high startup costs and low financial impact initially, this strategy is import-

The seven strategies cover three distinct areas of public transit companies' value chain: vehicle procurement, operations/traffic control, and sales and marketing

ant as it allows public transit firms to gain experience: Its full financial potential will unfold when self-driving vehicles come in and the business model can then be scaled up

Sales and marketing

STRATEGY 6:

CAPACITY MANAGEMENT

Public transit companies use tiered pricing to distribute the utilization of transit services more evenly. For example, they offer low fares at times when vehicles are not usually very busy and higher fares when they are. However, this does not mean introducing complex "revenue management" pricing models such as those used by airlines; public transit companies are still bound by the requirements of public service provision.

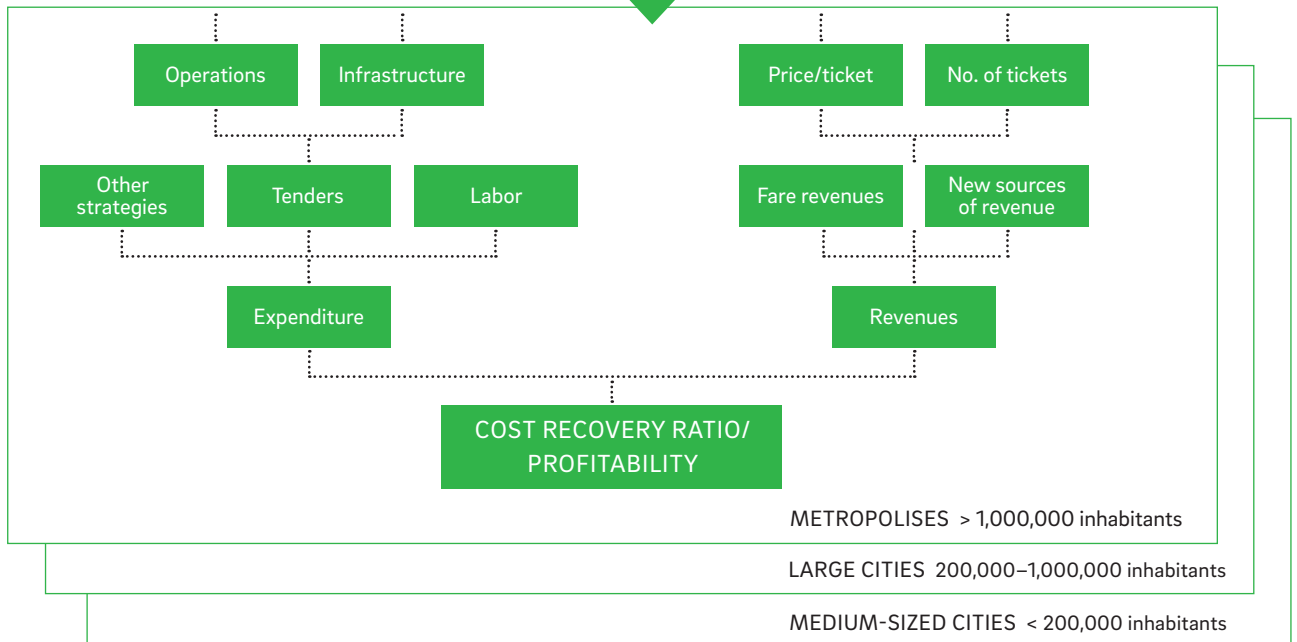
C: Threefold potential

Savings opportunities by type of city

STRATEGIES



PUBLIC TRANSIT MODEL BY TYPE OF CITY



Managing demand enables public transit companies to use their fleets better and meet additional demand. By reducing demand at peak times, they can also operate fewer vehicles in total.

