



technology that moves the world

Efacec electric mobility

1. Electric mobility at Efacec – an innovation episode
2. Timeline of main achievements
3. Main differentiating solutions
4. How do we stand and what's next?

Electric Mobility at Efacec

An innovation episode



- Efacec endorses the following definition of *innovation*
value creation in a context of change
- Our recent progress in delivering solutions for EV charging infrastructure is such a case
- It results from a virtuous combination of
 - anticipation of market trend towards emergence of EV → - Back in 2008, EVs were identified as a medium term trend for sustainable mobility
 - active knowledge management → - Efacec had important purses of knowledge in *energy automation* and electronic power systems
 - proper time-to-market → - The Mobi.e project, launched in Portugal, set the opportunity for fast development of innovative charging solutions for EM, particularly in the area of fast charging

3

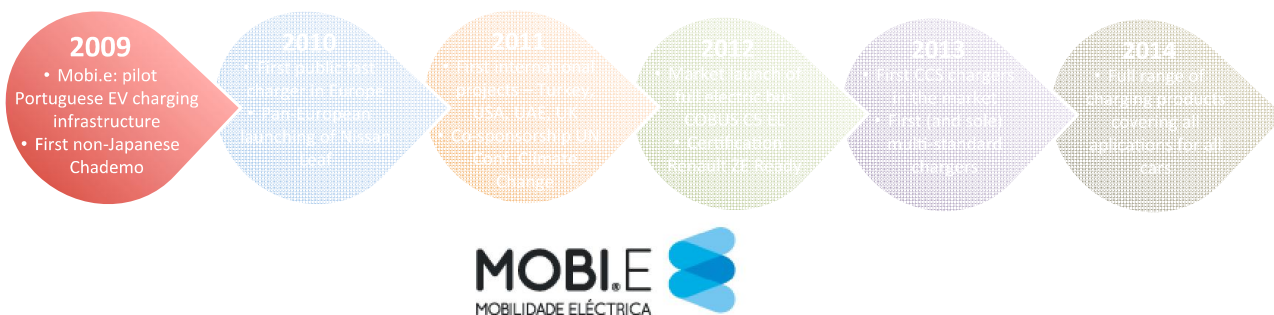
Efacec electric mobility



1. Electric mobility at Efacec – an innovation episode
2. Timeline of main achievements
3. Main differentiating solutions
4. How do we stand and what's next?

4

Timeline of main achievements



- Launching of the electric mobility business line as the technology partner of the Mobi.E consortium (nationwide pilot project for EV charging infrastructure)

5

Timeline of main achievements



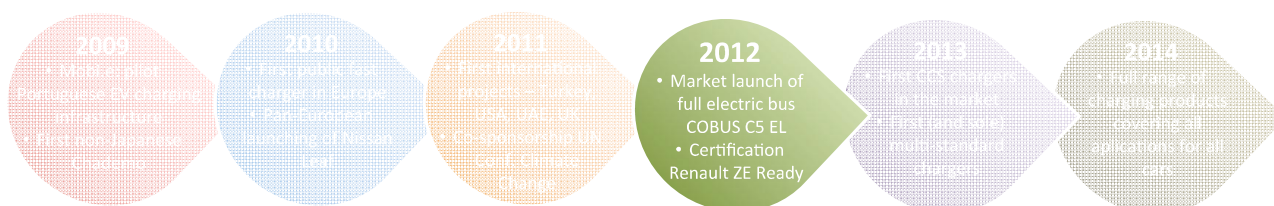
- First charging solutions for EVs; first fast charger certified CHADEMO outside Japan
- Installation of public charging infrastructure in Portugal (Mobi.E)
- First public quick charger in Europe – Galp petrol station at the A5
- Charging stations for the Nissan Leaf pan European tour

Timeline of main achievements



- First international projects (Turkey, USA, UAE, UK)
- Charging solutions for European Press presentation of Renault Fluence and Kangoo
- Sponsorship with Nissan of ONU COP 17 (Climate Change Conference, Durban Dec2011)

Timeline of main achievements



- Market launch of the CaetanoBus/Efacec full electric bus Cobus C5 EL
- Certification Renault ZE READY by Renault; new charger models in the market



Timeline of main achievements



- First fast charger in the market with the new Euro-American standard CCS
- First (and sole) manufacturer to offer multi-standard chargers



Combined Charging System



Audi



DAIMLER



Electric Mobility activity at Efacec



- Full range of charging products covering **all applications for all cars**

1. Electric mobility at Efacec – an innovation episode
2. Timeline of main achievements
3. Main differentiating solutions
4. How do we stand and what's next?

