

Cost optimised development of infrastructure for EV's

It is a proven basic requirement to recharge an EV at the existing infrastructure. Considering the given power limits and the different national standards defining of an improved and international solution seems to be an essential step towards promoting the growth and the acceptance of the EV.

Present situation

Although highly sophisticated charging technologies have demonstrated their ability to provide quick charging at a rate of 20kW or more and some of them are used it is uncertain that any of them represents the sustainable solution which is required in the near future [table 3]. Some reasons are:

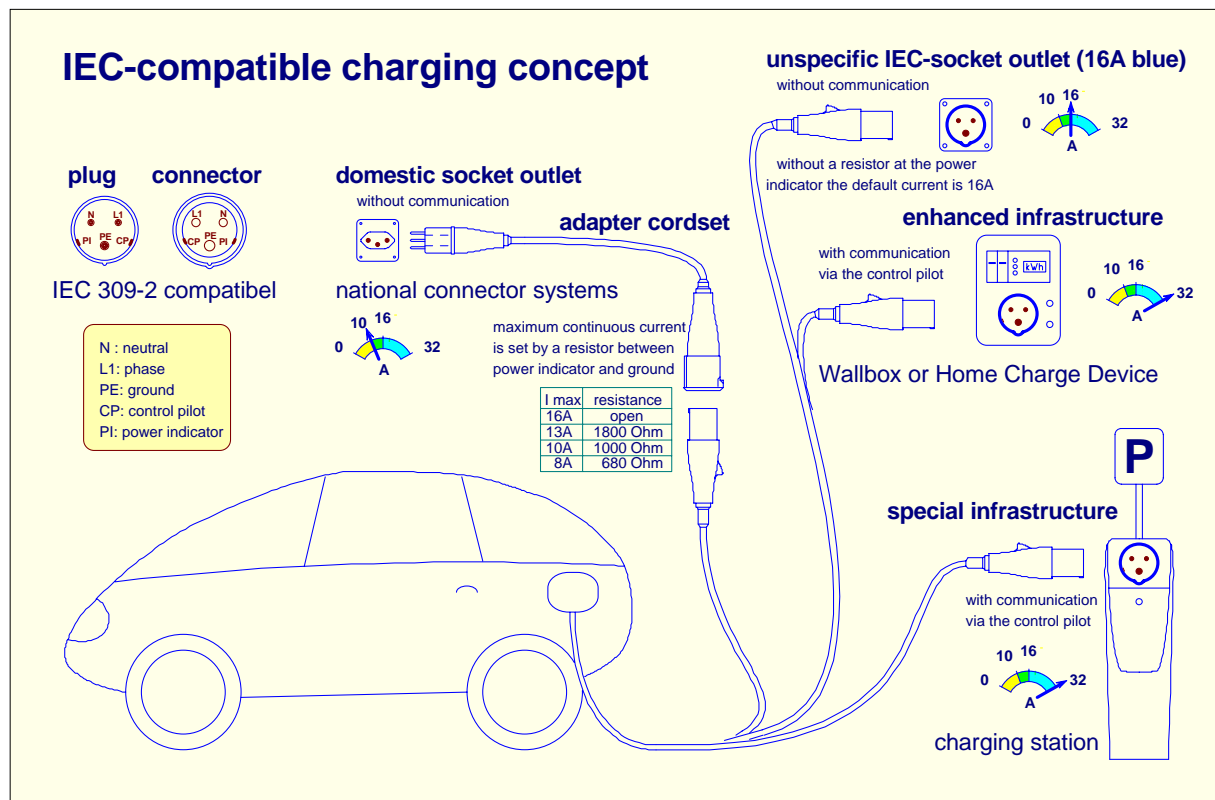
- very high initial costs for additional infrastructure
- extra production costs at the vehicle to provide quick charging ability at a considerable safety level
- charging at home with an on board charger still necessary
- reluctance of suppliers to support quick charge systems due to their high peak power demands
- test markets demonstrated lesser importance of quick charging on the part of the user than initially assumed

On the other hand, the given power limit of the existing household plug and socket system appears too low for the next generation of electrical vehicles (e.g in Switzerland 2.3kW). To meet the demands of modern EV's, the infrastructure should provide at least 7kW to achieve an attractive charging time time of 2 or 3 hours.

The concept

We are an international group of companies and organizations under the auspices of BRUSA Elektronik and have been commissioned by the Swiss Government to implement a sustainable structure for accelerated charging at the Mendrisio project, which should be fully compatible to the existing charging facilities particularly to the common household outlets.

This concept uses a single phase connection at a maximum current of 32A and will provide in Europe 7.2 kW @230V and in the United States 7.7 kW @240V input power. It is based on the IEC 309-2 plug and socket system and was introduced by MENNEKES to the car manufacturers in 1996 [see picture 2].



picture 1: schematic of the down compatible charging architecture

Charging a vehicle at a higher rate than common equipment needs shall have additional control and safety features according to an IEC proposal. These functions are provided by a

pilot contact and a second additional pin, the so called power indicator. The communication provided by the control pilot is done according to the US standard SAE 1772 „control pilot“.

Further the control pilot enables the control of the charging power e.g. by mains modulation or other means of power management.

To provide safety in public charging areas special features prevent from abuse or unauthorised operation.