Requirements and impact

- > One-time investments in developing and installing capacity management and price differentiation software
- > Savings from reducing the size of the fleet and related savings on labor
- > No new revenues
- > Cost recovery ratio increase of less than one percentage point in all types of cities

STRATEGY 7:

MOBILITY-AS-A-SERVICE

Various modes of transportation, run by both public and private transit companies, operate via a single intermodal transit platform. All options form part of the same ticket and pricing system. Customers choose the combination of modes of transportation that suits them best, or let the system automatically select the best option for them based on their preferences.

Intermodal transit platforms allow public transit companies to control capacity. Importantly, the companies retain the customer interface and access to data that goes with it. They can generate additional income both from advertising and commission payments from other providers. Furthermore, mobility-as-a-service is an important precursor for implementing other strategies, such as the use of real-time data.

Requirements and impact

- > Investments in software, apps and acquisition of new partners
- > Cost of hiring IT and specialist staff
- > Minor additional revenues from advertising and commission payments; new customer acquisition
- > Potential cost recovery ratio increase of three percentage points in metropolises, no change in large and medium-sized cities. Though not a financial lever, mobility-as-a-service is an important precursor for strategies such as using real-time data → [D](#)

WHICH STRATEGIES WORK TODAY? WHICH ARE LONGER-TERM?

Currently, some innovative approaches do not directly increase the cost recovery ratio. Even the technology and concepts currently attracting much attention from the media, the public and politicians do not necessarily generate additional income – indeed, some of them actually lead to additional costs. But they have a positive impact in areas other than profitability. Ride-pooling, for example, is important for connecting rural areas, even without the use of self-driving vehicles. Some strategies are also important as necessary precursors for other strategies. Mobility-as-a-service, for instance, enables the data to be collected that forms the basis for using real-time data in traffic control.

Currently, some innovative approaches do not directly increase the cost recovery ratio. However, these often bring advantages beyond profitability.

By contrast, strategies based on technology that is already established have a clear impact on profitability:

























- > Electrifying the existing fleet will increase the cost recovery ratio in all types of cities in the future, even if subsidies are needed for the initial investments
- > Using real-time data also significantly increases the cost recovery ratio, particularly through predictive maintenance, which allows companies to plan maintenance and repairs more efficiently and with greater foresight. The bigger the city, the greater the financial impact

In the long term, the introduction of self-driving vehicles also promises further savings potential:

- > Using robo-shuttles will significantly increase the cost recovery ratio in all types of cities, particularly if the vehicles replace buses on routes with few passengers or are used as taxi-vans in a ride-pooling system
- > Automating existing fleets will also raise the cost recovery ratio in all types of cities, particularly through savings on labor costs and operating procedures such as refueling and washing vehicles

D: Financial levers and precursors

Impact of strategies on cost recovery ratios by type of city

STRATEGY	METROPOLISES	LARGE CITIES	MEDIUM-SIZED CITIES	
 Real-time data	 +7%	 +4%	 +1%	Financial levers
 Robo-shuttles	 +5%	 +5%	 +4%	
 Fleet automation	 +4%	 +5%	 +3%	
 Electric buses	 +2%	 +2%	 +2%	
 Mobility-as-a-service	 +3%	Precursor only	Precursor only	Precursors
 Ride-pooling (non-autonomous vehicles)	 +1%	Precursor only	Precursor only	
 Capacity management	 +1%	 +1%	 +1%	

4. The upshot? Profitability is possible

Savings for all cities, profits for metropolises

Based on the impact on the cost recovery ratios of the different types of cities, which we calculated for each of the individual strategies, we can now calculate the potential impact of implementing all seven strategies on the profit and loss statements of public transit companies.

Our calculations reveal that, at least in metropolises, public transit companies can achieve profitability by implementing all seven strategies. Cost recovery rates range from 105 to 110 percent, depending on the precise combination of strategies. This translates into annual savings of up to EUR 390 million per metropolis compared with today's figures, realized gradually depending on the availability of the necessary technology, the time required for implementation and the financial resources

available. In other words, public transit not only delivers the general economic and environmental benefits of modern, high-quality transit infrastructure and reduces the external costs of individual transportation, but the companies operating public transit services are now in a position to operate at a profit.

