1 Amsterdam is renowned world-wide for its compactness and its wealth of green spaces. It's a thriving and pleasant city to live in. The city council's actions to improve Amsterdam's air quality will contribute significantly to preserving its quality of life.
Photo: Doede Bardok

2 Prins Hendrikkade, close to Central Station, is one of the city's main bottlenecks of air pollution control. It's a busy road with public transport buses, touring coaches, taxis, lorries and delivery vans emitting high levels of pollutants.
Photo: Edwin van Eis

Electric mobility is here

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Amsterdam is one of the world's leading cities in the field of electric transport. Together with its partners, the city has taken strong action to promote electric transport as well as ban polluting vehicles. The target is to become a zero emissions city by 2025, with opportunities for everyone to adopt electric transport.

For communities to thrive, people must have clean air and a healthy environment to enjoy. In cities, this requirement to maintain good air quality and a healthy environment is more urgent than anywhere else. Too much air pollution has a negative impact on our quality of life and can damage our health. It can also hinder the development of our cities, for instance prohibiting the building of new schools or homes because the air quality is too poor. The air quality is for a large part determined by local traffic, which has been on the rise in recent years as a result of increased crowding of our cities. The rise of online shopping and the resulting increase in distribution traffic is adding to the problem. Fortunately, the compact character of our cities makes them well equipped to fight the battle against pollution.

Sustainable, clean city

Amsterdam recognised this early on. It is an attractive city which is great for visiting, doing business and living in. Yet, although the city meets the EU standards for air quality, there remains a hazard to public health. Focusing on the health benefits of cleaner air, the city decided to set a target: to create more space for cyclists and pedestrians, to promote clean transport and achieve zero emissions in the city by 2025. The air quality targets, which include nitrogen dioxide, particulate matter and soot levels, have been formulated in the 2015 Amsterdam Sustainability Agenda. As well as the ambition to improve air quality, this Agenda also provides targets with regard to sustainable energy, a circular economy, a climate proof city and making the city more sustainable. By reducing carbon emissions through efficient energy transfer and making better use of locally generated energy, electric transport will also contribute to these other targets on the Sustainability Agenda.

Strategy: stimulate, support, regulate

A large part, sometimes up to 50%, of air pollution in Amsterdam is caused by motorised traffic. This means the transition to electric transport provides a significant means to improve the city's air quality. With freight, public and private transport concentrated in a relatively small area, the city is an ideal place for the introduction of electric mobility. Vehicles do not need to cover large distances, as average city journeys are frequent but relatively short. Moreover, local Amsterdam residents and businesses are renowned for being enterprising and creative early adopters. Amsterdam has decided to make electric driving the norm. Presenting it as an attractive proposition, people will see it as a logical next step and in due course prefer driving electric.
A large part of the legal and regulatory framework, including tax refunds, is governed by the central Dutch government. In addition, Amsterdam has determined its own strategy to stimulate, support and regulate, granting privileges and providing many public charging

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Polluting emissions in Amsterdam

1a-d Air polluting concentrations
Source: TNO, based on the 2015 Amsterdam fleet scan
Relative contribution to kilometres driven and concentration
- kilometres driven
- NO_2-concentration
- EC-concentration (indicative)
- PM10-concentration
- HC-concentration (indicative)

2a-c Share of traffic in total emissions in Amsterdam
a NO_2 | **b** Soot | **c** Particulate Matter
Source: TNO
- industry
- refineries
- energy sector
- waste processing
- agriculture
- households

Every year detailed research is carried out and recorded on emission levels in Amsterdam, including traffic flow measurements and calculations. According to calculations made by the RIVM (the national institute for public health and environment) and measurements taken by the GGD (public health service of Amsterdam) the city's air quality has gradually improved over the past few years. Yet despite this downward trend in air pollution, some areas still show polluting concentrations which exceed acceptable levels. It is expected that action already undertaken to improve the air quality along with new measures which have been proposed will sufficiently reduce these levels before 2018, as well as improve the overall air quality across the city.

