



Optimal energy management system for V2G chargers combined with PV and ESS in a real environment

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INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION



GrowSmarter project

www.grow-smarter.eu

Bringing together cities & industry to stimulate uptake of smart city solutions.



- 3 Lighthouse Cities: Stockholm, Cologne and Barcelona.
- Roll out of 12 smart solutions related to energy, mobility and infrastructure.
- 40 partners involved, more than 20 industrial companies.



Vehicle to Everything charging infrastructure

- This measure intends to approach **energy efficiency** and **sustainability** in both **mobility and buildings** by combining different technologies, **EV, V2G, stationary storage and PV**, and optimizing its use through an **Energy Management System**.
- The measure takes place in **Nissan headquarters** in Barcelona, where 250 employees commute everyday.





Vehicle to Everything charging infrastructure

- The integration of Electric Vehicles in smart buildings together with local renewable energy generation.
- To analyze the potential **flexibility** of the load associated to the **EV charging** and the possibility of discharging the EV using vehicle to grid (V2G).
- The use of **V2G** chargers requires **specific smart management** to exploit its potential.
- EVs can offer **values and services** that exceed its primary function as a mean of transportation.



Measure implementation

The aim of this measure is to evaluate:

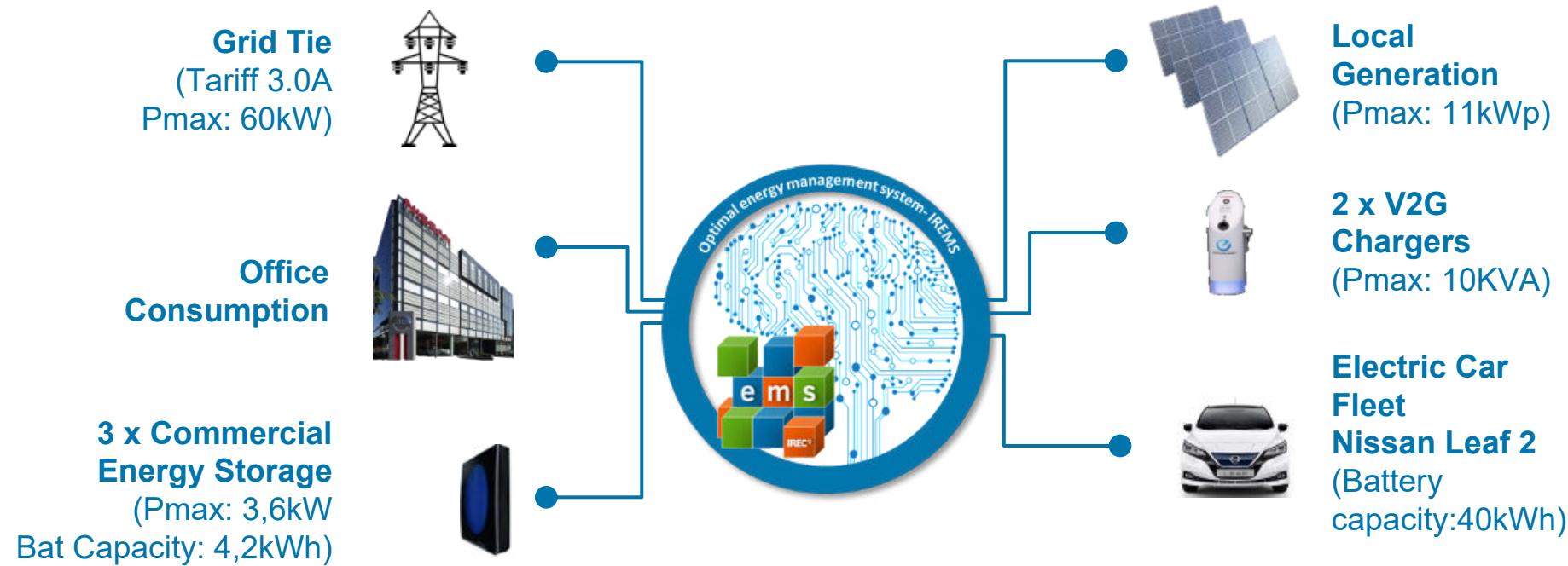
- the functionality **Charging Management based on V2G and EMS** and how this impact on consumption profile of the building.
- the installation of **Storage Systems** based on **2nd Life Batteries** and renewable generation unit.
- The deployment of a **SCADA and an Energy Management System (EMS)**



