Ministry of Infrastructure and Water Management

Purchase and use of the electric bicycle

KiM | Netherlands Institute for Transport Policy Analysis

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Summary

Electric bicycles have become increasingly popular in recent years. Originally popular among people over the age of 65, this means of transport is now enjoying increasing popularity among younger users. To date, the most important reason for buying an e-bike has been the fact that people want to get from A to B as quickly as possible and with minimal effort. They also believe that the e-bike is good for their physical health and mental well-being. People who are planning to buy an e-bike in the future regard being able to travel more quickly and with less effort as the most important reason for their purchase. Health reasons are of lower priority for this group.

The price of an e-bike is by far the most significant reason that people give for having doubts about buying an e-bike, or why they have not bought one already. Other major barriers to purchase are the high theft risk and battery life.

Dutch citizens consider a travelling time of just over half an hour to work or school by e-bike to be acceptable. Based on average cycling speeds, this corresponds to a distance of approximately 9.5 kilometres. They are willing to cycle longer distances for leisure purposes, while the acceptable cycling distance for going shopping or buying groceries is somewhat shorter.

Most trips made by Dutch citizens in the course of a year are within this acceptable distance (58%-88% depending on the travel purpose).

Ownership and, therefore, use of the e-bike are expected to increase in the coming years. As a result, e-bike use is expected to increase by 46%-69% over a five-year period between 2019 and 2024. Some of that growth comes at the expense of normal bicycle use. The total distance travelled by bicycle is expected to increase between 6% and 8%. As well as this increase in e-bike ownership, other factors, such as demographic and economic developments, are contributing to the increase in e-bike use. The Netherlands Institute for Transport Policy Analysis, KiM, has not taken these factors into account in this study. However, we will do this when we make our medium-term forecasts.

This research project has identified a number of possible action points to aid the government in drawing up a policy to encourage the use of electric bicycles. For example, improved facilities such as secure bicycle-parking facilities could encourage both ownership and use of the e-bike. Furthermore, the provision of better facilities by employers (changing areas, charging facilities) could encourage the use of the e-bike for travelling to work.

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ACKNOWLEDGEMENTS

1 E-bike in the Netherlands

Sale and use of e-bikes

Since 2018, more new e-bikes have been sold each year than city bikes or touring bikes. In 2021, approximately 52% of the 923,000 new bikes sold were e-bikes. While the e-bike accounted for only 8% of bicycle trips and 12% of the distance cycled in 2013, by 2019 the figures had risen to approximately 18% of bicycle trips and more than a quarter (26%) of the distance cycled.

Dutch citizens use their e-bikes mainly for leisure purposes: about one in three trips and 44% of the distance cycled are for leisure purposes (Figures 1 and 2). The fact that the e-bike accounts for a bigger share of the distance cycled than of the number of trips indicates that these trips are, on average, longer than other trips. One in five of the e-bike trips cycled by Dutch citizens are shopping trips. These trips are relatively short.

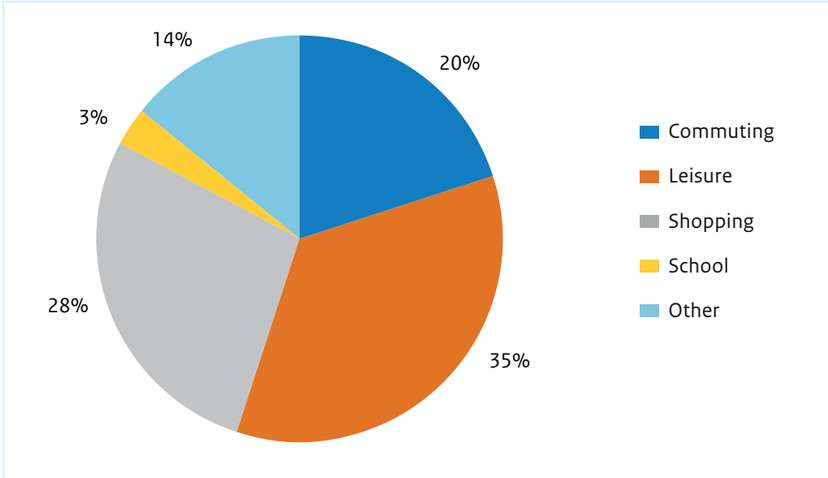


Figure 1 *Share of purposes for e-bike trips (Source: ODiN 2018/2019)*

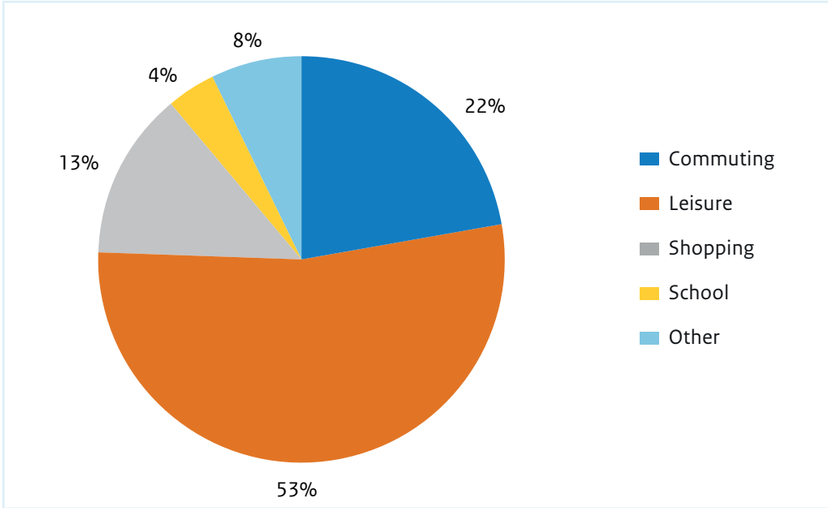


Figure 2 *Share of purposes for distance travelled by e-bike (Source: ODiN 2018/2019)*

Who owns an electric bicycle?

In 2020, an estimated 3.1 million people in the Netherlands owned an e-bike (ODiN 2020). E-bike owners are generally older than non-owners. About two thirds of the owners are aged 50 or over, in comparison to less than 40% of non-owners (see Figure 3). In relative terms, e-bike ownership is lowest in the under-35 age bracket.

