www.ce.eco
info@ce.eco

DESALINATION

EMPOWERING DEVICE

01/01/2024 *(dd/mm/year)*

technology introduction

something about us

We study and develop, on industrial-scale, systems capable of transforming the causes of pollution into a source of wealth.
Our patents range from the denaturation of asbestos to the treatment of almost every type of waste, from water purification to the production of aluminum without waste.
What's the point of devastating the environment around us to collect a few crumbs of resources when we can use our technologies to live great and achieve anything in a sustainable way?

Our goal

Smartly sustainability

Mission:

- Social progress
- Clean environment
- Wealth production
- Sustainable Development

Since we don't have a second home were to go, we need to make our planet more livable without stopping technological development!
Our goal is to make our planet more livable without stopping development.
For this reason we have developed industrial systems that transform the causes of pollution into an immediately usable source of opportunities: low-priced raw materials ready to be reused through further sustainable processes.
Let's protect nature without stopping progress!

presentation

The desalination of sea water is a process that occurs naturally on a large scale: the radiation from the sun gives energy to the oceanic surfaces, starting the distillation process which ends with condensation at low temperatures present at high altitudes. Solar energy is estimated to produce about 5 liters of evaporated water per m^2 of ocean at average latitudes.

The modern desalination was born in the United Kingdom up to the nineteenth century from the need to guarantee prolonged water autonomy on board British Navy ships.

Evaporative desalination for civil uses began in the 1950s driven by the wealth of oil-exporting countries with water supply problems.

Subsequently, another technology developed, reverse osmosis, which is increasingly taking hold in the markets, driven by technical innovations and lower costs of membranes.

The first plants, built in the United States in 1959, highlighted the current limits of technology: large electricity consumption, high costs and short life of the membranes.

The impetus for the application of this technology took place in the 90s thanks to the ever lower cost of membranes and the invention of recovery systems brought specific consumption from 10-12 kWh / m^3 to 6-7 kWh / m^3.

By combining osmosis with cavitation, the current state of the art was finally reached.

who we are...

We born close to the COVID pandemic. We immediately became a meeting point for numerous professionals, research institutions and production companies. All this started in Italy and is now spreading to other countries.

Often our projects precede the times of several years.

Our proprietary technology is totally innovative **but consolidated** and is essentially based on: cavitation, gasification and Coanda effect.

After having implemented and made the above more effective, we have adapted it to everyday life by creating complete processes whose application increases both the quantity and quality of the products obtained, decreasing energy requirements but paying great attention to the creation of a greater number of jobs compared to those eliminated by mechanization.

In addition to the real innovations, we are specialized in engineering and then applying improvements of technologies, mature in their field, to other areas often obtaining, this way, several real technological leaps simply because we had the courage to do what was before under everyone's eyes but no one dared to put it into practice.

We develop technology both independently and in collaboration with Universities (Sassari, Perugia, Amsterdam, Algarve, etc.) or with other public institutions (for example the National Research Center - CNR, Fundación Circe etc.).

We boast a vast proprietary product portfolio with several pilots viewable, by appointment, and several completely innovative process lines.

Some of our products have been defined extremely innovative and promising at international events by panels composed of scientists from all over the world. Our technology and our demo site have been deemed valid and usable in several Horizon Europe projects.

Our patents and innovations have made us immediately designate as members of technology suppliers within the Italian Biogas Consortium.

We have a framework agreement with RINA Consulting - Centro Sviluppo Materiali S.p.A. which allows us to request their supervision and therefore also to certify the production and engineering phase of our products wherever we choose to produce them. Therefore, choosing us also gives access to all the wealth of experience and technology gained in over 70 years by Centro Sviluppo Materiali which, I remember to everyone, was since its establishing the research and development department of IRI (Institute for Italian Industrial Reconstruction, among the top 10 companies in the world by turnover up to 1992).

Numerous specialized industrial plants, centres of excellence on their specific sectors, have made the production slots we need available to us; we are equipping ourselves with proprietary factories to carry out final assembly and to start specific productions.

We are present with companies in numerous European countries. We are opening companies in several African countries and in Asia. We have projects underway in various European, African and Asian countries. Our international staff represents our essence: motivated people with a wealth of personal experience who believe in what they are doing and who come from many different countries. In every nation in which we appear we respect local customs and traditions, bringing a bit of Italianness to the place and "*stealing*" part of their culture to ensure that no one is a ***Stranger in a Strange Land***.

Dr. Bruno Vaccari

... and what we do

- BIOZIMMI
- EMPOWERING DEVICE
- ZEB
- BIODIGESTERS
- FROM HEAT TO ENERGY
- THERMOELECTRIC PANELS
- ASBESTOS DENATURATION
- GASIFICATION & PLASMA
- INERTIFICATION
- WEEE
- UREA & AMMONIA
- FOOD PROCESSES
- HOSPITAL EQUIPMENT
- SOIL WASHING
- WATER TREATMENT
- WTE & WTC
- DESALINIZATION