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Measure implementation

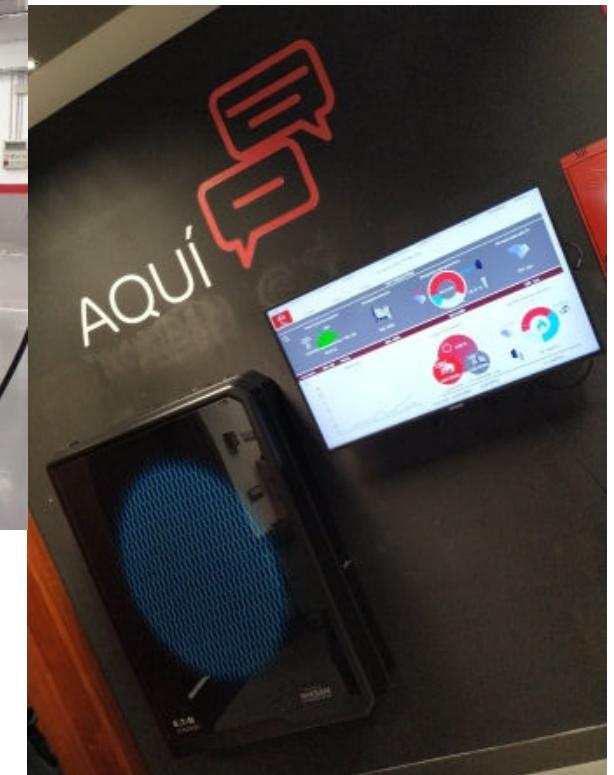




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Measure implementation





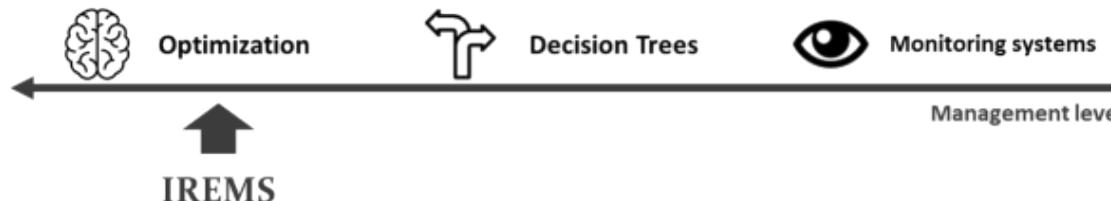
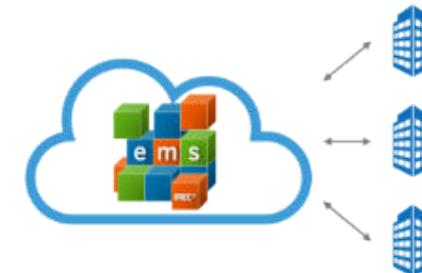
What is iREMS?

iREMS is an **Energy Management System** developed by IREC

iREMS is able to **optimally manage** several kind of generators, loads and storage units under a common goal: to make more cost-effective and efficient your system.

Modular system:

- ✓ **Intelligent module** adapted to install on cloud and to be able to manage more than 1 **Local Controller**;
- ✓ **Local Controller** installed locally on a mini computer in user's facilities.

