

# EVS 23

December 2 - 5, 2007

SUSTAINABILITY:  
THE FUTURE OF TRANSPORTATION

ANAHEIM, CALIFORNIA USA

## Designing low cost infrastructure

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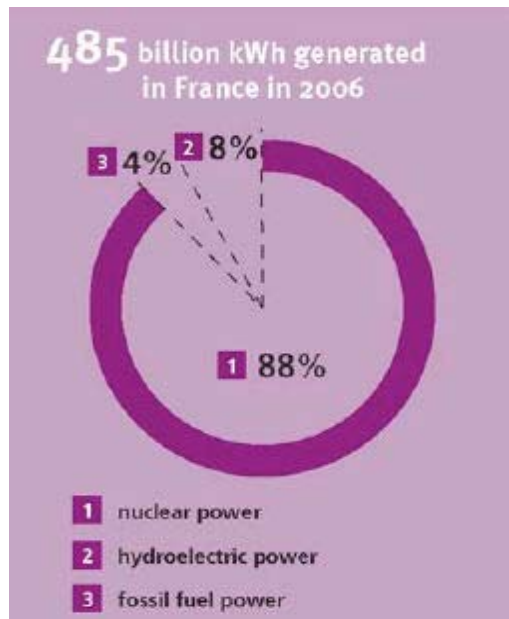
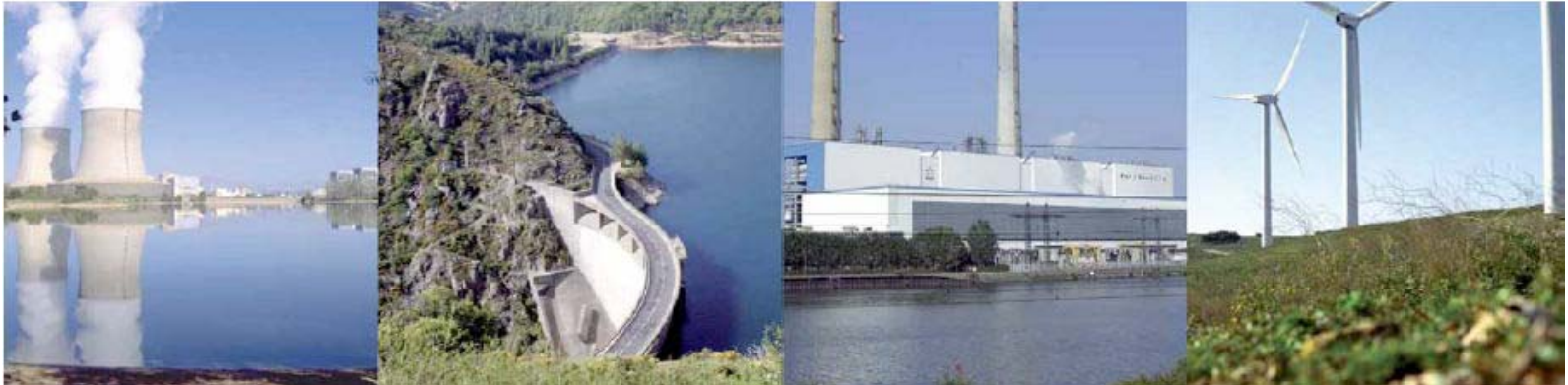


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## EDF : Key figures

- 37.8 million customers world-wide
- Total installed capacity 128.2 GW
- Total world-wide production 633TWh of which 485 TWh in France
- Very low CO<sub>2</sub> emissions (4% fossil fuel in France)
- 1500 EVs

# Present situation of European infrastructure

- Infrastructure installation has stagnated since 1999
- A few companies are still manufacturing systems
  - we have identified 4 companies in France, two in Italy, 2 in England, one in Switzerland. Others certainly exist .
- Most energy companies contacted simply indicate that a domestic plug is to be installed
- No consensus reached for an EV mains plug
  - Domestic plugs or IEC 309-2 style plugs are preferred.
- Maintenance of the existing IEC 61851 standards is under-way (subject treated later).