Air polluting concentrations

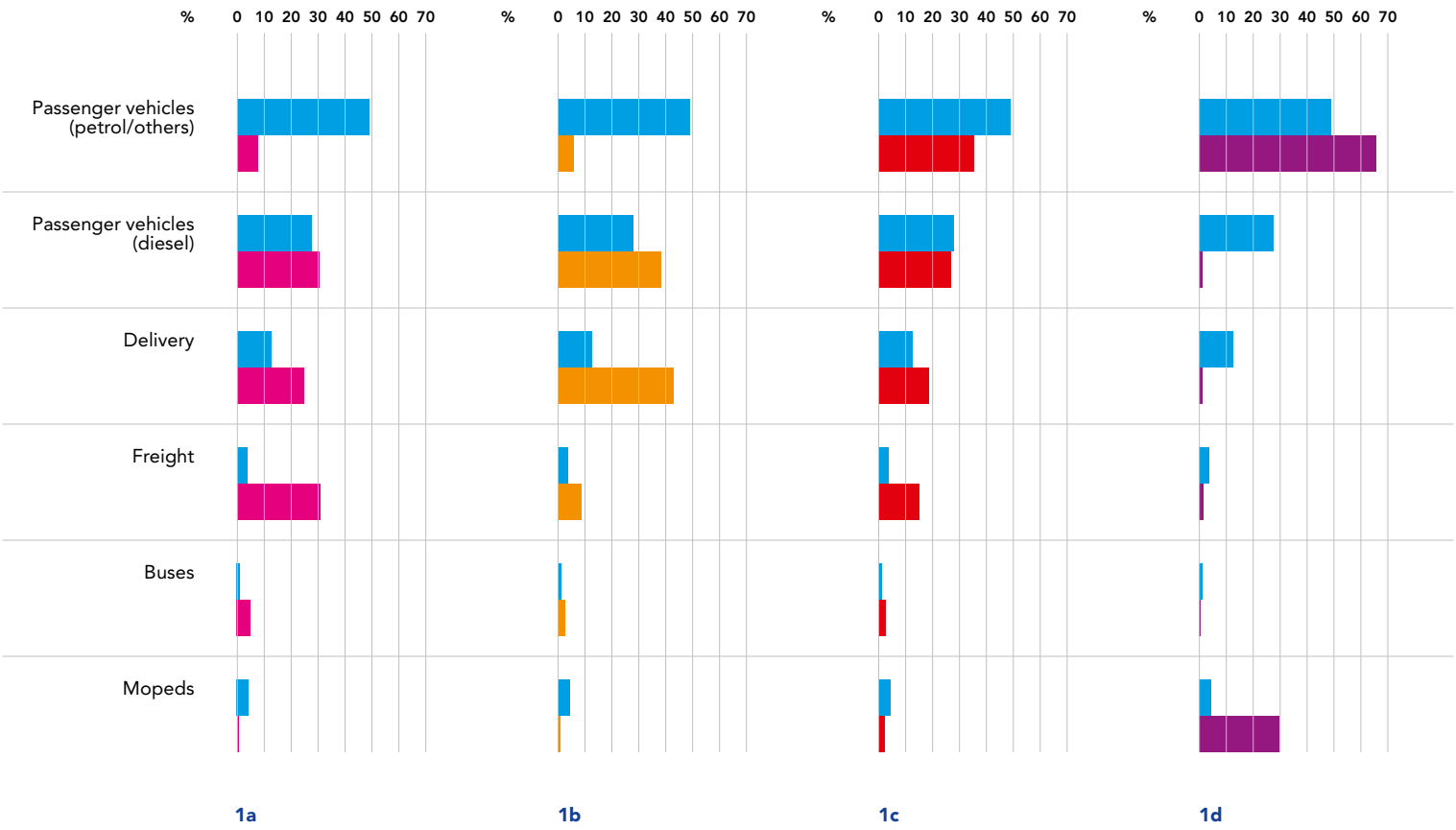
Figure 1a shows the nitrogen dioxide (NO_2) concentrations. Amsterdam still does not meet European standards for nitrogen dioxide emissions in all areas. Note that delivery vans and freight (LGVs) cover relatively few miles, yet contribute substantially to NO_2 emissions.

