

Operation and maintenance management of large-scale photovoltaic power plants

(SA-B-20210827-003)

In the whole life cycle of a photovoltaic power station, the operation and maintenance of a photovoltaic power station directly determines the investor's rate of return, so improving efficiency and reducing costs are always the goal of operation and maintenance personnel. If a large amount of funds and energy are invested in the early stage to improve the construction quality level of photovoltaic power stations, without paying attention to the operation and maintenance work after the completion of the power station, it will cause the ROI of the entire project to be greatly reduced. Therefore, doing a good job in the operation and maintenance of the entire life cycle of photovoltaic power plants is the top priority of the photovoltaic industry.

Photovoltaic power generation operation and maintenance management mainly includes: production operation and maintenance management (integrated operation and maintenance management), safety management, quality management, power marketing management, material management, and information management. Production operation and maintenance management is the core of the production field, and other management methods assist production operation and maintenance management.

1. Preparation before operation

1.1. Operation and maintenance staffing and intervention time

The deployment of photovoltaic power station operation and maintenance personnel is generally based on the capacity of the power station with 1.2 to 1.5 operation and maintenance personnel at 10MW, with a minimum of 4 people, and a two-shift mechanism is implemented. A power station is staffed according to the organizational structure of 1 station master, 1 deputy station master, 2 to 4 duty officers, electrical engineers, and ordinary operation and maintenance personnel. All personnel need to obtain a special operation certificate (high voltage electrician) and an operation and maintenance certificate issued by the dispatcher.

The best time for operation and maintenance personnel to intervene is when electrical commissioning starts during the construction period of the power station. At this time, the operation and maintenance personnel can participate in the commissioning of various power equipment with the manufacturers and commissioning unit engineers, familiarize themselves with the configuration of the power equipment of the power station, have a clearer understanding of the configuration of the electrical equipment of the power station, and conduct equipment materials and equipment installation quality inspection. The configuration of the monitoring platform is particularly important. During the configuration, the operation and maintenance personnel should

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communicate with the manufacturers to monitor the production details of the platform so as to facilitate their own use in the future. For the communication lines in the power station, it is necessary to promptly request the commissioning unit to make a label or do it by yourself, to facilitate the maintenance of the equipment in the later period. During the commissioning period, the operation and maintenance personnel should know the basics and be handy when taking over the operation and maintenance work after the power station is put into operation in the future.

1.2. Preparation of operation and maintenance system

Photovoltaic power plants must establish a sound operation management system, including but not limited to photovoltaic power plant operation and maintenance procedures, work ticket system, operation ticket system, operation monitoring system, tool management system, operation duty system, shift system, patrol inspection system, and equipment Maintenance and repair system, defect management system, operation analysis system, skill training system, spare parts and warehouse management system, etc.

1.3. Prepare power station materials

Before the power station is put into operation, it is necessary to purchase the necessary materials for operation, which generally include safety tools, commonly used tools, instruments, labor protection products, safety facilities, emergency and rescue supplies, office supplies, capital operation and maintenance vehicles, and handover from the construction period Product information, spare parts and other materials. At the same time, the team should manage the material ledger accordingly. There must be detailed records of all materials leaving and entering the warehouse, and the history can be checked.

1.4. Sorting out the operating data of the power station

Before the photovoltaic power station is connected to the grid, the operation and maintenance personnel need to obtain the relevant materials to be handed over from the construction party (including but not limited to, access system design review, electrical equipment product information, construction drawings, completion drawings, completion reports, equipment contracts, construction Contract and other documents) and save it.

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2. Grid-connected trial operation

2.1. Establish a grid-connected acceptance team

Establish a grid-connected team responsible for pre-grid project acceptance, equipment operation training, dispatch training, data collection and preparation of grid-connected plans and grid-connected start-up plans, etc., and should arrange for special personnel to connect and dispatch, and be responsible for communicating with the grid company about pre-grid matters.

2.2. On-site grid connection work

The operation and maintenance personnel need to contact the dispatch center at the time agreed by the dispatch, execute the operation ticket content issued by the dispatch, and report the dispatch operation one by one. After the equipment of the booster station is connected to the grid, the operation and maintenance personnel must confirm that all equipment is operating without abnormalities before sending power to the photovoltaic area. The main job is responsible for closing the transformer impulse cabinet and inverter. During the trial operation after the power station is connected to the grid, the operation and maintenance team needs to send a special person to check the operation of the equipment after the grid is connected, and pay attention to checking the background electrical data and the operating status of the primary equipment. If there is an abnormality, the operation and maintenance personnel should immediately report the dispatch request to disconnect the abnormal equipment. It will be connected to the grid after inspection and repair.

3. Related work after grid connection

After being connected to the grid, it has officially entered the operation and maintenance stage of the power station. At this time, the power station is the battlefield for operation and maintenance personnel. The operation and maintenance management of the power station after grid connection is the core work of the power station.

3.1. Production operation and maintenance management

Two tickets management: Two tickets run through all links of power station operation. Strict implementation of the two-invoice management system can effectively prevent mis operations and play a vital role in safety risk control and maintenance quality control.

