

TODOS

Industrial Ltd

Innovating the future of solar

FULLY AUTOMATIC PHOTOVOLTAIC CLEANING ROBOT

VERSION

2024

www.todos-china.com



CTO Dr. Liu.

Education Experience And Social Positions

- PhD: Chonbuk National University, South Korea
- Postdoctoral: Saint Francis Xavier University, Canada
- Director of DLNA International Alliance
- Director of the World Internet of Things Alliance
- Outstanding Contributing Entrepreneur in China's IT Solutions

Brand Story

We are Professional Solar Panel Cleaning Robot Manufacturer and Photovoltaic Energy Storage System Solution Experts. Todos Industrial Limited was established in 2009. In 2018, in response to the demand from an energy company for automatic cleaning of solar power plants, we began producing solar cleaning machines and providing customers with customized, cost-effective solutions.

Latest Technology: The latest version of the product uses the most advanced AI algorithm architecture system and Intelligent Obstacle Avoidance System, Remote Monitoring and Management, Automatic Fault Detection, Intelligent Alerts etc.

Research and Development: Innovation is at the heart of our business We invest heavily in research and development to continuously improve our products and solutions. Our R&D team is a renowned expert in the fields of IoT, artificial intelligence, and big data, and is committed to bringing cutting-edge technologies to market to improve the effectiveness and intelligence of our solar cleaning robots and energy storage systems.

The Pollution Of Photovoltaic Power Stations

Why do you need an automated solar panle system?

Numerous experiments have been conducted around the world to measure the effect of dust on solar cells. In moderate dust conditions, the performance loss of PV systems due to dust deposition can be between 10% and 30%. In the Middle East and Africa, where pollution is high, efficiency drops by 60%. During sandstorms, nearly 68% of the power of PV modules is lost.

Country	No Cleaning For A Month Decreasing Efficiency	Clean Up Every Day Decreasing Efficiency
Mexico	13%	<1%
Iran	80%	<1%
India	75%	<1%
Egypt	65%	<1%
Saudi Arabia	60%	<1%
China	26%	<1%
Oman	15%	<1%
United States	7.2%	<1%

Summary: Only high-frequency automated cleaning every month can ensure the efficiency of solar photovoltaic power stations.



Component Pollution Causing Adverse Effects On Photovoltaic Power Plants



Temperature effect: As dust accumulates on the surface of the module, it increases the heat transfer resistance of the photovoltaic module. It becomes an insulating layer on the photovoltaic module and affects its heat dissipation. If dust blockage persists for a long time, it can cause a local temperature rise of the battery components and generate a hot spot effect, causing component damage.

Occlusion effect: The dust on the surface of the panel has the functions of reflecting, scattering, and absorbing solar radiation. It can reduce the transmittance of sunlight, resulting in a decrease in the solar radiation received by the panel and a corresponding decrease in output power. This leads to a decrease in power generation efficiency by 10% to 30%. Its effect is directly proportional to the accumulated thickness of the dust.



Corrosion impact: Photovoltaic panels are mostly made of glass material. When moist acidic or alkaline dust adheres to the glass surface, the glass surface will slowly be eroded, forming potholes on the surface. The cover plate surface forms diffuse reflection, which disrupts the uniformity of light propagation in the glass, leading to a decrease in photovoltaic cell power generation. Rough and sticky surfaces with adhesive residues are more likely to accumulate dust than smoother surfaces. Moreover, dust itself also attracts dust. Once there is initial dust present, it will lead to more dust accumulation and accelerate the attenuation of photovoltaic cell power generation.

The Advantages Of Robot Cleaning

Pollutants seriously affect system efficiency, and robots can maintain long-term efficient power generation through high-frequency cleaning



Dust accumulation after 1 month of cleaning



Pollutants such as mud and bird droppings seriously affect system efficiency



Residual stains still present after wash



The effect of robot cleaning



Before Cleaning



After Cleaning

Strategies for Mitigating Solar Panel Pollution: Implementing Regular Automated Cleaning

According to research led by a Professor of Citizenship and Environmental Engineering at Duke University, the cleaning frequency of solar panels significantly impacts power generation efficiency in arid regions such as the Arabian Peninsula and northern and eastern India. If cleaned once a month, dust accumulation could lead to a 17%-25% decrease in power generation efficiency. Conversely, if cleaned every two months, the efficiency reduction could rise to 25%-35%.

