

THE E-BIKE: A NEW METROPOLITAN MODE?

—

**Data on e-bike uses and users based
on 6t's mobility panel**

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6t-bureau de recherche

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1 INTRODUCTION

The use of electric bicycles (e-bikes) rapidly grows all around the world. In Europe, the amount of electric bicycles sold has shifted from 98,000 in 2006 to 854,000 in 2012. In France, e-bikes are also gaining popularity, with 56,000 units sold in 2013, i.e. a 22% increase compared to 2012, but they remain much more restricted than they are in Germany and the Netherlands, which make up for two thirds of the European market¹.

If e-bikes have been available for the last thirty years, they have become more and more popular since the 2000s, thanks to two main elements:

- The evolution of batteries, which directly affects the performance of the e-bike;
- The development of new forms of sustainable mobility in metropolitan areas. Regular bikes are successfully used for short-distance trips in cities while e-bike is the complementary transport mode that is needed for longer trips (typically from 4 to 12 kilometres). Compared to other motorized two-wheelers, e-bikes offer a range of competitive advantages: a limited speed which improves safety; zero noise and local pollution; a light weight that moderates additional electricity demand; and lower purchasing, maintenance and charging costs.

In this situation, is the e-bike a new mode for medium-size trips in metropolitan areas?

In order to answer the question and to provide new data on the uses and the users of e-bikes in Western Europe, 6t-bureau de recherche addressed an explorative survey to e-bike users in four European countries: the Netherlands, the United Kingdom, France and Spain.

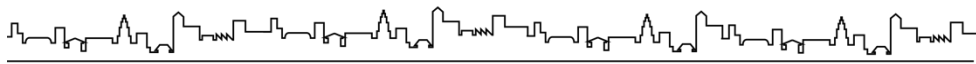
An online survey was launched in spring 2014. 100 people per studied country have been recruited through an access panel (SSI) and interviewed. The survey has been therefore been performed on a total sample of 400 people who declared having used an e-bike at least once in the last three months².

The survey is part of 6t-bureau de recherche's "6t Mobility Panel" program, an online panel that focuses on new mobility behaviours and new transport modes in Western Europe³.

¹ COLIBI / COLIPED, *European Bicycle Market 2013 edition - Industry and Market Profil (2012 Statistics)*, 2013; Bike Europe (bike-eu.com), French E-bike sales continue to Flourish, 24/08/2014

² The sample is not necessarily representative of the population of e-bike users in the four studied countries. Data on this subject has not been properly documented yet.

³ For example, 6t-bureau de recherche has published a 2014 report on *One-way carsharing: which alternative to private car?*, as a part of its Mobility Panel program. This report is available on www.6t.fr.



2 E-BIKE: THE PRODUCT AND ITS USES

2.1 AN URBAN BICYCLE GOING UP TO 25 KM/H

2.1.1 An e-bike is defined by its speed limit

An electric bike, or e-bike, is a hybrid electric two-wheeler combining pedal power with battery-based propulsion and displaying operating pedals, contrary to electric scooters, which don't have pedals. While their motor only propels electric scooters, on electric bikes **the motor assists pedalling but cannot replace it**. As any electric vehicle, e-bikes can have a positive effect on local air pollution; they are silent (engine noise under 40 dB) and found to be extremely energy-efficient (about 1 kWh of energy spent for a distance of 50 miles) (Cherry & Cervero, 2006).

Yet, two e-bike types have to be distinguished, named “pedelec” (for pedal electric cycle) and “speed e-bike”, as there are legal differences between them, but no legal term to distinguish them. The main difference between the two is **the maximal speed they can reach**⁴, and therefore whether they have to comply with the laws applying to regular bicycles or scooters. According to the European law, on a “pedelec”, the pedalling assistance stops when the vehicle reaches 25 km/h (European Union directive 2002/24/EC).

Hence, “pedelecs” are considered as conventional bicycles by the European law: cycle users, and therefore e-bike users, don't have to wear a helmet, they don't need a number plate, a licence or insurance and they can ride on cycle lanes. On the contrary, “speed e-bikes” are considered as scooters, i.e. low-power motorcycles: their users have to wear a helmet; a number plate and insurance are compulsory; they are not allowed on cycle paths.

This survey focuses on “pedelecs”.

2.1.2 E-bike owners declare riding a €1,000 urban e-bike

Number of e-bikes par household and price

In the sample, there are in average 1.05 e-bikes⁵ per two-or-more-people households and 1.8 e-bike users in these households. Therefore, when people have an e-bike, they frequently share with other people in their household.

The average price respondents declared for their last purchased e-bike is €1,053. But the

⁴ For instance, the “Stromer ST1” e-bike offers three different power systems for the same model, with maximal speeds of 25, 33 and 45 km/h. With the first one (25 km/h max), the Stromer ST1 is considered as a “pedelec” by the European law; with the two others (33 and 45 km/h max.), it is considered as a “speed e-bike” and has to use as a scooter.

⁵ There are 352 e-bikes for 333 people.

declared price varies greatly according to the country: in the Dutch subsample, the average declared price of purchase is €1,468. In the Spanish subsample, it is €626. For the French sample, it is similar to the average price (€1,060). For the British subsample, the average price is surprisingly low (€757). Yet, our survey indicates that a majority of British respondents have bought their e-bike in the Internet and 14% of them have bought it second-hand. While retail shops rather sell high-end bikes from European brands, e-bikes bought on the Internet are rather cheaper e-bikes, often made in Asia (especially China).

The average monthly cost of use of an e-bike, for the respondents who own one, is €22, including charging, maintenance and insurance costs. This is considerably cheaper than the cost of use for any motorized two-wheeler or private car. For example, the monthly cost of use of the private car including petrol and insurance is about €340 in France⁶. The cost of use seems negatively correlated with the cost of purchase: Dutch respondents are the ones who spend the most money to purchase their e-bike, but the least money to use it (€15 per month). On the other side, French, Spanish and British spend respectively €21, €24 and €30 per month for the use of their e-bike.

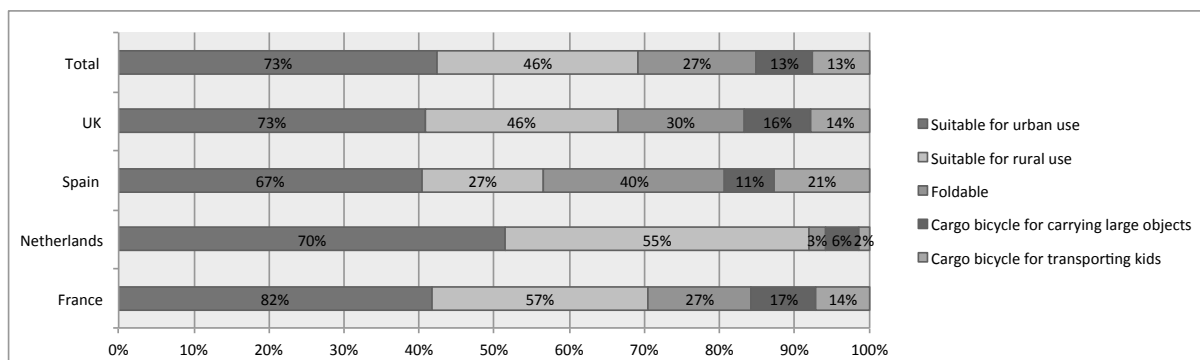
Shape of the e-bike: mainly an urban bicycle

73% of the respondents declare they have an e-bike that is suitable for urban areas. This is the most common characteristic. 46% of the respondents declare they have an e-bike that is suitable for rural areas and cycling in the nature (for instance on forest paths). 27% own a folding bike, and 26% own a cargo bike (13% own a cargo bike for carrying large objects and 13% own a cargo bike for transporting kids).