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Inspection management: Make inspection plans and inspection routes, make inspections once a day, and record them in the operation log, analyze the causes of abnormal defects found and deal with them in time. The inspection scope should be reasonably planned. For large power stations, the inspection scope should be reasonably arranged in combination with the data and fault information of the monitoring system, and the inspection should be targeted.

Handover management: The power station shift team shall conduct a comprehensive handover of information such as power station information, scheduling plans, spare parts usage, tool borrowing, key usage, and abnormal conditions to ensure that the shift team obtains comprehensive information about the power station.

Electricity report management: The power station attendant should record the power generation information regularly every day and summarize it in the power generation report. The square matrix with abnormal power generation should be reported in time to analyze the cause of the abnormality. At the same time, the monthly statistics of power generation are compared with the settlement power.

Maintenance management: All maintenance work must comply with the power station maintenance system to ensure the order and safety of maintenance work. Maintenance management includes maintenance and preventive testing of existing malfunctioning equipment.

Production insurance and claims management: in order to ensure the normal operation of the power station and reduce the power loss or business interruption caused by various factors. It is recommended that power stations purchase production-related insurances. The main types of insurance purchased include business interruption insurance, disaster insurance, and equipment quality insurance.

Document management: including document system construction (document coding system, document classification system, document grading system, etc.), design document management, completion report management, commissioning report management, contract document management, drawing management, daily production document management, technical transformation document management, Overhaul document management, equipment specification certificate, electronic document record management, document system management, document destruction process management, etc.

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3.2. safety management

Safety is the lifeblood of industrial production, and any production-oriented enterprise always puts safety in the first place. Photovoltaic power plants must establish a sound safety management organization system, supervision system, and assessment system. Work out safety management systems and safety production emergency plans. The operation and maintenance team needs to be equipped with complete safety tools and fire fighting tools, and conduct safety training and safety drills on a regular basis. At the same time, it is necessary to make, install, and set up corresponding safety production signs for the equipment in the power station.

3.3. quality management

The quality management of photovoltaic power plants is mainly divided into two stages: production preparation stage and operation stage. The production preparation stage includes the establishment of the power station quality system, project acceptance and transfer, production preparation activities, and material information management; the operation stage includes operation management, maintenance management, equipment and material procurement management, personnel training management, and technical transformation management. The quality management directly determines the health of the power station. A well-functioning photovoltaic power station requires quality management in all aspects.

3.4. Power marketing management

Power marketing management involves power generation management and marketing management. Power generation management includes the preparation of power generation plans, analysis of deviations between actual power generation and power generation plans, power generation assessment rewards and punishment systems, and power generation efficiency improvement; marketing management only refers to participating in grid power transactions, formulating power generation plans according to transaction rules, and formulating reasonable maintenance plans , And reasonably formulate power generation strategies in the case of limited power.

Electricity marketing management is an ever-changing management process that is guided by market policies and uses power station power generation to adapt to market demand. The results directly affect the operating conditions and turnover of power generation companies. In power marketing, we must have a good understanding of the power generation situation of our own power stations, and at the same time, we must

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actively communicate with the power grid marketing department to understand new policies. In accordance with the latest market dynamics and changes in management measures, we will increase revenue and reduce expenditure.

3.5. Material management

Material management involves four aspects of material purchase settlement, arrival inspection, storage and storage. Procurement management is the management of suppliers, demand plans, procurement plans, procurement strategies, purchase orders, purchase payment management, and the core business processing procedures associated with the entire procurement process; delivery acceptance determines whether the equipment and materials on arrival are consistent with the purchase order. If there are errors, omissions, damages, and model inconsistencies, all equipment and materials will not be signed until the acceptance of unqualified equipment; for qualified equipment and materials, they will directly enter the warehouse-in and out-of-warehouse stage. Warehousing, return, allocation, inventory adjustment, inventory and other inventory operations are efficiently processed; warehouse management includes facility inventory management, facility maintenance and maintenance, facility replacement management, facility periodic testing, facility inspection record management, etc.

3.6. Information Management

Photovoltaic power plants have a large amount of information during the production and operation stage. Reliable management of these production information systems will directly affect the power plant operation and maintenance team and the group company's management of the power plant. Information management includes the construction of data management system (design documents, project construction documents, contract documents, drawings, daily production materials, technical transformation, regular inspection documents, equipment specifications, certificates of conformity, electronic document record management, document system management, document destruction process management Etc.) and maintenance and upgrading management of software and hardware of information equipment.

Establish a complete data management system, including:

- 1) Use the information equipment system to electronically manage the relevant documents and assets of the power station, and implement KKS code management;
- 2) Use modern computer information system platforms to informatize and digitize all links in the operation and

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maintenance process can greatly reduce duplication of labor, undocumented, and missing data. Improve work efficiency in an all-round way.

4. Summary

The technology in the construction phase of photovoltaic power plants has been very advanced and mature today, but the operation and maintenance phase is still groping forward. Doing a good job in the operation and maintenance of photovoltaic power plants is not only the training and use of technical talents, but also the management of the entire operation and maintenance process. Although the operation and maintenance of photovoltaic power plants is mainly to ensure the normal and efficient operation of the equipment, the power generation, but the management of each link can improve the operation and maintenance efficiency, reduce the operation and maintenance cost, and truly achieve open source and reduce expenditure, and double the effort with half the effort.

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