The Electric City

04 | 2018
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Plan Amsterdam

met Nederlandse samenvatting
Amsterdam Elektrisch

Electric mobility is here

Electric Alliances –
the entrepreneurial view

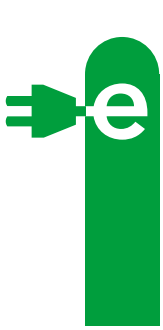
Amsterdam's demand-driven charging infrastructure

infographics Students of Amsterdam University of Applied Sciences analyse the data generated by the charging points and publish the results in monthly reports. This infographic shows the charging data of the whole of Amsterdam in the first six months of 2018.
Source: City of Amsterdam-Amsterdam University of Applied Sciences

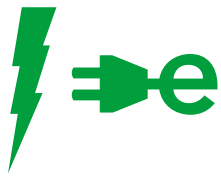
map Realised and requested charge locations in Amsterdam. Every charge location consists of two charge points.
Source: City of Amsterdam-Nuon/Heijmans

- realised
- request sent to city district
- application for connection requested
- application pending – under review by Nuon
- planning decision granted

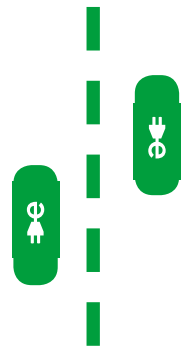
1 Amsterdam was voted European Capital of Innovation by the European Commission in 2016.
Photo: Doede Bardok



Number of charging points
2,600

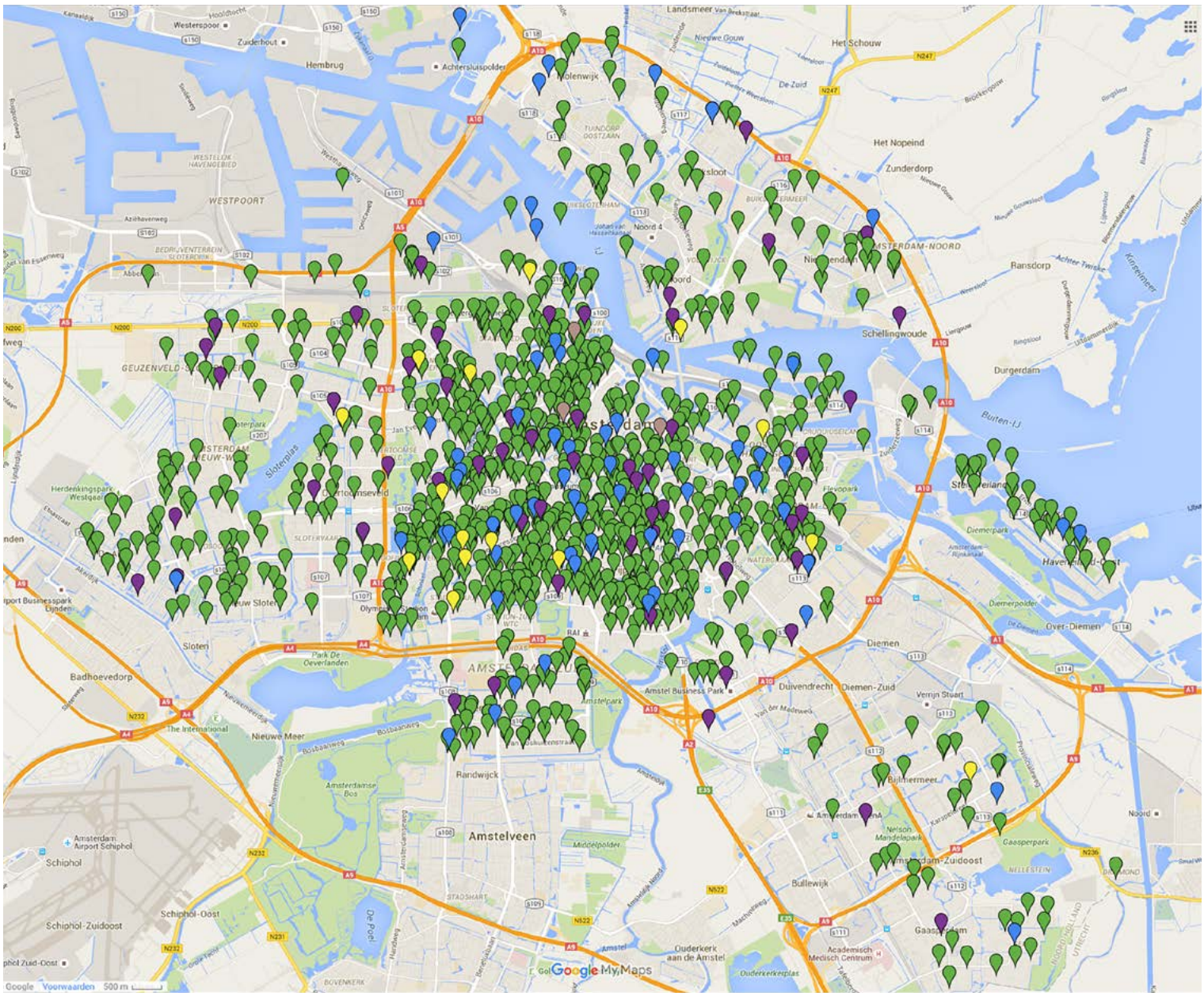


Amount of charging sessions
469,000



Amount of emissions-free kilometres charged
25,696,200

Individual users
20,400



Towards zero-emissions mobility

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No city in the world is as far ahead in the transition to electric transport as Amsterdam. This was once more confirmed in 2016 at the World Electric Vehicle Symposium in Montreal, where Amsterdam city council received the E-visonary award for the second time in succession. Motivating the decision to award the prize to Amsterdam, the jury of the World Electric Vehicle Association (WEVA) said: "Amsterdam has a long and solid track record of promoting the use of electric vehicles in the city, putting an effective charging infrastructure in place and promoting in general the transition to electromobility. The targets and the ambitious timing set for zero emission taxis, buses, small delivery vehicles, light vehicles and even boats are world leading and an example to all cities."

