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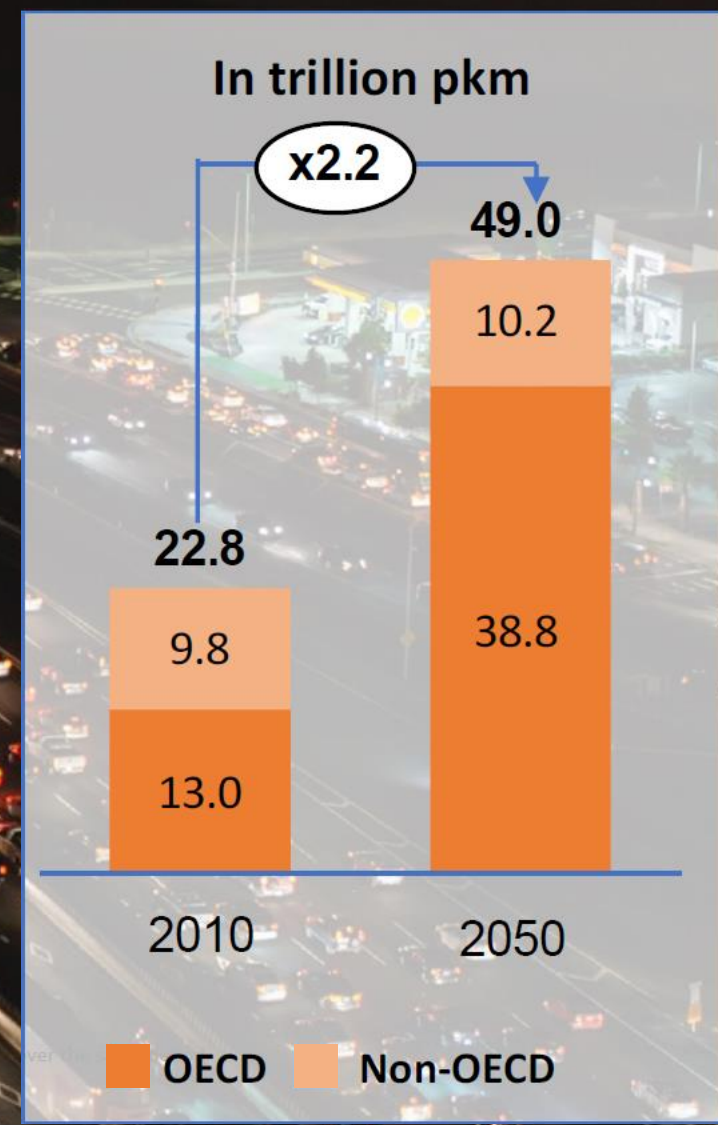
Integrated Smart Mobility in Urban Areas Under Environmental and Energy Aspects

Prof. Ulrike Stopka
11/05/2019, Auckland





1,2 billion vehicles worldwide
100 million new cars every year,
but there are also more than 9,8 Mio
vehicles get out of operation every year



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energie
wächter

Reference: Sauer, K.: Uber, Lyft, Hyperloop und Co –Lösung oder Problem? - Mobilitätssysteme in den USA, presentation
Münchner Kreis, April 2019

Urban Mobility in Cities Today Causes a lot of Problems

Carbon dioxide

385.000

Particulates

Premature deaths
worldwide due to
**traffic-related air
pollution in 2017**

13.000



114.000



74.000

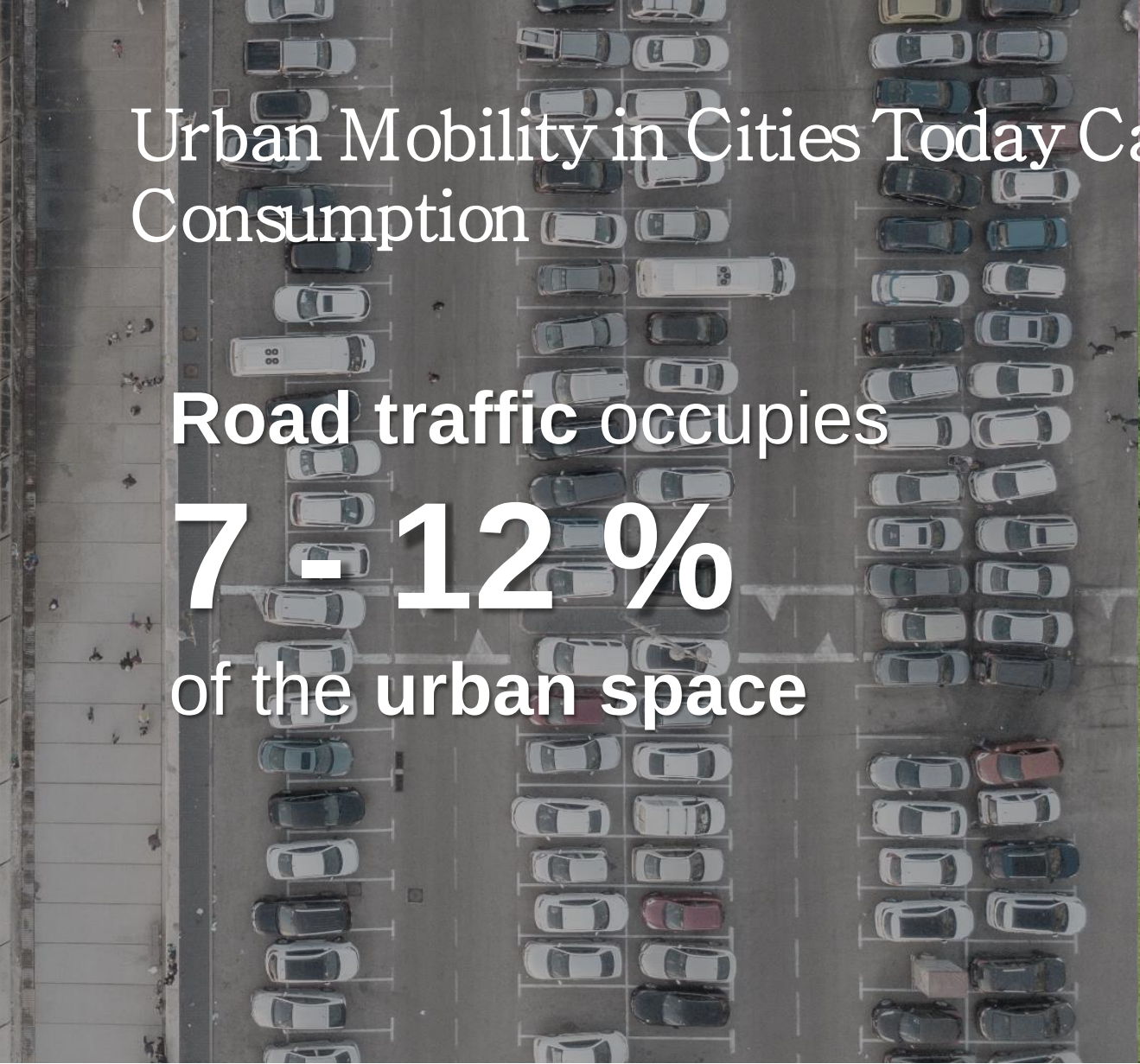


22.000



Nitrogen dioxide

Reference: ICCT (International Council on Clean Transportation): A Global Snapshot of the Air Pollution-Related Health Impacts of Transportation Sector Emissions, 2019.



