
wbcsd
Moving to sustainable
Mobility
trends/innovation/levers and beyond

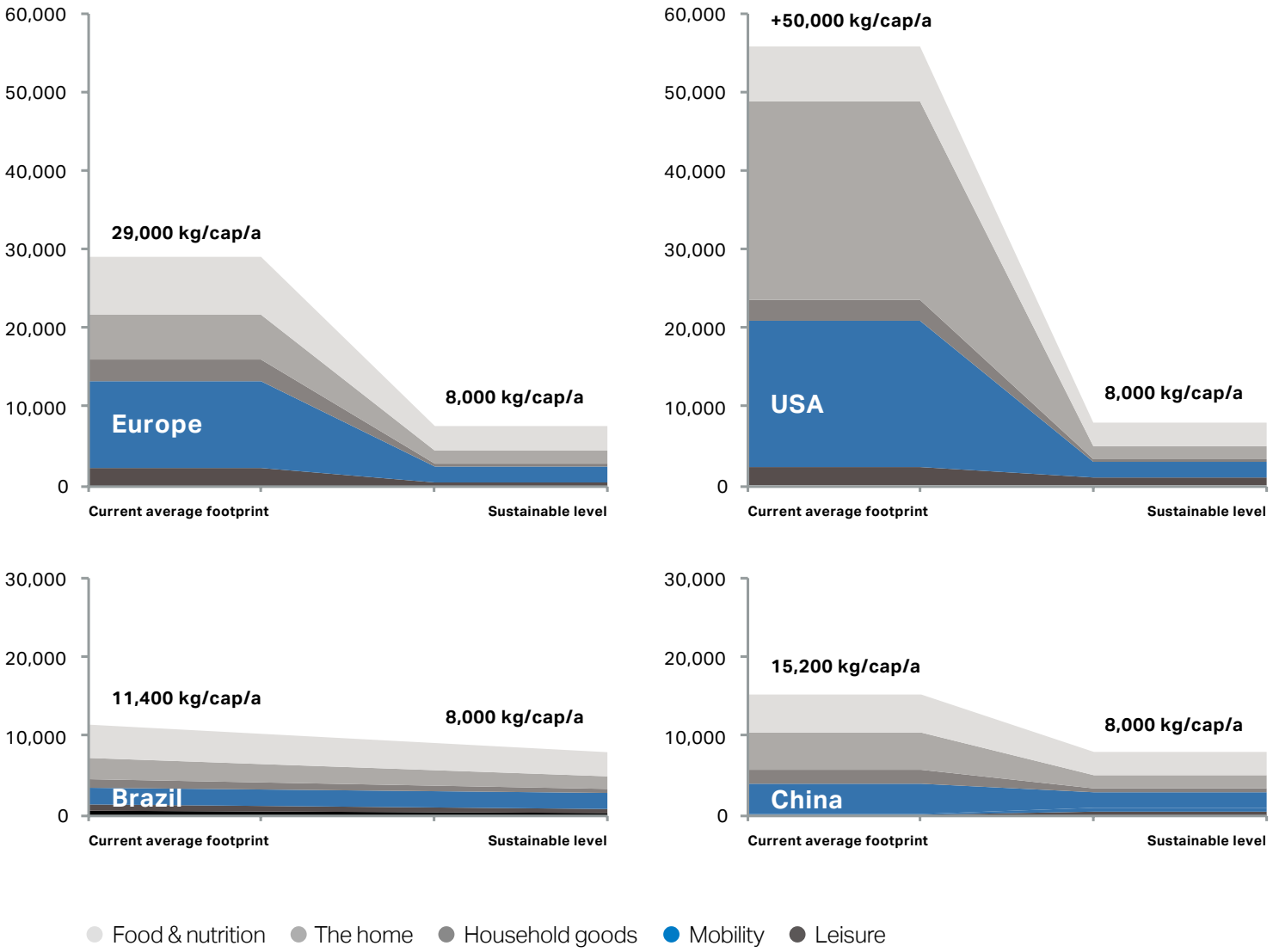
Mobility is a major contributor to lifestyle material footprints across the world: particularly in Europe

What is a lifestyle material footprint?