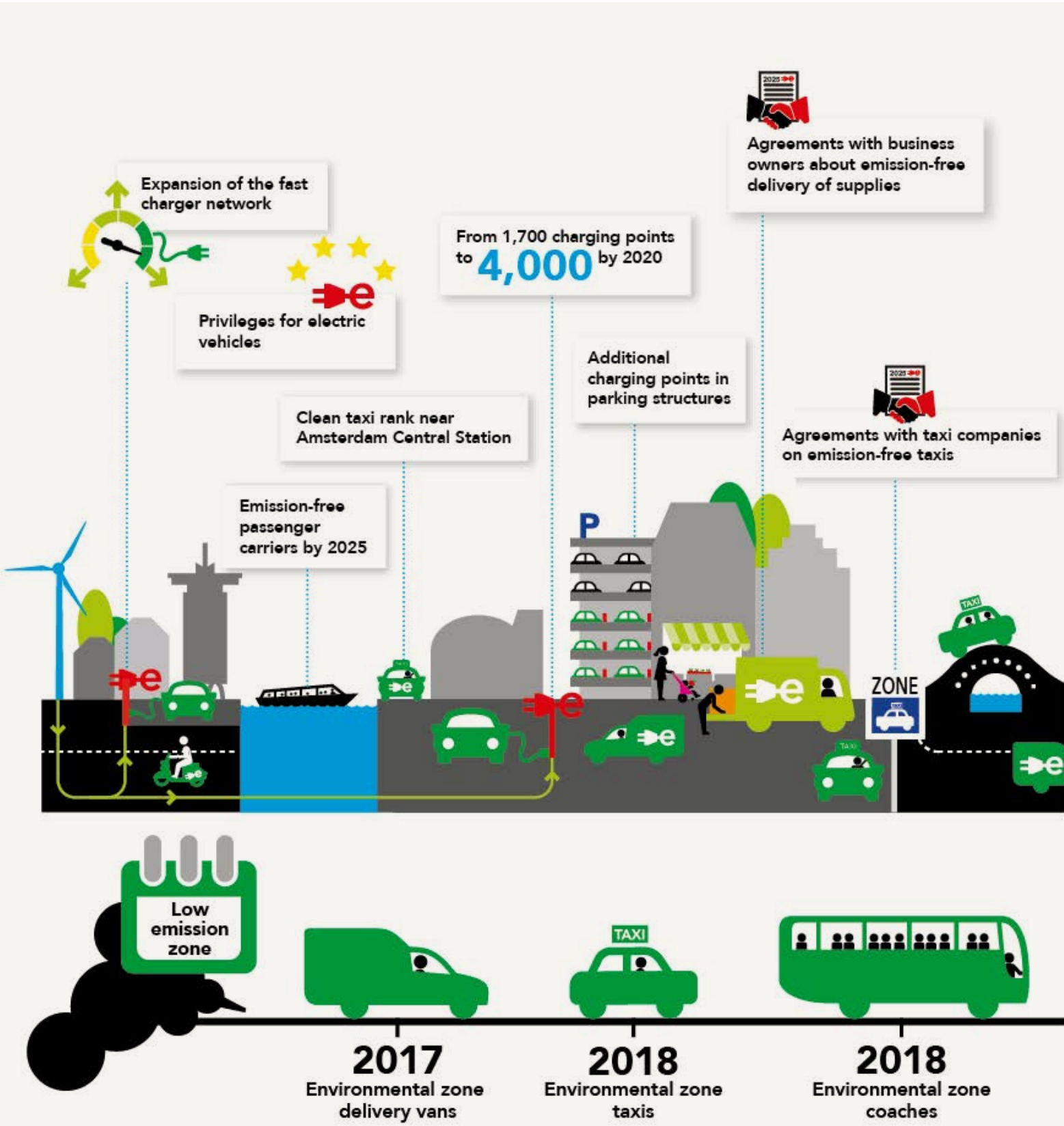
With an exceptionally innovative climate pervading the city – Amsterdam was also voted Europe's innovation capital this year – Amsterdam has developed into a true Living Lab for research institutes, innovation businesses and start-ups in the field of electric transport. Researchers and adventurous entrepreneurs are developing creative, technological solutions for fast charging, smart parking, data use and temporary battery storage for solar energy. For cars, but also for scooters, delivery vans and lorries.

Now is the time to push through these changes. Just over a century ago, it was a different picture. Around 1900 Amsterdam already had a preference for electric driving, with a significant number of electric trams and taxis traversing its streets. The ATAX Taxi Company had a fleet of around eighty electric cars and two charging stations which allowed for a quick and easy exchange of batteries. Unfortunately, it never led to an electric revolution. With the rise of the petrol car in the early 1920's, the electric car was relegated back to the margins.

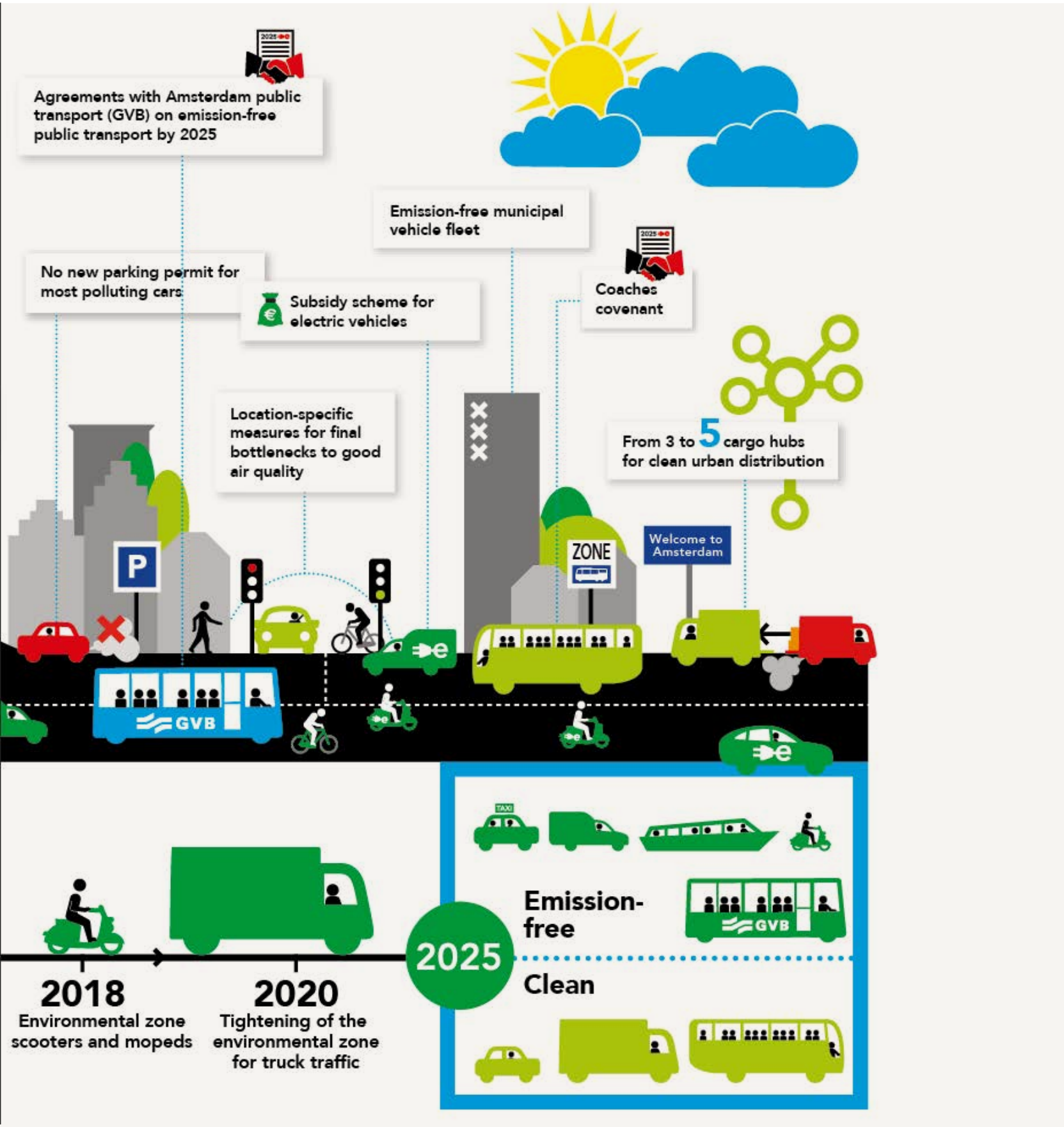
Luckily, the tide has turned again. Amsterdam is buzzing with new initiatives, turning it into a healthy city for every Amsterdammer. The city council facilitates its 'electric' pioneers as much as they can under the slogan of 'reward those who contribute', granting subsidies and privileges, allowing room for experiments and providing an impressive charging infrastructure. In this way, Amsterdam wants to show that electric transport can be the norm again, rather than the exception.

The editor

This infograpic is a visual representation of the package of measures known as 'Clean air for 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.’



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, 2016 (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 2020, as well as improve the overall air quality across the city.

