Economic feasibility of PV self-consumption in the French residential sector in 2030

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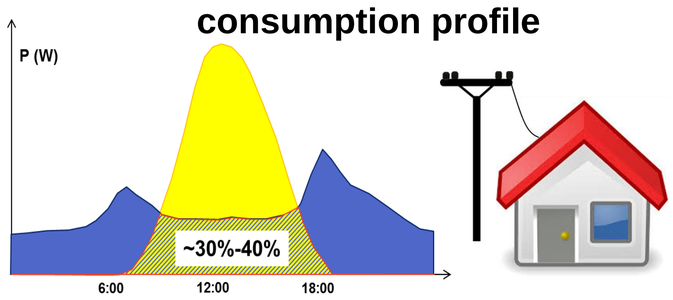
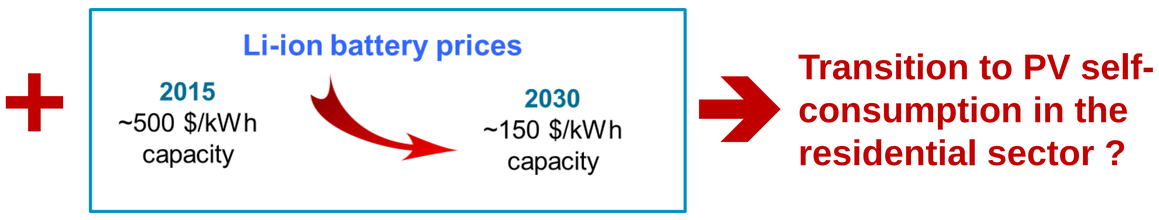
Introduction

Cost of PV modules [1]

Poor correlation with residential consumption profile



Continuous price decline in the batteries [2][3]



Transition to PV self-consumption in the residential sector ?

- Impacts on all stakeholders in electricity market ⇨ Necessity for policymakers to understand the timing of this transition.
- This study attempts to evaluate the economic attractiveness of French residential PV systems with batteries in the near future.

Methods

The study includes the following steps:

1. **Define the optimum battery size to achieve a significant level of PV self-consumption in the residential sector [4]**
   - Assumption: the use of 3 kWp PV systems coupled with 4 kWh Li-ion batteries is optimum reaching 80% to 90% of PV self-consumption.
2. **Estimate the PV LCOE in the French residential PV systems by 2030 based on the International Energy Agency (IEA) scenarios of PV deployment and the learning curve approach.**
   - Assumptions:
     - Average current cost of $ 3.1/Wp for the PV residential systems [5] and a learning rate of 18% [6]
     - Current battery price of $500/kWh including installation costs and a cost of $150/kWh for 2030 [3]
3. **Compare the results with the estimated price of electricity in 2030.**
   - Assumption: the electricity tariffs increase by 2% per year until 2030.