Compatibility to existing equipment

Each 32A dedicated outlet can be operated with existing vehicles without any restriction. In case of lack of communication the supply will behave as a common unspecific device.

For recharging of a vehicle equipped with a high power charger, the specific adapter cordset indicates the rated current of the national plug and socket system via the power indicator. Therefore the danger of tripping of the line fuse will be reduced significantly. The adapter cordset consists of a common male household plug and an IEC female plug, equipped with the particular additional contacts.

In both cases the power is automatically limited according to the given circumstances. At least the previous level will be reached at the highest possible safety level. The entire system complies with the recent IEC standard proposals of the IEC/TC69/WG4 committee.

How to introduce the system

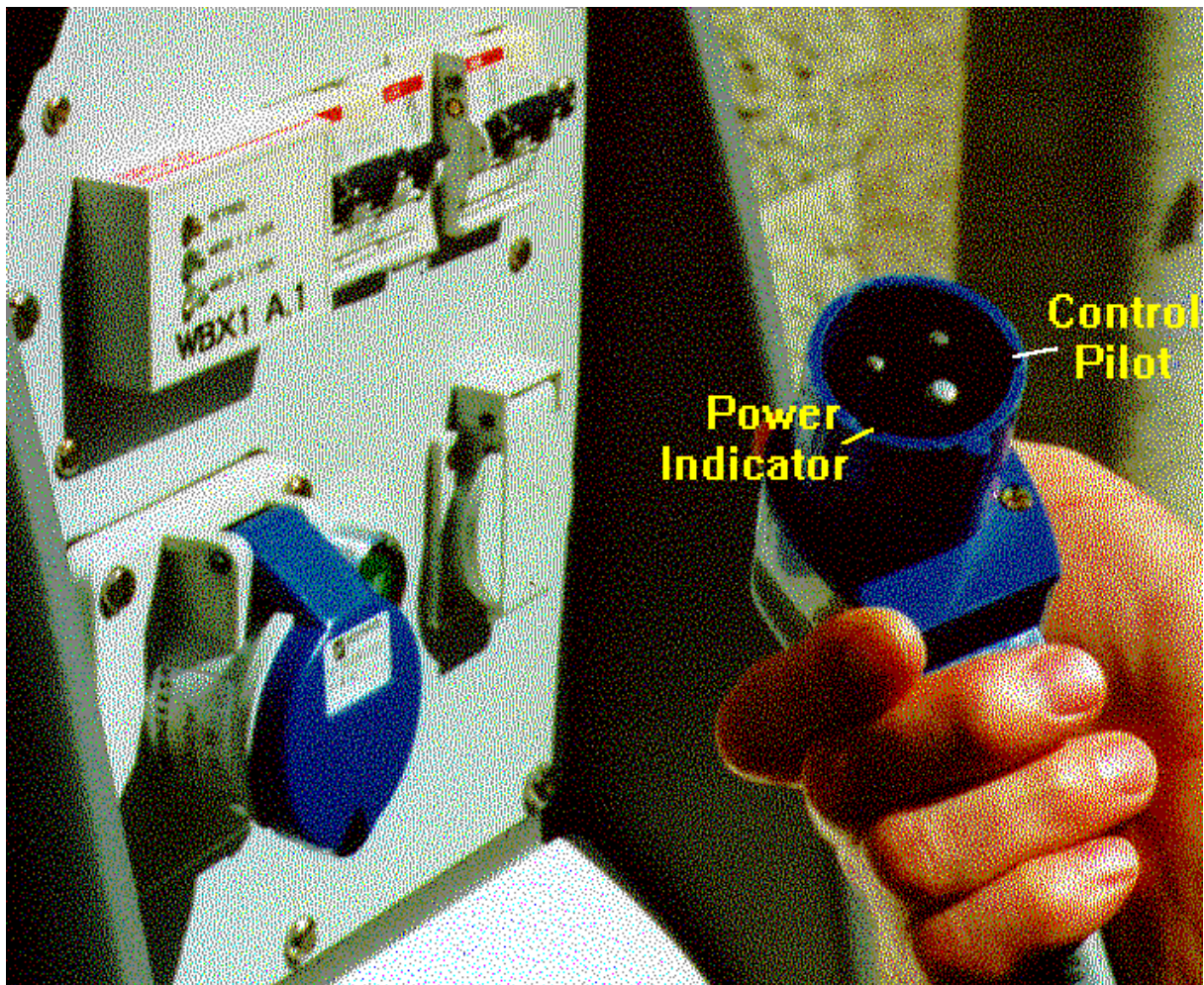
The first step was the introduction of a pilot charging station and vehicles equipped with a 7kW on board charger in June 1997 at the Mendrisio project.

Now partners are sought who can provide a commercially available or at least viable attractive EV, equipped with a battery system that can accept a charging power of 7kW.

By shortening the typical charging time we expect a significantly improved performance of the entire vehicle. Thus benefits to the user are gained without the high infrastructure investments necessary for other quick charging systems.

In a further step the public charging infrastructure of a restricted are will be improved according the system requirements. Minor changes according to the gained experience could happen in this phase.

Finally we try to achieve an agreement about the basic structure wherever a new EV test market is established. It is our main goal to support cost optimised and international compatible infrastructure solutions for EV's and to increase their attractiveness.



picture 2: the IEC 309-2 compatible plug and socket