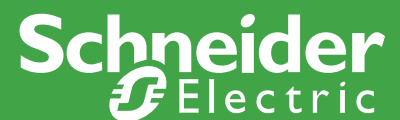
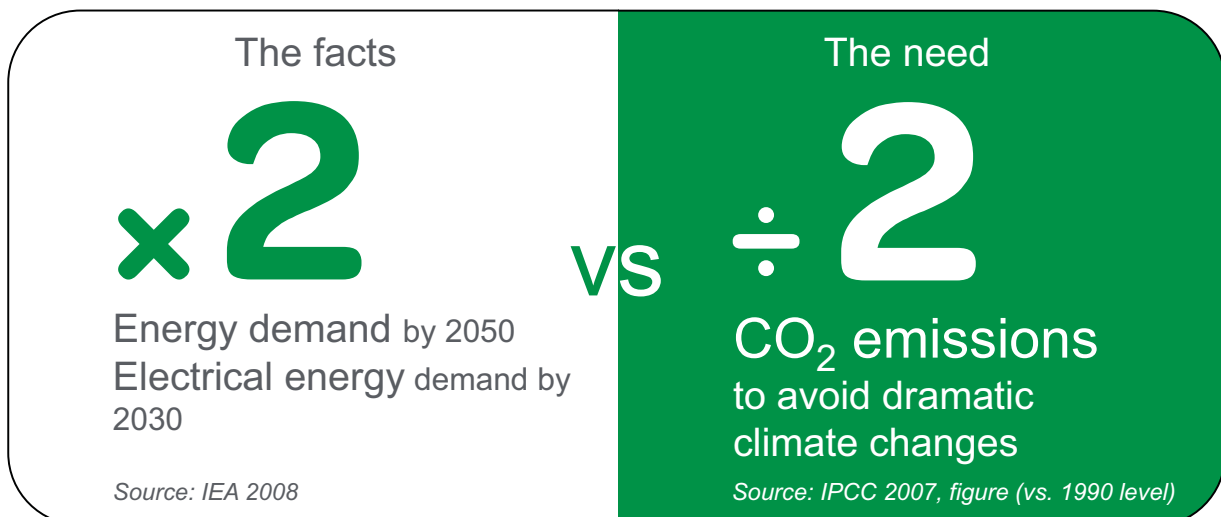


# Electric Vehicle Solution Schneider Electric

Jan. 2011

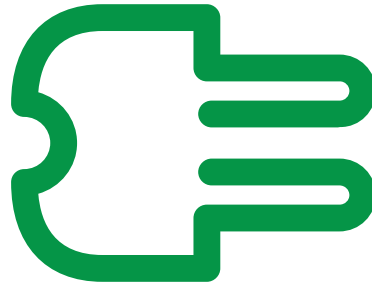


## The energy dilemma is here to stay



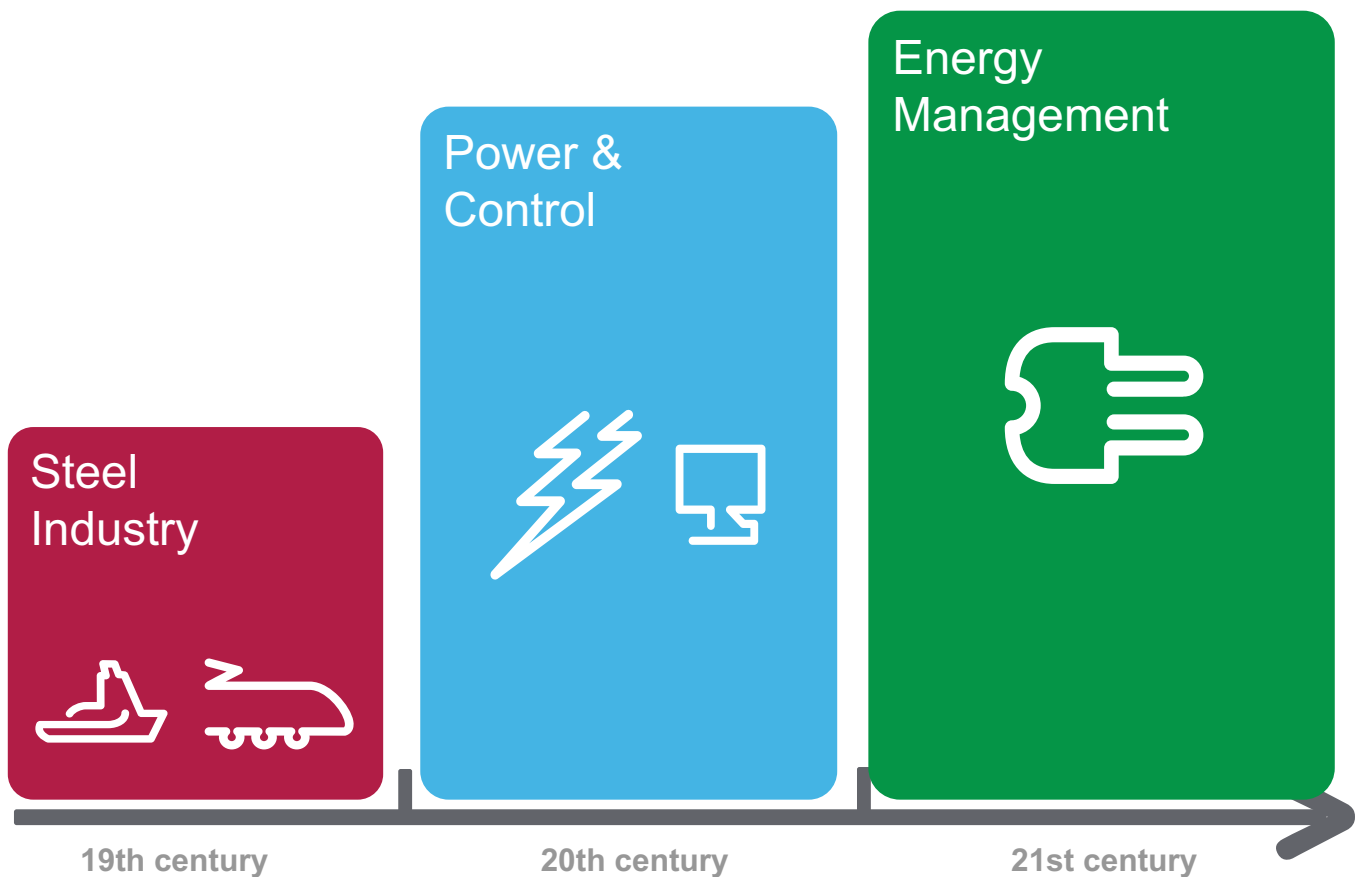
Energy management is the key  
to address the dilemma