Urban Mobility in Cities Today Causes Enormous Land Consumption

Road traffic occupies

7 - 12 %

of the urban space



Air quality

Green areas have

Positive Impacts

Neighborhood

Health



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Reference: Deckwart, A.: Bewertung von Maßnahmen zur Reduktion des MIV - Master Thesis, Dresden, 2019.

What Possibilities do we Have to Redesign the Cities Green, Low-Noise, Low-Emission...?

Comprehensive integration of
new and traditional transport
modes → **Multimodality**

**Mobility-as-a-Service
and integrated platforms**

Mainly shared fleets

**Demand
Responsive
Transport**

Active mobility
(cycling, micro-
mobility, pedestrian)

E-Mobility

Centrally managed traffic

IoT-Platforms

serving with all things sensing,
connected and intelligent based
on Big Data Management and
Analysis, AI, Cloud Computing



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The Need for an Optimized Transportation System is Greater Than Ever Before

Vehicles with combustion engine



Electric vehicles



Autonomous vehicles



Uber/Lyft vehicles



Reference: Zwick, M., Siemens Mobility GmbH: Innovationen im Verkehrsmanagement, einem Schlüsselement für MaaS, 2019.



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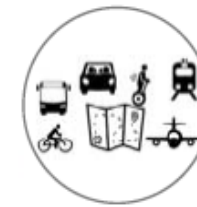
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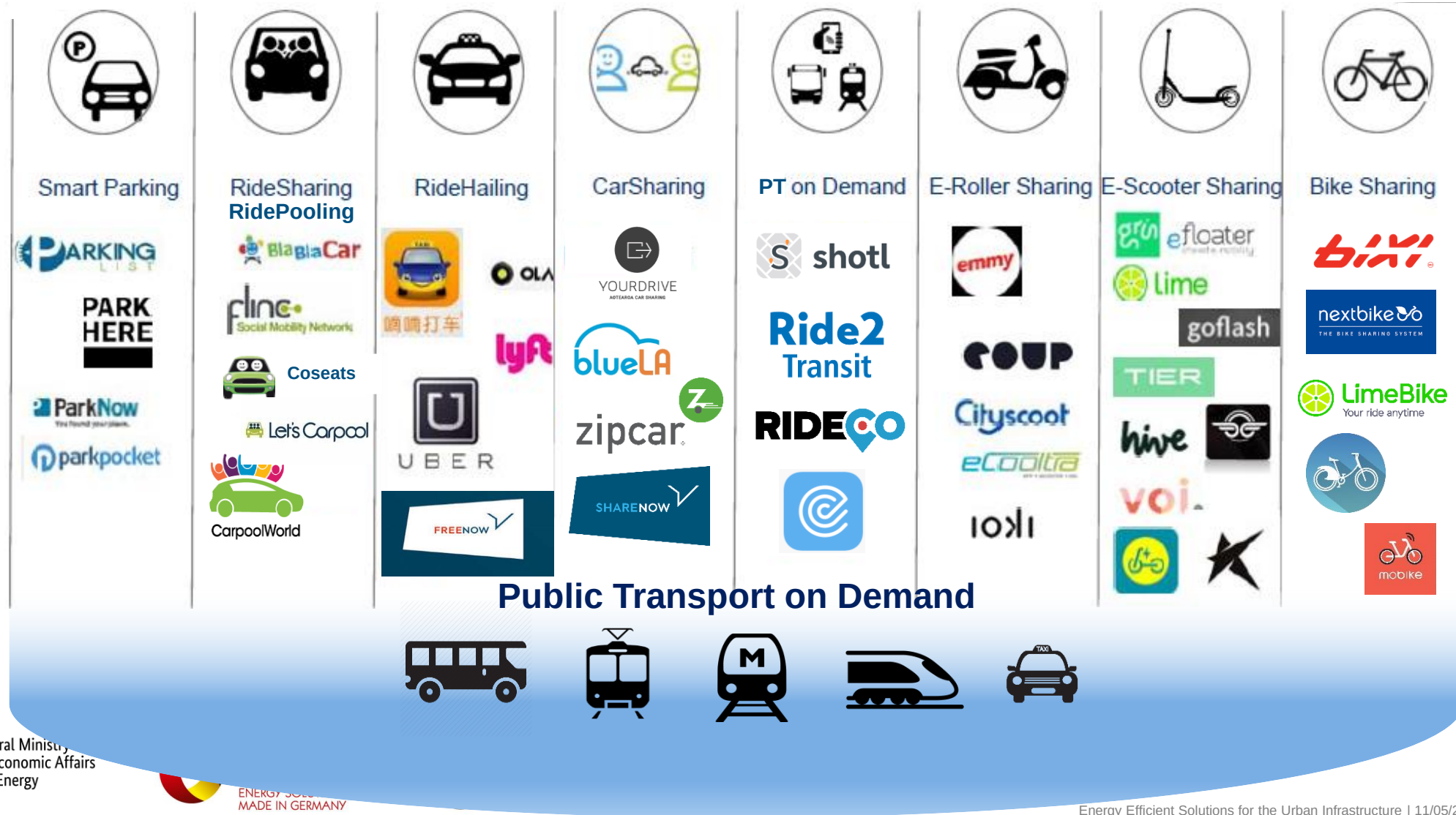
Smart Mobility in Urban Areas



Intermodal Mobility



Mobility platform integrates & aggregates mobility services into a single offer



Reference: Reinz-Zettler, J.: Conference on Smart Mobility Services, COSMOS, 2019.



