4th E-MOBILITY STAKEHOLDER FORUM

Train2Car project – How to charge electric vehicles with green energy through regenerative braking of metro trains

Antonio de Santiago Laporte, Metro de Madrid, S.A.

#eMSF2016 @eMobilityForum
Agenda

- TRAIN2CAR: the project
- The future
TRAIN2CAR: The Project

- R&D Funding Programme
  - INNPACTO 2011 Ministerio de Economía y Competitividad (MINECO)

- Participants
  - Metro de Madrid as project coordinator
  - SICA
  - ICAI (Instituto Investigación Tecnológica)
  - CIEMAT

- Other key collaborators
  - SIEMENS (sub-contracted)
  - CITROËN
TRAIN2CAR: The Project

Main objective
To use the excess of energy in the catenary, coming from the regenerative braking of the metros trains, to charge the batteries of the electrical vehicles (20 to 25 min fast charge in DC current) through an innovative and smart management of the DC grid and other electrical devices (traction substations, fixed accumulators, batteries…) of these metropolitan transportation systems.
That maximizes the harnessing of the energy regenerated during the braking (green energy) and the global efficiency of the system.
Aligned with the SET-Plan and specially with the EEGI

Dates
- Beginning of the project: October 2011
- Official end of the project: July 2014
- Still in the process of gathering information from all the vehicle charges
TRAIN2CAR: The Project

- Main Technical Activities (I)
  - Functional definition of the overall system and the connection between the catenary and the charging point
  - Development of a smart system to manage the energy. Simulation of the whole system.
  - Information and communication management
    - Connection between the existing and the new equipment
    - Software integration
TRAIN2CAR: The Project

- **Main Technical Activities (II)**
  - Laboratory tests and prototype development on a small scale
    - Ultracapacitors to simulate the vehicle
    - Accumulator on a small scale
    - Identical control strategy
TRAIN2CAR: The Project

- Main Technical Activities (III)
  - Technical room increased to install new equipment
  - Insertion of the equipment through the ventilation well
  - Trench digging for the cables
  - Charging point installation
TRAIN2CAR: The Project

Main Technical Activities (IV)

- Connection between the existing and new equipment (control panel, switcher cubicle, short-circuit device, DC/AC converter).
- Software integration and configuration
- Remote control server installation
- First tests without real charge and finally an electrical vehicle: fast charge in DC current (80% in 20-25 min)
TRAIN2CAR: The Project

Other Activities

- TRAIN2CAR logo design
- Logo and brand design registered
- Vinyl decoration of the charging point
- Patent registration requested
- Agreement between CITROËN and Metro de Madrid
  - Spot for the charging point in their own facilities
  - Any Electrical Vehicle with CHAdeMO connector can use the METROLINERA
  - 2 parking lots reserved specially for charging vehicles
  - 2 signs indicating the charging area and restricted charging time (30 min)
TRAIN2CAR: The Project

- Commissioning by Region of Madrid Elected Officials
  - All previous tests with 100% success
TRAIN2CAR: Summary

1. La energía de frenado de los trenes se recupera y se envía a un acumulador.

2. Mediante un sistema de control, una celda de corriente continua de catenaria y un convertidor, la energía llega al poste ya procesada.

3. Un aurador de 50 kW permite cargas de vehículos con suministro de corriente continua de 500V de hasta 86A, que cumple con el protocolo de carga CHAdeMO.
TRAIN2CAR: Summary
TRAIN2CAR: Summary

- Actual data
  - 7 to 10 charges per working day
  - 20 to 25 minutes per charge
  - All kind of users and car brands
    - Taxi (Nissan)
    - Private cars (Nissan, Citroën, Peugeot, Mitsubishi, Renault, Tesla)
    - Freight vans (Nissan)
    - Citroën car dealer
TRAIN2CAR: The Future, a real need of standardization

- Connector
  - CHAdeMO / COMBO

- Design of the Development
  - Permanent improvement loop of the current solution
    - Feedback from our users in case of malfunction
    - On line remote control of the charging point
  - New solutions
    - Different equipment (reversible sub-stations instead of accumulators)
    - Quicker charge
    - New possible users
      - electrical bikes and motorbikes
      - other electrical equipment through USB charge
Advantages of the Rail Infrastructure for the charging point locations

- Local (Metros and Light Rail)
- Interregional (Regional & Long distance)
TRAIN2CAR: The Future, business model

- **Strategic enhancement**
  - Public organization
  - Implementation of new rules
  - Environmental and Social Responsibility vs Financial profitability