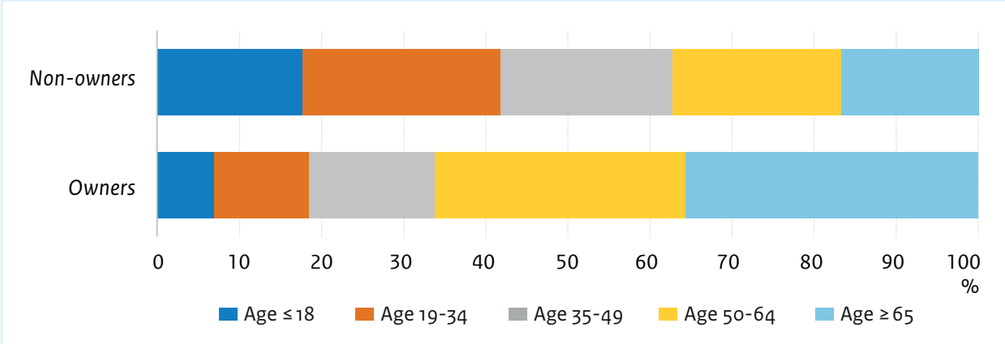


Figure 3 *Age distribution of owners and non-owners (Source: ODiN 2020)*

The electric bicycle is less popular in urban areas than in non-urban areas (Figure 4). Approximately 42% of e-bike owners live in an extremely urbanised or strongly urbanised area, compared to almost 60% of non-owners.

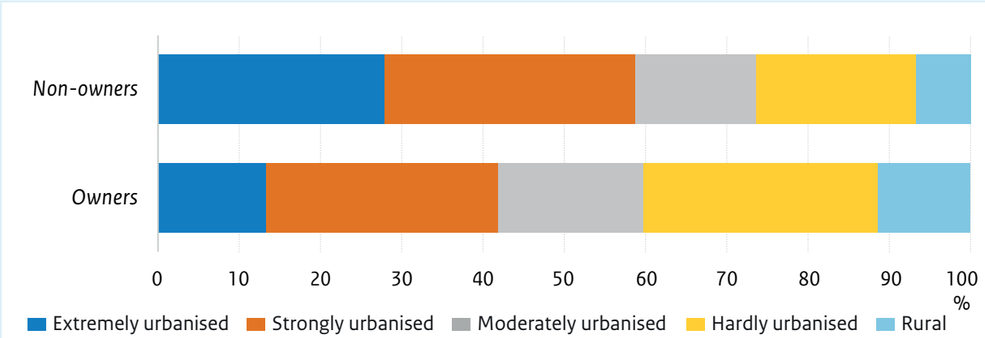


Figure 4 *Urbanisation of the residential environment of owners and non-owners (Source: ODiN 2020)*

Characteristics of the e-bike

The electric bicycle has mainly appealed to the elderly since it was first introduced in the Netherlands. This can be concluded from the share of people who have already replaced their e-bike (see Figure 5). Forty-two percent of e-bike owners older than 65 have replaced their e-bike at least once, compared to just 12% of people aged 18 to 35.

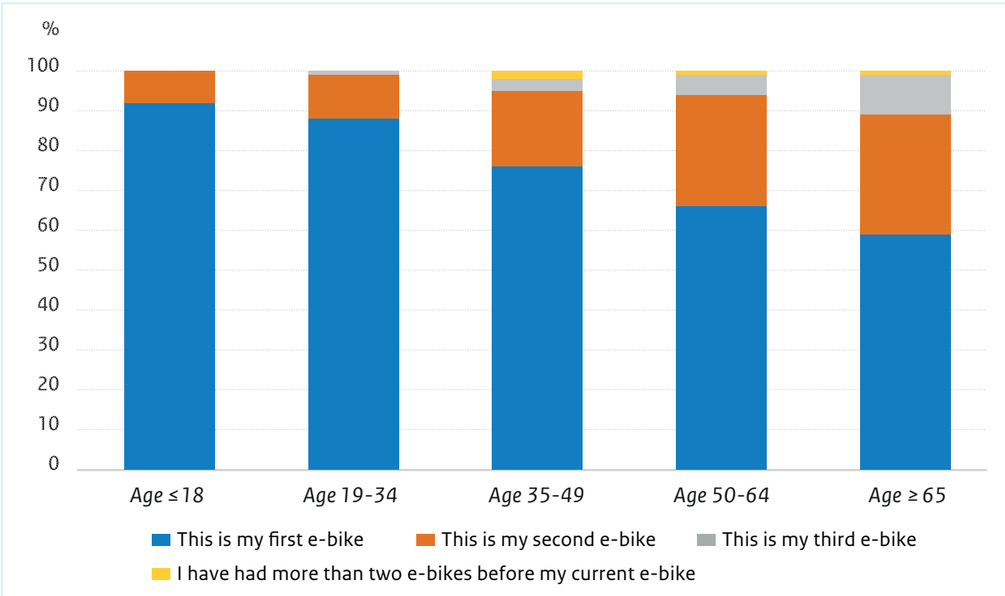


Figure 5 *Number of e-bikes owned according to age (Source: MPN)*

Approximately 18% of current e-bike owners have a second-hand bike. There is a considerable difference between the new price paid by the owners and the second-hand price (Figure 6). More than half of the bikes that were bought as new cost more than €2,000 and more than a quarter (27%) cost between The picture is very different for second-hand e-bikes: eighty percent of e-bikes bought second-hand cost less than €1,500.

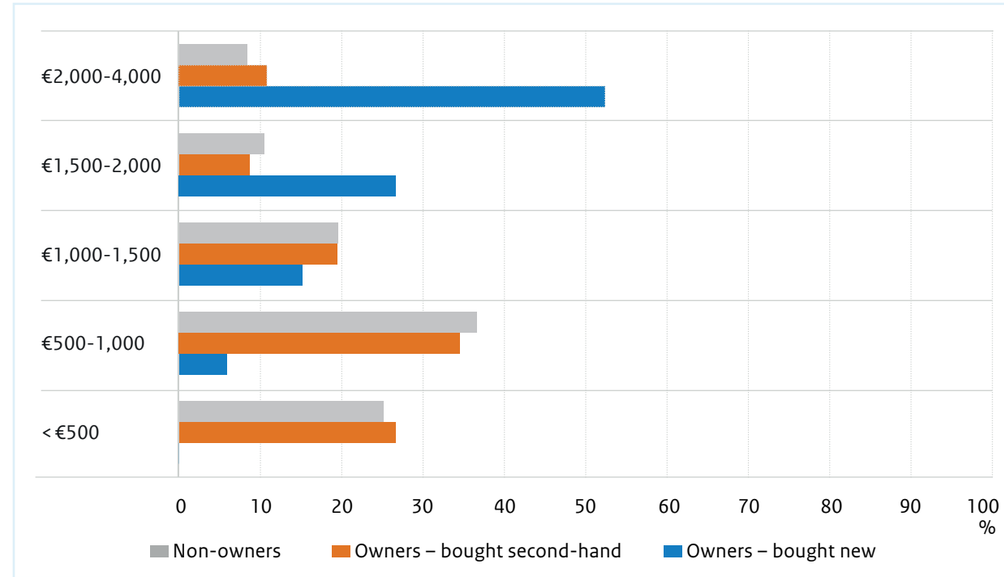


Figure 6 *The price that e-bike owners have paid for their e-bike compared to the price that non-owners are prepared to pay (Source: MPN)*

The price that people who have not yet owned an e-bike are willing to pay differs significantly from the price that buyers have paid for a new e-bike. Fewer than one in five (18%) potential buyers are prepared to pay more than €1,500, whereas almost 80% of those who bought new e-bikes paid at least that amount. The price that non-owners are prepared to pay is more in line with the price of a second-hand bike. Figure 6 shows this clearly.

