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The utilisation of recharging stations and reserved parking places

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The authors alone are responsible for the accuracy of the information contained in this report.

Summary

In the context of the large-scale fleet test for lightweight electric vehicles (LEVs) 61 recharging stations were installed throughout the canton of Ticino, with parking places reserved for LEVs. Between August 1997 and mid-January 2001 a total of 88,000 kWh was supplied by the 30 recharging stations monitored for research purposes. This amounts to an average supply per day of 93 kWh, corresponding to the energy consumption of 13 LEV automobiles for 3.5 years.

The findings show that the majority of LEV owners (56%) make use of the parking places reserved for LEVs. The ratio rises to 82 per cent if only 3- and 4-wheelers are taken into account. Surprisingly it falls to just 29 per cent in the case of 2-wheel LEVs. Exactly 59 per cent of those concerned make use of the LEV parking space at least once a week. The average duration is rather short, being at most 2 hours in 48 per cent of cases. In most cases owners take advantage of the recharging opportunity during the time their vehicle occupies one of the reserved parking place.

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1. Purpose of this study

The purpose of the present study is to collect and evaluate data and information on the utilisation of parking places reserved for LEVs and the recharging stations located there. This information serves for the evaluation of the measures adopted to promote LEVs.

2. Methods adopted

The following research methods were adopted for this study:

- **Recording of the energy supplied by the recharging stations:**
Between 1997 and mid-2001 InfoVEL kept track of the electricity supplied by the recharging stations on a regular basis. This also made it possible to record the frequency with which these facilities were used. Many of the recharging stations in fact supplied very little energy, reflecting the fact that the recharging behaviour of certain of the users in question can change radically.
- **Active monitoring of LEV parking places:**
The occupation of the LEV parking places in Mendrisio was monitored during a 12-day period in 1997 (10 working days and two Saturdays) on seven different occasions. The LEV parking places in the neighbouring communes were also monitored in 1997 and 1998 for a period of five working days on five separate occasions. After these observations the research commission decided to conduct further observations of this kind only if and when the number of LEVs in the Mendrisiotto region changed substantially.

The on-site observations of 1997/98 made it possible at relatively little cost (one paid staff) to obtain a first impression of the rate of occupation of the LEV parking places. Care was taken in the context of these observations to note whether or not the parking places were occupied and if so by what kind of vehicle (LEV or conventional). It was not possible however to record the exact amount of time the parking places were occupied. This can however be estimated. This method does not involve contact with the LEV owners or other persons occupying the parking places, so that it was not possible to study the reasons for utilisation or non-utilisation of the facilities.

- **Written questionnaire to LEV owners:**
The possibility of making additional observations of the LEV parking places was again considered in the summer of 2000, by which time the number of 3- and 4-wheel LEVs in the Mendrisiotto region had virtually doubled in comparison to the 1997/98 period. However there were some doubts as to the appropriateness of repeating the observations as carried out in 1997/98, and as monitoring by means of a video camera had to be ruled out for data protection reasons, the research commission decided to limit itself for the moment to sending a written questionnaire to LEV owners, inquiring about their utilisation of the recharging stations and reserved parking places.

This approach made it possible to question all LEV owners in the canton at the same time about their use of LEV parking places. The questions focused on recharging habits. The answers included a considerable amount of personal and often subjective data, of a less precise nature than findings obtained by means of direct in-situ observation. However this method provides additional information including the reasons for utilisation or non-utilisation of the parking

places. The questionnaire also made it possible to obtain individual assessments concerning the availability of parking places and the need for new parking places in other areas.

A total of 297 questionnaires were distributed, of which 179 (60%) were returned. The response rate in the case of 3- and 4-wheel LEVs was 68 per cent, compared to 54 per cent for 2-wheelers.

