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Snac WTE
WATER TECHNOLOGIE & ENVIRONMENT

osmosun®
By Mascara

CATALOGUE FOR SOLAR POWERED DESALINATION SOLUTIONS

PV - SWRO & BWRO

2022

Sommaire

All technical details and illustration provided are given for information purposes and are non-contractual. These may be subject to changes.

OSMOSUN® solutions: standard vs custom designed

OSMOSUN® are unique sustainable desalination solutions providing drinking water everywhere, for everyone.

Given the potential multiplier impact of optimization of plants producing larger capacities, the range of reverse osmosis units is broken down into two categories, for sea water (SW) and brackish water (BW) alike.

STANDARD OFF THE SHELF UNITS

Hourly fresh water production between 100L and 15m³/h or up to 350m³/day

CUSTOM DESIGNED UNITS

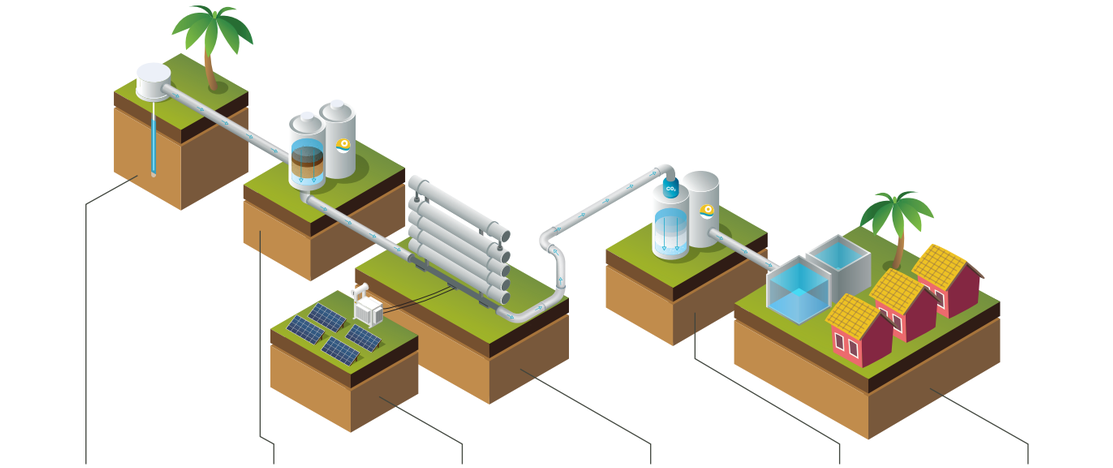
Hourly fresh water production between 15 and 110m³/hr, or up to 2600m³/day. For higher capacities, OSMOSUN® may be placed in parallel, to reach 15 000m³ per day.

This document details the specifications and capacities of the standard OSMOSUN® off the shelf units, producing up to 15m³ per hour.

About OSMOSUN® standard solutions

PV POWERED RO UNITS FOR BOTH BRACKISH AND SEA WATER

For a product output below 15m³/hour, the OSMOSUN® solutions are standardized, leaving the responsibility of the local integration to local qualified counterparts.



LOCAL INTEGRATION	STANDARD	STANDARD	STANDARD	STANDARD	LOCAL INTEGRATION
INTAKE Through an existing or new borehole.	**PRE-TREATMENT** Tailored to local raw water analysis.	**SOLAR GENERATOR** Installed according to land availability and local constraints.	**OSMOSUN® UNIT** According to your need, from 5 to 350m³/day.	**POST TREATMENT** To match your required water quality, including Bore concentration.	**DISTRIBUTION** Storage, pumping and metering Solar powered options.

OPTIMIZED ENERGY SUPPLY

To optimize the water production cost to the local capacities, OSMOSUN® units may operate under two types of energy supplies:

OFF GRID

Off grid, the standalone OSMOSUN® plants operate from sunrise to sunset, supplying fresh water at an unprecedented low cost even in highly remote locations.

