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Efficiency package for solar tracker

Solar power is optimally exploited on the Bindlacher Berg with a new automation solution

Using an innovative automation solution, the solar power plant on the Bindlacher Berg now operates with an even higher degree of stability and reliability than ever before. A SIMATIC S7-1200 PLC on each of the 229 trackers precisely tracks the solar modules to follow the sun. The free-of-charge tools from the „Solar Tracking Toolbox" also form the basis for additional tasks.

The solar power plant, operated by a group of investors, comprises three networked arrays with a total of 229 trackers (total power of 2.4 MWp). Each of the trackers can be automatically aligned to the sun through two axes; they can also be collectively moved together. As a consequence, an almost optimum radiation is guaranteed resulting in an up to 30% higher yield when compared to fixed systems.

The Gerlitz elektro-gmbh company from Bayreuth planned and implemented the automation, supported by Siemens specialists based in Nuremberg. The system integrator replaced the existing tracker control systems by SIMATIC S7-1200 controllers, ruggedized for industrial use. These are controlled by a higher-level master computer. The CPU 1212C selected as tracker control calculates the tracking using a high precision astronomical algorithm (a precision up to 0.0003° is possible). This means that each and every

tracker is optimally aligned to the sun, dependent on its geographical position and height as well as the time of day. As the calculation is performed in the control system, the trackers can also be commissioned and independently operated without the higher-level automation.

High efficiency for optimized operation

The S7-1200 and the SIMATIC HMI Comfort Panel for operating and monitoring the solar power plant were conveniently engineered, configured and programmed in the TIA Portal. Gerlitz adapted a preconfigured application example for SIMATIC WinCC for the operation of the 229 trackers; they also created their own user interface. All 458 tracker axes can be monitored and controlled from this user interface. The „back tracking" function, provided in the Solar Tracking Toolbox, was also used in this solar park. This function prevents the trackers from mutually blocking one another when the sun is low in the sky. The system identifies conditions such as these, and automatically moves the particular modules into a position that prevents the trackers from blocking one another, therefore optimizing the yield. Other functions include, identifying excessively high wind speeds. In these cases, the modules are automatically moved into a safe position. There is also a function that allows the trackers to shed any accumulated snow.

In the future, authorized users will be able to log on via a VPN tunnel and the WinCC option Sm@rtServer. This will allow them to operate and monitor the solar power plant without requiring an engineering system. The web server integrated in the S7-1200 can also be used to establish remote operation and monitoring. There is also a Sm@rtClient App for tablets and smart phones for remote access.

For the master computer there are systems that are adapted to the particular solar park size. These range from basic controllers up to high performance industrial PCs. By merging the open-loop control level with Windows in one device, the new SIMATIC ET 200 SP PC (open controller) offers significant advantages for solar park management systems. An industrial PC SIMATIC IPC 427C („Microbox-PC") is used in the solar park on Bindlacher Berg. In this project, a standardized communication algorithm runs on the Microbox. Via Ethernet, this interrogates all of the tracker controls and visualizes important operating data. A well-proven data concentrator application optimizes communication.

The free-of-charge „SIMATIC Automation Tool" ensures simple network management, which runs independently of the engineering system. As a consequence, during commissioning, IP addresses can be automatically allocated from a list, the states of SIMATIC components read out and nodes addressed, either individually or in groups. The tool saves time and avoids errors as a result of the selected update of the control firmware and application software via an Ethernet network.

The SINAMICS V20 inverter has proven itself for moving the axes.

Solar Tracking Toolbox – Modular efficiency for tracking solar systems:

Functions
- Algorithm to determine the position of the sun
- Back tracking to avoid trackers from mutually blocking one another
- Conversion to single-axis systems

Applications
- SIMATIC Automation Tool to quickly commission complete solar parks
- Linking drives and sensors via the Modbus protocol
- Data and recipe handling (local individual parameters))

Concepts
- Commissioning, update and backup scenarios based on free-of-charge tools
- Adaptive back tracking – can be freely parameterized for various terrains and geometry
- Optimized Tracker Control (OTC) – increased yield by adapting to the amount of sunlight and reduced movement of the trackers

Examples
- Export of the motion data to analyze the mechanical system and yield
- Remote access to the control system using HTML or Smartphone App
- Preconfigured program example for different tracker types

User interface

Control cabinet attached to a mast