A lifestyle material footprint shows the material intensity of resources that go into the products we consume as part of our lifestyles. All numbers refer to calculated kilogrammes of materials used per person per year.

How are they calculated?

You can find out further details on the calculation of the lifestyle material footprint in our explanatory document. The data we use here for Europe comes from the EU's Spread2050 Project, while the Brazil and India data has been drawn from CSCP and D-Mat analysis following research performed for WBCSD in 2015, The US footprint is an estimate based on CSCP and D-mat internal data on material intensities for Europe, combined with recent US official household consumption data publicly available online.



In Europe, mobility footprints are driven by more cars, more KMs and more flights

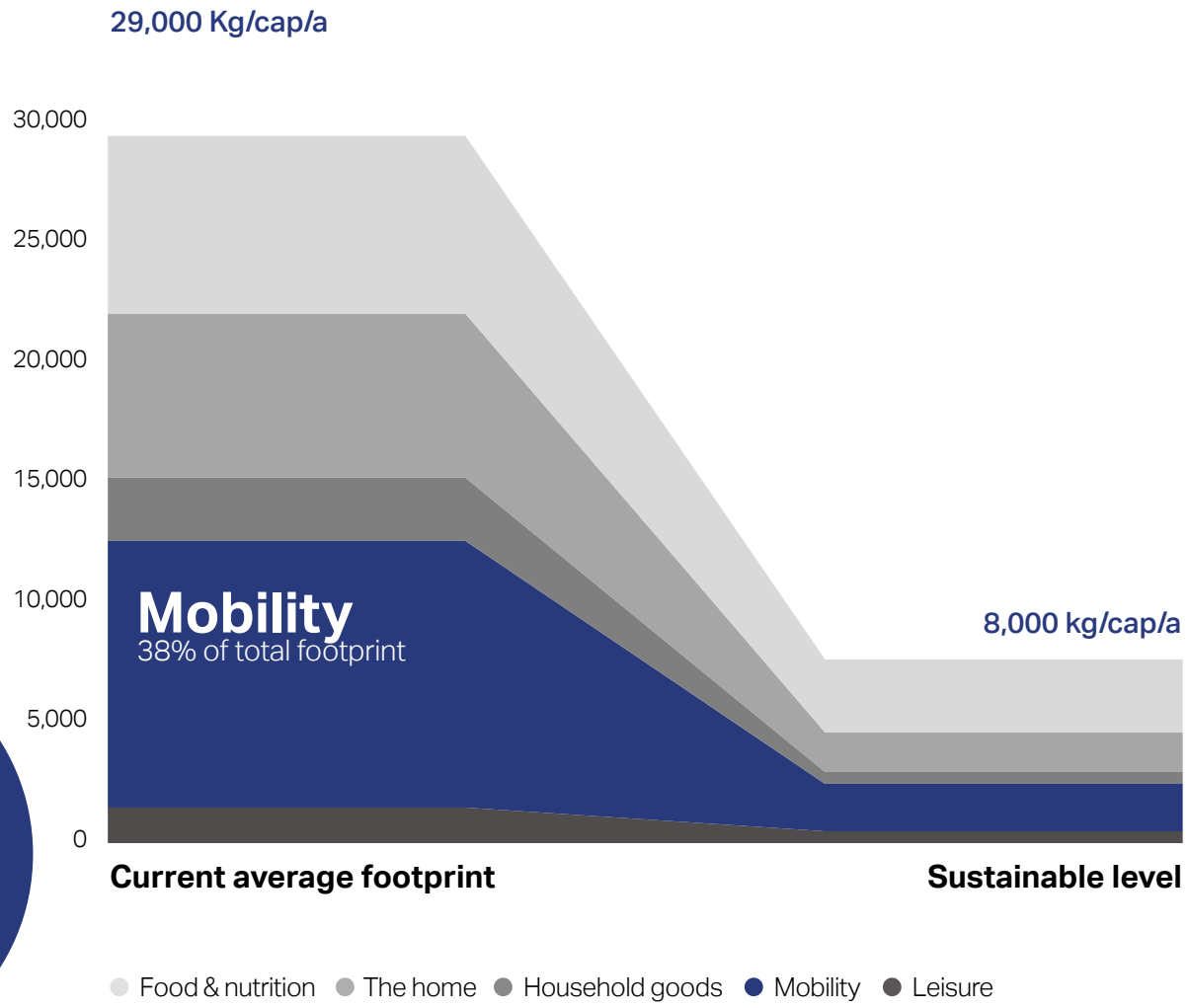
CAR USE CAUSES GREATEST IMPACTS
Because we use them every day, on average cars actually account for 94% of the mobility footprint in Europe.