- **Technical development**
  - Consortium as in the TRAIN2CAR R&D project
    - University and/or Development Centre
    - Industry
    - Operator
TRAIN2CAR: Contact persons

SICA: Carlos Redondo       qarlos@sica.es
IIT: Antonio Fernández Cardador  antonio.fernandez@upcomillas.es
CIEMAT: Marcos Lafoz       marcos.lafoz@ciemat.es
SIEMENS: Arturo Pérez Gaviria arturo.perezg@siemens.com
METRO DE MADRID: A. de Santiago  antonio_santiago@mail.metromadrid.es
○ SPECIAL THANKS TO OUR MAIN USERS/COLLABORATORS
  ▪ Taxi Drivers
    ➢ Antonio Berzal
    ➢ José Luis Rodríguez Mejías
  ▪ Private owners
  ▪ Citroën dealer

○ SPECIAL THANKS TO MY MDM COLLEAGUES
Thank you

Antonio de Santiago Laporte

Contact Details
Metro de Madrid, S.A.
c/ Néctar s/n
28022 Madrid (Spain)
antonio_santiago@mail.metromadrid.es
http://www.metromadrid.es

#eMSF2016
@eMobilityForum
4th E-MOBILITY STAKEHOLDER FORUM

Multimodality: Sharing & Optimizing the Charging Infrastructure

London & Paris experiences
Agenda

- Autolib’ Paris
- Source London – Pan London Charging Infrastructure
- Two Experiences : same Conclusions ?

BlueSolutions
TRANSPORT & LOGISTICS

- One of the world's leading transport group
- Leader in logistics and transport in Africa (harbour concessions and handling...)
- 1st domestic heating oil distributor in France and a key actor of petroleum logistic matters in Europe

COMMUNICATIONS & MÉDIAS

- One of the world's largest communications services group, with about 16,000 employees (the 5th largest in the world)
- The 2nd free daily newspaper
- 4G and Wifi

ELECTRICITY STORAGE & SOLUTIONS

- LMP® batteries (1) & supercapacitors
- Mobile applications
- Stationary applications
- IT development and consulting

Other stakes:

- Vivendi: 14.5% (€4.6 bn) Being €3 bn investments in 2015
- Universal Music Group UK: 1,200 employees
- Sogefin: 8%
- Other stakes...
Autolib’ : Facts & Figures

- Opened in Dec 2011
- 6100 Charge Points – 890 Stations
- 4100 Blue cars
- 100 000 Yearly Subscribers
- Average 10 rentals per day per car
- 3 000 active members for Charging
Sharing by Design
Autolib’ : “individual” public transport

From June 1\textsuperscript{st}, Autolib’ customers will be able to access charging & Car Sharing services with the NAVIGO PASS.
From Autolib’ to Distrilib’

- Self-service delivery pick up (C-discount)
- Late collections of orders from local shops (after working hours)

Optimizing the Shelters/Infrastructure/Cars for new Services to the residents & community
From Autolib’ to Bluetram…

A station-based system
The vehicle charges at each station while passengers are getting on and off.

New Sustainable offer of transport with unlimited autonomy while optimizing the grid…
E-mobility hubs including 100% « made in Europe » electric buses

- Sharing the infrastructure
- 5 M for Shuttle bus, “on demand” services, Hyper centers
- 12 M bus under trial in Lyon & Paris. Available in July 2017 for Right hand drive countries
Source London: Facts & Figures

- Created by TFL in 2011
- 1000 Charge Points
- One Charge point station (on-street)...
- Multi-brands
- In 27 boroughs...
- + 8 900 members (55% active)
Source London: Our Plan

- Install New Smart & Reliable charge points for real time availability
- Introduce Reservation Capability
- Interoperability between Operators eg. Source East
- Introduce Fees…
Our plan: Expansion, Expansion...

1 CP every 0.5 miles in 33 boroughs (£100 M investment)

2015: 1,000 Charge points

2020: 6,000 charge points
Our Vision …
Moving to multiple Charge points per Station and users…

2015: 1 Charge point Station

2020: Min 3 per on-street station
Our Vision: Optimizing the network

- Moving from 1 CP station to a small E-mobility hub with at least 3 CP per station and multiple users.