Our answer:  
Helping people make the most  
of their energy



3

More than 170 years of history



4

# An international and sustainable growth

**15.8**

billion sales in 2009

**34**

% of sales in new economies

**100 000+**

people in 100+ countries

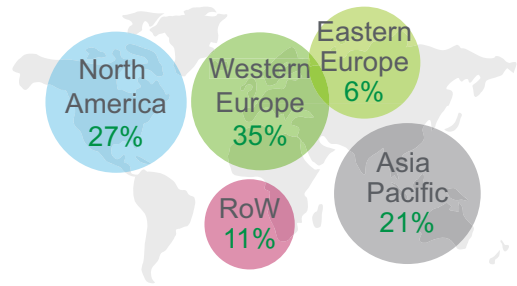
**330**

in *Fortune 500* ranking

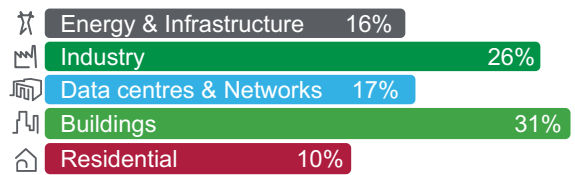
**5%**

of sales devoted to R&D

Sales by geography – 2009



Sales by End markets – 2008



Listed at the Paris Stock Market – CAC40

## A unique positioning...

Global specialist in Energy Management

Energy production & transmission



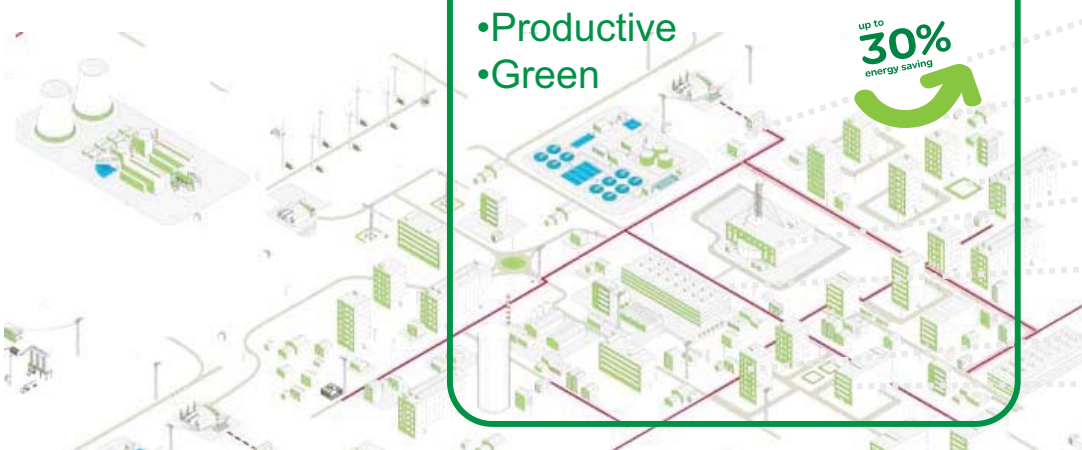
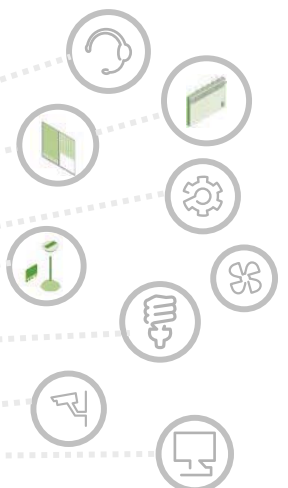
Making energy:

- Safe
- Reliable
- Efficient
- Productive
- Green

Covering **72%** World Energy consumption

up to **30%** energy saving

Energy usage



# A deep commitment to sustainable development...

## Environment

- Adherence to standards like RoHS, REACH, WEEE
- Eco-design
- ISO14001 certification



## Business

- Head of *Green Grid*
- Signing the *Clinton Climate Initiative*
- Partner of *Alliance to Save energy*



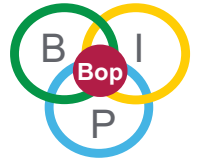
## Ethics

- Global compact of the United Nations
- Principles of responsibility signed by every employee



## Access to energy

- Access to electricity for 1.6 billion people
- Training disadvantaged young people in the field of energy
- Business angel for local entrepreneurs