2 Reasons for and against buying an e-bike

Intention to buy an electric bicycle

Approximately 22% of people who do not own an e-bike intend to buy one in the next 5 years, approximately 2% intend to buy one in the next 6 months, 8% intend to do so between 6 months and 2 years, and 12% between 2 and 5 years. Furthermore, 17% think that they will buy an e-bike in more than 5 years' time (Figure 7).

Willingness to pay is a decisive factor when considering the purchase of an e-bike. Those who are willing to pay no more than €500 for an e-bike and those who did not answer the question about willingness to pay are least likely to buy an electric bicycle. Fourteen percent of the non-owners who are willing to pay more than €2,000 for an e-bike intend to buy one within the next 6 months.

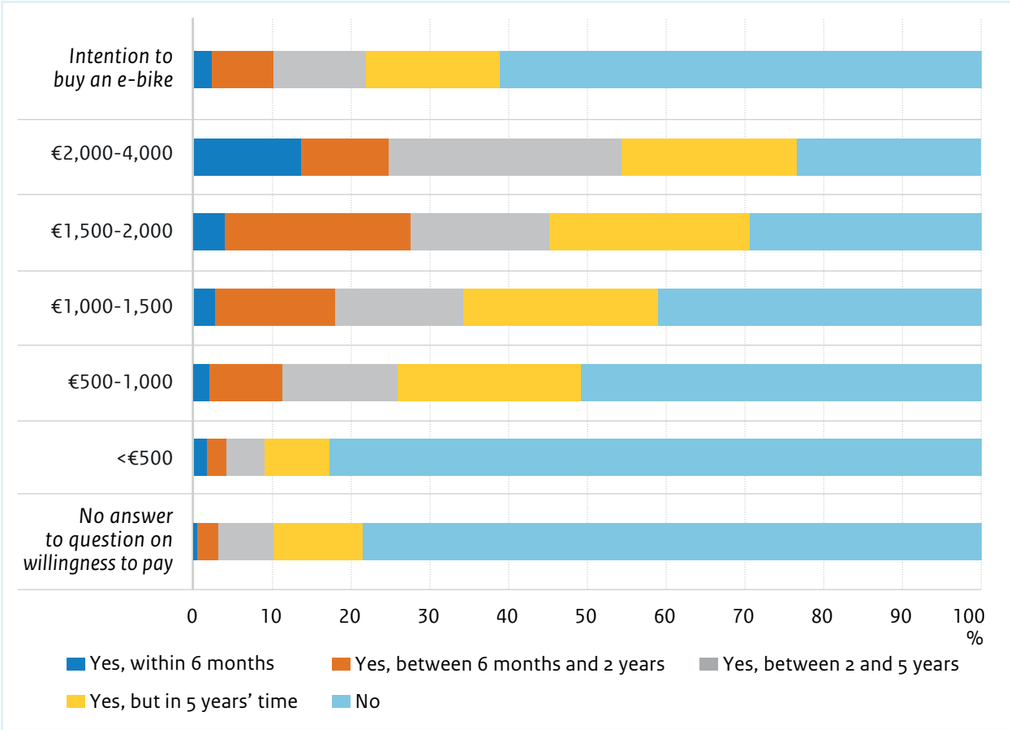


Figure 7 *Intention to buy an e-bike and intention in conjunction with willingness to pay (Source: MPN)*