OUR MAIN GOAL: environment and workers' conditions respect

our core team

Bruno Vaccari
CEO

Sabrina Saccomanni
LAWYER

Fabrizio Di Gennaro
CMO

Antonio Demarcus
CTO

Paolo Guastalvino
CIVIL WORKS

Gianni Deveronico
LEAD ELECTRICAL ENGINEERS

Jennifer Martinel
ACCOUNTING

Massimiliano Magni
ENGINEERING

Antonio Piserchia
COMMUNICATIONS EXPERT

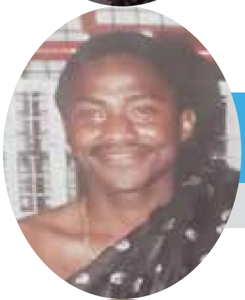
Barbara Spelta
LAB

Papa Ndiamé Sylla

COO Senegal

Noel Sciberras

COO Malta



Appiah Fofie Kwasi

COO Ghana

Eugen Raducanu

COO Romania

Awa Khady Ndiaye Grenier

COO Guiné-Bissau

Giorgio Masserini

Marketing

Pantaleo Pedone

Italian energy-intensive

Gianluca Baroni

Hospital Stuff

Stefano Diambu Nkazi

Marketing

Sarr Alioune Badara

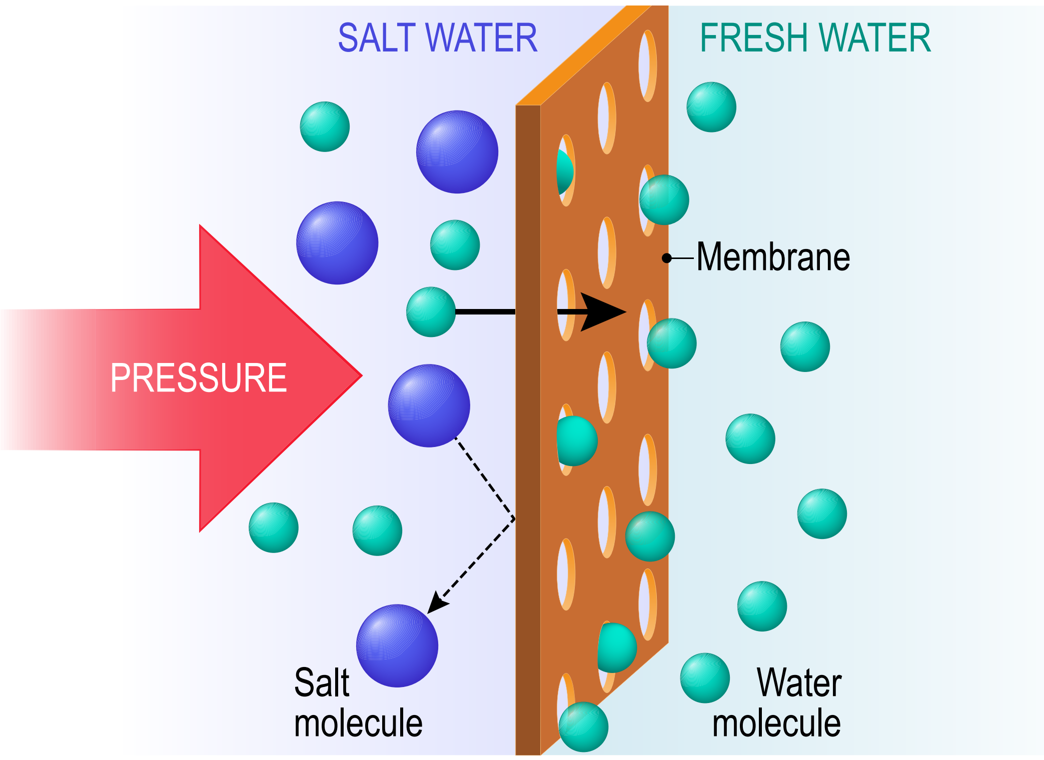
Marketing

Jérémie Saltokod

CCIMRDC Italie

desalination

Desalinating sea water or variously brackish waters, purifying it and making them available for human activities is a concrete and realistic solution to satisfy at least part of the thirst for fresh water.
The spread of these systems has been slowed down by costs initially really too high, a fact that made practically impossible their installation in many of the countries that would need them most.
In 2018, desalination plants around the world were able to supply more or less 95 million cubic meters per day, so about 95 billion liters per day, therefore equal to about half the average flow rate of **Niagara Falls**.
In the face of this production, 142 million cubic meters of hypersaline brine are also created per day.
The plants that use **thermal / evaporative** desalination technologies produce, on average, from two to four times more brine per cubic meter of fresh water obtained than the plants that use the **membrane** distillation method for water desalination.
This hypersaline brine is rich in anti-scalers, metals and various chlorides: if not used it should be treated exactly like other dangerous industrial waste.
In reality, however, most of this brine tends to be reintroduced directly into the oceans, into surface waters, into wastewater disposal plants through the sewers or, more rarely, into deep wells, significantly altering the salinity of the water near the coasts, compromising the marine ecosystem.
The high salinity produces a reduction in the level of oxygen in the water, and this significantly impacts the habitats of organisms living in the sea, with major ecological effects that can be immediately observed throughout the whole food chain.
This is an unnecessary damage as salts, metals and other elements can be recovered from the brine in significant percentages, like: **magnesium, gypsum, sodium, calcium, potassium, bromine, lithium chloride**, etc.
In this context, cavitation and the specific peculiarities of the **EMPOWERING DEVICE** come into play.



salty waters

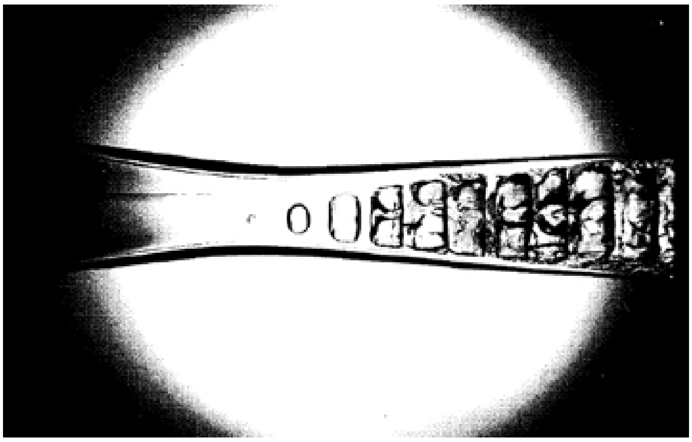
Sea water contains dissolved salts of different nature, the quantity of which varies according to the places, seasons and the surrounding environment.
On average, seawater has the following characteristics:

- pH between 7.6 and 8.4
- density at 20 ° C of about 1025 kg / m3
- conductivity at 20 ° C between 48000 and 60000 μS / cm
- TDS5 salinity between 34000 and 45000 ppm
- dissolved air between 20 and 28 ppm

