

Driving an electric vehicle. A sociological analysis on pioneer users

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Abstract In most of the western countries, car is the prevalent means of transport for local mobility. At the same time, sensitivity to environmental issues is increasing, correlated to the consciousness that carbon dioxide emissions have to be reduced. In regard to these two trends (individual mobility and public opinions favourable to a reduction of carbon emissions), energy-efficient vehicles will probably develop in the future—car manufacturers actually prepare new offers for the mass market. Comparable cases have

occurred during the last decades—probably more modest but full of learning: some local authorities have promoted innovations based on electric vehicles in the 1990s, and some people have chosen this kind of cars for their daily travels. This article deals with these pioneers (This article comes from a communication at the ECEEE Summer Study, June 2009, Panel 6: Energy efficiency in transport and mobility.). Reporting studies carried out in 2006 and 2008, we intend to identify the reasons of this innovative modal choice, to show the difficulties that electric vehicle drivers then encountered and to analyse the patterns of use that governed their mobility and their use of electric vehicles.

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Introduction

For several years now, local authorities have faced the need to ensure both the mobility of their citizens by reducing traffic congestion and of limiting CO₂ emissions by promoting transport which causes little carbon dioxide pollution. However, despite measures aiming to reduce automobile traffic and incentives for the modal shift to public transport and non-polluting methods of travel (walking, cycling, etc.), the car is still the method of transportation which is the most commonly used in France, involving about two thirds

of daily journeys, whereas public transportation covers less than 10% of the daily journeys of urban dwellers (Ries 2003; Armoogum et al. 2010). In fact, as for many other objects of consumption (televisions, telephones, computers and hi-fi units, etc.), in many households, when income enables this, household objects are duplicated, uses become individualised, and consumption occurs in the plural. Modes of transport do not escape this necessity, which involves enabling everybody to consume and to travel in complete independence and in complete freedom. Basically, the lastingness of the car's expansion lies squarely on the desire to be both independent and to link up with others. Some people—those which can be called “exclusive motorists” (Kaufmann et al. 2001)—would not give up this mode of transport for anything in the world as it enables them to reach their destination whilst ensuring freedom of movement and a feeling of mastering their space and time.

When the characteristics of the motorists' mobility are examined more closely, we have no choice but to note that most journeys cover a short distance at a low speed.¹ Making it possible to both limit the urban uses of the petrol-engine car and to preserve the potentials of individual mobility, the electric car seems, in theory, to correspond perfectly to a growth market. Within the hypothesis of an unchanged urban layout (dense towns—centres and spread out peri-urban suburbs) and taking into account the fact that the “local space is now for the car” (Dupuy 1999), it seems appropriate for everyday uses (Papon 1993). The current increase in the prices of fossil energies also adds weight to this scenario.

The French territory, a privileged study area

The electric car was thus the subject of development programs in France from 1980 to 1990: French manufacturers launched standard vehicles (converted internal combustion-engine cars) so that electric cars have been used for several thousands of users at this period. France is a country which is relatively favourable to these developments, due to the morphology of its territories, and to the role of the energy

¹ The average speed of a car for all of its journeys (city and motorways) is 37 km/h according to the queryINRETS (1995), as shown by Bellanger and Marzloff (1996). The average length of a journey is 8.5 km, and 50% of journeys cover a distance of less than 3 km.

specialist Electricité de France (EDF)—a state-owned company at the time—in this area. EDF, which had participated in the promotion of mass-transit electrical vehicles for decades (electric buses, guided transport such as tramways and trolleys, etc.), was specifically concerned by the potential development of this market and began to increase the awareness of the administration, manufacturers and the general public almost 20 years ago. In finding here the opportunity to develop technologies in the field of the electric vehicle (notably batteries), the energy specialist encouraged the circulation of these cars on exploratory markets, in fleets or as part of life-size experiments (Massot et al. 2006)—notably the operation in La Rochelle (Lauer 1996) or the Praxitèle plan of action in Saint Quentin en Yvelines (Michaud and Auvray 1999). A quite important charging infrastructure (several dozens of charging points in Paris for instance) has been installed then under EDF's and the local authorities' initiative.