Figure 1b shows the particulate matter (PM10) concentrations, including particles from tyre and brake wear. Amsterdam meets the European standards in all areas. Again, delivery vans and freight (LGVs) are responsible for a substantial amount of PM10 concentrations. Petrol passenger cars emit a great deal less PM10 than diesel passenger cars.

Figure 1c shows soot concentrations (EC-elemental carbon). Although there are no European standards in place for this element, soot is an important factor with regard to public health. This is why Amsterdam has laid down soot particle concentration targets in its Sustainability Agenda. Note that diesel passenger cars account for a much higher share of soot emissions than petrol passenger cars. Vans also emit relatively large amounts of soot.

Figure 1d shows concentrations of hydrocarbons (HC). Again, there are no European standards in place for HC, although they are highly hazardous. Note that mopeds emit very large amounts of hydrocarbons relative to their small share in the total amount of motorised traffic volume.

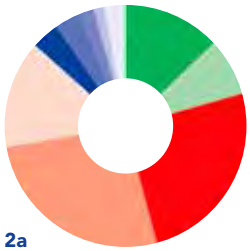
Figure 2a-c shows relative contributions from various sources to NO_2, particles and soot emissions. In some areas local traffic contributes up to 50% of soot emissions. Although soot is increasingly recognised as having a hazardous impact on people's health, there is still no European norm for soot emissions. Amsterdam does however take soot emissions into account in their decision making.



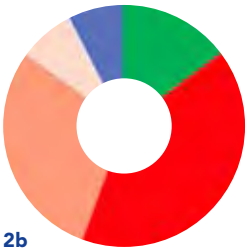
construction industry
other traffic (inland shipping, air, rail)
road traffic
local contribution
sea salt, dust and other
international shipping
abroad
NH3 from sea

3 In 2007 an air quality monitoring station was opened at Jan van Galenstraat. The station is part of a network of monitoring stations spread across the city, which are used to determine whether the city meets the national standards for air quality.
Photo: Edwin Raap

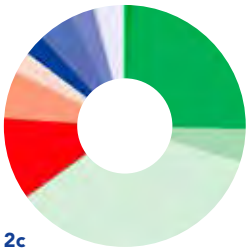
4 The busy A10 Amsterdam orbital motorway. A large part of the city's air pollution is caused by motorised traffic.
Photo: Edwin van Eis



2a



2b



2c

3

4

3 Amsterdam's Foodcenter is where many Amsterdam (catering) businesses get their supplies. The continuous stream of lorries and vans visiting the centre used to contribute to the poor air quality in the area. The construction of a second entrance and exit point has led to a more balanced distribution of traffic streams resulting in lower emissions of hazardous pollutants. In addition, more and more businesses at the Food-center are supplied by electric vehicles.
Photo: Edwin van Eis

4 On nearly all of Amsterdam's routes, cyclists share their bike lanes with mopeds and scooters. Waiting at traffic lights, where cyclists and pedestrians are close to mopeds and scooters' exhausts, this causes a peak in hazardous emissions (especially benzene). This is the reason the council wants to ban all non-emissions-free scooters in the city from 2025.
Photo: Doede Bardok

3

points to make electric driving in Amsterdam practical and enjoyable. The city also grants subsidies to support businesses to switch to electric driving. By introducing regulations such as environmental zones the city is able to ban the most polluting vehicles.