Air polluting concentrations

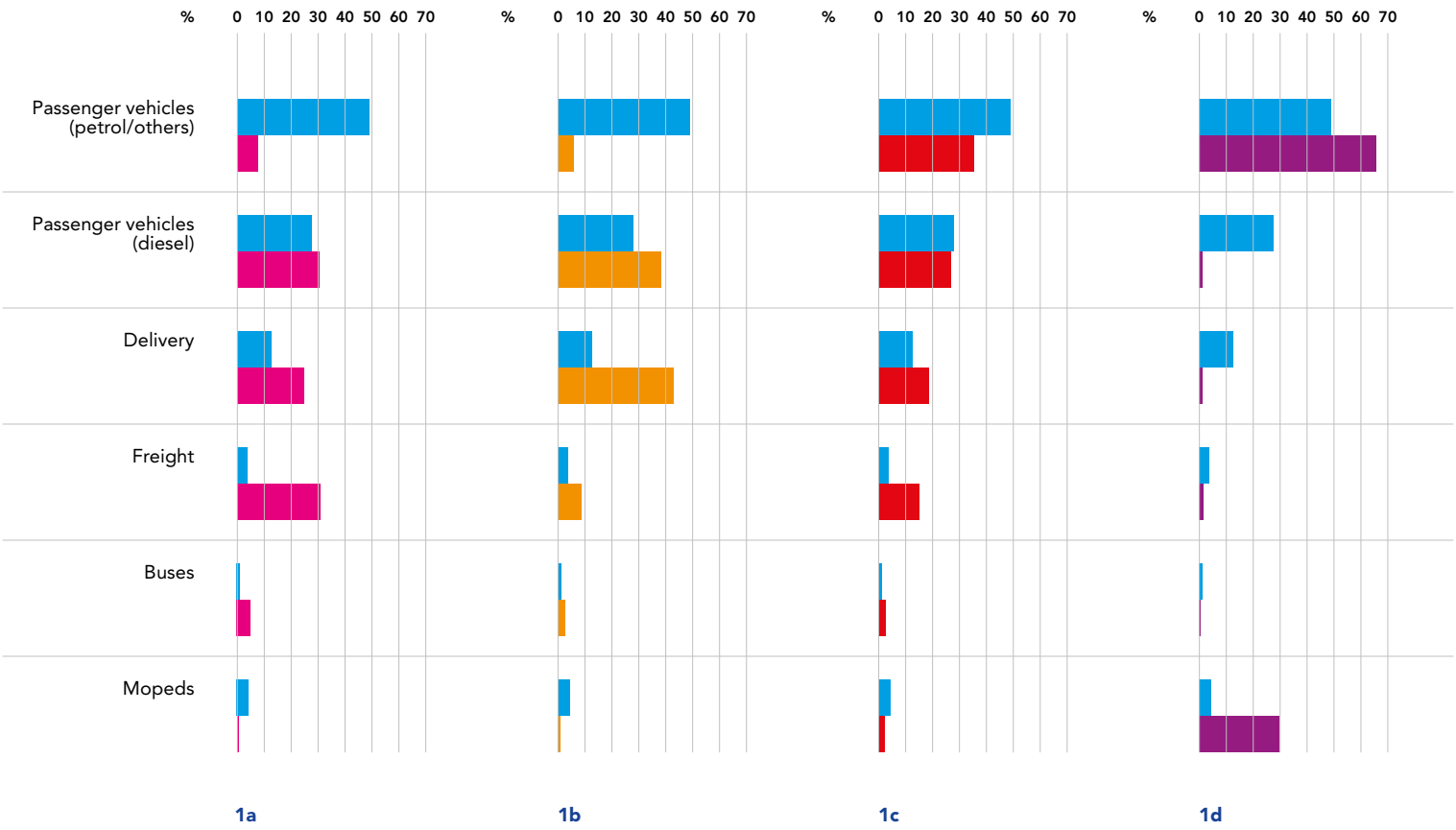
Figure 1a shows the nitrogen dioxide (NO_2) concentrations. Amsterdam still does not meet European standards for nitrogen dioxide emissions in all areas. Note that delivery vans and freight (LGVs) cover relatively few miles, yet contribute substantially to NO_2 emissions.

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.

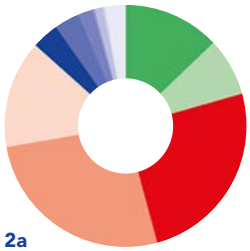
Figure 2a-c shows relative contributions from various sources to NO_2, particles and soot emissions. In some areas local traffic contributes up to 50% of soot emissions. Although soot is increasingly recognised as having a hazardous impact on people's health, there is still no European norm for soot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



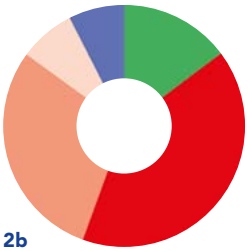
construction industry
other traffic (inland shipping, air, rail)
road traffic
local contribution
sea salt, dust and other
international shipping
abroad
NH3 from sea

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

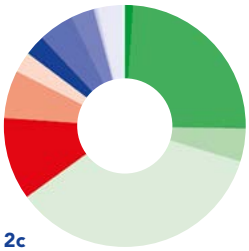
4 The busy A10 Amsterdam orbital motorway. A large part of the city's air pollution is caused by motorised traffic.
Photo: Edwin van Eis



2a



2b



2c

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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 includes vans since 2017 and, as of 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 2017, the environmental zone was expanded to ban certain types of diesel delivery vans, followed by taxis, touring coaches and scooters and mopeds in 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 are prohibited from getting a parking license since 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

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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.

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 were installed, the more electric cars appeared in the city's streets. (Future) owners of electric vehicles could

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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. Since 2017 the zone also applies to delivery vans, and it will impose tighter regulation from 2020.

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. 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.

2

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

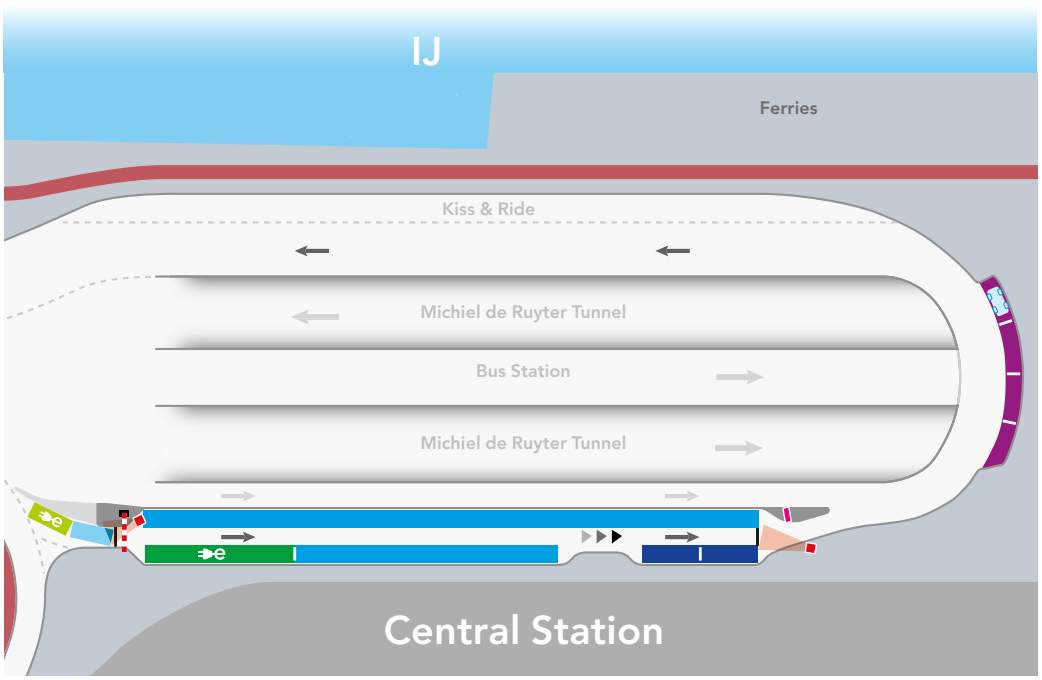
- barrier
- registration scan
- max. 1 electric taxi
- max. 1 taxi
- 4 charging bays with fast chargers for electric taxis
- 22 taxi waiting bays
- 2 waiting bays for taxi vans
- calling board
- Taxi Pick Up Point

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 are banned from the city by introducing a taxi environmental zone. Drivers and companies are supported with subsidies to purchase electric cars. Since 2018, only clean cars are allowed at the Central Station taxi 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

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 by the European Commission, followed in June by their second Avere's 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 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, almost a thousand electric taxis and a number of electric carsharing 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. ■

Electric Alliances – the entrepreneurial view

‘Healthy competition’

Interviews: Rob Beentjes
Photos: Marjolijn Pokorny

Joris Hupperets

Managing Director E-mobility NUON

“Since 2009 we’ve been working successfully with Amsterdam city council in the field of public charging points and services, the energy solutions for electric cars in the city. Currently, Nuon together with Heijmans manages more than 2,000 public and hundreds of private charging points in Amsterdam and the surrounding areas. The electricity for the charging points is generated by Windpoort, a wind turbine park operated by Windgroep Holland and Nuon in Amsterdam’s Western Harbour area. The charging points can be monitored real-time through the Nuon Charging Points App, which has been developed in collaboration with the city of Amsterdam and will be rolled out in other European cities as well.