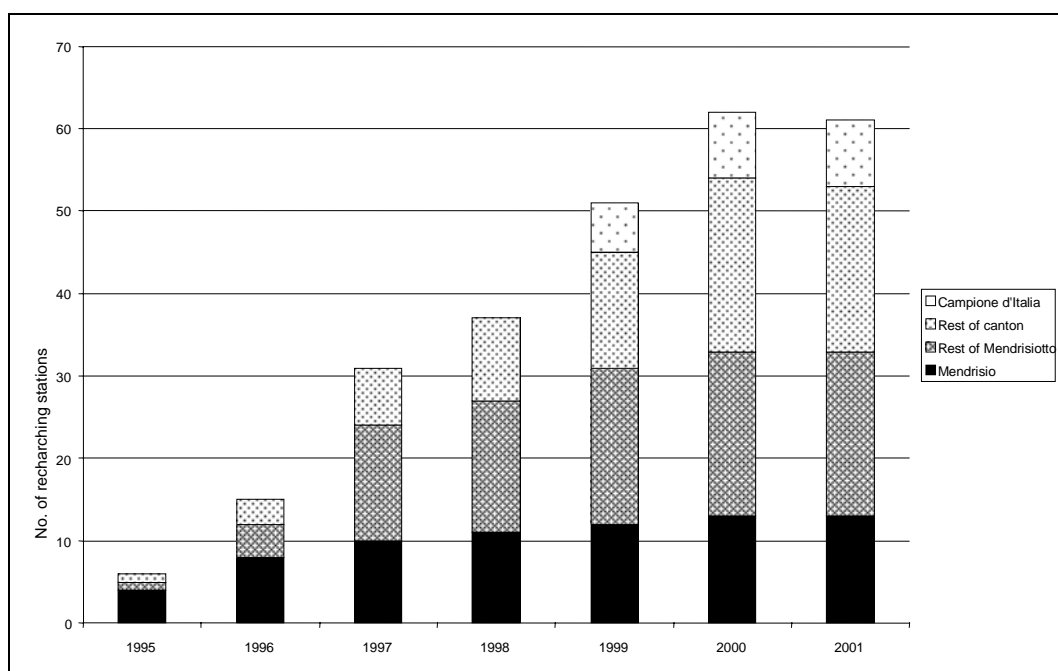
3. Network of recharging stations

At the beginning of 2001 there were 61 recharging stations with reserved LEV parking places in service for the whole of canton Ticino¹. Of these 54 were available to all LEV users. In 46 of these parking was free of charge, while eight were paying. Seven of the recharging stations were reserved for particular user groups (clients/visitors/employees of certain firms/institutions).

When the fleet test began in 1995 there were four recharging stations in Mendrisio, one in Capolago and one in Locarno (cf. Figure 1). The first 32-amp rechargers making it possible to recharge Honda EV models newly introduced on the market were installed in 1997.

In 1998 a recharging station was provided in the centre of Lugano (near the Congress Hall), and the following year another was put into service in Biasca north of the regional capital, Bellinzona. In the same year six recharging stations were installed in the Italian enclave of Campione d'Italia (surrounded by Swiss territory). In 2000 the network of recharging stations reached the canton's northern frontier, at Airolo.

¹ Status as per 10.01.01. Source: InfoVEL.



Source: InfoVEL

Figure 1:
Status of recharging station network in various regions, 1995-2001

4. Findings of in-situ monitoring in 1997/98

Rate of occupation of LEV parking places in Mendrisio

In Mendrisio a total of 14 parking places were kept under observation in 1997. In about 65 per cent of monitoring visits the parking places were found to be unoccupied (cf. Table 1). In 19 per cent of cases there was a LEV present, and in 17 per cent a conventional vehicle.

If the parking places of the Argor Heraeus company are excluded (being reserved for employees and available also for conventional vehicles), then the number of times a conventional vehicle was found drops to just 8 per cent.

For the purpose of comparison the parking places for conventional vehicles in Piazza del Ponte (automobiles) and Largo Soldini² (for both cars and motorbikes) in the centre of Mendrisio were monitored during the 12-day data-collection period. The situation is very different to that of the LEV parking places. The parking spaces were unoccupied in only 26 per cent of the cases. In 74 per cent the occupant was a conventional vehicle.

² Largo Soldini is right next to Piazza del Ponte.