GRID-TIED-SYSTEM

As a grid-tied system, the OSMOSUN® intallation may produce water 24-7 with smart energy magament coordinated with the power utillity.

Multiples integrations of OSMOSUN®

The benefits of standalone desalination enable different local integration specificities, from the facilitation of fast implementation to the collection of water sales cashflows.

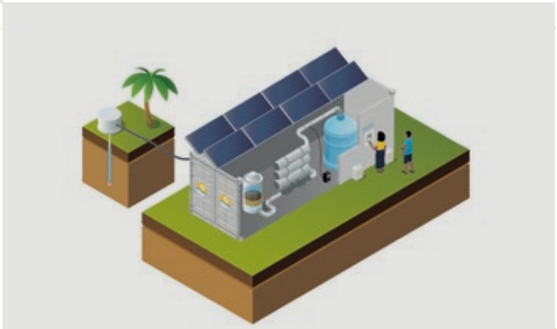
Each of these specific integrations have been standardized for multiple projects. More details available upon request.

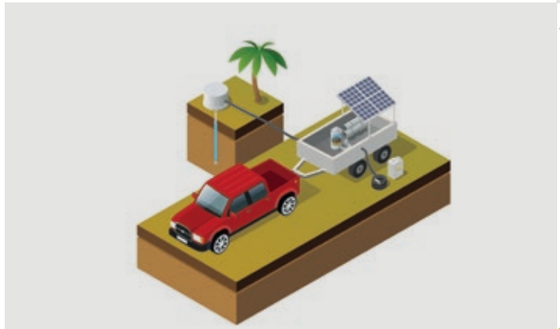
OSMO-WATT®

OSMO-WATT® is a containerized solar powered solution for seawater and brackish water desalination. A single 20 ft container using solar energy enables an autonomous production of a drinking water ranging between 5 to 150 m³ per day.

OSMOSUN® TAPS

OSMOSUN® TAPS is an integrated drinking water production solution for remote areas. From the water intake to the distribution station, OSMOSUN® TAPS is a fully autonomous solution powered by solar energy that guarantees long-term drinking water distribution.





OSMOSUN® NOMAD

Robust and rustic, OSMOSUN® NOMAD water treatment units integrate all the equipment for the pre-treatment and filtration water, brackish water, water polluted with fluorine or arsenic, to produce drinking water according to the criteria of the World Health Organization.

OSMOSUN® technical features and options

CODIFICATION FOR STANDARD OSMOSUN® BW

The raw water considered has the following parameters:

BW salinity (TDS): ..... *5 000 ppm*
Design temperature: ..... *25°C*
Turbidity (NTU): ..... *<5*

Code	Example:	OSMOSUN®	6	BW	P0-	H-	A0-	F0-	S0-	N0-	C0
	Nominal fresh water flow (m³/h)										
BW	**Raw water treated** Brackish water (TDS < 10 g/L)										
P0 P1	**High pressure pump size** Standard HP pump (TDS < 5 g/L) HP pump for high-salinity raw water (TDS < 10g/L)										
AC DC H	**Energy supply** Three-phase AC 400V only Solar DC 800V only Hybrid supply AC + DC										
A0 A1 A2	**Control, instrumentation and remote monitoring** (1) Basic version Advanced version Advanced version with GSM monitoring										
F0 F1 F2 F3	**Additional prefiltration** (2) None Disk filter Manual sand filter Automatic sand filter										
S0 S1	**Antiscalant dosing system** (3) None Dosing system (pump, tank, injection valve, pipes) included										
N0 N1	**Chemical cleaning system** (4) None Included, with the connection to the OSMOSUN® electrical cabinet										
C0 C1	**Chlorine dosing system for fresh water disinfection** (5) None Dosing system (pump, tank, injection valve, pipes) included										

CODIFICATION FOR STANDARD OSMOSUN® SW

The raw sea water considered has the following parameters:

SW salinity (TDS): ..... *35 000 ppm*
Design temperature: ..... *25°C*
Turbidity (NTU): ..... *<5*