Reasons for buying an e-bike

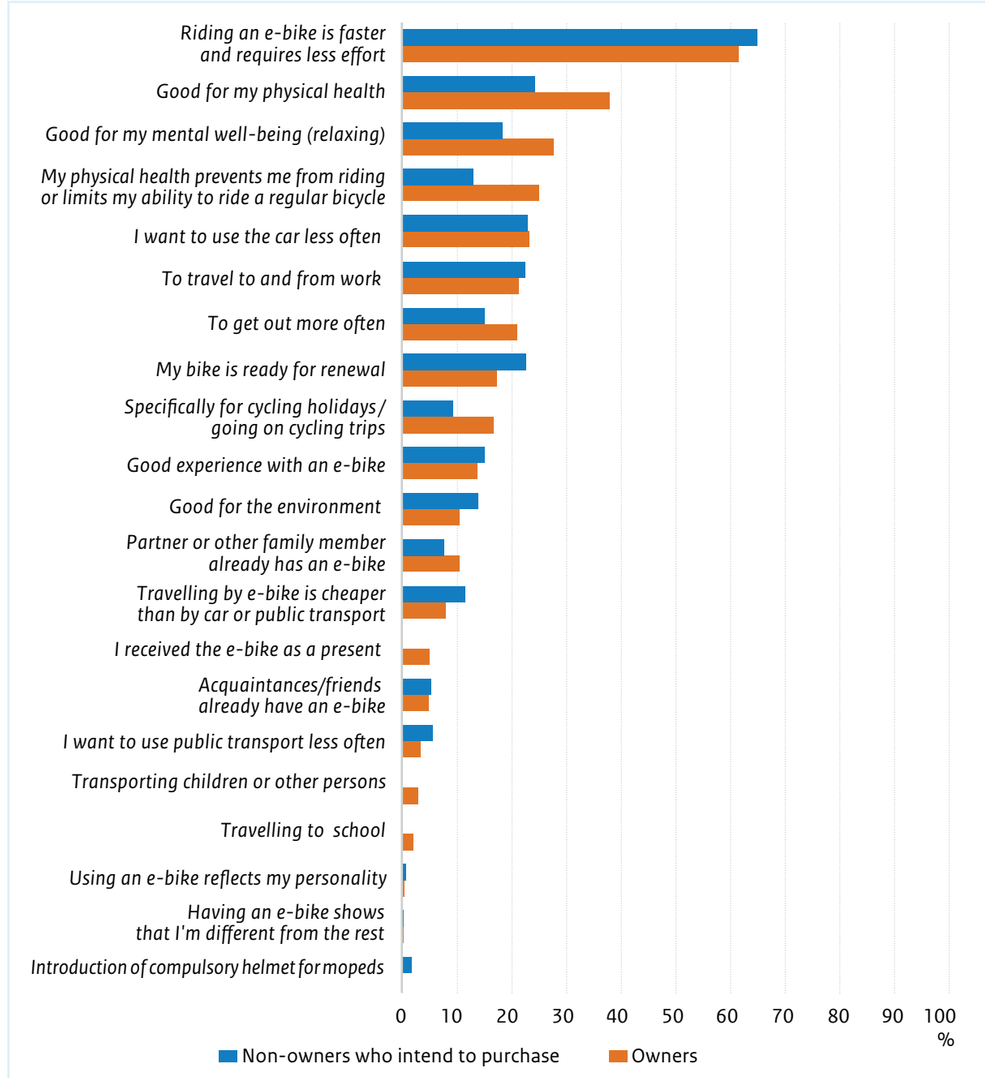


Figure 8 *Reasons for buying an e-bike (Source: MPN)*

E-bike owners said that their most important reason for buying an e-bike is being able to travel from A to B faster and with less effort (Figure 8). The three subsequently given reasons were associated with health. Almost 40% of e-bike owners bought an e-bike because they are considered to be good for physical health. Almost 3 in 10 owners (28%) cited the e-bike's benefit for mental well-being as an important reason for the purchase. Finally, a quarter of the owners said that their physical health restricted or prevented them from riding a regular bicycle. More than half of this latter group (52%) said they would cycle less often without an e-bike and 4 in 10 said they would not cycle at all without an e-bike. Only 5% said their bicycle use would remain unchanged. Therefore, the e-bike allows this group of Dutch citizens to travel actively in spite of their physical shortcomings.

The non-owners who intend to buy an e-bike in the future (39% of non-owners) also said that faster and more effortless travel was their most important reason for considering buying an e-bike. Health reasons are of lower priority for this group. Less than a quarter of this group (24%) said that they were considering the purchase because cycling is said to be good for their physical health. This difference can partially be explained by the age difference between owners and non-owners of electric bicycles. Owners are generally older, therefore it is likely that they may have relatively more health problems. Other important reasons are wanting to use the car less often (23%) and travel to and from work (22%). For some non-owners, the last 2 reasons given are interrelated. Approximately 22% of this group also said that they would want to buy an e-bike when their regular bike is due for replacement. This implies that some Dutch citizens regard the e-bike as a logical replacement for their regular bicycle.

Barriers to buying an e-bike

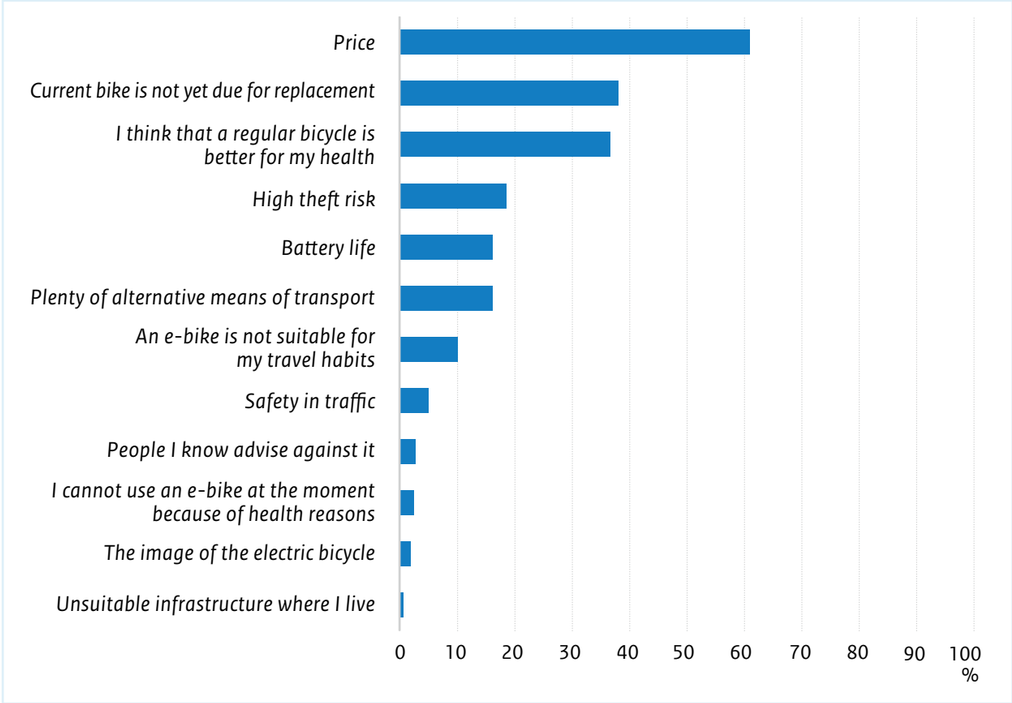


Figure 9 *Reasons why people who intend to buy an electric bicycle have not yet done so (Source: MPN)*

People who intend to buy an e-bike say that the most important reason for not having done so yet is the price, cited by 61% of this group (Figure 9). In the case of people who currently own an e-bike, 40% said that the price gave them reason to have doubts about buying (not shown in figure). The two subsequently given reasons are that the current bicycle is not yet due for replacement (38%) and that non-owners regard the regular bicycle as being better for their health (37%).

Almost 1 in 5 (19%) of non-owners who intend to buy an e-bike have not yet done so because of the high theft risk. A slightly smaller group (16%) have doubts about the battery life. Respectively 23% and 20% of the current owners also had doubts about buying an e-bike for the above reasons.

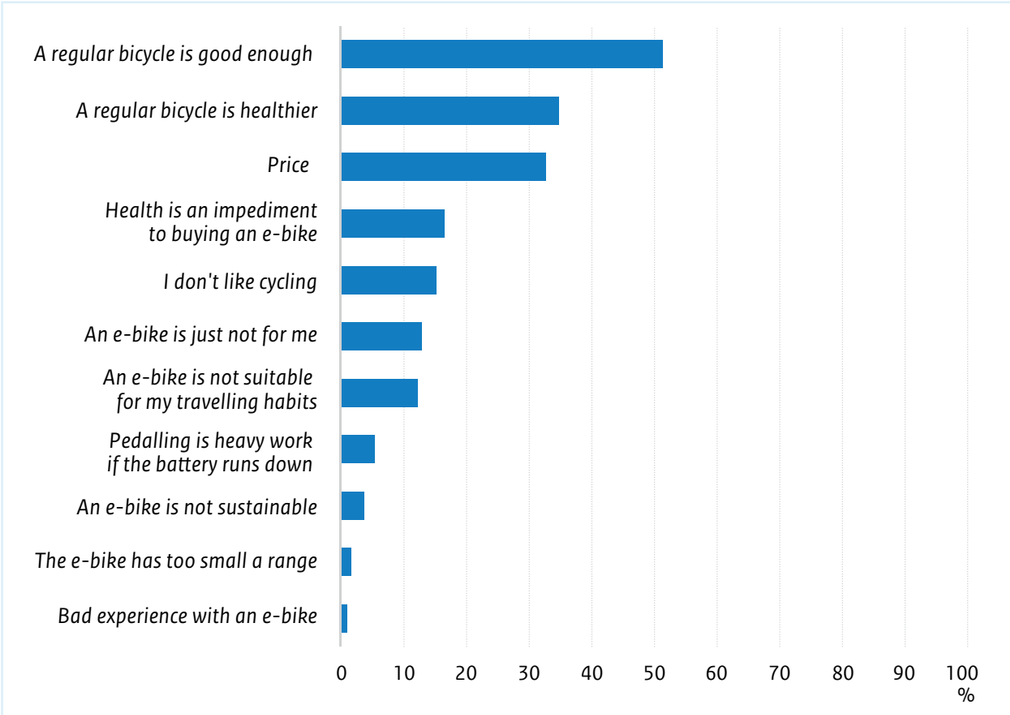


Figure 10 *Reasons why people do not consider buying an e-bike (applies to 61% of people who do not own an e-bike) (Source: MPN)*

The most important reason non-owners give (51%) for not buying an e-bike in the future is that a regular bicycle is satisfactory (Figure 10). This group also finds that a regular bicycle is healthier (35%) and that an e-bike is too expensive (33%). Furthermore, approximately 17% said that they would not be buying an e-bike due to health problems. The latter reason is particularly important to the elderly who often stop using their regular bicycle for the same reason.