Location (No. of parking places)	No. of observations	Parking not occupied	Parking occupied by....		
			No. of observations	LEV With recharging	Conventional vehicle
Municipal parking (2)	166 100%	166 100%	0	0	0
Co-op (1)	83 100%	70 84%	4 5%	1	9 11%
Piazza del Ponte (1)	83 100%	47 57%	34 41%	15	2 2%
Hotel Morgana (1)	83 100%	79 95%	4 5%	4	0
Fox Town shopping centre (2)	166 100%	97 58%	1 1%	0	68 41%
Mercato Coperto (2)	166 100%	54 33%	112 67%	103	0
Railway station (1)	83 100%	63 76%	19 23%	19	1 1%
Railway station - Kewet (2)	166 100%	120 73%	46 28%	29	0
Intermediate total (12)	996 100%	696 70%	220 22%	171	80 8%
Argor Heraeus company (2)	166 100%	54 33%	0	0	112 67%
Final total (14)	1,162 100%	750 65%	220 19%	171	192 17%

Source: Own observations

Table 1:
Rate of occupation of LEV parking places in Mendrisio, August - December 1997 (on 10 working days and 2 Saturdays)

Rate of occupation of LEV parking places in neighbouring communes

The rate of occupation of parking places in nearby towns, villages and hamlets was studied in August 1997 (1 working day) and in the spring of 1998 (4 working days). The 11 parking places monitored were unoccupied to the extent of 92 per cent at the time of the visit. In Castel San Pietro, Coldrerio and Ligornetto not a single vehicle was found parked. Only in Morbio Inferiore and Chiasso do the occupation rates begin to resemble those of Mendrisio.

Findings from the in-situ observations of 1997/98

The following findings are based on observation of the parking places and recharging stations:

- The reserved LEV parking places were in most cases under-utilised, with just two exceptions. The rate of occupation was higher on working days than on Saturdays.
- Rental cars were frequently seen to occupy LEV parking places, despite the special parking spaces reserved for rented vehicles in various areas.

- Parking behaviours in specific areas varied according to the type of LEV owner (private, company, etc.).
- LEV parking places were only rarely occupied by conventional vehicles.

There are several explanations for these findings:

- Between August 1997 and April 1998 there were 56 3- and 4-wheel LEVs in the Mendrisiotto region.
- As there is no shortage of parking space in Mendrisio LEV owners do not at all have to rely on the parking places reserved for LEVs. They are usually able to make use of normal parking places, and often at no charge.
- The real objective of the recharging stations and reserved parking places is psychological in nature.