## A measured commitment

- The planet & society barometer



6.00 / 10 | January 2010

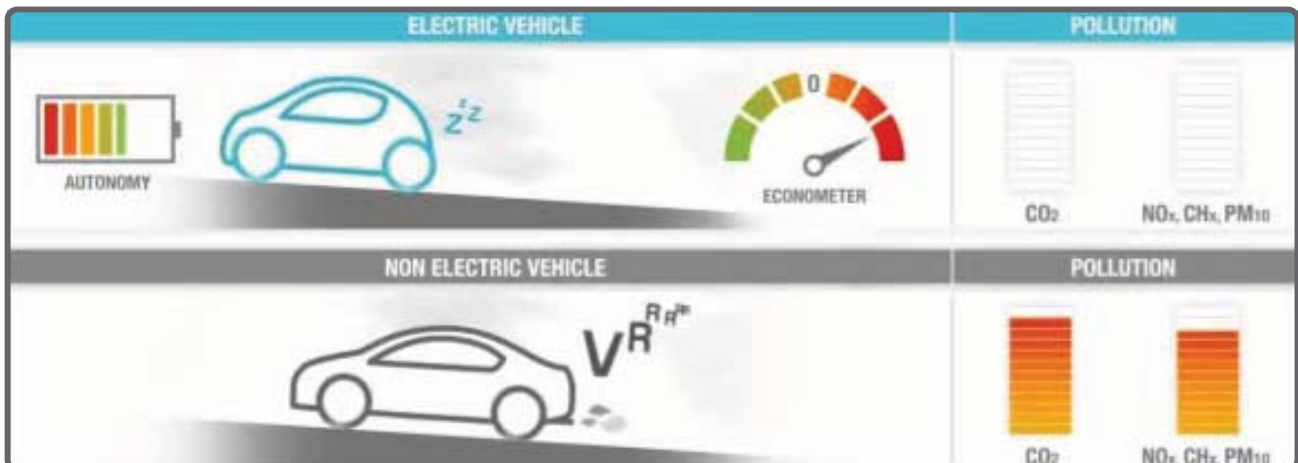
3.00 / 10 | Grade at January 2009

7

## ... especially to sustainable mobility

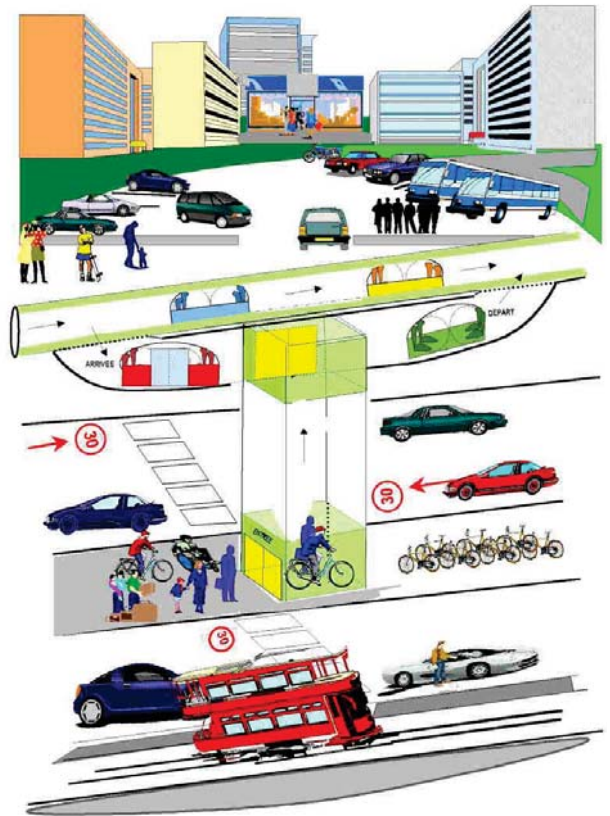
The electric vehicle is the automotive industry's answer to the climate change problematic and to fossil fuel scarcity.

With no greenhouse gas emission nor particles and silent, the electric vehicle is an efficient and sustainable solution for urban centres.



# EV, one of the links in the sustainable urban mobility chain

- 50% of the worldwide population is urban
- Their daily covered distance is lower than 20 km.
- One of the solutions to reduce urban pollution, congestion, and adverse health effects is the development of sustainable, energy efficient multi-modal transportation systems, from public mass transportation to individual transportation.
- The EV is the last missing link in the overall sustainable urban mobility chain and the adequate recharging infrastructure is a key success factor for this system.
- See UNCRD Environmentally Sustainable Transport initiative in Asia, Johannesburg Plan of Implementation, AMI3 program of ADEME...



## The connection between EV infrastructure and smart grid

- The introduction of EV will increase the demand for energy and thus solicit and stress the electrical network. → Demand response management by utilities.
- EV may one day enable their owners to inject their non consumed energy into the utilities electrical network. → Vehicle to grid  
This is most likely to happen in 2 cases:
  - In case of critical peak reached on the network to avoid black out. In that case, utilities would need to use the batteries' available energy for a very short time and in very rare occasions. Batteries were conceived to tract vehicles and not to feed the network.
  - In case of local black out provoked by storms or heavy snowing episodes. The battery could be used as back-up power to ensure the house's energy autonomy.

# Schneider-Electric is a partner in the development of electric vehicles

How to develop relevant offers for this new market?

- We participate in **experiments**.
- We are **Launching** our offer.
- We are involved in the **standardization** process.
- We are acting in **institutions working groups**.
- We build **alliances** to answer quickly.

Through this commitment, we build a **suitable offer for future needs**.

- Offer presentation.

