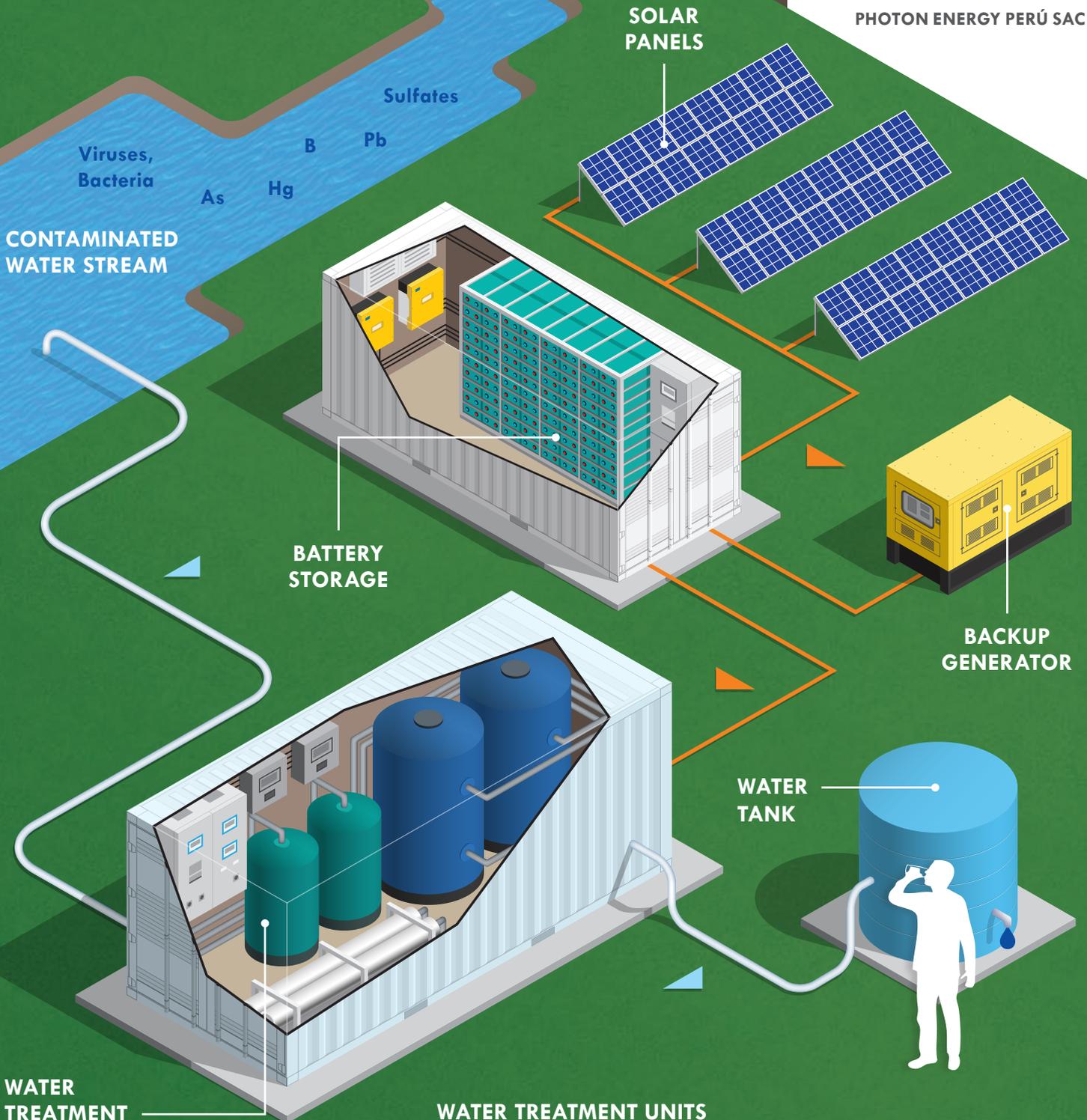


COMPREHENSIVE WATER TREATMENT SOLUTIONS

 **PHOTON WATER**

 **PHOTON ENERGY**

PHOTON ENERGY PERÚ SAC



WATER TREATMENT

Photon Water Technology s.r.o. and Photon Energy Peru SAC design water treatment units that can treat any type of contaminants present in the water, guaranteeing the production of high-quality water in a sufficient quantity, based on sustainable and environmentally friendly principles.