5. Results of the written questionnaire in the summer of 2000

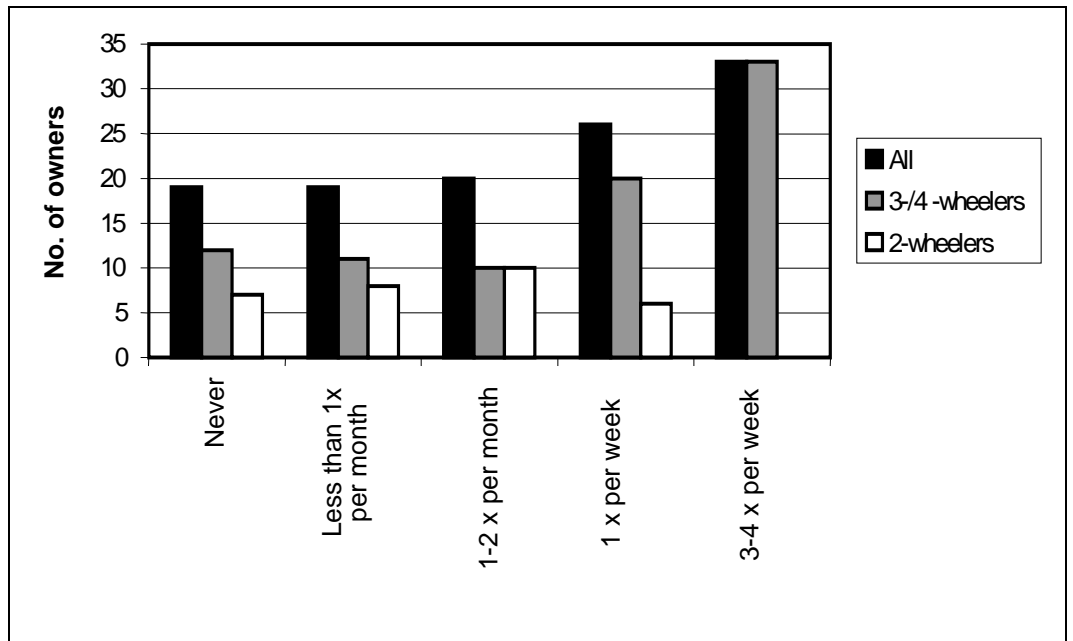
A sticker and a key

The owners of 3- and 4-wheel LEVs were provided on the day they bought their vehicle with a sticker and a key which entitled and enabled them to make use of the reserved parking places, and to recharge their batteries there. The same sticker and key were provided to the owners of 2-wheelers only on request.

Two thirds of the 179 who responded to the questionnaire were in possession of a sticker and a key, and of these 73 per cent were the owners of 3- or 4-wheel LEVs, and 27 per cent 2-wheel LEVs. Some 94 per cent of the former had a sticker and a key compared to just 36 per cent of the latter.

Frequency of utilisation of parking places

A total of 84 per cent of the sticker-and-key holders (98 participants) made use of the parking places. Some 33 per cent of the persons who used the places reserved for LEVs, did so 3-4 times per week. What is surprising is that only the owners of 3- and 4-wheel LEVs made frequent use of the parking places. The owners of 2-wheelers used the reserved parking places once a week at best (cf. Figure 2). Extrapolated to the whole large-scale fleet test these findings indicate just 30 utilisations a day of the parking places for the owners of 3- and 4-wheel lightweight electric vehicles.

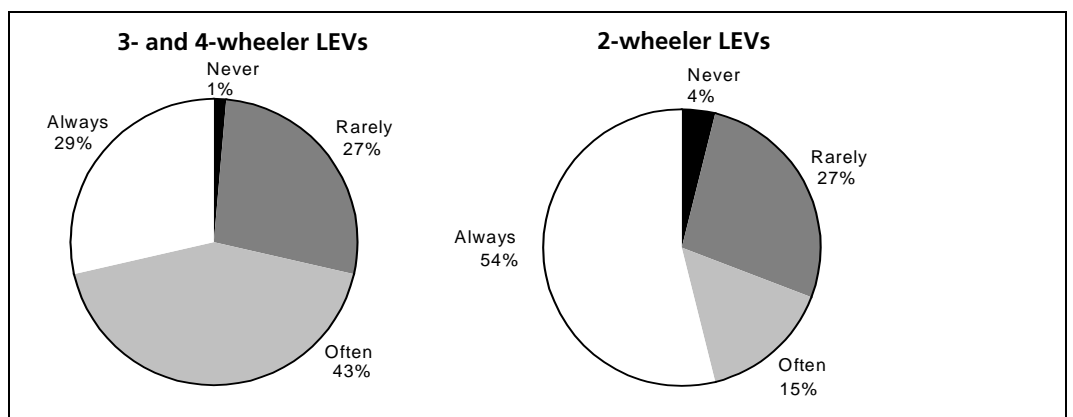


Source: Survey on the utilisation of parking places reserved for electric vehicles, summer 2000
 Basis: 117 persons with the required sticker and key

Figure 2:
 Rate of utilisation of parking places

Recharging of battery while parking

Figure 3 shows the frequency with which batteries were recharged while vehicles occupied the reserved parking place. It relies exclusively on data provided by those who recharged their batteries on such occasions. In the case of the owners of 2-wheel LEVs the park-and-recharge rate is 54 per cent, compared to just 29 per cent for the owners of 3- and 4-wheel electric vehicles. This is no doubt due to the more restricted range of the former.