- Open access to ALL Car club operators, Taxis, E-bus, Residents, Visitors & all EV users

- Introduce EV-car Sharing Services
Future: Multimodal Mobility Hubs …

Multiple Charging Infrastructure

- 50 KW
- 22 KW
- 7 KW
- 3 KW
- 50 KW

ALL EV users
- Residents
- Corporate
- Visitors

E-bikes

E-Taxis

Bike-Sharing

Car clubs

Multiple Mobility Services
One stop shop with ONE CARD

Oyster, Credit Card

Multiple Mobility Services

E-Taxis

Bike-Sharing

EV Users

Car clubs

E-bikes
Two Charging Networks:
Same Technical & Business constraints

- SHARING the same Charging Infrastructure as the only Way to Optimize the costs & Benefits for the whole community (business/private/car clubs…) to spread the costs and ensure a reliable charging infrastructure to all.

- Part of Public transport System – fully integrated ONE CARD OPENS it ALL & EVERYWHERE
Thank you

Maryline Marilly
Maryline.marilly@blue-solutions.com
+33 6 13 60 93 83

#eMSF2016
@eMobilityForum
Lessons from the ELIPTIC project

Michael Glotz-Richter
City of Bremen / ELIPTIC coordination

#eMSF2016
@eMobilityForum
not to solve with e-cars
not to solve with e-cars

“green” traffic jam = traffic jam!
...after introducing electric vehicles... not to solve with e-cars
Factor 100
TomTom congestion index 2016 (European ranking)
ELIPTIC pillars

E-buses

Energy efficiency

Multi purpose use of electric infrastructure
Uncertainty about technological paths
18m battery bus long range
Electric infrastructure

- Underground: Various voltages
- Light rail: e.g. 750 V DC
- Tram: e.g. 600 V DC
- Trolleybus: Various voltages

Internal – different voltage
Electric infrastructure

Underground

Light rail
  - Various voltages
  - e.g. 750 V DC

Tram
  - e.g. 600 V DC

Trolleybus

Internal – different voltage
Electric infrastructure

- Underground: Various voltages
- Light rail: e.g. 750 V DC
- Tram: e.g. 600 V DC
- Trolleybus

Internal – different voltage
Energy-efficiency

Quelle: http://www.tickettokyoto.eu/en
Electric infrastructure

- Underground
- Light rail
- Tram (e.g. 750 V DC)
- Trolleybus (e.g. 600 V DC)

400 V DC

E-buses

Internal – different voltage
Electric infrastructure

Underground

Light rail

Tram
  e.g. 750 V DC

Trolleybus
  e.g. 600 V DC

400 V DC

E-buses

Internal – different voltage

External – selling electricity
E-buses in practice

e-bus recharging at tram substation
e-bus recharging at tram substation
Electric infrastructure

- Underground
- Light rail
- Tram
- Trolleybus

E-buses
- e.g. 400 V DC

Internal – different voltage

External – selling electricity

- Taxis
- Others (cars, delivery vans)
Electric infrastructure

- Underground
- Light rail
- Tram
- Trolleybus

E-buses
- e.g. 400 V DC

- Internal – different voltage
- Smart grids – bi-directional flow

External – selling electricity
- Taxis
- Others (cars, delivery vans)
Multi-purpose use of electr. infrastructure

2016: feasibility study TfL underground grid – TfL bus fleet recharging
2018: taxis „zero-emissions capable“

Quelle: http://www.pocket-lint.com
multi-modal (e-) mobility

Public transport + car sharing = alternative to car ownership
Electric infrastructure

- Underground
- Light rail
- Tram
- Trolleybus

E-buses: e.g. 400 V DC

E-car sharing
Thank you

www.eliptic-project.eu

#eMSF2016
@eMobilityForum
The Corri-Door Project

Patrick GAGNOL
EDF

#eMSF2016
@eMobilityForum
A network of 200 fast charging stations for electric vehicles in France

* Deployment of 200 interoperable and multistandard fast charging stations along main TEN-T roads and highways:
  - Help *develop* the EV market and give *confidence* in EV range;
  - *Connect* cities and local charging infrastructures together (a station every 80 km)
  - Offer an open *interoperable eMobility service* ([www.sodetrel.mobilite.fr](http://www.sodetrel.mobilite.fr))
  - Awarded the « *dimension national* » *status* in France

*Corri-Door: a private initiative co-funded* by the EC TEN-T program up to 4,85 M€
  - EDF (coordinator)
  - SODETREL (operator of the Corri-Door network)
  - RENAULT, NISSAN, BMW and VW
  - ParisTech (academic)
  - TEN-T project duration: 22 months (end Dec 31rst 2015)

* In the framework of the « Trans-European Transportation Network » (TENT-T) call of December 2013
An open interoperable fast charging service

