Simulation of Lithium Ion Batteries in PV*SOL / PV*SOL premium

1 Lead acid and lithium ion batteries PV*SOL / PV*SOL premium

PV*SOL / PV*SOL premium can design and simulate grid connected photovoltaic systems with battery storage. The model developed to simulate battery storage takes into account all the relevant chemical and electrical effects of lead acid batteries.
Currently, more than half of the storage systems available on the market are equipped with lead acid batteries. If you want to simulate a solar PV system with lead storage batteries, you can simply enter the batteries and the inverters in PV*SOL / PV*SOL premium and obtain reliable, validated simulation results. The second most common type of battery currently used in PV storage systems is the lithium ion battery. PV*SOL / PV*SOL premium does not yet include this battery type in its simulation model, as the technology is still relatively new and reliable measurement data is not available. However, you can in principle simulate battery storage systems with lithium ion batteries in PV*SOL / PV*SOL premium. To do this, you just need to take account of the following points when entering data and interpreting the simulation results.

2 Data entry

2.1 Battery inverter

For the battery inverter data, you should refer to the manufacturer's data sheet and enter it in PV*SOL / PV*SOL premium. You don't need to change any data for lithium ion batteries. However, if the manufacturer provides data on the loading strategy for the energy management system in the battery inverter, we recommend that you enter this in the dialog "Charging Strategies". For example, lithium ion batteries may often be discharged deeper than lead acid batteries.

2.2 Battery

The lithium ion battery data should be handled as follows for simulation:

Characteristic	Source	Notes
Battery cell voltage		Must be specified as 2V, even though lithium Ion batteries usually have a cell voltage of about 3.7V to 4V
Battery bank total voltage	Data sheet	Bring the total voltage to the desired level through the number of cells in series. For example, for a bank of lithium ion batteries with 48V, set the cell voltage at 2V and 24 cells in series.
Internal resistance	Data sheet	Should be at a comparable level as in lead acid batteries of the same nominal capacity
Self-discharge	Data sheet	
Number of discharge cycles	Data sheet	The selection on the "Type" page affects how the numbers of cycles are internally converted: Type: "enclosed" -> Number of discharge cycles at 60% depth of discharge Type: "vented" -> Number of discharge cycles at 40% depth of discharge
Capacity characteristic	Data sheet	

3 Simulation results

The main differences between lithium ion and lead acid batteries can thus be considered in PV*SOL / PV*SOL premium. Please note, however, that the lack of reliable data means that the model for lithium ion batteries could not be validated. The following should therefore be taken into account:

- The energetic aspects of the simulation, i.e. the stored and discharged energy, correspond to a good approximation of reality.
- For the loading cycles and aging of the batteries, however, you should not use the simulation results. When entering the investment costs in the economic efficiency calculation you should, therefore, simply enter the lifespan as specified by the manufacturer.

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