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Schneider-Electric offer :  
Launched at Paris Auto Fair



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# Standardization : SE is an actor in committees for the EV charging infrastructure :

Organism	TC/SC	Published standards	Topic
IEC	TC69	61851 1, 2.1, 2.2	Charging systems
IEC	SC23H	NP 62196	Physical connectors
IEC	TC22/SC21a	PT LiP	Lithium ion cells
IEC TC64	TC64	50364-7-760	Electrical installations
ISO	TC22/SC21	N2086	Lithium ion batteries
ISO	TC22/SC21	6469	Electric security on EVs
ISO/IEC	TC22/SC3	JWG V2G C1	Communication protocol vehicle/grid
USA-SAE	Hybrid vehicle task force	J1771	Definition of charging connector
USA-SAE	Hybrid task force	J2836	Communication between vehicle and grid

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## IEC 61851- Mode 1

### Mode 1: Fixed, non-dedicated socket.

Electric vehicle connected to the main AC distribution network through standard plug-in connector bases (standard current: 10 A) located on the power supply side, single-phase or three-phase, with earthing power supply and protection conductors.

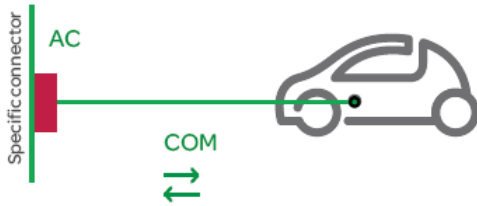


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# IEC 61851- Mode 3

## Mode 3: Fixed, dedicated circuit-socket.

Electric vehicle connected to the main AC distribution network through specific connector and dedicated circuit; control and protection functions permanently installed in the installation.



(installed with smart device and protection device)

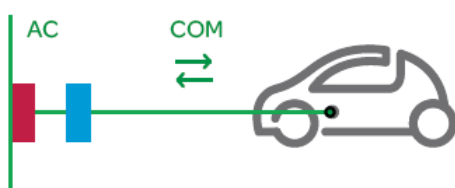


15

# IEC 61851- Mode 2

## Mode 2: Non-dedicated socket with cable-incorporated protection device.

Electric vehicle connected to the main AC distribution network through standard plug-in connector bases, single-phase or three-phase, with earthing power supply and protection conductors and cable-incorporated piloting function between the electric vehicle and the control connector or panel.



(cable-incorporated smart device and protection device)



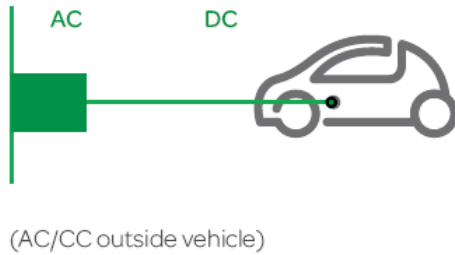
16



# IEC 61851- Mode 4

## Mode 4: CC connection.

Electric vehicle indirectly connected to the main AC distribution network through a standard external charger. Control and protection functions and vehicle recharging cable permanently installed in the installation.



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## EV Plug Alliance by 17 major industrial players



→ Create an **eco-system** with one strong standard, easing development of solutions and practical applications to revolutionize the electric vehicle charge

→ Alliance is totally **open** to new members



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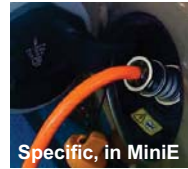


# On the car side...

## Large variety of inlets and connectors

Several for low power (16A-32A)

2 connectors for high power (1 DC, 1 AC)



- type 1,
- type 2
- DC connectors
- Specific connectors
- Small vehicles (bikes, scooters, ...) have their own connector types.
- New types under study (e.g., AC + DC)

# On the infrastructure side...

In the 3 types defined in the future standard **CDV 62196-2**, types 2 and 3 are considered...



### Characteristics

Nb of Phases

**Type 1**  
Single Phase

**Type 2**  
Single Phase  
Three Phases

**Type 3c**  
Single Phase  
Three Phases

Current

32 A

70 A (Single Ph)  
63 A

32 A

Voltage

250 V

500 V

500 V

Nb of Pins

5

7

7

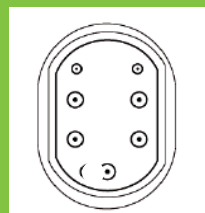
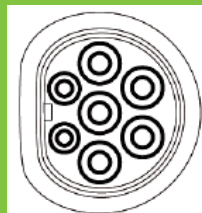
Shutters IPxxD

No

No

Yes

Socket Drawing



# So, how to deal with the plug issue

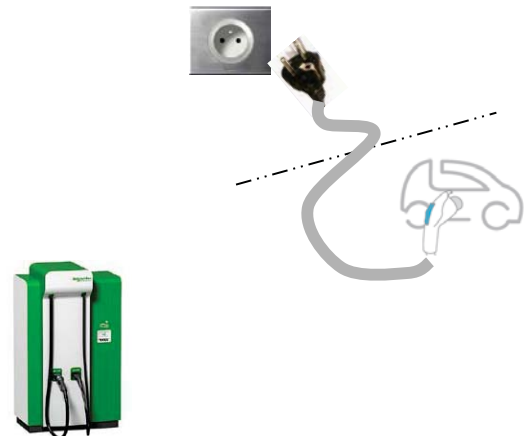


- A large variety of connectors on vehicle side and plugs on infrastructure side...
- Could lead to the need for many cables in a car
- User: « I just want **ONE** cable with my car ! And be able to charge everywhere in my country and in Europe ».