MORE CARS
Private car use increased by 20% in the past 20 years in the EU27. 69% of all KMs travelled in Europe are by car.

MORE KMs
The number of KMs travelled per person increased by 20% between 1995-2007.
In Germany about 30% of the population drove more than 10,000 km in 2016 with their own cars.

MORE FLIGHTS
Air travel grew by 50% in 20 years in the EU27, with large impacts on carbon emissions.

The challenge:
Reaching an environmentally sustainable level will require an 81% reduction in the average European mobility footprint



What does a Europe with more sustainable mobility look like?

Living more sustainably will require dramatic reductions in impacts, but what can we achieve today? How far do current technologies take us? What business models, policies and behaviors will be required? We have asked these questions to help us imagine what more sustainable mobility will look like.

People move around more actively, using bikes or walking. For longer distances cars with alternative propulsion technologies, such as electric vehicles, are used to a greater extent, as is public transportation. Urban space is reclaimed by cities and returned back to public, rather than vehicle, use. Cars are no longer seen as a status symbol and car sharing models scale.

Solution pathways
delivering more sustainable mobility are already available today

MOBILITY solutions

1 **Active Mobility**

Getting people out of cars and into more active, emission-free modes of transport

2 **eMobility**

Using smart technology and alternative propulsion to reduce the impact of travel.

3 **Integrated Mobility**

Creating smart, integrated systems to make travelling quicker, easier and more energy efficient.

1 Active Mobility

The hotspot
Cars in cities

Getting out of cars and onto bikes and paths could reduce Europe's mobility footprint by 53% – and lifestyle material footprint by 20%.*

This reduction would require wholesale change: currently 69% of all KMs travelled are by car. This needs to be shifted to 62% of all KMs travelled by bike or by foot. However, for a growing urban population, this is becoming increasingly possible.

Smaller changes can also have a big affect. Tripling cycling in Europe from 5% to 15% of total KMs travelled would translate to a decrease in fossil fuels used per day of around 353,000 barrels – or 8% of oil used currently – saving European consumers US$ 8.37 billion each year.[1]

* To calculate impact reduction we've assumed a modal split equivalent to the one in Amsterdam – 32% bicycle, 22% car, 16% public transport, 30% walking, with a suggested total cap of 10,000 km travelled per year.[4]

Trend
The rise of the eBike

China is world leader in eBikes, making up 85% of total ebikes sales. However, the trend has now hit Europe.[5]

Taking Germany as an example, eBike sales between 2007 and 2013 grew from 70,000 to 410,000, and that trend has continued since. In the medium term it is possible that electric bikes will reach a 15% market share, translating to 10.65 million e-bikes in Germany alone.[6]

Traditional bike use has also generally grown over the past 40 years, including in Europe. For instance bicycling in Dutch, German, and Danish cities increased between 20% and 43% between 1975 and 1995.[7]

In 2015 the global bicycle market was valued at US$ 45.08 billion. This market is expected to witness a compound annual growth rate (CAGR) of 3.7% - to reach US$ 62.39 billion in 2024.[8] This growth is driven by an increase in biking for leisure, but also by traffic congestion and fuel prices.[9]

The AsiaPacific region currently dominates the market with over 63% of the overall bicycle market share in 2015, which is mainly attributed to the high use of bicycles in China.[7]

The innovation frontier Design & infrastructure

Further innovation is needed to improve bicycle designs and infrastructure, particularly for commuters.