Amsterdam sets the example
In order to encourage the use of electric transport, the city council will give preference to working with companies which operate an electric fleet. This means companies will be able to benefit from operating electric vehicles in Amsterdam. All city council relocations for instance are carried out using electric vehicles. By 2025, the city's own fleet will need to be fully emissions-free. Already, where possible, all new personal and delivery vehicles bought by the council need to be electric. For larger vehicles, the council will always choose the most environmentally friendly option available.

Environmental zones
Environmental zones will ensure that older, more polluting vehicles no longer gain access to the city. Since 2009, Amsterdam has had an extensive environmental zone in place for LGVs, which will impose increasingly stricter regulations. The zone will include vans from 2017 and, from January 2018, taxis, coaches and mopeds as well.

5 Since 2009, Amsterdam has been operating an environmental zone for lorries. As well as encouraging electric transport, the city has also set regulations to accelerate the banning of the most polluting vehicles. In the years ahead, the environmental zone will be further expanded to ban certain types of diesel delivery vans (from 2017) as well as diesel taxis, touring coaches and scooters and mopeds (from 2018).
Photo: Edwin van Eis

6 In the autumn of 2014, Amsterdam Schiphol Airport announced that all taxi journeys from the airport will be made by electric cars operated by Schipholtaxi and BIOS Groep. This is also a big plus for Amsterdam, as it is estimated that more than 80% of taxis from Schiphol have Amsterdam as their destination (and vice versa).
Photo: Doede Bardok

7 Amsterdam's electric transport policy focuses on commercial vehicle drivers who clock up high mileages in the city. Electric vehicles eligible for subsidies include taxis, lorries and delivery vans. These groups will also receive privileges for driving emissions-free vehicles.
Photo: Doede Bardok

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The reason to implement the environmental zones is the direct negative effect motorised traffic has on the health of Amsterdam's residents.

Although Amsterdam aims to reduce traffic in the city centre, in recent years the use of most types of vehicles has increased. Moped traffic has almost doubled, showing an increase of 91% between 2008 and 2014. Recent research by Dutch science institute TNO confirmed suspicions raised by previous research: mopeds emit pollutants which are hazardous to health; emissions which can be anything between 10 to 100 times higher in mopeds than in passenger cars and which are directly inhaled by pedestrians and cyclists.

The most polluting passenger cars are banned through the city's parking license system and will be prohibited from getting a parking license from April 2017. In this way, all traffic types are required to contribute to the clean-up of the city.

Subsidies

Research has shown that local hazardous emissions are for the most part caused by company cars, lorries, taxis and distribution vehicles. Business traffic accounts for most vehicle miles travelled in the city, often in polluting diesel cars. This is why the city supports Amsterdam businesses who want to switch to electric driving by

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8 More and more companies choose to use emissions-free vehicles, including multinationals such as UPS. The courier company was one of the participants in a pilot giving privileges to electric delivery vans.
Photo: UPS

9 Cargohopper is not only a clean concept but also a smart one. At the city's perimeter, goods from different companies are collected, bundled and dispatched in the city by a special lorry, designed for city driving with reduced width to cause minimum disruption while unloading.
Photo: Cargohopper

8

9

offering them purchase subsidies. Fully electric taxis, company cars or delivery vans receive 5,000 euros per vehicle, while for plug-in electric lorries and buses up to 40,000 euros per vehicle is available. At the time of writing, 450 companies have purchased subsidised electric vehicles worth more than 50 million euros.

Privileges

It can be very difficult to find a parking space in Amsterdam's city centre, but electric cars do not have this problem. They can park at a charging location at any time, provided they connect the car. Apps show drivers where charging points are available. Electric cars are also given priority for residential parking permits – a real privilege in Amsterdam, as in some city districts permit waiting times can run up to several years.