Code	Example:	OSMOSUN®	7	SW	R0-	H-	A0-	F0-	S0-	N0-	C0

Nominal fresh water flow (m^3/h)

SW — **Raw water treated**
Sea water

R0 — **Energy recovery device** [6]
None
R1
Energy recovery device included

AC — **Energy supply** [6]
Three-phase AC 400V only
DC
Solar DC 800V only
H0
Hybrid supply AC + DC only hybrid powered operation
H1
Hybrid supply AC + DC enabling 100% solar powered operation

A1 — **Control, instrumentation and remote monitoring** [1]
Advanced version
A2
Advanced version with GSM monitoring

F0 — **Additional prefiltration** [2]
None
F1
Disk filter
F2
Manual sand filter
F3
Automatic sand filter

S0 — **Antiscalant dosing system** [3]
None
S1
Dosing system (pump, tank, injection valve, pipes) included

N0 — **Chemical cleaning system** [4]
None
N1
Included, with the connection to the OSMOSUN® electrical cabinet

C0 — **Chlorine dosing system for fresh water disinfection** [5]
None
C1
Dosing system (pump, tank, injection valve, pipes) included

DESCRIPTION OF THE CODIFICATIONS

(1) - Details of the Automation, instrumentation and remote monitoring options.

Basic automation version (only for OSMOSUN® BW):
- 3.5» touch screen human-machine interface.
- No analog 4-20 mA instrumentation. Direct reading of pressures (pressure gauges) and flow rates (float-type flowmeters).
- Data recording on USB flash drive: volume of water produced and alarms.

Advanced automation version:
- 5.7» touch screen human-machine interface.
- Instrumentation with analog 4-20 mA sensors, connected to the controller. Recording of production data on USB flash drive, numerous data available (pressures, flow rates, permeate conductivity, alarms).

GSM remote monitoring: an additional module sends alarms by SMS to the operators' telephone. It is also possible to retrieve the quantity of water produced, and other production statistics by SMS. It is possible to configure the recipients of SMS alarms on the touch screen (name, phone number).

(2) - Additional pre-filtrations

A cartridge filter is provided on all OSMOSUN® versions as standard. The additional pre-filtration, highly recommended, comes upstream of the cartridges.

When turbidity =< 3 NTU, TSS (total suspended solids in mg/L) =< 3 mg/L and/or SDI (Silt Density Index) =< 3, we recommend to use a disk filter.

If turbidity > 3 NTU, TSS > 3 mg/L and/or SDI > 3, we recommend to use a sand filter, manual or automatic.

Manual sand filter: the operation of sand filter backwash and rinsing is done manually, with a valve on top of the filter.

Automatic sand filter: an electric valve (for small RO units) or a set of electric valves (for bigger units) manage the backwash and rinsing of the sand filter. The valve is controlled by the OSMOSUN® cabinet.

Small (on the left) and big (on the right) automatic sand filter and their electric valves.

(3) - Antiscalant dosing system

Antiscalant injection is recommended when the recovery rate of a reverse osmosis unit is over 30-35%. We highly recommend to take this option.

(4) - Chemical cleaning system

A chemical cleaning is required every 1000h of operation. The chemical cleaning consists in a circulation of chemical solutions, acid and alkaline, in order to remove clogging in the reverse osmosis membranes. An external pump with a tank is necessary. The chemical cleaning skid provided in option includes a tank, a pump, a flowmeter, a cartridge filter and valves. The electric supply is also included in the OSMOSUN® cabinet.

Chemical cleaning skid

Electric plug for the cleaning pump, included in the OSMOSUN® cabinet

(5) - Chlorination injection for fresh water disinfection

The fresh water produced by OSMOSUN® is potable, and can be directly used to human consumption. However, if the fresh water is stored in a tank for example, the biological quality of the fresh water may decrease over time. That Is why it can be necessary to use chlorine.

(6) - Energy management for SW units

The Energy recovery device enables the drop of energy consumption by up to 60%, compared to reverse osmosis units without energy recovery system.