Other countries adopted legislation which was very favourable to the electric car—such as California—which positioned itself as the leader of electric drive in the 1990s.² The question remains open as to whether the most favourable ground is that of sprawling towns or, on the contrary, urban centres. Studies reflect this hesitation: the promotion of the electric car in the USA was based on the premise that it would “maintain this landscape of houses and gardens which characterises Southern California” (Beillan 1994), whereas cities such as Hanover or Nantes have preferred public transport in exclusive lanes. On the other hand, the electric car is, from a technical standpoint, better adapted to traffic in dense areas than in peri-urban areas—due to its performance in circumstances calling for frequent stops (Zentelin 1994). Thus, the urban and social conditions leading to the development of the electric car has been considered as less favourable in the USA (large daily distances, sprawling cities, little public transport, internal combustion-engine cars, inexpensive petrol

² In the 1990s, California launched a program aiming to compel manufacturers to sell at least 2% of *Zero Emission Vehicles* in 1998 (and 10% in 2003!), an idea which gave the electric vehicle more than its due (see Bleijs 1995). In 1992, the Cal-Start consortium was created, regrouping 85 organisations (suppliers of electricity—LADWP and SC Edison—research laboratories, etc.) to make California the “capital of the electric car” (see Beillan 1994).

and drivers demanding air conditioning) than in France (Bleijs 1995).

Despite these common sense arguments, electric cars have not yet obtained the success that the development of mobility would appear to guarantee (see Lys 1978; AIE 1994). And since research into the spreading of innovations has existed, it is well known that it is not the quality of a technical object which ensures that it spreads—but the fact that, firstly, it corresponds to a social demand and, secondly, that it falls within a mature sector and is supported by a solid professional network extending from the production of all its components (electricity networks, cars, batteries, charging terminals, etc.) to after-sales services and supply infrastructures (see Soulas 1990). There are thus many conditions which are difficult to bring together (see Nicolon 1984; Callon 1979).

The social science studies which were carried out in the 1990s³ take note of the fact that these two levels—i.e. social demand and a constituted sector—condition the distribution of the electric car. Thus, surveys in the field were carried out in the 1990s to define the uses of the electric vehicle more closely. The individuals questioned were either individuals who were placed in situations in which they used electric cars during experiments or were people who called upon a fleet of electric vehicles within a professional context.

The feedback from the socio-technical experiments carried out in France at this period indicates that a large majority of these 1-day users of electric cars had a positive perception of them: the silence, the smooth handling and the comfort are particularly appreciated. The drawbacks mentioned were based on elements which were not experimented but foreseen by these users, even though some of these questions referred to real problems: the issue of the low range, the lack of power, the cost of the vehicle, the rental of batteries, etc.

The feedback from these trials is, however, limited due to the fact that it was based on individuals who were placed in an experimental situation (Wolf 1999), which has little in common with real life conditions. As the question of social demand thus remained

relatively open, we launched in 2006 and then 2008 ad hoc studies among people who chose to own an electric vehicle and to use it daily.

How to analyse driving practices: goals and methodology of our study

The studies conducted in 2006–2008 and that we plan to develop here aimed to trace the different stages of use of an electric car (awareness, purchase, first steps, daily practice, breakdowns, maintenance, etc.) for regular users in order to analyse the main components thereof. As we will see, examining people who use an electric car on a daily basis both supports numerous results obtained from the feedback of experiments carried out in the 1990s and also lead us to re-question the evidence which portrays the electric car in the position of a vehicle of secondary importance.

Proceeding with comprehensive interviews, we have tried to turn in the diversity of the mobility practices and of the uses of electric vehicles, as forerunners transcribed it. Thus, in the surveys conducted in 2006 and 2008, we analysed the way in which an electric car was used within specific ways of life. The persons individually questioned (slightly fewer than 30 in 2006 completed by 10 people in 2008)⁴ were contacted in three different ways: discussion chat rooms on the Internet (people spontaneously talking about their electric vehicle), through the intermediary of promotional associations (active members were found) and then from word of mouth (interviewees gave us another person's contact). They were interviewed at their home in order to apprehend their surrounding area and to observe their recharging facilities there. The semi-opened interviews lasted 1 or 2 h on average.

The interviews were about the reasons for using an electric car and the drawbacks encountered by users. They also dealt with the description of the recharging

³ The Research Department of *Electricité De France* (EDF) has considered the relevance of these questions since the 1990s and has carried out technical studies into the storage and distribution of electricity, accompanied by feasibility studies and feedback of sociological experiments on people who had driven such vehicles.