WATER TREATMENT UNITS

Our water treatment units are designed based on the pollution present in the water and operate using electricity from the grid or autonomously through the use of solar systems.

We are able to design small units for family households or units for large cities, in areas with access to electricity to the most remote areas.

We place emphasis on the coexistence of the technology with the local population, contributing to the preservation of water in a sustainable way.

PHOTON WATER UNIVERSE

OUR ACTIVITIES

PURIFICATION AND TREATMENT

Drinking water treatment using near-nature methods, emergency units, recycling of gray water.

WATER RESOURCES

Complete services for water resources, including new resources, pumping tests, well diagnostics, regeneration, remediation and decommissioning of wells.



CONTAMINATED LAND REMEDIATION

Nanoremediation, steam enhanced extraction, reactive barriers, in-situ remediation, design services, monitoring.

WATER MANAGEMENT

Studies and projects, storm water, self-operating sites, small water reservoirs and watercourses, flood protection and prevention, algae and biofilm control.

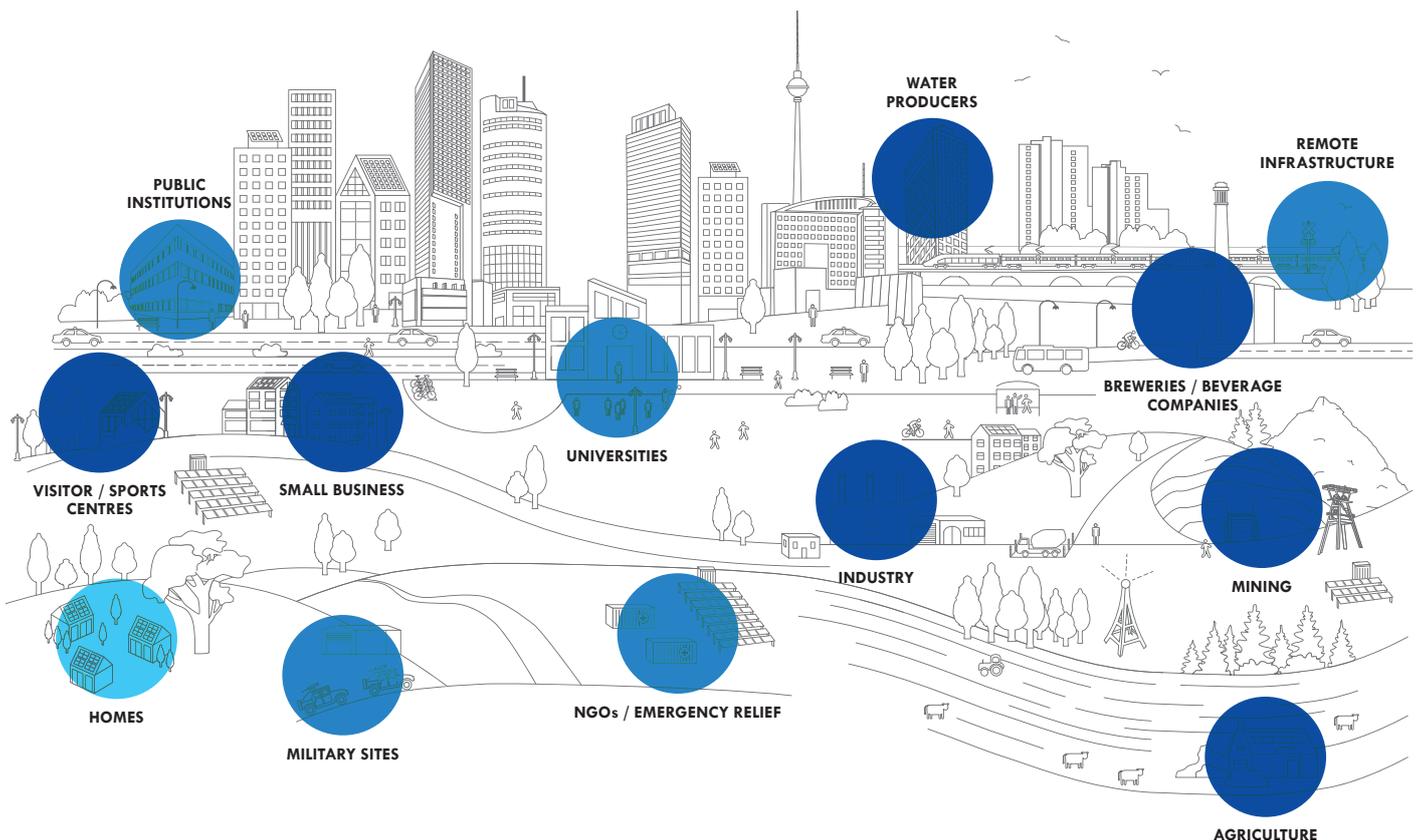
RESEARCH AND DEVELOPMENT

Support and expansion of our services in close cooperation with leading academic institutions. Participation in national and EU research programmes.

SITE INFORMATION SYSTEM

Collection and management of data from geological, hydrogeological, remedial, water supply and other sites.

OUR CUSTOMERS



MEMBRANE TECHNOLOGY

Membrane processes are a valuable and highly effective method of removing all kinds of pollutants. They are robust, fully automatized, efficient and have low energy consumption. Our units can be used for final treatment of water from water distribution pipelines, rain water or less polluted surface water.

In some cases the technology can even be used without dosing of chemicals, as it consists of a remote monitoring panel, which renders it self-sufficient to the maximum extent. The easy and robust design of the technology is most suitable for remote locations and developing countries.

