

Cleaner for Photovoltaik panels

Why and how cleaning

A FUCHS Group
company



Feb 2023 | P.H.C.

Rivolta

CASSIDA

VITROLIS

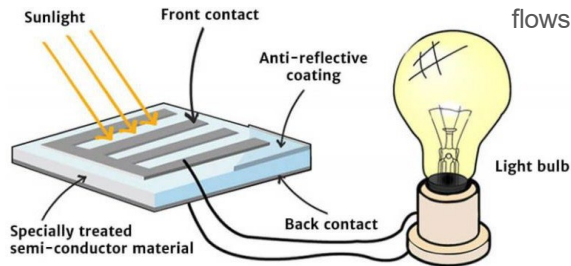
antidot.

Photovoltaic system

The function of a PV module

PV Modul

Photovoltaic (PV) cells generate electricity by absorbing sunlight and using that light energy to create an electrical current. There are many PV cells within a single solar panel, and the current created by all of the cells together adds up to enough electricity to help power your school, home and businesses.



The electrons migrate to the front surface of the solar cell, which is manufactured to be more receptive to the free electrons. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load, electricity flows.

Source: www.solarschools.net



The photoelectric effect was first noted by a French physicist, Edmund Bequerel, in 1839, who found that certain materials would produce small amounts of electric current when exposed to light. In 1905, Albert Einstein described the nature of light and the photoelectric effect on which photovoltaic technology is based, for which he later won a Nobel prize in physics.

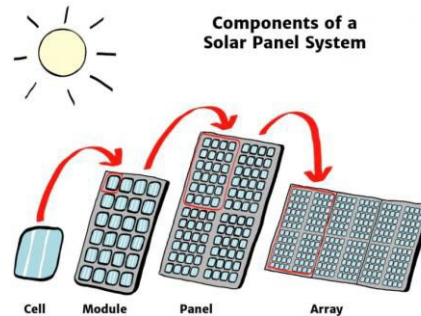
Photovoltaic system

The function of a PV module

PV Modul

Individual solar cells vary in size from about 1 cm to about 10 cm across. A cell of this size can only produce 1 or 2 watts, which isn't enough power for most applications. To increase power output, cells are electrically connected into a module. Modules are connected to form an array. The term "array" refers to the entire generating plant, whether it is made up of one or several thousand modules.

The performance of a photovoltaic array depends upon sunlight. Climate (clouds, fog) has a significant effect on the amount of solar energy received by a PV array and, in turn, its performance.



Source: www.solarschools.net



The word photovoltaic (PV) comes from the Greek word "photo" meaning light and the modern word "Volt" or "Voltage", a unit of electrical potential energy (named in honour of the Italian physicist Alessandro Volta (1745–1827)).

Photovoltaik system

Basic Electric knowlege

Units

V	→	Voltage	
Kw	→	Kilowatt	
kw/h	→	Kilowatt hour	
kw/p	→	Kilowatt peak	→ means the power the system could deliver by best conditions
Feed-in tarif	→	cent per kw/h you get from the energy supply company or the money you save by not having to pay energy supply company.	
specific yield	→	means the kw/h the system could produce per year for every kw/p	



James Watt (19 January 1736 – 19 August 1819) was a Scottish mathematician and engineer. He did not invent the first steam engine, but he did modify it to work better. There were other patented steam in use by the time Watt started his work on them. His major contribution is in developing the modern form of the steam engine. The Watt steam engine is credited for driving the Industrial Revolution of the 18th and 19th centuries.

