

Box 6: Battery system costs and Levelised Cost of Energy (LCOE)

As discussed in section 3, a battery installation is comprised of several components. These include battery cells (for cell-based batteries), a power conversion system, materials in the module, a battery management system and other components. In addition, labour, maintenance and other variable costs must be taken into account. While individual cell costs (for cell-based batteries) may be a good economic indicator for comparison purposes, they only represent around 20% of all relevant costs. Total system and variable costs depend on location, application, additional equipment needed, vendors, commercial availability, size of the system and other variables.

There are a number of indicators used for cost comparison, such as cost per kW (power), cost per kWh (energy), or cost per kWh per cycle. Table 1 shows the data for three battery storage systems available in the German market. All battery systems can provide a nominal power of 5 kW, but the capacity, maximum depth-of-discharge determining the usable capacity, the number of cycles, and the prices are different (Photovoltaic, 2012). The data shows that the li-ion battery with the highest system price actually provides the lowest cost per cycle.

Table 1: Calculating cost of battery storage systems available in the German market

battery technology	lead-acid	li-ion	li-ion
battery power	5	5	5
battery capacity (kWh)	14.4	5.5	8
usable capacity (kWh)	7.2	4.4	8
cycles	2800	3000	6000
price (EUR)	8900	7500	18900
EUR/kW	1780	1500	3780
EUR/kWh	618	1364	2363
EUR/useable kWh	1236	1705	2363
EUR/useable kWh/cycle	0.44	0.57	0.39

Furthermore, the cost of a complete system can be represented by the calculation of the LCOE. This is determined by adding all relevant initial, variable and end-of-life costs for an installation. This is then divided by the life time output of electricity, measured in kWh or MWh. The calculation takes into account the time value of money with an appropriate discount rate over the life of the system. EPRI and DOE provide LCOE statistics in their 2013 storage handbook for specific applications. Vendors are anonymous. For instance, lithium-ion batteries utilised for distributed energy storage applications of various capacities and power output ranged from about USD 0.5-2/kWh and upwards (EPRI and DOE, 2013, p.106).

The LCOE statistic must be viewed with caution as it does not necessarily represent the value of the service provided. For instance, a backup storage facility not often used will have a very high LCOE but may provide a valuable service. These types of installations may be economic if flexibility is accurately valued and compensated for under the local market and regulatory structure.