Business sectors which make the switch to electric driving, will receive certain privileges. The city council has entered into covenants with business organisations, Amsterdam's public transport operator GVB and the Amsterdam taxi sector (see box). The city council has started several pilots to research whether there are any other benefits which might be effective to encourage the various target groups. For instance, allowing electric vans and lorries to deliver outside of the regular delivery time windows and stop to load and unload on the pavement. These privileges are designed to persuade people to switch to electric driving in Amsterdam in due course. Privileges for electric taxis include free parking, also during daytime hours, while charging their batteries. The city council is also looking into the possibility of only allowing electric taxis on tram and bus lanes. And they have already been granted priority at the Central Station taxi rank, while the redesign at Leidseplein also aims to realise a clean taxi rank for emissions-free taxis only.

Public charging points

In the city, it's crucial to have an effective charge point infrastructure for electric vehicles. As more than 90% of Amsterdam people do not have their own parking space, the council has to take its responsibility. Amsterdam was the first council in the Netherlands to solve the chicken-and-egg problem of whether to promote electric transport by providing charge points or to wait until there are actually electric cars around to use them. Amsterdam chose not to wait. On the contrary, as early as 2009, the council installed public charge points with exclusive parking spaces for electric cars across the city. This created a snowball effect: the more charge points

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1 Amsterdam's city centre has a lot of delivery traffic, causing congestion, delays and frustration. The council has started pilots to explore whether electric delivery vans could be granted privileges, such as being allowed to deliver outside of time windows and to park on pavements.
Photo: Alphons Nieuwenhuis

2 Busy traffic in Amsterdam during the European Athletics Championships in July 2016. The city council has agreed with Amsterdam's public transport operator GVB to make all public transport in the city emissions-free and sustainable by 2025.
Photo: Peter Eijkman, Flickr

Smart and clean city driving

Every day, 3,000 lorries and 25,000 vans drive through Amsterdam to deliver their supplies across the city. In order to make this traffic flow cleaner and greener, the city introduced an environmental zone for lorries several years ago. This zone will impose tighter regulation from 2020 and also apply to delivery vans from 2017.

However, just applying stricter regulation alone is not sufficient to make goods transport emissions free. A zero emissions city centre, which is the target for 2025, can only be achieved in collaboration with residents, businesses and carriers. Sometimes these collaborations are laid down in official agreements. A good example of such an agreement is the city's Smart and Clean Covenant, which is a partnership between the city council, the Amsterdam University of Applied Sciences and the Amsterdam business organisations. In the covenant, all parties have agreed to reduce or clean 3.5 million kilometres of city centre miles annually. Key actions to achieve the targets of the covenant are:

- Create smart spaces for loading and unloading. Drivers will be able to check their availability and save unnecessary road miles.
- Cargo hubs for drop-off and distribution allow delivery of goods at times when shops are closed or retailers are not present at their premises.
- Major employers in the city will make an effort to reduce company miles within the city.

1

Public transport

The GVB public transport company runs all of Amsterdam's bus, tram, underground and ferry services. Emissions-free buses could contribute significantly to the improvement of air quality, as they currently still account for a large part of the total amount of emissions in the city. Furthermore, they run across the busiest parts of the city, where emissions are highest.

The GVB and Amsterdam city council have agreed to make Amsterdam's public transport fully emissions-free and sustainable by 2025. This means that two hundred buses must be replaced with electric buses, which will be introduced from 2018. At the moment, the GVB, the City Region of Amsterdam and the council are looking into the most efficient charging methods. Together they will determine which technique should be used and where the electric bus charging infrastructure can best be realised.

The covenant also includes agreements about the Amsterdam ferry services. Currently, the city and the GVB are looking into the possibilities of improving their sustainability and making them (partly) electric.