Dutch respondents have a comparatively high share of e-bikes they deem suitable for urban use (70%) and for rural use (55%), but few foldable bikes (6%) and few cargo bikes (8% vs. 26% in the total sample). The Spanish respondents, on the contrary, have a comparatively high share of folding bikes (47%) and a lower share of bikes designed for rural areas (27%).

⁶ Data from a paper of the DGCCRF available at http://www.economie.gouv.fr/files/directions_services/dgccrf/documentation/dgccrf_eco/dgccrf_eco14.pdf (consulted 2015/02/25).

Figure 1: online survey - characteristics of the e-bikes owned by respondents



Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Several answers were possible.

Main motivations: more convenient than a regular bike and cheaper than a car

In the total sample, the main motivation of the respondents to use an e-bike is that they find it more convenient or better adapted to their needs than a conventional bike (29% of the answers). The second most chosen answer is that an e-bike is cheaper than a private car. Yet, the former is at first rank because a very high share of the Dutch respondents chooses it (59% of them do). In the French, Spanish and British subsamples, it is actually the cost of an e-bike compared to a private car that comes at first rank.

In the British subsample, a significantly high share of the respondents uses an e-bike because it is cheaper than public transport. E-bikes could replace public transport when used for commuting.

The e-bike's convenience and environmental-friendliness compared to a private car or public transport is only the main motivation for a small minority of respondents. The options related to convenience compared a private car or public transport gather 18% of the answers and those related to environmental-friendliness gather 12% of the answers.

Figure 2: online survey - respondents' main motivation to use an e-bike

	France	Netherlands	Spain	UK	Total
More convenient / adapted to needs than conventional bike	22%	59%	13%	20%	29%
Cheaper than a private car	29%	9%	31%	31%	25%
Cheaper than public transport	10%	6%	11%	18%	11%
More convenient / more comfortable than public transport	8%	5%	15%	10%	10%
More convenient than a private car	10%	4%	8%	8%	8%
More environmentally friendly than a private car	11%	4%	11%	3%	7%
More environmentally friendly than public transport	7%	1%	5%	5%	5%
I don't know	2%	4%	5%	2%	3%
Other	1%	8%	1%	3%	3%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

Main concerns: charging issues and the weight

The most frequently quoted obstacle to the use of an e-bike is charging issues (28% of the respondents in the total sample choose this option). Technical problems due to the bicycle itself are also common (20%). The weight of the bikes comes at second rank (19%), followed by road safety (16%). Theft and damages caused to the e-bike come at 6th and 7th: 13% of the respondents have already had their e-bike stolen and 10% have had it damaged, which is quite a high rate given the price of these vehicles.

Spanish respondents put a stress on the lack of maintenance and repair services (26% name it as obstacle vs. 16% in the total sample) as well as problems linked to road safety (28% vs. 16% in the total sample), and there is a lack of cycling infrastructures which certainly contributes to the feeling of a lack of safety among cyclists.

A comparatively high share of British respondents (19% vs. 10% in the total sample) quotes damages caused to their e-bike, which makes a strong case for folding e-bikes.

The Dutch respondents are by far those who tend to encounter the least problems with their e-bike: 56% declare they haven't met any obstacle to the use of it (vs. 30% in the total sample). Notably, lack of maintenance services, vandalism and problems of road safety are hardly quoted by them.

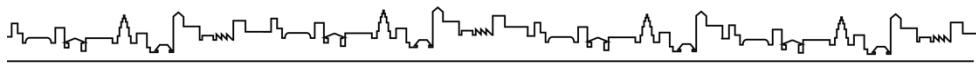
Figure 3: online survey - obstacles encountered when using an e-bike

	France	Netherlands	Spain	UK	Total
Technical problems related to the e-bike itself	21%	17%	12%	30%	20%
Recharging problems	25%	12%	36%	38%	28%
Lack of maintenance or repair services	12%	3%	26%	22%	16%
Damages caused to the e-bike (vandalism)	9%	3%	9%	19%	10%
Theft	12%	8%	14%	17%	13%
Problems linked to road safety	18%	4%	28%	13%	16%
Weight of the e-bike	25%	12%	18%	22%	19%
No obstacle	24%	56%	24%	17%	30%
Other	5%	4%	2%	2%	3%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Several answers were possible.

In our survey, four e-bike owners out of ten have already purchased insurance for one of their electric bicycles (39%). Yet, in the Netherlands, a short majority of the respondents already has (51%), while it is only the case for 26% of the Spanish respondents. French and British respondents behave as the average (respectively 39% and 36% have insurance)

When respondents have insurance, it nearly systematically covers theft (96%). Damage caused to third parties is covered in 54% of cases and repairing fees are covered in 34%.



People are more willing to own their e-bike than to share it

Only 33% of the respondents strongly agree with the sentence that «it would be useful to have e-bike sharing programs».

On the other hand, 66% of them are interested in a long-term lease with insurance against theft or damage caused to/by third parties. They are willing to pay €27 per month in average for this offer, which is a little more than the monthly cost of use of an e-bike (€22, cf supra.).

According to these results, promoting e-bike sharing programs seems to be less of a priority than encouraging people to own an e-bike. E-bike long-term lease could dispatch the purchasing price of e-bike over a longer period. And it is easier to set it up than to develop e-bike sharing programs. The location and regulation of e-bike sharing stations are complex. Because e-bike users cover longer distances than traditional bike user, the network of stations for e-bike share service has to be more spread out than the network for regular bike share service (see 2.2.2).

2.2 A DAILY USE IN URBAN AREAS

2.2.1 A daily transport mode

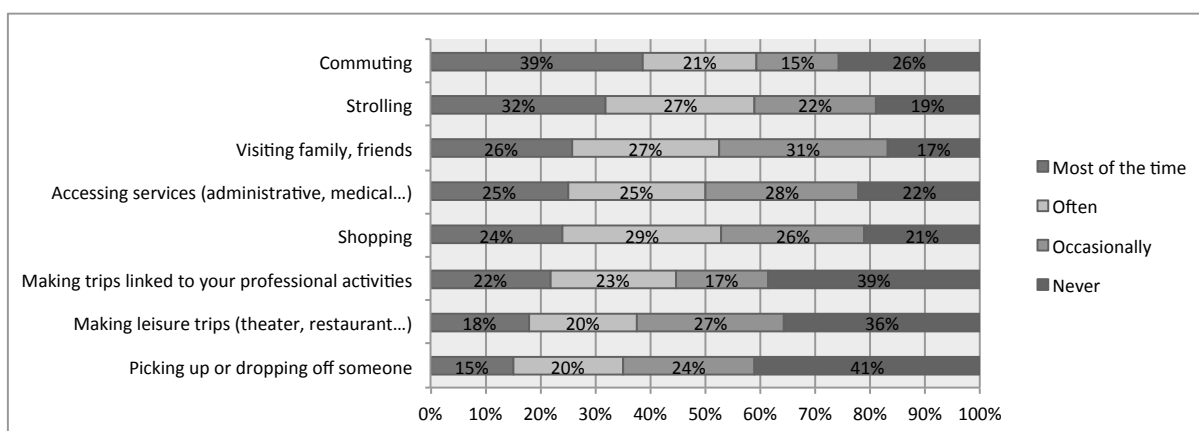
The frequency of use doesn't vary significantly according to the country: **e-bikes are used on a very regular basis in all four countries**. 45% of them use one daily or almost and 43% use one 2 to 3 times a week.