The DC solar power supply alone is only permitted in the presence of an energy recovery device. Indeed, without energy recovery, the energy consumption generates too high additional cost for solar panels.
The solar generator must respect the following characteristics:
- Vmpp per string: > 600 Vdc
- Voc per string: < 800 Vdc

For AC+DC hybrid OSMOSUN® SW only hybrid powered operation, solar energy and the network are connected simultaneously to the electrical cabinet, with priority to solar energy at anytime. Solar operation alone is not possible.

For AC+DC hybrid OSMOSUN® SW enabling 100% solar powered operation, OSMOSUN® can operate in all modes:
- In solar mode only: variable operation over the sun
- In simultaneous solar + network mode

OSMOSUN®: technical features for SW

The benefits of standalone desalination enable different local integration specificities, The OSMOSUN® SW product range consists of the following models:

OSMOSUN® 0.1 SW	**OSMOSUN® 0.52 SW**	**OSMOSUN® 1.3 SW**
OSMOSUN® 2.6 SW	**OSMOSUN® 7 SW**	**OSMOSUN® 13 SW**

OSMOSUN® unit	0.1 SW (2)	0.52 SW	1.3 SW	2.6 SW	7 SW	13 SW
Fresh water flow capacity [m³/h]	0.1	0.52	1.3	26	7	13
Nominal daily production solar-powered [m³/day]	0.7	3.6	9.1	18,2	49	91
Maximum daily production hybrid-powered [m³/day]	2.4	12.5	31.2	62,4	168	312
PV requirement [kWp] (1)	1.3	5.5	11	22	33	66

(1)

The peak-power of photovoltaic panels is given +/- 5%, depending on local weather conditions and PV panels manufacturer.

(2)

There are only two possible references for OSMOSUN® 0.1 SW:

- OS 0.1 SW R1-DC-A0-F0-S0-N1-C0
- OS 0.1 SW R1-H0-A0-F0-S0-N1-C0

Each basic version (reference R0-AC-A1-F0-S0-N0-C0) contains:

CARTRIDGE FILTERS

Material ..... *PVC-U*
Cartridge type *5µm*

HP PUMP

Technology ..... *Axial pistons*
Material ..... *Stainless steel Super Duplex*
Max operating pressure ..... *80 bar max*

VESSELS

Diameter ..... *8″*
Material ..... *Fiber Reinforced Plastic*
Max operating pressure ..... *82.7 bars*
Test pressure ..... *110 bars*
Operating Temp. ..... *-7°C à 49°C*
Operating pH range ..... *3 to 11*
Cleaning pH range ..... *2 to 12*

MEMBRANES

Size ..... *8″*
Max operating pressure ..... *83 bars*
Operating Temp. ..... *40°C max*
Maximal SDI *5*
Water turbidity ..... *1NTU max*
Max free Cl_2 ..... *<0.1 ppm*
Operating pH range ..... *2 to 11*
Cleaning pH range ..... *1 to 13*

CONTROL VALVE

Type ..... *Motorized Ball valve*
Material ..... *Stainless Steel 316L*
Operating mode ..... *Automatic and manual*

HP PIPES

Type ..... *Rigid and flexible*
Material ..... *SS Duplex*

BP PIPES

Type ..... *Rigid and flexible*
Material ..... *HDPE and PVC*

CONTROL SYSTEM

PLC
Modular circuit breaker
Emergency stop button
Status indicators

POWER SYSTEM

Main Switch Disconnector
AC Safety breakers
Frequency variable speed drives

INSTRUMENTS

Pressure sensors 0-10 bars
Pressure sensors 0-100 bars
Pressure indicators
Permeate conductimeter
Flow meters

OSMOSUN®: technical features for BW

The OSMOSUN® BW product range consists of the following models:

OSMOSUN® 0.2 BW	OSMOSUN® 1 BW	OSMOSUN® 2 BW
OSMOSUN® 3 BW	OSMOSUN® 6 BW	OSMOSUN® 15 BW

OSMOSUN® unit	0.2 BW (2)	1 BW	2 BW	3 BW	6 BW	15 BW
Fresh water flow capacity [m³/h]	0.2	1	2	3	6	15
Nominal daily production solar-powered [m³/day]	1.4	7	14	21	42	105
Maximum daily production hybrid-powered [m³/day]	4.8	24	48	72	144	360
PV requirement [kWp] (1)	1.3	7	10	13	25	60

(1)

The peak-power of photovoltaic panels is given +/- 5%, depending on local weather conditions and PV panels manufacturer.