3 Acceptable distances and travel times

With its 'Nationaal Toekomstbeeld Fiets', the Dutch government hopes to encourage the use of the bike. This means of transport is to become the best choice for distances under 15 kilometres. We investigated people's willingness to cycle this distance on an e-bike.

Distances and travel times of trips

First of all, we looked at the distances cycled by Dutch citizens. We concluded that trips made by e-bike were on average almost 75% longer than trips on a regular bicycle. The average distance travelled on a regular bicycle is 3.4 kilometres, whereas the average distance travelled on an e-bike is 5.9 kilometres (Figure 11). People cycle significantly longer distances by e-bike for leisure purposes, while the difference for trips to the shops and for other purposes is smaller. The greatest difference is represented by travelling to school. The average distance cycled to school on an e-bike is 2.7 times greater than the distance travelled on a regular bicycle.

Travel times by e-bike are also longer than travel times by regular bicycle (Figure 12). However, the travel times by e-bike and by regular bicycle differ less from each other than the distances travelled. This is due to the fact that cyclists can obtain higher speeds on an e-bike. An average trip on a regular bicycle takes about 20 minutes. A trip on an electric bicycle is 45% longer and takes an average of 29 minutes.

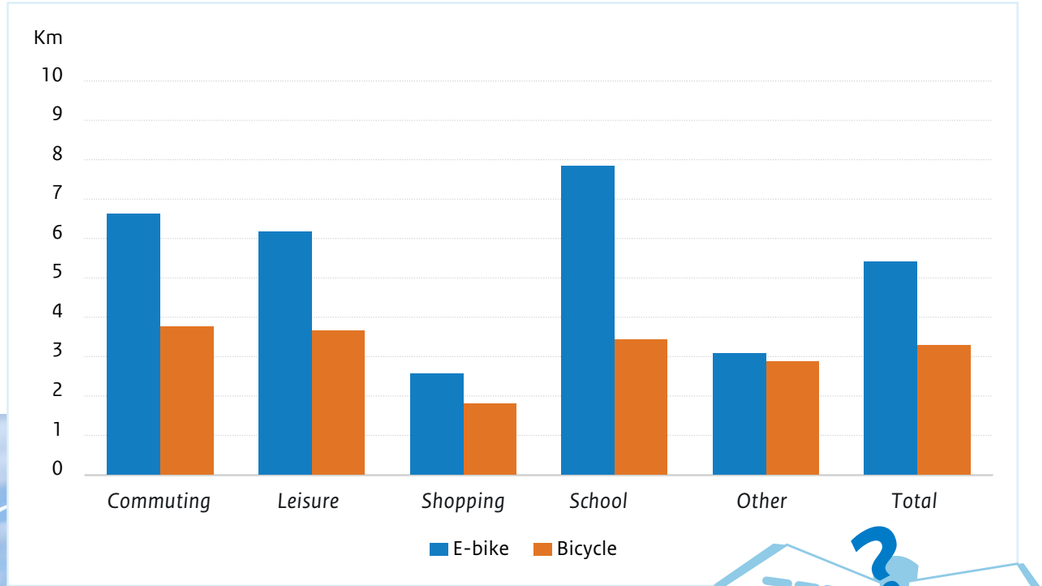


Figure 11 *Average distance travelled (km) per trip according to travel purpose (Source: ODiN 2018/2019)*

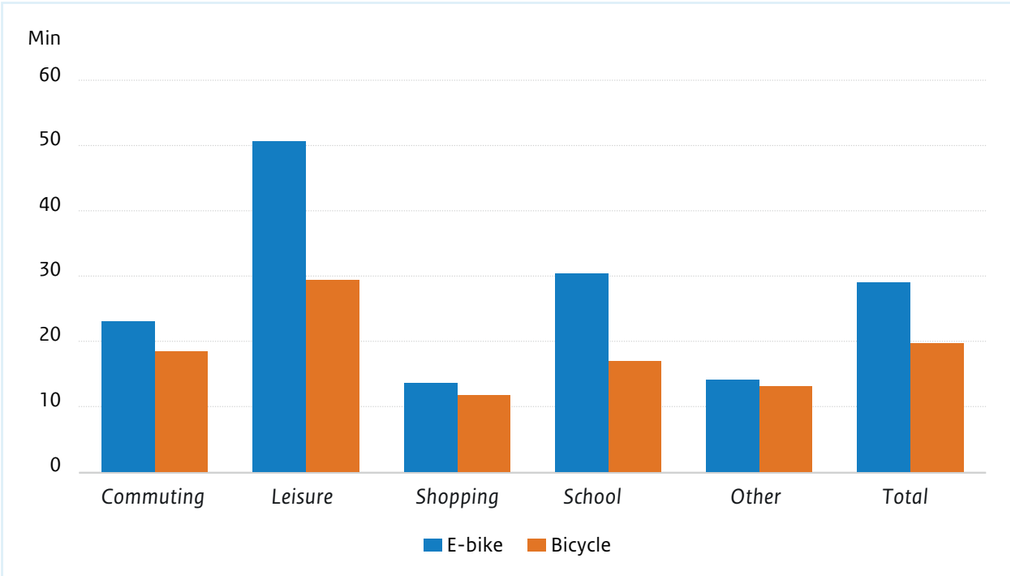


Figure 12 *Average travelling time per trip according to travel purpose (Source: ODiN 2018/2019)*

Acceptable distance and travelling time

Together with the Netherlands Mobility Panel (MPN), we conducted research to find out what distance and travelling time Dutch citizens find acceptable for an e-bike. Table 1 displays an overview of the acceptable travelling time per travel purpose. There is a noticeable difference between what people regard as being acceptable, both within and between travel purposes. For some travel purposes, there are also differences between owners and non-owners of e-bikes.

