EMERALD

Energy ManagEment and RechArging for efficient eLectric car Driving

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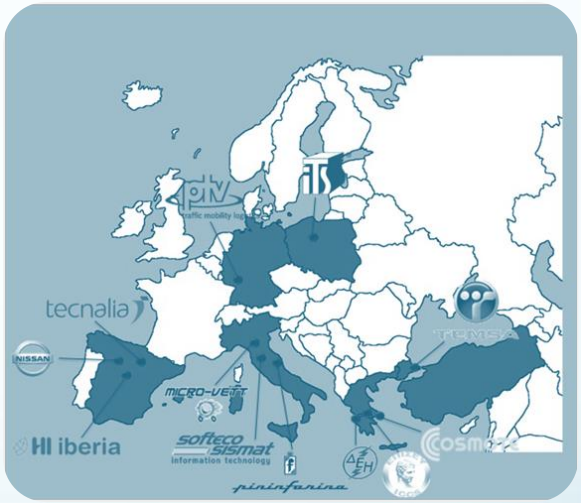
Synopsis

- ECGI Call 8 ICT
- Topic: ICT solutions for improving **energy efficiency** of FEVs and enabling seamless **integration** of the FEV in the **transport** and **energy infrastructures**
- Project start: 1st October 2012
- Duration: 36 months
- STREP, 12 partners, 6 countries
- Background: EcoGem



Project Consortium

ICT

1. SOFT – Softeco Sismat, Italy (*coord*)
2. PTV – Planung Transport Verkehr, Germany
3. HIB – HI-iberia Ingenieria y Proyectos, Spain
4. COSM – Cosmote Mobile Telecommunications, Greece

Research

5. ICCS – Institute of Communication and Computer Systems, Greece
6. TEC – Tecnalia Corporation, Spain
7. ITS – Motor Transport Institute, Poland

FEV Manufacturers

8. PINF – Pininfarina, Italy
9. TEMSA – Temsa Global, Turkey
10. MCV – Micro-Vett, Italy
11. NMI – Nissan Motor Iberica, Spain

Power distributor

12. PPC – Public Power Corporation, Greece

Project Objectives

EMERALD will innovate a range of advanced **services** and ICT **applications** in the following key areas:

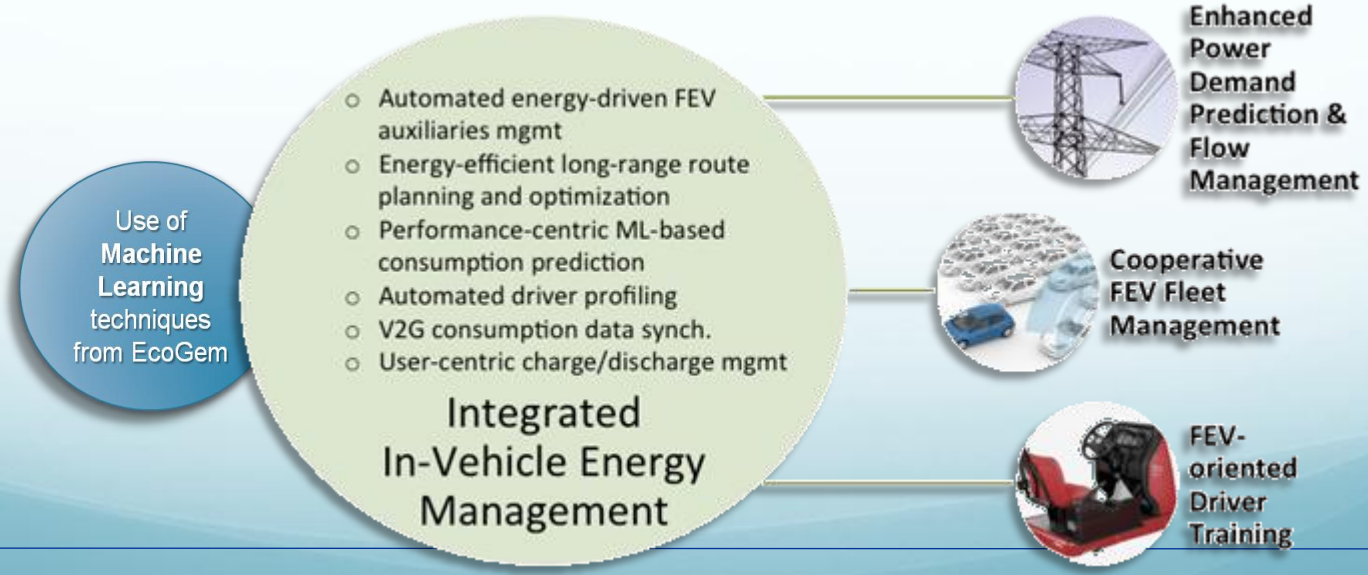
A. Integrated in-vehicle energy management

