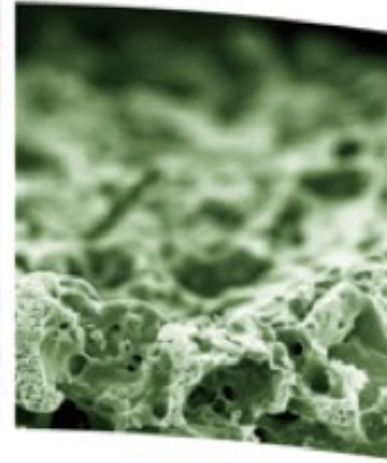
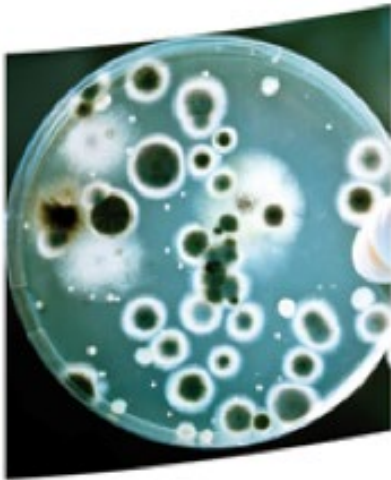




Institut de Recerca en Energia de Catalunya
Catalonia Institute for Energy Research



Energy flexibility in buildings: a key asset in the future energy system

22 November 2018
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PROJECT OBJECTIVE

The REFER project aims to **reduce** energy consumption, to improve the available **flexible** energy sources and to **increase** the energy efficiency in tertiary buildings.



Demo site: Montgat library with photovoltaics generation, second life battery and smart heating, ventilation, and air conditioning management system

PROJECT DATA

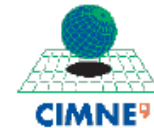
REFER belongs to the RIS3CAT Energy Community



3 years project 2016-2019

Project consortium: 15 partners

- 2 Research institutes
- 2 Technological institutes
- 7 companies
- 1 university
- 1 public administration



PROJECT DATA

REFER project has many different objectives and developments:

- New energy sources: BIPV solar modules development, new battery technology development
- IOT and harvesting: harvesting and load sensing for the PV generation
- Theoretical analysis of aggregator agent, second life EV batteries, zero energy buildings simulation,
- ...

But this presentation will focus on the solution implemented in the demonstration site. This solution aims to be commercially viable, easily implemented and exploited and replicable.

SOLUTION FEATURES

The project demo site aims to test a smart system for the energy management of a tertiary building. This solution must be easy to install and operate.

Key features:

- ✓ **Automatization** of heating, ventilation, and air conditioning (HVAC).
- ✓ **Flexibility** coming from HVAC system, photovoltaic generation and energy storage system.
- ✓ To decrease the installation of electrical storage, **second life EV battery** is used.
- ✓ **Aggregator** agent exploits the flexibility of the building
- ✓ Always considering **users** constraints and building usage.
- ✓ **Cloud** solution that allows the building manager to install and control several buildings at the same time.

SOLUTION FEATURES

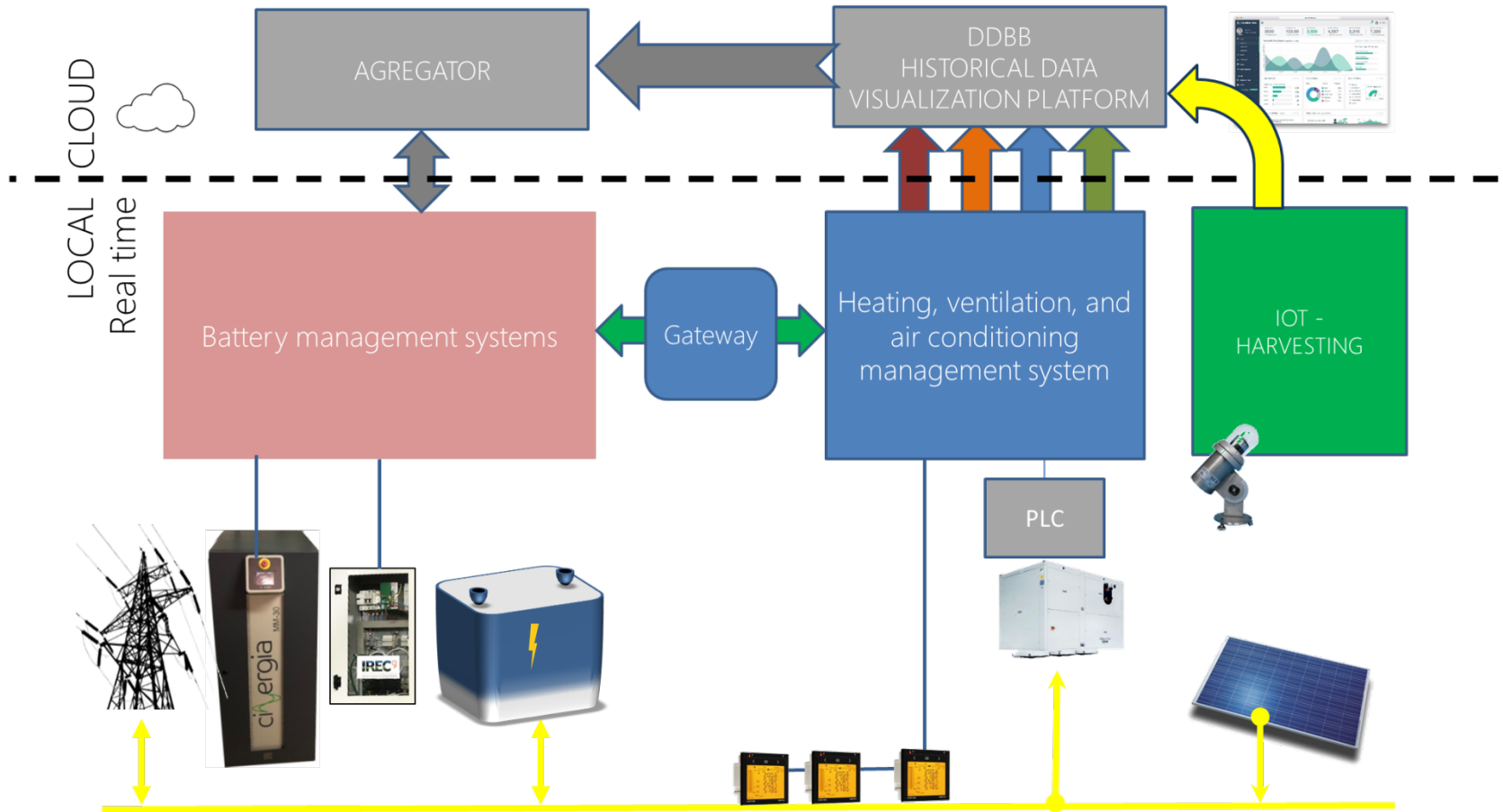
Demo site characteristics:

- ✓ Photovoltaic systems (PV) already installed
- ✓ The library open hours do not match with the hour of maximum PV generation → PV surplus injected into the grid without generating revenues.
- ✓ 63 libraries with similar characteristics in the metropolitan area of Barcelona

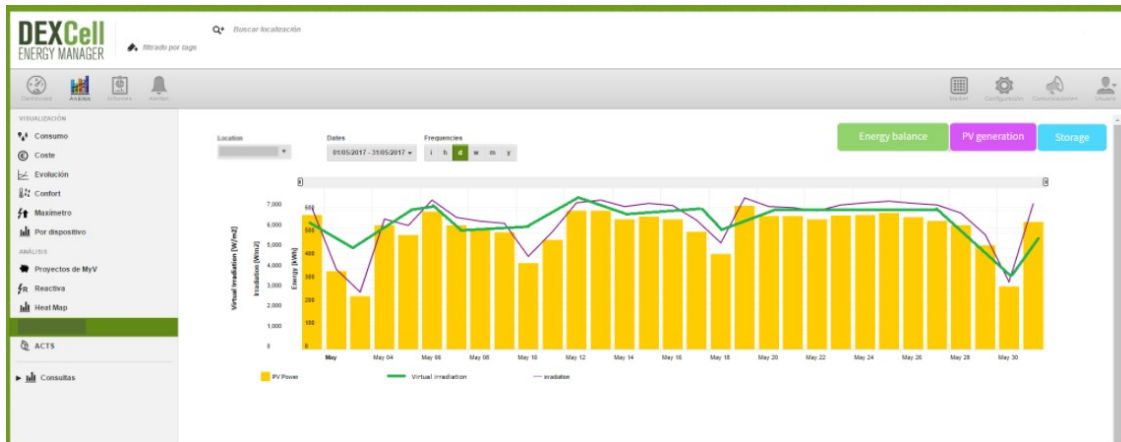
Key results:

- ✓ Decrease the amount of self-generated PV energy injected into the grid (PV surplus)
- ✓ Allow new business to exploit flexibility (aggregator)
- ✓ Decrease energy costs
- ✓ Automatization avoids excess of energy consumption due to misuse of HVAC system

SOLUTION ARQUITECTURE



USER INTERFACE



- Comparison real vs forecast radiation



- Energy flow between generation, demand and storage

USER INTERFACE



- Battery management system (SOC, T^a battery, energy (supply/storage))

LESSONS LEARNT

- Combining existing hardware and software (PV, HVAC) with new elements (management software, energy storage systems) is time consuming due to communication issues, incompatibilities, absence of existing hardware manufacturer supports, ... This should be take into consideration when evaluating the economic difference between installing all-new solution or combining new and already installed components.
- Second life EV batteries need further testing and evaluation. Lab experiments are basic for assuring security and performance. Installing this kind of device in a public building causes different unexpected problems such as non-existing insurance policies, transport and installation requirements, ...
- Aggregator agent represents a great opportunity but its expected benefits will be simulated given that current regulation does not allow this agent to operate.

CONCLUSIONS

- A new energy solution has been installed in a tertiary building including:
 - Existing hardware (PV and HVAC system)
 - Second life EV battery
 - New smart energy management software cloud based with aggregator capabilities.
- Users requirements considered and implemented in the energy management (users comfort, open-hours, security...)
- Demo site running for 6 months (December 2018 – June 2019).

Thank you for your attention

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