Global Solar Radiation

Middle East

DESCRIPTION

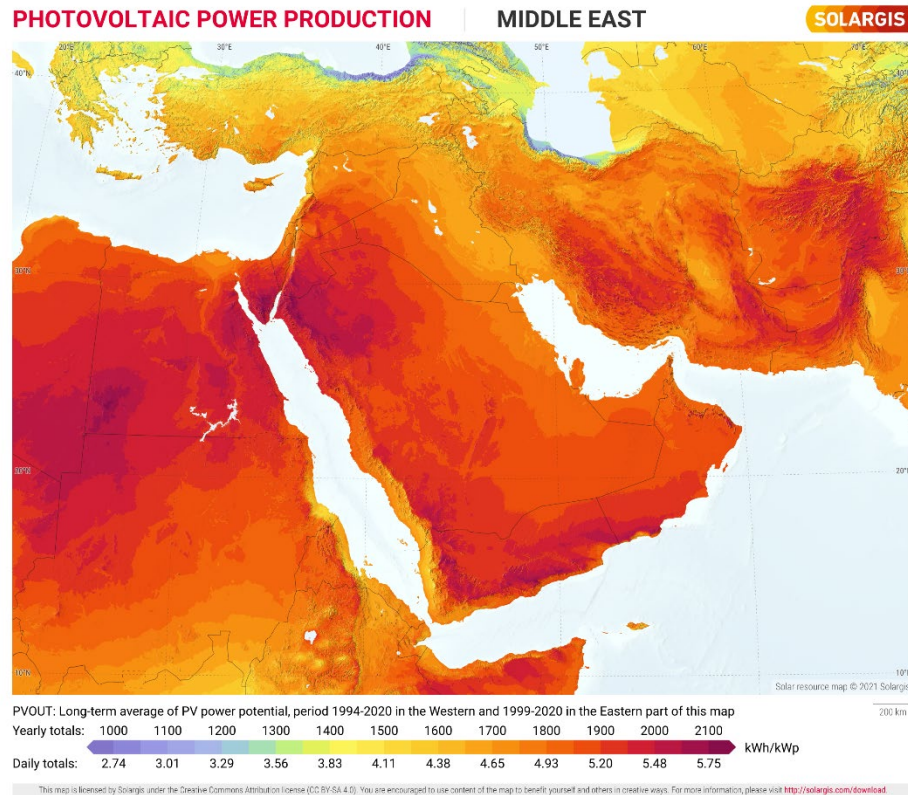
This map provides a summary of the solar photovoltaic (PV) power generation potential. It represents the average yearly/daily totals of electricity production from a 1 kW-peak grid-connected solar PV power plant, covering the period from 1994 to 2020 in the West part, from 1999 to 2020 in the East part of this map.

The PV system configuration consists of ground-based, free-standing structures with crystalline-silicon PV modules mounted at a fixed position, with optimum tilt to maximize yearly energy yield. Use of high efficiency inverters is assumed. The solar electricity calculation is based on high-resolution solar resource data and PV modeling software provided by Solargis. The calculation takes into account solar radiation, air temperature, and terrain, to simulate the energy conversion and losses in the PV modules and other components of a PV power plant. In the simulation, losses due to dirt and soiling was estimated to be 3.5%. The cumulative effect of other conversion losses (inter-row shading, mismatch, inverters, cables, transformer, etc.) is assumed to be 7.5%. The power plant availability is considered to be 100%.

The underlying solar resource database is calculated from atmospheric and satellite data with a 15-minute and 30-minute time step, and a spatial resolution of 1000 m.