To mitigate the adverse effects of dust pollution on power generation, we recommend using automated cleaning robots. By cleaning solar panels every morning before dawn, we can ensure that the solar panels maintain optimal efficiency. Additionally, selecting efficient and environmentally friendly cleaning methods can maximize cleaning effectiveness while minimizing environmental impact.

The Advantages Of Robot Cleaning

Manual Cleaning



VS

Robot Cleaning



- Personnel Safety Hazards
- Low cleaning efficiency and short durability after cleaning.
- High water consumption cost and potential damage to components.
- Manual stepping can easily cause hidden cracks and roof leaks.

For 1MW, cleaning 4 times a year with a cost of approximately 2000 yuan each time and an annual cost of approximately 8000 yuan. Limited cleaning frequency per year and short maintenance effectiveness. High-pressure water can easily damage the battery panel.

Manual roof cleaning is prone to safety accidents. Moreover, during the cleaning process, it is inevitable to step on the photovoltaic panel, which is prone to cracking.

- One Lifetime Service Investment
- No need for personnel participation, eliminating safety hazards!
- No water required, avoiding damage to components!
- Solves cleaning efficiency and frequency issues, increasing power generation by 5 - 25%!

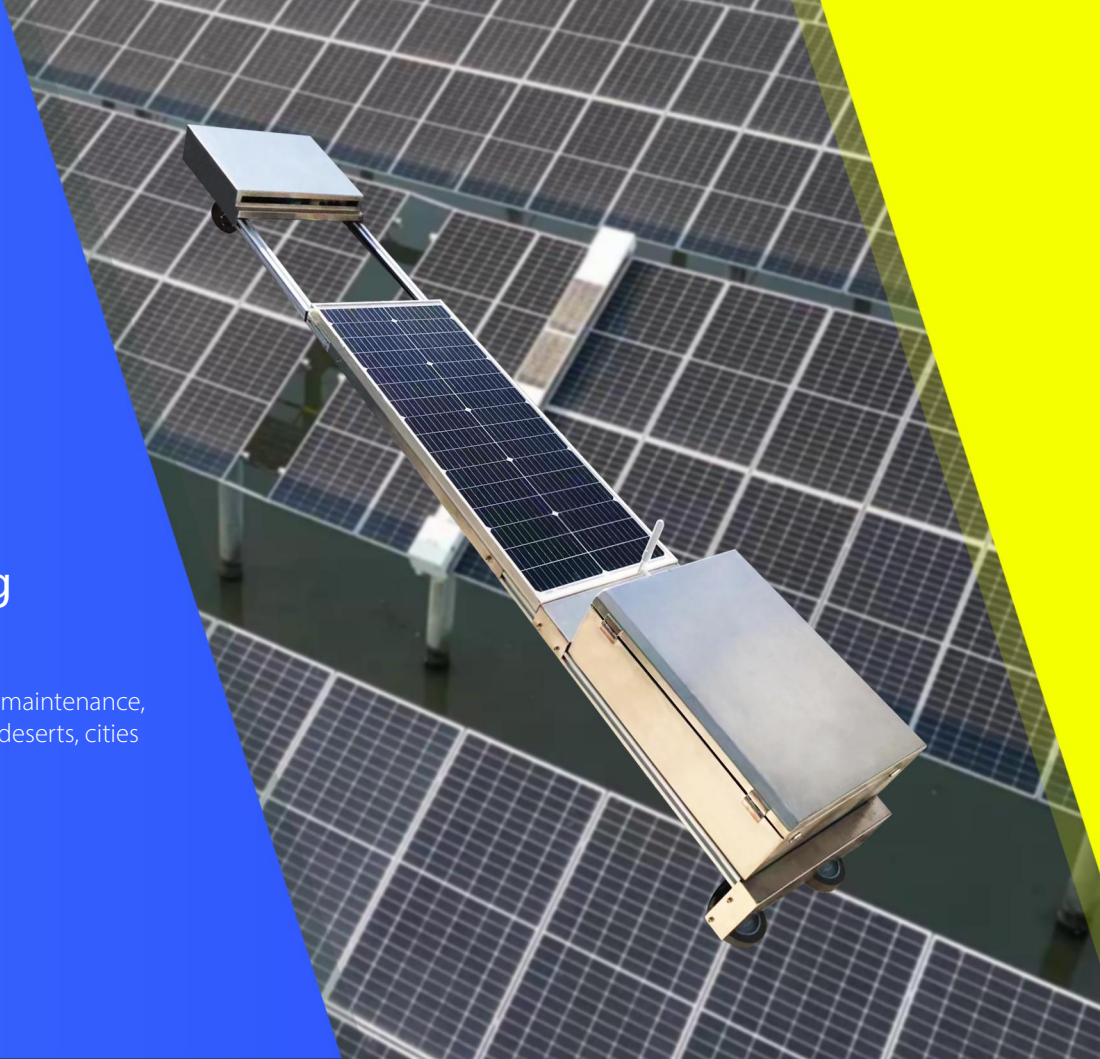
Single cost investment for lifelong enjoyment of cleaning services; More than 160 - 180 cleaning cycles per year; Long retention time. Flexible materials that do not damage the battery board; Remote operation, no manual labor required, eliminating safety risks.

