



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

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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

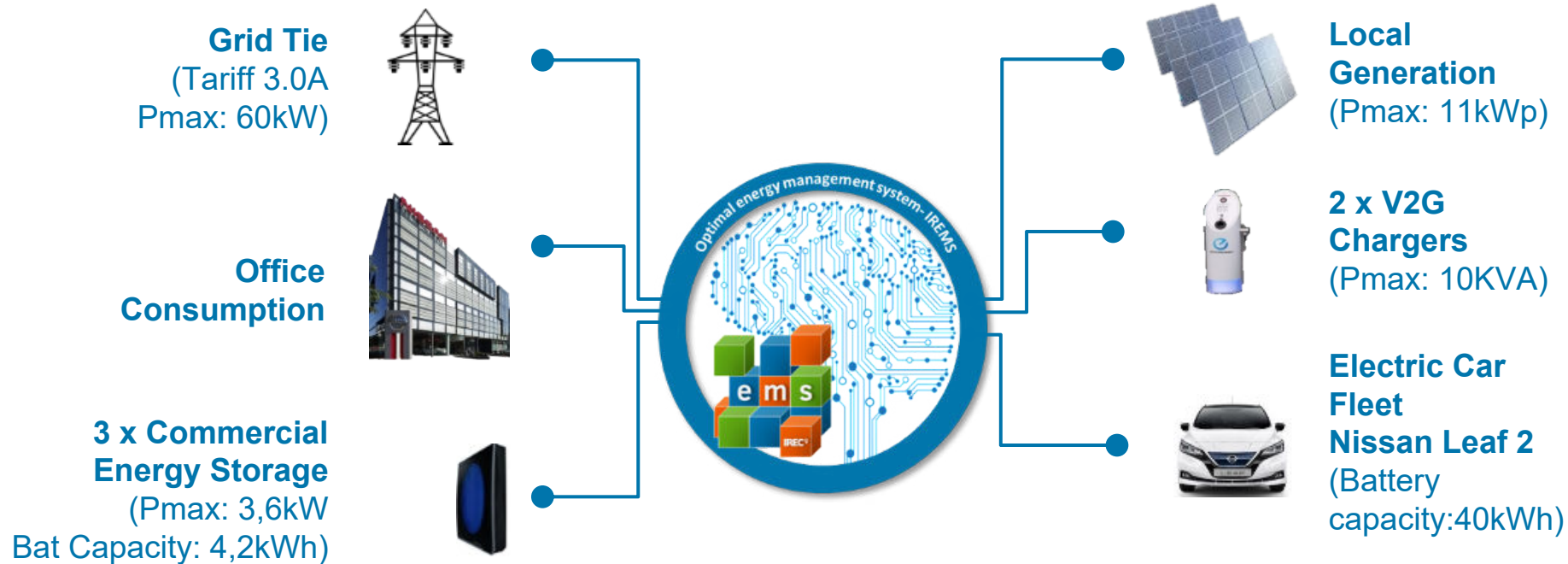
- The integration of Electric Vehicles in smart buildings together with local renewable energy generation.
- To analyze the potential **flexibility** of the load associated to the **EV charging** and the possibility of discharging the EV using vehicle to grid (V2G).
- The use of **V2G** chargers requires **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

