

Solar panels plus lead-acid batteries to increase electricity self-sufficiency

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Photovoltaic systems coupled with lead-acid batteries do not ensure electrical self-sufficiency for a residence at a reasonable cost. This is the conclusion of a study from the Université libre de Bruxelles: simulations reveal that the maximum rate of self-sufficiency of solar panels would only be about 40 percent, while the addition of complementary lead-acid batteries would result in a considerable increase of the energy prices

Currently, in Belgium, [photovoltaic systems](#) coupled with lead-acid batteries do not ensure the electrical self-sufficiency of a residence at a reasonable cost. This is the summary conclusion of the study two ULB researchers: their simulations reveal that the maximum rate of self-sufficiency of solar panels would only be about 40%, while the addition of complementary lead-acid batteries would result in a considerable increase of the energy prices.

Today, the use of solar panels and [energy storage](#) in homes is a much discussed subject. As countries push for renewables and new technologies such as solar panels or electric cars become ever more accessible, it seems as if the house of the future is set to be self-sufficient, independent from the grid, feeding its inhabitants' needs with green energy from the sun.

At the Université libre de Bruxelles, Faculty of Sciences, Aero Thermo Mechanics, researchers led by Guilherme Silva and Patrick Hendrick have been focusing on the problematic of home energy self-sufficiency for a long time and have come up with interesting results, recently

published on the *Applied Energy* journal under the title "Lead-acid batteries coupled with photovoltaics for increased electricity self-sufficiency in households". They started by crunching up-to date Belgian data from the Royal Meteorological Institute, energy suppliers and installers and then ran these numbers through their [simulation](#) models. The conclusion is that energy self-sufficiency in homes with solar panels and batteries may come with an expensive price tag and that there may be better solutions out there to go green.

The problem starts with the bad timing of solar energy and energy consumption: while the sun shines at its maximum around midday, most homes consume the most in the morning and in the evening. Add to that the fact that in many countries most of the solar energy is available in the summer months and you're set for dark times. No matter how many solar panels are added up, the maximum attainable self-sufficiency will be around 40%. The good news is that 40% self-sufficiency is achievable at prices close to the grid ones, given the recent strong reduction in the cost of solar panels and their long lifetime. To go beyond 40% self-sufficiency, energy storage seems the natural answer. The researchers coupled the solar panels with lead-acid batteries and the results are striking: all of a sudden, the energy consumed becomes really expensive. Trying to reach a self-sufficiency of 60% can easily cost twice as much as using the grid. And the batteries' short lifetime and high price are not the only ones to blame: installation costs and extra required electrical equipment also play an important role.

The lack of a long term energy policy keeps homeowners and installers cautious, afraid to invest and bear all the risks, a problem that recently granted Belgium a public reprimand from the International Energy Agency. The researchers also took a look at the impact on the power grid of solar panels and home energy storage and the results seem grim. Homes equipped with such systems place a greater strain on the power grid. Also, power plants will need to be able to answer to quicker

variations in demand. All this will impact power grid prices, a field where research is still lacking.

Fortunately, all is not lost. The paper points out that a hybrid approach must be taken for a sustainable energy use. Using several energy sources helps to balance out each one's disadvantages. Consumption can also be adapted through intelligent appliances that can adjust to the conditions available, as can the energy storage system work in a more intelligent way. Recent [energy](#) storage technologies, such as li-ion batteries, continue to enjoy strong price reductions while the share of electric vehicles continues to increase. The field is evolving fast and research continues but, in the meanwhile, there is no magic bullet, the best option is to keep some [solar panels](#) and continue to play along with the grid.

More information: Guilherme de Oliveira e Silva, Patrick Hendrick. Lead-acid batteries coupled with photovoltaics for increased electricity self-sufficiency in households. *Applied Energy* 178: 856-867 (2016)

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