FABRIC

Feasibility analysis and development of on-road charging solutions for future electric vehicles

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Case study on integration of renewable energy and storage on an e-road

Overview

Grid impact of massive upscale of DWPT for electric transportation have been studied within FABRIC assessment activities for several scenarios: motorway (e-Corridor), periurban (e-Launcher) and urban bus (e-Trench).

Possible solutions are presented for each scenario and for motorway, integration of renewable energy and storage is shown.

Simulation results show that daily pattern e-road demand is beneficial for solar PV integration. Storage for 24-h smoothing provides substantial reduction of grid impact in terms of demand peaks and ramps.

Objectives

- Definition power and energy requirements of specific scenarios.
- Evaluate energy balances and CO2 emissions for upscale at European level.
- Study impact of additional demand with integrated distributed generation and storage.
- Analysis of economic consequences.

Partners involved

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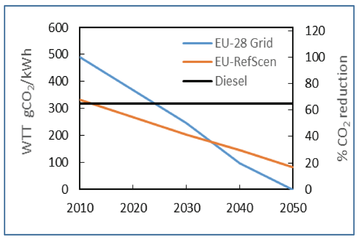
QiEurope Technology to Market

POLITECNICO DI TORINO



Electricity WTT CO2 emissions vs. Diesel fuel

Methodology

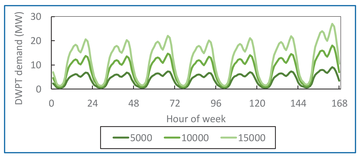
Well-to-Wheel (wtw) energy consumption and CO2 emissions were calculated with a vehicle performance model, considering different vehicle types and driving missions.

Range extension vs. Battery shrink

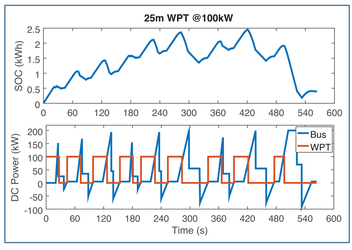
- Battery shrink reduces wtw energy consumption;
- Range extension is only viable business model for motor-way and periurban scenario;
- Urban bus scenario good candidate for battery shrink.

Based on estimated traffic pattern, **annual energy** and **peak power** consumption has been estimated for 3 basic scenarios, which were used later as basis for the FABRIC feasibility study (SP5):

- Motorway: 25-km e-Corridor, 50-kW/vehicle;
- Periurban: 10-km e-Launcher, 100 kW (heavy vehicles);
- Urban bus: 25-m e-Trench on each bus stop, 100 kW.



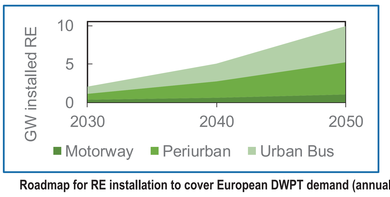
Motorway DWPT demand August (25 km, 50 kW/veh.).



Urban bus scenario, 100-kW DWPT at each stop.

Achievements

- 3 DWPT reference scenarios have been developed;
- E-Road deployment will not be limited by the grid – for both, energy and power requirements;
- Daily patterns are ideal for integration of solar power (55% self-consumption in Spain);
- 24-h storage mitigates intra-daily fluctuations and can reach up to 60-87% self-consumption rates.



Roadmap for RE installation to cover European DWPT demand (annual zero net energy)

	Power (GW)			Energy (TWh)		
	2030	2040	2050	2030	2040	2050
Motorway	0.02	0.15	0.62	0.04	0.34	1.4
Periurban	0.44	2.4	8.5	0.3	1.6	5.7
Urban Bus	0.48	1.4	3.2	2.8	8.3	18.9
Total	**0.94**	**4.0**	**12.3**	**3.2**	**10.2**	**25.9**

European DWPT upscale, power and energy requirements.

	2030	2040	2050
Number of EVs in Europe (millions)	107.4	168.8	189
Expected EV electricity demand (TWh/a)	242	380	425
Percentage of 2015 gross generation	7.5%	11.7%	13.1%
Percentage of DWPT demand vs. EV demand	1.3%	2.7%	6.1%

Projected electricity demand of entire EV fleet in Europe.

Final Event & Demonstration | 21-22 June 2018 Italy

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Project facts

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Consortium

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