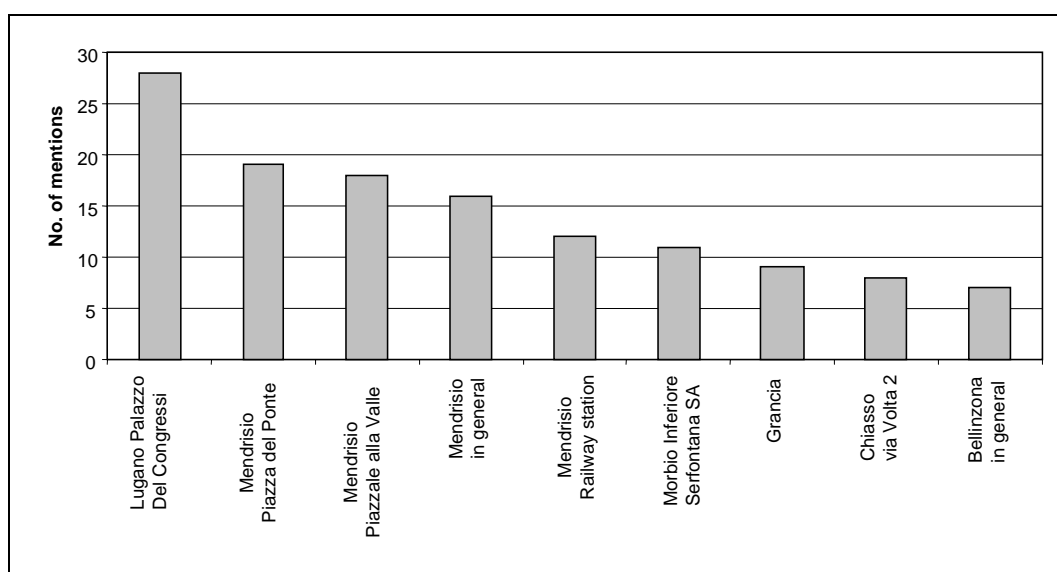
Source: Survey on the utilisation of parking places reserved for electric vehicles, summer 2000
 Basis: for 3- and 4-wheel LEVs 69 participants; for 2-wheel LEVs 26 participants

Figure 3:
 Rate of battery recharging while parking

Rate of utilisation of parking places in different areas

A total of 94 persons answered the question as to the most frequently used parking places: 51 said they used the parking places in Mendrisio; 23 used those available in Lugano. On average each LEV owner mentioned 2.2 parking places (multiple mentions were possible).

The parking place at the Congress Hall in Lugano received the most mentions (28). The parking places in Mendrisio received 78 of the 207 mentions, Bellinzona 14, Lugano 28, Chiasso 8 and Locarno 8. Figure 4 shows the nine most frequently mentioned parking locations.

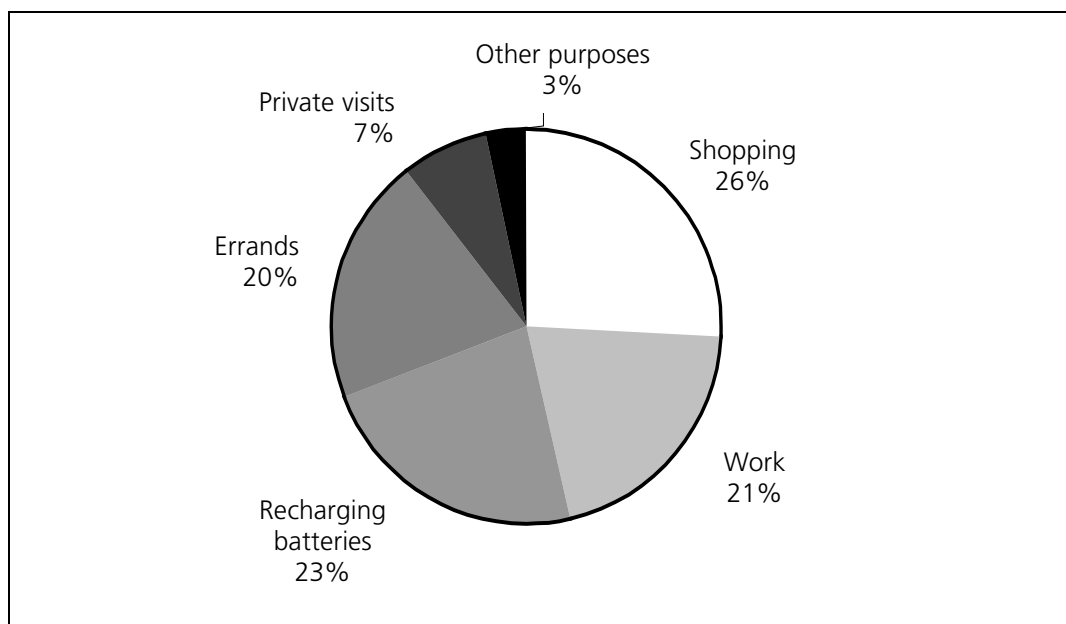


Source: Survey on the utilisation of parking places reserved for electric vehicles, summer 2000
Basis: 207 mentions by the 94 persons who answered this question