The most frequent uses of the e-bike are commuting and strolling (see figure 4). 39% use it for commuting "most of the time" and 21% "often". Plus, 32% use it for strolling "most of the time" and 27% it "often".

Visiting family and friends is the activity made with an e-bike by the highest share of respondents (83% have already done it), but not necessarily on a frequent basis.

The least popular trips made with e-bikes are trips linked with professional activities (other than commuting), leisure trips other than strolls and picking up or dropping off someone. Only 15% of the respondents pick up or drop off someone "most of the time" when they use an e-bike and 41% have never done it.

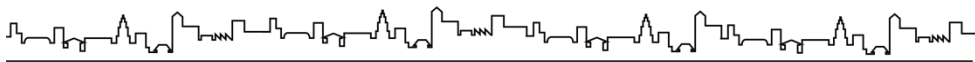
Figure 4: online survey - trip purposes with e-bikes - total sample



Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

In France, Spain and the United Kingdom, the proportion of users who mostly or frequently use an e-bike for commuting is very similar, which is not the case in the Dutch subsample.

The most frequent activity for the Dutch respondents is shopping. Commuting is the second most frequent type of trip made with an e-bike, but compared to the other types of trips the Dutch do with an e-bike, there is a small proportion of respondents who use an e-bike "often" or "occasionally" to commute (29%, while 57% use an e-bike "often" or "occasionally" for shopping). This shows that for Dutch users, e-bikes are used in a way that is close to regular bikes, as an everyday transport mode used for a variety of "utilitarian" purposes.



2.2.2 Medium-size trips of about 30 minutes

E-bike users cycle faster than most urban transport modes

We have asked the respondents to give estimations of the average distance and duration of the trips⁷ they make with an e-bike. With these results, we calculate an average speed for each respondent⁸. It appears that **the average speed of the respondents when they use an e-bike is 19 km/h**. The average speed being close to the median speed, half the respondents (51%) ride an e-bike at an average speed of 20 km/h or more.

This is very close to available data about the Netherlands, according to which “the average cruising speed of the entire population of e-bike owners is approximately 18.7 kilometres per hour” (Fietsberaad, 2013). Our survey’s result is also coherent with Pini et al.’s study (2009) according to which e-bike users in the Geneva canton ride at a calculated average speed of 19.5 km/h. In the Netherlands, this means that e-bike users can keep up with the speed of regular bike commuters estimated between 17.6 and 20.1 km/h (Simons et al., 2009), which is likely to improve the overall safety on cycle lanes⁹.

People who ride e-bikes for commuting might reach an average speed that is closer to 25 km/h, since they are among the youngest e-bike users and looking for time-efficiency.

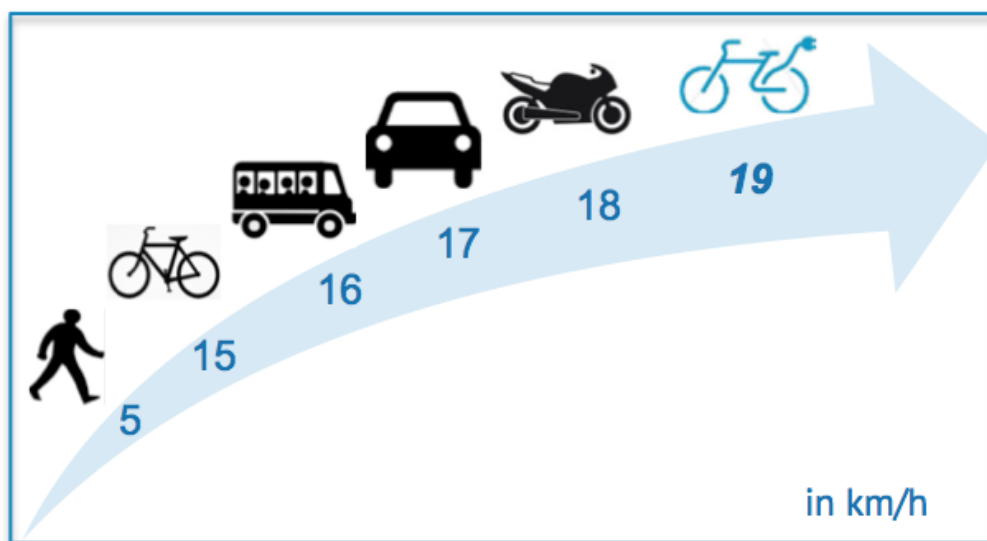
In large cities, an average speed of 19 km/h is definitely competitive compared to other transport modes (see figure 5).

⁷ In the questionnaire, the notion of “trip” was defined and explained as follows: “By ‘trip’ we mean going from one place to another (one way trip). For example: a journey between your home and your workplace / study place, or a journey from your workplace / study place to the theatre is considered as a trip.”

⁸ In order to guarantee the credibility of the results, we only take into account the answers of the 223 respondents whose average speed is no less than 7 km/h, under which it seems hard to find a balance with an e-bike and no more than 30 km/h, since the assistance stops at 25 km/h and e-bikes are heavier than conventional bikes, which makes it harder to reach a high speed.

⁹ One has to notice that the Netherlands benefit from excellent cycling infrastructures, which allow bikers to ride at high speed in general.

Figure 5: the calculated average speed of the e-bike in the survey in comparison with the average speed par mode of transport in some large European cities (in km/h)



Conception: 6t-bureau de recherche, 2014.

The range of speeds per mode of transport is based on data available from different household travel survey¹⁰. The data for the e-bike was calculated from the answers respondents gave in the survey.

E-bike users cover longer distances per trip than most urban transport modes

The mean duration of the trips made with an e-bike by the respondents is **30 minutes**. Yet, the median (20 minutes) value is smaller than the mean value, which shows that a majority of respondents (57%) makes trips, which last less than 30 minutes in average, but the mean is lifted up by a minority of respondents.

The mean distance of the trips made with an e-bike by the respondents is **9 km**. Yet, the median (6 km) value is smaller than the mean value, which shows that a majority of respondents (65%) make trips of 9 km or less, but a minority of respondents lift the mean up.