⁴ The 2006 survey specifically dealt with the question of electric-vehicle use. As the 2008 survey concerned other aspects (and notably the charging stations in public places), it contains only a small number of interviews with electric vehicle users. However, we included them in our analysis because it completed the 2006 sample, especially concerning the charging issue. These surveys have been carried out by Christophe Jemelin and Nicolas Louvet from the EPFL (Lausanne Federal Polytechnic School) within the framework of contracts with EDF R&D and by Magali Pierre from EDF R&D (see Pierre et al. 2007).

process (sometimes completed by a visit of the private car park or by a ride in the electric vehicle) and with the vision of the future for the electric vehicle sector; they also concerned the mobility routines of the questioned person and of the other household members in order to understand how the electric car integrates the system of mobility which it shapes—even though the petrol-engine car retains a certain position.

The sociodemographic profiles are quite the same for the two surveys: the interviewed persons used either an electric car or an electric scooter. It was mainly driven to go to work, but our sample also includes some retired persons. Most of the time, the other partner drove a conventional car. These middle-class people had children at home for the most of them—the children had left the home only for the eldest ones. They lived in diverse French territories, but most of them were located near to large cities (the suburbs of Paris, Lyons or Bordeaux) or in medium-sized towns (Metz, Annecy, Sophia Antipolis, etc.). Indeed, the electric vehicle broadcast (except for the electric scooter) seems to be less attractive to people living in centres of very big towns, probably because car parking is more difficult there and because of the better public transport offer.

In this article, we undertake to question the issue of social demand in a more precise manner. In order to do this, we analyse the main results of the two recent exploratory surveys mentioned, carried out in France amongst users of electric cars; thus, by starting with the uses of the electric car, we will know its audience and areas of development better. For whom has the electric car been intended and how did users come to choose this original mode of transport? How can their mobility and their uses of the electric vehicle be qualified? What kinds of problems are encountered by these users, and what do they do to overcome them?

The reasons for the modal choice and the typology of users of electric cars

As highlighted by the two surveys, the purchase of an electric car involves those people who live in residential suburban housing, as accessibility to a socket is a prerequisite. Moreover, this residential location determines the modal arbitration of those persons who own an electric vehicle.

Users are multi-modal rather than convinced ecologists

The interviewees have mainly purchased their electric vehicle during the 1990s. Considering the difficulties that they had to overpass at this time to acquire such a vehicle, we can surely assess that this act attested a strong willingness to change their modal practices. Indeed, these people then worked in places where they had been sensitised to such innovations—even as electricians or in a municipality using a fleet of electric vehicles—and where they could learn how to drive it.

Most of the individuals questioned have (at least) another car at their disposal in their household—a conventional car. At once, uses clearly indicate that an electric car is complementary to other modes of transport within a system of mobility.

The analysis of general mobility practices amongst those persons having an electric vehicle shows a certain heterogeneousness⁵: amongst the users of electric cars, one finds both *exclusive motorists* who only use their (electric + petrol engine) car(s) to travel and multi-modal users who combine the use of their car with other modes of transport (suburban trains, the underground, etc.); the latter are thus either *sensitive to the transport offer* and choose the most appropriate mode with respect to the journey they must make or they are in head-on opposition to petrol-engine cars (one can talk about *civic ecologists*). Generally speaking, the use of an electric car encourages a more rational use of the car and sometimes multi-modal behaviour.

For some people, the use of public transport represents an interesting complement in the area of mobility (for example, to get to the town centre once the park-and-ride has been reached—the public charging infrastructure is mainly located in city centres and in underground public car parks close to the ring road), whilst for others, their use is completely outside the realms of possibility. For users of the electric car, this does not involve avoiding CO₂ emissions at all costs (ecological motive), but also involves satisfying a preference for the private vehicle, as indicated by the persons questioned: “Public transport? It’s not practical and it’s restrictive,

⁵ We here export the typology of Kaufmann et al. (2001) to our field work.

the transfers, the poor services... I never use it.” (user of an electric car, Lyons, France).

Thus, the drivers of electric vehicles neither reject nor adhere en masse to public transport, but are very often in residential situations which cause them to prefer the use of the private vehicle to public transport (incomplete service). The positioning of the electric vehicle within the range of modes of transport available should thus be the subject of an in-depth study—when this vehicle is available to the general public in order to reach the different key targets.