# Examples in Europe

Italy : some activity

Switzerland still busy



Gifas in Florence  
Standard IEC 309 plug  
3 pins (no pilot wire)



Progetti for Zincar  
(Milan 42 charging points)



An « honesty » payment  
System that would  
Not work in all places

Italian legislation requires the  
pilot function (mode 3)

# England

## Elektromotive



- Several stations installed
- Use of standard 3 pin plug
- Billing on the post

## Park and Drive



London has become an interesting test ground for commuter EVs

# Existing infrastructure in France



**Curbside charger  
With payment system**



**Simple charging plugs  
without payment  
systems**



**Fast charge (35 kW)  
(some 20 are installed)**

- All connecting plugs are regular domestic 3 pin models
- Some 400 charging points in France
- Usage is low

# The USA

- Mode 3 is obligatory
- The charging cable is often on the charging post
- Question, how will we standardize multi pin plugs ?



## **Standardization : a major element for success**

- To reduce costs we must have compatible systems
- The IEC TC69 committee is revising the existing IEC 61851 standards, SAE is revising the J1772 standards
- Close cooperation has been established between all concerned
  - IEC TC69
  - ISO TC22/SC21
  - the SAE task force



# **We must ensure that the systems in the USA and in Europe be economically compatible**

Most of Europe is satisfied with mode 1

The USA and three other countries require mode 3

# Mode 1 and Mode 3 charging

- Mode 1 charging is accepted by most countries for all charging needs
- This only requires standard leakage current and over-current protection
- There is presently nothing specifically designed for billing and information exchange
- It is proposed at the IEC level that mode 1 charging be allowed up to 32 A. (7300 W at 230 V)

Mode 1 =



+



- Mode 3 requires verification of the earth continuity generally done with a pilot wire (fourth pin)

## But:

- Nobody is worrying about billing
- Efficient billing is a major cost factor
- Data transfer is not clearly identified
- People tend to want to do everything without analyzing real needs

# Present costs are prohibitive

**We must prepare simple cheap systems for the next generation of vehicles**

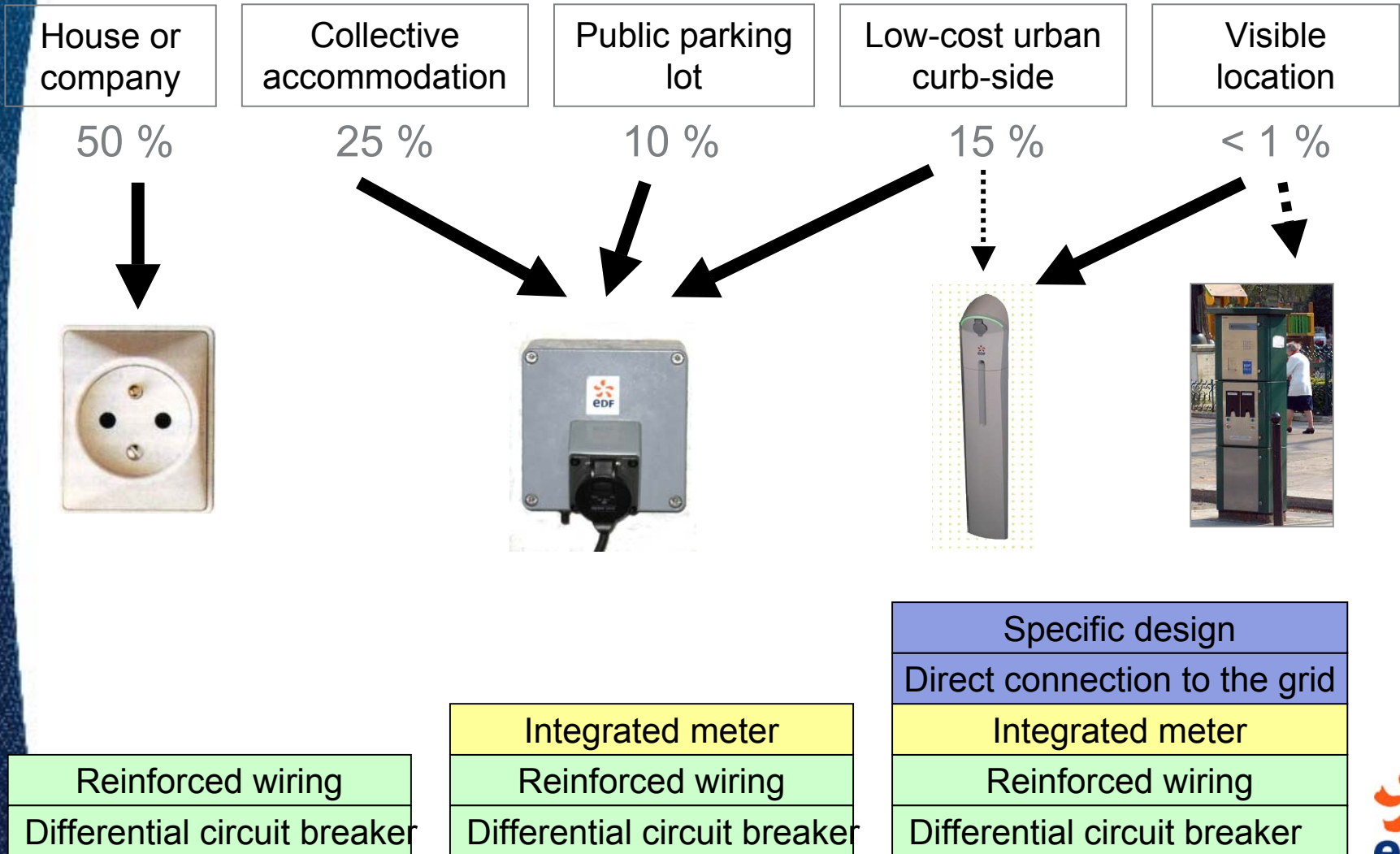
To satisfy the needs of some 2 million electric vehicles  
(plug-in hybrids or electrics)