Solution exists for several use cases

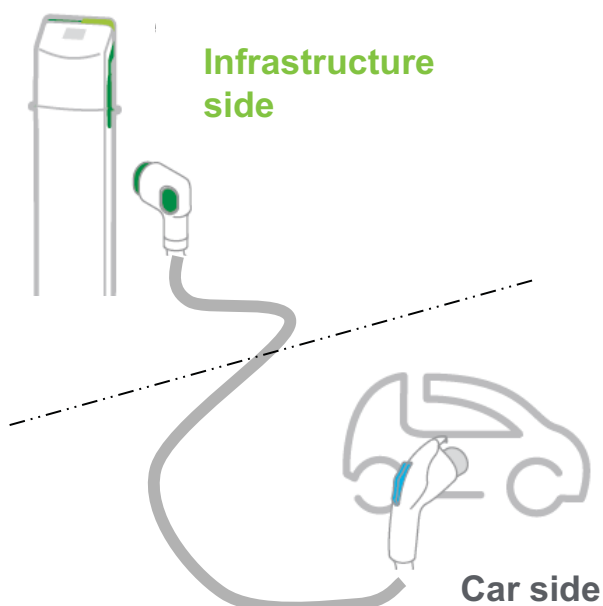
- For slow charge on domestic socket : with a limitation to 10A, will provide a europe wide solution, in mode 2.
- For fast charge : problem solved with attached cable to the charge spot
  - Only type 2 inlet / connector on the car in AC
  - Chademo DC inlet/connector on car for DC
  - Dual cord pump, like diesel and unleaded

But what about standard charge (3-22 kW ?)



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## Standard charge (3-22 kW AC)



Must comply with **existing standards and safety regulations.**

- IEC 61851-1 Ed2 **safety** standards
- Several countries impose « **Shutters IP xxD** » on the **infrastructure** side.

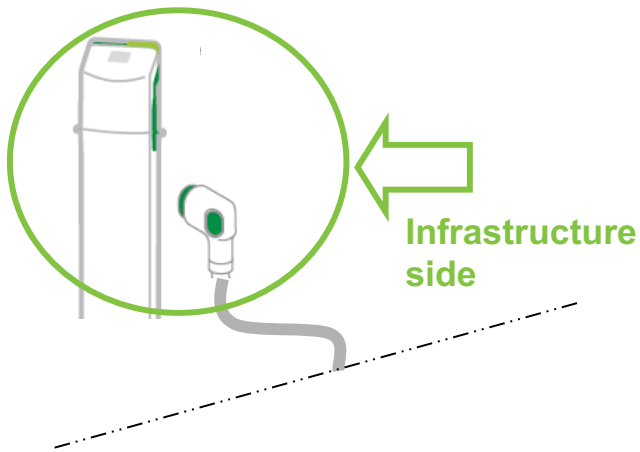
Must address **car OEM** requirements on car side connector.

Must provide **single** cord solution for user.

The question is not to select a plug but to select a **connection system.**

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## EV Plug Alliance proposal up to 32 A...

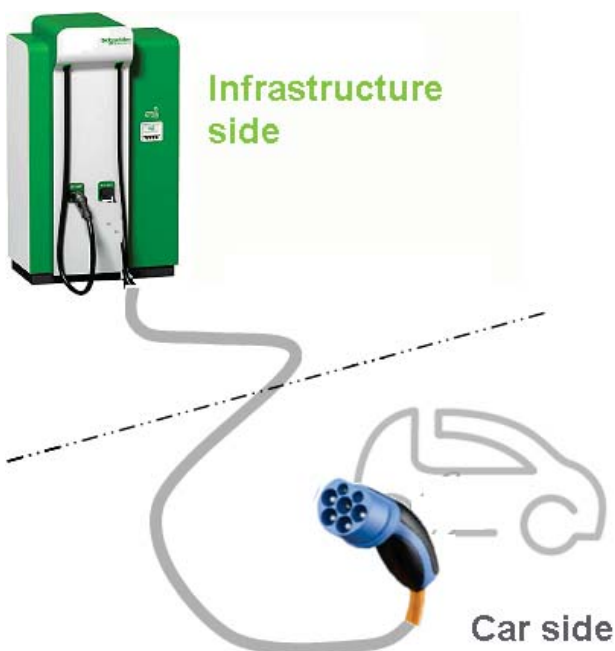


- Apply a concept similar to **USB standard**: a unique standard with **different type at each end**.
- On **infrastructure side**, up to 32A, when the cord is **detachable**, select type 3 EV Plug Alliance, with unique footprint for mono / tri, 16 or 32 A and with shutters.
- On car side, connector selected by car OEM.



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## EV Plug Alliance proposal Over 32A



- Over 32A (not at home), cord should be permanently attached to the spot, stored in a storage compartment which may be locked, hence not useable by non informed persons.
- The connector at the end of this permanently attached cord is type 2.

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# A convergence solution that benefits everyone



The approach solves all issues :

- A unique cord needed in each car in Europe, as required.
- Type 3 on the wall provides a solution fully compatible with national codes in all european countries and optimized for the use in buildings, ready for V2G.
- Type 2 connector on the car for fast charge, which is critical for many car OEM who have already completed car design
- Fully in line with existing IEC standards and standards in preparation

A very flexible solution:

- Allows evolution of connectors on the car side without need of retrofit in buildings (eg., if the car plugs features AC/DC capability in the future)
- Because it does not impose the same type on both sides, it gives flexibility to select an optimized connector on the car for low power EVs: the cord for these cars would have a type 3 on the wall side; this will be very important for interoperability for small cars or scooters to use the charge spots.

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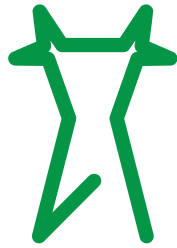
## Schneider-Electric Offer

# Our 4 stakes



Safety of users

Daily connection & disconnection of 30 to 60A sockets !