Typology of relations with the electric vehicle

Our surveys about the users of electric vehicles show that the decision to buy an electric vehicle is not always directly linked to environmental concerns, but other motives also come into play—especially the attraction for cutting-edge technologies. Ecological convictions can be combined with a taste for technical innovations and their performances, as indicated by the user of an electric car in Besançon: “I came across electric vehicles when I was small, I had an electric Ferrari when I was 4 years old... I adopted the electric vehicle thanks to a technical mix which was due to my training and ecological aspects. You have to set a good example.”

- The pioneering-ecological spirit

The methodology that we employed (qualitative survey) does not allow us to approximate the relative proportions of the different types of electric vehicles’ forerunners. Its interest rather lies on the variety of behaviours and practices that it shows. Nevertheless, if we try to synthesise the cases that occurred, we can draw two ideal types

concerning the relation that these forerunners have to their car and to their mobility system, and these ideal types combine many aspects concerning the individual attitudes and the use of electric vehicles (Fig. 1): For a person living in Annecy, mobility is a domain of life that has to become “greener”: “I plan to install solar panel at home. It should be ready for December. (...) They will produce the energy that I need to drive – that is more important to me than the energy that I need to heat the water that I use.”

As such, the hybrid vehicle is considered to be an intermediary solution and, in their opinion, only electric vehicles are really able to limit the degradation of the environment. In the same way (sustainability), these individuals prefer to buy the batteries for their vehicles rather than to hire them. For these people, whose incomes are slightly above the average, the living area (areas in which most activities are carried out) and types of leisure are determined by the capacities of the electric car. As a consequence, and to say it quickly, driving an electric car is for them an input data of their mobility system and not a solution among others to answer a mobility need.

For some people with a pioneering spirit, the wish to strive for more innovative forms of mobility more generally lies behind the initiative to purchase an electric car, enabling a maximum amount of independence and guaranteeing respect for the environment. The technical aspects are really prevalent for them. It is clearly indicated by a resident of Bordeaux: “We have an approach to electric vehicles, but we really don’t have an ecological approach. (...). The aspect which interests me is the technology. I am not at all

Fig. 1 The users of electric cars, between pioneering-ecological spirit and seizing opportunities



interested in the ecological aspect – even though I am sensitive to this, like all people are - but no more. No more, no less.”

Relatively speaking, technological and ecological convictions thus prevail over considerations of cost, as says a person living in the Parisian suburb when he answers to the question of the cost of his vehicles compared to petrol-engine cars (he owns two electric cars): “No, the driving comfort is more important to me than the financial issue.”

These individuals do not hesitate to disseminate information about electric vehicles to the people around them, as they are convinced of their quality. Moreover, they participate in (or even organise) chat rooms which promote this mode of transport. An interviewed man from Bordeaux explains: “I have driven my neighbour, my family and my friends, just for them to try [the electric car]. Even if a stranger in the street asks it to me, I take him/her with me; there is no problem if I have time enough.”

- Those who seize opportunities

For other individuals who were questioned, the purchase of an electric car did not initially meet an environmental concern; the purchase was made for reasons of cost, following an opportunity (a low-priced second hand car), or following close friends and family. A woman living in a small city near Paris expresses it clearly: “My ‘relational network’, it is only the colleagues of mine who also use an electric car. I am a mere user, and I’m not fond of technique. I don’t want to fully invest myself in it, I just need it to run, It’s just a means of transport.” It seems that these people have adopted the electric vehicle rather “by chance” or in response to a sort of windfall effect.

This practice, which was initially envisaged as being amusing and pleasant, has been bolstered over the years. All these increased their awareness of the advantages of this engine type. Indeed, the practice can sometimes be the first step towards a more profound awareness of energy saving (which can go as far as reducing the home/work distance following the purchase of an electric vehicle). An electric car user says it this way: “The fact that we have a reduced energy stock compels us to avoid useless and erratic accelerations; you can’t take the liberty of unneeded journeys.” As we can see here, these individuals consider actions in favour

of the environment in a different way than the persons moved by a “pioneering-ecological spirit”. They seem to be more motivated by the refusal to waste fossil energies than in defending the environment. It would be interesting to confirm and complete this topic by deeper studies. These complements could concern in particular the perception of energy and of actions in favour of the environment.

