Forecast 2030: stored electricity at $0.05/kWh

BY: MICHAEL FUHS

Winfried Hoffmann, a well-known figure throughout the PV world, has created a learning curve for battery storage that predicts costs will fall much faster than many experts believe.

Winfried Hoffmann predicts that average energy storage costs are likely to fall by 7% per year based on current learning curves.
Solarpraxis/Andreas Schlegel

"Experts in their own field are often unable to imagine how fast prices can fall," Winfried Hoffmann of the consulting firm ASE told **pv magazine**. The former CTO of Applied Materials was one of the pioneers who, at an early stage, analyzed and employed the learning curve for solar modules which has, with hindsight, proved to be accurate.

Now Hoffmann has applied the same method to the cost trend of lithium-ion battery cells - with equally amazing results, as he outlined in a presentation at this week's EU PVSEC in Amsterdam. Accordingly, prices for mobile phone batteries have fallen by about 20% in the past when the quantity produced was doubled in watt-hours; car batteries, meanwhile, by about 15% (see Figure 1). On average, a similar value emerges to that of the price experience curve for solar modules. A module that cost US$5-$6 in 2000 costs just $0.50 to $0.60 cents in 2014.
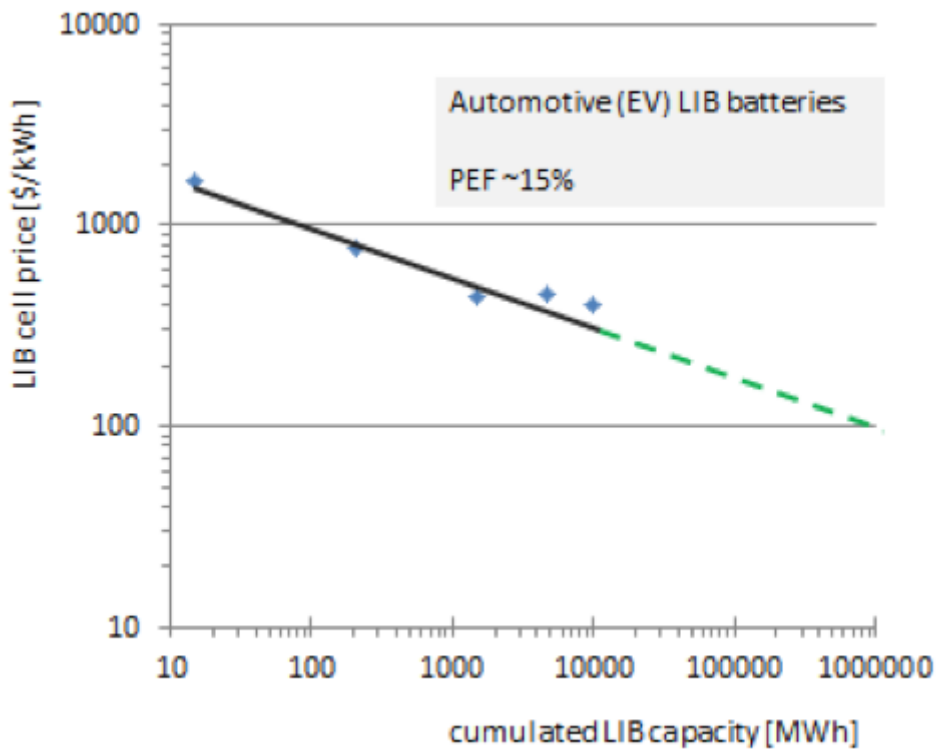
(Figure 1: Learning curve for lithium-ion batteries for electric cars in the past, and forecast for the future, as presented at the EU PVSEC.)

Both cell phone and lithium-ion car batteries for electric vehicles will, according to Hoffmann's price experience curve, break the sound barrier of $100 per kilowatt hour (kWh) capacity when batteries with a cumulative capacity of one terawatt hour (tWh) are installed.

Sound barrier to be broken in 2030

The question is: when will this production volume be achieved? Currently, the cumulative volume for electric car batteries is approximately 7 GWh. With an average annual growth rate of 31%, the cumulative capacity of one tWh will be achieved by 2030. Hoffmann considers this rate to be realistic based on the fact that the cumulative capacity in the solar industry increased on average by 41% between 2000 and 2010. "$100/kWh of storage capacity is therefore possible by 2030," he says. It can be assumed that prices would fall on average by 7% per year.

This learning curve applies only to cells. They only become batteries when surrounded by the so-called packaging. If a Lithium-ion car battery cost $520/kWh capacity in 2012, approximately one-third went towards packaging; the rest, about

$340, was spent on the production of the cells. By 2020, these packaging costs will, according to an estimate by analysts avicenne, fall to $50, and Hoffmann expects them to fall even further by 2030 by a factor of two.
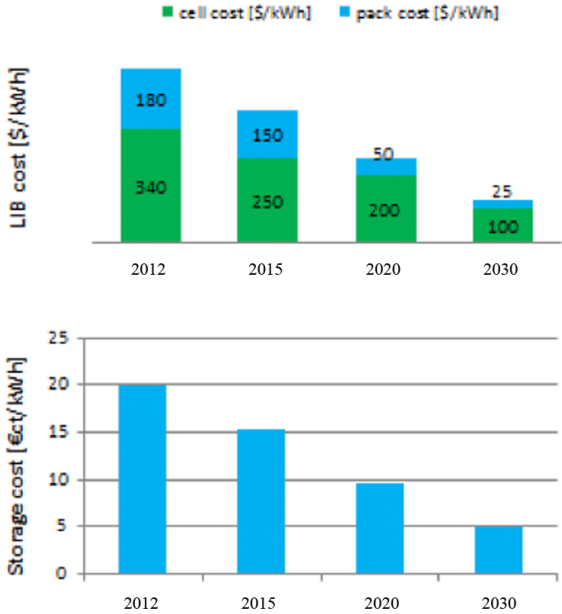
(Figure 2: Forecast for cost of lithium-ion batteries and resulting costs for stored electricity. Data is provided by analysts from avicenne and Winfried Hoffmann, who presented the assessment to the EU PVSEC.)

Decentralized supply cheaper option

If the battery has 80% usable capacity and holds 5,000 cycles, the cost of stored electricity in this evaluation will fall from €0.20/kWh ($0.25) in 2012 to €0.05/kWh ($0.06) in 2030. Should the solar power generation costs fall to €0.05-€0.10/kWh, electricity costs that are more than competitive with the cost of household electricity will result. The cost of this decentralized supply is, according to Hoffmann, notwithstanding transference costs, and will arrive at below the cost of electricity from new nuclear power plants and coal power plants with CCS technology for carbon dioxide storage.

That this brave new world of decentralized energy supply is already slowly dawning is demonstrated by an energy-independent commercial building that was recently opened in southern Germany.

Winfried Hoffmann will be presenting and elaborating on his findings at the 15th Forum Solarpraxis, to be held