11

Main differentiating solutions

Full range of chargers



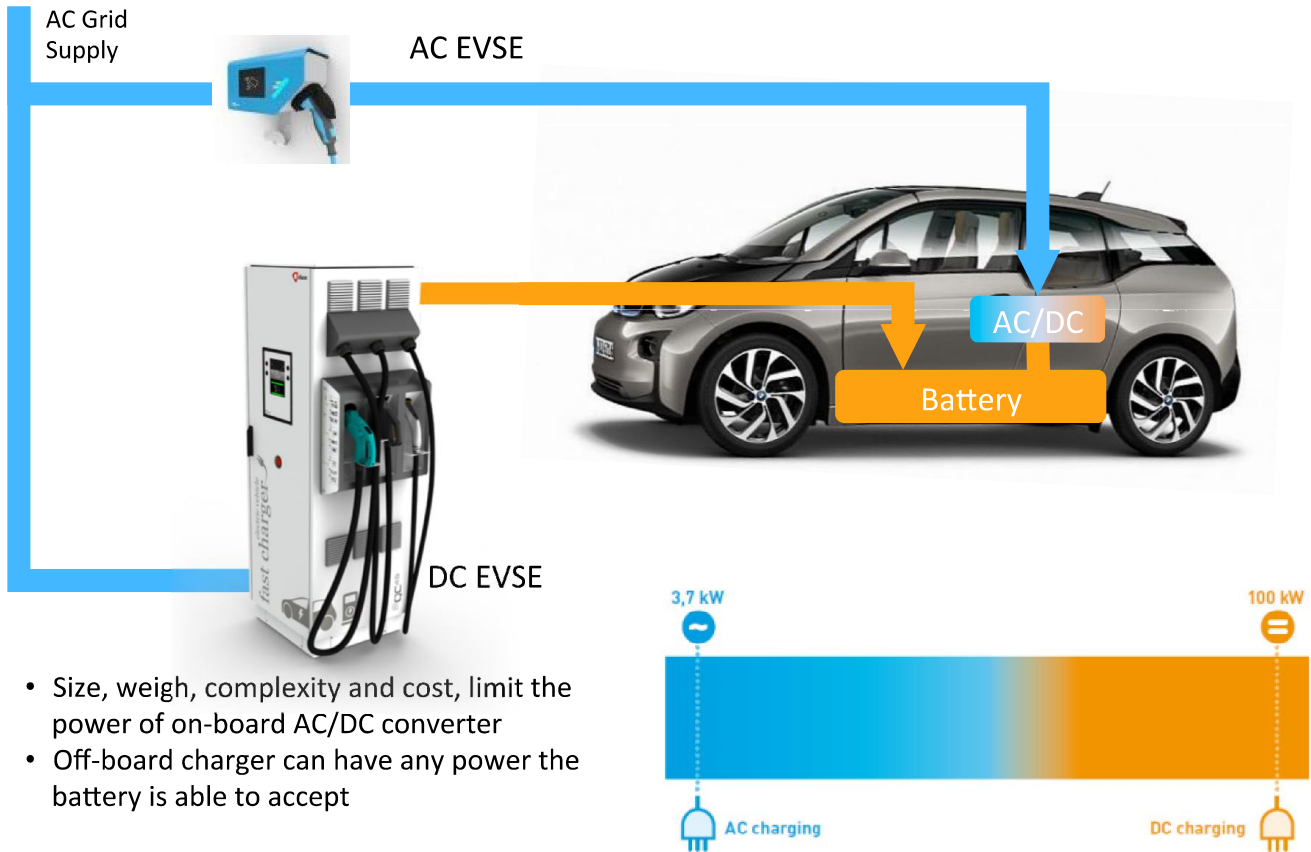
Charger Type	Quick Charger		Public Charger				HomeCharger			
	DC + AC		AC				AC			
Output Power (kVA)	20 kW	50 KW	3,7	7,4	11	22	3,7	7,4	11	22
Estimated Charging time ⁽¹⁾	<60m	<30m	~6/8h	~3/4h	~2h	~1h	~6/8h	~3/4h	~2h	~1h
Price	€€€		€€				€			
Network connectivity and data statistics	✓		✓				✓ (limited)			
Modularity	✗		✓				✗			
Size and footprint	Large		Medium - Small				Small			
Delivery time	+++		++				++			