Amsterdam has always spread its focus across several groups and areas, encouraging the installation of charging points as well as giving incentives to businesses which clock up high mileages in the city, and involving relevant stakeholders (car manufacturers, charging point operators, grid operators) in the city’s plans. And Amsterdam has always tried to meet the needs of electric drivers in the city and encouraged healthy competition between commercial stakeholders, for instance by putting out new tenders for charging points every 5 to 7 years. In this way Amsterdam creates an environment which is favourable for electric transport to grow.”

‘Making money in a sustainable way’

Ruud Zandvliet

Founder Taxi Electric

“We chose to launch in Amsterdam because it’s the largest taxi market in the Netherlands and Amsterdam already had installed a number of fast chargers. We had a look at Rotterdam and Utrecht as well, but the combination of market and chargers available was the best in Amsterdam. It also helps that I live in Amsterdam myself.

Even more important though is that Amsterdam gives priority to electric taxis at a number of key taxi ranks, including Central Station and Schiphol Airport, and that they have installed fast chargers at Central Station. I think that’s just great. It gives us the confidence that the city actually has a vision and will continue to promote electric transport. Getting priority at a taxi rank is more valuable than any subsidy scheme.

As far as I’m concerned, the council could even take it a step further. With hundreds of electric taxis around, it could just say ‘if you want to drive a taxi in the city centre, you’ll need to drive electric’. It’s the kind of regulation which is not going to cost any money but will make a huge difference. I think most taxi drivers would be happy to go along with such a rule. They’d all like to make their money in a sustainable way.”

‘We felt we had to do it’

Jan Laan

Managing Director Aad de Wit Removals

“In 2011, I and my business partner witnessed the launch of the first electric Nissan Leaf. Shortly after, we took the most irrational decision in our careers: we decided to buy an electric removal truck. This was madness to be honest. There are no such things as electric removal trucks. You need to strip a diesel and convert it, which is expensive. Nevertheless, we decided to go ahead with our plan, because we felt we had to do it. Eventually with the support of a number of partners, including Amsterdam city council, we managed to pull it off.

Since, we have acquired three more electric lorries. But they are still as expensive as five years ago. Without the subsidies we would not have been able to buy them. It would be a good thing if the government intervened. I think the environmental zone for lorries could be more strictly regulated for instance. And I think the government could play a part in the production of electric lorries. Why not, as an experiment, convert DAF Trucks’ assembly line on a Friday evening to build 100 electric lorries on Saturday, then convert it back so that on Monday their usual diesels will roll off the conveyor belts again? I believe this can be done. And it’s cheaper as well. But the market is not going to pick this up, so the government needs to lend a helping hand.”

‘The best kept secret’

Kristof Vereenooghe

CEO EV-Box

“If you consider how successful Amsterdam has been with the number of charging sessions and the millions of emissions-free miles travelled each month, I can only be really proud of this city. This is one of the reasons why we moved our head-quarters from the town of Almere to Amsterdam. When it comes to electric transport, Amsterdam is definitely the best kept secret – the most innovative EV charging city in the world. Not only because of its smart, connected charge points, but also because of the way electric transport is offered as an option to its citizens – fast and efficient. If you have acquired an electric vehicle, it’s quite easy to see if and where you can charge your car near your home and, if there are none available, request a charge point.

Amsterdam is taking it step by step to do what’s needed to become an emissions-free city. It’s an approach that is working and which the city should continue to use. Just as they should continue to make intelligent use of technology, for instance by storing sustainable wind and solar energy in batteries to accommodate peaks in energy demand. Because with the increase of electric cars, electricity usage will increase and the network alone might not be sufficient to meet demand at peak times.”

‘A clear goal’

Roland Steinmetz

Owner EV Consult

“Amsterdam is a great place for a specialised Electric Vehicle Consultancy company like ours. Since the first steps on the electric mobility market in 2008 we have been involved with the charging network in Amsterdam. Back then we knew every single EV-driver by his first name. Now there are 5,000 unique users every month on one of the most intensely used charging networks in the world. Because of the large EV scale in Amsterdam, EV services have been optimised. We are proud to have contributed to this great success and are still involved with the future of this electric mobility challenge.

Amsterdam has set a clear goal toward a Zero Emissions Transport in 2025. Not only for passenger cars, but also boats, taxis and buses. This integrated approach also supports us in our daily consultancy practice. We help public and private entities accelerate electric mobility by giving insight in EV developments and managing projects like charging infra network. Our focus is not only on the Netherlands. We also designed a fast charging network in Shenzen, China. And for the World Bank we analysed the EV policy in Bhutan, leveraging the knowledge developed in The Netherlands, specifically in Amsterdam.”

‘Allow consumers to have a choice’

Willem Haitink

Vice President Sales Europe, Middle-East and Africa,Tesla

“Tesla chose to set up offices in Amsterdam because it’s a lively and inspiring city. Amsterdam is centrally located and easily accessible from most European countries. And it’s very important for Tesla to have access to the top talents in the work-force in and around Amsterdam.

Amsterdam’s current approach for rolling out the public charging infrastructure is essential, providing a large part of the charging needs of electric vehicles in the city. In order to stay in the lead, Amsterdam will have to scale up and link the transition to electric transport with the generation of sustainable energy. More charging facilities at home, in the public space and at the workplace, so we can charge our cars in a smart and flexible way. A direct link with (locally generated) sustainable energy. Invest in energy storage where needed in order to accommodate demand peaks and benefit from solar and wind peak production times. Charging options should be just ahead of the transition to facilitate room for growth and allow consumers to have a choice. Because electromobility will rapidly become a full-fledged alternative means of transport, accessible to an ever larger part of the market.”

Amsterdam's demand-driven charging infrastructure

Bart Vertelman and Doede Bardok b.vertelman@amsterdam.nl d.bardok@amsterdam.nl

Amsterdam's extensive public network of EV charging points is the backbone for the city's ambitions in electric transport, with high visibility throughout the city and providing guaranteed charging facilities to electric drivers. In addition, the charging points offer great opportunities to achieve other sustainability targets, including (temporary) storage and use of sustainable energy. In this way, electric transport also contributes to the city's overall energy transition.

In 2009, Amsterdam introduced its first public charging points. At the time, there was only little demand from electric drivers. Rather, the idea behind the initiative was to provide charging points in order to raise confidence in electric driving and increase demand. With the experience and insights gained from a first test with one hundred charging points, the city went on to tender one thousand new charging points in 2011. Stipulating strict requirements with regard to standardisation and access for a variety of charging subscriptions, the Amsterdam model was soon replicated by other Dutch cities. Part of this Dutch approach is to concentrate on the interoperability of charging stations, ensuring any car can be charged at any station with a standard plug, regardless of the type of subscription. In addition, Amsterdam has set a maximum price suppliers are allowed to charge electric drivers in order to make electric driving attractive and affordable. This has been necessary to raise trust and offer peace of mind to electric drivers as well as to make sure electric cars keep a competitive edge over fuel cars.