(2)

There are only two possible references for OSMOSUN® 0.2 BW:

- OS 0.2 BW P0-DC-A0-F0-S0-N1-C0
- OS 0.2 BW P0-H-A0-F0-S0-N1-C0

Each basic version (reference P0-AC-A0-F0-S0-N0-C0) contains:

CARTRIDGE FILTERS

Material ..... *PVC-U*
Cartridge type *5µm*

HP PUMP

Technology ..... *Multistage centrifugal*
Material ..... *Stainless Steel 316L*
Speed ..... *3000 rpm max*
Max operating pressure ..... *25 bar max*

HYDRAULIC RECOVERY BOOSTER

Technology ..... *Multistage centrifugal*
Material ..... *Stainless Steel 316*
Speed ..... *3000 rpm max*
Max operating pressure ..... *25 bar max*

VESSELS

Diameter ..... *8″*
Material ..... *Fiber Reinforced Plastic*
Max operating pressure ..... *31.0 bars*
Test pressure ..... *34.1 bars*
Operating Temp. ..... *-7°C à 49°C*
Operating pH range ..... *3 to 11*
Cleaning pH range ..... *2 to 12*

MEMBRANES

Size ..... *8″*
Max operating pressure ..... *41 bars*
Operating Temp. ..... *40°C max*
Maximal SDI *5*
Water turbidity ..... *1NTU max*
Max free Cl_2 ..... *<0.1 ppm*
Operating pH range ..... *2 to 11*
Cleaning pH range ..... *1 to 13*

CONTROL VALVE

Type ..... *Ball valve*
Material ..... *Stainless Steel 316L*
Operating mode ..... *Manual*

HP PIPES

Type ..... *Rigid*
Material ..... *SS 316L and Duplex*

BP PIPES

Type ..... *Rigid and flexible*
Material ..... *HDPE and PVC*

CONTROL SYSTEM

PLC
Modular circuit breaker
Emergency stop button
Status indicators

POWER SYSTEM

Main Switch Disconnector
AC Safety breakers
Frequency variable speed drives

OSMOSUN®: quality solutions built to last

All our solutions are design according to high technical standards, based on three key features:

HIGH GRADE MATERIAL

LOW ENERGY CONSUMPTION

USING RENEWABLES

SIMPLIFIED DESIGN AND EQUIPMENT SELECTION WITH EXCEPTIONAL DURABILITY

Every OSMOSUN® part have been chosen for their durability, and assembled in a simplified design that facilitates the maintenance operations, which are essential for the long-term operation of the desalination units:

- Feed pumps, high pressure and energy recovery and energy recovery pumps: corrosion resistant corrosion resistant thanks to the use of stainless steel such as duplex and superduplex. From the most recognized suppliers of the sector with very high MTBF (Mean Time Between Failures) maintenance operations are required only every 8,000 hours

- Hydraulic couplings: with instantaneous disassembly, they offer simplified access to the main components designed in «plug and play» mode

- Pre-filtration: Mascara recommends whenever possible the use of beach wells for the collection of sea water. These allow to benefit from the filtration by the natural grounds. The quality of this filtration allows to reduce the pre-treatment of sea water, real economic and technical constraints of exploitation.

- Automatic system management: thanks to the remote monitoring, OSMOSUN® equipment is equipped with remote monitoring and maintenance systems using GSM. All incidents are subject to alarm and maintenance interventions are possible at a distance.