auxiliaries mgmt, consumptionUser prediction, route planning/optimisation, user-centric charge mgmt, driver (driving style) profiling, …

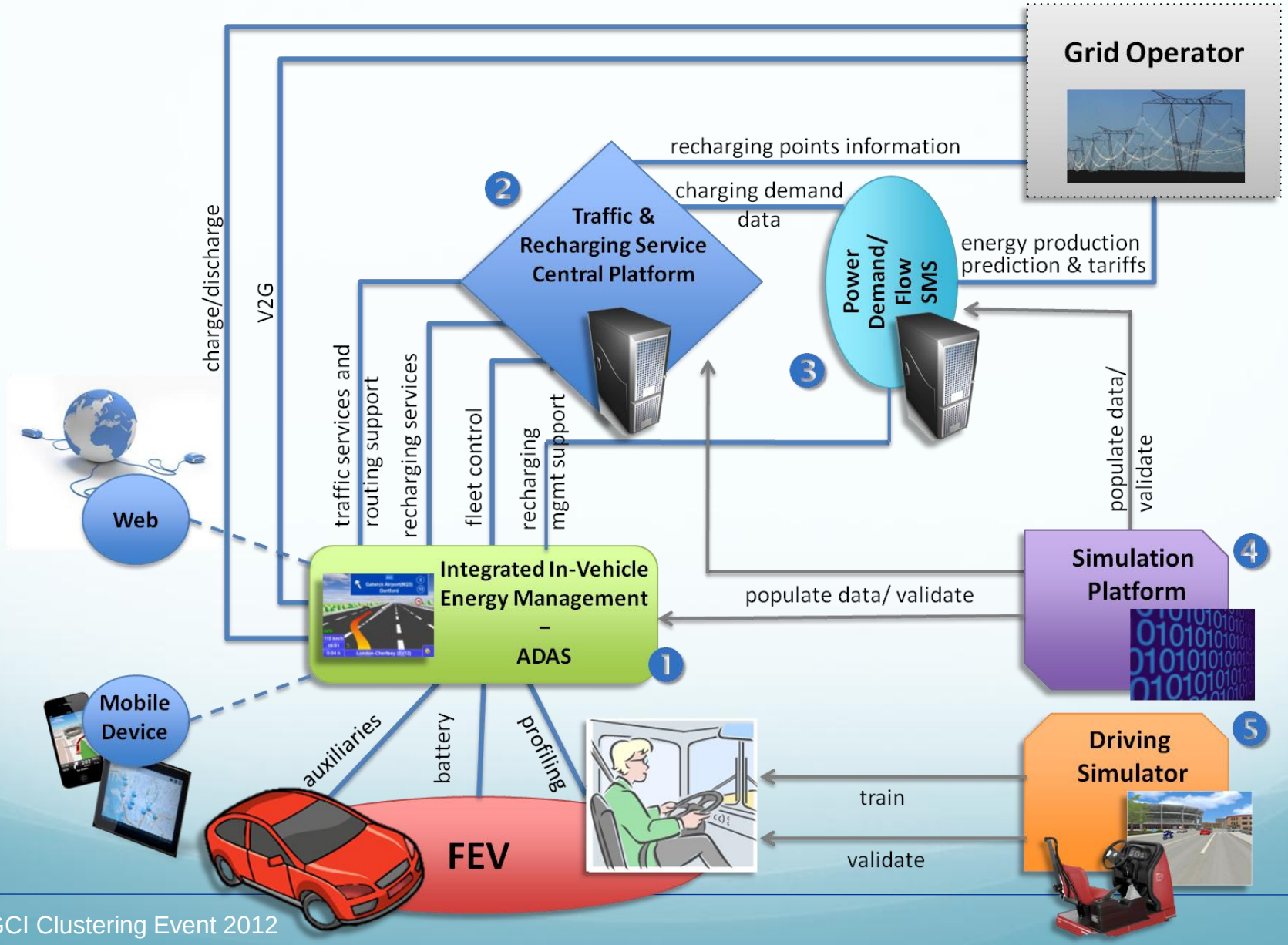
B. Integration with power distribution grid