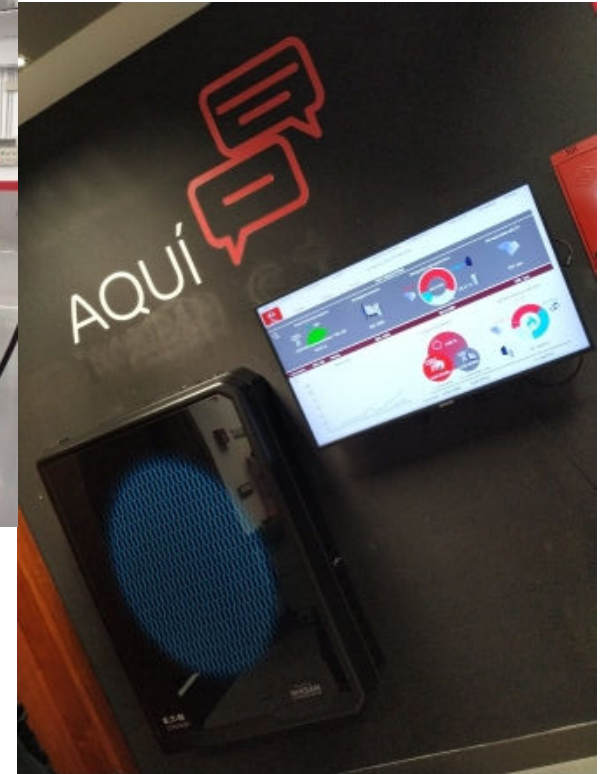
The aim of this measure is to evaluate:

- 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)**

Measure implementation



Measure implementation



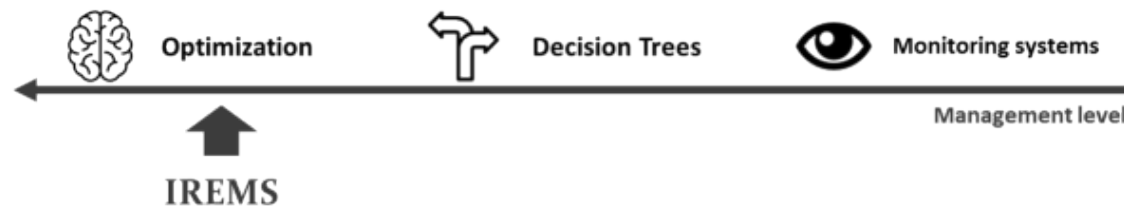
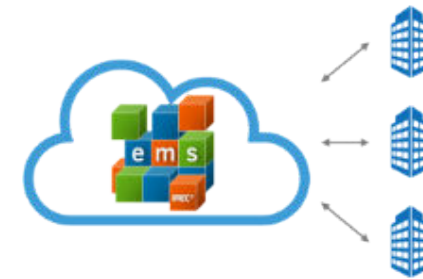
What is iREMS?