To obtain additional maps and information, please visit solargis.com

Source: <https://solargis.com/maps-and-gis-data/download/middle-east>



Developement approach

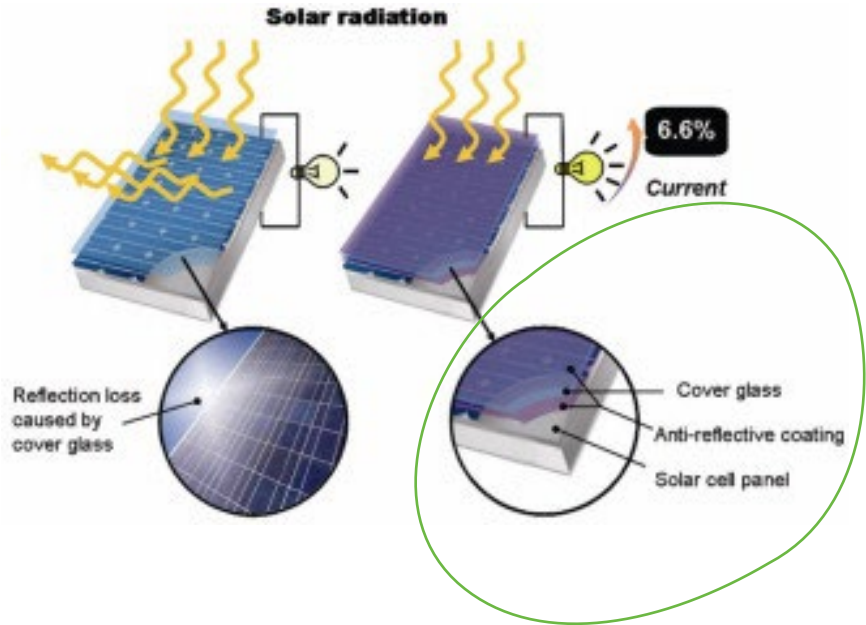
Difficult cleaning

The problem is following components of PV modules:

- aluminum frames with anodised layer (aluminum)
- silicone edge sealing (silicone)
- glass with anti-reflexion coating (ARC-glass)

can be damaged by chemical interaction when come into contact with a cleaning agent.
The performance of a PV system decreases by damaging e.g. anti-reflexion coating.

For this reason we contacted Fraunhofer Center for Silicon Photovoltaics to verify the material compatibility of our cleaning agent with PV module components.



Source: www.sciencedirect.com/science/article/abs/pii/S0025540813002043

Development approach

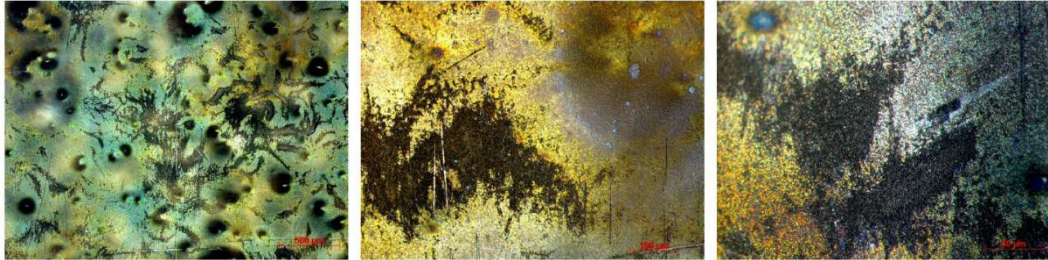
What is the ARcoating?

ARcoating (shines bluish) apparent



ARcoating mostly not apparent anymore

Corrosion at basic glass clearly visible, glass is attacked extremely





Rivotla P.H.C. is a

- material gentle
- highly efficient
- not classified as hazardous
- easily biodegradable

cleaning concentrate for removing pollution from photovoltaic systems.

Rivotla P.H.C.

Startet in 02/2023 as the (at this time) only tested cleaner for photovoltaic panels.

Rivotla P.H.C. got the Approval from Fraunhofer centre for Silicon Photovoltaics (GSP)

Benefits

Rivolta P.H.C.

- ✓ Improved output of PV system after cleaning
- ✓ Excellent cleaning effect
- ✓ Verified material compatibility by Fraunhofer center
- ✓ Easily biodegradable (according to OECD guidelines)
- ✓ Has not been classified as hazardous according to Regulation (EC) No. 1272/2006 (REACH)
- ✓ Economical concentrate
- ✓ Acceleration of cleaning process (robot speed)
- ✓ Decreases recontamination



Benefits

Rivolta P.H.C.



- before cleaning



- cleaning with water



- cleaning with Rivolta P.H.C.