→ Intermodal Transport Has to Become as Comfortable as Your Own Car



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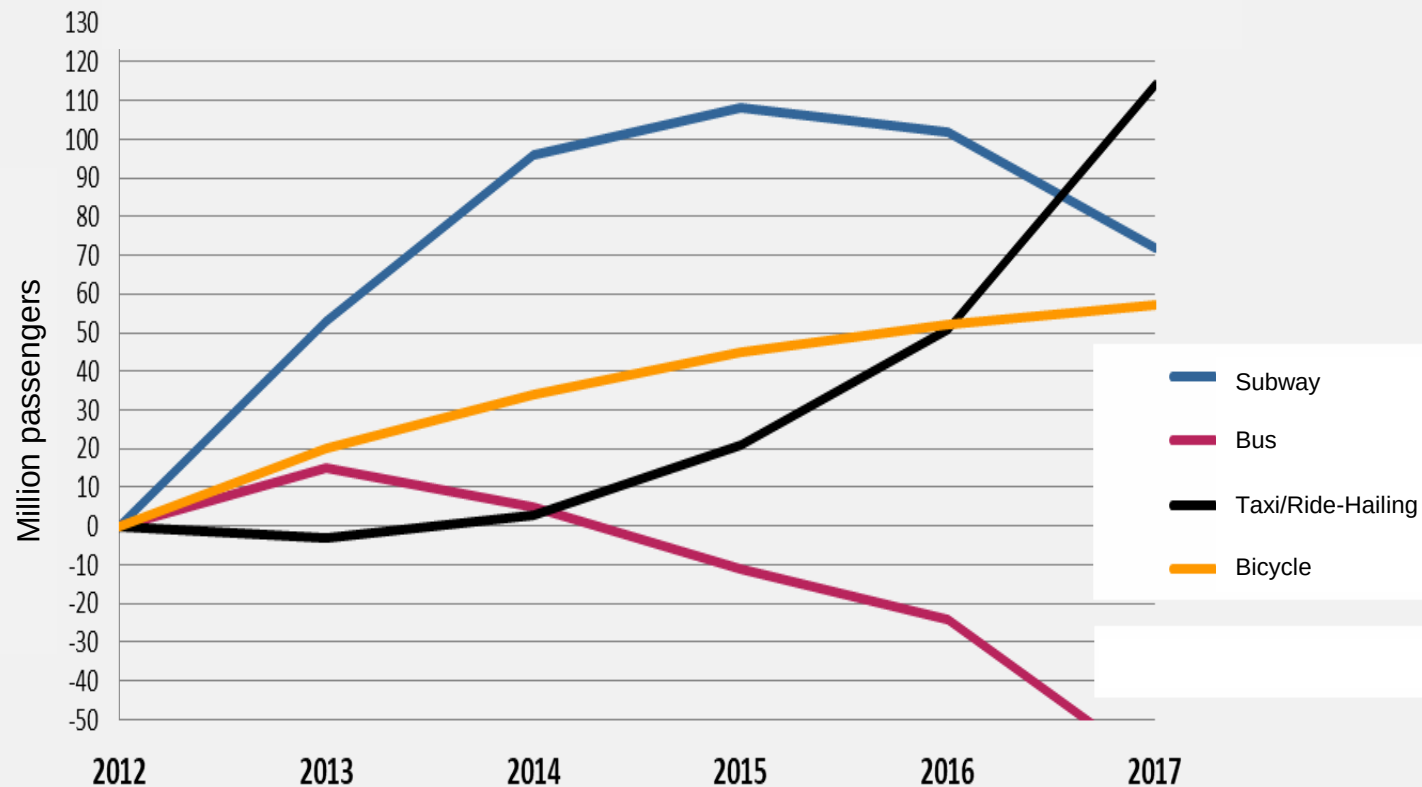


Reference: Dr. Kirschbaum, T.: Utopia ante portas – Der Weg zur autofreien Stadt, Dresden, January 2017.

But: Less Traffic with Transport Network Company Services like Uber, Lyft & Co.? No

Example New York City

Changes in demand for mobility services in relation to the previous year (summed up, mio. passengers per year)



- TNCs added 976 million miles of driving to **New York City streets** from 2013 to 2017. [Schaller Consulting 2018]
- TNC usage increased vehicle miles traveled by 85% in the **Denver area**. [Henao 2017]
- *“Ride-hailing is adding new auto trips ... [and] exacerbating congestion on the [Boston] region’s roadways.”* [MAPC 2017]

Better: Shared Demand-Responsive Transport Services



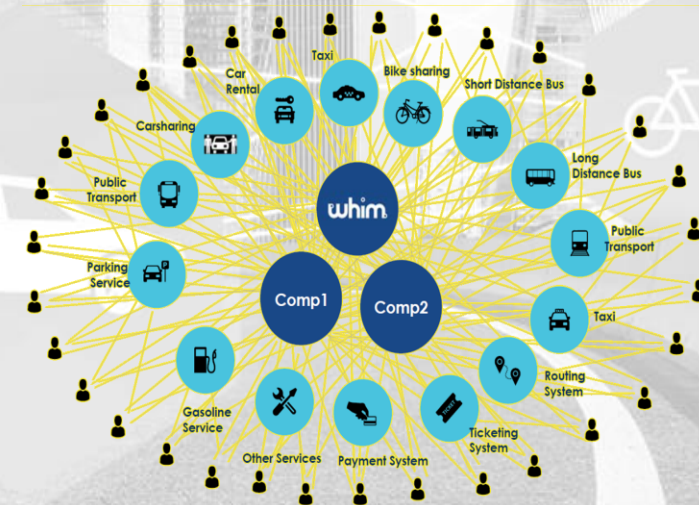
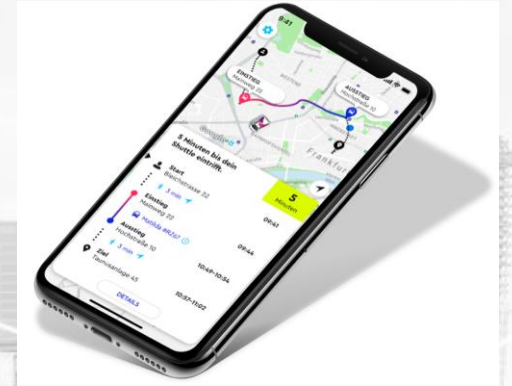
Reference: Dr. Kirschbaum, T.: Utopia ante portas – Der Weg zur autofreien Stadt, Dresden, January 2017.

- HIGH FLEXIBILITY
- BOOKABLE ON AN APP
- ALGORITHM CALCULATES OPTIMAL ROUTE.
- AS CHEAP AS THE PUBLIC TRANSPORT.
- AS COMFORTABLE AS YOUR OWN CAR.