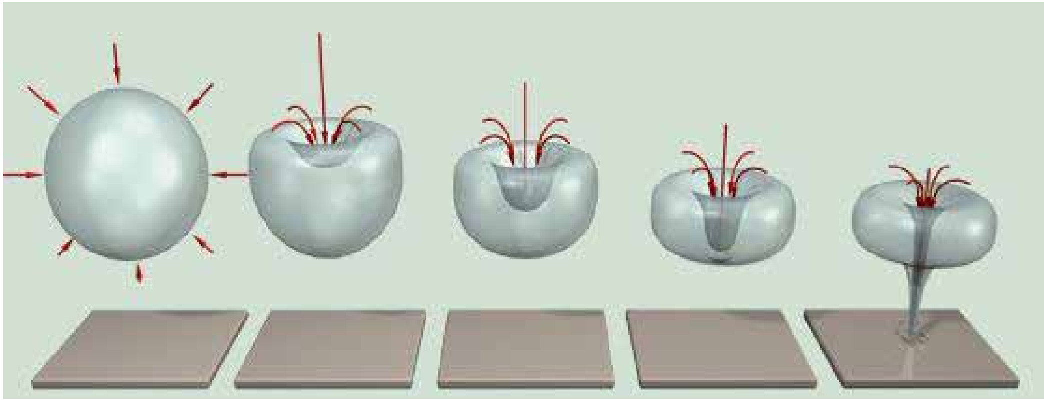
Conductivity and salinity are closely linked: the former is often used as an index of salinity as it is more easily measurable. The pH instead depends on the quantity of dissolved CO_2.
Salinity is the most important parameter as it reports the total quantity of dissolved salts (sodium chloride, magnesium, calcium sulphates and bicarbonates). The highest accuracy is obtained by using the parts per million (ppm) as the unit of measurement, other units of measurement are also popular, including «grams on kg» or the percentage on the total mass.
Among the main dissolved elements, **calcium** (C), always present in large quantities in ionic form, represents a rather critical element because during desalination processes it can concentrate up to precipitate and thus produce incrustations. Calcium in the presence of **carbonate ions** forms calcium carbonate ($CaCO_3$) which, slightly soluble in water, tends to precipitate, while in the presence of **sulphate ions** it produces calcium sulphate ($CaSO_4$) which is also slightly soluble. To avoid the formation of these compounds, it is good practice not to concentrate the brine beyond the precipitation limit, thus also safeguarding the correct operation of the plant.
Recent studies on water magnetism have shown that super magnets produced with rare earths contribute significantly to eliminating calcium sedimentation by acting on its intrinsic nature.
The presence of **boron** in the water affects its potability as the WHO has set the limit below 0.5 ppm. The problematic nature of this element occurs in reverse osmosis systems because the particles are small enough to pass through the membrane and concentrate in the permeate.
The sea is the largest **carbon dioxide** receptor in the air, in fact the CO_2 dissolves particularly well in the water. Its presence, interacting with bicarbonates, can cause problems in the reverse osmosis process as its molecules, passing through the membrane, concentrate in the permeate with a consequent increase in acidity.
Other elements and compounds to which you need to pay attention are **oils** and **hydrocarbons** that can create inconveniences such as the generation of **foams** during thermal processes or, in reverse osmosis, adhere to the membranes causing their occlusion. Finally, the presence of **ammonia** if it exceeds certain concentrations represents a threat of chemical corrosion for copper and its alloys, widely used in thermal processes.
The water is divided into four types according to the quantity of dissolved salts:

- Fresh water up to 450 ppm
- Brackish water from 500 to 30,000 ppm
- Marine water from 30.001 to 50.000 ppm
- Brine over 50,000 ppm

cavitation



Water has the ability to convey many substances thanks to its particular chemical and physical properties: very high solvent power, high chemical reactivity and considerable specific heat. Moreover, its molecular capacity, two hydrogen atoms bound to an oxygen atom, allows it to behave like a crystal: not only in the solid state (ice) but also in the liquid state.
Cavitation applied to water acts mainly on this characteristic.
Through the violent implosion of the bubbles, it causes the release of nascent oxygen, allows the elimination of viruses and bacteria present; furthermore, it supports the magnetic conversion of calcite (responsible for the formation of scale) insoluble in soluble aragonite and not able to aggregate in the formation of limestone.
Finally, since the molecular structure of water is not uniform, the distance between the molecules is never the same, nor is the reciprocal attraction force; there are therefore areas or points of emptiness or pockets of gas (oxygen, nitrogen) and foreign bodies, sometimes not totally wet.



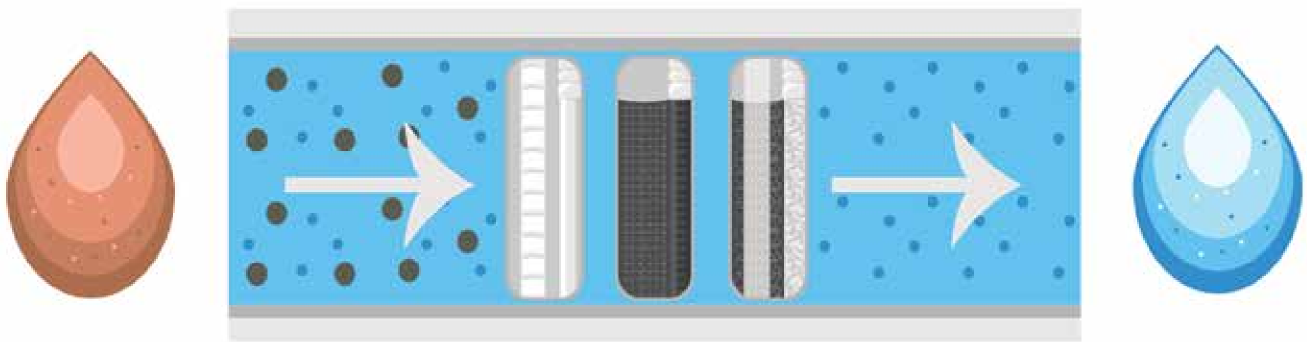
As the pressure decreases, the air pockets expand, the liquid evaporates and the steam fills them. The subsequent phase of implosion violates the oxygen, which can thus exert all its oxidative action on the surrounding organic substrate, mimicking the action of hydrogen peroxide.
Another fundamental aspect of cavitation with respect to all other water purification and filtering treatments consists in the fact that with cavitation they are the same water molecules that, after the implosion phase, assume a homogeneous crystalline configuration, which gives the water the original characteristics of the formation from the source.
Therefore, unlike the other treatments applicable to water, nothing is added or removed, such as ion exchange resins for inserting and subtracting ions or magnetic filtering to subtract iron, but on the contrary it is amplified and enhances the natural ability of water to biodegrade and break down pathogens by oxidation.
Furthermore, our equipment also includes an ozonator that further enhances the oxidation of any pollutants present.

reverse osmosis...