(1) - Depending on the battery total capacity, SOC and on-board charger

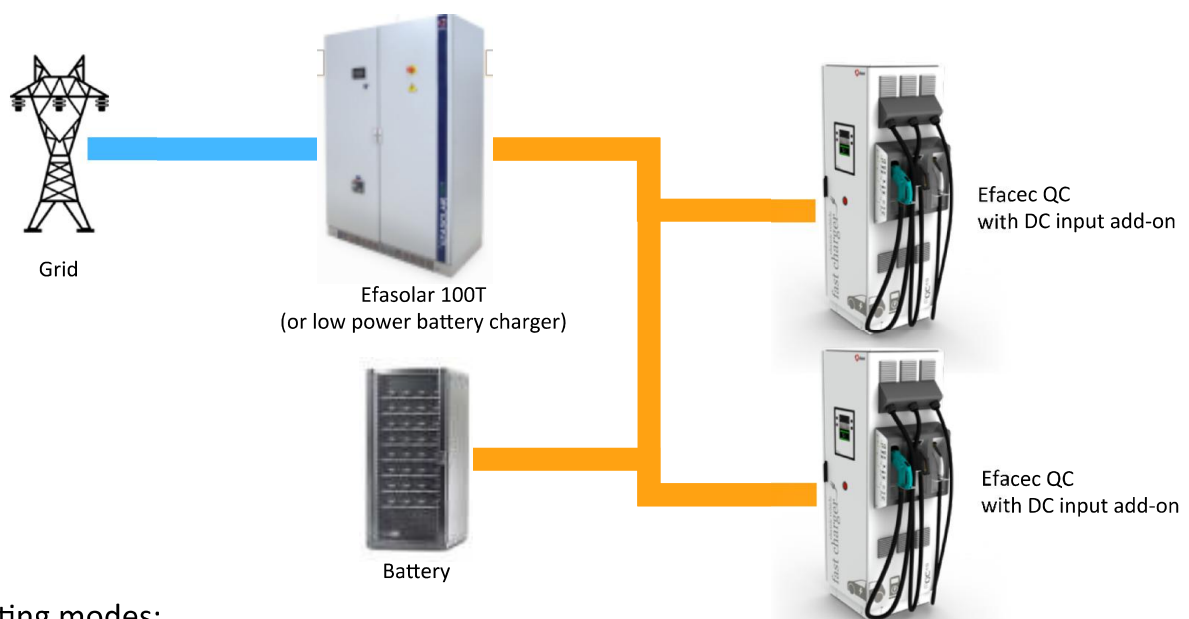
Main differentiating solutions

A strong bet on DC fast charging



Main differentiating solutions

Highly sophisticated management environments



Operating modes:

- Power drawn from battery until low level is reached; then, if and when EV charging, drawn from grid or stop charging
- Grid power limited to a low value: always, or unless battery empty and EV charging
- Optional bi directional operation of battery charger
- Optional PV source (or hybrid with other energy sources)

Main differentiating solutions

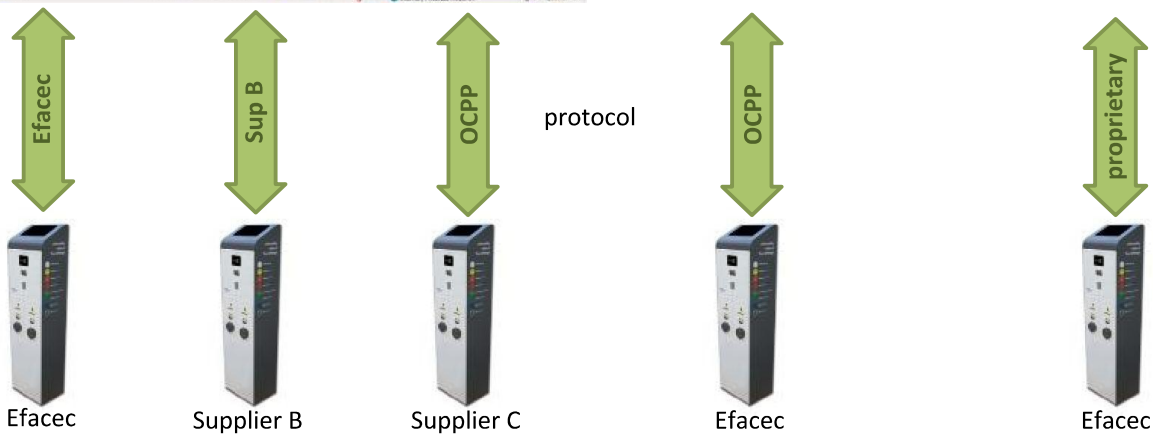
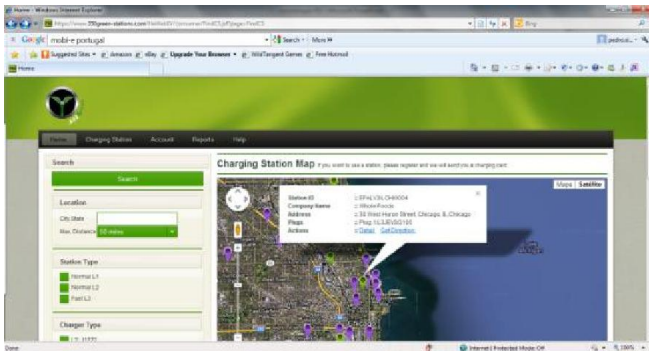
An open systems approach