• **Deployment of multi-standard interoperable fast chargers (50 kW)**
  - Up to 80% range back in 30 mn
  - Compliant with all mass-market EVs (DC Chademo, DC CCS, AC triphase, E/F) and anticipating the EC Directive on alternative fuels
  - Contactless access (RFID, NFC)
  - Adjustable AC/DC charging Power up to 50 kW
  - Open communication protocol: OCPP

• **An interoperable fast charging service by SODETREL open to every single EV driver**
  - Open to all customers with or without contract
  - « ad hoc access / payment »: 2-charge Pass at gas station shops or SMS, smart phone apps
  - Service subscriptions by Sodretel or other operators in partnership (interoperability)
  - Hotline
  - www.sodetrel.mobilite.fr

• **Powered from 100% Renewable Energies by EDF**
Complex implementation of a multi-site countrywide public network

* Set up complex partnerships with many different stakeholders:
  * Private and public land owners/managers (highway and gas station operators, cities, State, supermarkets …) => get the « site »
  * DSOs => be connected to the grid with low impact, time and cost
  * Other operators and eRoaming platforms => a fully open service

* Find out pragmatic solutions due to the present lack of adapted regulations and simple processes
  * Disable access: redesigning stations and cost sharing
  * Safety: 15 m distance requirement from gasoline supply areas
  * A charging place is an actual parking place on highways
  * Grid connection: new processes being worked with ERDF (DSO)
  * Upstream signalization …

* Mapping is a key step to get a countrywide interoperable network open to the public
  * Complementary of local charging infrastructures by public territories or private stakeholders
Corri-Door interoperable multi-standard fast charging stations
Customer perspective: a high quality fast charging service is expected

- **Main charging locations are at home or in company parking lots**
- **Fast charging services are expected by the EV customers**
  - « Brand-new » EV driver: reduce the « limited range » anxiety
  - « High mileage » EV runner: increase range for daily or weekly trips
  - « Leisure » EV drivers: increase range for leisure trips (regular WE, ...)
  - Corri-Door stations on main roads and highway: a good choice
- **Ready to pay for reliable high quality fast charging services**
  - But less than the equivalent gasoline cost
  - Do not want to queue up at fast charging stations
  - Want information (locations, availability, ...) and reservation
- **Fast charging- and eMobility- service interoperability is compulsory**
  - Need simple and seamless national and cross-border services
  - Want only one access pass
Stand-alone business models are not balanced with only B2C revenues

- **EV market is taking off in Europe and France:**
  - Over 20,000 EV sales in France in 2015
  - Over the « 1% » threshold for the monthly sales since September 2015

- **Still need financial back-up both for CAPEX and OPEX**
  - Uncertain EV market and fast charging market share
  - A fast charging infrastructure costs 10 times as high as a « 22 kW » charging point
  - High recurrent operational costs

- **Need to mitigate and share the business risk during the first operating years**
  - Pure B2C-based revenues are very uncertain in the first operation years
  - All the « interested-in » stakeholders should be involved
  - Help reduce the « front » price for the end customer
National and European interoperability has to be implemented

- **Fast charging & eMobility services must be seamless and access easy for EV drivers**

- **Interoperability must be implemented between operators**
  - Bilateral connection between backends
  - Connection to one eRoaming platform
  - Fair and non discriminatory fees
  - Create high quality and value-added services (availability, reservation, …)

- **Cross-border interoperability can be achieved by eRoaming platform connection**
  - Pan European eRoaming platform initiative (Gireve, Hubject, eClearing.net)
  - Each station with an ID in Europe

- **Need to standardize IDs, information exchange and protocols at the European level**
  - National bodies or de facto operator associations (AFIREV, eViolin, …)
  - De facto interoperable frameworks are set in some countries (F, NL, D, P, …)
Potential roadmap for further French and crossborder fast charging station roll-outs

* Corri-Door as a key node for a European eMobility core network
  * The « dimension national » status already awarded in France

* CEF UNIT-E project: + 38 interoperable multi-standard fast charging stations
  * RCN (+ 6 stations) and Corri-Door (+ 5 stations) connection
  * Brand-new stations in Belgium (23) and Italy (4)

* Interoperability: bilateral and connection of Sodetrel’s backend to Gireve’s eRoaming platform in France

* Complementary development in link with local territories’ public networks and foreign projects

* On-going feedback: need to add chargers on some stations?
CEF UNIT-E fast charging network being deployed
Thank you

Patrick GAGNOL
Tel. : + 33 6 20 88 39 50
patrick.gagnol@edf.fr
www. corri-door.eu
www.sodetrel-mobilite.fr

#eMSF2016
@eMobilityForum