Improving bicycle design for commuters: In order to increase the share of biking, one innovation frontier is the design of bikes themselves – to make them a more attractive option for commuters. This includes enabling seamless multi-modal transport. Innovations needed include better foldable bikes, lightweight designs, easier eBikes, digitalisation and connectivity.

Another key area is safety – through innovations such as lighting and helmets.[10]

Improving infrastructure: The other innovation frontier is infrastructure. Key to this will be responsive and multimodal bike sharing systems that address redistribution problems. Linked to improved mobility infrastructure are smartcard integration, tracking and locking mechanisms, and infrastructure that incorporate eBikes.[7]

1 Active Mobility

Examples
of existing solutions

Cyclist-friendly innovation
Including navigation systems and route planning for cyclists, mobile rental systems, lighting systems, folding bikes, cargo bikes, eBikes, parking infrastructure, and even foldable and inflatable helmets.[1]

Source: BBC news website

Smart infrastructure
For example, Italy is implementing solar-powered smart booths across cities where people can charge their eBikes and eScooters, make phone calls and use the internet.[2]

New sharing models
One example is the Community Library Bike Program in several US cities. It operates in the same way a library does: users can borrow bikes for up to six months. People can also donate old bikes, which volunteers then refurbish.[3]

Cyclist-friendly policy
Countries including Germany, the Netherlands and China, and cities such as Copenhagen, London and Paris, have put in place financial incentives and regulations – plus better infrastructure – to encourage cycling.

2 eMobility, alternative fuels, ride sharing

The hotspot
Fossil fuels & driving alone

Based on current car usage, changing from driving alone to ride sharing with one other person for 50% of KMs travelled could reduce Europe's average mobility footprint by 23% – and total average lifestyle material footprint by 9%.

These estimates are based on the assumption that the material consumption attributed to each vehicle-KM travelled is halved for each passenger when the ride is shared by two people.

This does not take into account potential rebound effects (on a simple level, the car will be heavier). But as a counter-balance, the transition to electric (eMobility) fuelled by renewables is expected to drive considerable reduction of carbon emissions.[11]

Trend
More electric, more sharing

More EVs:
In 2015, electric passenger vehicle sales still represented just 1.2% of new cars sold in the EU. In all, 0.15% of passenger cars on European roads are electric.[17] However sales are growing rapidly. And with improvements in electric vehicle design, that trend looks set to continue.

Less premium:
Researchers have also found the current cost disadvantage of electric vehicles will fall to around 20% by 2020. In 2030 electric vehicles might even have a cost advantage in most vehicle categories compared to vehicles powered by internal combustion engines.[18]

Great car sharing:
The integration of energy supply, ICT and eMobility will continue, driving shifts in the way we move around.[2] A 2011 survey of 66 cities found an average of 89 cars being shared between every million citizens. This number has only increased. Since its inception, Uber alone has accounted for 3 billion rides. The future of mobility looks increasingly certain to be shared, electric and autonomous.[19]

The innovation frontier
Digitalisation, smart grid and driverless cars

Car autonomy: progress in driverless cars is currently restricted by regulations, consumer acceptance and to some extent technology. However, these obstacles will be resolved. Seemingly relentless technological advancement and innovation in software-based systems will continue to advance this future vision.[20]

Alternative propulsion: look out for growth in alternative propulsion technologies. Particularly 'power-to-gas' where electricity generated through regenerative energy sources are transformed to gas-fed solutions.[2]

Lightweight design and battery technologies will extend driving range of electric cars.[21]

Integration with smart grid: systems such as vehicle-to-grid allow plug-in electric vehicles to communicate with the power grid to sell demand response services – by either returning electricity to the grid or throttling their charging rate.[2, 22]

Business and financing models: private individuals can now buy charging units and sell their own-produced electricity. We're also seeing models combining electric mobility & low-energy buildings, e.g. where the purchase of an EV is required to buy an energy-efficient house, with the EV and battery (for energy storage) included in the finance model of the house).[2]


SECTIONS The New York Times SUBSCRIBE

BUSINESS DAY

Car Companies Take Expertise in Battery Power Beyond the Garage

By TODD WOODY MARCH 25, 2014

A home by Honda and the University of California, Davis, is expected to make more energy than it consumes. Thor Swift for The New York Times

DAVIS, Calif. — As more homeowners generate their own electricity from solar panels, they still need power from a utility after the sun goes down.