2

3a-b Amsterdam Central Station Taxi Rank.
Photo: Edwin van Eis

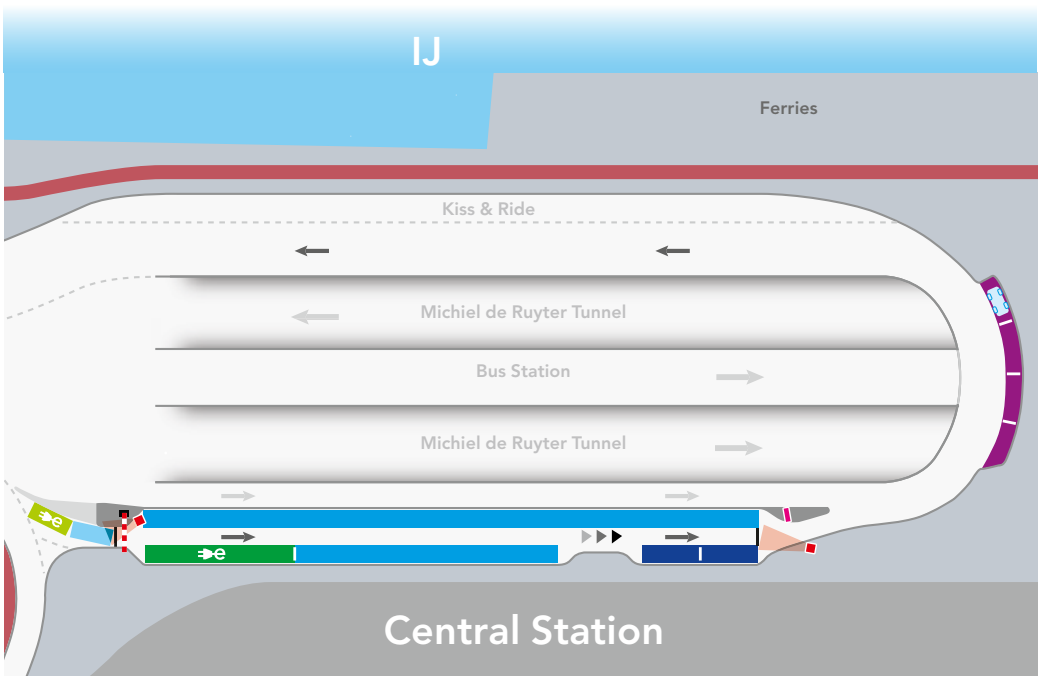
- barrier
- registration scan
- max. 1 electric taxi
- max. 1 taxi
- 4 charging bays with fast chargers for electric taxis
- 22 taxi waiting bays
- 2 waiting bays for taxi vans
- calling board
- Taxi Pick Up Point

Taxis

There are around 4,000 taxis in Amsterdam, covering many miles and almost exclusively running on diesel. This means that on average they emit 35 times more hazardous emissions than an average petrol passenger car. At the same time, taxis tend to make short journeys, which is ideal for electric driving. Therefore, the council has agreed with Amsterdam's taxi companies that all taxis should be fully emissions-free by 2025. The Clean Taxis for Amsterdam Covenant has been signed by all licensed taxi companies in Amsterdam.

Like the agreement with the freight and delivery transport companies in the city, this covenant includes a combination of benefits and responsibilities which makes it attractive to purchase clean taxis and discourages the use of polluting taxis. From 2018, the most polluting taxis will be banned from the city by introducing a taxi environmental zone. Drivers and companies are supported with subsidies to purchase electric cars. Initially, electric cars will have priority status at the Central Station taxi rank. Currently, one in four taxis which are allowed to pick up passengers at the rank are clean taxis. From 2018, only clean taxis will be allowed at this rank. The Central Station taxi rank can accommodate around 28 taxis. As electric taxis cover many miles, they need to be able to charge quickly and frequently. This is why fast charge points have been installed for electric taxis at the Central Station rank and at other strategic locations in the city. While queuing at the Central Station rank, taxis can use the available fast charging points.