Ultrafiltration unit

Type: MDWTP-S

Types of treated water: Water sources without significant chemical pollutants, possible microbiological pollutants (bacteria), organics; e.g. water from distribution pipeline, rain water, surface water.

Possible deliverable volume:

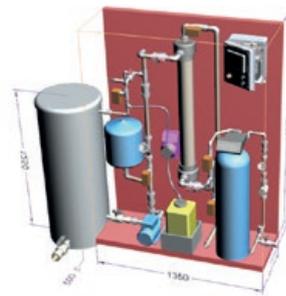
- MDWTP-02S: 0.2 m³/h
- MDWTP-05S: 0.5 m³/h

Description of the technology: The treatment unit is based on membrane processes. First, suspended solids are removed and organoleptic properties are improved by zeolite and active carbon filters. Subsequently, the water is treated through an ultrafiltration membrane unit. Hygienisation with a UV lamp is the last step to ensure water safety and quality.

Removal of: Turbidity, bacteria, viruses, organics, suspended solids.

Parameters:

Water supply	Dimensions	Weight	Operational cost for 1 m ³ of water	Water consumption 5 l/day	Water consumption 100 l/day
0.2 m ³ /h	1250 × 1350 × 500 mm	120 kg	0.22 USD	960 people	48 people



Ultrafiltration unit with pH adjustment

Type: MDWTP-M

Types of treated water:

Water sources without significant chemical pollutants, possible microbiological pollutants (bacteria), organics; e.g. surface water.

Possible deliverable volume:

- MDWTP-2M: 2 m³/h
- MDWTP-6M: 6 m³/h
- MDWTP-12M: 12 m³/h

Description of the technology:

The treatment unit is based on membrane processes. First, the pH is adjusted, coagulant is dosed and the pollutants in the water interact with each other. Then, suspended solids and pollutants are removed and organoleptic properties are improved by 130-micron filter and active carbon. Subsequently, the water is treated through an ultrafiltration membrane unit. Hygienisation with a UV lamp or chlorine is the last step to ensure water safety and quality even in the distribution pipeline.

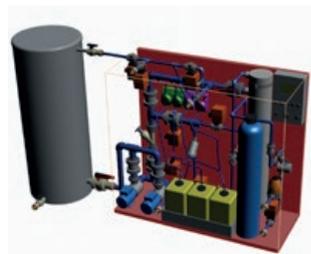
Removal of: Turbidity, bacteria, viruses, organics, suspended solids.

Optional additional feature:

Adjustment of organoleptic properties – odour, taste. Removal of pesticides, total water hardness.