If you see the pollution on the surface, the Modul will Produce 6% less Power



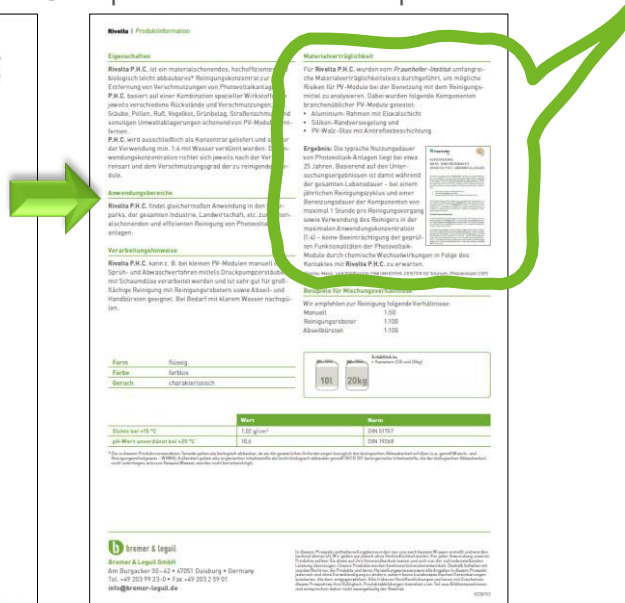
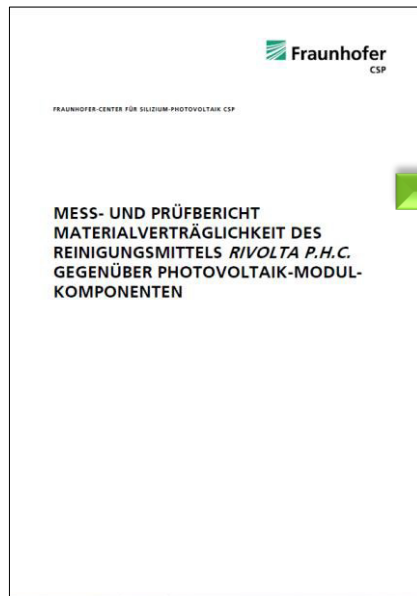
Rivolta P.H.C. has not been classified as hazardous and does not need to be labelled according to regulation (EU) no 1272/2008 (CLP).

Certifications & approvals

Rivolta P.H.C.

Measurement and test report of Fraunhofer Center for Silicon Photovoltaics (CSP):

Material compatibility of Rivolta P.H.C. on photovoltaic module components.



Result: The typical service life of photovoltaic systems is about 25 years. Based on the test results, no impairment of the tested functionalities of the photovoltaic modules due to chemical interactions as a result of contact with **Rivolta P.H.C.** is to be expected during the entire service life – with an annual cleaning cycle and a wetting time of the components of maximum 1 hour per cleaning process and use of the cleaner in the maximum application concentration (1:4). *

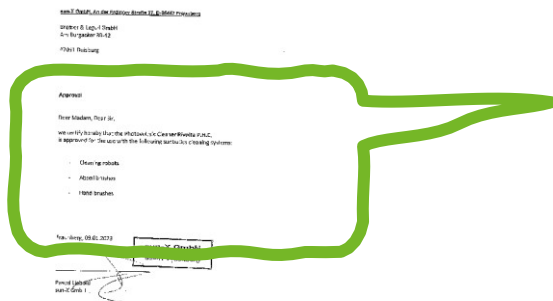
* **Note:** Normal required concentration is between 1:50 and 1:100, and sometimes less

Certifications & approvals

Rivolta P.H.C.

Approval by company „Sun-X“ for using Rivolta P.H.C. in cleaning robots, abseiling brushes and hand brushes.