The water molecules have an electrically positive and negative part. In the presence of an electrically active ion (positive or negative) the molecules are attracted forming a stable agglomeration of molecules of dimensions proportional to the electrostatic force of the ion.
The membranes exploit the difference in size between agglomerates and molecules to filter the water: the osmotic ones prevent the passage to monovalent ions such as sodium and chlorine and for this reason they are used in the filtration of sea water.
Osmosis is the phenomenon of diffusion of water molecules that occurs when an osmotic membrane is interposed between two solutions with different salinity: a pressure proportional to the concentration gradient that pushes the water from the solution poor in solute to the richer one.
This pressure responds to the need of the system to bring itself into equilibrium, ie to equalize the salinity of the two solutions. The osmotic flow can be interrupted by applying a pressure equal to the osmotic pressure to the more concentrated solution, if the pressure increases further the flow is reversed thus obtaining the reverse osmosis process.
The pressure, therefore the energy to be supplied to reverse the process, depends on the difference in concentration.
The process involves high energy consumption due to the compression of the water, to ensure that only part of it (about 50%) is desalted.
The brine rejected by the membrane still contains a lot of pressure energy which is recovered through special systems (turbo-pumps or pressure exchangers).
Osmosis systems usually consist of:

- Water pretreatment systems (clarification, filtration, pH correction)
- Membrane systems where real osmosis takes place
- Post-treatment systems (remineralization)

The greater the pretreatments to which the water is subjected, the less energy will be needed to complete the osmosis process.
In addition, correct use of the membranes will allow for self-maintenance as well as reduced production of brines to be disposed of or discarded at sea.



...& cavitation

Cavitation triggers multiple effects in salt water; among these it should be noted that first of all it makes the physical bonds of the saline molecules less strong with those of the water: therefore in the subsequent reverse osmosis the saline molecules «detach» more easily from those of the water and will be able to pass the membranes easily.
Therefore much less energy is used than comparable systems.
The Empowering Device combines the effects of cavitation with osmotic membranes and filters that can remove the precipitate or floated substances, obtaining a complete purification of the treated water while removing also oils, pathogens and pollutants.
The use of cavitation ultrasound will also help in cleaning the membrane surface through mechanisms such as acoustic streaming, microstreaming, microstreamer, microjet and shock waves.
The acoustic streaming mechanism improves membrane cleanliness by transmitting acoustic energy through the feed solution to produce a flow of liquid that is obstructed, causing unidirectional waves of liquid flow with a flow velocity reaching up to 10 m / s parallel to the surface of the deposits, which can be of great help in removing dirt.
The cavitation bubbles are attracted to the antinodes of the standing wave and structured in a certain path in which the size of the bubble increases as it travels towards the antinodes located on the surface of the membrane. Once the antinodes reach the surface of the dirty membrane, bubbles are formed which cause a entrainment and detachment effect on the particles deposited on the surface of the membrane.
The shrinking effect of the cavitation bubbles moves the liquid molecules away from the surface of the membrane, while the expansion effect pushes the molecules onto the surface of

the membrane, causing shear and drag forces necessary for the removal of fouling from the membrane surface.
When the cavitation bubble reaches its minimum size, at the end of the compression cycle, the cavitation bubbles reach a sudden stop causing the liquid molecules, moved towards the bubbles, to reflect with high pressure towards the surface of the membrane.
The increase in high flow when switching from a low to a high CFV (cross flow rate) with the ultrasound facing the support layer confirms that the use of ultrasound in the support layer induces mixing and turbulence zones and thus, it reduces the impact of the ICP and improves the flow of water.
The advantages of this cleaning technique are the absence of use of chemicals, the shutdown of the system and the need to remove the membrane from the system for ex situ cleaning, in order to minimize possible contact of the membrane with the 'air.
Ultrasound affects membrane filtration through three ways: by detaching deposited contaminants and moving particles and molecules away from the membrane interface (i.e. reducing concentration polarization) (cleaning effects), improving water transport across the membrane (effects mass transfer) and increasing the heat transfer of water for thermally operated membrane processes.
Furthermore, by applying cavitation it is possible to collect the precipitated salts by passing the post-shock wave samples through a special filter, the precipitate is crystalline in nature, comprising spherical particles that are larger when derived from groundwater.
The particles contain various elements - such as chlorine, potassium and magnesium - which are consistent with the dissolved content of the original water.
The approach to desalination that we have chosen for the **EMPOWERING DEVICE** is by no means the one that has been tested for a long time in the Russian / Chinese context and considered, at least for a few years, rightly or wrongly, the way forward to apply cavitation to the removal of salt from the sea water.
These exploited the chemical and thermal conditions of cavitation to obtain an intensive evaporation of a solution in the purification phase: the superheated water after an electromagnetic treatment, in the presence of fixed obstacles placed according to a peculiar geometry, went into cavitation.
For us, however, cavitation must be understood as a process that prepares the water for osmotic desalination, also providing for its purification. Then the membranes are inserted inside the **EMPOWERING DEVICE** device becoming an integral part of it.
With both cavitation systems, the **EMPOWERING DEVICE** and the Russian / Chinese system, no chemicals are added to the water but the **EMPOWERING DEVICE**, the **SOFRON16** which represents the largest model, can desalinate over 23,000 m3 / d with a consumption of approximately 0.05 kW per m3 while the other system produced up to 1,200 m3 / d with a consumption of 3 kW per m3.
Furthermore, the **EMPOWERING DEVICE** is modular and therefore allows the installation of multiple systems side by side or overlapping.