We need at least 2,2 million charging points  
(including all domestic and exterior systems ...)

But not everybody has a garage !

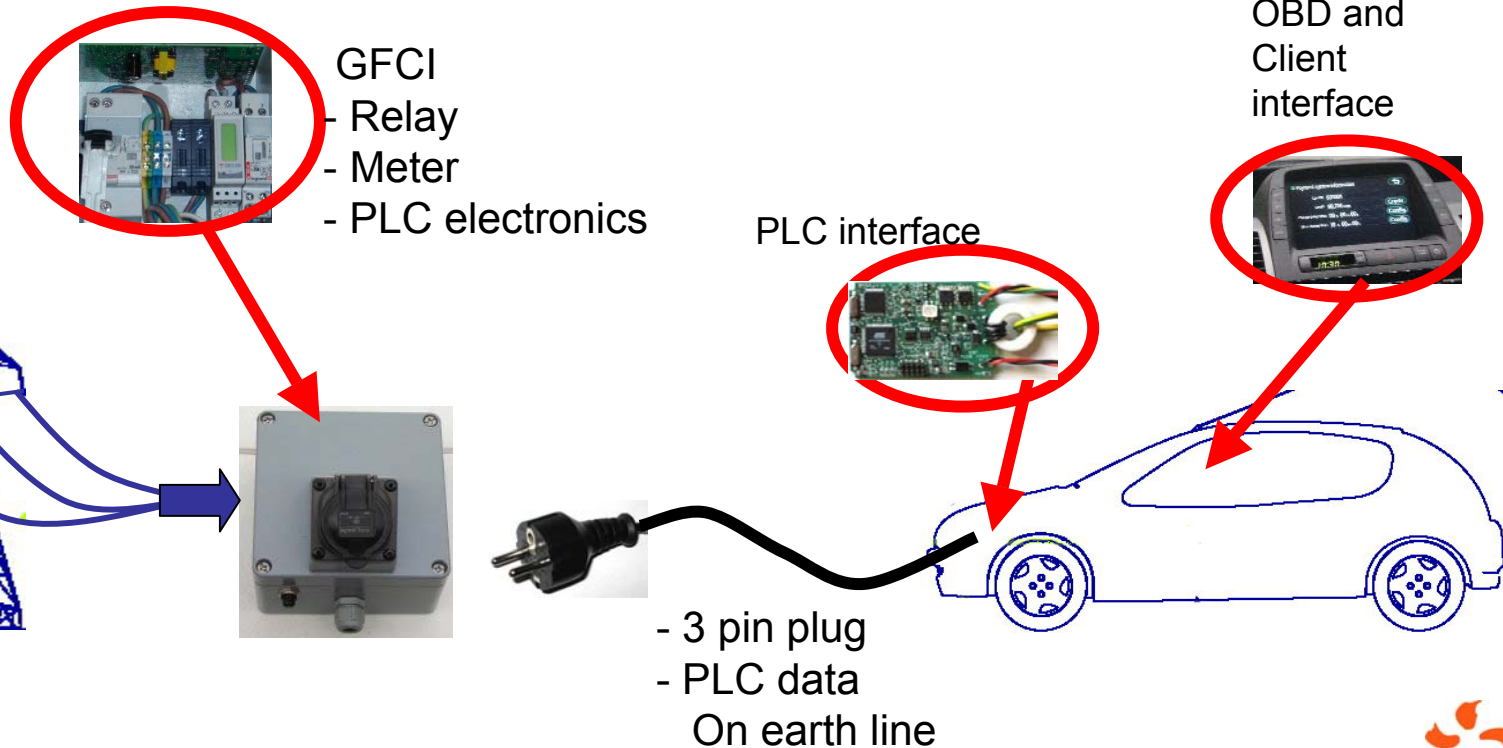
**Curbside infrastructure may double the cost of electricity**