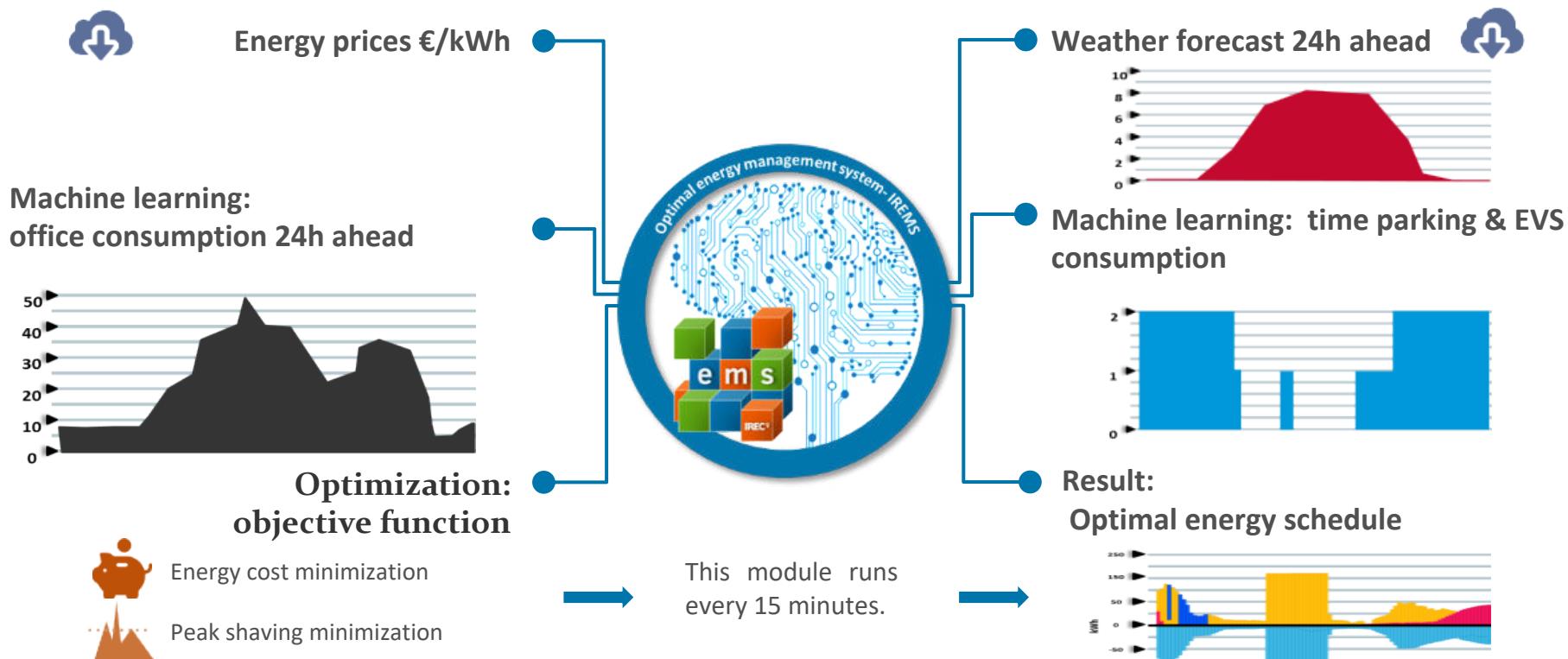




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How does iREMS work?





Methodology

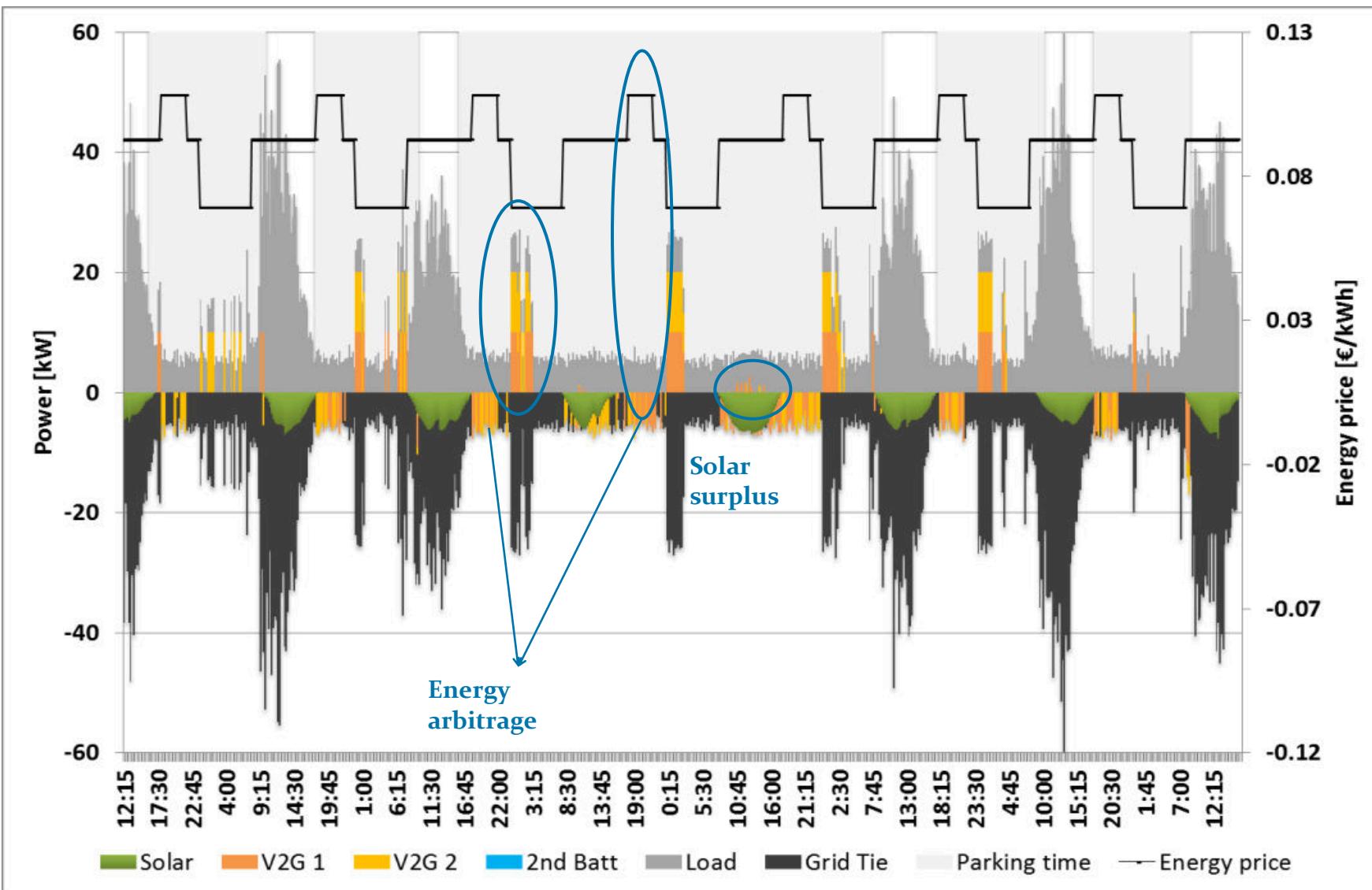
	Consumption & Solar Pannels	Dummy chargers	Smart chargers	V2G chargers	Battery 2nd life
Test 1	✓	✓	✗	✗	✗
Test 2	✓	✗	✓	✗	✗
Test 3	✓	✗	✓	✓	✗
Test 4	✓	✗	✓	✓	✓

To evaluate the impact of V2G technology in the installation compared with standard charging policies and technologies.

Results

Test 3: V2G

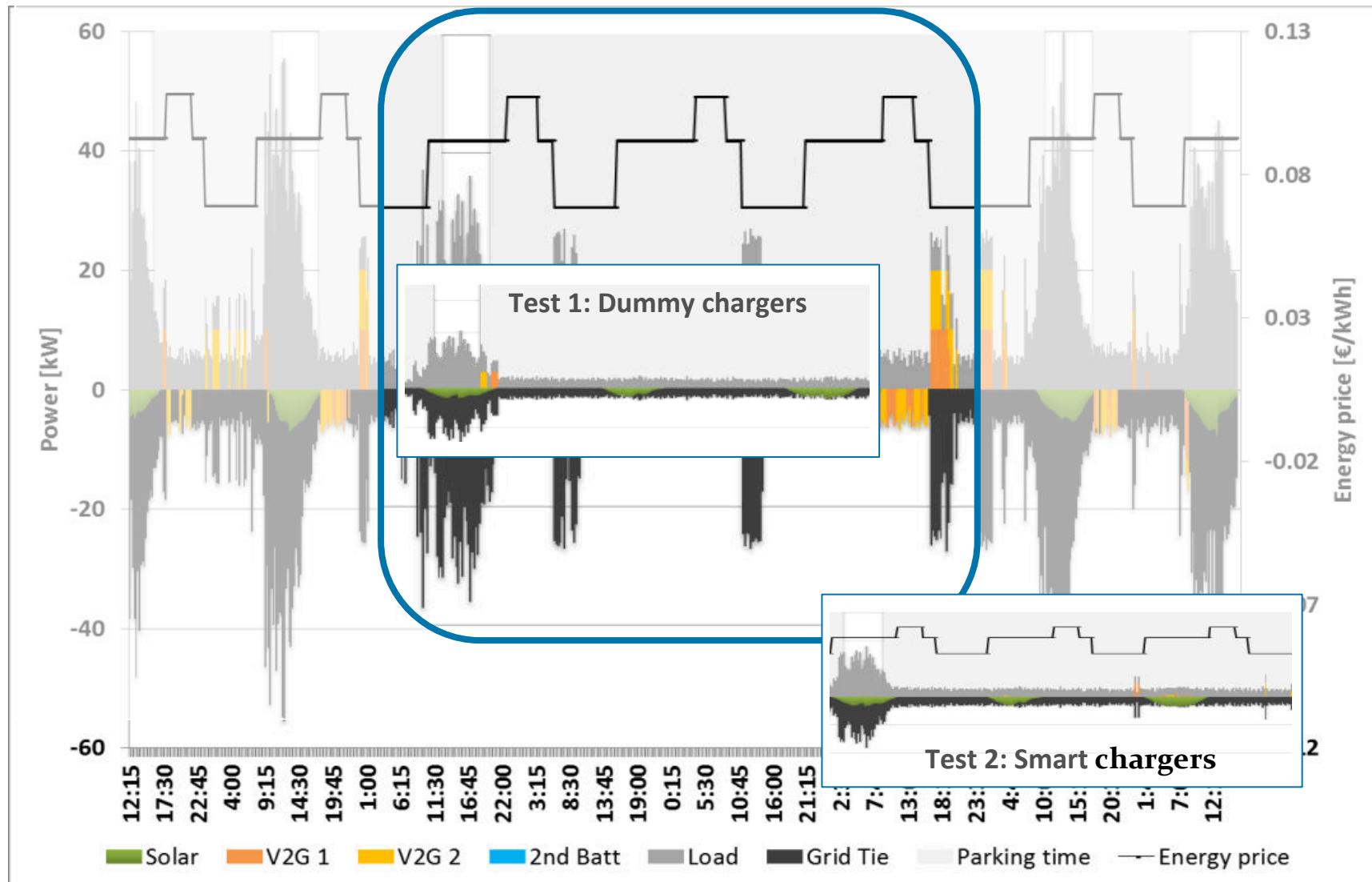
- Solar panels
- Smart charge
- V2G
- Building consumption



Results

Test 3: V2G

- Solar panels
- Smart charge
- V2G
- Building consumption





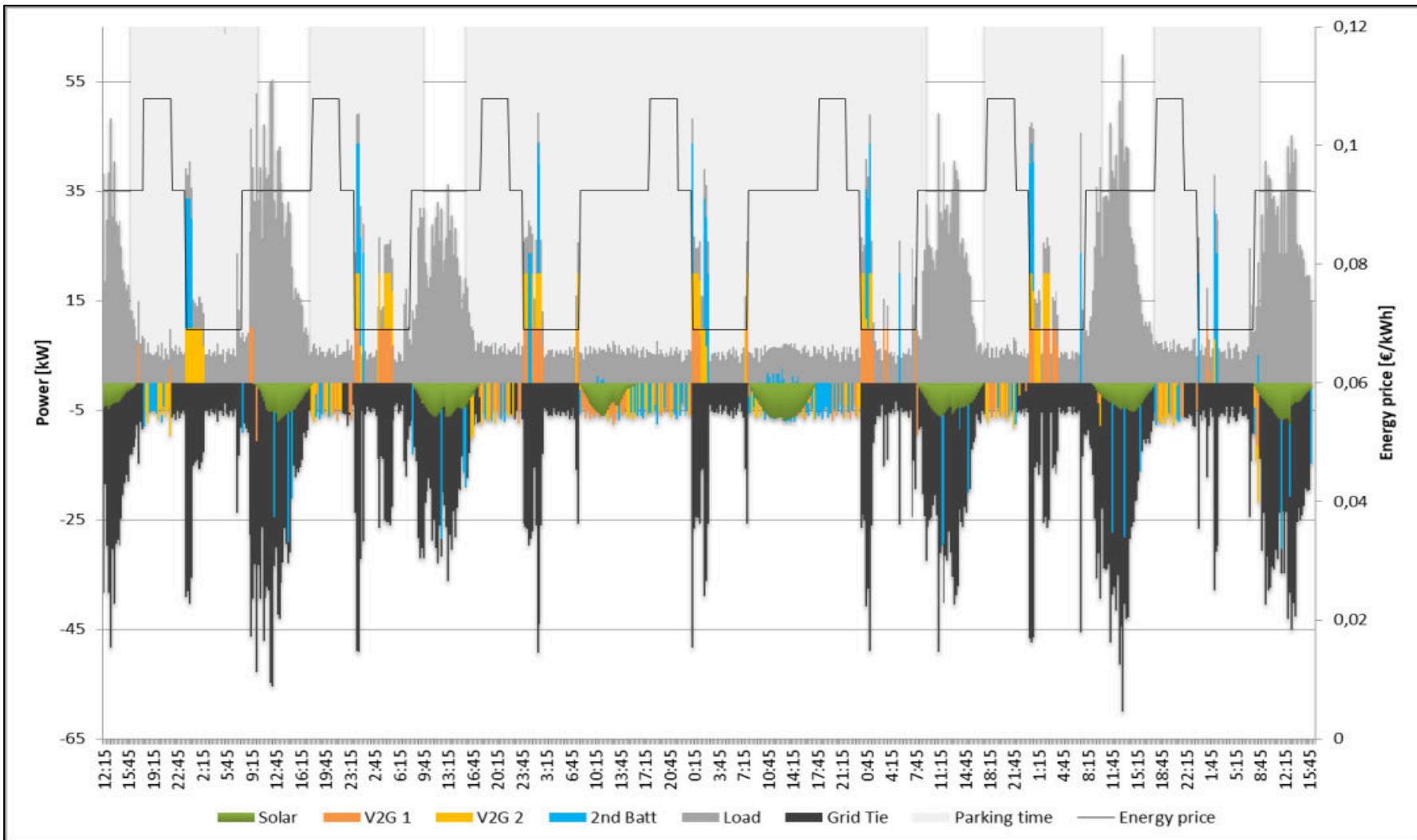
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Results

Test 4: V2G + ESS

- Solar panels
- Smart charge
- V2G
- Building consumption
- 2nd Life Batteries





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Results

	Dummy chargers	Smart Charge	V2G	V2G + ESS
Solar surplus [kW]	1,9	0,0	0,0	0,0
Max. power from grid [kW]	55,31	55,31	55,31	40
Energy cost [€]	169,54	164,3	159,99	154
Average cost per kWh [€/kWh]	0,09	0,088	0,084	0,082
Load supplied by V2G	0	0	10,63%	9,38%

- ✓ With the smart charge, surplus solar production is used.
- ✓ The possibility of discharging EV's batteries and thanks to optimization cost of IREMS, the energy arbitrage strategy obtains a better cost-efficiency management.
- ✓ The integration of second life batteries into the system, emphasizes the benefits of optimal management of V2G chargers



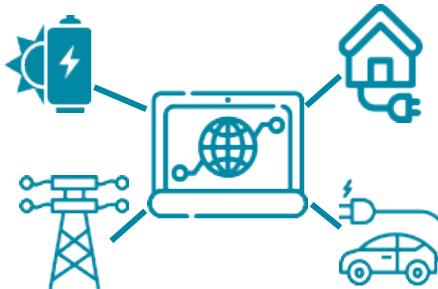
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Potential applications



Enabling the participation into Demand Response and DSM programs



Global and integrated management of several commercial energy systems



Increase of energy use from RE systems



10-15%
Reduction of electricity bills for customers/users



Global reduction of power peaks



Better EV integration to the system



Potential applications

- Management private or municipal EV fleets
- Vehicle to Grid: potential ancillary services of EV
- Vehicle to building applications
- Interaction with commercial demand aggregators
- Smart charging solutions



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Thank You!

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