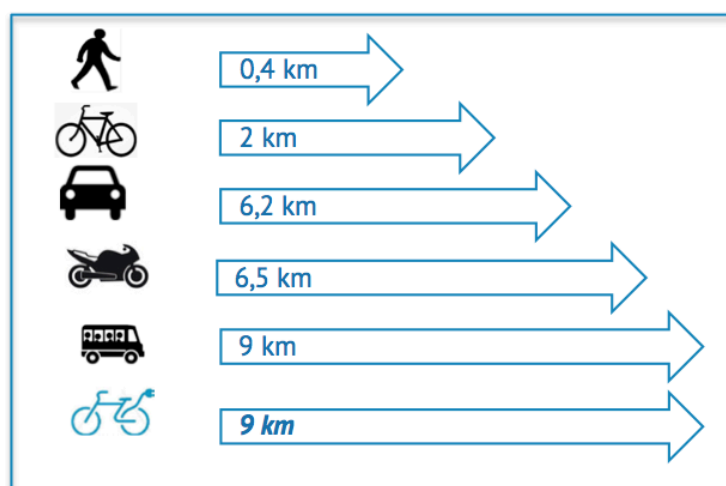
In the Netherlands, 9.8 km is the average distance e-bike users cover when they commute with their e-bike, while regular bike users cover an average distance of 4.5 km when they commute (Fietsberaad, 2013). In our survey, the distance between the respondents' workplace or study place and their home is 13 km in average and the median is 10 km; it doesn't vary significantly for people who frequently commute with their e-bike. Therefore, the e-bike does seem to allow its users to cover longer distances than with a regular bike,

¹⁰ Source: Copenhagen (conventional bike), Berlin (public transport), London (private car cf TfL), Paris (motorized 2-wheelers, cf global transport survey, 2010).

including for commuting. While 7.5 km is commonly considered in the Netherlands as the maximal distance for which people accept to commute with a regular bike, it seems that with e-bikes this limit can at least be brought up to 10 km.

E-bike users are not only faster, but they also cover longer distances per trip than motorized urban transport modes. As figure 6 shows, in the Paris region, the average length of a car trip is 6.2 km; the average length of a trip with a motorized two-wheeler is 6.5 km and the average length of a trip with public transport is 9 km¹¹. **Hence, in our survey, the average distance covered for a single e-bike trip (9 km) is longer than those of all these urban transport modes. In this respect, e-bikes seem to be a suitable transport mode for metropolitan areas.**

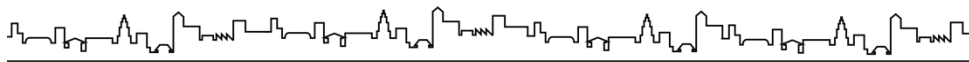
Figure 6: estimated average trip distance made by the e-bike in the survey compared to average distance per trip per mode of transport in the Paris region (in km)¹²



Conception: 6t-bureau de recherche, 2014

¹¹ Figures from the 2010 global transport survey in the Paris region, detailed summaries for each transport mode available at <http://www.omnil.fr/spip.php?article87> (consulted 2014/05/02).

¹² Data on distances per trip per mode of transport was available in the 2010 Paris region global transport survey.



2.3 E-BIKES IMPACT MODAL CHOICES

2.3.1 E-bikes don't really remove cars...

In the survey, **e-bike users are generally car owners**. 61% of the respondent own a car and 25% two or more. On the opposite, only 13% of the respondents don't own a car in their household.

It is interesting to notice that **e-bike users seem much more likely to purchase electric and hybrid cars** than the rest of the European population: 27% of the respondents who currently own one or more private cars own an electric or hybrid car and 3% own two or more. On the opposite, hybrids, electrics, natural gas and ethanol-fuelled vehicles only made up 3% of the new cars sold in Europe in 2013¹³.

The respondents were asked to indicate the number of private cars (none; one; two or more) in their household, before they started using an e-bike and at the time the survey was completed. The total amount of cars of by the respondents is estimated to have shrunk by 7% since they have started using an e-bike, meaning that some respondents could have got rid of their car, probably the second or third car of the household. The differences observed between the countries are not significant.

20% of the respondents think the use of an e-bike has pushed them to forgo the purchase of a car (see figure 7), but 13% think it has pushed them to buy a car. Yet, 43% of the respondents declare that using an e-bike has had no effect at all on their motorisation.

Figure 7: online survey - influence of e-bike use on transport equipment

Would you say that the use of an e-bike pushed you to... (multiple answers possible)	n=539
... forgo the purchase of a car (or of an additional car)	20%
... get rid of a car	17%
... forgo the purchase of a motorcycle	15%
... buy a conventional bicycle	14%
... buy a car	13%
... buy a motorcycle	8%
... subscribe to a bicycle sharing system	6%
None of the above	43%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

¹³ Data from the International Council on Clean Transportation. See http://www.theicct.org/sites/default/files/publications/EU_vehiclemarket_pocketbook_2013_Web.pdf (consulted 2014/04/11).

2.3.2 ... but they do replace car trips

Among the respondents who currently have one or several cars in their household, **49% declare that they make less use of a private car as a driver since they have started using an e-bike**. If e-bikes might not replace car, they might replace car trips.

Figure 8: online survey - evolution in the use of a private car – for respondents with one or more private cars in their household

Since you have started using an e-bike, you have driven a private car...

	More	Less	No Change
France	17%	55%	28%
Netherlands	10%	51%	39%
Spain	13%	55%	32%
UK	29%	33%	38%
Total (n=350)	17%	49%	34%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Subsample of 350 respondents owning one or more cars.

2.3.3 E-bikes do not remove many regular bikes...

The amount of regular bikes owned by the respondents' households has shrunk by 15% since they have started using an e-bike. It has dropped in nearly all countries, but not to the same extent: it drops by 32% in the Dutch subsample and 7% in the Spanish subsample. In France, it remains the same (figure 9). While Dutch e-bike users are ageing people for whom the e-bike totally replaces the regular bike for fitness or health reasons (see part 3), in France, Spain and the United Kingdom, e-bikes might be more complementary to regular bikes: one could suppose, for instance, that e-bikes are rather used for commuting and regular bikes are rather used for recreational purposes.

Figure 9: online survey - evolution of regular bikes owned by the respondents' households per country

	REGULAR BIKES BEFORE	REGULAR BIKES AFTER	DIFFERENCE	EVOLUTION
France	127	127	0	0%
Netherlands	170	115	-55	-32%
Spain	134	124	-10	-7%
UK	101	88	-13	-13%
TOTAL	532	454	-78	-15%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

In the total sample, most e-bike users remain heavily equipped with regular bikes: 80% of them have at least one in their household.

2.3.4 ... and they have replaced less regular bike trips than car trips

While one could fear that e-bikes would mostly replace regular bike trips, according to our survey, **e-bikes probably replace less regular bike trips than car trips**.

Since they have started using an e-bike, 42% of them have made less use of a regular bike and 29% more use of it (see figure 10). The evolution in the use of regular bikes does not vary significantly according to the country.