3a



3b

10 In partnership with 'clean' businesses and car manufacturers, the city has organised several events to encourage electromobility.
Photo: Wim Salis

10

were installed, the more electric cars appeared in the city's streets. (Future) owners of electric vehicles could request a charge point near their home or apply for subsidies to build a charge point on their own premises. This demand-driven approach raised confidence in the 'electric revolution', leading to increasing numbers of residents and businesses buying electric vehicles. The Amsterdam approach became the blueprint for many other cities in the Netherlands as well as abroad. In the meantime, Amsterdam has been preparing to accommodate charging facilities for the increasing numbers of electric vehicles and exploring how to fit these in the public space. New technological developments such as battery capacity and charging times will have a large impact on future charging solutions.

Capital of Innovation

In April 2016, Amsterdam was voted European capital of innovation, followed in June by their second E-visionary award as the world's leading city in the transition to electric transport. One of the explanations for this success has been the opportunities Amsterdam allows innovative businesses. The council is constantly engaged in discussions with innovative, creative and inspirational companies who can help to increase the sustainability of transport in Amsterdam. If these discussions involve large corporations , this generates a lot of publicity, but small and middle sized enterprises are just as important in this process. Large companies such as Heineken, DHL and PostNL as well as smaller companies like Abel (taxi sharing) and Cargohopper (local distribution) have introduced large numbers of electric vehicles in the city.

One of the pioneers in this field is the car sharing company car2go. In 2011, they chose Amsterdam as their first European hub for electric vehicles, partly because of the large amount of charge points in Amsterdam and because of the city's newly introduced free floating zero emissions parking permits. These permits are available for all car sharing companies that run a 100% electric fleet, giving them permission to park anywhere in the city. Car2go's 350 electric car-sharing cars have contributed to the public familiarity and recognition of e-driving in Amsterdam. This is why Nissan, BMW and Tesla chose Amsterdam to launch their new electric car models; and Tesla set up their head offices in the city's Zuid-Oost district. Other electric mobility companies which have set up business in Amsterdam include MisterGreen, Taxi Electric, EV-box, The New Motion, EVConsult and Fastned.