C. Cooperative FEV fleet management

D. Energy-efficiency-aware driver training and support



Reference Architecture



Expected Impacts

- **Energy-efficiency** through (1) energy management of auxiliaries, (2) optimal energy consumption estimation and (3) energy-efficient route planning
- Seamless **integration with the grid** and the **transport infrastructure** through (1) power flow and buffering management, (2) user-centric recharging strategy management, (3) V2G interactions and (4) cooperative FEV fleet management
- Raise of energy-efficiency awareness through **FEV-specific driver profiling and training**

Measurable Success Criteria

- **Energy efficiency**: 8-10% improvement over EcoGem-enabled vehicles
- **Consumption prediction**: 10% prediction accuracy over EcoGem-enabled vehicles
- **Machine-learning performance**: one order of magnitude fewer machine learning engines for consumption prediction, making the engines' storage and training far more lighter tasks
- **FEV fleet recharging costs**: overall savings at least 10%

Project Validation and Evaluation

Micro-Vett plan to support Italian field trials with its **Fiorino Electric**, derived from the well-known compact commercial vehicle from FIAT. Fiorino Electric is an ideal solution for urban deliveries, featuring a convenient payload-to-size ratio, a range of 140 km and a top speed of 115 km/h

Nissan will contribute to EMERALD with their prototype **e-NV200**, the electric version of NV200, which has been selected as "New York City's Taxi of Tomorrow". The E-NV200 is powered by a 80kW engine, fed by a pack of

Li-ion batteries that grant a max range of 160 km, and will be produced from late 2013

The present…
…and the future
of Fully Electric
Vehicles

Pininfarina will install and evaluate EMERALD ADAS on **Nido EV** prototype , a two-seat

city car approaching sustainable mobility from different angles: use of alternative materials, active and passive safety, native integration with intelligent traffic management and "green" tires developed by Pirelli

TEMSA plan to use for EMERALD their prototype **Prestij Deluxe FEV**, specially targeted for urban public transportation and for shuttle purposes. The specifications of Prestij Deluxe include 23+1 seats, Li-ion batteries and 106 km/h maximum speed

Project Validation and Evaluation

1. **Simulation trials**

   validation of the **EMERALD** concept in the lab, both before as well as in parallel to the field trials

2. **Driving simulator**

   targeted for FEV driver behaviour analysis, analysis of the impact of driver behaviour and training on energy efficiency of FEVs and driver training

3. **Field trials**

   test FEVs provided for integration and testing by the automotive industries of the consortium; trials of **EMERALD** systems in real-life conditions, within realistic application scenarios

Field Trials (1/2)