Now, automakers say they may have an answer, by storing that carbon-free energy in electric car batteries for later use.

2 eMobility, alternative fuels, ride sharing

Examples
of existing solutions

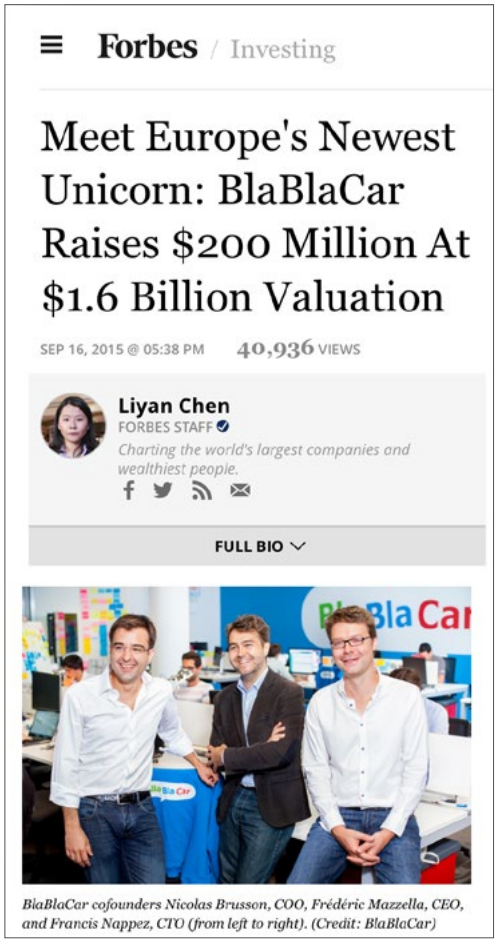
Smart technology
BMW's app ParkNow, which provides users with a clear overview of parking options, reducing the driving time.
And Ford's electric car combined with a wind power energy card, achieving the level of 4g CO_2/km.[12]

Innovative business models
- Vehicle-to-grid models where EV batteries are used as electricity storage.[13]
- Car-sharing models: private (e.g. Uber, BlaBlaCar), fixed and floating [29] or corporate mobility-on-demand.[2]
- Pay-As-You-Drive (PAYD), a programme implemented by insurance companies around the world, which rewards drivers who reduce their mileage travelled by car in the form of premium savings.[15]

Policies to incentivize EVs
These tend to be in the form of subsidies for consumers when buying an EV, as well as incentives such as the use of bus lanes and free parking. They also include stricter regulation on car emissions in cities. Athens, Madrid, Mexico City and Paris have all said they will phase out diesel vehicles on their streets in the next decade.[16]

In the 2011 White Paper on Transport, the European Commission set a target of halving the use of conventionally fuelled cars in urban transport by 2030 and phasing them out in cities by 2050.[17]

Source: TIME magazine, March 2016



Source: Forbes

3 Integrated Mobility

The hotspot
Individual transport

Calculating the potential impact reduction of integrated mobility on its own isn't possible – having an integrated system of transport is one of the underlying conditions for making active mobility and eMobility possible. So its impact is already embedded in these other pathways.

However, in terms of taking public transport in general – every KM travelled by metro instead of by car sees a 85% impact reduction, while buses compared to cars emit 80% less CO_2.[23] According to APTA, the growing use of public transport in the US (since 1995 public transit ridership has increased 39%) has resulted in a decrease of carbon emissions by 37 million tonnes per year. It's been estimated that public transport avoids the emissions of 57,000 tonnes of hydrocarbons and 70,000 tonnes of nitrogen oxides[23].