Tabel 1 *Overview of acceptable travelling times (min) MPN research*

	Com-muting	School	Leisure purposes (touring)	Leisure purposes (not touring)	Shop-ping	Buying groceries
Owners (min)	34	34	132*	84*	34*	25*
Non-owners (min)	32	32	110*	64*	27*	19*

** Significant difference between owners and non-owners*

We have calculated the acceptable travel times per travel purpose based on the acceptable travel times shown in Table 1 and the average speeds of all e-bike trips recorded in ODiN (see Table 2). A distance of 9.5 km is regarded as an acceptable distance for travelling to school or work by e-bike. The acceptable distance for leisure purposes is greater and it is shorter for going shopping or buying groceries.

Tabel 2 *Acceptable distance calculated on the basis of acceptable travel times identified by the MPN and speeds recorded by ODiN*

	Com-muting	School	Leisure purposes (touring)	Leisure purposes (not touring)	Shopping/ Buying groceries**
Average speed (km/hour)	17	17.1	9.9	12.7	12.2
Owners (km)*	9.5	9.5	21.8	17.8	6.0
Non-owners (km)*	9.5	9.5	18.1	13.6	4.6

** If the acceptable travel time does not significantly differ between owners and non-owners we take the average for both groups*
***Shopping and buying groceries fall under the same category in ODiN; therefore the acceptable distance is taken as the average of the categories recorded in MPN data as shopping and buying groceries*

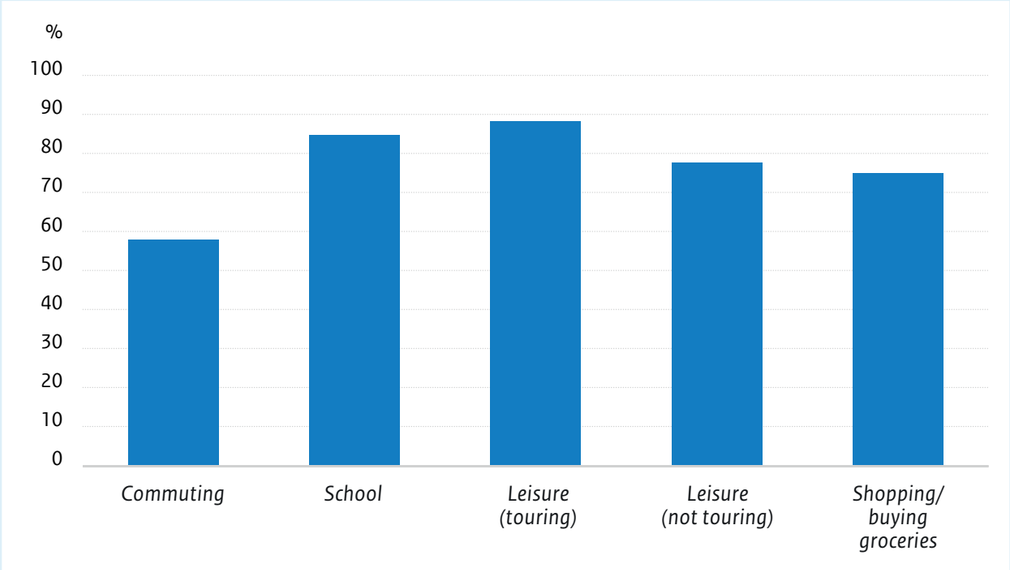


Figure 13 *Number of trips made annually by Dutch citizens within the acceptable distance, per purpose (Source: ODiN 2018/2019)*

Based on the figures in ODiN, we have determined per purpose which share of the trips corresponds with these distances (Figure 13). For example, it appears that 58% of all trips to and from work made by Dutch citizens on an annual basis are within the acceptable e-bike cycling distance. A large number of these trips are made by regular bicycle (15% of owners, 47% of non-owners) or by e-bike (37% of owners, 2% of non-owners). Thirty percent of trips to work that are within an acceptable distance are made by car, by both owners and non-owners of an e-bike. However, this does not mean that all of these trips could be made by electric bicycle. In addition to distance, people have other reasons for using their car. For example, they may need their car for performing work-related tasks, or they may have after-work activities for which they need their car. In such cases, it is unlikely that the e-bike will replace the car.

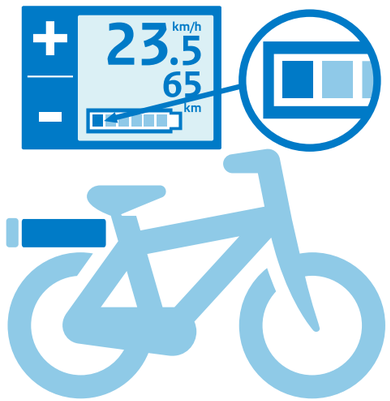
For the other purposes, a large proportion of the trips made annually Dutch citizens falls within the acceptable distance. In the case of school, the bicycle (e-bike and regular bike) already has a relatively high share while the car (as driver) has a low share. The car's share for leisure purposes[1] and for shopping/buying groceries, in particular, is relatively high. The purpose of leisure (not touring) includes a wide variety of activities and the purpose of shopping/buying groceries probably involves regular transportation of large objects or heavy goods. Therefore, it is difficult to estimate which share of these trips could actually be made by the electric bicycle.

1 *This refers to the leisure trips whereby someone visits a particular place, not to trips whereby the cycling is actually the main purpose (touring).*

4 Expected effect of e-bike ownership on use

If we take into consideration the increase in e-bike ownership and the travel habits of the new owners, e-bike use is expected to rise by 46% to 69% between 2019 and 2024. No account has been taken of other relevant factors which may affect usage, such as demographic and economic developments. Therefore, we do not have a complete picture of the expected development of e-bike use. This estimate is based on a number of key assumptions. For example, that the travel habits of the current e-bike owners will remain unchanged and that future owners will use their e-bikes for the same purposes as the current owners with the same characteristics (age, gender, work situation, etc.). A complete list of these assumptions can be found in the background report to this brochure.

In order to determine the expected effect of e-bike ownership on use we drew up both an pessimistic scenario and an optimistic scenario. The pessimistic scenario predicts a much smaller growth rate in e-bike ownership than the optimistic scenario.