Figure 4:
The nine parking places most often cited

Reasons for utilisation of parking places

No meaningful trend is evident in the reasons given for utilisation of the various parking places. The most frequently cited reasons (multiple mentions possible) were shopping (26%), recharging the battery (23%), work (21%) or errands of one kind or another (20%). Private visits were also cited in 7 per cent of all cases and other reasons in 3 per cent (cf. Figure 5).



Source: Survey on the utilisation of parking places reserved for electric vehicles, summer 2000
Basis: 179 mentions by 96 participants

Figure 5:
Purpose cited for using parking place

Length of occupation of parking places

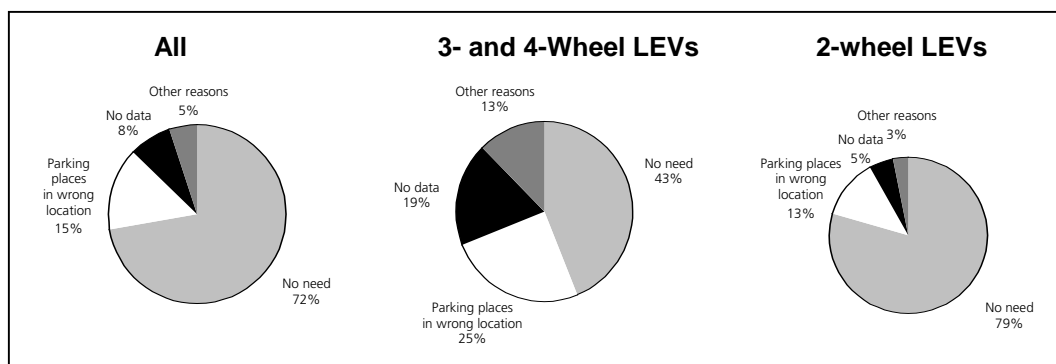
The parking places were occupied by 33 per cent of respondents for a period of 1-2 hours, by 28 per cent for various lengths of time of an irregular nature, in 18 per cent of cases for less than one hour, in 14 per cent for 3-4 hours and just 7 per cent occupied the spaces for longer than four hours.

Reasons for non-utilisation of parking places

In 72 per cent of the cases LEV owners who stated they never made use of the parking places said they had no need for them, while 15 per cent were of the opinion that the parking places are not conveniently located. Another 5 per cent gave other reasons, and the remaining 8 per cent gave no reason at all (cf. Figure 6).

Evaluation of available parking places

A total of 43 per cent of those who returned the questionnaires were of the opinion that not enough parking places are reserved for LEVs. Considering only those who provided an answer, the proportion increases to 56 per cent; 31 per cent felt the parking places available were sufficient; 13% found the number sufficient, but too often used by unauthorised persons. The respondents made 137 proposals for new parking place locations. Most of these concerned Lugano, Chiasso, Mendrisio and Locarno.



Source: Survey on the utilisation of parking places reserved for electric vehicles, summer 2000

Basis: All: 79 non-users
 3- and 4-wheel LEVs: 16 non-users
 2-wheel LEVs: 63 non-users