Lucca, Italy

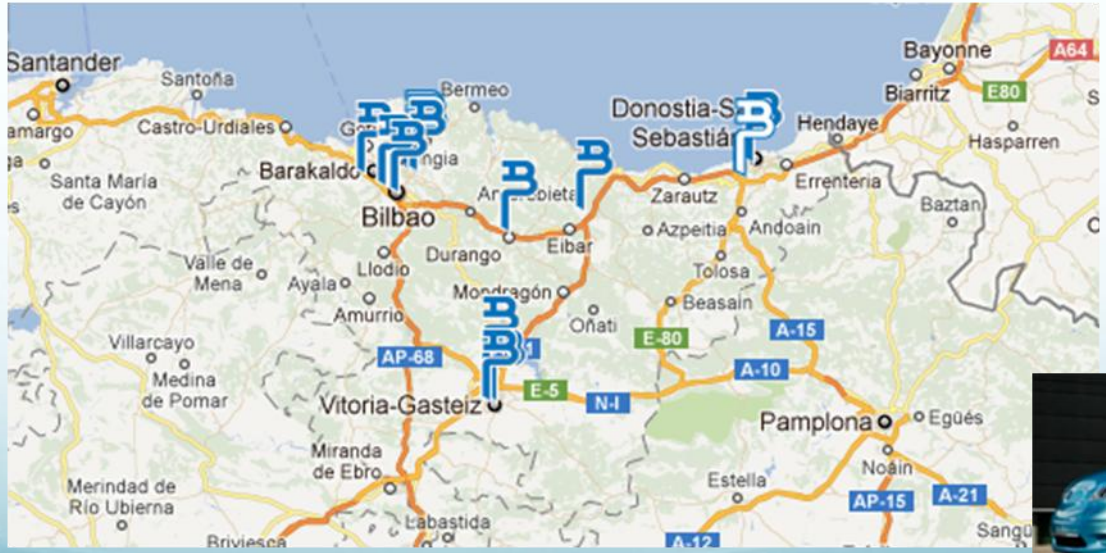
- Mid-sized city (80.000 inhabitants), Tuscany Region, Italy
- City Distribution Terminal (CDT, LuccaPorto), operating a small fleet of electric vans for last mile deliveries and an ICT system for route planning
- Field trials involving the overall operation of the city logistics platform
- Main focus on Cooperative FEV Fleet Management
  - energy-efficient planning, power flow management, recharging, …
- Partners mainly involved: SOFT, ICCS, PTV, MCV

Field Trials (2/2)