- Reverse osmosis membranes: The membranes are the most expensive and fragile element of any desalination unit. Their preservation is the object of a very particular attention.

- Photovoltaic panels: when Mascara is responsible for the supply the solar panels are guaranteed 25 years with a maximum decrease of 15% in efficiency.

TECHNOLOGY FOR A SMART SOLAR POWERED DESALINATION

Off grid or grid tied, the patented innovation lies in the flexibility of the production for an optimized energy consumption, key element for a sustainable and competitive water production.
To operate smoothly when powered by solar energy only with no battery, the OSMOSUN® process:

- Adapts to instantly and automatically optimize flows, pressures and recovery rates to the variable solar power

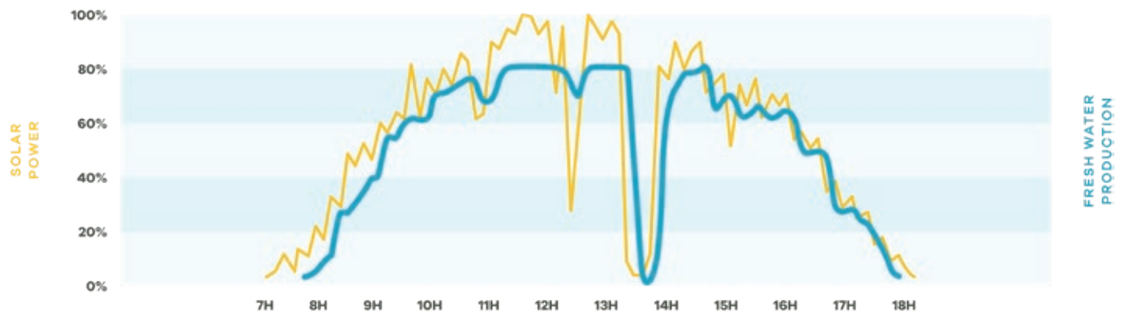
- Monitors the key parameter of the membrane lifespan* by smoothing out the flow and pressure variations thanks to an hydraulic accumulator and a night-time automatic fresh water membrane flushing

- Enhances the energy consumption (2.5 kWh/m^3 for seawater with a salinity of 35 g/liter) with an efficient energy recovery device (96 %) for the whole range up to the smallest units

- Optimizes the solar production with a patented DC /AC variator with variable frequency, including the MPPT (Maximum Power Production Tracking)

- Ensures a permanent remote monitoring

The result is impressive: « The OSMOSUN® lives to the rhythm of the sun"



**Development with the European Membrane Institute (IEM)*

Behind the innovative solution: a company supporting water access

The company Mascara is specialized in innovative water treatment solutions with the use of renewable energy. The first development phase resulted in the industrialization of OSMOSUN®, the world's first industrial product range of seawater and brackish water solar powered desalination plants, with off the shelf solutions a daily production capacity ranging from 1 to 350m³.

The company has acquired an expertise on custom design desalination plant for a daily production reaching 15 000 m³ with hybridized energy sources. Since 2014, this major patented innovation is allowing communities, utilities, and private organizations across the world to produce fresh water at an unprecedentedly low cost with no greenhouse gas emissions.

OUR VISION

Climate change and population growth will double the demand for water by 2030 (UN). Nearly 3.9 billion people could run out of water by 2040 (OECD), foremost among them are the poorest. Faced with this challenge, Marc Vergnet and Maxime Haudebourg created Mascara NT, a company specialized in innovative water treatment using renewable energies, to produce fresh and affordable water for all.

WHAT WE DO

To support the local integration of the standard reverse osmosis units Mascara is manufacturing, we may provide additional services to our customers, such as:

DESIGN

We assist you to develop a modular and robust system to address your water needs sustainably.

BUILD

We deliver a turnkey solution ready to supply water autonomously, even to your most isolated sites.

FINANCE

We offer a range of financial services so you can directly benefit from the affordable water production.

OPERATE

We provide full O&M packages to maintenance support, including long term spare parts supply.

REFERENCES