Figure 6:
Reasons for non-utilisation of parking places

Findings on the basis of the written questionnaire in the summer of 2000

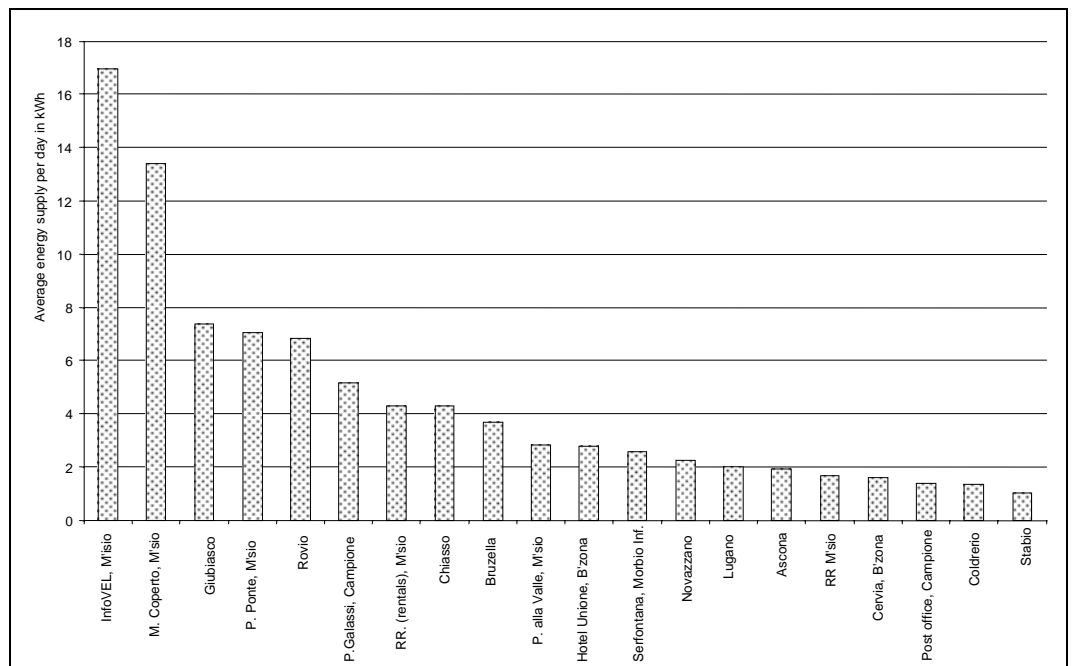
The written questionnaires led to the following findings with regard to the utilisation of the LEV parking places:

- A majority of LEV owners (56%) make use of the parking places reserved for LEVs. The ratio increases to 82 per cent, if only 3- and 4-wheel LEVs are taken into consideration. It is striking that in the case of 2-wheel LEVs the number falls to just 29 per cent.
- Some 59 per cent of those who use the LEV parking places, do so at least once a week. Generally speaking the duration of parking is brief. In 48 per cent of cases the duration was at most two hours.
- When using the parking places most LEV users take advantage of the opportunity to recharge their batteries. Some 68 per cent said they always or often recharged while using the parking place.
- Some parking places are well used, others hardly at all. The former are those in the town centres or close to shopping facilities.

6. The energy supplied by public recharging stations

The energy provided in the 1997 – 2001 period

Between August 1997 and mid-January 2001 the total energy supplied by the 30 recharging stations monitored amounted to about 88,000 kWh, corresponding to an average daily rate of 93 kWh or enough to run 13 LEV automobiles for 3.5 years. With 93 kWh a lightweight electric car can cover a distance of about 360 kilometres. In all 54 per cent of the energy supplied was provided by the recharging stations in Mendrisio. The most commonly used recharging stations were those of InfoVEL and Mercato Coperto, amounting to 32 per cent of the total, cf. Figure 7. The "Lugano, Congress Hall" parking place, which was the single most frequently used space in the summer of 2000 according to the written survey, provided just 2.0 kWh/day.



Source: InfoVEL

Figure 7:
The 20 recharging stations supplying the greatest amount of electricity