MaaS and Integrated Mobility Platforms

- **One-stop access** to different public and private transport modes on demand based on consumer's preferences
- Information, registration, journey planning, booking and payment via a **single smartphone app**
- **Single contract with a Mobility operator/integrator** → registration, information, booking and payment via the appropriate operator's platform
- **Single invoice** at the end of the month for all used mobility services, the operator handles the clearing between the mobility providers
- **Choice between different tariff options** (bundled mobility packages with a special price structure or “pay-as-you-go” scheme)



Forerunner on the MaaS –Market

Helsinki (Finland)

- Start up “MaaS Global” launched monthly mobility packages in late 2016, **full launch in Nov 2017**
- Whim operates also in **Birmingham (UK)** and **Antwerp (Belgium)**
- late 2019 **over 100.000 registered users**



Whim Urban 30

€59,7

/ 30 days

A 30-day **HSL ticket**, unlimited 30-minute trips with **city bikes**, 10€/5km taxi rides, **car rental** 49€/day



Whim Weekend

€249

/ 30 days

Car rentals for any weekend from Friday to Monday, a **15% discount** on all **taxi** rides, 30-day **HSL ticket** and unlimited 30-minute **city bike** rides



Whim Unlimited

€499

/ month

Choose daily whether you'll go for **unlimited taxi rides up to 5 km**, or **rent a car**. Unlimited **HSL-ticket**, unlimited 30-min **city bike** rides



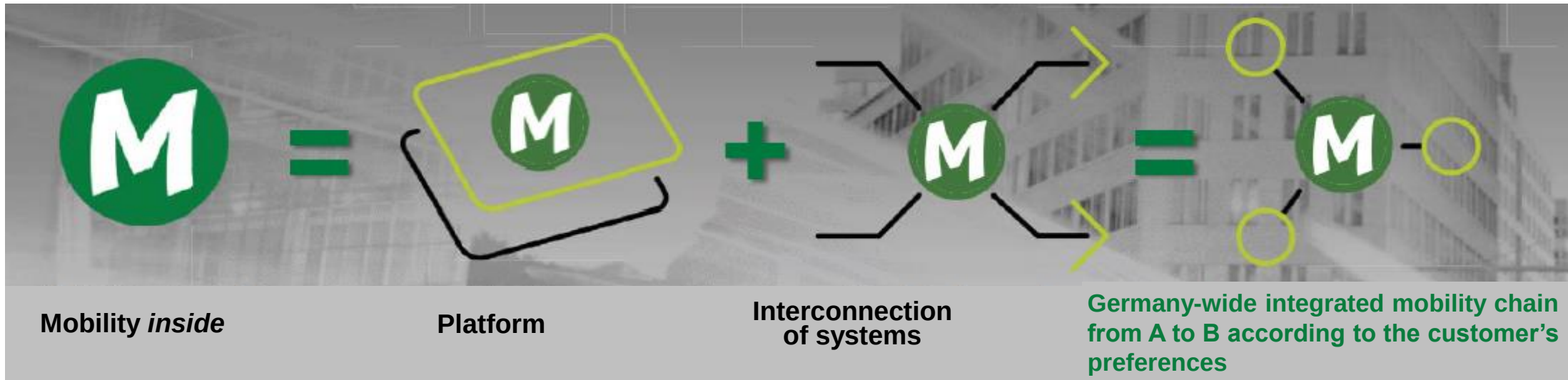
Whim to Go

Pay as you go

No subscription fee, no surcharges, and Whim always gives you the **price up front**.

Reference: <https://whimapp.com/>

„Mobility Inside“ as a Public Transport Sector's Platform and Networking Initiative in Germany



Reference: Mobility inside: Durchgehende Mobilität für den Kunden – Mit Mobility inside vernetzt in die Zukunft (2018)

- Public transport companies create a **common comprehensive network** to **keep customers loyal** to the industry and **attract new customers**
- Secures the **sales channel sovereignty** for the **PT-Industry**
- Offers **intermodal/multimodal routing** based on **real time data**
- Generates **additional revenues** by expanding digital customer relationships

Mobility Inside – Platform Architecture

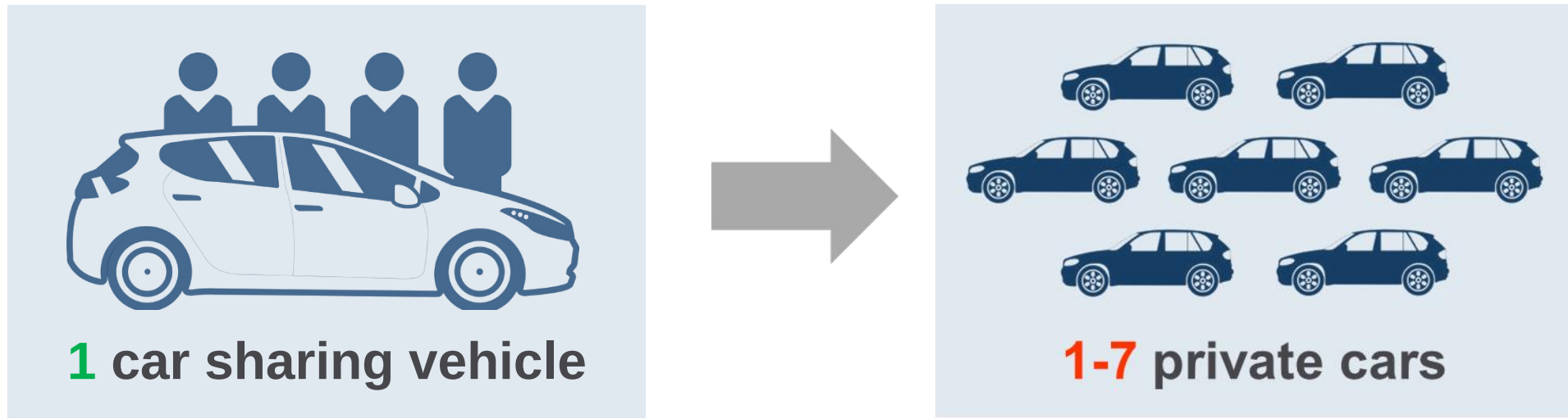
- **Open mobility platform “as-a-Service”**
- **Transport operators** can use their **own sales background** and **CRM systems**
- **White Label Solutions** for smaller PTOs
- Interconnection of servers and **multi-tenant systems**
- **Interfaces for data exchange** (e.g. tariff products, real time data, clearing, ...) based on PKM, DELFI, ITCS ...
- **Interoperable, standardized booking and payment systems**



Reference: Mobility inside: Durchgehende Mobilität für den Kunden – Mit Mobility inside vernetzt in die Zukunft (2018)