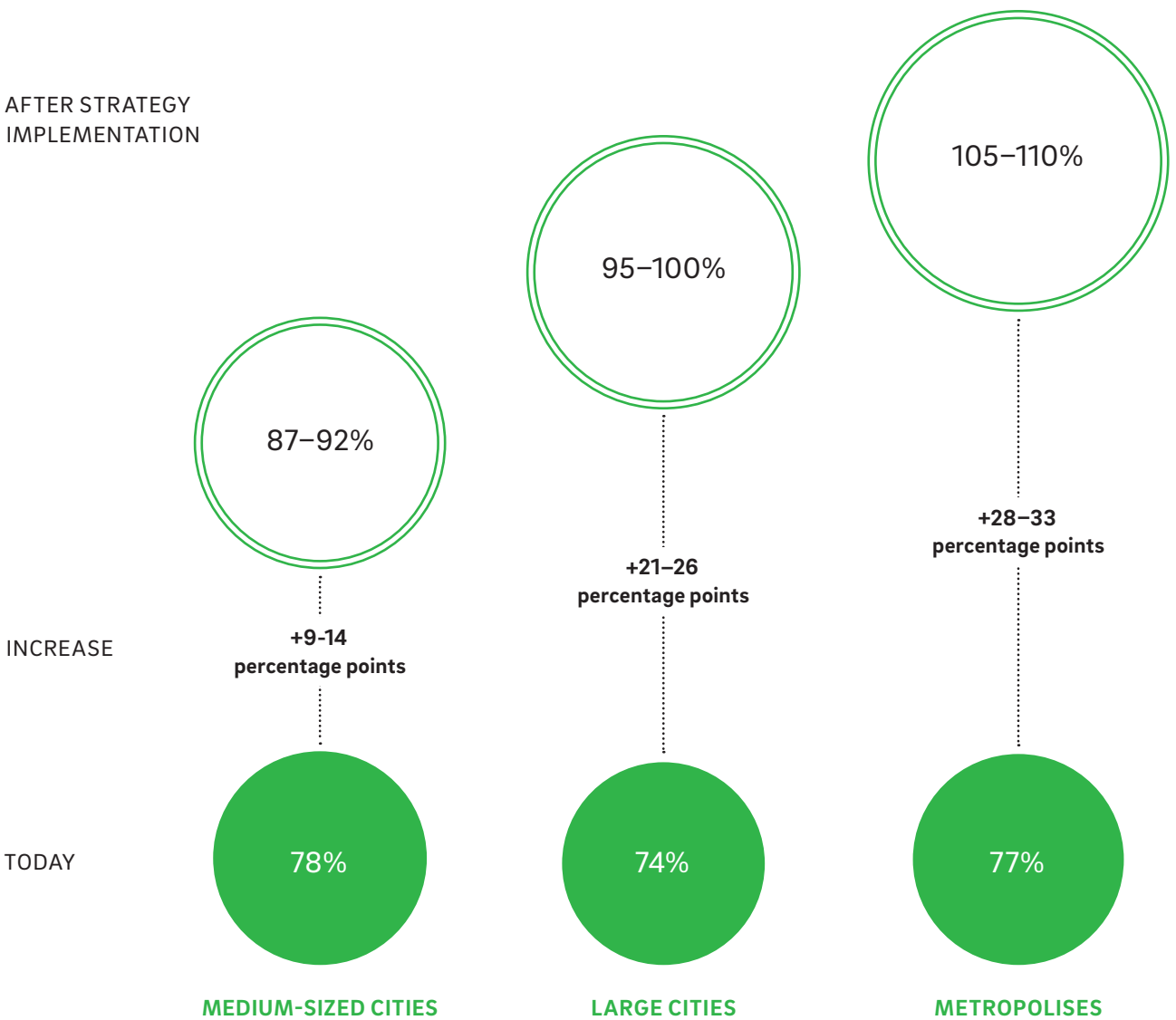
Large and medium-sized cities can also make considerable savings. A cost recovery rate of 95 to 100 percent is possible in large cities, and 87 to 92 percent in medium-sized cities. Compared with today's figures, that translates into annual savings of up to EUR 60 million in large cities and EUR 6 million in medium-sized cities.