EMPOWERING DEVICE

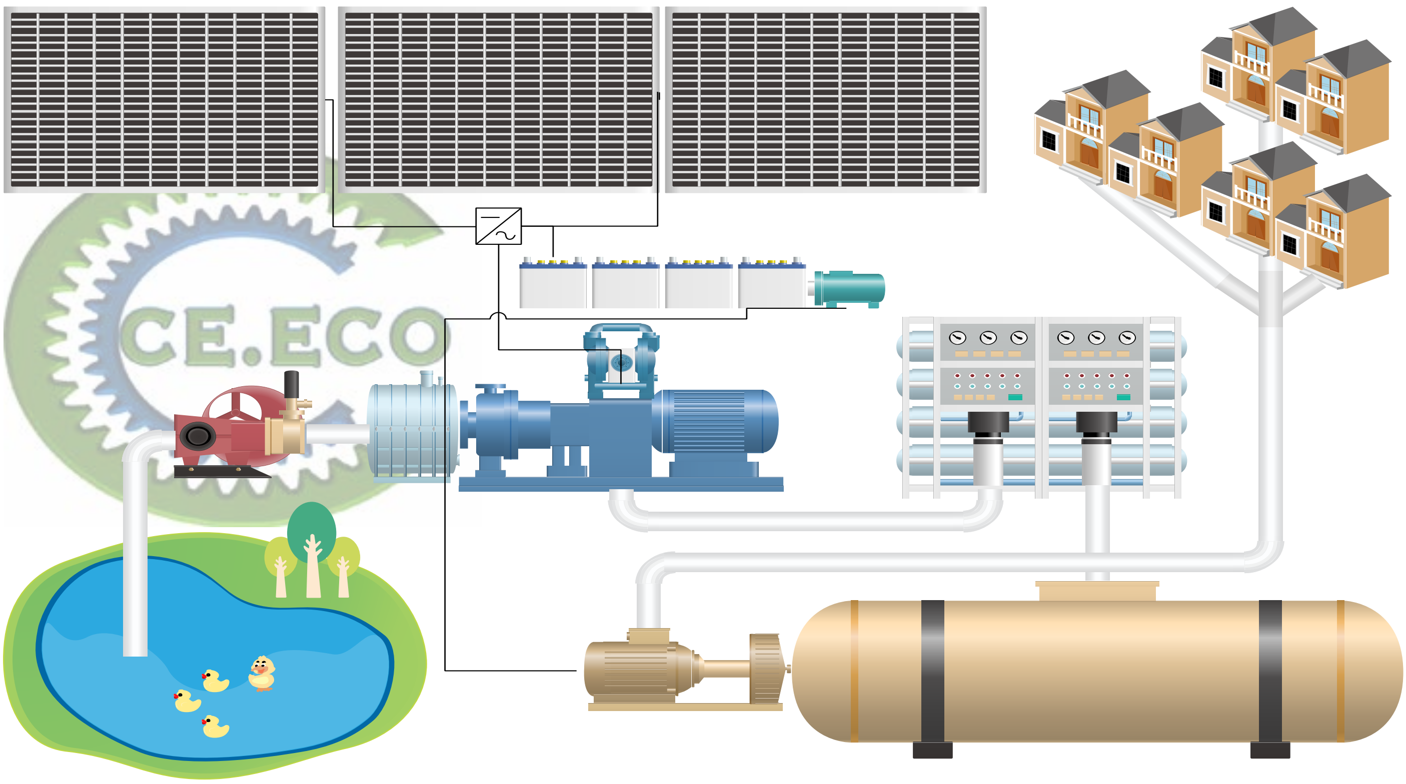
EMPOWERING DEVICE has been fully conceived, developed and implemented by our team and is able to simultaneously manage different types of controlled cavitation, of which 5 of a different nature but which coexist harmoniously to the point that no significant vibrations are detected.
The summation of the effects produced by each cavitation further implements the efficiency of the chemical, physical and biological processes that take place within the apparatus, resulting in a subsequent cut in the already low energy consumption as well as a sharp reduction in processing times.
A prototype with a special set-up, prepared for experimentation and of 1:1 size, has been used by us since the beginning of 2017 to conduct the required tests on the samples of materials brought by our customers.
Our machinery is equipped with test certificates and international operating certifications with different types of liquids on different chemical, physical and biological processes.
What makes our system, today, unique compared to what the market offers in the field of controlled cavitation is the fact that although it is already extremely difficult to control a cavitation, in our system there are controlled cavitation's numerous and of different kinds, at least one of which is sonic.
The machine body has an element, with the functions of a static mixer, called by us “Il Cedro” (the Cedar) for the peculiar conformation of the “leaves” that make up its design.
This special monobloc mixer, in the presence of processes that involve the formation of crystalline chemical elements, has the ability to favor the formation of Crystallization Germs, with further acceleration of chemical reactions.
Another significant improvement compared to what has existed so far is represented by the evident lower pressure drops compared to machines equipped with motors of similar installed power, with a sensible and consequent energy savings during operation: the **EMPOWERING DEVICE** requires only a fraction of the electrical energy used by the other cavitators.
This is due to the fact that the machine body of the **EMPOWERING DEVICE** is structured to form a true “diffuser”, with the consequent recovery of a percentage of the

outlet pressure.
Furthermore, it has been designed to be easily and quickly reconfigured according to the use: some of its parts can be removed if very dense and / or viscous liquids have to be treated and / or with extensive granularity or they can be added, inlet or outlet, accessory elements suitable for almost any use.
Moreover, in the presence of organic matter, cavitation leads to the consequent partial physical destructuring, a lysis of the cell walls and the consequent release of the intracellular content.
This action translates into a greater availability of cellular juices, an acceleration of hydrolysis processes and, consequently, an acceleration of the anaerobic digestion process as a whole.
In our cavitator, based on experiments conducted and certified by third parties, the rate of bacterial degradation can accelerate from 4/5 times to over 10 times compared to conventional treatments.
The certifications performed by the Rina Group show that the COD of the waste water from a gasifier is reduced by 90% in just 15 minutes.
By using the supplied inverter system, at the start, consumption is less than the 25kWh of rated installed power, similarly during full use; in the absence of an inverter, at least 36kWh would be required to start.
The standard version can treat up to 60 cubic meters of fluid per hour.
Compactness, simplicity of installation and use, are undoubtedly some of the peculiarities of our cavitation apparatus but it is the total flexibility of use that makes it unique.

SAMPLE	COD mg/L
AS IS material	15.380
after cavitation material	1.508
COD reduction percentuage	90,2%

models available

Not all models of the **EMPOWERING DEVICE** are suitable for desalination even if the whole range of models allows the installation of accessories suitable for this purpose.
For limited needs in terms of quantities of fresh water, even the smaller models can perform this task very well. The state of the art in terms of treatable volumes and reduction of electricity consumption is achieved with the **SOFRON** product family.
This line was conceived and designed specifically for this purpose: all the models are housed in skids that allow the assembly of several elements also on top of each other.
Furthermore, the materials adopted for this line allow the use of a single rotating chamber of larger but heavy dimensions like that of the smaller models but designed to have to withstand even in use with high acidity products.
So the motor of a **SOFRON16** will be identical and will consume like that of a **STANDARD** model while being 16 times bigger!
We have also created models specifically designed for specific uses: a model that can be easily placed in war zones or devastated by natural phenomena and a multi-utilities / multimedia hub to be used as an operational command center or as a village center in inaccessible areas. Both are self powered.
All systems are designed to receive maintenance interventions of a few hours a year, with remote control and without the consumption of chemicals to be recharged.
On request, we can provide adequate energy systems, with storage, which allow the **EMPOWERING DEVICE** to have complete energy autonomy, further reducing its operating costs.