Mconverge

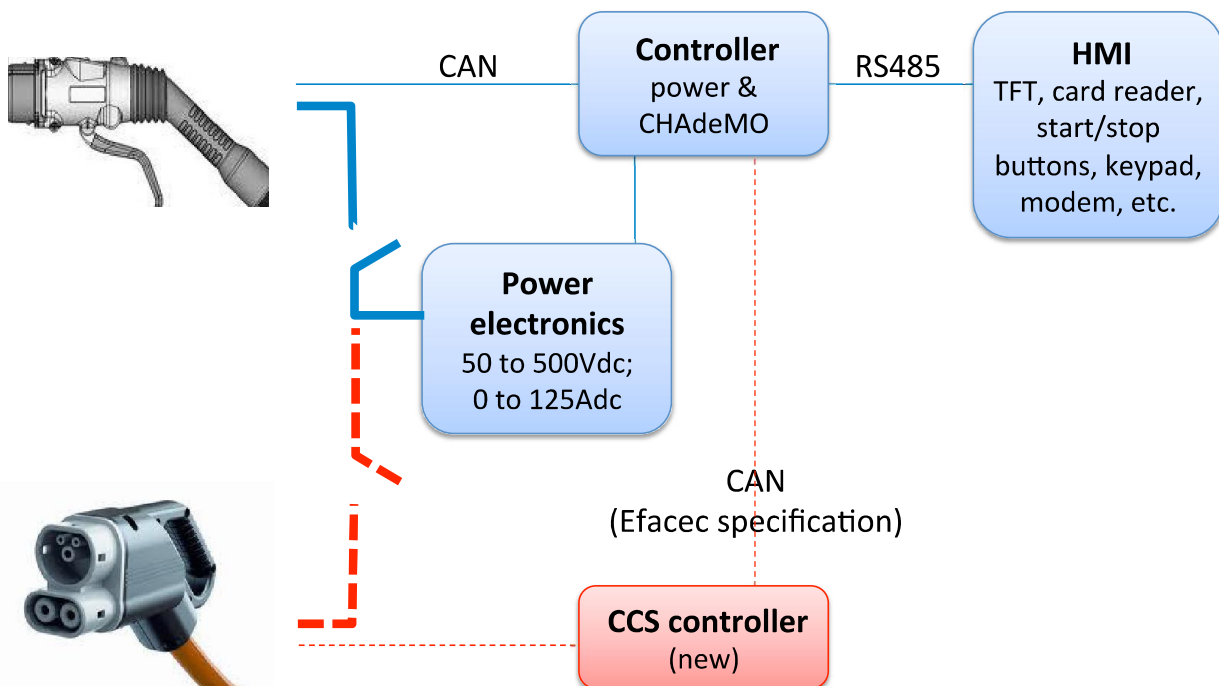
Efacec management System

Third party Management System



Main differentiating solutions

Multi-standard approach



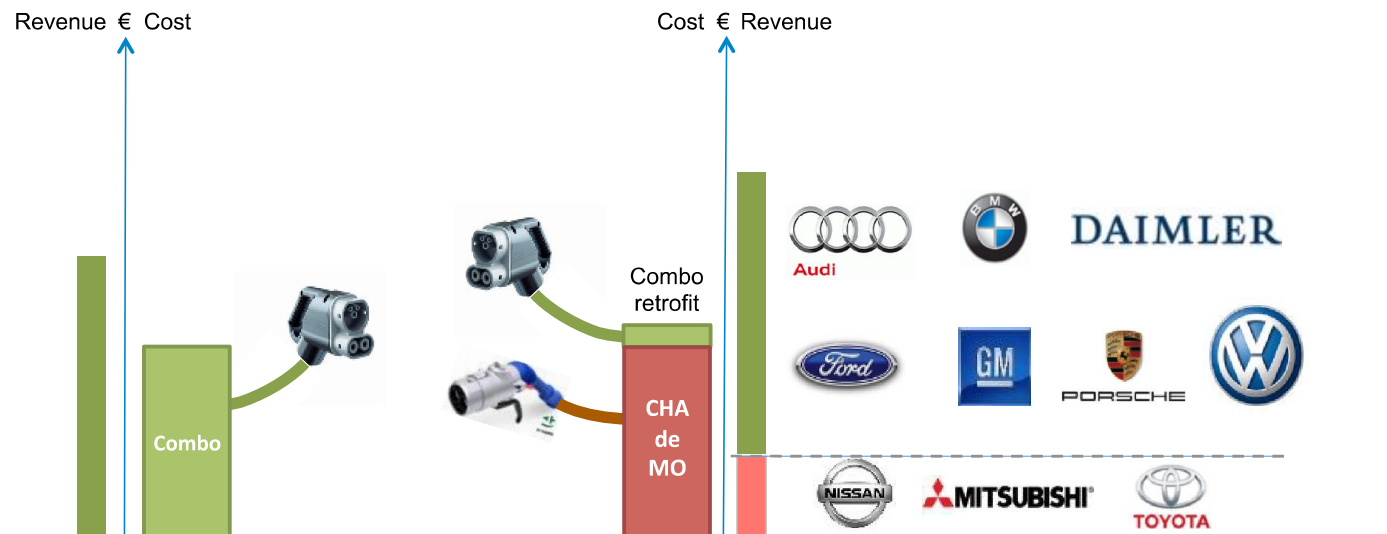
Blue: Efacec QC50; QC45; QC20

Red: CCS add-on

Significant innovations



Legacy + Combo Retrofit



Upgrading legacy through *Combo retrofit technology* to boost profitability

17

Significant innovations

Quick Charger - QC45



- ✓ 50 kW DC output
- ✓ Triple output (CHAdeMO, CCS, AC⁽¹⁾)
- ✓ Network integration
- ✓ OCPP Protocol (and others)
- ✓ User-Friendly HMI (Color display; RFID reader; 2-click to charge)
- ✓ High power factor and efficiency
- ✓ Customized design

(1) - Up to 43 kVA



Significant innovations

Public Chargers – Modular master-slave architecture



- 1 Command station
 - with network connectivity and user authentication
- Cheaper slave outputs
- Less wiring (simpler bus topology)