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G3

Fully Automatic Photovoltaic Cleaning Robot

It is very suitable for large power station maintenance, especially for large power generation in deserts, cities and high pollution areas.



G3 Product Information

Cost Reduction:

Lower Labor Costs: Automatic cleaning robots operate independently, reducing the need for human labor.

Reduced Maintenance Expenses: Regular cleaning by robots extends solar panel lifespan, minimizing damage and maintenance costs.

Safety Enhancement:

Lower Risks: Robots perform cleaning tasks in unmanned conditions, eliminating the safety hazards associated with manual cleaning at heights.

Intelligent Management:

Smart Operation: Equipped with advanced sensors and software, our robots offer remote monitoring, real-time feedback, and efficient management.

Automatic Scheduling: Intelligent systems schedule cleaning based on environmental conditions for optimal performance.

Eco-Friendly:

Water and Energy Efficiency: The robots optimize resource usage, minimizing water and energy consumption.

Item	G3-1	G3-2
Options	Cleaning Robot	Cleaning Robot
Machine Length	2300*450*420(Customizable)	4600*450*420(Customizable)
Cleaning Distance	1800-2000m	1800-2000m
Motor	200W	200W
Battery	24V/20Ah	24V/20Ah
Panel Power	80W	80W
Brush	Non-dust flexible material PA610	Non-dust flexible material PA610
Obstacle Crossing Angle	≤ 22°	≤ 22°
Environment Temperature	(-30°C~70°C)	(-30°C~70°C)
Walking Speed	12m/min	12m/min
Cleaning Mode	Dry cleaning	Dry cleaning
Control Mode	Internet Remote Control + Manual Control	Internet Remote Control + Manual Control
Level of Protection	IP65	IP65
Working Hour	2.5H	2.5H

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G4

Fully Automatic Photovoltaic Cleaning Robot

The cleaning distance is longer and can be cleaned
across multiple rows.



G4 Product Information

Improved Efficiency and Cost Savings: The G4 builds on the G3's strengths with enhanced cleaning capabilities, allowing it to clean across rows and reach greater distances. This boosts solar panel efficiency and energy output while reducing labor and maintenance costs, thus extending panel lifespan.

Enhanced Safety: The G4 robot eliminates safety risks from high-altitude cleaning. It efficiently cleans in unmanned environments, ensuring personnel safety and reducing accident risks.

Smart Management and Eco-Friendliness: Equipped with advanced sensors and intelligent software, the G4 supports remote monitoring and automated scheduling for better management. Its eco-friendly design optimizes water and energy use, promoting sustainability while effectively maintaining solar panels with cross-row cleaning.