EMPOWERING DEVICE

STANDARD

model parameters	max flow rate m3 / h	120
	liters / minute	*2.000*
	liters / second	*33,33*
	liters internal circuit	240
	liters storage tank	0
	days of operation	364
	ozone grams / h	60
	annual maintenance	6,2%
rated power kW	engine	15,0
	main pump	5,5
	ozone system	1,0
	PLC & sensors	0,4
	UV system	*0,7*
	booster pump - opt.	*5,5*
	other optional	*0,0*
	Actual kWh	**7,8**
system equipment	ozonators	2
	UV system	1
	graphene filter IN	0
	graphene filter OUT	1
	membrane	1
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	no

rpm **1.500**

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	33,3	11,1	5,6	3,7	2,8	2,2	1,9
max m3 / hour	120,0	40,0	20,0	13,3	10,0	8,0	6,7
m3 / hour - desalinated	60,0	20,0	10,0	6,7	5,0	4,0	3,3
max m3 / day	2880,0	960,0	480,0	320,0	240,0	192,0	160,0
seconds for 1 m3	30	90	180	270	360	450	540
kW processing	0,016	0,047	0,093	0,140	0,187	0,234	0,280
kW / m3	0,065	0,195	0,389	0,584	0,779	0,973	1,168
ozone gr./ processing	0,12	0,36	0,72	1,08	1,44	1,8	2,16
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,062	0,185	0,370	0,555	0,740	0,925	1,110
2000,00 *kW / m3 min.*	0,084	0,252	0,505	0,757	1,009	1,261	1,514
3000,00 *kW / m3 min.*	0,178	0,535	1,070	1,605	2,140	2,675	3,210

desalinates water for approx	7.200	*inhabitants (150 l / d)*
system size	3,90	*m2*
modular and stackable → x	130	*cm*
↑ y	300	*cm*
↗ z	261	*cm*
dimensions of energy subsystems	-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*suitable*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

EMPOWERING **DEVICE**

TWIN-MAX

rpm **1.500**

model parameters	max flow rate m3 / h	240
	liters / minute	*4.000*
	liters / second	*66,67*
	liters internal circuit	480
	liters storage tank	0
	days of operation	364
	ozone grams / h	120
	annual maintenance	6,2%
rated power kW	engine	30,0
	main pump	11,0
	ozone system	2,0
	PLC & sensors	0,8
	UV system	*1,4*
	booster pump - opt.	*11,0*
	other optional	*0,0*
	Actual kWh	**21,8**
system equipment	ozonators	4
	UV system	2
	graphene filter IN	0
	graphene filter OUT	2
	membrane	2
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	66,7	22,2	11,1	7,4	5,6	4,4	3,7
max m3 / hour	240,0	80,0	40,0	26,7	20,0	16,0	13,3
m3 / hour - desalinated	120,0	40,0	20,0	13,3	10,0	8,0	6,7
max m3 / day	5760,0	1920,0	960,0	640,0	480,0	384,0	320,0
seconds for 1 m3	15	45	90	135	180	225	270
kW processing	0,022	0,066	0,131	0,197	0,262	0,328	0,393
kW / m3	0,091	0,273	0,546	0,819	1,092	1,365	1,638
ozone gr./ processing	0,24	0,72	1,44	2,16	2,88	3,6	4,32
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 kW / m3 min.	0,062	0,185	0,370	0,555	0,740	0,925	1,110
2000,00 kW / m3 min.	0,101	0,304	0,609	0,913	1,218	1,522	1,827
3000,00 kW / m3 min.	0,178	0,535	1,070	1,605	2,140	2,675	3,210

desalinates water for approx 14.400 *inhabitants (150 l / d)*

	system size	9,61	*m2*
modular and stackable	→ x	310	*cm*
	↑ y	310	*cm*
	↗ z	261	*cm*
	dimensions of energy subsystems	-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

EMPOWERING DEVICE

TRIO

rpm **1.500**

model parameters	max flow rate m3 / h	360
	liters / minute	*6.000*
	liters / second	*100,00*
	liters internal circuit	720
	liters storage tank	0
	days of operation	364
	ozone grams / h	180
	annual maintenance	6,2%
rated power kW	engine	45,0
	main pump	16,5
	ozone system	3,0
	PLC & sensors	1,2
	UV system	*2,1*
	booster pump - opt.	*16,5*
	other optional	*0,0*
	Actual kWh	**35,9**
system equipment	ozonators	6
	UV system	3
	graphene filter IN	0
	graphene filter OUT	3
	membrane	12
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	100,0	33,3	16,7	11,1	8,3	6,7	5,6
max m3 / hour	360,0	120,0	60,0	40,0	30,0	24,0	20,0
m3 / hour - desalinated	180,0	60,0	30,0	20,0	15,0	12,0	10,0
max m3 / day	8640,0	2880,0	1440,0	960,0	720,0	576,0	480,0
seconds for 1 m3	10	30	60	90	120	150	180
kW processing	0,024	0,072	0,144	0,215	0,287	0,359	0,431
kW / m3	0,100	0,299	0,598	0,897	1,196	1,495	1,794
ozone gr./ processing	0,36	1,08	2,16	3,24	4,32	5,4	6,48
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,062	0,185	0,370	0,555	0,740	0,925	1,110
2000,00 *kW / m3 min.*	0,107	0,322	0,644	0,966	1,287	1,609	1,931
3000,00 *kW / m3 min.*	0,178	0,535	1,070	1,605	2,140	2,675	3,210

desalinates water for approx 21.600 *inhabitants (150 l / d)*

system size		9,61	*m2*
modular and stackable	→ x	310	*cm*
	↑ y	310	*cm*
	↗ z	261	*cm*
dimensions of energy subsystems		-	*m2*

the set configuration

sterilization level	*great*
targeted removal of pollutants	*great*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