Parameters:

Water supply	Power consumption	Dimensions	Weight	Operational cost for 1 m ³ of water	Water consumption 5 l/day	Water consumption 100 l/day
2 m ³ /h	150 W	2000 × 500 × 2000 mm	520 kg	0.22 USD	Up to 9600 people	Up to 480 people



Low-pressure reverse osmosis

Types of treated water:

Water sources with high concentrations of mercury, lead and various metals, arsenic, calcium, sulphates, suspended solids, bacteria, viruses, organics.

- Possible deliverable volume:**
- ▶ MDWTP-Low-pressure: 8 l/h
 - ▶ MDWTP-Low-pressure: 50 l/h
 - ▶ MDWTP-Low-pressure: 100 l/h



Description of the technology:

The technology is capable of removing nearly any kind of chemical and biological pollutants. The low-pressure reverse osmosis unit is based on membrane processes. First, suspended solids are removed and organoleptic properties are improved by zeolite and active carbon filters. Subsequently, the water is treated through a reverse osmosis membrane. Hygienisation with a UV lamp is the last step to ensure water safety and quality. Distribution of treated water is performed by external tap in the sink.

Removal of: Turbidity, bacteria, viruses, organics, suspended solids, heavy metals, sulphates.

Parameters:

Water supply	Power consumption	Dimensions	Weight	Water consumption 5 l/day	Water consumption 100 l/day
8 l/h	55 W	370 × 450 × 200 mm	9.2 kg	38 people	2 people

Water source parameters:

- ▶ Pressure: min. 2.2 bar
- ▶ Water temperature: 2 °C – 40 °C
- ▶ Total hardness: max. 170 ppm
- ▶ Free chlorine: max. 0.1 ppm
- ▶ Iron, manganese: max. 0.1 ppm
- ▶ pH: 3–11

Optional additional feature:

Removal of boron, iron, manganese, heavy metals.



High pressure reverse osmosis unit

Types of treated water:

Water sources with high concentrations of mercury, lead and various metals, arsenic, calcium, sulphates, suspended solids, bacteria, viruses, organics.

- Possible deliverable volume:**
- ▶ MDWTP-High-pressure-2M: 2 m³/h
 - ▶ MDWTP-High-pressure-6M: 6 m³/h
 - ▶ MDWTP-High-pressure-12M: 12 m³/h

Description of the technology:

The treatment unit is based on membrane processes. Firstly, large contaminants are removed with a 130-micron filter and the ion exchange process subsequently reduces the total hardness. Secondly, the suspended solids and smaller contaminants are removed, and the organoleptic properties are improved with a Turbidex filter and activated carbon. Subsequently, the water is treated in two steps through a high-pressure reverse osmosis membrane unit (maximum 5–8 MPa), with 70–75 % permeate production (pure drinking water). Hygienisation with a UV lamp or chlorine is the last step to ensure the safety and quality of water in distribution pipelines.

Removal of: Turbidity, bacteria, viruses, organics, suspended solids, adjustment of organoleptic properties – odour, taste, arsenic and heavy metals (some forms of oxidation).

Optional additional feature:

Heavy metals and arsenic (oxidation forms that are not removed by reverse osmosis), boron, radon, radionuclides.



SORPTION, ION EXCHANGE, MECHANICAL FILTRATION

This filtration process through filter cartridges is designed for surface water, groundwater and water with heavy metal pollutants, boron, radionuclides, salt, and high total hardness.

These contaminants cannot be effectively removed by membrane technologies due to their small size or their chemical interaction in the water. A combination of different filter cartridges connected into series can help remove several problematic contaminants.

We are focusing on regenerable filter cartridges with a lifetime of several years. The filtration units can be applied to locations with anthropogenic or natural contaminants in the water sources that are being used for drinking or agriculture.

They can be applied in remote areas due to their robustness, remote monitoring potential and full automatization. The filtration units have very low energy and chemicals consumption as well as waste production volumes.

Manganese, iron and water hardness removal unit

Type: FDWTP-IM

Types of treated water:

Water sources with pollutants – manganese, iron, microbiological pollutants (bacteria), organics, total water hardness, turbidity; e.g. groundwater.