Figure 10: online survey - influence of e-bike use on conventional bicycle use and private car use

Since you have started using an e-bike, ...	MORE		LESS		NO CHANGE		TOTAL
You have ridden a conventional bicycle...	100	29%	145	42%	102	29%	347
You have driven a private car...	62	17%	179	49%	123	34%	364

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

2.3.5 The e-bike has led to a smaller use of all transport modes... except the shared ones

Globally, the e-bike use has led to a slight decrease in the use of nearly all other transport modes. This is coherent with the high frequency of e-bike use that was stated in our survey (see 2.2). **The e-bike is not only a daily transport mode: it is also versatile enough to modify the use of other transport modes.**

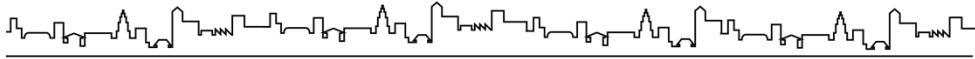
Nevertheless, the evolution in the use of these transport modes is not unilateral. As shown above, the use of the private car and regular bike has diminished, but this is also true of the use of motorcycle (48% of the respondents who own a motorcycle have used it less, but 24% have used it more) and of public transport (36% have used public transport less, but 24% have used it more).

Conversely, the use of shared transport modes has risen: 46% of the respondents who have a subscription to a bike share service have used it more, while 32% have used it less. 44% of the respondents who have a subscription to a car club have used cars from their car club more, 30% have used them less.

Figure 11: online survey - influence of e-bike use on the use of other transport modes

Since you have started using an e-bike, ...	MORE		LESS		NO CHANGE		Total
<i>You have ridden a conventional bicycle...</i>	100	29%	145	42%	102	29%	347
<i>You have driven a private car...</i>	62	17%	179	49%	123	34%	364
<i>You have taken a public transport...</i>	96	24%	144	36%	160	40%	400
<i>You have walked for an entire trip..</i>	94	24%	132	33%	174	44%	400
<i>You have driven a traditional rental car..</i>	66	17%	133	33%	201	50%	400
<i>You have used carpooling..</i>	64	16%	120	30%	216	54%	400
<i>You have taken a cab...</i>	63	16%	143	36%	194	49%	400
<i>You have ridden a shared bicycle (e.g. Barclays Cycle Hire)...</i>	50	46%	35	32%	23	21%	108
<i>You have driven a motorcycle</i>	49	24%	97	48%	56	28%	202
<i>You have driven a car from a car club</i>	38	44%	26	30%	23	26%	87

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users



3 THE E-BIKE USERS

3.1 PROFILE OF THE E-BIKE USERS

3.1.1 The socioeconomic profile of e-bike users

A short majority of men

There is a majority of men among the respondents (57%). There is a particularly strong majority of men in the U.K. (69%), followed by Spain (57%), while the share of men is the smallest in the Netherlands (50%) and in France (51%).

The shares of men and women among e-bike users might depend on how e-bikes are used in each country. It could seem logical to find a higher share of men in countries such as Spain, where e-bikes are mostly used for commuting purposes, than in the Netherlands, where e-bikes are mostly used by elderly people for shopping trips and strolls on the countryside (see 2.2).

Middle-aged people

The respondents are 40 years old in average. This result turns down the assumption that elderly people are the main e-bike adopters. The e-bike users' age might be slightly underestimated due to the fact that the survey was online and elderly people tend to be less connected to the Internet than others, but e-bikes are definitely not only owned by people over 60. The average age varies according to the country: the Spanish respondents have the lowest (33) and the Dutch respondents have the highest (48). French and British respondents are in between (respectively 40 and 38).

As figure 12 shows, classifying the respondents' ages in categories reveals that:

- People between 40 and 49 are overrepresented within the French respondents (24% vs. 16% in the total sample);
- People over 60 are strongly overrepresented among the Dutch respondents (37% vs. 16% in the total sample) and people over 50 represent a majority of Dutch respondents (56% vs. 26% in the total sample);
- People between 30 and 39 are strongly overrepresented among the Spanish respondents (47% vs. 27% in the total sample);
- The share of people between 20 and 29 is significantly higher in the British than in the French subsample (35% vs. 21%).

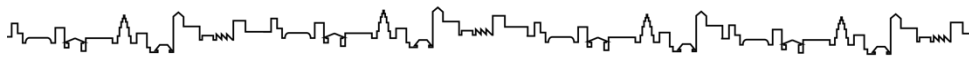


Figure 12: online survey - respondents' ages, sorted per decade

	up to 20	20 - 29	30 - 39	40 - 49	50 - 59	60 and above
France	2%	21%	31%	24%	11%	11%
Netherlands	4%	23%	7%	10%	19%	37%
Spain	7%	28%	47%	11%	6%	1%
UK	5%	35%	24%	18%	7%	11%
Total	5%	27%	27%	16%	11%	15%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

Mostly working and studying people, except in the Netherlands

Half the respondents (51%) are working on a full-time basis. The share of full-time working respondents is particularly high in the French and Spanish subsamples (69% and 67% respectively). While there is a lower share of working people in the British subsample, there is a significantly higher share of students (22%, vs. 11% in Spain and 6% in France). This confirms **the interest of e-bikes for working people in all three countries**, and to some extent for studying people in Great Britain. The e-bike appears as an alternative to the private car for compulsory trips.

The Dutch subsample is very specific, since it includes a very small share of full-time workers (17%) and comparatively high shares of people looking after their family or home (11% vs. 5% in the total sample), people working part-time (25% vs. 15%) and retired people (28% vs. 12%). This result confirms **the specificity of Dutch e-bike users** and can be explained by the higher share of women - a lower share of which are working than men - and elderly people.

Figure 13: online survey - respondents' activity

	France	Netherlands	Spain	UK	Total
Full-time or part-time student	6%	14%	11%	22%	13%
Looking after the family or home	1%	11%	3%	3%	5%
Working full-time (more than 32 hrs a week)	69%	17%	67%	49%	51%
Working part-time (up to 32 hrs/week)	9%	25%	12%	13%	15%
Looking for a job	4%	5%	6%	4%	5%
Retired	11%	28%	1%	9%	12%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

Not only wealthy white-collars

In our survey, e-bike users have different professional positions: there are equivalent shares of executives (28%) and employees (30%) in the total sample. Yet, the share of workers remains small (7%).

Dutch respondents remain specific, since entrepreneurs and self-employees are overrepresented (29% vs. 15% in the total sample), while employees are underrepresented (10% vs. 30% in the total sample).

There is a significantly high share of executives and higher professional employees in the French subsample (38% vs. 28% in the total sample), so maybe e-bikes remain more used by white-collars there than in other countries.

Figure 14: online survey - respondents' working status

	France	Netherlands	Spain	UK	Total
Entrepreneur or self-employee	8%	29%	13%	19%	15%
Executive or higher professional employee	38%	29%	24%	18%	28%
Intermediate professional employee	12%	26%	23%	27%	21%
Employee	32%	10%	34%	34%	30%
Worker	10%	7%	6%	2%	6%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users
– subsample of 261 working or studying users

Half of the respondents to the surveys (50%) have passed a university degree and another half have not. It is interesting to notice that the e-bike seems less selective than other new transport modes, such as car club (6t-bureau de recherche, 2014).

Once again, the Dutch respondents have a very specific profile, with owners of a master's degree being strongly underrepresented (5% vs. 21% in the total sample) and owners of a technical degree (42% vs. 23%) or a primary education degree (13% vs. 6%) being strongly overrepresented.

A significantly high share of French respondents have a master's degree or beyond, which supports the hypothesis that there are more white-collars among e-bike users in France than in the other surveyed countries.