Trend
Urbanisation

Growing cities
It's estimated that by 2050 the number of people living in urban areas will reach 6.3 billion, almost double the number today. According to a study on urban mobility performed by Arthur D. Little, 64% of all KMs travelled are in urban environments. That number of urban KMs travelled is expected to treble by 2050. As a result, major investments are expected within the transport sector to make sure cities can keep moving.[19]

Changing habits
People's travel habits are changing, too. Transport providers are going to have to satisfy demand for services that are increasingly convenient, fast and predictable.[19]

Growing awareness
People are becoming more concerned about the sustainability of their mode of travel, and some are prepared to sacrifice individual forms of transport for the cause – leading to the introduction and rapid penetration of new services such as car sharing and bike sharing.[19]

The innovation frontier
Digital

Progress in integrated mobility is all about digital technology: solutions that can provide real-time information, planning, booking and payment, comfort, speed, congestion avoidance and transport demand management (TDM).[19] According to Tekes (an Innovation Hub and Funder in Finland), the worldwide market for digital solutions in transportation is € 10 trillion.[28]

Another key frontier is the development of single-point-of-access systems, such as smart mobility cards or apps that can also be used for other services and products.

Mobility as a Service (MaaS) business models such as apps that manage daily travel, including value-added services like grocery or restaurant meal deliveries, with payment on a monthly subscription basis or pay-as-you-go.[29]

Source: The Economic Times, India

3 Integrated Mobility

Examples
of existing solutions

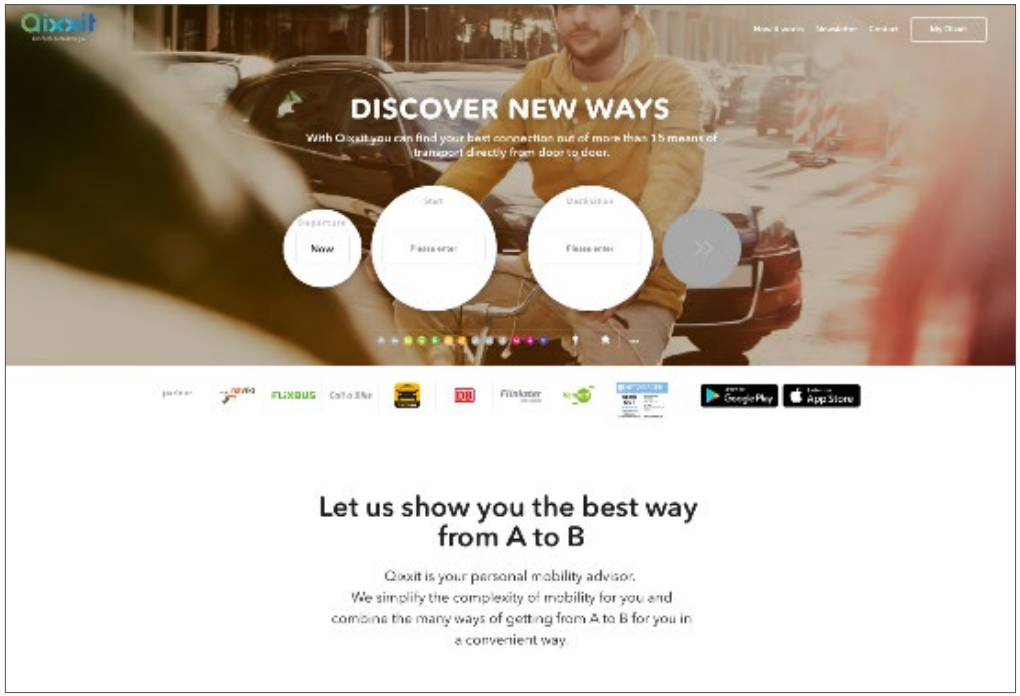
New products and solutions
There are a growing number of apps and platforms offering intermodal mobility solutions. One example is German Railway's Qixxit, a platform open to third parties that aggregates rail, long-distance buses, airlines, taxis, car rental, car sharing, bike sharing and local public transport in Germany. Google Now is an intelligent personal assistant with voice recognition that makes mobility-related recommendations based on your location and calendar entries. Besides travel and hotel information, the platform even helps you with car rentals, event tickets and reminders. [24, 25]

Extensive research is being performed into intelligent traffic-planning systems that can reduce traffic and associated emissions.

Mobility hubs will be key: these are locations served by several transport options that are central points for employment, housing, recreation and shopping.[26]

Business models
Smart ticketing allows users to have access to different modes of transport with one single card, avoiding cash payments.[27] It also provides an opportunity for fairer pricing and smarter incentives.