SUN-X



Approval

Dear Madam, Dear Sir,

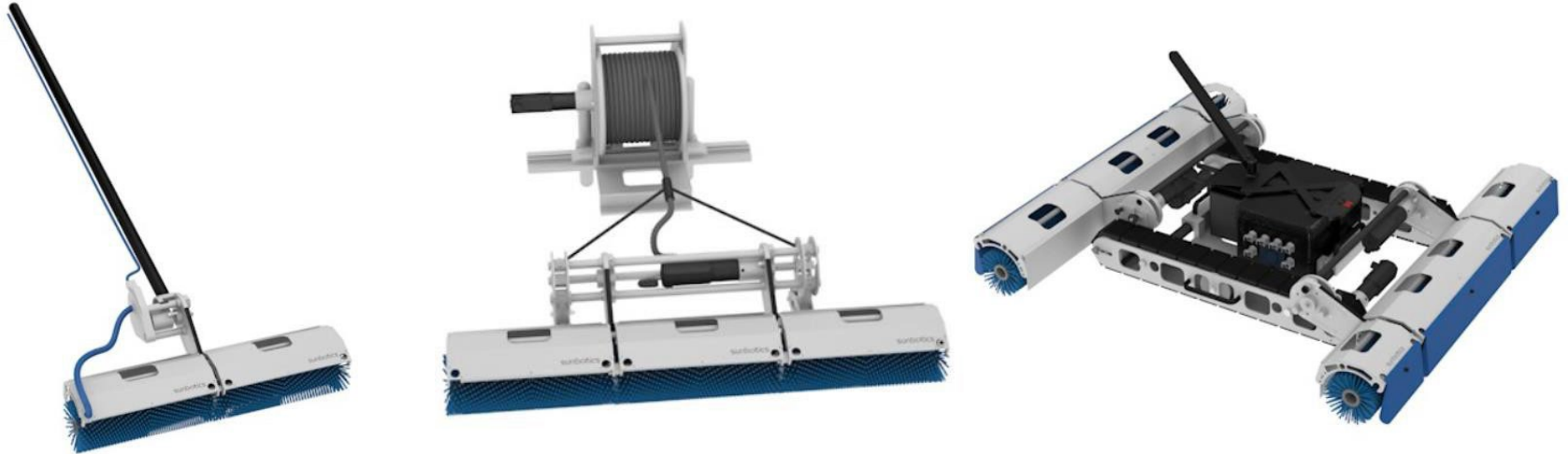
we certify hereby that the Photovoltaic Cleaner **Rivolta P.H.C.** is approved for the use with the following sunbotics cleaning systems:

- Cleaning robots
- Abseil brushes
- Hand brushes

Certifications & approvals

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Application fields and pictures

Rivolta P.H.C.

All types of photovoltaic systems



Application fields and pictures

Rivolta P.H.C.



Application instructions

Rivolta P.H.C.

- Adding of cleaning agent by dosing unit
- Mixing of cleaning solution in e.g. IBC container





One dirty module
will reduce the
power of the whole
array.

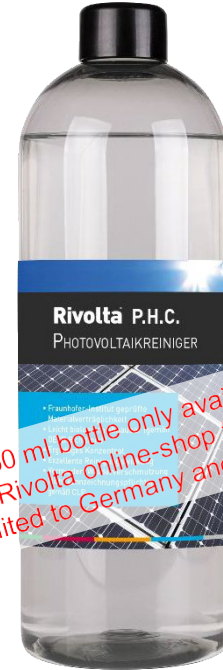


If you see the pollution on the
surface, the module will Produce
6% less power

Target industries

Rivolta P.H.C.

- Solar parks
- Building service providers (even though they do not offer this service yet)
- Industrial customers with photovoltaic systems
- Public utilities
- Companies for plumbing, heating, and air conditioning
- Farms
- Private customers (Rivolta shop)
- Solar installers
- OEM Panel manufacturer
-?



Arguments pro „Rivolta P.H.C.“

- Excellent cleaning performance
 - improved output of PV system after cleaning
 - acceleration of cleaning process (robot speed)
 - decreases recontamination
- Verified material compatibility by Fraunhofer center
 - material gentle cleaning process
- Easily biodegradable
 - complies with OECD guidelines
 - environmentally friendly
- Has not been classified as hazardous according to Regulation (EC) No. 1272/2006 (REACH)
 - user-friendly
 - low transportation and shipping costs
- Economical concentrate



Containers

Rivolta P.H.C.

- Container sizes: **10 Litre can, 20 Litre Can, and 1,000 Litre IBC.**
(Drums can be made available for special cases)
- For this cleaning task below, 100 litres of Rivolta P.H.C. were used
- Mixing ratio: e.g. 1:100 (concentrate : water)



Examples at customer locations

Rivolta P.H.C.