Figure 15: online survey - respondents' education level

	France	Netherlands	Spain	UK	Total
No diploma	1%	4%	0%	5%	3%
Primary education	2%	13%	5%	4%	6%
Secondary education (A level)	19%	17%	14%	22%	18%
Technical degree	14%	42%	22%	14%	23%
Bachelors' degree	29%	19%	31%	38%	29%
Master's degree and beyond	35%	5%	28%	17%	21%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

3.1.2 E-bike users are mostly metropolitan dwellers

In rather urban areas...

Two-thirds of the respondents in the total sample declare that they live in a rather urban area. The highest rate of respondents declaring to live in an urban area is to be found in the Spanish subsample (84%) and the lowest rate is to be found in the Dutch subsample (50%).

Figure 16: online survey - residence in an urban or a rural area

	urban area	rural area	don't know
France	70%	29%	1%
Netherlands	50%	48%	2%
Spain	84%	14%	2%
UK	75%	20%	5%
Total	70%	28%	2%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

... but not only in core cities

In the total sample, the shares of respondents who declare they live inside and outside the main city of their area are equivalent (47% and 45%). There is a low rate of Dutch respondents who declare they live in the main city of their area, which is coherent with their stronger tendency to declare they live in rural areas than the respondents from other countries. Yet, although a large majority of the respondents from France, Spain and the United Kingdom declare they live in urban areas, only a short majority of them live in the main city of their area (from 50% in France to 59% in Great Britain).

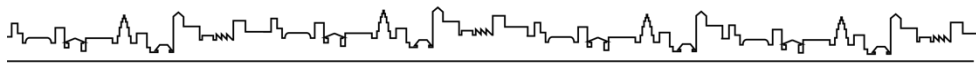
Indeed, **not all the respondents who live in urban areas live in the main city of their area**. In the total sample, more than a third of the respondents who live in an urban area live outside the main city (37%).

Figure 17: online survey - residence inside or outside the main city of the area

	In the main city	Out of the main city	don't know
Urban area	61%	37%	2%
Rural area	13%	67%	21%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Subsample of 390 respondents who answered living urban or rural areas.

These results show that the e-bike is a transport mode used mostly, but not only, in urban areas; and if used in urban areas, mostly, but not only, in the main cities. It is used on a daily basis, mostly for commuting and strolling. An average trip made by e-bike lasts about 30 minutes, travelling a distance of about 9 km at about 19 km/h. **To some extent, they give credit to the hypothesis of the e-bike emerging as a new metropolitan mode, not only used in the main cities of large urban areas, but also in the peripheries. In this context, the e-bike appears as an alternative to the private car.**



3.2 WHAT E-BIKE USERS THINK OF OTHER MODES OF TRANSPORT

Each respondent was asked to give up to three adjectives to describe, in turn, public transport, the private car, the conventional bike and the e-bike. Equivalent adjectives were then grouped together to obtain some forty harmonized adjectives, allowing comparison between samples (Kaufmann et al, 2010). By classifying the adjectives relating to each mode according to the number of mentions, we can distinguish the most relevant images of each of the forms considered.

As the ranking of adjectives shows major differences between the Dutch subsample and the others, adjectives quoted by French, Spanish and British respondents are systematically grouped and compared to those quoted by Dutch respondents who tend to be older and to live more in rural areas.

As described below, respondents have a highly positive image of the e-bike, a positive image of the private car and the conventional bicycle, which are both individual modes like the e-bike, but they have a mixed image of public transport.

3.2.1 A mixed image of public transport

The ranking of adjectives regarding public transport reveals contradictory perceptions among members of the sample. While 28% of the French, Spanish and British respondents find public transport “expensive”, 25% find it “cheap”. 36% of the Dutch respondents find it “practical”, but conversely, 14% qualify it as “not practical”.

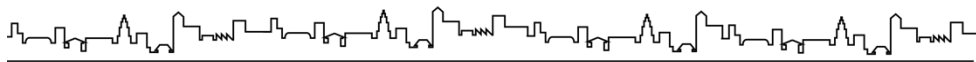
Neither the Dutch, nor the other respondents have a very positive opinion on public transport. In the two rankings, 6 adjectives out of 10 are negative. Since half of them live on the countryside, the Dutch respondents might not be as experienced with public transport as respondents from other countries. 15% of the latter qualify public transport as “crowded” and 7% as “dirty”, while these two adjectives don’t appear in the Dutch respondents’ “top 10”. A higher share of the French, Spanish and British respondents find public transport “cheap” (25% vs. 9% in the Dutch subsample).

Moreover, respondents from these four countries don’t find public transport as an “ecological” mode.

Figure 18: online survey- ranking of adjectives regarding public transport

Rank	France / Spain / UK		Netherlands	
1	Expensive	28%	Expensive	38%
2	Cheap	25%	Practical	36%
3	Practical	19%	Easy to use	16%
4	Crowded	15%	Not practical	14%
5	Slow	13%	Unreliable	13%
6	Unreliable	13%	Slow	12%
7	Ecological	9%	Cheap	9%
8	Dirty	7%	Stressful	7%
9	Comfortable	7%	Unsufficient	7%
10	Unpleasant	6%	Ecological	5%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users



3.2.2 A positive image of the private car

When it comes to the private car, both rankings show that e-bike users tend to have a positive perception of it. In both rankings, only 3 adjectives out of ten are negative.

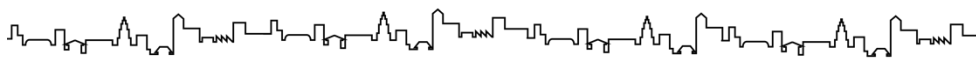
The French, Spanish and British respondents' most quoted adjective is "expensive" (quoted by 44%), while only 28% of the Dutch respondents qualify the private car as "expensive". Dutch respondents prove to be more enthusiastic than the others about this transport mode. Their most quoted adjective is "practical", and the second most quoted is "easy to use". Moreover, while 16% of the other respondents qualify the private car as "polluting", only 5% of the Dutch respondents do.

The difference of perception between Dutch respondents and others might be due to the fact that a majority of the latter live in cities, where cars are more likely to be considered as a problem.

Figure 19: online survey- ranking of adjectives regarding the private car

Rank	France / Spain / UK		Netherlands	
1	Expensive	44%	Practical	39%
2	Practical	28%	Easy to use	33%
3	Comfortable	27%	Expensive	28%
4	Fast	18%	Fast	16%
5	Polluting	16%	Comfortable	13%
6	Gives autonomy / freedom	10%	Enjoyable	11%
7	Useful	9%	Accessible	6%
8	Personal / selfish	6%	Polluting	5%
9	Enjoyable	5%	Essential	5%
10	Cheap	4%	Uncomfortable	4%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users



3.2.3 A positive image of the conventional bicycle

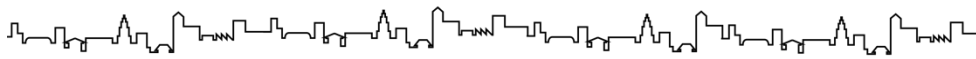
E-bike users have a positive opinion about the private car but also about the conventional bicycle. Above all, respondents from the four countries find it « practical », « cheap » and « healthy ».