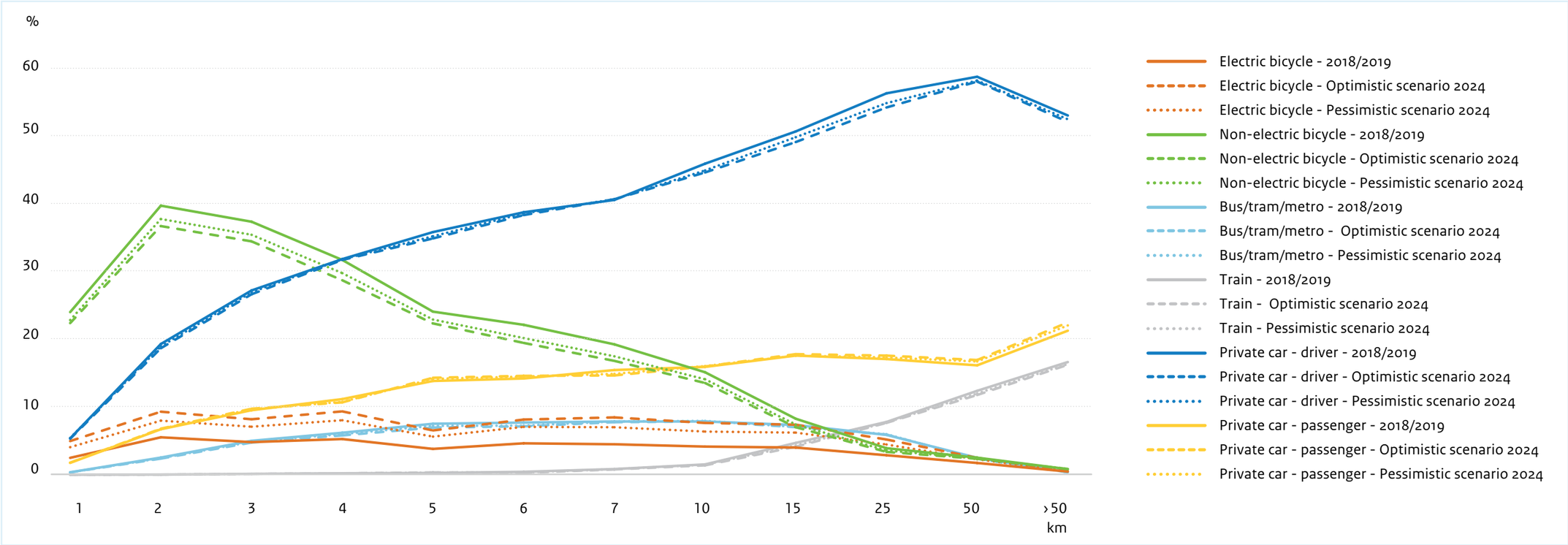


Figure 14 *Effect of expected development of e-bike ownership on the modal split classified per distance (Source: Analysis based on ODiN 2018/2019 and MPN)*

In the optimistic scenario, the distance covered by e-bike will rise by an estimated 69% within 5 years, from 4.1 billion km to 6.9 billion km per year. A significant part of this increase is due to the number of people who switch from their regular bicycle to the e-bike. The distance covered by regular bicycle will then drop by 10%, from 13.9 billion km to 12.6 billion km. This will cause the e-bike's share of the total distance covered by bicycle to increase from 23% to 35%. The total distance covered by e-bike will rise more than the distance covered by regular bicycle will decrease, causing the total distance covered by bicycle to increase by about 8%.

In the pessimistic scenario, the effects are much smaller because, in that case, we assume that fewer people will buy an e-bike. In that scenario, the distance covered by e-bike would increase by 46%, from 4.1 billion km to 6 billion km. The distance covered by regular bicycle would fall by about 6%. According to this scenario, the e-bike's share of the total distance covered by bicycle would increase from 23% to 31%. Therefore, the total distance covered by bicycle would show a net increase of 6%.

Both of these scenarios reflect changes in the use of other means of transport than the regular bicycle. Figure 14 shows the changes in the share of trips for a number of transport means classified by distance. Both scenarios show the regular bicycle being exchanged for the e-bike for distances under 7 km, while the use of the car (as driver) and the train for longer distances also slightly declines. However, these results have to be interpreted carefully. Earlier analyses based on MPN data have only shown a significant decrease in the use of the regular bicycle by people who have bought an e-bike. The use of the electric bicycle for commuting to work did, however, also lead to a decrease in the number of car trips. There was little or no discernible impact on railway travel. Therefore, we cannot say for sure that an increase in e-bike ownership will actually lead to a decrease in train use. The earlier study carried out by the MPN indicated that the increase in e-bike ownership is likely to lead to a reduction in car usage. However, on the basis of this research, we cannot conclude with certainty to what extent car usage will decline.

The development of e-bike ownership does not lead to an equally large increase in e-bike use for all purposes (see Figure 15). A relatively high number of working people intend to buy an e-bike. Therefore, we expect that the e-bike will have the largest impact on commuter traffic. E-bike use could rise by 122% for this purpose (optimistic scenario). The e-bike's share of the distance that commuters cover by bicycle would then rise from 23% to 44% and the total distance cycled for this purpose would rise by about 17%. The e-bike currently accounts for a quarter (26%) of all trips made for leisure or to the shops. In the optimistic scenario this share will increase to 40% and 36% respectively. For both purposes, the total distance covered by bicycle would increase by about 5%. The use of the e-bike for going to school would increase by 110%, which would increase the e-bike's share in the total distance covered by bicycle from 7% to 14%. The total distance covered by e-bike would also increase by about 5% for this purpose.