Smart Mobility: Exonerative Effect of Car Sharing

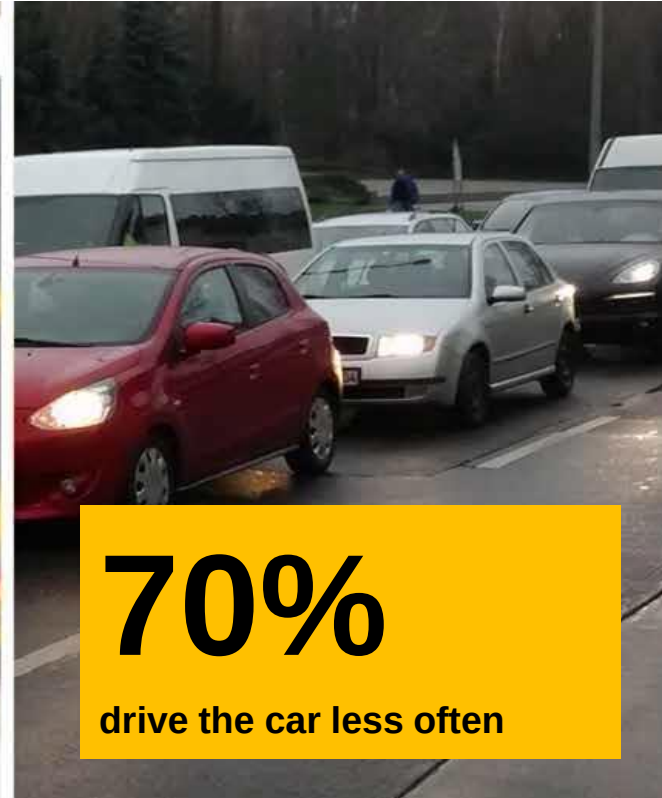
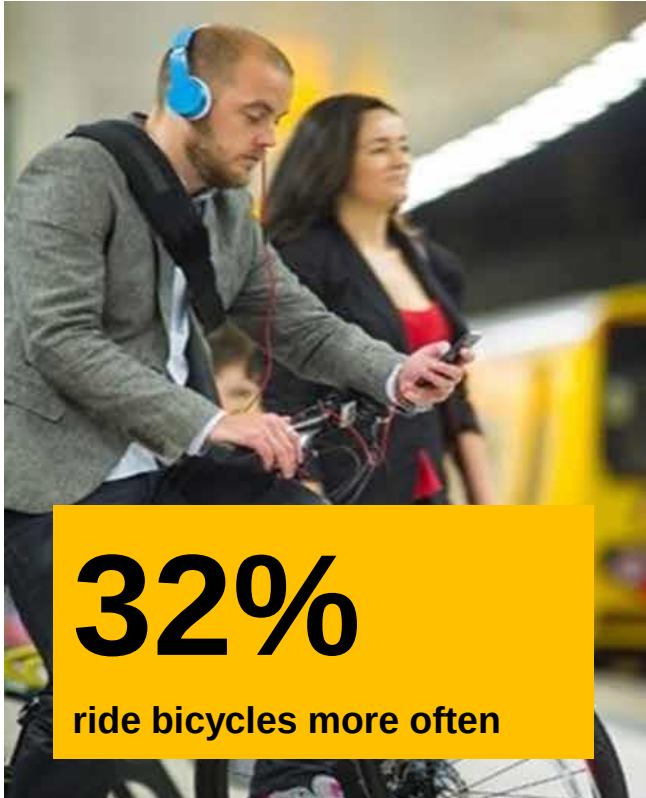
Numerous studies in German cities (F/M, Cologne Stuttgart, Bremen) showed:



- **Station-based car sharing** is regarded as a **car substitute**
→ high impact on private car ownership
- **Free-floating car sharing** is often **used in parallel with the own car**

Beneficial Impacts of Car Sharing

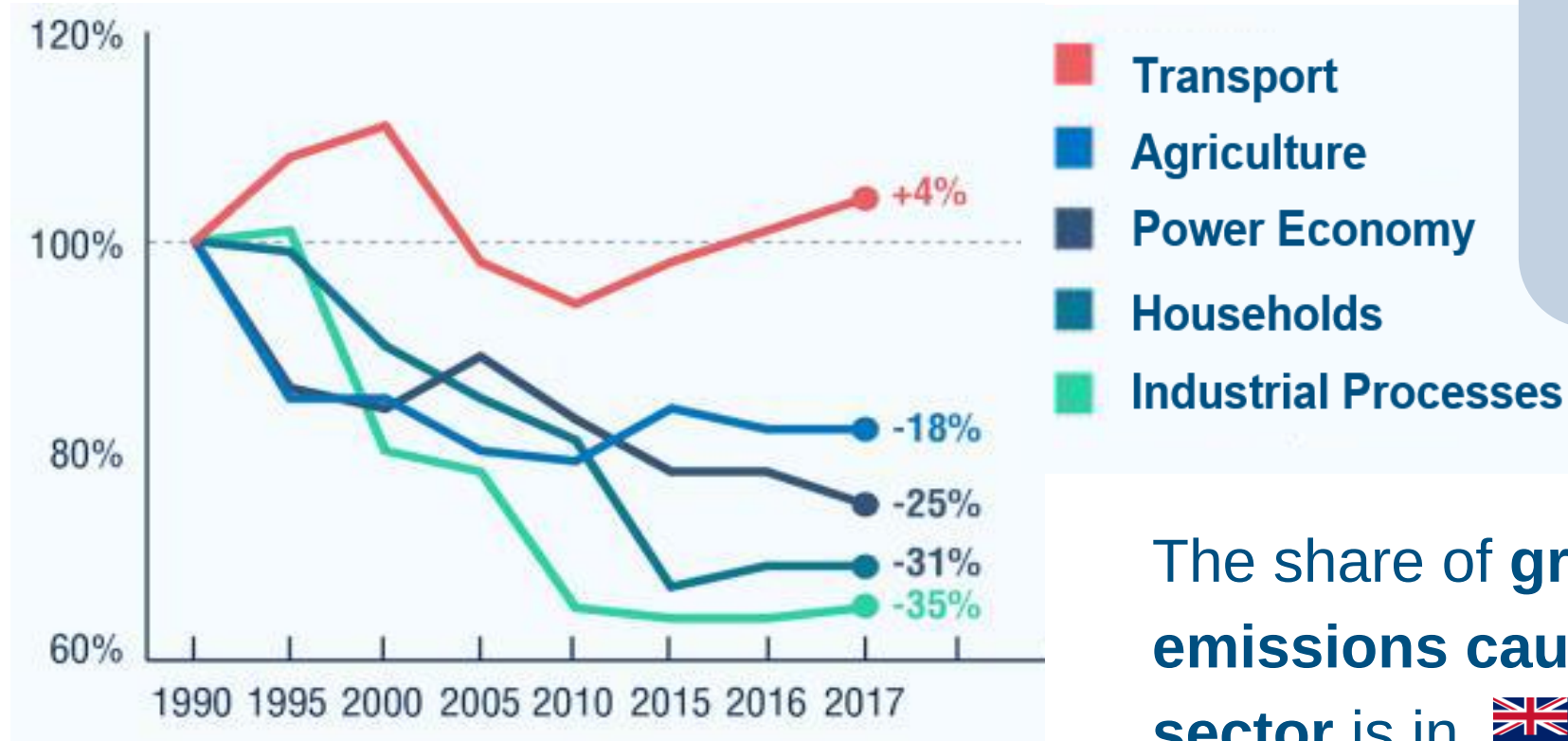
Changes in mobility behavior → **new modal split especially after abandoning the private car**



Reference: Nehrke, G., Bundesverband CarSharing e.V.:
Entlastungswirkung unterschiedlicher CarSharing-Angebote, VDV-
Symposium on Multimodality, Munich, February 2019.