The EUR 3.2 billion currently provided by the public sector could be reduced considerably, as could part of the EUR 8.5 billion that the government pays in concession fees for local rail transit in Germany. What is more, there would be no downside for customers: On the contrary, public transit companies implementing all the strategies could offer a broader range of services to the public, more closely aligned with demand and operated more sustainably than is currently the case. → [E](#)

**Public transit companies
in metropolises can
achieve profitability
by implementing all
seven strategies.**

E: Local public transit can be profitable

Cost recovery ratios following implementation of all seven strategies



5. New perspectives, new partners

What public transit companies and politicians must do

Our calculations show that it is possible to make local public transit in Germany significantly more profitable. To achieve this goal, however, all parties involved need to rethink their approach – not just public transit companies but also politicians, vehicle manufacturers and providers of technology and mobility solutions.

PUBLIC TRANSIT COMPANIES

Public transit companies should focus less on developing new business models and more on exploiting modern technology. They should immediately implement existing technology and concepts such as predictive maintenance, real-time data and non-fossil fuels. Furthermore, they should prepare now for future technologies so that they can integrate them the moment they hit the market. This is especially true for technology related to autonomous driving, which harbors considerable potential for savings. At the same time, public transit companies should drive the development of new

sales channels and pricing models so as to generate the financial resources that they will need for the upcoming investments.

To benefit from the new technology, public transit companies also need the financial wherewithal to invest in scaling, infrastructure and traffic centers. They would be well advised to form partnerships with private companies, especially if said companies have expertise or infrastructures beyond the core area of competence of the public transit companies. They should also try to generate as much knowledge as possible, for example through dialogue with academics and cooperation with universities. In addition, they should actively participate in the political process in order to create the general framework needed for new mobility solutions.

POLITICIANS

Politicians should quickly establish the general framework needed so that public transit companies can implement the strategies described above. Legislators should take an open-minded, proactive approach to instituting new, flexible concession models, especially in the areas of mobility-as-a-service, capacity control and real-time data. Local public transit companies should be integrated into this process.

Furthermore, politicians should identify where new rules and regulations are needed in order to facilitate the use of new technology in cities. They should seek out possible partnerships with the private sector – although the task of planning and integrating new modes of transportation should remain the responsibility of public transit. They should continue to view all modes of transportation available to the public as a whole, in order to create the most efficient overall system possible.

Politicians should also make efforts to enable public transit companies to carry out the necessary investments, especially with regard to developing new technology during the transformation phase. This will pay

Public transit companies should focus less on developing new business models and more on exploiting modern technology.

off in the medium and long term, when the companies become more profitable and state subsidies can be cut accordingly. Implementing the strategies outlined above will also have a positive impact on the environment, improving air quality in cities and reducing noise pollution, for example. This will improve the public perception of policymaking in general.

Politicians must also establish new financing rules for those transit companies that manage to cover their costs, so that it is worth them striving to make their business profitable in the first place.

VEHICLE MANUFACTURERS AND PROVIDERS OF MOBILITY SOLUTIONS

Finally, vehicle manufacturers, tech companies and providers of mobility solutions should seek to form partnerships with cities and public transit companies. This will enable them to increase their access to the customer interface and benefit from the knowledge they acquire by doing so. They may also benefit from marketing effects, such as increased recognition and a positive image thanks to their commitment to the public. However, the goals of the public sector – in particular the creation of an integrated public transit system – must take precedence when designing such partnerships, and such partnerships should also benefit public transit companies.

Politicians should make efforts to enable public transit companies to carry out the necessary investments.

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WE WELCOME YOUR QUESTIONS, COMMENTS AND SUGGESTIONS

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