# Estimated needs for the infrastructure of the future in France

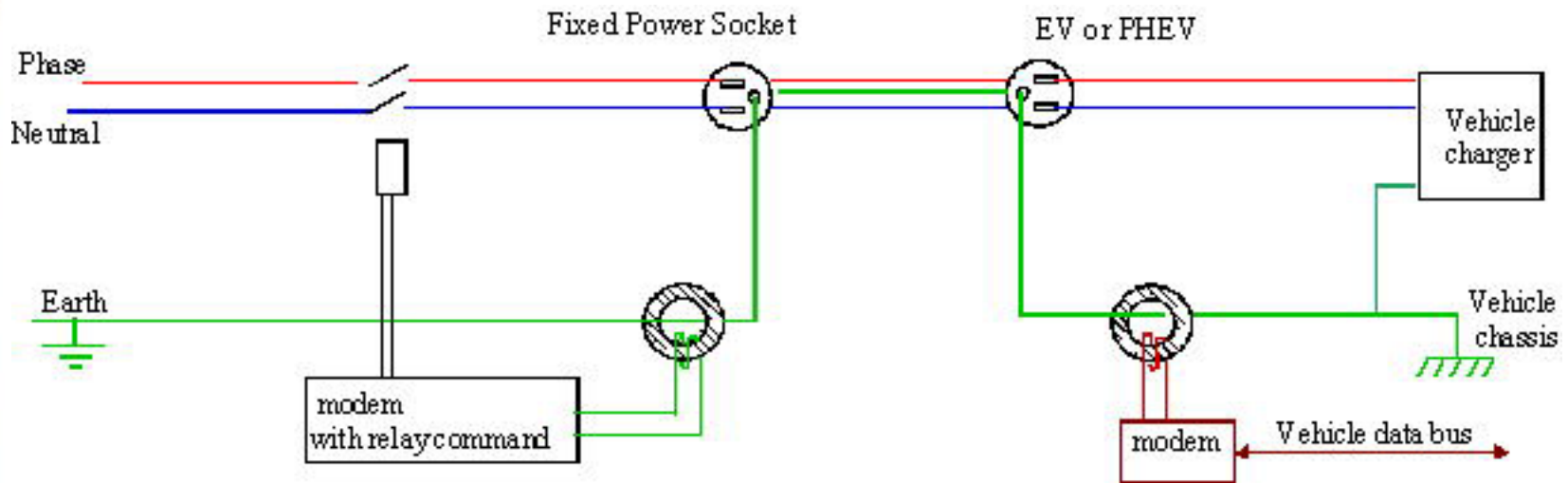


# Design of a simplified charging system

This system optimizes the complet system.  
It uses a display within the car to greatly simplify  
and lower the total cost of the infrastructure.



# Equivalent mode 3 protection with only 3 pins



Data is transmitted on the earth wire

If the earth wire is cut:

- No data is transmitted
- So no energy supplied
- So we have equivalent mode 3 protection

The system was presented the 5<sup>th</sup> of September in Paris and is now undergoing intensive testing