For the people for whom the purchase of an electric vehicle meant seizing a good opportunity, promoting the electric vehicle is usually limited to family and friends—and they are not overly enthusiastic by the idea of being forerunners.

In short, although some convinced individuals act as pioneers, in displaying and defending their values, there is also a category of users which are quite simply interested in the specific advantages of the electric car and which have adopted it almost by chance. This result matches a study carried out in California to test the propensity to purchase an electric car (Kurani et al. 1996). This experimental survey rejects the hypothesis of a small potential market made up of “extreme ecologists” and households which substitute an electric vehicle for a second car which is not used much. Indeed, the potential lies amongst hybrid households (ib.)—i.e. households which use an electric vehicle for their first car and a conventional car as a complement.

Configuration of the mobility of users of electric vehicles and uses of the electric vehicle

Driving an electric car: is this a practice which can be wholly comparable to driving an internal combustion-engine car? What are the differences in terms of driving, and what is the general configuration of mobility for the users of electric vehicles? Can a different relationship with the environment be identified? Is our typology separating pioneers and opportunists still significant for this aspect of the analysis?

Driving an electric car on a daily basis

For most of the interviewed persons, the electric vehicle serves as the main vehicle for at least one of

the partner of the household. People who use an electric car on a daily basis and in a recurring manner appreciate its comfort and silence. Its low running costs are also mentioned.

Contrary to expectations, the driving range of the vehicle (70–80 km),⁶ which is often considered to be one of its weak points, is fairly not perceived as a drawback. The main restriction of the electric car (its limited range) is, in fact, considered by users as being one of its basic components. The distance from the place of residence to the workplace is a prerequisite to purchasing an electric car: the range of the car corresponds to one or two return journeys between the home/workplace or corresponds to the boundaries of the user's living area. Thus, the car can usually be recharged at the end of the cycle—with those people who do not rent but own their battery being particularly sensitive to this. This unexpected result, which had already been emphasised by an American study, was mentioned by the French *Centre de Prospective et de Veille Scientifiques et Techniques* in 1998: “A study carried out by the Institute of Studies in the USA (Kurani et al. 1996) reveals that in the case of households (...) equipped with both a traditional vehicle and an electric car, low range is not a major handicap thanks to the fact that the household divides up its vehicles depending on the journeys to be made” (CVPF 1998). As a consequence, range is “not such a big handicap as it might at first appear” (ib). Everything happens as if the purchase of an electric car models the household's system of activities (type, frequency and destination of the activity) and encourages the latter to acquire skills in anticipation. A man living in the suburb of Lyons explains how this required anticipation progressively became a skill: “At the beginning I calculated everything: if I have to go there, I have to take this path, etc. I was afraid that my car couldn't get onto a slope. Then my brain adapted progressively and now it has become natural, I don't even need to calculate anymore; as soon as I see the position of the gauge, I know exactly if it is going to be enough.”

⁶ The electric vehicles manufactured in the 1990s did not exceed this range in real driving conditions. Moreover, these electric vehicles require complete recharges (because of the memory effect of nickel–cadmium batteries).

What the electric car changes with relation to modes of driving

The two outstanding features of the mobility of drivers of electric vehicles are: anticipating the journeys to be made and adopting smooth driving in order to save the battery. This anticipation of energy requirements leads to a host of changes in driving mode behaviours. Notably, this involves paying attention to pedestrians, who do not hear them coming, as pointed out by the driver of an electric car who lives in the suburbs of Paris: “You have to be very careful of pedestrians who do not hear the car.” Nevertheless, drivers of electric vehicles have the impression that electric vehicles cause a lot less accidents than petrol-engine vehicles because driving them is easier (there is no gearbox), which has a relaxing effect.

Moreover, even though the initial reasons for purchasing an electric car are not necessarily linked to concerns for the environment, very economic habits are adopted in connection with the low battery range. Thus, users of electric vehicles use the engine brake and anticipate stops as much as possible. “Typically... when you see that the lights ahead are red, you start to lift your foot a long time beforehand in order to save the battery (...); instead of continuing to accelerate till the last minute, and then braking, you lift your foot and let the engine brake take over.” As driving an electric car leads to specific habits, it can be an important stepping stone leading to special attention to environmental aspects.