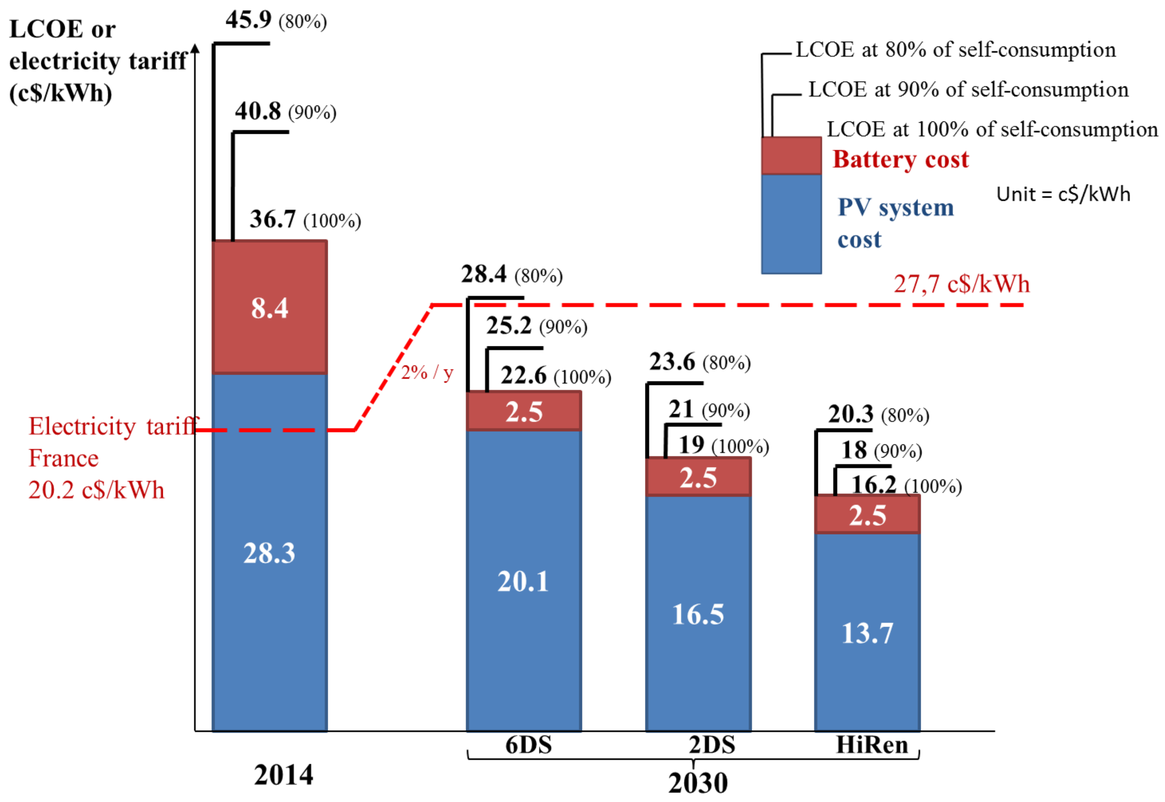
The conclusion discusses the policy implications.

Results

1. **Estimated residential PV system costs in 2030 from 1.5 $/Wp (hi-Ren scenario) to 2.19 $/Wp (6DS scenario).**

	2013	IEA's scenarios for 2030		
		6DS	2DS	HiRen
World PV cumulated installations (GWp)	135	451	842	1721
Residential PV system costs ($/Wp)	3.1	2.19	1.84	1.5

2. **Calculated LCOEs* for PV systems with batteries in 2030 and comparison with the residential electricity tariff**



**Assumptions for LCOE calculations : an irradiation of 1000 kWh/kWp/year, WACC=5%, 20 year lifetime for PV system and 10 year lifetime for Li-ion battery system*

In conclusion :

- Even by adding the cost of batteries, **PV systems would become competitive in France by 2030 under all IEA scenarios with a self-consumption rate of above 80%.**
- France has 18.8 million individual houses [7] : a potential PV production of 56 TWh/year (12% of the French electricity production)
- **Risks**: **sub-optimization of electricity system** with massive & uncontrolled PV self-consumption deployments

Conclusions

✓ **PV self-consumption with batteries could become profitable in France before 2030.**
- The demand in the residential sector would thus be natural in the near future in France.
- It gives an important opportunity for PV development with advantages (e.g. no grid reinforcement needed and no new land usage).
- It is also possible to advance the timing by improving PV economic competitiveness (e.g. non-module sector).

✓ **However, expanded PV integration through a self-consumption model raises new issues related to changes in the interests of stakeholders in the energy market.**
- Losses in terms of the network funding (loss of grid operator revenues, max. 3.4 billion $/year).
- Negative impact on long-term investment choices in electricity sector

✓ **Important to prepare a regular and progressive policy for the transition to PV self-consumption.**
- Enable the relevant stakeholders to have enough time to adapt to the new market situation
- Limiting the systemic impacts of PV power in the future as PV penetration becomes significant

How policymakers prepare for this change with a proper institutional framework supported by a long-term vision will affect the success of PV integration.

References

[1] IEA PVPS Trends in photovoltaic applications 2006 and 2015
[2] TECSOL, 2015. La batterie de Tesla est 2 à 2,5 fois meilleure marché que la concurrence.
[3] Deutsche Bank, 2015. Crossing the Chasm: Solar grid parity in a low oil price era
[4] Weniger, J., Bergner, J., Tjaden, T. & Quaschning, V., 2014. Economics of residential PV battery systems in the self-consumption age. s.l., 29th European Photovoltaic Solar Energy Conference and Exhibition
[5] IEA Technology roadmap: Solar photovoltaic energy 2014 edition
[6] IEA Technology roadmap: Solar photovoltaic energy 2010 edition
[7] ADEME, Bâtiment édition 2013 - Chiffres clés

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