Useful Links

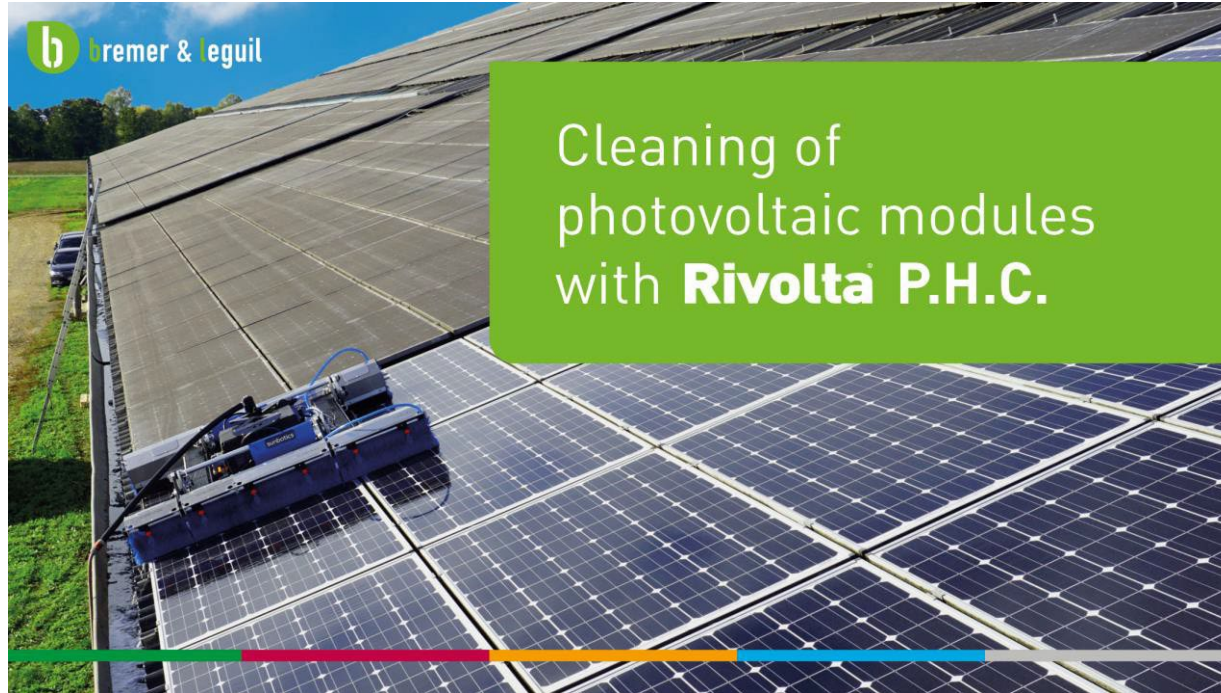
Rivolta P.H.C.

- [Cleaning of photovoltaic modules with Rivolta P.H.C. – YouTube](#)
- [ONESOLAR testet erstmals den neuen Spezialreiniger für PV-Module „Rivolta P.H.C“ von bremer & leguil – YouTube](#)
- [Clean energy for the future \(bremer-leguil.de\)](#) for the Photovoltaic calculator showing savings by using clean PV panels

Time for questions

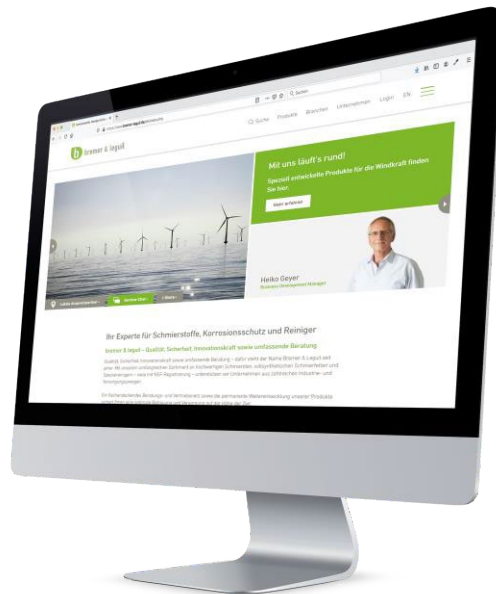


Thanks for the attention



Weitere Informationen zu uns und weiteren Branchen finden Sie auf unserer Webseite www.bremer-leguil.de

Besuchen Sie uns auf unseren Social Media Kanälen.



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