EMPOWERING DEVICE

SOFRON4

rpm **1.500**

model parameters	max flow rate m3 / h	480
	liters / minute	*8.000*
	liters / second	*133,33*
	liters internal circuit	960
	liters storage tank	0
	days of operation	364
	ozone grams / h	240
	annual maintenance	6,2%
rated power kW	engine	15,0
	main pump	22,0
	ozone system	4,0
	PLC & sensors	1,6
	UV system	*2,8*
	booster pump - opt.	*22,0*
	other optional	*0,0*
	Actual kWh	**27,4**
system equipment	ozonators	8
	UV system	4
	graphene filter IN	0
	graphene filter OUT	4
	membrane	4
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	133,3	44,4	22,2	14,8	11,1	8,9	7,4
max m3 / hour	480,0	160,0	80,0	53,3	40,0	32,0	26,7
m3 / hour - desalinated	240,0	80,0	40,0	26,7	20,0	16,0	13,3
max m3 / day	11520,0	3840,0	1920,0	1280,0	960,0	768,0	640,0
seconds for 1 m3	7,5	22,5	45	67,5	90	112,5	135
kW processing	0,014	0,041	0,082	0,123	0,165	0,206	0,247
kW / m3	0,057	0,171	0,343	0,514	0,686	0,857	1,029
ozone gr./ processing	0,48	1,44	2,88	4,32	5,76	7,2	8,64
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,053	0,159	0,318	0,476	0,635	0,794	0,953
2000,00 *kW / m3 min.*	0,053	0,159	0,318	0,476	0,635	0,794	0,953
3000,00 *kW / m3 min.*	0,085	0,254	0,508	0,761	1,015	1,269	1,523

desalinates water for approx		28.800	*inhabitants (150 l / d)*
system size		12,40	*m2*
modular and stackable	→ *x*	310	*cm*
	↑ *y*	400	*cm*
	↗ *z*	350	*cm*
dimensions of energy subsystems		-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

EMPOWERING **DEVICE**

SOFRON8

rpm **1.500**

model parameters	max flow rate m3 / h	960
	liters / minute	*16.000*
	liters / second	*266,67*
	liters internal circuit	1920
	liters storage tank	0
	days of operation	364
	ozone grams / h	480
	annual maintenance	6,2%
rated power kW	engine	15,0
	main pump	44,0
	ozone system	8,0
	PLC & sensors	3,2
	UV system	*5,6*
	booster pump - opt.	*44,0*
	other optional	*0,0*
	Actual kWh	**53,6**
system equipment	ozonators	16
	UV system	8
	graphene filter IN	8
	graphene filter OUT	0
	membrane	8
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	266,7	88,9	44,4	29,6	22,2	17,8	14,8
max m3 / hour	960,0	320,0	160,0	106,7	80,0	64,0	53,3
m3 / hour - desalinated	480,0	160,0	80,0	53,3	40,0	32,0	26,7
max m3 / day	23040,0	7680,0	3840,0	2560,0	1920,0	1536,0	1280,0
seconds for 1 m3	3,75	11,25	22,5	33,75	45	56,25	67,5
kW processing	0,013	0,040	0,080	0,121	0,161	0,201	0,241
kW / m3	0,056	0,168	0,335	0,503	0,670	0,838	1,006
ozone gr./ processing	0,96	2,88	5,76	8,64	11,52	14,4	17,28
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,051	0,154	0,309	0,463	0,618	0,772	0,926
2000,00 *kW / m3 min.*	0,051	0,154	0,309	0,463	0,618	0,772	0,926
3000,00 *kW / m3 min.*	0,069	0,207	0,414	0,621	0,828	1,034	1,241

desalinates water for approx 57.600 *inhabitants (150 l / d)*

system size		14,00	*m2*
modular and stackable	→ x	350	*cm*
	↑ y	400	*cm*
	↗ z	350	*cm*
dimensions of energy subsystems		-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

EMPOWERING DEVICE

SOFRON12

model parameters		
	max flow rate m3 / h	1440
	liters / minute	*24.000*
	liters / second	*400,00*
	liters internal circuit	2880
	liters storage tank	0
	days of operation	364
	ozone grams / h	720
	annual maintenance	6,2%
rated power kW	engine	15,0
	main pump	66,0
	ozone system	12,0
	PLC & sensors	4,8
	UV system	*8,4*
	booster pump - opt.	*66,0*
	other optional	*0,0*
	Actual kWh	**79,8**
system equipment	ozonators	24
	UV system	12
	graphene filter IN	12
	graphene filter OUT	0
	membrane	12
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

rpm **1.500**

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	400,0	133,3	66,7	44,4	33,3	26,7	22,2
max m3 / hour	1440,0	480,0	240,0	160,0	120,0	96,0	80,0
m3 / hour - desalinated	720,0	240,0	120,0	80,0	60,0	48,0	40,0
max m3 / day	34560,0	11520,0	5760,0	3840,0	2880,0	2304,0	1920,0
seconds for 1 m3	2,5	7,5	15	22,5	30	37,5	45
kW processing	0,013	0,040	0,080	0,120	0,160	0,200	0,240
kW / m3	0,055	0,166	0,333	0,499	0,665	0,832	0,998
ozone gr./ processing	1,44	4,32	8,64	12,96	17,28	21,6	25,92
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,051	0,153	0,306	0,459	0,612	0,765	0,918
2000,00 *kW / m3 min.*	0,051	0,153	0,306	0,459	0,612	0,765	0,918
3000,00 *kW / m3 min.*	0,064	0,191	0,383	0,574	0,765	0,956	1,148

desalinates water for approx 86.400 *inhabitants (150 l / d)*

system size		14,80	*m2*
modular and stackable 〉	→ x	370	*cm*
	↑ y	400	*cm*
	↗ z	350	*cm*
dimensions of energy subsystems		-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

EMPOWERING DEVICE

SOFRON16

model parameters	max flow rate m3 / h	1920
	liters / minute	*32.000*
	liters / second	*533,33*
	liters internal circuit	3840
	liters storage tank	0
	days of operation	364
	ozone grams / h	960
	annual maintenance	6,2%
rated power kW	engine	15,0
	main pump	88,0
	ozone system	16,0
	PLC & sensors	6,4
	UV system	*11,2*
	booster pump - opt.	*88,0*
	other optional	*0,0*
	Actual kWh	**106,0**
system equipment	ozonators	32
	UV system	16
	graphene filter IN	16
	graphene filter OUT	0
	membrane	16
	insufflator	0
	dosing pump	0
	weir	0
	refrigerator	0
extra	atex	no
	ped	no
	teflon	no
	renewable energy	no
	energy storage	si