This does not mean that Toyota has definitely adopted the system

But Toyota, amongst others, is seriously testing the system with EDF



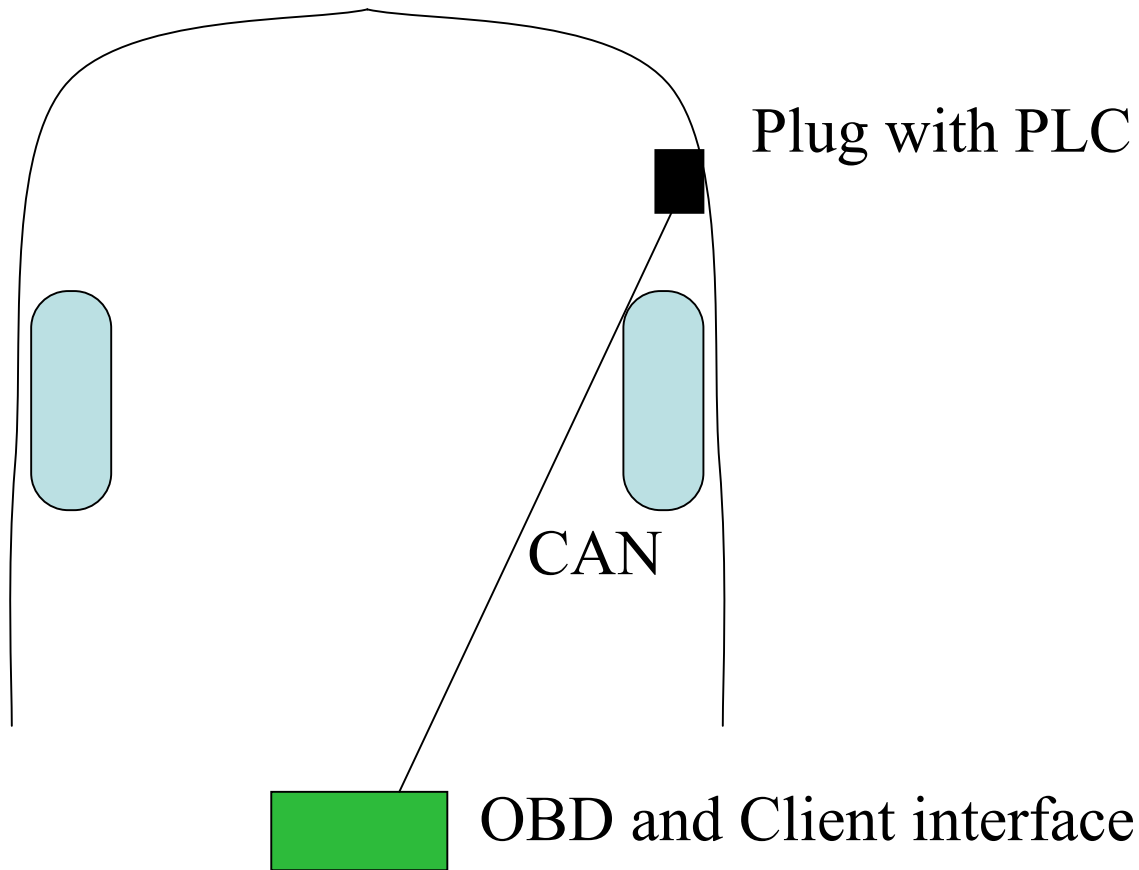


## The vehicle navigation interface is used for the payment system



The client interface for charging and payment is integrated into the proto-type vehicle dash-board by Toyota

# The system greatly simplifies wiring in the car



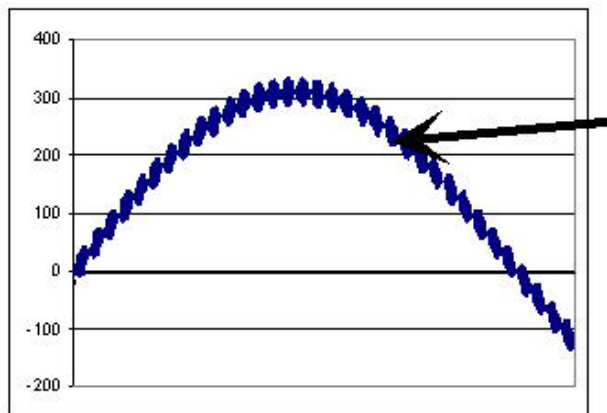
# Tests done on the complete system

- Tests are carried out in accordance with IEC 61851-xx
- The device is totally compatible with present requirements
  - ▶ Supply voltage harmonics > 17% THD
  - ▶ Voltage dips and supply interruption
  - ▶ RF immunity (80MHz – 1000 MHz) > 25V/m
  - ▶ 5 kV stand off
  - ▶ etc.



# Susceptibility to adjacent CPL systems

- The standard test only requires criteria B (recuperation after loss of control)
- The device maintains full control when subject to interference that far exceeds all possible voltage levels



14V RMS  
110 kHz  
signal applied  
to 230V

(14 V RMS at 110 kHz with  
frequency and  
amplitude modulation)

# The same system will be used in city centers



- The same electrical scheme is proposed as shown in the preceding case
- Esthetics are a major concern
- Installation costs in cities remain very high

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Thanks for listening

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