E – Mobility: Climate Protection Program 2030 of the Federal Government of Germany

Development of greenhouse gas emissions in Germany

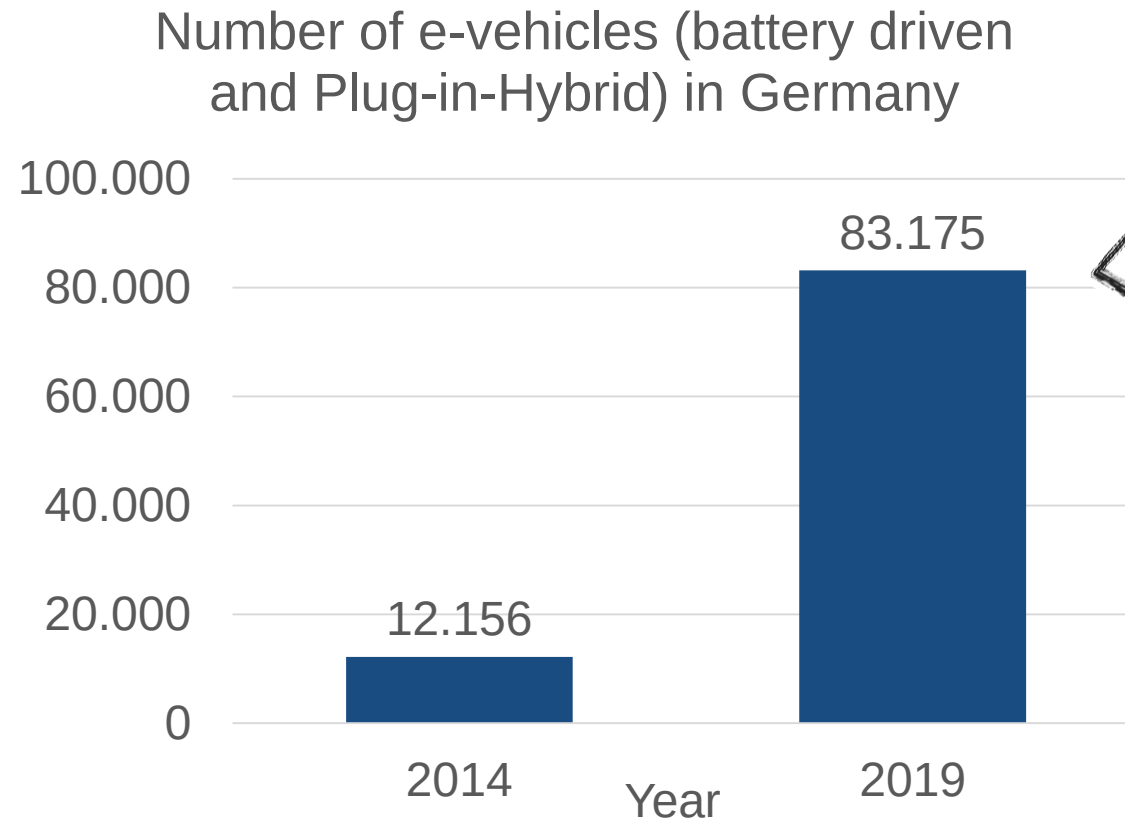


Transport sector has to reduce emissions by 40 - 42% until 2030 (compared to 1990)

The share of greenhouse gas emissions caused by the transport sector is in  and  **20%**

Reference: GRV Gesellschaft für Rationale Verkehrspolitik
e.V.: GRV – Nachrichten – Folge 114, Essen, April 2019.

E – Mobility: Climate Protection Program 2030 of the Federal Government of Germany



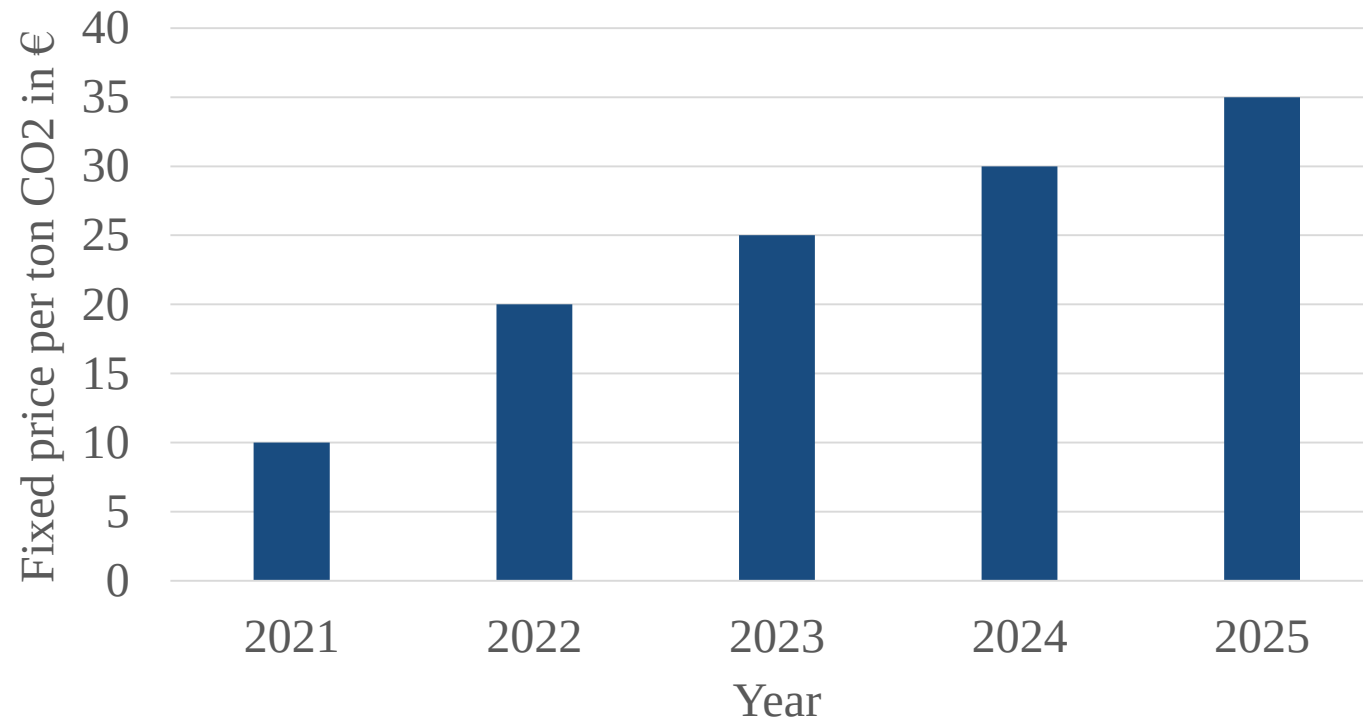
Plan until 2030: 7-10 million e-vehicles

Market share of electric vehicles in the total number of vehicles (2018):

	battery driven	plug-in-Hybrid
	0,71%	0,85%
	20,0%	18,4%
	0,6 %	

Climate Protection Program 2030 of the Federal Government of Germany

CO₂ pricing for the transport and heat sectors



**from 2026 auction of
emission certificates in a
corridor between 35€ and
60€/t CO₂**



E-Mobility



Reference:
<https://www.spektrum.de/new/s/wie-ist-die-umweltbilanz-von-elektroautos/1514423>

Electro cars have a significantly better carbon footprint than diesel and gasoline vehicles.