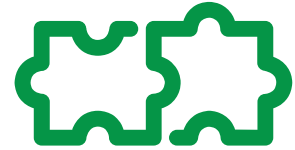
Energy Management

Charging load to manage / Demand Response



Panel and installation

Before or after the meter, management integrated or not with home control

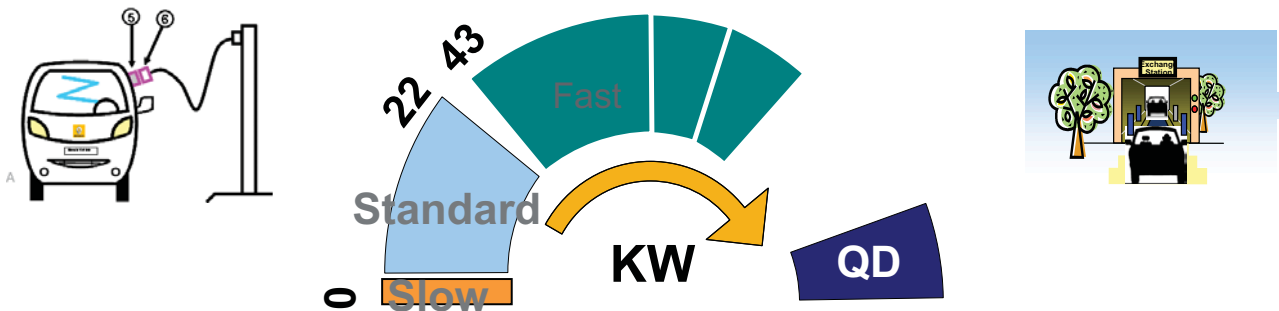


Ergonomics

Take into account the end user's requirements (simplicity, rapidity...)

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# Charging power / duration (ex 20kWh)



	<b>Slow charge</b> ➔	<i>AC Single Phase : 230V – 8/10A Domestic Socket !</i>		<i>12h to 8h</i>
	<b>Standard charge</b> ➔	<i>AC Single Phase : 230V – 16/32A AC Tri-Phases : 400V – 16/32A</i>		<i>8h to 1h</i>
	<b>Fast charge</b> ➔	<i>From 43kW up to 150kW (future) DC or AC – pending on car architecture</i>		<i>30min to 10min</i>
	<b>Battery exchange</b> ➔	<i>In a few minutes</i>		<i>3min</i>

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# The recharging infrastructure, the key success factor for the electric vehicle



## Our Offer

- **Products: All the components for EV Recharging Spots and Stations.**

- MCB, RCDs, RCBO, RCCB, Contactors, Load Controller, Surge Arrestors, Energy Measurement, ...



- **Equipments:**

- Ready to install Recharging Spots and Stations



- **Solutions**

- Supervision
- Services
- Customised projects



# Our offer's key added values

1. **Interoperability** → EV, PHEV, all brands
2. **People and goods safety** → NO compromise
3. **Ergonomy** → simple gesture, fast, auto, pilot lamp...
4. **Charging efficiency** → best compromise between rapidity and economy, energy management (modulation de charge, délestage, Vehicle to grid...)
5. **Identification and authentication** → vehicle, people
6. **Measurement** (time, cycles, kWh, statistics, billing) → for all types of business models and to guaranty EV footprint)
7. **Services enabler** → billing, fleet management, alerts, and services still to be invented (diagnosis, pre-heating, hotline, info...)

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## Residential

- **Safety**
  - Mode 3
  - Earth leakage protection
  - Shutters on connectors
  - Lighting protection
- **Ergonomics**
  - Cable arrangement
  - Outlet arrangement
  - User Interface
  - Connectors
- **Energy management**



sept 1 - MURAL

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# 1. Resi recharging spot

- Wall mounted
- Ground-set



## Standard offer 3kW

- Residual current device
- Contactor
- Contrôleur FP ou CPL
- Socket
- Coffret extérieur

## Options

- 2<sup>nd</sup> socket
- 6 KW upgrade
- Surge arrester
- Metering (statistics, billing)
- Off-peak contactor
- Digital time switch
- Load-shedding contactor
- GPRS Modem
- Cable and base

## Evolutions

- New enclosure (look& feel, ergonomoy)
- Socket (ergonomy, standard)
- Energy management (Load-shedding, etc.)
- Vehicle to grid



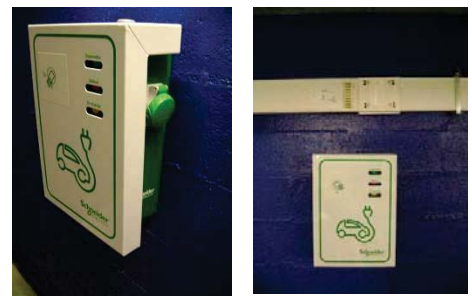
Socket moving possibility

## Customer's benefits

- Safety
- Robustness and sealing
- Flexibility

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# Parking wallmounted



# Parking floorstanding



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## 2. Parking recharge station

- Wall-mounted cabinets coffrets muraux
- Ground-set



### Architecture standard

#### 4 spots (6 – 23kW)

- Connection to existing LV switchboard
- Customer interface cabinet
  - Residual current devices
  - Badge reader
  - Controller (identification)
  - Contactor
  - FP or CPL controller
- Recharging spots
  - Sockets
  - Lights

### Options

- 2<sup>nd</sup> socket on spots
- Surge arrester
- Metering (statistics, billing)
- GPRS Modem
- Vehicle presence detection
- Socket interlocking
- Energy management, diagnosis...