Example 1 - Public Master Slave configuration

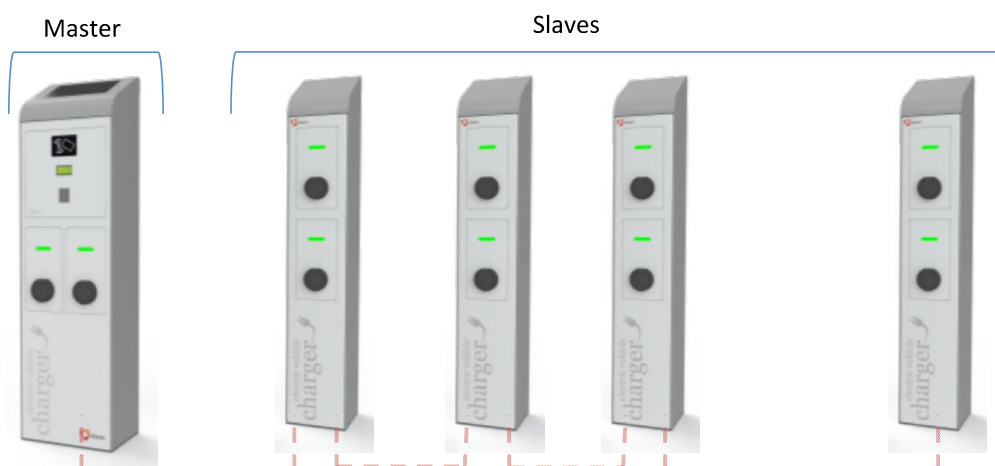


Significant innovations

Public Chargers – Modular master-slave architecture



Public Modular Master Slave configuration

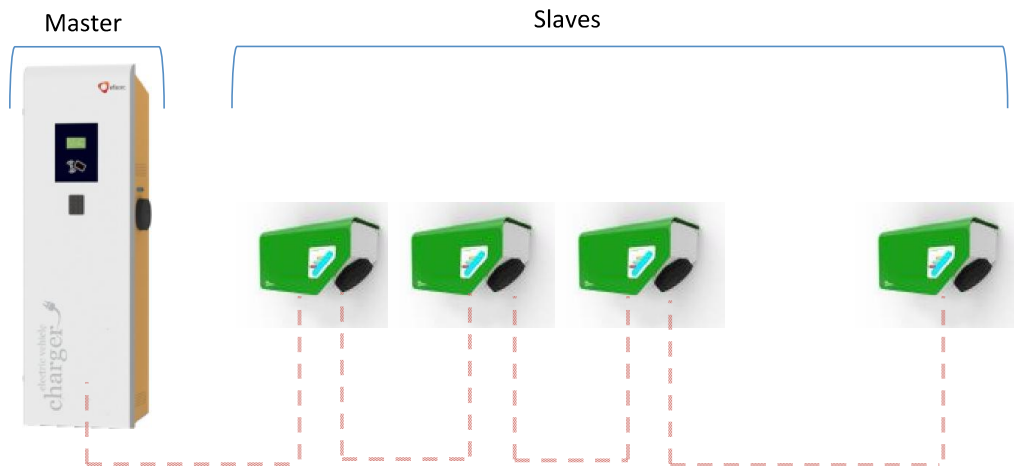


Significant innovations

Public Chargers – Modular master-slave architecture



Public Master Slave configuration

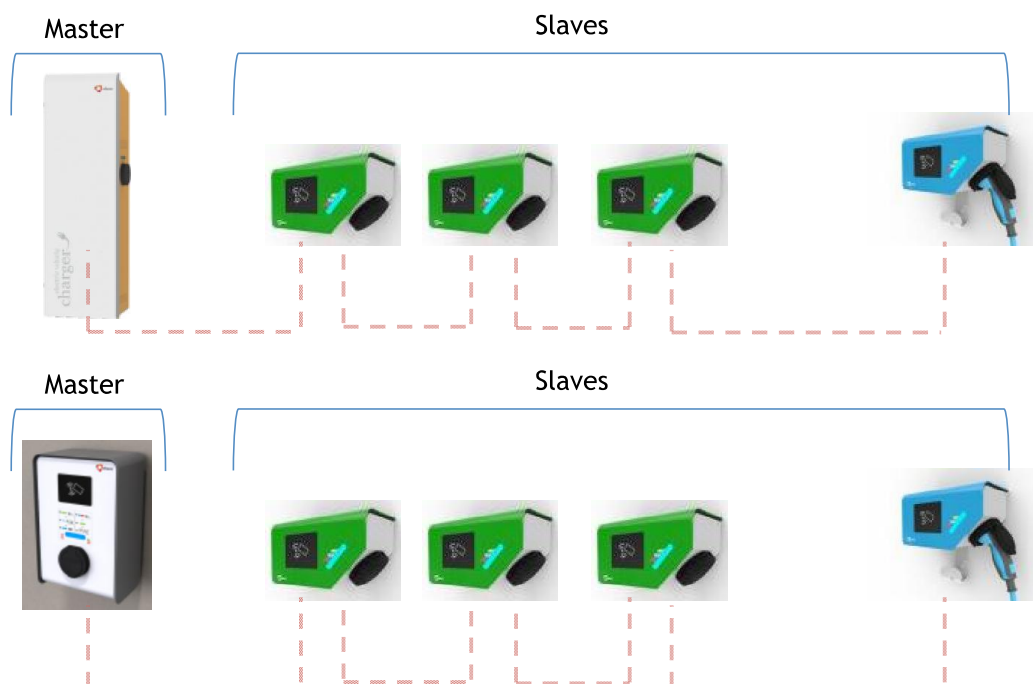


Mandatory to have Homecharger Plus (HC + MID Meter)



Significant innovations

Public Chargers – Modular master-slave architecture



Mandatory to have Homecharger RFID Plus (HC + RFID + MID Meter)