Possible deliverable volume:

■ FDWTP-2IM: 2 m³/h ■ FDWTP-6IM: 6 m³/h ■ FDWTP-12IM: 12 m³/h

Description of the technology:

Multiple steps of filtration through special sorbents remove suspended particles, bacteria, viruses, iron and manganese. The ion-exchange process subsequently reduces total water hardness. The sorbents and ion exchange resin are re-generable, thus increasing their lifetime by several years. In addition, the unit also ensures pH adjustment of the water. Lastly, hygienisation with a UV lamp or chlorine is the final step to maximize water safety and quality.

Removal of:

Turbidity, bacteria, viruses, suspended solids, iron, manganese, total hardness, odour, taste.

Optional additional feature:

Removal of nitrite, nitrate, heavy metals, radon, radionuclides, arsenic, boron, organics.

Parameters:

Water supply	Dimensions	Operational cost for 1 m ³ of water	Water consumption 5 l/day	Water consumption 100 l/day
2 m ³ /h	1800 × 1800 × 1200 mm	0.22 USD	9600 people	480 people



Heavy metals and arsenic removal units

Type: FDWTP-A

Types of treated water:

Water sources with significant industrial and natural contaminants – arsenic, lead, and other metals. For example, contaminated surface water or groundwater.

Possible deliverable volume:

- FDWTP-005A: 0,05 m³/h
- FDWTP-025A: 0,25 m³/h

Description of the technology:

A special GEH sorbent is a granulated iron hydroxide material, which mainly removes metals such as iron, manganese and heavy metals such as lead, arsenic and others without altering the natural and valuable properties of the water.

The GEH sorbent is regenerable and its service life can reach several years. This unit can be used for arsenic (III and V) removal or can be connected to the reverse osmosis unit as a pre-treatment step for arsenic (III).



Removal of:

Turbidity, some bacteria, suspended solids, all forms of oxidation of heavy metals and other types of metals.

Parameters:

Water supply	Dimensions	Weight	Water consumption 5 l/day	Water consumption 100 l/day
0.05 m ³ /h	800 × 600 mm	approx. 70 kg	240 people	12 people

Heavy metal, boron and arsenic removal units

Type: FDWTP-AB

Types of treated water:

Water sources with significant industrial and natural contaminants – arsenic, boron, microbiological contaminants (bacteria). For example, contaminated surface water or groundwater.

Possible deliverable volume:

- FDWTP-005AB: 0.05 m³/h
- FDWTP-025AB: 0.25 m³/h
- FDWTP-1AB: 1 m³/h

Description of the technology:

Boron is a complicated pollutant; for example, only 30% is removed during reverse osmosis. Katalox Light is a unique sorbent – zeolite coated by MnO₂, the unit is designed with 30% recirculation to improve boron removal. This recirculation and absorbent properties allow boron to concentrate and create complexes, which are trapped in subsequent steps such as reverse osmosis.

This absorbent as an individual unit eliminates heavy metals and arsenic (III and V) or can be connected to a reverse osmosis unit as a pre-treatment for arsenic (III) and boron. Katalox light is regenerable and its service life can reach several years.

Removal of:

Turbidity, some bacteria, suspended solids, arsenic V and III, heavy metals, boron (in combination with reverse osmosis).

Parameters:

Water supply	Dimensions	Weight	Water consumption 5 l/day	Water consumption 100 l/day
0.05 m ³ /h	800 × 600 mm	approx. 70 kg	240 people	12 people



COAGULATION TECHNOLOGY

This coagulation process is an effective solution for high volumes of water treatment.

The main part of the technology is a clarifier designed for flocculation and coagulation, which means that small particles clump together into bigger flocs that are easily removed in the next technological stage.

The special design of the clarifier provides easier and faster coagulation than other classic clarifiers.

The coagulation technology is very similar to membrane technologies in its application, however, the operational costs are lower on a large scale.

The coagulation technology can also easily solve high water hardness, which can be a limiting factor in many other membrane technologies.

Mobile coagulation unit

Type: Mobile SDWTP-C

Types of treated water:

Water sources with pollutants – microbiological pollutants (bacteria), organics, suspended solids; e.g. surface water.