Policies
Many cities are recognising the need for mobility policies. Through Transport for London (TfL), London has an integrated authority that controls all aspects of mobility. Innovative funding models have helped to improve the transport network and in London over 95% of all commuters use rail, bus or the underground to get to work.[19]



Solution pathways
Summary

1

Active Mobility

- Hotspot: cars in cities (53% footprint reduction potential)
- Solutions: cyclist-friendly innovation, models and policy
- Trend: the rise of the eBike
- Innovation frontier: bike design and smart infrastructure

2

eMobility, alternative fuels, sharing

- Hotspot: fossil fuels (23% footprint reduction potential)
- Solutions: smart tech, batteries as storage & EVs
- Trend: more electric, more sharing
- Innovation frontier: smart grid & driverless cars

3

Integrated Mobility

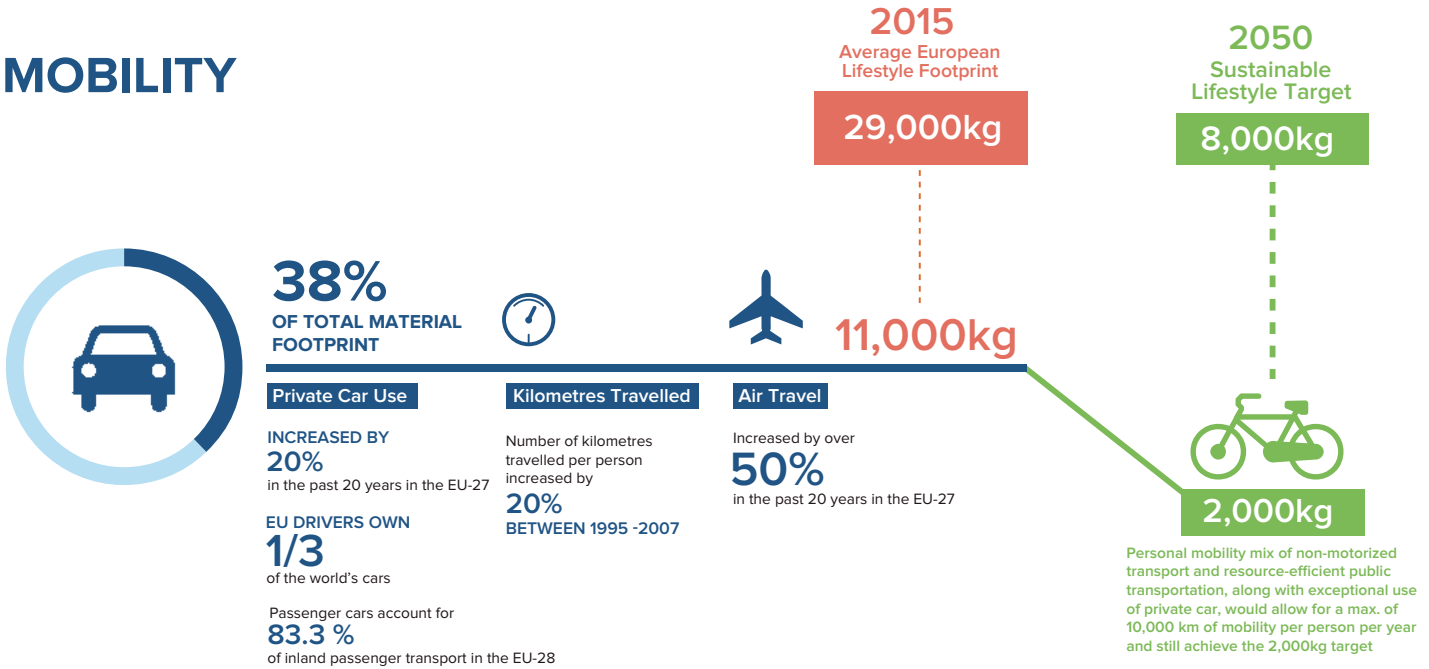
- Hotspot: individual driving
- Solutions: transport apps, smart tickets and city policy
- Trend: growing cities, habits and awareness
- Innovation frontier: digitalization

