

Optimized PV generation according to the load profile is achieved by intelligent orientation and inclination of PV arrays.



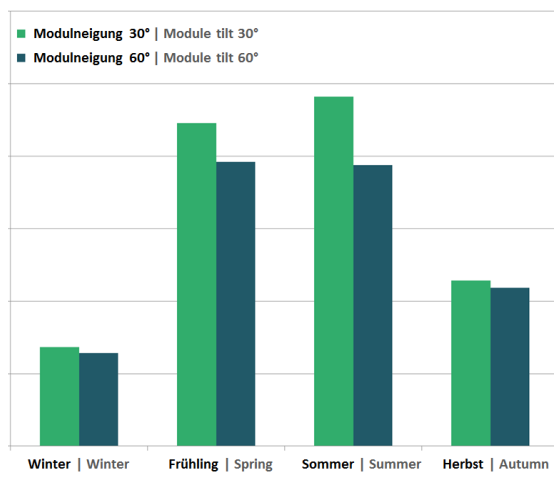
## The Solar Storage Park: Research and Harvest



PV facility with Lithium-ion storage system

In 2012, scientists of KIT thought about how to reasonably use regenerative energy sources and sustainably integrate them in its energy concept. They came up with the idea of covering part of the high energy consumption of Campus North by solar power produced by its own PV facility. Then, it was quite logical to launch a parallel project to study the interaction of solar modules, power inverters and lithium-ion batteries. The PV facility was installed in 2013 and since then, all solar power generated has been used to operate large-scale research infrastructure on Campus North. The facility is not only used to cover own power consumption, but also to conduct research. It has been integrated into the Energy Lab 2.0 and provides valuable data for different simulations and evaluations.

Average daily energy per season and tilt angle



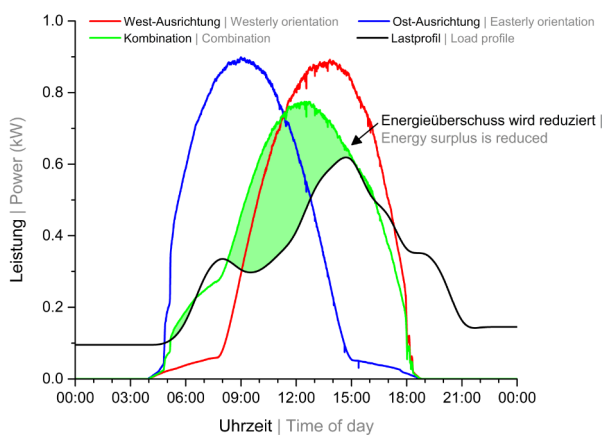
### Facts and Figures

The research facility has a peak power output of 1 MW, made up of more than 100 different PV array configurations differing in their orientation, inclination and/or electronic components: The PV facility, consisting of 102 PV panels, is equipped with six different PV module types and four different power inverters made by different manufacturers. The PV panels are oriented at 37 different angles. Their inclination varies in steps of 15° from 2° to 60°, east/west orientation also varies in steps of 15° from -60° to +60°. This allows for more than 100 different system configurations in which the performance of the commercial components can be assessed.





# The Solar Storage Park



Anpassung des Last- und Erzeugungsprofils durch Kombination der PV Orientierung  
 Load and generation profile matching using combined PV orientations

## Load and generation profile matching using combined PV orientations

intervals of seconds for research purposes. The data are statistically evaluated and analyzed. The resulting findings are of particular interest when equipping houses and industrial facilities with photovoltaic systems to which a stationary storage system is connected. Various cases are calculated. On this basis, orientation and dimension of the PV facility and the resulting diurnal cycle of energy production in combination with the size of the battery are optimally adjusted to the anticipated energy need. Work is aimed at reaching maximum energy efficiency taking into account other parameters, such as the degree of autonomy of the operator. Additionally, the PV generation data are used for the development of self-learning forecast algorithms that contribute to an intelligent overall system control. Within the Energy Lab, the data can also be used for various simulations. The PV park also represents an environment for field tests and optimization of power electronics in PV systems.

PV panels with different orientations



## Research Focus and Approach

For about ten years now, the performance data of the individual PV panels have been stored at



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