Item	G4-1		G4-2	
Options	Cleaning Robot	Ferry Vehicle	Cleaning Robot	Ferry Vehicle
Ferry vehicle Dimensions(mm)	3900		4600	
Cleaning Distance	1800-2000m		1800-2000m	
Motor	200W	200W	200W	200W
Battery	24V/20Ah		24V/20Ah	
Panel Power	80W		80W	
Brush	Non-dust flexible material PA610		Non-dust flexible material PA610	
Obstacle Crossing Angle	< 22°		< 22°	
Environment Temperature	(-30°C~70°C)		(-30°C~70°C)	
Walking Speed	12m/min		12m/min	
Cleaning Mode	Dry cleaning		Dry cleaning	
Control Mode	Internet Remote Control + Manual Control		Internet Remote Control + Manual Control	
Level of Protection	IP65		IP65	
Working Hour	2.5H		2.5H	

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G2

Crawler Cleaning Robot

Focusing on solving the environment where people cannot stand or the telescopic rod cannot be cleaned, robots can be used for remote control cleaning. Ability to use complex environments, flexible control.

This is the most commonly used style of cleaning company, easy to transport and carry.





Tracked Chassis For All-terrain Operation

With the tracked chassis, the robot can move forward, backward, and turn left or right under remote control, allowing it to operate in any direction for comprehensive cleaning of photovoltaic panels.

150-meter Remote Control Cleaning

This robot uses remote wireless control, with a control range of up to 150 meters, making it more flexible to use.

Electric Roller Brush For Wet And Dry Cleaning

The front of the robot is equipped with a rotating cleaning roller brush, with a nozzle installed in front of the brush. The combination of these features achieves efficient cleaning of photovoltaic panels, capable of cleaning approximately 1.2 megawatts per day.

Operation: Remote Control	Li-ion: 33.6 / 20V / Ah	Motor Power: 500W	Noise: <50dB
Voltage: 24V	Brush: PVC / Single Roller	Roller Brush Diameter: 130mm	Endurance time: 3~4h
Power Supply: lithium Battery	Roller Brush length: 1100mm	Work efficiency/day: 0.8~1.2MWP	Weight: <40KG
Working Temperature: -30~60°C	Roller brush speed: 400~500rpm	Operation mode: crawler walking	Dimensions: 1240*820*250mm
Operating speed: high speed 40 m/min, low speed 25 m/min			

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G2 Upgrade

Crawler Cleaning Robot Prevent Falling Collision

The new version of the photovoltaic cleaning robot adds a new anti-drop function based on the original anti-drop function.



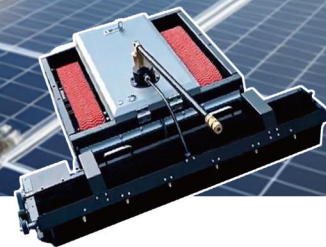


Anti-Drop Function

The omnidirectional anti-drop sensor, when remotely controlled to the edge of the PV panel, can trigger a stop forward or backward command.

Sensor Active Shielding

Cross spacing function: between each PV panel array (the viewing distance is 10-15CM), the screen function handle in the upper left corner of the remote control can be pushed long, so that the PV cleaner can pass through this spacing.