Recharging the battery at home and at the workplace

How is the vehicle recharged at the home? Keeping the cable in a safe place (avoiding contact with water) and limiting the amount of required handling often involve a DIY work on parking areas. These fittings vary in durability.

The possibility of recharging the battery at work depends on the policy which has been adopted by site managers to promote alternative vehicles. Thus, at his former workplace, one of the interviewees from the Parisian suburbs could easily recharge his vehicle (this is no longer the case since his transfer): “[In my former position], (...), I recharged my vehicle half the time at work, and there was absolutely no difference between the work and the home. The charging

terminal was right in front of my building. It worked almost all the time. (...). People always left the spaces for electric vehicles free. This was a well-established thing, and the spaces weren't very convenient with regard to the building's entrance (...). Thus, nobody wanted to take them. (...). [Whereas now, at work], the space (...) is right in front of the main door. So, obviously, it's the first space that people take."

On the contrary, however, some users are assisted by their employer in this project, in the sense that their company gives them access to a charging infrastructure or let them charge for free, or insists on letting the reserved parking place unoccupied, as explains an electric vehicle driver in Lyon: "My company installed a charging terminal for free and does not make me pay for recharging, it thinks this is a question of image."

Recharging the battery in public places: users of electric vehicles are looking for energy autonomy

For users of electric vehicles, the number of kilometres to be covered everyday determines the choice between an internal combustion-engine and an electric car, as does the possibility of recharging the battery once the destination has been reached. Due to this, the electric vehicle is mainly used for routine journeys so that batteries can be recharged on known ground (i.e. at home).

Due to recharging, the experienced daily user of the electric vehicle does not seem to be as confident for all of his journeys. In fact, for commonplace or indeed routine journeys, such as between home and the office, he/she does not think twice and fully integrates the recharging stage into his/her journey—with the recharging often being carried out in familiar places such as the home (or the workplace). On the other hand, for more occasional journeys—e.g. for leisure—he/she does not want to run the risk of not being able to recharge his vehicle as this would be a nasty surprise which would negate all the benefits of the leisure, as explains a user of an electric vehicle in Paris: "[For my leisure activities], I take my petrol-engine car, because it just wouldn't do to run out of electricity upon leaving a show. [...] I need to be sure that I can recharge my vehicle. But when I go to work, if the quick charging terminal is occupied or if a petrol-engine vehicle is parked in front of it (which happened for a time), and I cannot recharge, I can

always plug my car into the office's network to get home (although this is forbidden I wouldn't mind doing it). If I go to a show and I don't find a charging terminal or if there is only one and for some reason I cannot recharge my vehicle, I may not be able to get home. That's why I take my petrol-engine car."

It should be specified that although the constraint of recharging seems to be more easily accepted for journeys which are, in themselves, constraints (or, in any event, routine), attitudes can be differentiated depending on the place of residence within the town or city. In fact, a user who lives near to the city centre does not feel restricted by recharging the battery for his leisure and thus for journeys which are of a less organised or less routine nature. Thanks to recharging—even when basic apprenticeship of the range has just begun for home/work journeys—the user next learns to increase uses and, in particular, to extend them to leisure, as pointed out by one of the Parisians who was questioned: "[With my electric scooter] I mainly travelled between my home and workplace for 4 years, and that's all I did (...). I then discovered charging terminals and so I started to use my scooter for other things – such as going out in Paris – whether alone or as a couple as my scooter has two seats. Now I don't think twice about using it for two of us, and even my wife has an electric scooter, so that when we go out in Paris with the children, we go by scooter [...] and that's part of the outing... it's pleasant."

When there are plenty of charging terminals (for example, in Bordeaux), leisure journeys can also be made without any particular problems. But some areas which are lacking in recharging systems are still off limits.

In short, the users of electric vehicles try to avoid the situation of recharging the battery in public areas because satisfying their requirements would entail too much uncertainty. Due to this, they use the electric vehicle mainly on journeys which they know will enable them to respect the limits of battery range. The use of the electric vehicle is thus compromised mainly on journeys for leisure and holidays: the question thus involves freeing oneself from constraints and making journeys more reliable.