Nearly all adjectives in the French, Spanish and British respondents' ranking are positive. Yet, they find the conventional bicycle "tiring", while this adjective doesn't appear in the Dutch respondents' ranking. The conventional bicycle is a broadly used, daily transport mode in the Netherlands: this may be why Dutch respondents don't see it as much as an effort. For 18% of them, the conventional bicycle is easy to use and for 10% it is fast. On the opposite, only 8% of the French, Spanish and British respondents consider the conventional bicycle as an easy mode to use. The lack of bicycle paths could be one explanation.

Figure 20: online survey- ranking of adjectives regarding the conventional bicycle

Rank	France / Spain / UK		Netherlands	
1	Practical	31%	Practical	36%
2	Cheap	27%	Healthy	28%
3	Healthy	25%	Cheap	21%
4	Ecological	18%	Easy to use	18%
5	Tiring	16%	Fast	10%
6	Comfortable	15%	Ecological	9%
7	Easy to use	8%	Enjoyable	5%
8	Enjoyable	8%	Slow	5%
9	Fast	7%	Restrictive	4%
10	Sociable	7%	Unpleasant	4%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users



3.2.4 A most positive image of the e-bike

The e-bike is probably its users' favourite transport mode. Nearly all of the top ranked adjectives they quote to qualify it are positive.

Many respondents call the e-bike "practical", as they do for all other transport modes. Yet, the Dutch respondents do not highlight the same advantages as the others: among the former's three most quoted adjectives are "practical", "easy-to-use" and "fast", while other respondents put forward the e-bike's "cheap" and "ecological" sides. In other words, the French, Spanish and British respondents thus mainly value the positive externalities of the e-bike (good for the wallet and for the planet), the Dutch respondents mainly value aspects of the mobility offered by the e-bike.

The only negative adjective, "expensive", appears in the Dutch respondents' ranking. The 9% of them who find the e-bike expensive might think so because they compare it to the cost of a conventional bike (as a reminder, the Dutch respondents are mainly using e-bikes as a more convenient way to get around than a conventional bike). On the other side, 32% of respondents from France, Spain and the United Kingdom consider the e-bike as "cheap". It is probably because they compare the cost of an e-bike with the cost of the private car.

Figure 21: online survey- ranking of adjectives regarding the e-bike

Rank	France / Spain / UK		Netherlands	
1	Practical	38%	Easy to use	42%
2	Cheap	32%	Practical	36%
3	Ecological	26%	Fast	23%
4	Comfortable	22%	Enjoyable	15%
5	Fast	15%	Cheap	14%
6	Easy to use	13%	Ecological	13%
7	Enjoyable	12%	Healthy	10%
8	Sociable	9%	Expensive	9%
9	Healthy	9%	Comfortable	9%
10	Useful	8%	Leisure	7%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users

3.3 A TYPOLOGY OF E-BIKE USERS BASED ON MODAL CHOICES

3.3.1 A method developed by 6t

While most of the studies on mode choices are based on standard variables such as travel time or travel cost, 6t-bureau de recherche has developed a new approach combining these variables with households' mode choice behaviours and perception of modes of transport (Kaufman et al, 2010; 6t-bureau de recherche, 2014).

Three main dimensions are taken into account to elaborate the typology:

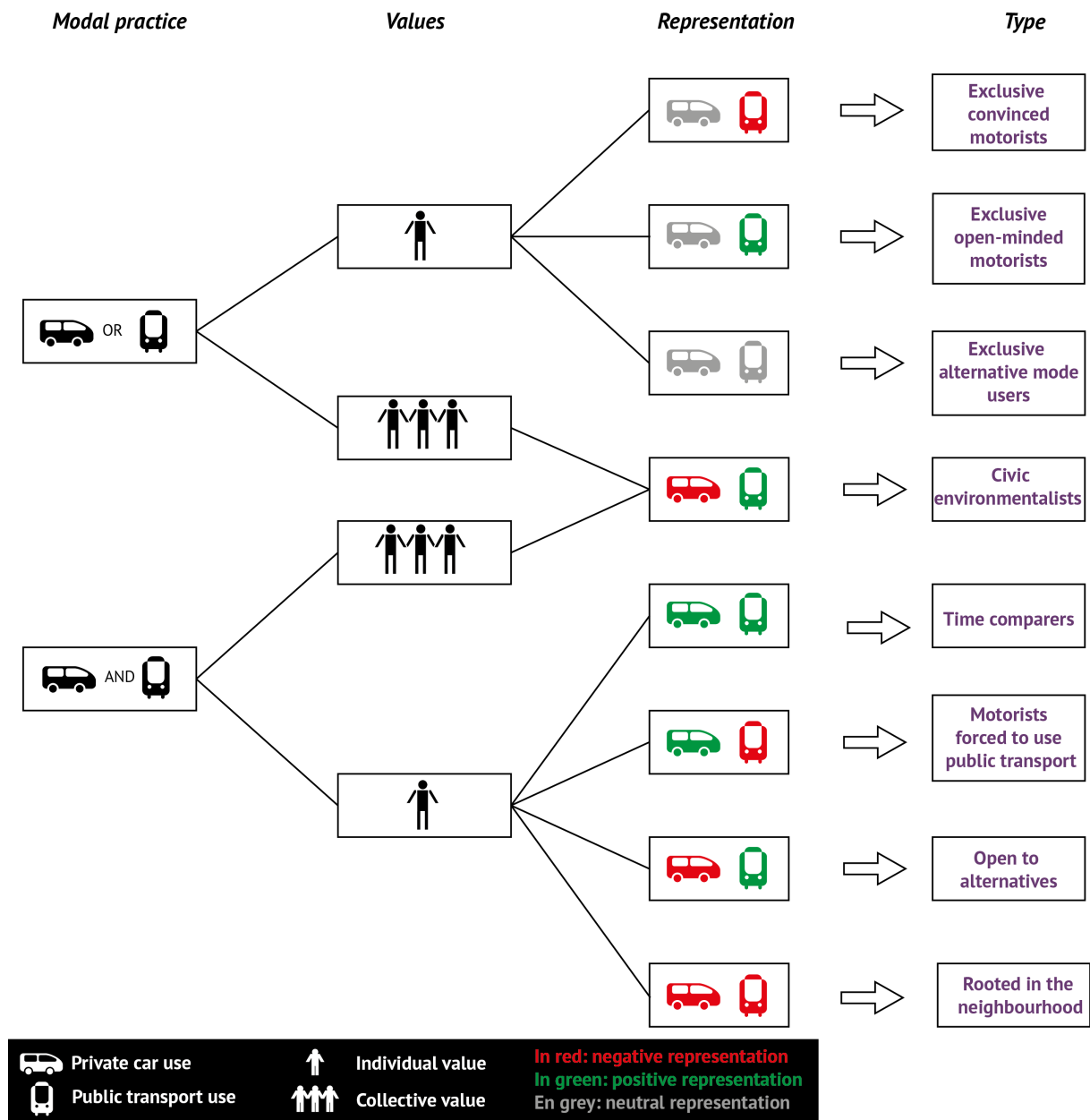
- **The modal patterns dimension** differentiates individuals using only one mode of transport from those who use several. This dimension gives information about how often the different modes of transport are used.
- **The values dimension** differentiates respondents who describe available modes of transport according to their personal interest (it promotes independence, it is comfortable, etc.) from those describing modes of transport based on the general interest (ecological, pollution, noise, etc.). This method makes use of the adjectives quoted by the respondents (see 3.2).
- **The attitudes dimension** differentiates respondents according to their usage preferences, i.e. their opinion (positive, neutral or negative) of different modes of transport. This mode is based on the adjectives quoted by the respondents (see 3.2).