Possible deliverable volume:

- Mobile SDWTP-1-5C: 1.5 m³/h

Description of the technology:

This mobile unit is designed for locations with frequent natural disasters, such as earthquakes, floods, disruption of infrastructure, contamination of drinking water, etc.

First, the water is channelled through a pre-filter to remove all mechanical impurities, and subsequently the pH is adjusted. The technology is based on a two-stage water treatment principle. The first separation stage involves a hydraulic pulsation clarifier system with a sludge cloud, which ensures that the suspended particles clump together and form larger and denser particles called flocs.

The second separation stage is based on pressure filtration, which removes all of the created flocs. Hygienisation with a UV lamp or chlorine is the last step to ensure water safety and quality.

Removal of: Turbidity, bacteria, viruses, organics, colloid solids, suspended solids.

Optional additional feature: Removal of heavy metals, radionuclides, pesticides, total hardness, odour, taste.

Parameters:

Water supply	Power consumption	Dimensions	Weight	Operational cost for 1 m ³ of water	Water consumption 5 l/day	Water consumption 100 l/day
1.5 m ³ /h	1.5 kW	2600 × 1500 × 2500 mm	1300 kg	0.22 USD	Up to 7200 people	Up to 360 people



Container coagulation unit

Type: SDWTP-C

Types of treated water:

Water sources with pollutants – microbiological pollutants (bacteria), organics, suspended solids; e.g. surface water.

Possible deliverable volume:

- ▶ SDWTP-1-5C: 1.5 m³/h
- ▶ SDWTP-5C: 5 m³/h
- ▶ SDWTP-10C: 10 m³/h
- ▶ SDWTP-15C: 15 m³/h
- ▶ SDWTP-20C: 20 m³/h
- ▶ SDWTP-30C: 30 m³/h



Description of the technology:

First, the water is channelled through a pre-filter to remove all mechanical impurities, and subsequently the pH is adjusted. The technology is based on a two-stage water treatment principle. The first separation stage involves a hydraulic pulsation clarifier system with a sludge cloud, which ensures that the suspended particles clump together and form larger and denser particles called flocs. The second separation stage is based on pressure filtration, which removes all of the created flocs. Hygienisation with a UV lamp or chlorine is the last step to ensure water safety and quality.

Removal of: Turbidity, bacteria, viruses, organics, colloid solids, suspended solids.

Optional additional feature: Removal of heavy metals, radionuclides, pesticides, total hardness, odour, taste.

Parameters:

Water supply	Power consumption	Dimensions	Weight	Operational cost for 1 m ³ of water	Water consumption 5 l/day	Water consumption 100 l/day
5 m ³ /h	6 kW	6500 × 2500 × 2500 mm	4000 kg	0.22–0.44 USD	Up to 24000 people	Up to 1200 people



UNIQUE AND OPTIONAL TECHNOLOGIES

Sediment removal

The first step is an automatic cleaning disc filter, which eliminates mechanical particles larger than 130 microns. The second step is pressure filtration through a Turbidex material, which is an improved method for the removal of smaller particles that can damage or clog up the ensuing technologies, such as membranes or filters. Turbidex is an aluminosilicate with a large porosity and is more effective than sand.

Removal of: Turbidity, suspended solids, sediments.



Water hardness removal

Calcium and magnesium (total hardness) are removed by ion exchange. Calcium or magnesium ions are exchanged for sodium ions. Ion exchange resins are substances of high molecular weight with a sufficient porosity. The system is designed as a duplex system, because the regeneration of resins is needed. The elimination of water hardness also prevents the formation of lime during cooking in water heaters, etc.

Removal of: Calcium and magnesium (total hardness).



Algae treatment in reservoirs

An ultrasound algae control transducer kills blue-green algae, green algae and prevents biofilm formation.

This device floats on the surface of a waterbody (e.g. a reservoir) and is powered by photovoltaic solar energy (solar panels).

Removal of: Blue-green algae, green algae, biofilm.