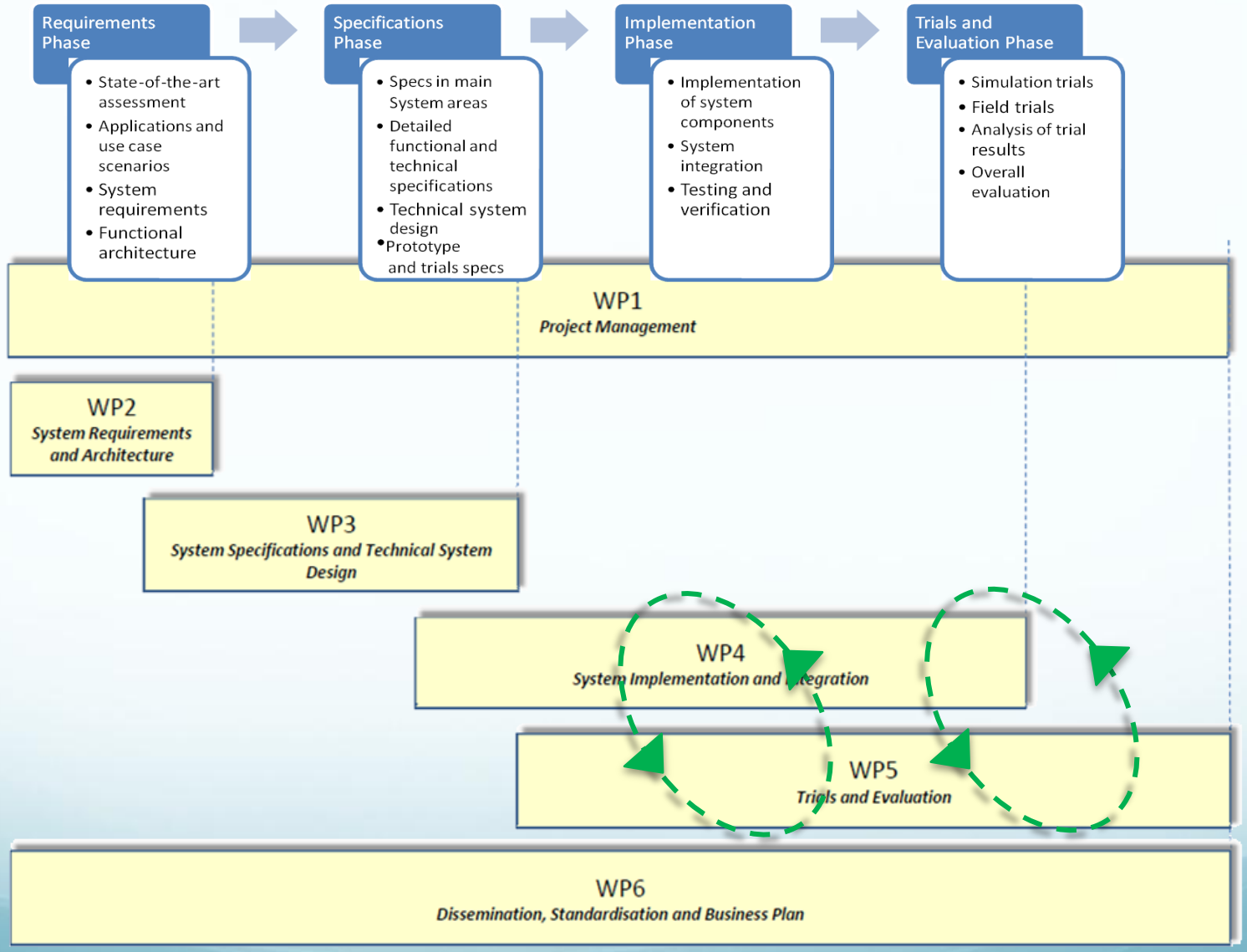
Basque Country, Spain

- Region between Bilbao, Vitoria-Gasteiz, Donostia-San Sebastian
- interurban FEV travels between urban centres, private cars, commercial vehicles (van),

  → energy-efficient long-range route planning and optimisation
- Field trials involving the local recharging infrastructure, Smartgrid test facilities at TECNALIA
- Partners mainly involved: Nissan, TECNALIA, Softeco