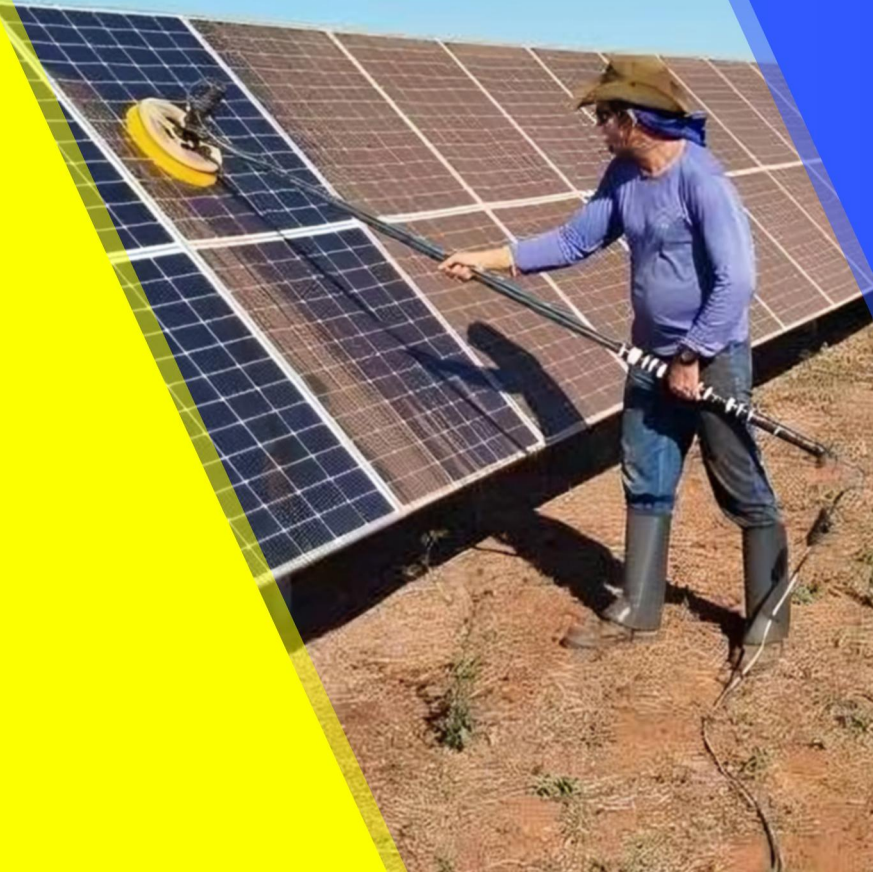
Voltage: 24V	Working Temperature: -30-60°C	Working angle: <15°	Security Assistance: Anti fall Assist Function
Cleaning Width: 1.1m	Endurance Time: 3-4h	Work Efficiency: 0.8-1.2MWP	Operation Mode: Crawler Walking
Rolling Brush Speed: 200r/min	Weight: 45kg	Control Mode: Remote Control	Dimension: 1160*960*320mm
Walking Speed: 0.16 m/s	Roller Brush Material: Nylon	Remote Control Distance: 150m	Cleaning Method: Dry / Wet Cleaning
Power Supply: lithium Battery (25.6V/20ah)x2	Steering mode: Omnidirectional Steerin	Rolling Brush Rotation Method: Forward And Reverse Rotation	

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G1

Electric Photovoltaic Cleaning Brush

Electric photovoltaic cleaning brushes can provide customized water supply solutions for dry cleaning or waterwashing. Three versions are available for different water and power supply environments. The structure is more reasonable, the stability is better, and the cleaning efficiency of photovoltaic panels is doubled.





G1 Cleaning brush brushless motor version

This version is the latest upgraded version, which upgrades the traditional brush motor to a brushless motor and operates autonomously, greatly reducing the interference of electric sparks on remote control radio equipment. The operation is smooth and reduces noise.

G1 Cleaning brush drawing motor version

Brushed motors have excellent low-speed torque performance and high torque, which are irreplaceable performance characteristics.













Brushless motor version and Brushed motor version

Motor	Speed Comparison	Torque Comparison	Noise Comparison	Life Comparison	Handling Comparison
	360 rpm/min	150W	40-60 dB (A)	Theoretical life 20000 H	Digital frequency conversion control, strong controllability, can be easily achieved from a few revolutions per minute to tens of thousands of revolutions per minute.
	The speed of the brushless motor version is increased by 15% and the cleaning efficiency is steadily improved.	The brushless motor version has more power and torque, and is more powerful and it is still stable against oily and rust environments	Brushless motors without carbon brushes operate quietly and smoothly, Brushed motors are prone to damage due to noisy brushes	The brushless motor version adopts brushless technology, which reduces the excitation loss and carbon brush loss, and there is no internal spark, which greatly improves the product life.	
	300 rpm/min	120W	75-107 dB (A)	Theoretical life is 5000 hours	Using carbon brush motor, has a constant working speed after starting, but speed regulation is difficult.
	The speed of the brushless motor version is increased by 15% and the cleaning efficiency is steadily improved.	The brushless motor version has more power and torque, and is more powerful and it is still stable against oily and rust environments	Brushless motors without carbon brushes operate quietly and smoothly, Brushed motors are prone to damage due to noisy brushes	The brushless motor version adopts brushless technology, which reduces the excitation loss and carbon brush loss, and there is no internal spark, which greatly improves the product life.	