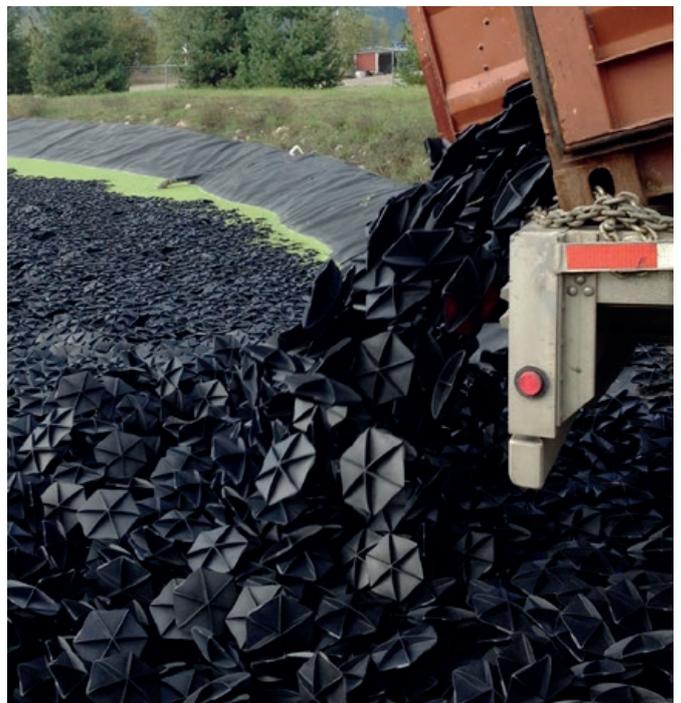


Protection against algae formation

Special plastic particles are applied to a waterbody (e.g. a reservoir) and float on the surface of the water.

They protect the water against UV light and eliminate organic growth such as algae and weeds. They also serve as a barrier against heat loss, odour, emissions and evaporation.

This method does not require maintenance, repair or operation, it is easy to install, distributes automatically and has a 25-year service life.



CASE STUDIES

Kirigueti

Photon Water Technology and Photon Energy Peru with the support of the Czech Development Agency and the Ministry of Foreign Affairs of the Czech Republic, in collaboration with Repsol and the Carpintero Kirigueti Native Community, donated two water treatment equipment to primary and secondary educational institutions in the Community, benefiting more than 400 boys and girls in the community with drinking water for their consumption. This is a sample that, by articulating efforts, positive impacts can be achieved for the benefit of vulnerable populations by promoting innovative solutions according to the geographic context.

The water treatment equipment delivered to the community belonging to the Lower Urubamba (Matsigenka ethnic group), uses Photovoltaic cells to generate electricity. This energy allows the Reverse Osmosis units to operate and purify the water, which will allow the community to overcome health problems such as ADD (acute diarrheal diseases) by using drinking water in Educational Institutions.

The Kirigueti Carpenter Native Community is located in the Megantoni district, La Convencion province of the Cusco department of the Republic of Peru.



Coracorani

Experts from Photon Energy Peru S.A.C. installed a water treatment unit at the Coracorani Town Center. The water sources in this area are highly polluted by heavy metals as a result of volcanic activity in the nearby areas. Coracorani is located at an altitude of 4,800 m above sea level, just below the Jucuri volcano. The water treatment unit was placed in a medical facility. The population is 189 people and the medical center provides complete medical services to children and the general public, in addition to being able to attend emergency medical situations.

The installed unit was donated to the regional government of Tacna, which provided support for the implementation of the B2B project based on a cooperation agreement signed and aimed at combating water shortages and promoting the use of technologies to improve quality and treatment of water for consumption by the local population. Coracorani representatives attended the technical and information workshops held in Tarata and took an active interest in the topic of drinking water treatment. The unit now produces drinking water well within the limits allowed by the peruvian standard and the town benefits from better health for all.



SOLAR POWER SOLUTIONS FOR WATER UTILITIES



Solar energy is reliable, sustainable and clean. Photon Energy is a global solar power solutions and services company, covering the entire lifecycle of photovoltaic power systems, from project development to operations and maintenance. We've built and commissioned PV power plants with a total capacity of over 100 MWp worldwide. We understand that the requirements of water utility companies are often unique, depending on location, demographics and governmental infrastructure.