As we have seen, all forerunners (pioneers and opportunists) use their electric cars on routine journeys (home/workplace runs) in order to ensure

that the issue of driving range does not cause any problem. The target public of the first electric vehicles, in the 1990s, was constituted with respect to the household's propensity to make routine journeys. In fact, depending on whether the electric car is used for "pendular" journeys or for "multi-purpose" reasons (Faivre d'Arcier 1996), the anticipation of the battery's range is more or less problematic. The question will be posed in a completely different manner for users of the future: quick recharging technologies, lithium-ion batteries (no more memory effect) and the interchanging of batteries should make it possible to get round this limit and, as a consequence, broaden the range of users.

The difficulties encountered by users of electric vehicles—important obstacles to the development of this innovation

For the current user of an electric vehicles met in 2006–2007, a certain number of problems are to be considered relating to the acquisition, the insurance and the reparation of the vehicle—and also relating to charging terminals. Hopefully, the different difficulties which are connected to the sector's low maturity will probably disappear with the development of the overall market.

Purchasing an electric car: a real obstacle course

As we have seen, there are two reasons behind the action of purchasing an electric vehicle: an ecological conviction which can be combined with a particular taste for technical innovations or simply an opportunity which arises (the impression of making a bargain). In both cases, the purchase turned out to be a real obstacle course for the users that we interviewed. Actually, they bought their cars during the 1990s, and at this period, the promotion of these vehicles by automobile manufacturers was lacking—to such an extent that it was difficult to obtain information on types of vehicles, their prices, their options and ways of purchasing them, etc. Moreover, purchasers sometimes came up against lack of sales staff experience, sales procedures which were made difficult by waiting periods and poorly adapted payment systems. These are drawbacks which have to be removed—considering that the propensity to

acquire is based on "detailed and transparent information on range, running costs, maintenance conditions and the number and location of charging terminals" (Legros and Le Gallais 2000).

Interviewed users of electric cars are conscious that they benefit from a *club effect*; in many towns, they have free parking spaces and charging terminals. However, the lack of intermediary recharging points (whether in places of public use or at the workplace) and/or the shortfall of information on the state of the market of the existing network make the question of low range more acute and represents a real problem—especially when the user wishes to make an unforeseen journey. A desire for technical improvements making greater autonomy possible stems from these shortfalls (the technological development of batteries) as a dense network of recharging infrastructures is only conceivable over the medium term.

The upkeep of batteries (the cost of the maintenance contract and the duration of the vehicle's immobilisation) also poses a major problem. The other area of dissatisfaction concerns the leasing contract for the battery as this is expensive and masks a simple rental contract—one is never the owner of the battery.

Another criticism involves the lack of the sector's maturity. In fact, the main hardships arise in the event of a breakdown, as finding a repair service requires a miracle: the only resources are the internet and the network of mutual help. A man living in a small city near Lyons describes it this way: "Most of the electric vehicles users are passionate amateurs who became experts of the question, who have a relational network to support it. Because fixing an electric vehicle requires skills, and finding new batteries when the previous ones are off is a real problem."

Moreover, proposals are formulated to improve the distribution channels of electric cars and thus to make purchasing and repairing them easier. If the sector is not set-up, the reduced involvement of the institutions which are considered to be driving forces (the State, EDF and automobile manufacturers) is also deplored by these atypical motorists—who find themselves in an isolated position which sometimes discourages them.

Infrequently used charging terminals for the electric vehicle in public areas

As we have seen, for the majority of users of electric vehicles, most recharging is carried out at home. This

makes it possible to “gamble” on the return journey whilst almost running the batteries flat.

In this scenario, what is the point of having charging terminals in urban areas? Firstly, the existence of charging terminals serves as insurance in the event of unforeseen journeys, and secondly, they can encourage the use of a certain type of car park rather than another. Reserved spaces represent a favour to the users of electric vehicles, although some people take advantage of the flexibility of regulations in underground car parks. The user of an electric car in the suburbs of Paris thus admits that: “[Using spaces for electric vehicles when it’s not for recharging them but to have a space], yes, I did that once in a Vinci car-park, when I was running late and I didn’t want to go down to the fifth level. I said to myself: “Ok. I’ll take the space for the electric car. It’s not indicated that you have to be recharging your car.” These drivers appreciate this advantage as such and consider it as being a way to encourage the distribution of the electric vehicle.