### Evolutions

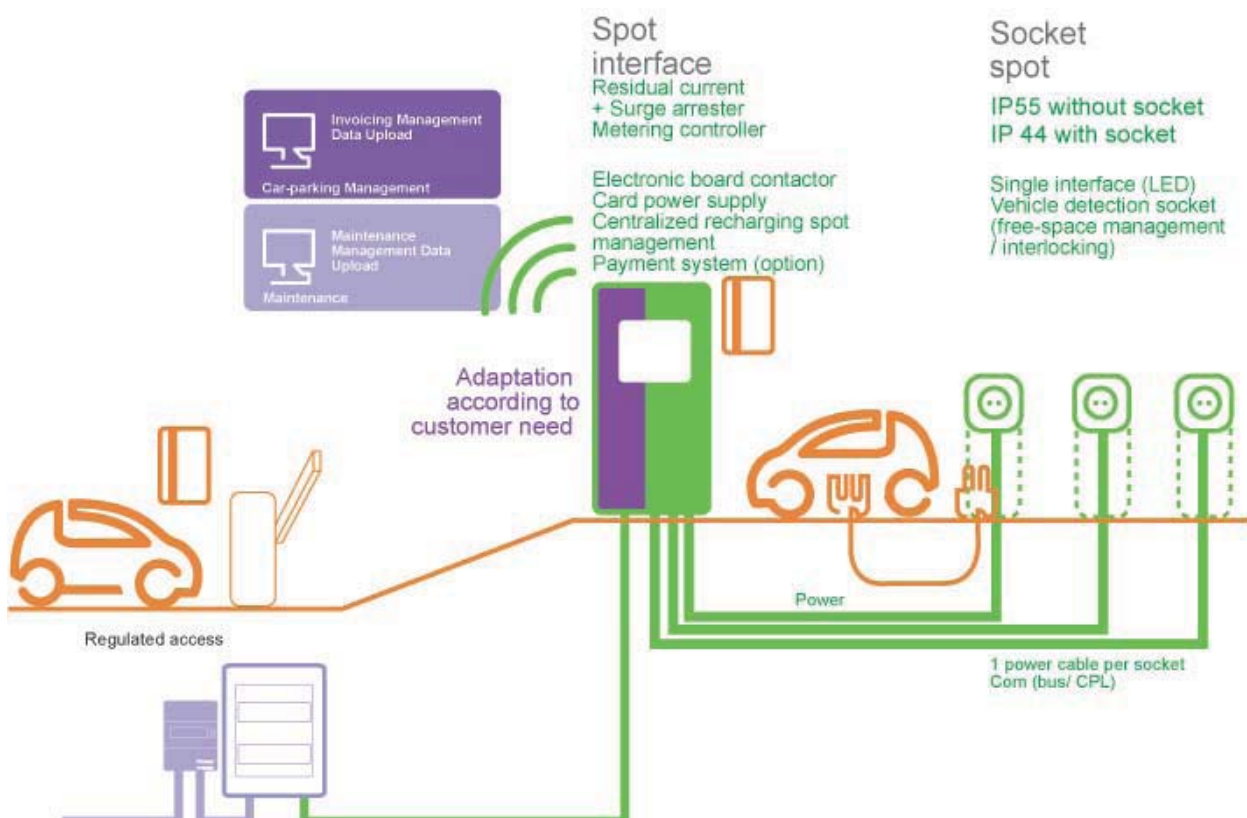
- New enclosure (look & feel, ergonomics)
- Socket (ergonomics, standard)
- Energy management
- Distributed architectures

### Customer's Benefits

- Safety
- Evolutivity

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## Example of car park type architecture



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# Fast charging Station Development

- AC, DC or AC+DC solution
  - DC output 500V 125A Chademo
  - AC output 400V 63 A
  - Payment Device integrated
  - Time to market 01/2011



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## 3. Fast charging station

### Standard content 4X43kW

- MV/LV substation network connection
  - Not necessary if no power increase expectation
- LV distribution cabinet
  - Residual current device
  - FP or CPL controller
  - Contactors
- Pole and connectors
- Badge reader
- Controller and HMI
- GPRS Modem

### Options

- Dry transformer (indoor)
- DC charger
- Active filtering
- Environment integration design

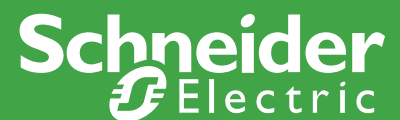


### Customer benefits


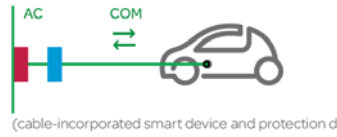


- Safety
- Robustness
- Upgradeability
- Compactness

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# Standard IEC v.s. GB



## Charging Modes in IEC & GB (Mainland China)




	<u>IEC 61851</u>	<u>GB/T XXXX *</u>
<b>Mode 1</b> 	<b>IEC-Mode 1</b> <ul style="list-style-type: none"> <li>• Not specify</li> </ul>	<b>CN-Mode 1</b> <span style="color: red;">Not Recommended</span> <ul style="list-style-type: none"> <li>• 16A, 250V</li> <li>• 1 Phase / RCD</li> </ul>
<b>Mode 2</b>  <p>(cable-incorporated smart device and protection device)</p>	<b>IEC-Mode 2</b> <ul style="list-style-type: none"> <li>• Not specify</li> <li>• Depend on countries</li> </ul>	<b>CN-Mode 2</b> <ul style="list-style-type: none"> <li>• 16A, 250V</li> <li>• 1 phase / Pilot</li> </ul>
<b>Mode 3</b>  <p>Specific connector</p>	<b>IEC-Mode 3</b> <ul style="list-style-type: none"> <li>• Not specify</li> <li>• Depend on countries</li> </ul>	<b>CN-Mode 3</b> <ul style="list-style-type: none"> <li>• 32A, 250V</li> <li>• 1 phase / Pilot</li> </ul>
<b>Mode 4</b>  <p>(AC/CC outside vehicle)</p>	<b>IEC-Mode 4</b> <ul style="list-style-type: none"> <li>• Up to 1000 VDC</li> <li>• Depend on countries</li> </ul>	<b>CN-Mode 4</b> <ul style="list-style-type: none"> <li>• 750V DC</li> <li>• 125A / 250A / 400A</li> </ul>

\* It has not been officially released but in the progress of final review.