Solar power is perfectly suited to meet these needs, as there are a variety of ways it can be harvested, stored and distributed, and can be adjusted to any size or setting. In addition, since many water and wastewater treatment facilities are located outside residential areas, they're often ideally situated to host large PV systems. We've partnered with water utility companies around the world, giving us a proven track record and the expertise to provide you with tailor-made solutions you can trust.

OUR CAPABILITIES

PROJECTS

Project development for rooftop and green-field installations from 300 kWp to 300 MWp.

OPERATIONS

Operations and maintenance of PV power plants, including own control room and monitoring platform.



SOLUTIONS

Design and construction of on-grid and off-grid installations, including battery storage solutions.



INVESTMENTS

Investments in PV power plants for the sustainable production and sale of solar energy.



TECHNOLOGY

Trading and distribution of PV components (panels and inverters).



FACTS & FIGURES



100+ MWp
PV plants installed



Own portfolio
71.9 MWp



O&M services
supplied for
300+ MWp



43.8 GWh
produced in 2019



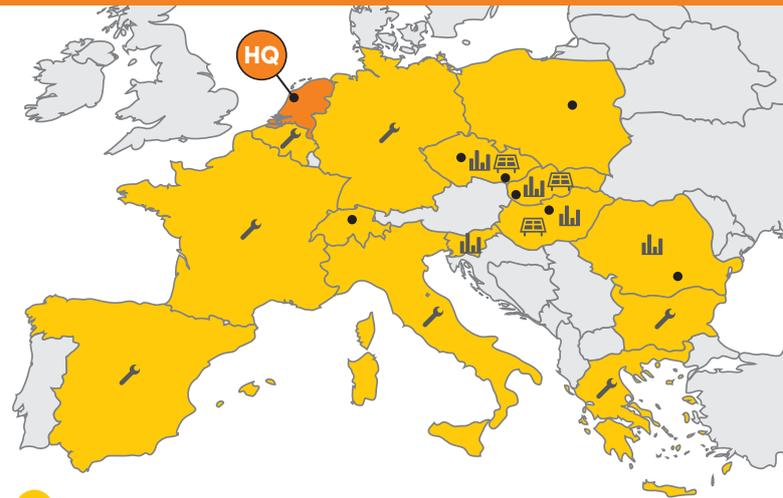
Energy supplied for
10,000+
households



Active in
10+ countries



GLOBAL PRESENCE



Power plants owned by Photon Energy

Power plants under O&M

Other O&M services

• Offices



Solar power solutions for water utilities

Bangalow Sewage Treatment Plant

Location:	Bangalow, NSW, Australia
Type:	Ground-mounted
Installed capacity:	50 kWp
Annual production:	87,500 kWh
Annual CO₂ emission savings:	76 tons
Grid connection date:	2019
Technology:	Canadian Solar CS3U-385-MS, Huawei SUN2000-50KTL
General contractor:	Photon Energy Engineering Australia Pty Ltd
O&M:	Photon Energy Operations Australia Pty Ltd



Brunswick Valley Sewage Treatment Plant

Location:	Brunswick Valley, NSW, Australia
Type:	Ground-mounted
Installed capacity:	99.9 kWp
Annual production:	167,700 kWh
Annual CO₂ emission savings:	146 tons
Grid connection date:	2019
Technology:	Canadian Solar CS3U-385-MS, Huawei SUN2000-50KTL
General contractor:	Photon Energy Engineering Australia Pty Ltd
O&M:	Photon Energy Operations Australia Pty Ltd



Byron Bay Sewage Treatment Plant

Location:	Byron Bay, NSW, Australia
Type:	Ground-mounted
Installed capacity:	150 kWp
Annual production:	225,500 kWh
Annual CO₂ emission savings:	196 tons
Grid connection date:	2019
Technology:	Jinko JKM380M-72, Huawei SUN2000-50KTL
General contractor:	Photon Energy Engineering Australia Pty Ltd
O&M:	Photon Energy Operations Australia Pty Ltd



This document was created as part of the „Drinking water treatment plants for small and medium-sized municipalities in Peru“ project, supported by Czech Development Agency and Ministry of Foreign Affairs of the Czech Republic under the programme of Czech International Development Cooperation.