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

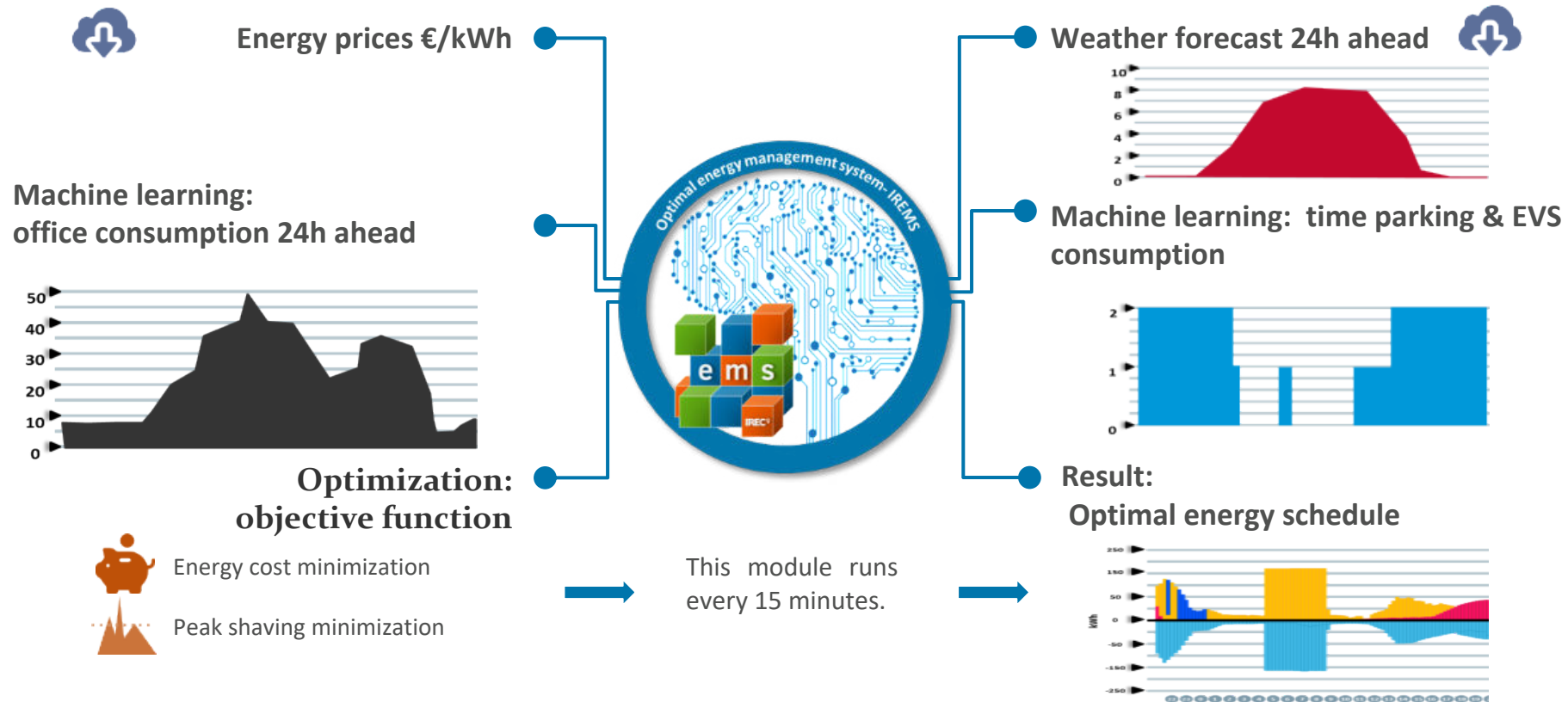
IREMS is able to **optimally manage** several kind of generators, loads and storage units under a common goal: to make more cost-effective and efficient your system.

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.



How does iREMS work?



Methodology

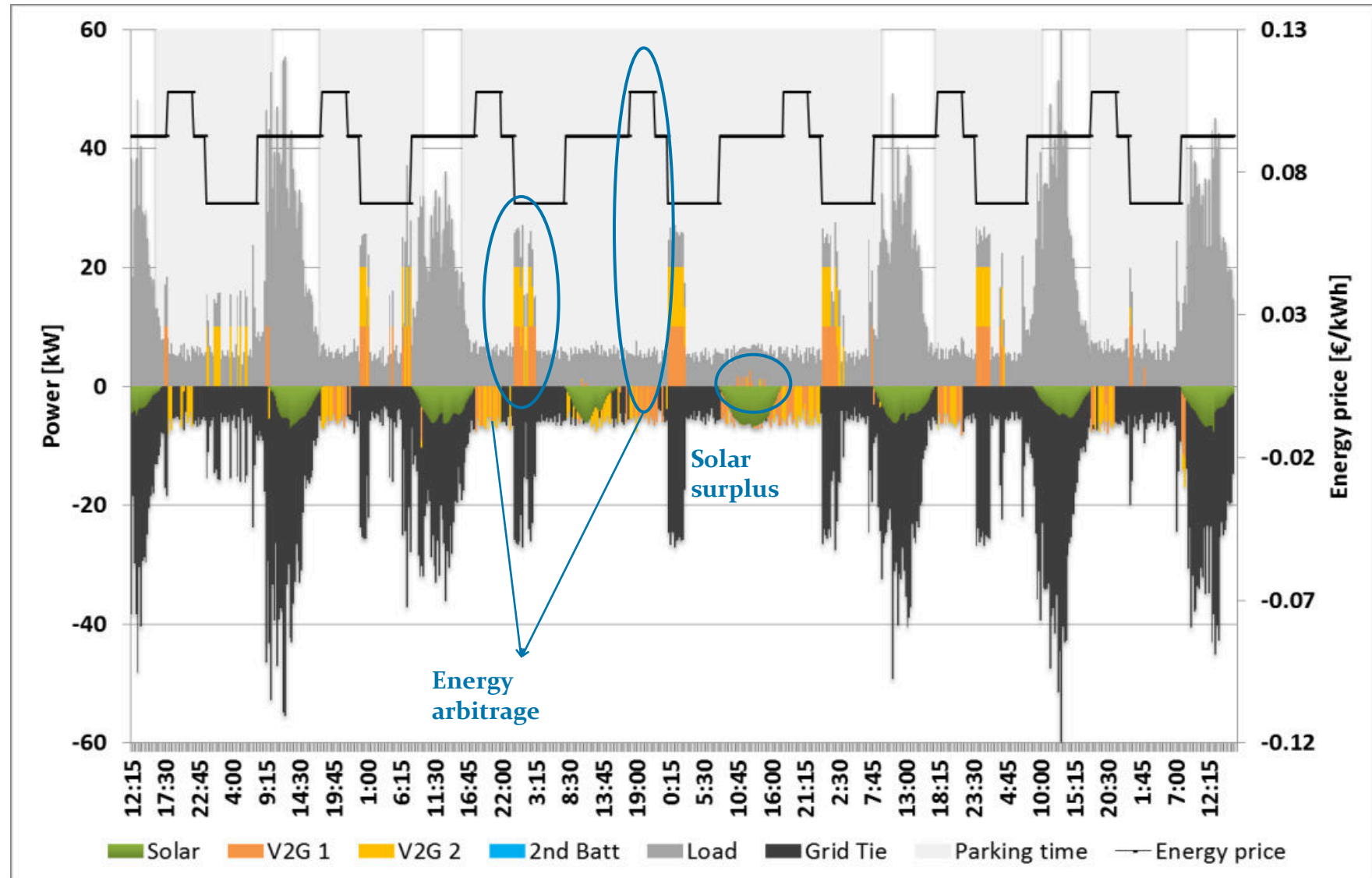
| | Consumption & Solar Pannels | Dummy chargers | Smart chargers | V2G chargers | Battery 2nd life |
|--------|-----------------------------|----------------|----------------|--------------|------------------|
| Test 1 | ✓ | ✓ | ✗ | ✗ | ✗ |
| Test 2 | ✓ | ✗ | ✓ | ✗ | ✗ |
| Test 3 | ✓ | ✗ | ✓ | ✓ | ✗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

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

Results

Test 3: V2G

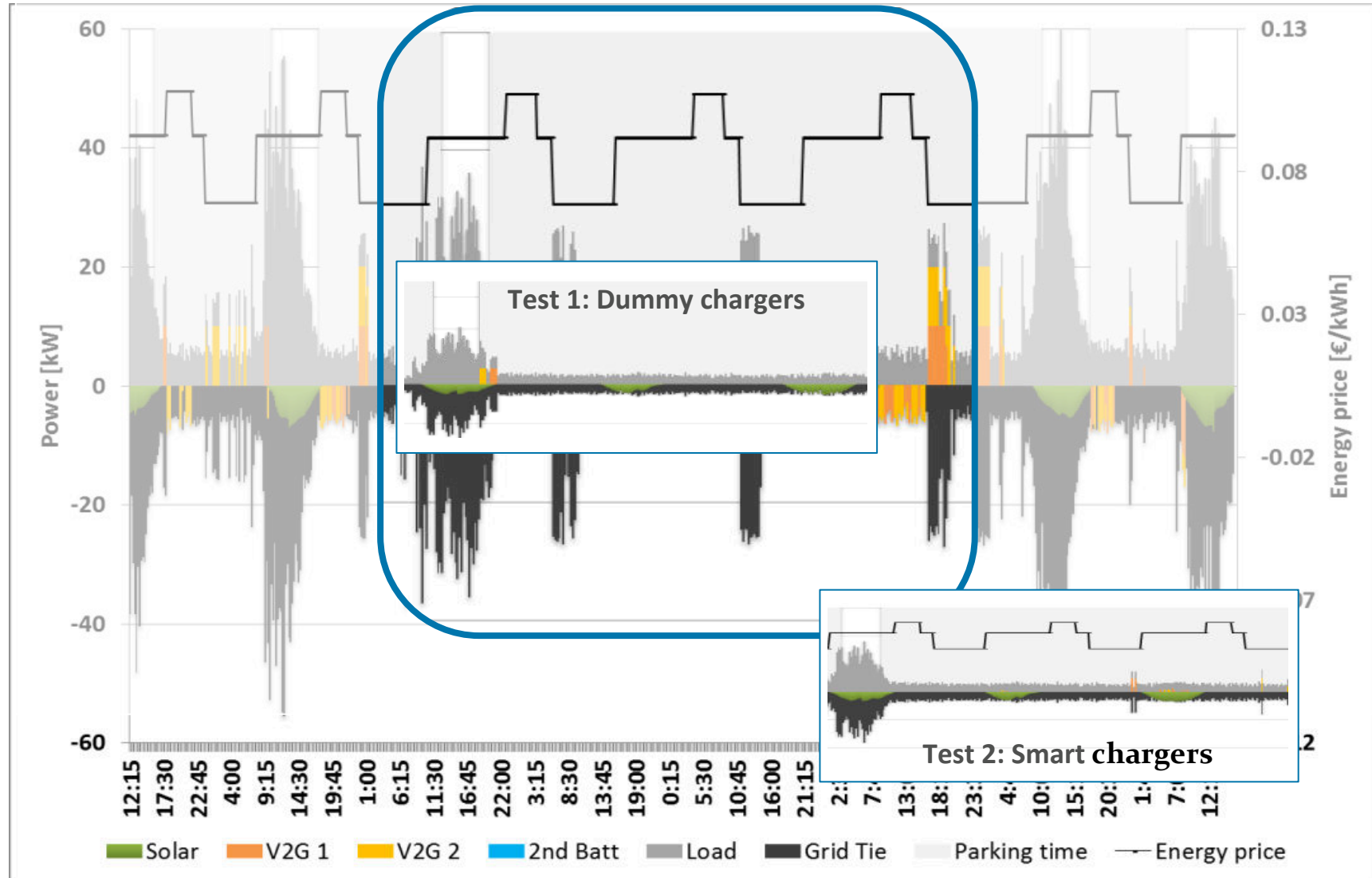
- Solar panels
- Smart charge
- V2G
- Building consumption



Results

Test 3: V2G

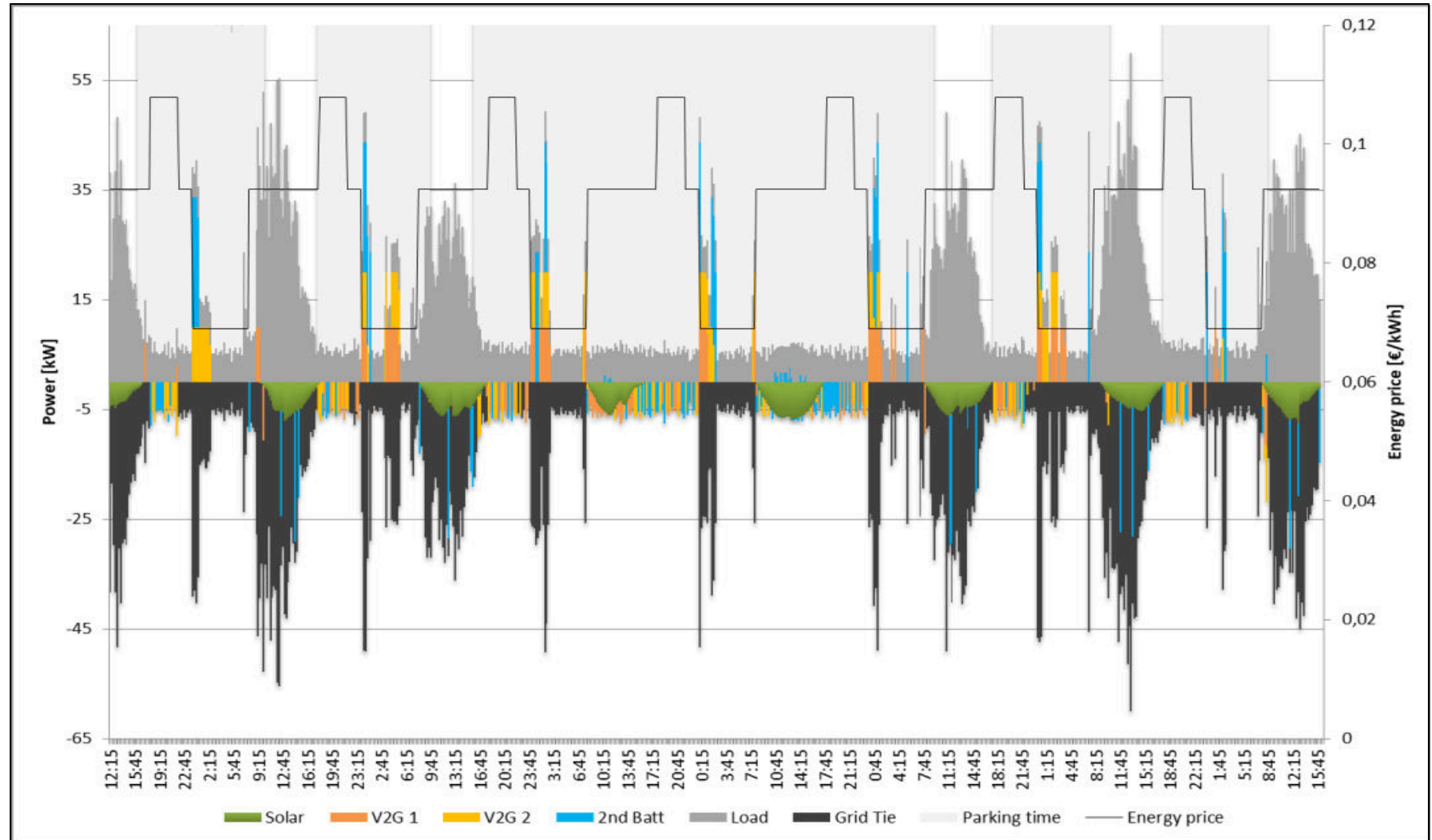
- Solar panels
- Smart charge
- V2G
- Building consumption



Results

Test 4: V2G + ESS

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



Results

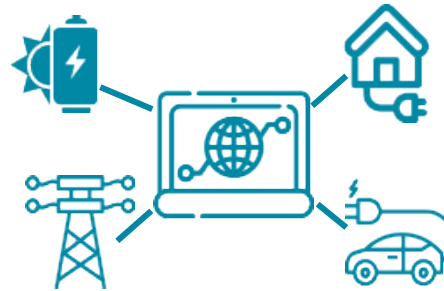
| | Dummy chargers | Smart Charge | V2G | V2G + ESS |
|-------------------------------------|-------------------|-----------------|---------------|--------------|
| Solar surplus [kW] | 1,9 | 0,0 | 0,0 | 0,0 |
| Max. power from grid [kW] | 55,31 | 55,31 | 55,31 | 40 |
| Energy cost [€] | 169,54 | 164,3 | 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 thank 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

Potential applications



Enabling the participation into
Demand Response and DSM
programs

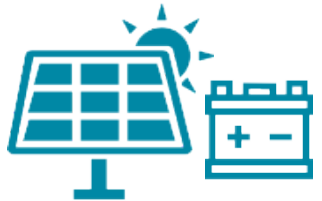


Global and integrated
management of several
commercial energy systems



10-15%

Reduction of electricity bills for
customers/users



8-10%

Increase of energy use from RE
systems



**Better EV integration to the
system**



Global reduction of power
peaks



INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION



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



INTERNATIONAL ELECTRIC VEHICLE SYMPOSIUM & EXHIBITION



Thank You!

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