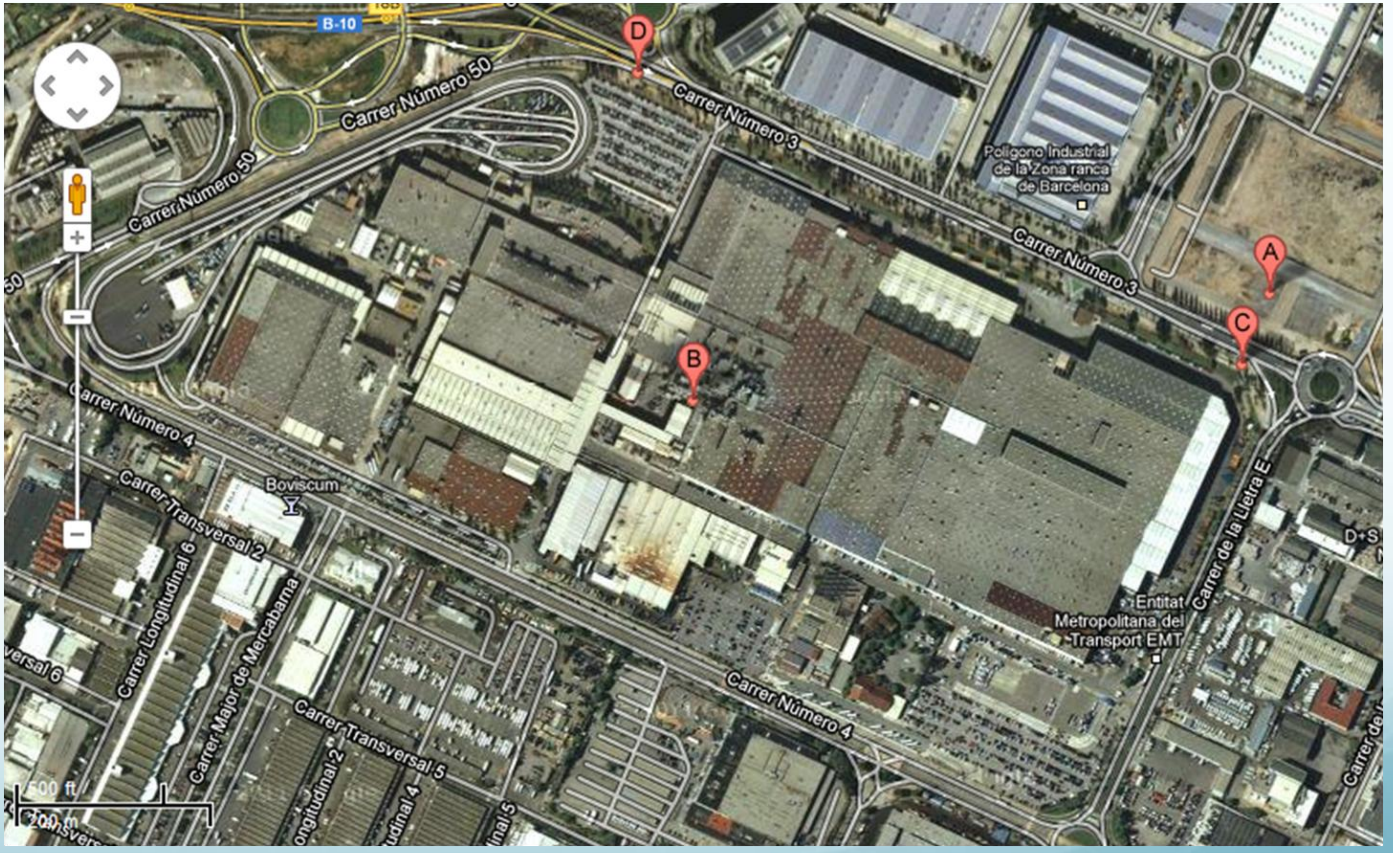


Project Work Package Time Plan



Test track and lab test facilities

- At FEV manufacturers (PINF, TEMSA, NISSAN)
- At TECNALIA (test Smart Grid)



(e.g. NISSAN test track in Barcelona)

Driving Simulator

- At ITS, commercial product, several scenarios
- Will be **adapted** to FEV reqts

Car simulator

Producer: AutoSim (2010)

Model: AS1200-6 (Opel Astra IV)

Visual system: 4 x projector + 3 channels inside (mirrors)

Motion system: MOOG 6DOF (6 degrees of freedom)

Software: 100 traffic objects, 200 km of roads

Evaluation and Trials (summary view)

Feature/Function/Component	Field trials	Lab tests	Simulation	Driving simulator
Energy-driven mgmt of FEV auxiliaries	Lucca, Basque Country	✓	✓	
Energy-efficient long-range route planning and optimisation	Basque Country	✓	✓	
Performance-centric machine learning for consumption pred.	Lucca, Basque Country	✓		
Driver profile data collection	Lucca, Basque Country	✓		✓
V2G traffic and consumption data sync		✓		
User-centric charge/discharge mgmt	Lucca, Basque Country	✓		
Enhanced power demand prediction & power flow mgmt		✓	✓	
Cooperative FEV fleet mgmt	Lucca			
FEV-oriented driver training				✓

Clustering opportunities

- Several commonalities
  - ADAS and advanced driver services
  - energy-efficient driving
    - route planning, routing, recharging, …
    - consumption prediction
  - User acceptance of FEV-enhancing services
  - Simulation (FEVs)
  - *others* ….
- Potential synergies among
  - (EcoGem), OpEneR, eFUTURE, SmartV2G, eDash, …
  - *others* …
  - CIP ICT-PSP pilots …(→ user acceptance …)

Thank you !

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