# Charging Plug/Socket in IEC & GB

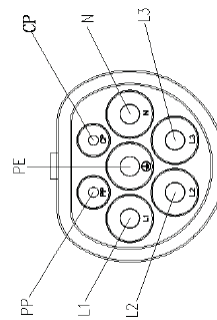
## International recommendation

Types of socket

	Type-1	Type-2	Type-3
Phase	Single-phase	Single-phase / three-phase	Single-phase / three-phase
Current	32 A	70 A (single-phase) 63 A	32 A
Voltage	250 V	500 V	500 V
No. prongs	5	7	5 or 7
Sockets			

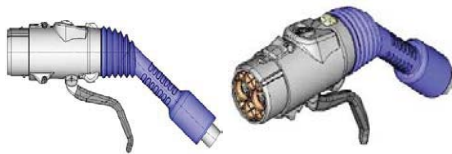
### AC Socket

### GB/T XXXX \*



• It appears that GB still adopts socket/prong definition from Type-2 (AC) ISO recommends.

- For DC power supply, in France
  - Plug will be Yasaki 125A



### DC Socket

• Specified Chinese DC coupler.



充电模式编号	额定电压	额定电流
4	750V	125A
		250A
		400A

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## Draft of China EV Standards (under discussion)

- Connection set for charging — Conductive charging of electric vehicles — **Part 1: General requirements**
- Connection set for charging — Conductive charging of electric vehicles — **Part 2: AC charging coupler**
- Connection set for charging — Conductive charging of electric vehicles — **Part3: DC charging coupler**

To be officially released in Dec end 2010 or Jan 2011

Lead by CATARC

- Communication protocols between **off-board conductive charger and BMS**
- Communication protocols between **EV onboard charger and AC charging spot**

To be official ly released in Q1 2011

Lead by CEC

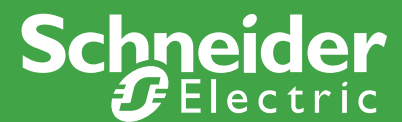
- **Design code** for electric vehicle charging station

The launching schedule is not clear

Lead by CEC

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# Case Reference



## EV :Experiments (extract)



- France, Kleber: Toyota
  - Strasbourg city
  - 100 Toyota Prius Hybrides Plug-In
  - 135 WallMounted and Poles recharging spots Schneider-electric
  - Q1 2010 to 2011



- France, SAVE: Renault et Nissan
  - Yvelines/Seine Aval/Ile de France
  - 100 Renault & 20 Nissan EV
  - 300 WallMounted and Poles recharging spots Schneider-Electric
  - Installation = Q1 2011
  - Experimentation = 2011 to 2012

# EV :Experiments (extract)



- **Danemark, UN conference**
  - **Copenhagen city**
  - SE Vehicles and Recharging Stations available at this UN summit
  - Installation = Q4 2009



- **Belgium, Fast Charge**
  - **Schneider Electric delivers universal charging spots for electric vehicles to Total Belgium**
  - **6 Fast chage stations**
  - Installation = Q4 2010

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## Case Pictures



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# Strasbourg Project – Multipoint Spots

## ● Kleber , France

- Multipoint spot (6~23 KW)
- Electrical protection
- Card Reader
- Specific Coupler – by EV Alliance
  - ✓ Schneider is one of 3 founders of the EV Alliance
- 1 spot for 2 EV cars.
- Flexible Cable



EV Alliance  
AC Type III



# EV pilot projects

### Pilot projects with partners



135 spots in Strasbourg starting from April 2010



Supply fast chargers by Schneider Electric / Fuji to Nissan premises in Japan



100 spots near Paris in October 2010

**RENAULT**

Ultra fast charging station in Grenoble with advanced energy management functions

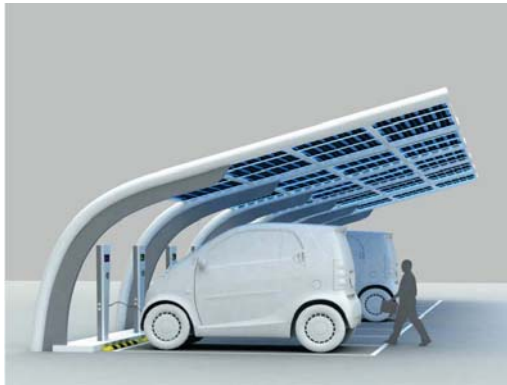
350 set of HMI for fast chargers in Japan





# Huangming Project - 1st Project in China

- Huangming Sunny Vally, Dezhou, Shandong Province, China
  - 8 AC Charging Spots



- AC Charging spot, provide
  - 220V / 380V, 32A
  - meanwhile DC 48V
  - no pilot function due to less the offer of control board
- Combined in electrical monitoring system
  - Schneider SCADA also provided by project team

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Thanks for your attention!



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