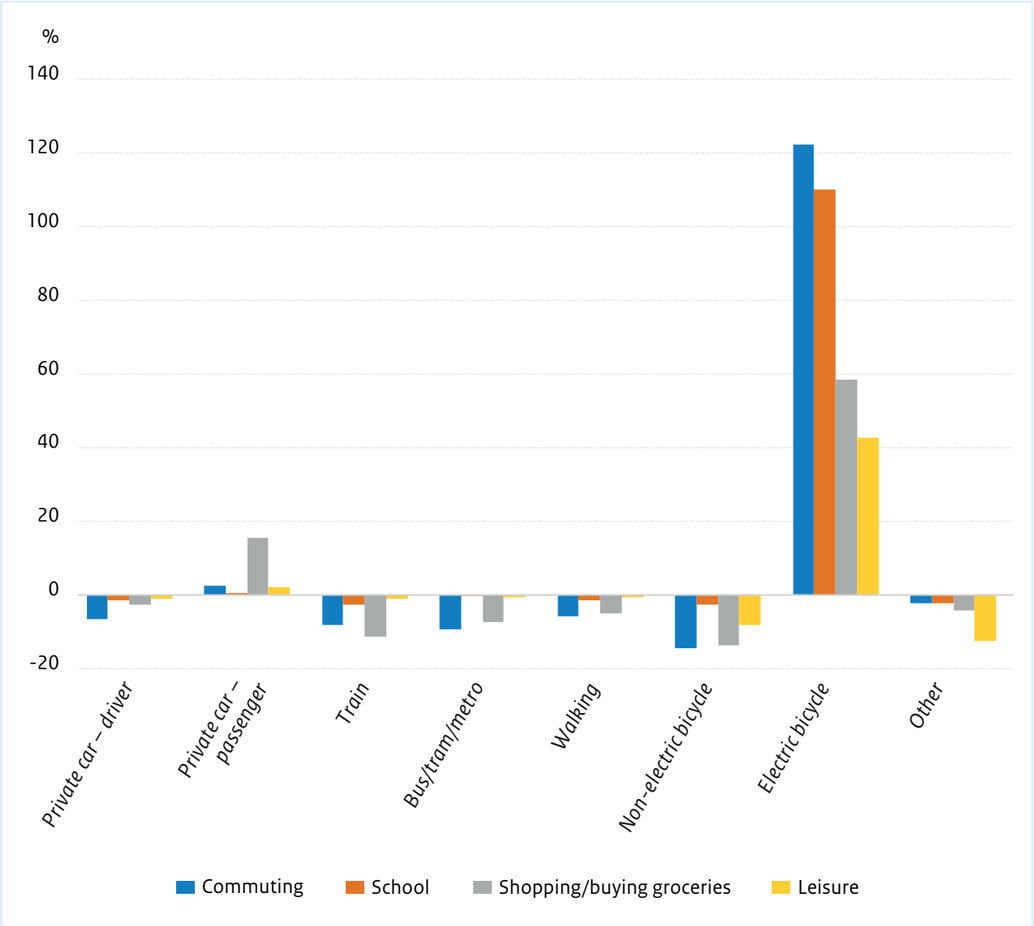


Figure 15 *Changes in distances covered per purpose per means of transport in the optimistic scenario*[2] *(Source: Analysis based on ODiN 2018/2019 and MPN)*

2 *The method we have applied to conduct this analysis has some limitations. One of these limitations is reflected in the large increase of car passengers in the category Shopping. It is likely that the actual effect will be smaller.*

5 Possible action points for policy development

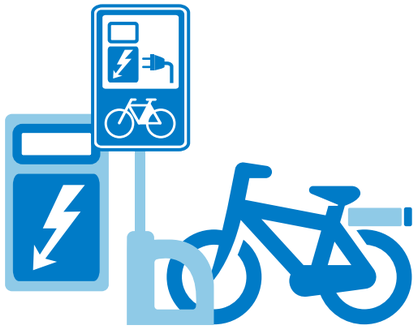
This research project has produced a number of key action points for developing policy aimed at encouraging ownership and use of the e-bike.

Encouraging e-bike ownership

Purchase subsidy

The most-voiced objection to buying an electric bicycle is the price. Both non-owners who intend to buy an electric bicycle and non-owners who do not intend to buy one say that the price is a major barrier. If the price were lowered, for example through the introduction of a subsidy, this could (partially) remove the barrier. However, there are two points to consider:

1. First of all, it appears that the people who already have a strong intention to buy an e-bike are particularly sensitive to a price reduction. Therefore, it is possible that a purchase subsidy would mainly reach people who would buy an electric bicycle regardless of a subsidy.
2. People who are not planning to buy an electric bicycle are prepared to pay significantly less than the average asking price for e-bikes. The purchase subsidy would need to cover a substantial amount of the cost before this group would consider buying an electric bicycle.



Promote awareness of the possibilities and advantages of the e-bike
Many people mostly see the electric bicycle as an alternative for the regular bicycle. A major barrier to buying an e-bike is that they are satisfied with their regular bicycle and they regard this as the healthier option. The e-bike makes it possible to reach higher speeds and it requires less effort than a regular bicycle, therefore it is suitable for making longer trips which are now done by car. People who replace driving by cycling on an e-bike will find that their purchase also has health benefits because they are more active. The government can encourage the purchase of an e-bike by creating awareness of the fact that the e-bike is much more than just an alternative for the regular bicycle.

Improve facilities for the e-bike
The high theft risk is for many non-owners a major barrier to buying an e-bike. The provision of more and larger guarded bicycle parking facilities is a possible way of encouraging e-bike ownership.

It is also important to realise that there is a group of Dutch citizens, amounting to more than 20% of all people who do not have an electric bicycle, who will probably never be convinced to buy an e-bike. People over the age of 65 are overrepresented in this group.

Encourage e-bike use

In addition to encouraging e-bike ownership, there also appear to be several ways to encourage e-bike use among the current owners. A large proportion of all traffic movements made by Dutch citizens each year is within the distance that they regard as acceptable for the e-bike. There are many reasons why someone may not use the e-bike for their trip even if the destination is within the acceptable distance. For example, they may need to transport large objects or heavy goods, drop someone off at another destination or visit several places in a row, etc. Nevertheless, this research project has produced a number of key action points for policy development.

Improve facilities for e-bikes
Current owners share the non-owners' concerns about the high theft risk of e-bikes and they also see this as a point of attention. Almost one fifth of them say they would use their e-bike more often if more secure bicycle parking facilities were available. In addition to encouraging e-bike ownership, it appears that an increase in guarded bicycle parking facilities would also promote the use of the e-bike. A slightly smaller group (17%) would use the e-bike more often if the cycling infrastructure were improved, for example broader cycle paths or safer crossing points.

Increased costs of using other modes of transport
The increase in the cost of using the car (16%) or public transport (4%) would encourage some other users to use their e-bike more often. It is not yet known to what extent the recent fuel price rises have actually led to people using the e-bike instead of the car.

Encouraging e-bike use for commuting to work
A large proportion of current e-bike owners who are in employment use this mode of transport for commuting to work. The main reason for e-bike owners not to do this is the distance to their place of work. This group lives relatively far from work (29 km on average) and it will probably not be easy to convince them to use the e-bike for this purpose. Another, smaller group of e-bike owners does not use the electric bicycle for commuting to work because they do not want to get wet or arrive at their destination covered in sweat, or because their place of work does not have secure bicycle parking facilities. This implies that removing or reducing these barriers, for example by encouraging employers to improve facilities for commuters on bicycles (showers, changing areas, secure bicycle parking facilities), would increase the use of the electric bicycle for commuting to work.

Acknowledgements

Method

In this research project, we have made use of data from the Dutch National Travel Survey (ODiN) and the Netherlands Mobility Panel (MPN). We invited owners and non-owners of an electric bicycle to participate in focus group discussions in order to identify the factors which play a role in deciding whether or not to buy an electric bicycle. The focus groups provided qualitative insight into these factors. The results obtained from the focus groups were used for developing a questionnaire which we sent to a group of MPN respondents. This is a representative sample, supplemented by extra e-bike owners.

A total of 1,046 e-bike owners and 1,461 non-owners replied to the questionnaire. We have estimated the expected e-bike use for the coming years by combining data obtained from the MPN and ODiN. On the basis of answers given to the survey questions by MPN respondents, we know to what extent non-owners intend to buy an e-bike in the next few years. We have used this information to predict how the population of e-bike owners and how e-bike use will develop in the next few years.

Background report

If you would like more information on the data used, the applied research methods and the results of this project, please see the background report to this brochure. The background report is available for download (only in Dutch) via the website www.kimnet.nl

De Haas, M.C., Huang, B. (2022), *Aanschaf en gebruik van de elektrische fiets*, [Purchase and use of the electric bicycle], Background report. KiM Netherlands Institute for Transport Policy Analysis.

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