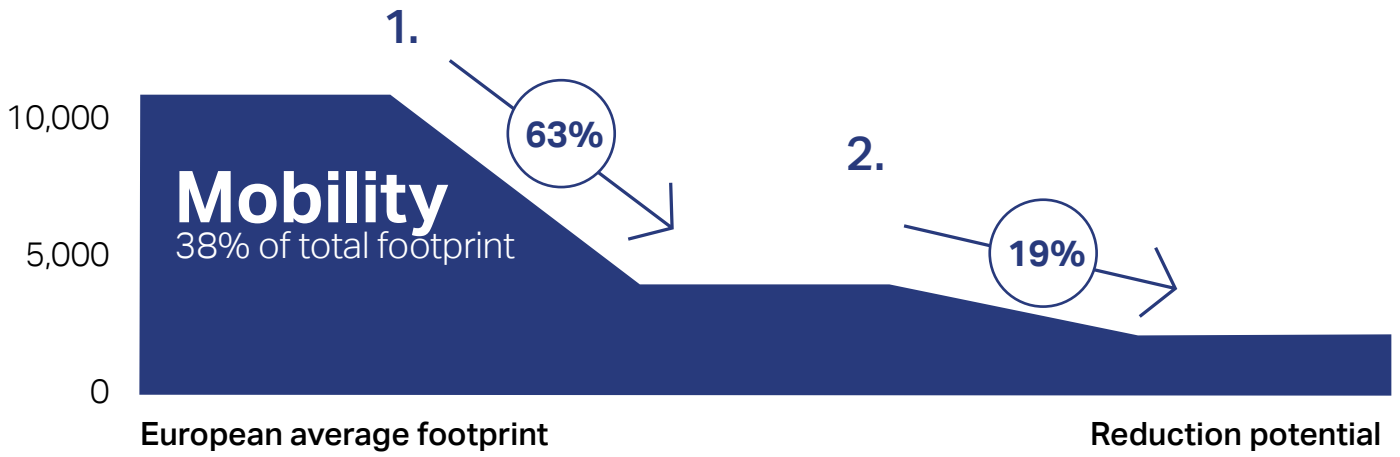
Mobility footprint and reduction potential

1. If we adopted mobility infrastructure, patterns and habits in line with the three discussed pathways, we could **reduce the average European mobility footprint by 63% -** well on the way to the 81% reduction required.

2. **From 63% to 81%?** A person who travels **by car 50% less** than in the pathways presented (so about 1,100 km/a), and then travels that 50% on public transport, will achieve the environmentally sustainable level for mobility – an 81% reduction in relation to the European average.

MOBILITY





Other benefits (sweetspots) provide even more incentives for moving to more sustainable mobility

The beauty of active mobility is the positive impact it has on our health and habitat, as well as our material footprint.

According to WHO, 30 minutes of physical activity a day can halve the risk of diseases such as heart disease, diabetes and obesity. It decreases the chances of hypertension by 30%, and contributes to relieving depression and anxiety.

Cars require roads and parking lots that destroy habitats and divide communities. In contrast about 10 bikes can be parked in the space required for one car, and one lane of road can accommodate 2,000 cars per hour or 14,000 bikes.

EVs and ride sharing will free up space in cities, and provide a possible new revenue stream for individuals to sell energy back to the grid.

EVs contribute 20% – 80% fewer GHGs compared to fossil fuel-powered cars. They also reduce noise. On top of that, ride sharing means more space. It's estimated one car in a car-share scheme replaces 4 to 8 private cars. Thus available land for parking or other uses increases from 36 to 84 m^2 per car.

In addition, the battery capacity available in EVs is an untapped resource. The potential for owners to sell excess electricity back to the grid when needed could be as high as € 1,200 per vehicle per year.

A higher use of integrated public transport leads to less congestion with fewer emissions and better air quality.

But the further benefit is that communities with high-quality public transport tend to drive less and walk and cycle more. This reduces traffic accidents, increases physical fitness and mental health.

These impacts are significant, but are often overlooked or undervalued in conventional transport planning.

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