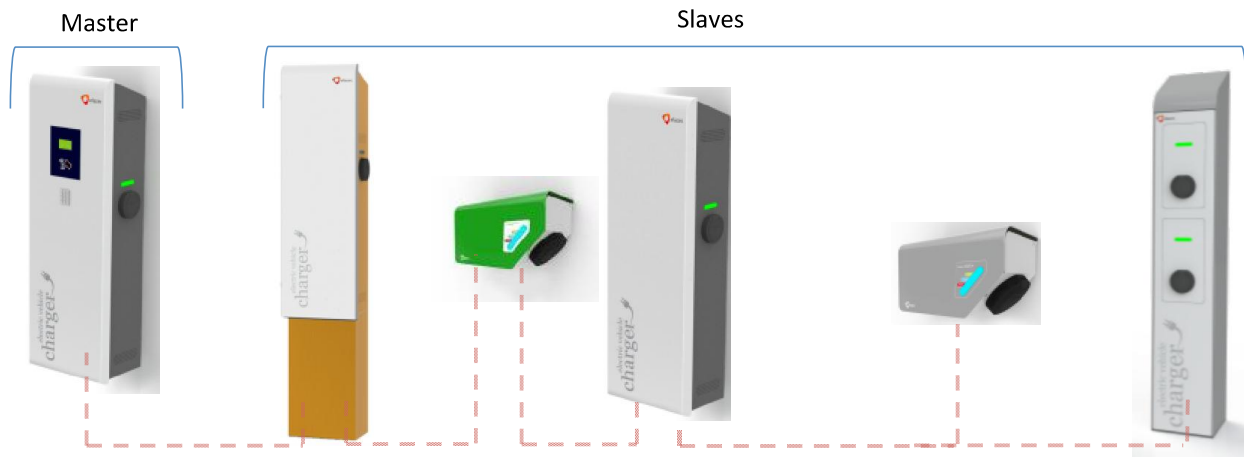


Significant innovations

Public Chargers – Modular master-slave architecture



Different output configurations



Mandatory to have Homecharger Plus (HC + MID Meter)



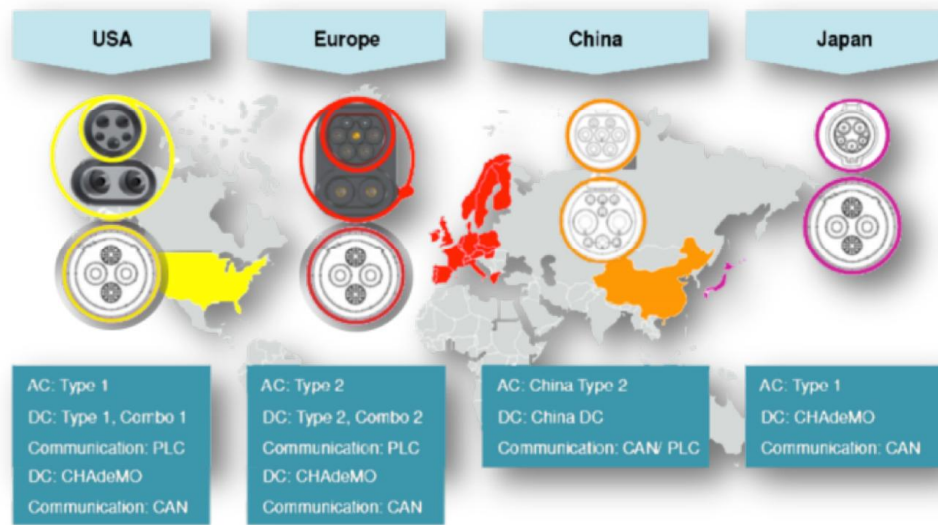
Efacec electric mobility



1. Electric mobility at Efacec – an innovation episode
2. Timeline of main achievements
3. Main differentiating solutions
4. How do we stand and what's next?

How do we stand and what's next?

Market leader in Fast Chargers



CHAdeMO



AC Fast Charging 43kVA



Combined Charging System



AC Charging 22kVA



25

References of Clients



Customer vehicles using Efacec Chargers:



Some of our clients:



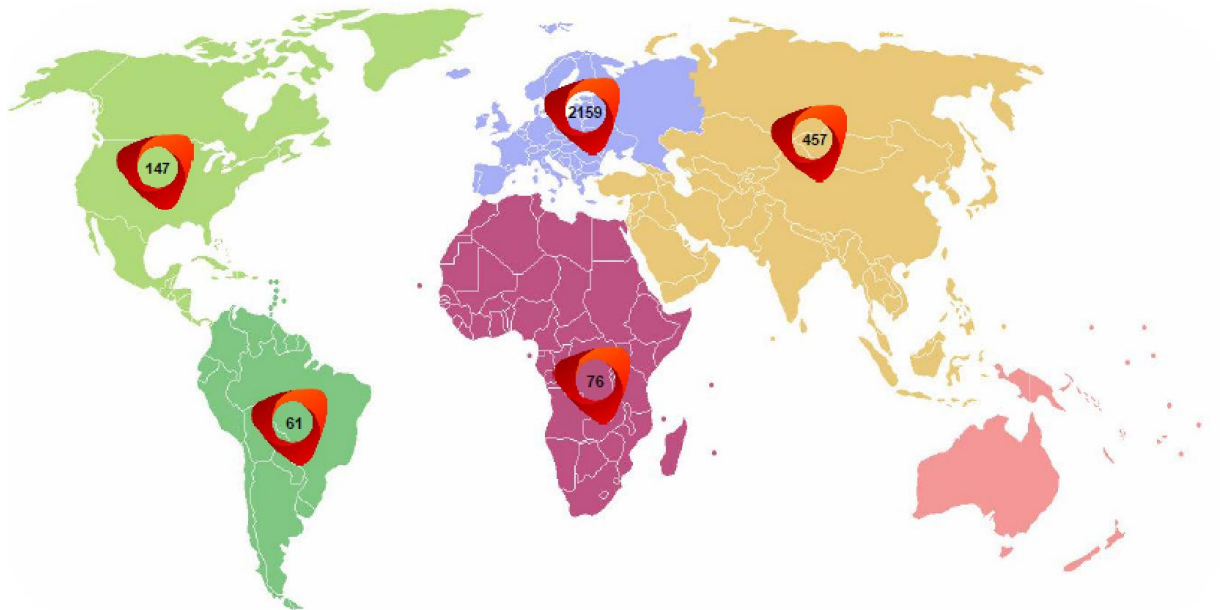
Our Partners:



Installed EV chargers



2900 Installed Plugs (DC+AC)
(September 2014)

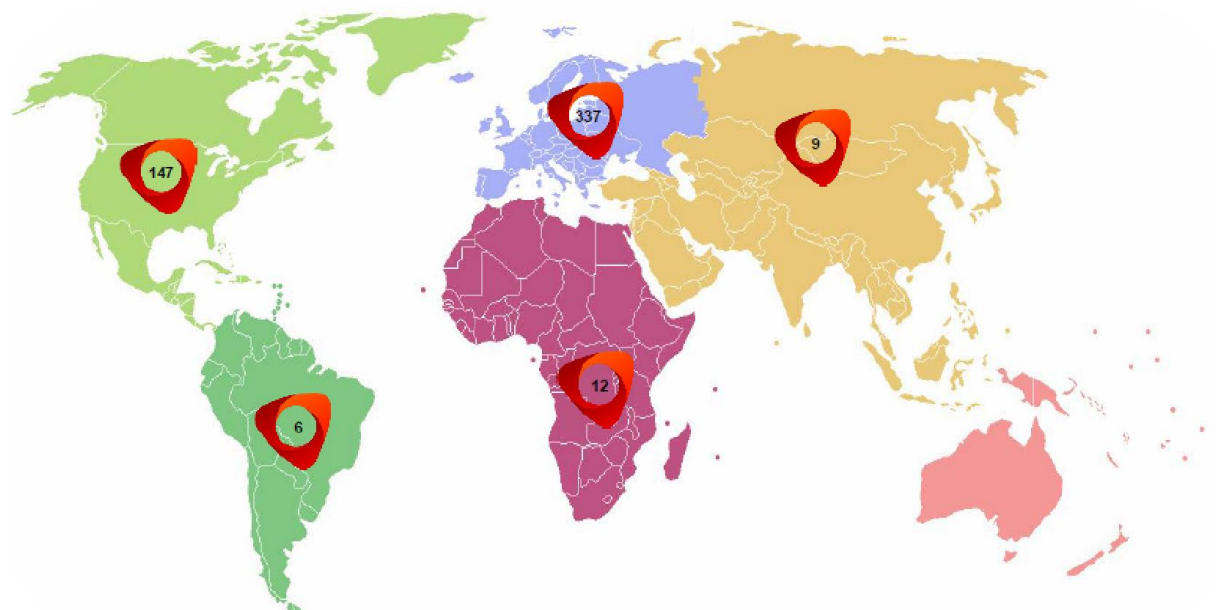


27

Installed EV chargers



Efacec has more than 500 Quick Chargers sold Worldwide
(September 2014)



28



Presented at eCarTec in Munich, october 2014

29

How do we stand and what's next?

Main areas of present R&D



Efacec maintains numerous ongoing R&D programs, most on international partnerships with other companies or academic groups

- Smart charging
- Demand management
- Solutions for fleets and condominiums
- v2x
- Communication EV – charger
- New charger models
- Lower and higher power chargers
- Wireless charging
- Payment systems, roaming, integration with different systems
- Open protocols
- Energy storage solutions
- Energy and traction systems for electric buses

30

Pedro.silva@efacec.com