rpm **1.500**

	continuous	short	medium	long	prolonged	accurate	scrupulous
processing cycles	1	3	6	9	12	15	18
seconds needed	7,2	21,6	43,2	64,8	86,4	108	129,6
processes per hour	500,0	166,7	83,3	55,6	41,7	33,3	27,8
liters per second	533,3	177,8	88,9	59,3	44,4	35,6	29,6
max m3 / hour	1920,0	640,0	320,0	213,3	160,0	128,0	106,7
m3 / hour - desalinated	960,0	320,0	160,0	106,7	80,0	64,0	53,3
max m3 / day	46080,0	15360,0	7680,0	5120,0	3840,0	3072,0	2560,0
seconds for 1 m3	1,875	5,625	11,25	16,875	22,5	28,125	33,75
kW processing	0,013	0,040	0,080	0,119	0,159	0,199	0,239
kW / m3	0,055	0,166	0,331	0,497	0,663	0,828	0,994
ozone gr./ processing	1,92	5,76	11,52	17,28	23,04	28,8	34,56
ozone grams / m3	0,50	1,50	3,00	4,50	6,00	7,50	9,00
1000,00 *kW / m3 min.*	0,051	0,152	0,304	0,457	0,609	0,761	0,913
2000,00 *kW / m3 min.*	0,051	0,152	0,304	0,457	0,609	0,761	0,913
3000,00 *kW / m3 min.*	0,061	0,183	0,367	0,550	0,734	0,917	1,101

desalinates water for approx 115.200 *inhabitants (150 l / d)*

system size		16,00	*m2*
modular and stackable	→ x	400	*cm*
	↑ y	400	*cm*
	↗ z	350	*cm*
dimensions of energy subsystems		-	*m2*

the set configuration

sterilization level	*maximum*
targeted removal of pollutants	*maximum*
desalination	*to verify*
oil separation	*suitable*
alimentary use	*to verify*
self-powered	-
use dangerous and / or explosive environments	*to verify*

Chemical Empowering AG

emergencies device

The system is modular and housed within 3 standard 20 and 40 foot containers.
The first container houses the mechanical parts inside, the second the water tanks, the second the storage and the pre-assembled solar panels.
Once the system is placed near the source of water, the preassembled photovoltaic panels will be extracted from the special housing chamber and oriented through the metal frames supplied to form canopies over the containers themselves or to be placed on the sides, on the ground, to create shaded areas.

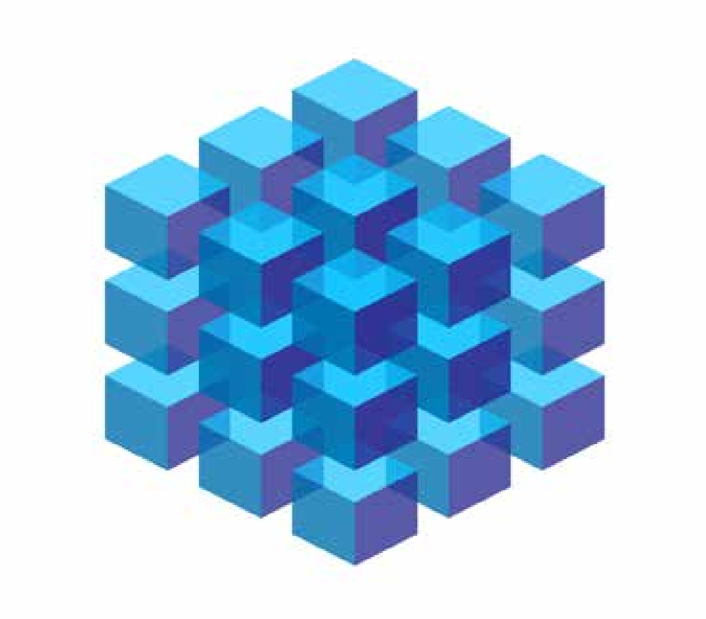
At one end of the container that houses the mechanical parts there is the pumping system for abduction and the loading tank; follow the cavitation section and the area occupied by the self-cleaning membranes.
A special container is dedicated only to the treated water storage tanks.
Once emptied from the photovoltaic panels, the third container, on whose walls the storage batteries are housed, can become a small workshop or an office.
Special inlet filters are provided to remove any traces of oils, magnetic filters to stabilize the calcium in order to prevent its deposit and systems to eliminate boron and ammonia.
An ozonation system will assist the elimination of all traces of polluting agents present.
In the storage tanks, special slow-release mineralizers will optimize the levels of minerals contained in the water.

A booster pump served by batteries will allow the distribution of water to the community even at night.
The system is optimized to work during the day by exploiting the production of photovoltaic energy and accumulating a reserve of water to be available also during the night.
Optionally, additional packs of batteries and photovoltaic panels can be supplied to guarantee uninterrupted operation up to 72 hours.

Purity 3.0 alkaline

The plant is located in a standard 40-foot shipping container.
Once positioned on the ground, the photovoltaic panels will be placed on the roof of the container for a total of about 14 kW for the production of the electricity needed to power the system.
The energy will be stored in special batteries with a capacity of about 25 kW in order to be used even at night and during the absence of the sun.
The electricity generation section will be complete with governed general protection and power line protection units.
The system that is going to be configured is of the type defined as “island”.
From the general production framework, power will be supplied to both a maximum of 30 electrical utilities installed in the area of the settlement and the plant management control systems.
In particular, the system will be set up with 30 external connections to be able to supply energy to as many housing units sufficient to operate some LED lamps, it will be able to power a 600-liter refrigeration unit common to the settlement, it will be able to power internet connectivity, it will be able to power the purifier water with relative chiller apparatus to cool the drinking water supplied and a multimedia control unit with high definition maxi screen.
The structure was designed to be permanently placed outdoors at an altitude of up to 2000 meters, even in areas with strong seismic activity.

The machine has been sized for the purification and treatment of 36m3 / day of river water with non-complex pathogens to be collected near the installation site by means of an electric abduction pump. The water treatment involves osmotic filtration, ozone additives and sterilizing UV lamps.
Inside the container there will be an accumulation of ready-to-dispense water equal to 7,000 liters from which it can be drawn directly through special dispensing taps. It will be possible to use a chiller capable of cooling up to 6 liters of water per minute.
Purity can store a maximum of 7 m3 of purified water.
On the container there will be a satellite antenna that will offer wireless internet connection from 3 to 30 Mbps.
A refrigerator with a capacity of 600 liters will be placed in the container.




Chemical Empowering

AG

Alpenstrasse 16, 6300 Zug — Switzerland

SRL

Via La Louviere 4, 06034 Foligno — Italy

MAIN PARTNERS: