VERDE PROJECT

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Demand Side Management and Electric Vehicle Integration

The VERDE Project is a CENIT project from the Ministry of Science in Spain led by SEAT. The VERDE Project will issue a new concept for both, the plug-in electric vehicle (PEV) itself and the PEV management, so that at the end of the R&D project, new standards, devices and systems, will be ready for industrialization processes and pilot deployments.
This will lead to a new Energy Management concept, in which these PEVs will play a new role to support and enhance the current electrical generation versus demand curve, able to flat it due to load movement from peak to valley.

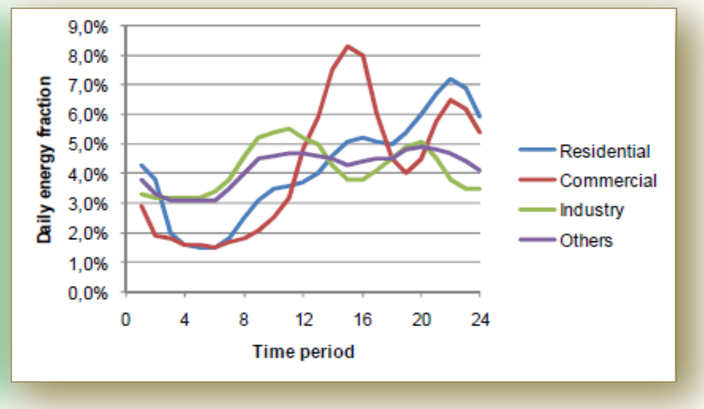
Objective

Analyze the effect of load management in a 2030 scenario with a **massive introduction of Plug-in Electric Vehicles** (PEV) in the Spanish grid.

Methodology

"Bottom-up" approach simulation model based on optimal behavior of PEV users.

It has been considered a part of the electricity distribution grid of Vitoria (Spain) with about 30.000 clients.

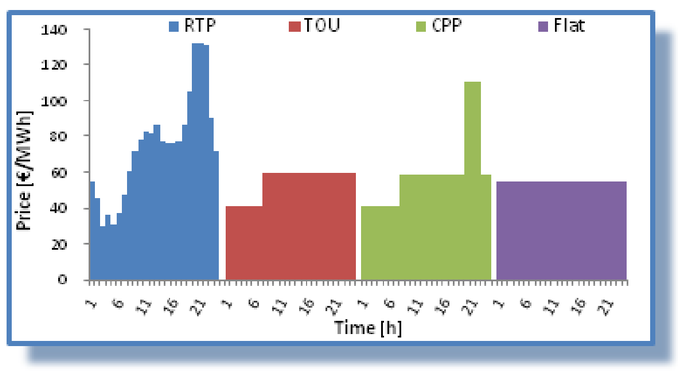


Mobility behavior is modeled by using a survey-based mobility database of Spanish urban areas.

18.000 electric vehicles are modeled and grouped into 16 different-sized **user profiles** taking into account the penetration scenario for 2030:

- *30,82% PHEV of the total cars*
- *36,67% BEV of the total cars.*
- *68,49% Electric Motorcycles of the total amount of motorcycles.*

Different **price schemes** are estimated:

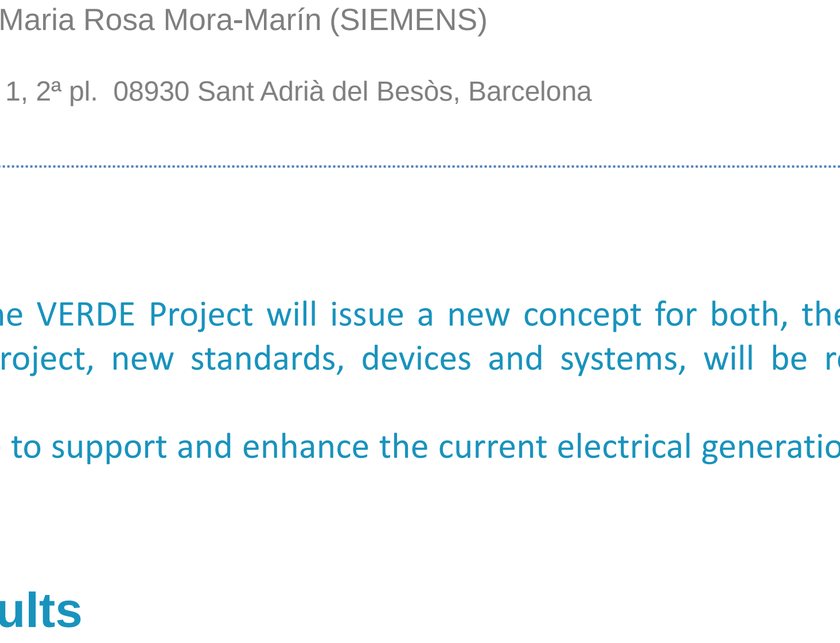


Results

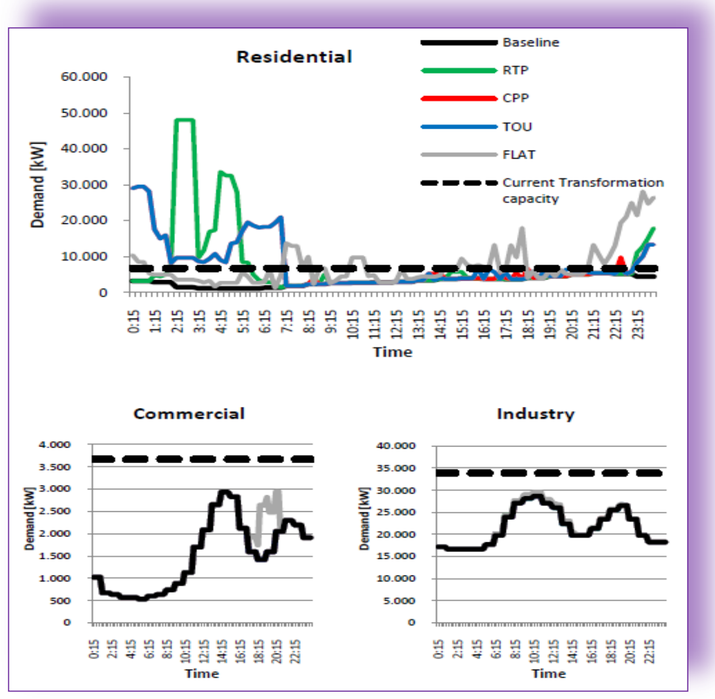
Electric Vehicles' **demand response** has been simulated with **DEMS** from SIEMENS by using different tariffs.

Results show how dynamic pricing might:

- Shifting PEV consumption to off-peak periods, but
- Producing charging inrushes in low pricing periods



Finally, it has been obtained the **load profile** of electric vehicle that **minimize** user's electricity cost.



Scheme	Cost	Extra cost	Peak load	Peak load increasing
RTP	4,076€	-	46,259kW	33%
CPP	4,840€	19%	26,271kW	2%
TOU	4,830€	18%	26,271kW	2%
Flat	6,156€	51%	23,729kW	-

Conclusions

- ❑ The **most cost-effective** tariff for PEV users implies an **increase of peak load** and vice versa.
- ❑ The charge of electric vehicles are concentrated in **residential areas** and located **during the night.**
- ❑ **In future research** other demand side management strategies must be considered apart from price signals.

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