But: Mobility and cars will never be up for free!

The climate balance of e-vehicles is influenced by the

- **energy demand in battery production and recycling**
- **mix of charging power** (electricity from fossil fuels vs. renewable sources)
- **intelligent charging management**
- ...

Break Even Mileage for E-Vehicles (CO₂ balance over the entire lifecycle “Cradle to Grave”)

Compact class vehicle	E-vehicle (Electricity Mix Germany)	E-vehicle (100% regenerative)
Benzine (with 5% bioethanol)	from 127.500 km	from 37.500 km
Diesel (with 7% biodiesel)	from 219.000 km	from 40.500 km
Natural gas CNG (with 15% biomethane)	never	from 48.000 km
Hydrogen H₂ (100% regenerative)	never	from 115.500 km

Reference: Johanneum Research, Graz; ADAC.

Database: "Golf class" vehicle, gasoline consumption (E5) 6l (=0,52 kWh/km), diesel (B7) 5,2l (=0,5 kWh/km), CNG 4,1 kg/100 km (=0,63 kWh/km), H2 1,02 kg/100 km (=0,34 kWh/km); power 0,19 kWh/km. Car service life 15 years, **annual mileage 15.000 km**, battery capacity 40 kWh, battery service life 150.000 km. CO2 equivalent value 580g/kWh (CO₂, methane, CH₄, nitrous oxide N₂O) from electricity mix Germany, published in the Federal Gazette on 10/30/2018, valid for 2019.

With the actual electricity mix in Germany, **electric cars** have a **better environmental footprint** than gasoline and diesel only **after 8,5 resp. 14,6 years** (with an annual mileage of 15.000 km).

Measures and Regulations for Less Private Car Ownership



Paris will be **banning all Diesel vehicles** as of 2024 and **Petrol vehicles** by 2030. By 2020, they will **double the amount of bike lanes** and **make multiple streets exclusive to electric and no-emission vehicles**.

PARIS



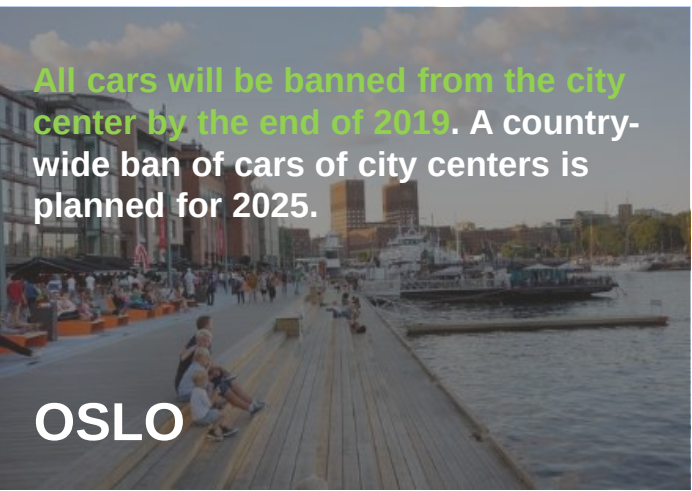
As of April 2019, central London will implement zones for vehicles, including **zero-emission zones in core business & tourist areas**. Additionally, **more protected bike lanes and pedestrian-only areas** will be installed.

LONDON



Madrid will be **banning non-resident vehicles**. By 2020, they will **install a 500 acre perimeter in its core** **banning cars and heavy vehicles**. **Repurpose 24 main arteries exclusively for bike and pedestrian use**.

MADRID



All cars will be banned from the city center by the end of 2019. A country-wide ban of cars of city centers is planned for 2025.

OSLO



The German High Court passed a **bill to allow cities to ban Diesel vehicles**, bans in **Frankfurt, Munich, Stuttgart, Düsseldorf and Aachen**.

GERMANY



Copenhagen has pledged to **become Carbon Neutral by 2025**. They currently have **over 200 miles of bikelanes** and **39 bike "Superhighways"**. **Already half of the population bikes to work**.

COPENHAGEN



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Promote More Active Mobility

No greenhouse
gas emission

Quiet

Low land
consumption

Health benefit

Particulate

Low costs



picture: Fotolia / william87



picture: Katrin Dziekan



Parking spaces:

- Car parking space costs: approx. 3.000-25.000€
- Bicycle parking: approx. 100-200€ per hanger

Access roads are about 10 times more expensive (approx. 1.5 million €/km) to build than a cycle path (approx. 0.15 million €/km)