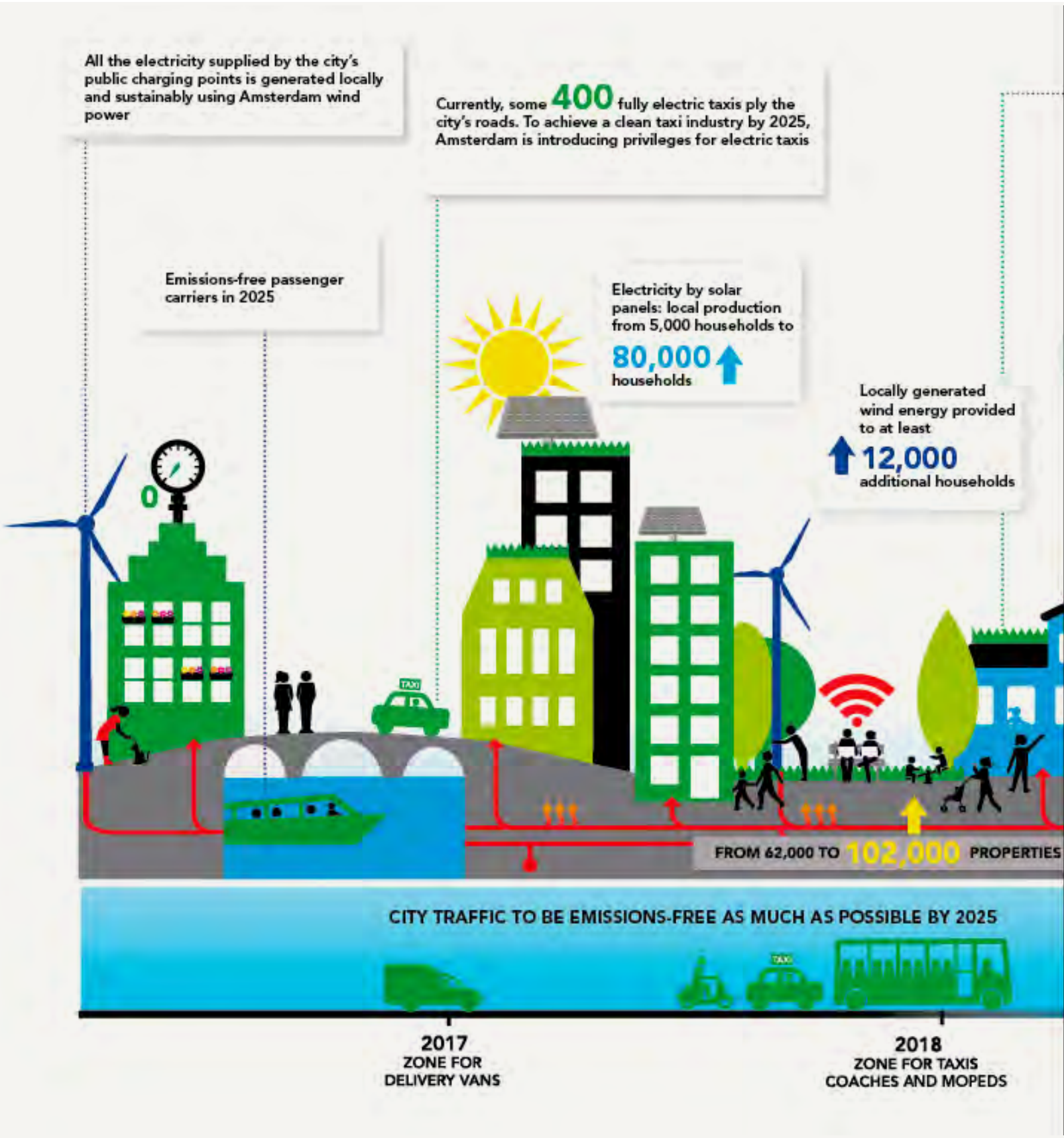
Living Lab

Amsterdam is growing fast, bringing new opportunities to (international) electric transport businesses and developers. The city appeals to these businesses because it has a clear vision on sustainability and because it encourages new initiatives and bold experiments. On top of this, the Amsterdam metropolitan area provides access to a large pool of talented, motivated, highly educated and multilingual workers. The area is a thriving tech hub with direct access to the single European market, comprising 500 million potential customers. The city's leading position in promoting and supporting electric transport has worked like a magnet and has turned Amsterdam into a living lab with 30,000 unique users, more than 400 electric taxis, 350 electric car-sharing cars, special courses in electric transport at the city's schools and universities and a growing number of companies which are bringing smart solutions in electric transport to the market.

New technological challenges include making electric driving even cleaner and greener than it is at the moment. The wind turbines in Amsterdam's harbour area are already powering all of the city's charge points. The next challenge is to use local solar energy to power electric transport in the city. Real time insights in all relevant data will make it possible to apply smart charging methods, using the peaks in power production to store in the batteries of electric cars – energy which can be used at a later time.

For Amsterdam, collaborating with innovative businesses and educational institutes represents a new step in the development of the smart city: building an innovative, sustainable and thriving community. A clean, green city which is pleasant to live and work in for local people and enjoyable to visit for people from outside. A city where cyclists are not being choked by exhaust fumes while waiting for a green light and where electric transport is the norm. ■

This infographic is a visual representation of the Sustainability Agenda of the City of Amsterdam, including measures for an emissions-free Amsterdam in 2025. By then, all motorised road traffic will either be clean (LGVs, buses and coaches, private passenger cars) or emissions-free (taxis, vans, motor scooters and passenger ferries).
Infographic: City of Amsterdam



'The Amsterdam approach became the blueprint for many other cities in the Netherlands as well as abroad.'