Eight clusters or user profiles are identified, each corresponding to a specific combination of behaviour choices (see figure 22):

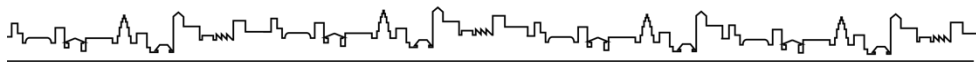
- **The "exclusive convinced motorists"**: they only use the private car in everyday life and have a poor image of public transport. Their spatial habits issue from the accessibility offered by this mode of transport;
- **The "exclusive open-minded motorists"**: they only use the private car in everyday life and do not have a poor image of public transport. Their spatial habits issue from the accessibility offered by this mode of transport;
- **The "exclusive alternative modes"**: they are captive users who never take the private car. Their spatial habits issue from the accessibility offered by public transport, walking and cycling;
- **The "motorists forced to use public transport"**: they prefer to use the private car, but are restricted by parking conditions to use other modes of transport for some daily destinations;

- **The "open to alternatives"**: they prefer to use public transport, to walk or cycle rather than using the private car because of the mobility aspect offered by these modes of transport;
- **The "time comparers"**: they use the fastest mode of transport. They have a good knowledge of what is offered by public transport and the private car, and choose their mode of transport according to the needs of each trip. They are the quintessential multimodal users;
- **The "civic environmentalists"**: they prefer to use environmentally friendly modes of transport to be consistent with their beliefs;
- **The "rooted in the neighbourhood"**: they do not like to travel by motorised modes of transport, and their spatial habits issue from active modes of transport and from what is on offer nearby.

Figure 22: method for creating the typology of approaches to mode of transport choice



Source: 6t-bureau de recherche, 2014



3.3.2 E-bike users are time comparers or motorists forced to use public transport

Among the height types of the typology, three types are found to dominate among e-bike users (see figure 23): “time comparers”, “motorists forced to use public transport”, “rooted in the neighbourhood”. The profile of e-biker users is similar to the profile of carsharing users. The same three types dominate (6t-bureau de recherche, 2014, 2013).

The high share of “**time comparers**” (26%) confirms that e-bike is a fast and cheap mode of transport. Time comparers are multimodal and enjoy travelling by public transport or private car. The share of time comparers is high in the four studied countries. Therefore, e-bikes seemingly prove to be an efficient alternative to the private car and public transport, whatever the country and the context (urban or rural areas).

The share of “**motorists forced to use public transport**” is almost equivalent to that of multimodal people (24 vs. 26%). This high shared of “motorists forced to use public transport” is coherent with the small share of “open to alternatives” (8%). It shows that e-bike users are not all fans of alternative modes to the private car by a long shot. They mostly use the e-bike because it could be adopted as a convenient alternative to the private car when the latter becomes too difficult to use due to traffic congestion and lack of parking space in cities.

The “**rooted in the neighbourhood**” are also well represented within the sample (16%). They come in third position. These people live mostly in the main city. They neither like the private car nor public transport. Thus, e-bikes might be the only “motorized” transport mode they are willing to use.

Moreover, “exclusive alternative mode users” only account for 9% of the sample and “civic environmentalists” for 7%. Their share is lower than in the average population (Kaufmann et al, 2010). E-bike users are few to use the e-bike for personal beliefs. They mainly use it because it is convenient.

Finally, the low share of “exclusive motorists” (11% as a whole) underlines that the e-bike does not support the use of the private car but could be seen as an alternative to the private car. This share would be even lower if it wasn’t for the Dutch respondents, who are represented in the two “exclusive motorists” types (27% as a whole). In the Netherlands, the situation is very specific: many e-bike users there are elderlies who live on the countryside. E-bikes thus seem to allow them to reduce their dependence to the private car.

Figure 23: online survey - typology of modal choice as applied to e-bike users

	n=360	
Time comparers	93	26%
Motorists forced to use public transport	88	24%
Rooted in the neighbourhood	58	16%
Exclusive alternative mode users	31	9%
Open to alternatives	27	8%
Civic environmentalists	24	7%
Exclusive convinced motorists	22	6%
Exclusive open-minded motorists	17	5%

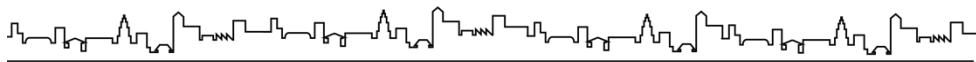
Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Subsample of 360 respondents who gave the necessary information for their classification within the typology of modal choice

Figure 24: online survey - typology of modal choice as applied to e-bike users, according to their country

	France	Netherlands	Spain	UK	Total
Time comparers	24%	24%	33%	22%	26%
Motorists forced to use public transport	25%	18%	27%	27%	24%
Rooted in the neighbourhood	16%	8%	14%	26%	16%
Exclusive alternative mode users	5%	16%	3%	11%	9%
Open to alternatives	7%	5%	9%	9%	8%
Civic environmentalists	13%	3%	10%	0%	7%
Exclusive convinced motorists	5%	14%	2%	4%	6%
Exclusive open-minded motorists	5%	13%	2%	0%	5%

Source: 6t-bureau de recherche, 2014, online survey addressed to 400 European e-bike users. Subsample of 360 respondents who gave the necessary information for their classification within the typology of modal choice

4 CONCLUSION



To conclude, e-bikes appear as a new metropolitan mode, mainly used for daily commute. Although traffic congestion is often evoked as a reason for the use of e-bikes in urban areas, it is not the only, and probably neither the main reason why people adopt them. E-bikes are indeed faster than most urban transport modes, if not the fastest of all, but they are also a cost-effective alternative to the private car and a way to cover longer-distance.

Contrary to conventional bikes, e-bikes are not primarily used by people who live in the centre of metropolitan areas. In very dense, crowded city centres, distances are smaller, average speeds are slower and parking issues are most acute, so this is certainly not where e-bikes prove the most relevant. They are indeed used to link city centres and less dense areas and to travel from periphery to periphery. In a way, e-bikes seem to be more of a substitute to the private car than a substitute to the conventional bike. Therefore, it would make sense to promote e-bikes as a metropolitan transport mode, more as a competitor to the individual use of the private car than as a complement to the other alternative modes of transport.

According to the respondents, three measures are the most likely to foster e-bike use: a decrease in the cost of e-bikes, the development of cycle paths and the development of secure parking spaces. In order to support sustainable mobility, public authorities have a key role to play in promoting e-bike use as a part of a global set of alternatives to the individual use of the private car.

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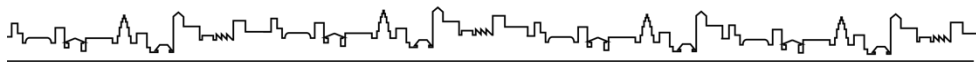
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