Amsterdam's policy has always been geared towards electric vehicles replacing fuel cars on the city's streets. This is the only way in which local traffic emissions can be reduced. This is why charging points are only installed for electric drivers who cannot park on their own premises and no additional parking permits will be issued for electric cars. Electric drivers do have priority on the city's parking permit waiting lists.

Out on the streets

Because of the pressure on public space and public parking facilities, the council tries to minimise the addition of new street furniture objects. However, public charging points are essential for electric drivers who do not have private parking facilities to charge their batteries. In recent years, the city has gained much experience with the processes, tasks and responsibilities

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1 In 2011, car2go chose Amsterdam as the launch city for the full version of their car sharing concept. The city wide parking permit for electric car-sharing cars and the installation of the extensive public charging network made Amsterdam the perfect place to introduce their concept with a fleet of 300 electric Smarts.
Photo: Doede Bardok

2 Amsterdam's excellent infrastructure and leading position in the field of electromobility in the Netherlands inspired BMW to launch their first pure electric car, the i3, in the Dutch capital.
Photo: Doede Bardok

3 Charging points are only installed for electric drivers who cannot park on their own premises. No additional parking permits will be issued for electric cars. The electric driver does have priority on the city's parking permit waiting lists.
Photo: Doede Bardok

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4 Ten steps to install a new charge point.
Source: City of Amsterdam / Beukers Scholma

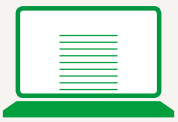
1
The (new) electric driver makes a request online for expansion of the public charging network.

2
Nuon/Heijmans check that the request meets the requirements and whether a new charge point is needed in the area concerned. Their considerations include:
– the walking distance to the nearest existing or planned charge location
– the occupancy rate of the nearest charge locations (based on data available)
– previous requests which have been turned down

3
Amsterdam city council will ultimately decide whether a new location will be installed.

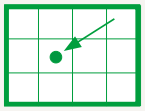
4
If a new charge point is going to be installed, Nuon/Heijmans will draw up an installation plan in consultation with the grid operator and the relevant city district (the road authority).

5
As the road authority, Amsterdam council will formally give permission for the installation plan and publish its decision in the Staatscourant (Dutch official journal of record) – after which the six week period to challenge or amend the decision starts.



6
The location and the plan are published online on a map and communicated to electric drivers in the area.

7
The contractor will request connection to the network from the grid operator.



8
Amsterdam council instructs the installation of the charge point and the design of the location.

9
Following a soil survey, the grid operator will allocate the connection to Nuon/Heijmans and release the location for installation. Nuon/Heijmans can now start planning the work.

10
The contractor will install the charge point, set up the location(s) and connect it/them to the electricity network. This will take a maximum of 4 hours. The locations and current availability of charge points are available through a number of apps and websites (open data).

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involved in placing charging points. Although the actual charging point seems to be a simple device which is easy to operate by just swiping your pass, behind the scenes there are many parties involved in its preparation and realisation. All these parties are included in frequent discussions about (legal) obligations, responsibilities and limitations. These are all matters that can have an impact on the speed at which Amsterdam's charging network can grow.

Smart installation

To be able to keep pace with the growth of electric driving and install sufficient charging points, Amsterdam is constantly in discussions with various stakeholders to ensure the installation process is carried out as efficiently as possible. Before new charging locations are decided on, the parties involved exchange important information, for instance on available network capacity in combination with data of existing charging stations and the locations of underground cables. Another example is the new agreements which the council has made with distribution network operator Liander with regard to connecting charging locations to the electricity grid. It was decided that the construction company (Heijmans) can take care of the connection, which means a charging location can be installed and ready for use within four hours. Previously, because of difficulties in aligning the planning of several different parties, it could sometimes take weeks before a charging point was ready for use and all the rubble cleared. An additional advantage is that there are now less disturbances for local residents, such as road blocks, traffic diversions, vans parked in the road and confusing traffic situations.

Increased experience and an improved process have resulted in progressively fewer delays during the implementation stage. As a result, multiple charging locations can be installed in one day in Amsterdam, and 20,400 unique users per month have access to the more than 2,600 public charging points. Each month, these electric drivers charge their batteries in 78,300 charging sessions to drive 1.5 million emissions-free miles.

Ready for the future

In order to be emissions-free from 2025, the council has opted to install standard as well as fast charging points. The overall approach the city has taken will ensure

‘Public charging points are essential for electric drivers who do not have private parking facilities to charge their batteries.’

Using data as a guide

Amsterdam’s public charging infrastructure is without compare. The collaboration between the city and the Amsterdam University of Applied Sciences (AUAS) has greatly contributed to this success. Amsterdam’s more than 2,600 charging points generate data on roughly 78,300 charging sessions each month. In recent years, dozens of researchers, students and PhD students have worked on the analysis of this data in a series of unique research projects resulting in valuable input for decision making. This interaction between science and policy ensures a future proof charging infrastructure.

This research into users’ charging behaviour is a form of applied science. The AUAS researchers formulate their research questions in consultation with the city council, asking where people charge and when, what the battery levels are before they recharge and whether they use one or several charging points. The answers to these questions are used to set up user profiles and conduct simulations. For instance, what’s the effect of larger car batteries on charging behaviour? Does the charging speed have an effect on users’ charging patterns? What does this mean for the type of chargers the city needs? In addition to these questions, the city also encourages the researchers to analyse the data and report anything that strikes them as interesting, to come up with answers to questions the policy makers might not even realise they had.

The research results inform decisions on the further expansion of the charging infrastructure and can be used to influence charging behaviour. They also provide a basis for communications with local communities and users, for instance if there are questions about charging points’ utilisation rates.

Influencing charging behaviour

The next step is to research if and how charging behaviour can be influenced. The data shows, for instance, that on average users are connected for much longer than their actual charging times. This means there is room for improvement in the efficient use of charging points. Recently, an app was built for users to contact each other and make agreements on the use of charging points. And there has been research into so-called excess users who charge their cars for longer than 24 hours in one uninterrupted session. Currently, 20% of total connectivity is accounted for by a group comprising only 3% of all users. We will need to convince these users to change their behaviour in order to make more efficient use of the network.

Towards an optimal expansion of the charging infrastructure

Further analysis of the use of different types of chargers can help design an optimal roll-out strategy for the future. Tesla cars, for instance, already have batteries with large capacities. Their charging behaviour might be a reliable predictor of what’s in store for the future. Will users fast charge more frequently or will they opt for longer sessions using standard charging points?

The AUAS uses the data of all standard and fast chargers in Amsterdam but also in the wider Amsterdam Metropolitan Region and the cities of Rotterdam, The Hague and Utrecht. Using all this data, they will be able to give more accurate analyses of users’ charging behaviour, such as where users live and what their destinations are, and what this means for their choice to either use fast chargers, standard chargers or charging hubs. Not only will this information contribute to a cost efficient expansion of the charging infrastructure, it will also give more insight into the role the electric car can play in the city’s overall energy transition. This is because an electric vehicle is not only a mode of transport, but also a large travelling battery which can be used as buffer storage for sustainably generated (wind or solar) energy.

a reliable, accessible and efficient charging network. The optimised installation process and data analysis will allow Amsterdam to meet the growing need for charging facilities in the future and open up new business opportunities.

In the public space the basic network of standard (smart) charging points will be complemented with charging hubs (an extension or cluster of multiple charging points using one network connection) and fast chargers. Outside of the public space, commercial parties install charging facilities, for instance in commercial company parking garages and in apartment building garages. Charging data of the various target groups is continuously monitored to assess their needs and install additional (fast) chargers where needed. Data clearly show that private users charge their cars predominantly overnight at home and during the daytime at the workplace, rather than using fast chargers. Taxi drivers on the other hand do have a need for fast charging facilities to charge their cars during their shifts. Amsterdam has a network of 13 public fast chargers in place at several strategic locations across the city, including the clean taxi rank at Central Station. The council wants to leave the extension of this basic fast charger network to the market, with a preference for installations at private premises or at locations such as petrol stations, in order to ease the pressure on the public space. Besides these, there are also public fast charging stations on private premises owned by Total, BP and ANWB (Dutch Automobile Association) and a number of taxi companies have installed their own, private charging stations. If this approach proves to be insufficient to meet demand, Amsterdam will take the lead to create additional fast charging locations.

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5 In October 2015, the new taxi rank at Central Station opened as the first clean taxi rank in the Netherlands (and probably the world). (Semi-) electric taxis have priority over other taxis in the queue and can make use of four fast chargers while waiting. The introduction of clean taxi ranks is part of the Clean Taxis for Amsterdam covenant.
Photo: Marjolijn Pokorny

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As well as promoting electric transport, Amsterdam also aims to improve the quality of the public space in the city by having as many cars as possible park in garages. It's a major challenge to realise sufficient charging facilities in (semi) public parking garages, at Park & Ride locations, company garages and new apartment buildings owned and maintained by owners' associations.

By anticipating the arrival of electric cars, high costs to make garages suitable for charging points at a later stage can be avoided. In existing parking garages there are possibilities to charge multiple cars making smart use of the power capacity available. For new parking garages, charging facilities should be a standard feature in the building plans.

In order to ease pressure on the public space and control costs, the council has commissioned research into the possibilities of installing network connections in street objects. One could think of placing charging points in lamp posts or installing charging facilities at major network connections used by bridges or pumping stations. These are in use only 5% of the time, so they offer opportunities to make more efficient use of the remaining capacity.

Innovation and future proof design – as well as user friendliness – have been the main considerations in Amsterdam's tender for its 4,000 charging points. It's essential for a future proof charging network to be built in such a way that it can accommodate future

6 One of the innovations Amsterdam seeks to expand is the installation of 'charging hubs'. These are locations where different charge points are clustered, using one connection. Raamplein is a popular charging hub with seven charging points.
Photo: Doede Bardok

7 Two major Dutch beer brands have come up with creative slogans drawing attention to their expanding fleet of electric lorries. Currently, there are more than 30 electric lorries operated by local companies on Amsterdam's roads.
Photo: Vijay Slager

8a-b Amsterdam encourages electric transport and parking in garages to give more space to cyclists and pedestrians in the city and enhance the quality of the public space.
Photos: Doede Bardok / David van der Mark, Flickr

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innovations, new standards and procedures as well as soft and hardware changes. Such a modular design prevents rapid outdating of the charging infrastructure and avoids having to make frequent and costly modifications.

Innovations

New solutions which are currently being tested include the extension of charging hubs (a cluster of various charging methods, possibly in combination with sustainable energy) at strategic locations and flexible network connections, which offer the possibility of faster charging at particular times in the day, for instance when sustainable, locally generated energy is available.
In the near future, more pure electric vehicles with larger battery capacities will reach the market, impacting on charging methods (standard, fast or using induction) as people will not all have to charge their vehicles at the same time to be able to cover the required distances the next day. Large battery packs in cars, charging infrastructure or buildings can also be used to store sustainable or cheap energy which can be released back to the network at times of shortage. Increased battery capacity also means that peak loads in the electricity network can more easily be prevented, as there will be more flexibility in loading times. For instance, the driver can indicate whether the car should be charged instantly or whether it can wait until later at night. As well as offering the driver increased reliability and mobility, larger battery capacity will also benefit the owners of

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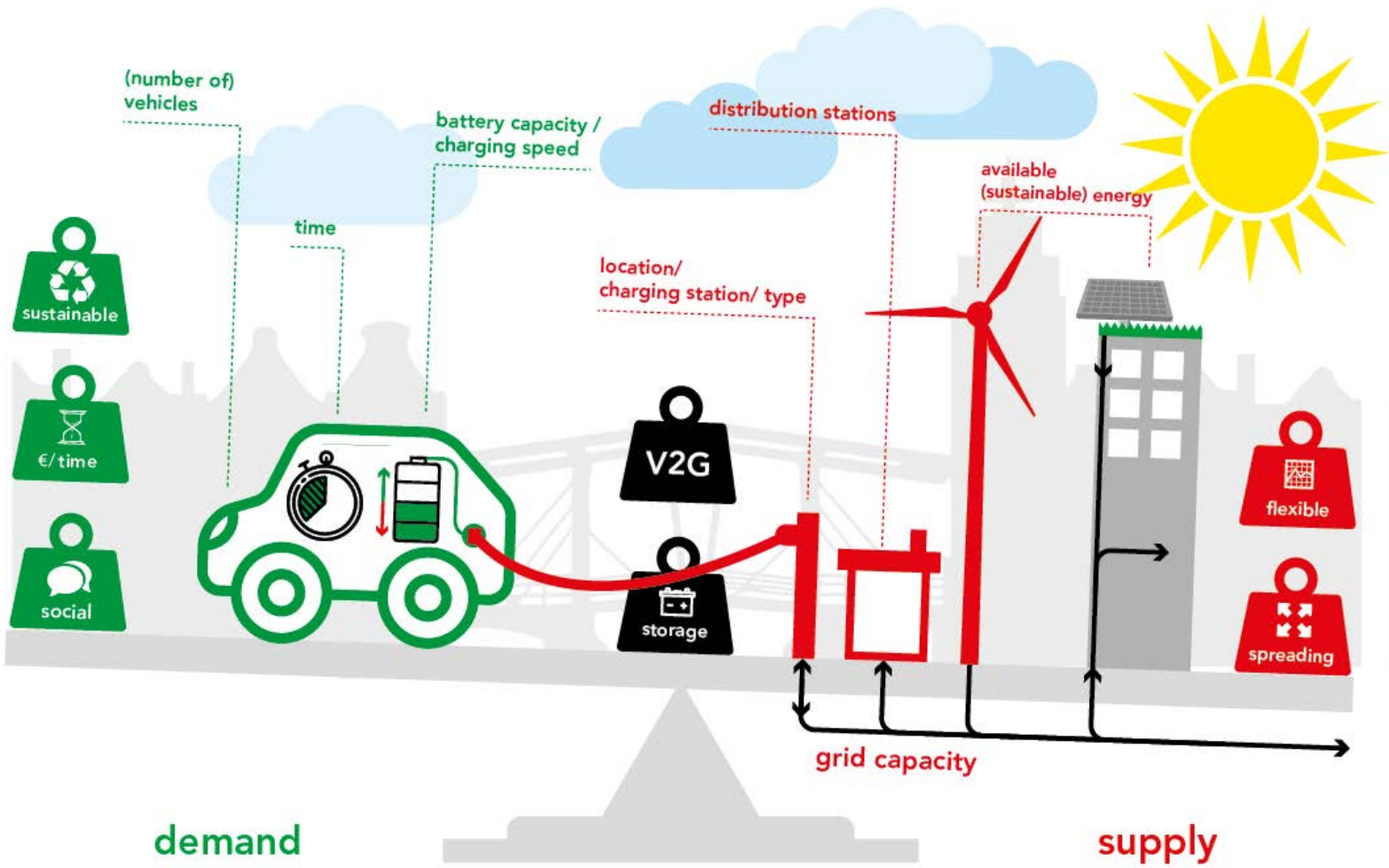
1 The illustration shows ways of balancing energy supply and demand.
Infographic: City of Amsterdam
V2G: Vehicle-to-grid

Charge-wise: Well-balanced Intelligent Sustainable Energy charging

In preparation for the future, Amsterdam is getting ready to accommodate a large increase of electric vehicles in the city and their link-up with locally generated sustainable energy. The development of new types of electric vehicles and the number of charging points will determine charging behaviour. On the supply side, the availability of sustainable forms of energy and the capacity of the power grid will be key.

It's already clear that peaks in energy demand will present a real challenge. If all electric cars arrive back home at six in the evening to be recharged, the network will not be able to cope. At other times in the day, the challenge is to accommodate as best as we can the supply peaks of sustainable wind and solar energy.

The solution will lie in cleverly balancing supply and demand. We can, for instance, try and influence energy demand by changing charging times or speeds, making users aware of the issue and offering them price incentives. The supply side can be influenced by providing extra capacity and faster charging speeds outside of peak times, or for instance when there are strong winds. In the coming years, Amsterdam will together with its partners study the various different elements in this game of supply and demand and integrate them into (parts of) the existing charging infrastructure.



9 In March 2016, Mercedes-Benz' new self-driving car the F015 was sent out for a supervised test drive through Amsterdam. Crossing Dam Square and driving along the IJ, the car had travelled to Amsterdam to be presented at an informal meeting of European transport ministers discussing new traffic technologies, including self-driving cars.
Photo: Mercedes-Benz

10 Taxi drivers have a need for fast charging facilities to charge their cars during their shifts. In 2018 13 public fast chargers are located in Amsterdam. Within the coming years, this amount will increase to 65.
Photo: Richard Mouw

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charging stations, as more electricity will be charged while the car is connected. It is expected that this will significantly reduce government investment in charging infrastructure.

The development of self-driving cars will also impact on electric transport, charging methods and the public space in the city. It could for instance mean that cars can autonomously charge their batteries outside of the dense city centre, which would reduce the need for parking space in the city. With self-driving vehicles already a reality, this breakthrough could come faster than we can foresee at the moment. The same goes for wireless or induction charging. This technology is used to transfer electricity through a magnetic field between two objects - similar to an electric toothbrush which is placed on a charger - making the use of a plug redundant.

Smart Charging

The most effective method to make supply and demand flexible is the temporary storage of energy, for instance in vehicles' battery packs or in separate (re-used) batteries. An added advantage is that sustainable (solar or wind) energy can be stored and released during peak demand periods. For the public charging network, balancing supply and demand will most probably take place on city district level. Teaming up with the network operator, the energy company, the Amsterdam University of Applied Sciences (AUAS), the users and other stakeholders, Amsterdam has started various research studies and pilots to asses how to approach this and what actions need to be taken to make this work.

The combined array of solutions to deal with supply and demand in a flexible way is also known as 'smart charging'. These innovative solutions will in the future allow Amsterdam people to choose to charge their vehicle with affordable, 100% sustainable energy without overloading the electricity network. With temporary storage of energy ensuring more efficient use of solar energy and electric transport fostering greater independence from fossil fuels, smart charging will significantly contribute to the energy transition targets.

Partnerships

Amsterdam has the ambition to continue leading the way, keeping abreast of innovations and new developments in the electric charging and car industries. The city engages with stakeholders in various national and Europe-wide projects, including the EU Sustainable Energy Electric Vehicles for the City project (SEEV4City), a partnership between the city, the AUAS and the Amsterdam ArenA to develop the storage of sustainable energy. In this way, Amsterdam can maintain its position as the city with the most widely used and 'smartest' charging network in the world, and keep responding to new developments in the future. ■

Amsterdam Elektrisch

Schone lucht is essentieel voor de leefbaarheid en wordt in grote mate beïnvloed door lokaal verkeer. Amsterdam neemt dan ook maatregelen om aan de ene kant elektrisch vervoer te stimuleren en aan de andere kant vervuilende voertuigen te weren. De aanpak werkt: er rijden steeds meer elektrische voertuigen in Amsterdam en in 2016 won de stad voor de tweede keer de E-Visionary award als wereldwijde koploper in de transitie naar elektrisch vervoer.

Op kop met elektrisch vervoer
Het doel is om in 2025 een volledig uitstootvrije stad te zijn, waarin iedereen de mogelijkheid heeft om elektrisch te rijden. Alle verkeersgroepen leveren een bijdrage. De meest vervuilende voertuigen worden geweerd door middel van regulerende maatregelen, zoals milieuzones. De huidige milieuzone voor vrachtwagens wordt in 2020 aangescherpt, sinds 2017 kregen ook bestelvoertuigen met een milieuzone te maken, gevolgd door taxi's, bussen en scooters in 2018. Oude personenvoertuigen komen sinds april 2017 niet meer in aanmerking voor een parkeervergunning in de stad.

Privileges en de beschikbaarheid van veel publieke laadpalen, waaronder snelladers, maken het mogelijk en prettig om met elektrische voertuigen te rijden in Amsterdam. Bestuurders van elektrische auto's mogen te allen tijde op een oplaadplek gaan staan, mits ze de auto aankoppelen om te laden. Ze krijgen bovendien een parkeervergunning met voorrang. Om ondernemers over te halen en te ondersteunen in de overstap naar elektrisch rijden, zijn er aanschafsubsidies. En met het georganiseerde bedrijfsleven, het Gemeentevervoerbedrijf (GVB) en de taxibranche heeft de gemeente concrete doelen en maatregelen afgesproken om de luchtkwaliteit te verbeteren. Schone taxi´s krijgen bijvoorbeeld voorrang op de taxistandplaats bij het Centraal Station. Sinds 2018 is deze standplaats, net zoals die op het Leidseplein, alleen nog toegankelijk voor schone taxi's.

Amsterdam is een 'living lab' voor innovatieve bedrijven en kennisinstellingen die werken aan slimme oplossingen voor elektrisch vervoer. Nu al leveren windturbines in het Amsterdamse havengebied alle elektriciteit voor de publieke oplaadpunten. De volgende uitdaging is om elektrische auto's op te laden met lokaal opgewekte duurzame energie. Voor Amsterdam is de samenwerking met deze ondernemers en onderzoekers een nieuwe stap in de ontwikkeling naar een 'smart city': innovatief, leefbaar en duurzaam, waar elektrisch vervoer de normaalste zaak van de wereld is.

Een vraaggestuurd openbaar oplaadnetwerk
Door de laadzekerheid voor elektrisch rijders en de zichtbaarheid in de stad vormt het uitgebreide Amsterdamse openbare oplaadnetwerk de ruggengraat voor de ambities op het gebied van elektrisch vervoer. De stad heeft een basisnetwerk van reguliere laadpunten aangevuld met laadpleinen en openbare snelladers. Amsterdam stelde in de aanbesteding hoge eisen op het gebied van standaardisatie en toegankelijkheid voor diverse laadabonnementen, en al snel kreeg deze aanpak in andere Nederlandse steden navolging.

Om zicht te krijgen op het laadgedrag van de verschillende doelgroepen, monitort de gemeente in samenwerking met de Hogeschool van Amsterdam (HvA) de laadsessies van ruim 2.600 laadpunten in de stad.
De gegevens uit deze database maken het mogelijk om beter te communiceren met gebruikers en om extra (snel)laders te plaatsen op plekken waar dat nodig is. Snelladen kan inmiddels op een aantal strategische locaties in de stad, waaronder de schone taxistandplaats bij het Centraal Station.
De gemeente wil de uitbreiding van het snelladnetwerk grotendeels overlaten aan de markt, bij voorkeur op private locaties of in combinatie met benzinestations. Ook laat de gemeente onderzoeken of laadmogelijkheden te koppelen zijn aan lantaarnpalen of grote stroomaansluitingen van bruggen en rioolgemalen.
Innovaties zoals een grotere accucapaciteit, inductieladen en de zelfrijdende auto zijn van invloed op de manier waarop gebruikers opladen. 'Smart charging' is het geheel van oplossingen voor het flexibel omgaan met vraag en aanbod, bijvoorbeeld het tijdelijk opslaan van (duurzame) energie in accu's. Amsterdam wil voorop blijven lopen en volgt daarom de ontwikkelingen in de oplaad- en autobranche op de voet. Zo blijft het Amsterdamse laadnetwerk het best gebruikte en ' slimste' laadnetwerk ter wereld.

Ondernemers aan het woord
Zes ondernemers met een passie voor elektrisch vervoer vertellen waarom zij voor Amsterdam kozen. Kristof Vereenooghe van EV-box verplaatste zijn hoofdkwartier van Almere naar Amsterdam omdat hij "apetrots is als je kijkt naar het succes van Amsterdam, het aantal laadsessies en het aantal miljoenen emissievrije kilometers dat per maand gereden wordt." Ook autofabrikant Tesla vestigde zijn hoofdkwartier in Amsterdam, omdat het "voor de groei van Tesla van belang is dat we toegang hebben tot het toptalent in en rond Amsterdam", aldus Willem Haitink van Tesla. Ronald Steinmetz van adviesbureau EV-Consult past de kennis en ervaring die hij in Amsterdam opdoet inmiddels ook toe in Bhutan en China. En Jan Laan, directeur van Aad de Wit Verhuizingen, is erg te spreken over de subsidies waarmee hij vier elektrische verhuiswagens kon aanschaffen die hij in Amsterdam inzet. Volgens Joris Hupperets van Nuon is de aanpak in Amsterdam zo succesvol omdat de stad op meerdere pijlers heeft ingezet: het oplaadnetwerk, concurrentie tussen marktpartijen, stimulerende maatregelen en regulering. Wat dat laatste betreft mag de gemeente nog wel een stapje verder gaan, vindt Ruud Zandvliet van Taxi Electric: "Er zijn al honderden elektrische taxi's, dus zeg gewoon: als je in het centrum wilt rijden, dan moet je elektrisch zijn."

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- Studied Law (LLM), Radboud University Nijmegen
- Recent/current projects include: extension of Amsterdam's fast charging network; clean taxi ranks at Central Station and Leidseplein; clean ferries

Bart Vertelman (1973)
- Project Manager for Amsterdam Electric, part of the Amsterdam Electric team since 2010
- Studied Technology Management, Environment and Behaviour studies (MSc), Eindhoven University of Technology
- Recent/current projects include: tender and contracts for 4,000 public charging stations in Amsterdam; overall management charging infrastructure; ChargeWISE Amsterdam

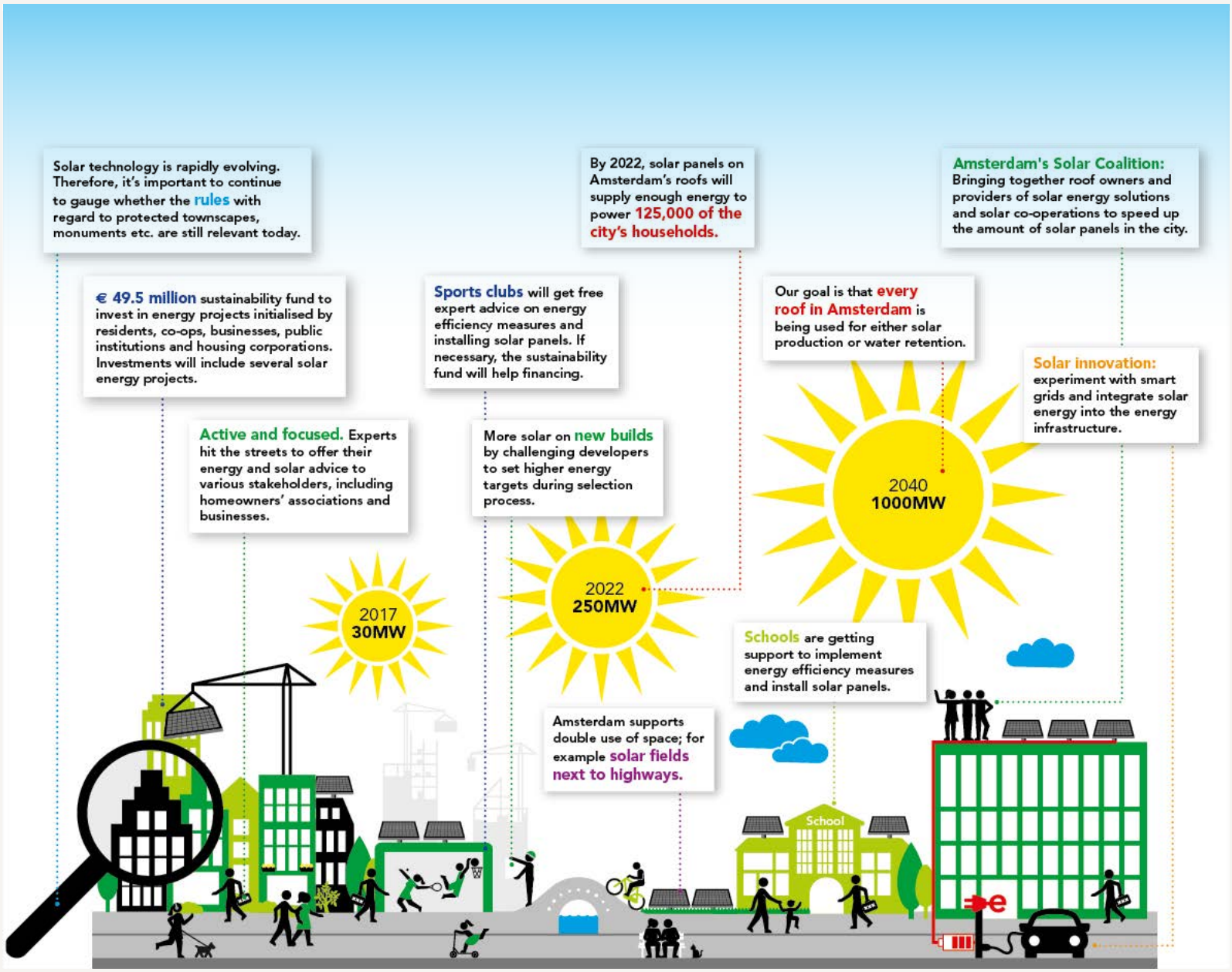
Doede Bardok (1981)
- Project Manager for Amsterdam Electric, part of the Amsterdam Electric team since 2010
- Studied Architectural History (BA), VU University Amsterdam
- Recent/current projects include: tender and contracts for 4,000 public charging stations in Amsterdam; installation of public charging infrastructure

The following people also contributed to this issue:

Stijn ter Woerds (1986)
- Communications Officer for Amsterdam Electric since 2013
- Studied Communications (BA) at Inholland University of Applied Science
- Recent/current projects: public relations and communications for clean air measurements, including Amsterdam Electric, low emission zones, air quality

Manon Junger (1963)
- Assistant Project Manager Amsterdam Electric
- Recent/current project: tender and contracts for 4,000 public charging stations in Amsterdam

Cityscape 04/18
Solar Scale-Up



Infographic: City of Amsterdam

Amsterdam has a large potential of solar energy

In the future, all power for our houses and electric transport will be fully sustainable. In order to achieve these targets Amsterdam will need a Solar Scale-Up! The city council's targets are to increase capacity to 250 megawatts by 2022. The end goal is that no roof in Amsterdam is being left unused.

Amsterdam can realise such a large capacity of solar panels by using the roofs of owner-residents, companies, housing cooperations and community organisations. Residents who do not have a roof of their own can join civil cooperatives to invest in solar energy and make use of sustainable energy. Roof owners can seek support from the council or the Amsterdam Solar Coalition, who can advise them on the possibilities.

More information available on www.amsterdam.nl/zon