Photovoltaic Cleaning Configuration / Parameters

Plug-in version (AC100V-240V)	G1-1		 Accessory kits	 8m powerextension cord	Aluminum alloy Telescopic rod 3.5M/5.5M/7.5M
			 20m Water Pipe	 Power supply converter	
	G1-2		 Accessory kits	 8m powerextension cord	Aluminum alloy Telescopic rod 3.5M/5.5M/7.5M 10M
			 20m Water Pipe	 Power supply converter	

Equipped with a power converter and 8 meters of wire, it can be used by connecting to 100v-240v AC, and can be directly connected to the water source / the pump can be purchased separately. Telescopic poles are available in carbon fiber and aluminum alloy!

Lithium Battery Version	G1-3		 Accessory kits	 Electric Control Spring Wire	 Charger	Telescopic Rod 3.5M/5.5M/7.5M
			 20m Water Pipe	 battery Pack	 Backpack	
	G1-4		 Accessory kits	 Electric Control Spring Wire	 Charger	Telescopic Rod 3.5M/5.5M/7.5M
			 20m Water Pipe	 battery Pack	 Backpack	

Equipped with a set of piggyback lithium battery packs, 24V/26ah, about 4 hours of battery life, can be directly connected to the water source / can be purchased separately from the pump. Telescopic poles are available in carbon fiber and aluminum alloy

Pv Cleaning Dual Head Brush Configuration / Parameters

Plug-ins + Lithium Battery Version	G1-5		Accessory kits	8m Powerexte Nsion Cord	Electric Control Spring wire	Charger	Telescopic rod 3.5M/5.5M/7.5M
			20m Water Pipe	Power Supply Converter	Lithium Battery Pack	Backpack	
	G1-6		Accessory kits	8m Powerexte Nsion Cord	Electric Control Spring wire	Charger	Telescopic rod 3.5M/5.5M/7.5M
			20m Water Pipe	Power Supply Converter	Lithium Battery Pack	Backpack	

The combination of lithium battery version and mains version provides two powersupply solutions, free choice, direct connection to water source / separate optionalpump.Telescopic poles are available in carbon fiber and aluminum alloy!

Product name	Aluminum alloytelescopic rod	Carbon fibertelescopic rod	Drive the motor	Brush head
Electric photovoltaic cleaning brush	Length(M): 3.5/5.5/7.5 Diameter(MM): 30/35/40	Length(M): 3.5/5.5/7.5/10 Diameter (MM): 34/36/39.5/43	Name: DC motor Voltage: DC24V	Brush disc diameter(CM): 33 Service life: 1-2 years(Frequencyofuse)
	Number ofstanzas (section): 4/5/6 Wall thickness:1mm	Number of stanzas (section): 3/4/5 Wall thickness:1mm	Total power: 150W Rotate speed: 360r/min	Cleaning width(CM): 65 Material: Nylon wire

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Commercial Solar Power Station

More Professional Solar Pv Battery
Storage Systems Solution



Why Choose Our Commercial Solar Battery Storage System?

Efficient Cleaning Technology: Our automatic cleaning system ensures that solar panels maintain optimal performance, enhancing energy output.

Real-time Monitoring and Management: Advanced monitoring tools allow you to easily track energy generation and consumption, optimizing resource management.

Safety and Durability: The system is equipped with enhanced safety features, ensuring long-term stability and reducing the risk of failures.

High Capacity and Scalability: We provide ample storage capacity that can be flexibly expanded to meet various commercial needs and adapt to future growth.

Independence from the Grid: Reduce reliance on the grid and mitigate price fluctuations, thereby increasing energy security.

Economies of Scale: As a well-established solution provider, we lower the overall cost of our solutions through large-scale production and optimized supply chains, offering more competitive pricing for our customers.

Battery Backup: Effectively store excess renewable energy to easily meet energy demands during nighttime or cloudy days.



Industrial And Commercial Solar Energy Storage Cases



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Phone: +86 177 2261 8207
Email: info@todos-china.com
Website: www.todos-china.com