At what moment in time, in what circumstances and for what kind of use do these charging terminals serve a purpose? Drivers of electric vehicles explain that they use public charging terminals very infrequently. In fact, the public knows that terminals exist but tends to consider that they are difficult to access and not very reliable:

- not accessible because they are difficult to locate and are sometimes reserved for professional fleets, as was pointed out by the user of an electric car in Bordeaux: “In Bordeaux, there is a system of quick recharging but (...) you need the access card. (...) This is a special card which is allocated to the user. (...) Of course, my wife has an electric car, and she works quite near to the City Hall. The City Hall also has four electric cars and so there are three charging terminals which are available for public use. However, every time my wife wants to go there, they don’t work. But I understand all of that – sometimes there are travellers so there is a danger that... anyway, that’s the argument they came up with. So you have to ask for authorisation from the Assistant Mayor.”
- poorly maintained and thus unreliable, depending on how the maintenance is organised, especially

in underground car parks. A Parisian user gives his opinion: “People [who have an electric vehicle] do not go in those car-parks, and when they do, they find an offer which is not maintained, which is not in service. (...) It really is absurd (...): there is a positive offer and then people very quickly give up, because its false; although they’re free – you’d might as well say that there aren’t any! (...) I think that if there was a good density of electric charging terminals, there would be a lot of electric scooters!”

The reliability of public charging terminals is, however, fundamental to make their use possible. This opinion has negative effects on practices (and thus on the use of terminals) as it leads to avoidance of situations in which charging terminals are used in order to prevent any problems. An electric vehicle user puts it this way: “If we want to go further, we take the other car [the petrol-engine car]. (...) But it depends. If we go to a friend’s house where we can recharge the battery, we can take the electric car because it’s enjoyable – even for a long drive – but if we’re not sure, if we need to park in Fontainebleau town centre, where we cannot recharge, we take the petrol-engine car.”

In absolute terms, the recharging terminal gives greater flexibility to the electric vehicle because all journeys don’t necessarily have to be planned to the nearest kilometre. Admittedly, considering the range of electric vehicles (about 80 km), recharging is not vital for most urban journeys. In fact, most of the time, it is customary to recharge the battery at home. However, the existence of a network for recharging batteries represents a weighty commercial argument as this reassures people about the possibility of recharging their cars. Thus, the visibility of charging terminals seems to incite people to use the electric vehicle more than the terminal itself. Due to this fact, it appears to be vital to increase the volume of terminals in public areas, to improve communication relating to the presence of terminals and to monitor their maintenance more closely.

Conclusion

In short, all users are unanimous about the electric car: it is pleasant to drive and practical. On the other

hand, two major drawbacks are clearly identified. The first drawback involves recharging the battery—charging terminals other than those found at the home are in short supply, and leasing is also very expensive; and the second drawback is based on a sector's existence (for the manufacturing of electric cars, their maintenance/repair and the network for recharging batteries, etc.). This point is echoed with regard to uses. During its development, the electric car should resolve certain problems linked to the lack of maturity in the sector but, at the same time, this may bring about the end of the advantages which were granted to forerunners (for example, free car parks).

On the other hand, the issue of driving range is not really perceived as a problem as individuals fix their mobility according to what is seen as basic data—and a well-integrated constraint. Thus, does the use of the electric car lead to both the real remodelling of the system of driving (anticipating traffic movements in the absence of noise and thus of signals for other road users) and also to the remodelling of the system of mobility (the journey is planned)? To a certain extent, daily use of the electric vehicle introduces new driving practices and the restructuring of the organisation of daily life. This result is confirmed for both of the two ideal types that we draw in this communication: despite different motives of purchase, register of use and way to broadcast their choice, people driven by a pioneering-ecological spirit as well as people just trying to seize an opportunity both meet on fact that the electric vehicle increases their sensitiveness to transports issues, to energy savings and to environmental questions. Above all, the users of electric vehicles search to increase the security of their journeys as the charging terminals located in public areas are, at present, used infrequently. The reasons for this non-use must be questioned as much as for the conditions of use. The main causes stem from the weak network of charging terminals in French territories during the 2000s and the partial maintenance of the existing network in the last decade—which, in itself, can be explained by the marginality of uses. Despite this infrequent use, the presence of infrastructures for recharging batteries in public areas represents a weighty argument in the development of the electric vehicle: the charging terminals are the sine qua non conditions of the spread of this mode of transport. Furthermore, they can encourage drivers to make

judicious parking decisions—in car parks which propose preferential conditions.

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