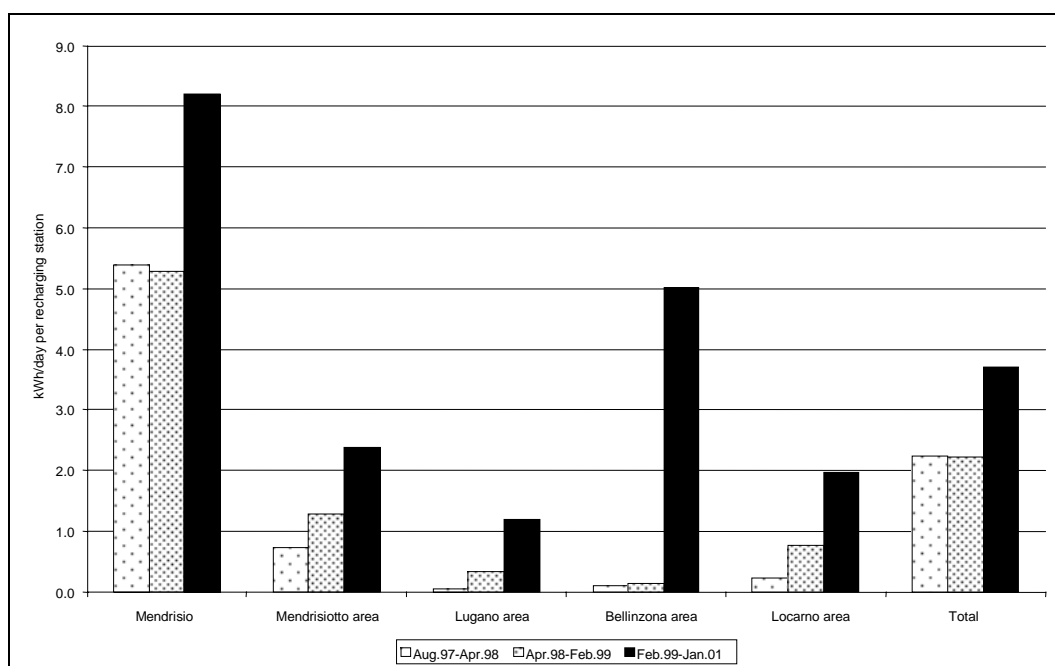
It may seem strange but more energy was consumed in small and relatively remote villages such as Rovio and Bruzella than in the centre of Lugano. It is strange indeed when one realises that there were just six LEV owners in Rovio at the beginning of 2001, and only two in the entire Muggio valley where Bruzella is located. This compares to the 70-odd in and around Lugano, of which about 30 in the town itself.

The explanation is presumably to be found in the different ways of using this installation. The parking places of Rovio and Bruzella are provided free of charge and, both villages being small, are fairly close to the homes of the LEV owners. In Lugano on the other hand there is just one recharging station, and the parking is not free.

This difference is also an indication of how the behaviour of a small number of users can have a meaningful impact on results, i.e. the amount of energy supplied by the recharging station in a given area. The absence of a single regular user can cause a significant drop in the amount of energy supplied by the local recharging station.

The energy supply trend

The daily amount of energy supplied by each recharging station between the August 97/April 98 and April 98/February 99 periods remained constant at 2.2 kWh. In the February 99/January 01 period there was an increase of 68 per cent to 3.8 kWh over the previous period. With 2.2 kWh an LEV automobile travels a distance of about 8.6 km, and with 3.8 kWh a distance of about 14.8 km.



Source: InfoVEL

Figure 8:
Daily energy supply trend for each recharging station, by region, in 1997 - 2001

All regions showed growth, but this was particularly strong in the area of Bellinzona, where the daily energy supply per recharging station rose from 0.1 kWh (April 98/February 99) to 5.0 kWh (February 99/January 01). Only in Mendrisio itself was the consumption of energy greater at each recharging station on each day between February 1999 and January 2001, i.e. 8.2 kWh. In the other regions the daily energy supplied by each recharging station varied between 1.2 and 2.6 kWh.

This significant growth presumably reflects the boom in the sale of LEVs that followed the introduction of battery rentals in the summer of 1999 (cf. the *Detailbericht*³ and the summary report "LEV demand, user typology and catchment area").

Findings based on the energy supply data

The energy supply data provided by the various recharging stations reveals the following:

- The amount of energy supplied in the August 1997 - January 2001 period corresponds to the energy requirement of 13 LEV cars for a period of 3.5 years.
- The greatest amount of energy supplied was in Mendrisio at the recharging stations of InfoVEL and Mercato Coperto (close to the Autonoleggio Sud car rental company).
- The energy supplied by the recharging stations has increased considerably since 1999. The main reason for this is presumably to be found in the LEV sales boom of mid-1999.

³ The Detailbericht is available only in German

- Quite a large number of recharging stations provided an extremely limited amount of energy, an indication of how the behaviour of individual users can have a major influence.

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