

Cleaning Vehicle

At present, most of the heliostat cleaning vehicles in the market use ordinary vehicles. It is necessary to park the cleaning vehicle next to the heliostat, and then manually rinse or use a mechanical arm to clean, the overall efficiency is low. The fully automatic heliostat cleaning vehicle designed by ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD (SUPCON SOLAR hereinafter) adopts a new leapfrog design structure and adopts four-wheel steering, which enable good passing performance. Through the feedback of specially designed cleaning mechanism and sensors, it can ensure that the cleaning mechanism and the mirror surface are always kept parallel and the distance is suitable for cleaning, so as to realize the cleaning of the entire heliostat surface while the cleaning vehicle is walking , which greatly improves the cleaning efficiency .

In order to realize cleaning of the heliostat field around the clock, especially the heliostat cleaning at night, so as to shorten the cleaning cycle and improve the cleanliness of the mirror field, the fully automatic heliostat cleaning vehicle designed by SUPCON SOLAR uses GPS, inertial joint navigation and infrared automatic detection and other technologies truly achieve unmanned automatic cleaning, which fundamentally solves the problem that the traditional heliostat field cleaning requires a lot of manpower. At the same time, the automatic cleaning mode allows the cleaning vehicle to perform cleaning work at night, while extending the working time of the cleaning vehicle and ensuring the availability of the heliostat field during the day.

Because the project is located on the Qinghai-Tibet Plateau at an altitude of 3000 meters, the winter is very long and the temperature is extremely low. At this time, the heliostat cannot be washed with water mode, in winter, the water spray mechanism can be turned off, and the dry brush cleaning mode can be applied. In the dry brush mode, the cleaning vehicle will use a double-row brush roller cleaning mechanism. Compared with the single brush roller cleaning vehicle, the fully automatic heliostat cleaning vehicle designed by SUPCON SOLAR can be washed once to achieve two-washes effect, which is effective and improves the cleaning effect and ensure the cleanliness of the entire heliostat field.

Since the first heliostat cleaning vehicle started operation at the SUPCON SOLAR Delingha 50MW molten salt tower CSP project in July 2018, the heliostat cleaning vehicle has become the main force in the heliostat field cleaning work. At present, total 5 heliostat cleaning vehicles are in operation on site. Each cleaning vehicle can clean the heliostat on an average of 2,000 square meters per hour. After cleaning once, the cleanliness of the heliostat can be increased to more than 0.98. The successful operation of the cleaning vehicle has greatly reduced the labor cost of the power plant operation team, improved the average cleanliness and availability of the heliostat field, and improved the overall economics of the power plant.



Figure 1 Automatic heliostat cleaning vehicle

Table of cleaning vehicle participants

NO.	Name	Date of birth	Sex	Specialty	Company	Education	Position	Professional Title	Undertake the main tasks and technical contributions of the project
1	Zhang Xuzhong	1979/12/3	Male	machinery manufacturing process and equipment	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	本科 bachelor	Deputy Director of r&d Center	Senior Engineer	Project leader, responsible for the overall plan design of the project, put forward the plan of adopting leaping cleaning, and at the same time, which greatly improved the cleaning efficiency while ensuring the cleaning effect and made the distance between the cleaning mechanism and the cleaning mirror more adaptive to achieve the effect of cleaning while walking.
2	Xu Neng	1979/10/1	Male	measurement and control technology and instrumentation	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	bachelor	President and Executive Deputy Chief Engineer	Senior Engineer	Cooperate with the project leader to control the technological breakthrough and R&D progress of the project.
3	Mi Xiaoling	1985/3/29	Male	control science and engineering	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	master	Deputy Chief Engineer and Director of r&d Center	副高级工程师 Deputy Senior Engineer	Responsible for project R&D human resource preparation and the design and development of automatic cleaning software, realized the unmanned driving function of the cleaning vehicle.
4	Chen Kangli	1988/8/14	Male	mechanical engineering and automation	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	bachelor	Mechanical Engineers	中级工程师 Intermediate Engineer	Responsible for the design and development of the specific structure of the cleaning truck, which made the designed product realize the function of leaping and cleaning while walking. Provided technical support in the product manufacturing process and made important contributions to product design and stereotypes.
5	He Long	1988/7/17	Male	mechanical engineering	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	master	Mechanical Engineers	Intermediate Engineer	Responsible for the testing various functions and performances of cleaning car products and discovering problems during the test and proposing improvements. Made great contributions to the stable work of the products in low temperature and high altitude environment, and also for the successful finalization of the products.
6	Hu Yuchao	1981/2/12	Male	mechanical engineering and automation	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	bachelor	Assistant Director of R&D Center	Deputy Senior Engineer	Responsible for the overall plan design of the automatic navigation system of the cleaning vehicle, and the selection and installation of the hardware equipment of the automatic navigation system of the cleaning vehicle.
7	Xue Gangqiang	1988/9/16	Male	mathematics and applied mathematics	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	bachelor	Algorithm Engineer	Intermediate Engineer	Responsible for the software development of the automatic navigation system of the cleaning vehicle, realized the motion control algorithm of the cleaning vehicle based on GPS information and the target path, and controlled the cleaning vehicle to automatically follow the required path.
8	Li Xiaobo	1986/11/26	Male	information and Computing Science	ZHEJIANG SUPCON SOLAR TECHNOLOGY CO., LTD	bachelor	Algorithm Simulation Engineer	Intermediate Engineer	Responsible for the software development of the automatic navigation system of the cleaning vehicle, realized the optimal path planning of the automatic navigation of the cleaning vehicle and data interaction with the heliostat field control system, and realize the efficient operation of the cleaning vehicle.