Another Alternative: „Mi Teleférico“ from La Paz to El Alto



Largest urban cable car network in the world

33 km length, 10 lines, daily used by 550,000 passengers

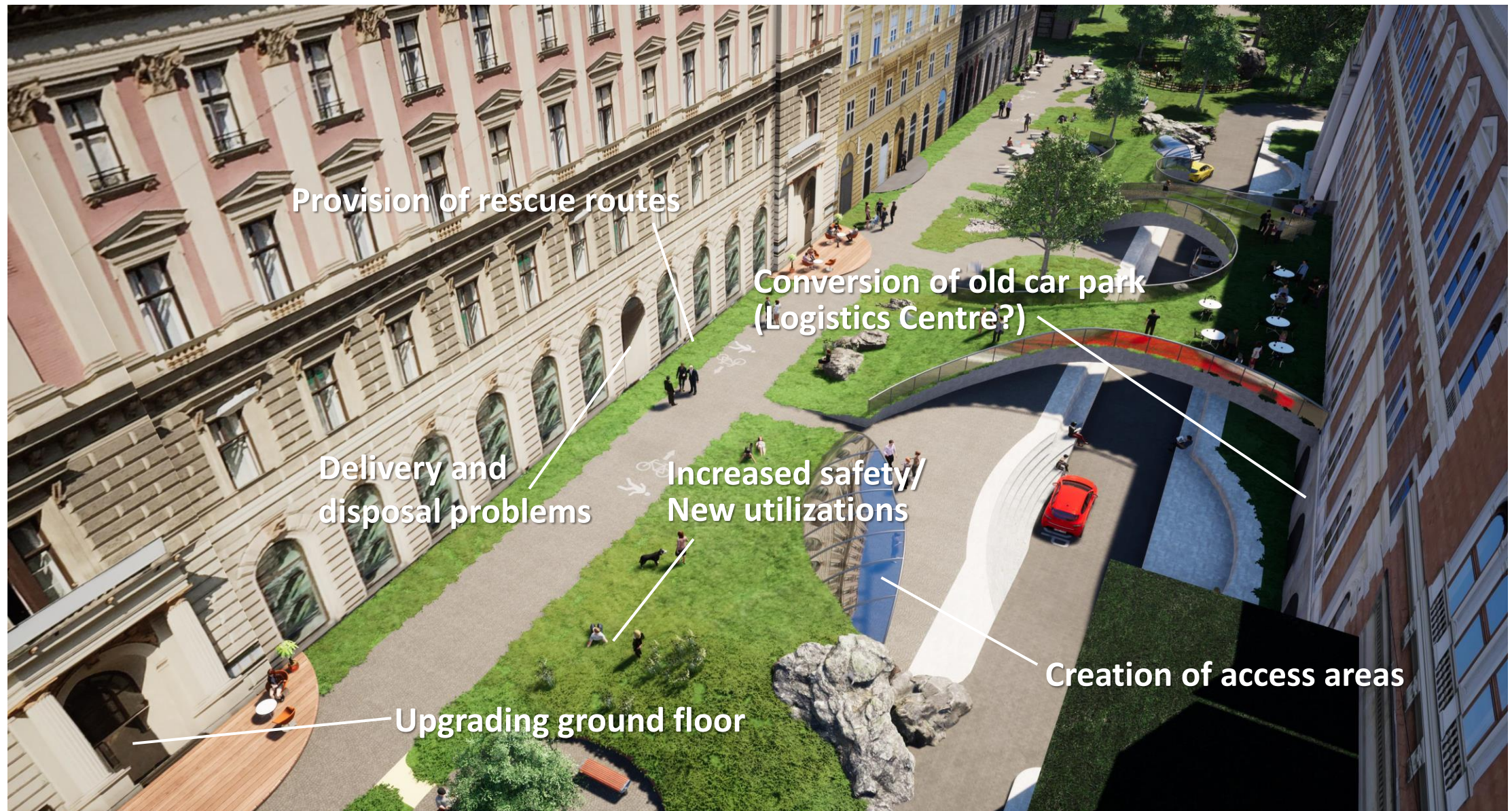
No traffic jams, no emissions, but:

- Investments in infrastructure required
- Massive influence on the cityscape

Cities are the Nucleus of Mankind's Success – But How Do Cities Look Like Today?



Reference: Bertram, O., Wideshot Design GmbH, Austria: Mobilität im urbanen Raum, presentation at the Expert Conference "Mobility systems in digital transition", Potsdam, March 2019



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WHAT if



Reference: Bertram, O., Wideshot Design GmbH, Austria: Mobilität im urbanen Raum, presentation at the Expert Conference "Mobility systems in digital transition", Potsdam, March 2019

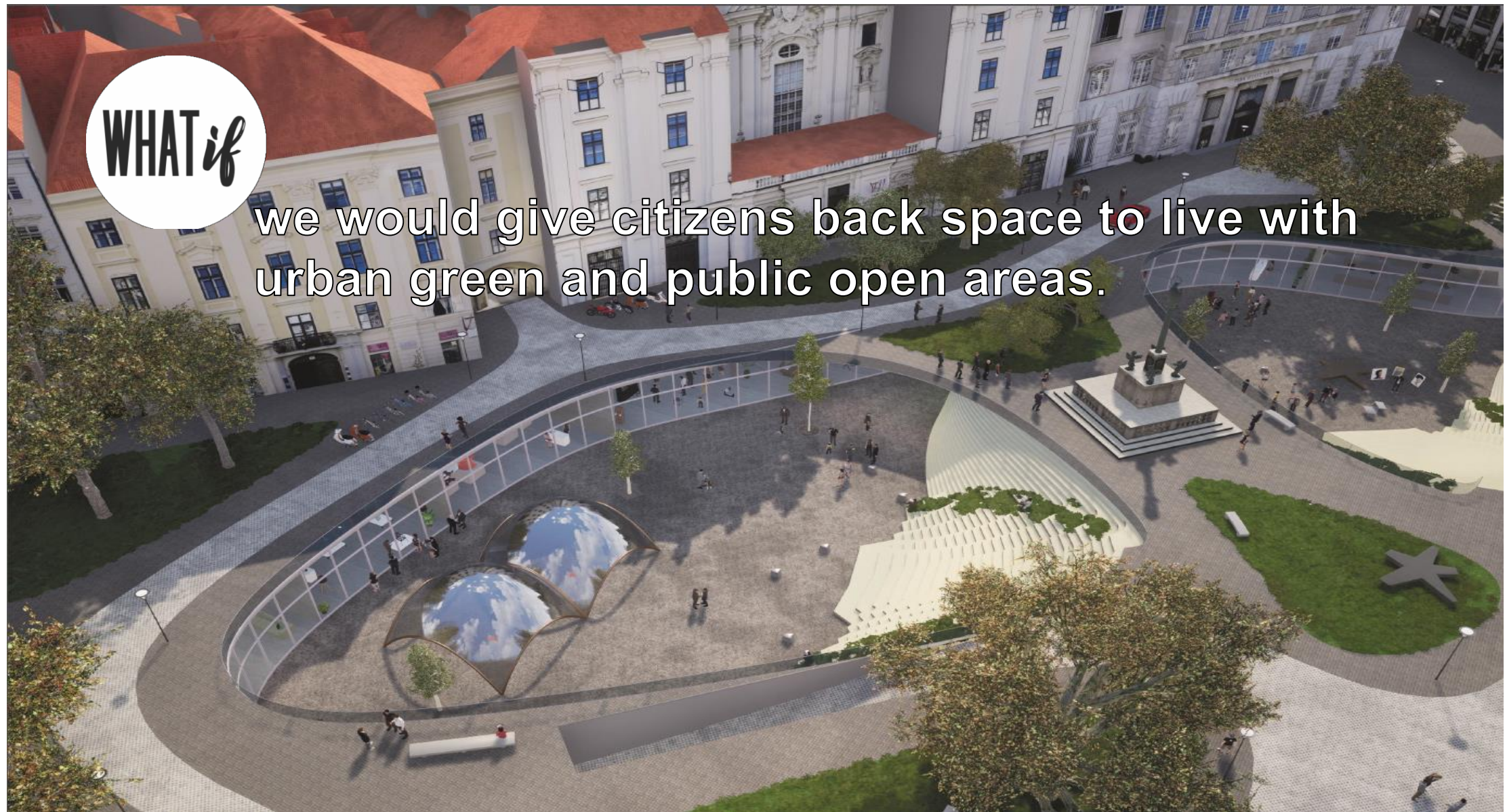


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WHAT if

we would give citizens back space to live with urban green and public open areas.

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Thank you for your attention!

Prof. Ulrike Stopka
11/05/2019, Auckland

