



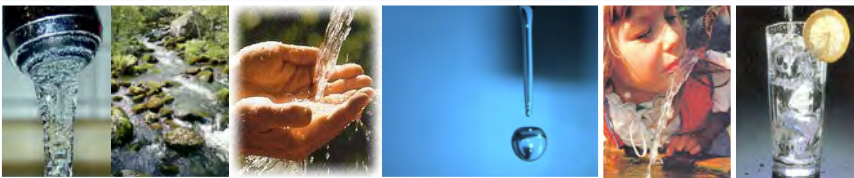
MAGE

Water Management

TINOX

Water Management

Sea Water Desalination Systems Using Solar Energy or Waste Heat



Efficient and Reliable
Production of
Pure Drinking Water
using
Multi-Effect-
Humdification (MEH)



MiniSal™ 1000

MidiSal™ 5000

MegaSal™ 10000

MaxiSal™ 50000

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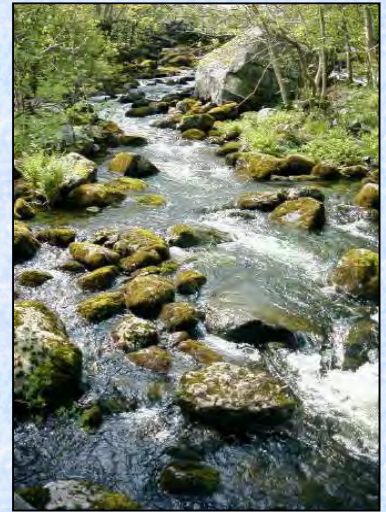
Facts about the Water Situation in the World 2005

Water is essential for life. Clean and healthy fresh water is the one resource having the highest demand growth rates compared to all basic foodstuffs or comestibles worldwide.

This is an apparent fact and concerning as well drinking water and water for human consumption as water for irrigation in agriculture and for human comfort in households or tourism. The main reason is a growing world population coinciding with ebbing resources - mainly in the third world. Further reasons are growing demand on comfort and availability - in the industrialized countries.

Already now about one third of the human being has no direct access to clean, consumable fresh water. In many places the access to drinking water is the one and only daily task for women and children in third world families, and it is becoming even an emerging subject in the "developed" world to supply drinking and fresh water within times of breakdown of the public grid.

The solution strategies for the upcoming squeeze are complex - but main components will be water management - meaning a growing prudence in water consumption - and the opening of new sources of water supply - one of them being the desalination of salty water. In its millennium declaration dated 18. September 2000 the UNO resolves to halve the proportion of people who are unable to reach or to afford safe drinking water by the year 2015.



Global freshwater consumption rose sixfold between 1900 and 1995 - more than twice the rate of population growth. About one third of the world's population already lives in countries considered to be 'water stressed' - that is, where consumption exceeds 10% of total supply. If present trends continue, two out of every three people on Earth will live in that condition by 2025.

-- Kofi Annan, in *We The Peoples*, 2000

Decentralized desalination enables water supply all over

Only cities or metropolitan areas facing water shortage are more and more supplied by large desalination plants with capacities from 5 000 up to 120 000 m³ per day. The consumption and distribution of this water needs a reliable and powerful distribution network.

This is not feasible for dispersed settlements on the countryside. For the supply of decentralised, remote locations - even with low infrastructure or without permanent grid connection - we have developed the reliable, autonomous and self-sufficient MEH desalination systems **MiniSal™1'000**, **MidiSal™5'000** and **MegaSal™10'000**. They are producing reliable high quality fresh water everywhere on this planet where salty water is available.



Low energy demand is essential for cost-effectiveness

The energy demand of desalination is often prohibitive – electricity is expensive or not available within the needed capacities.

The TiNOX-MAGE desalination systems solve this obstacle by tremendously reduced energy demand for the desalination process, applying a very effective and energy saving heat recovery system. This patented process is recycling the thermal energy of distillation up to 10 times. The following heat sources can easily be applied for the desalination process:

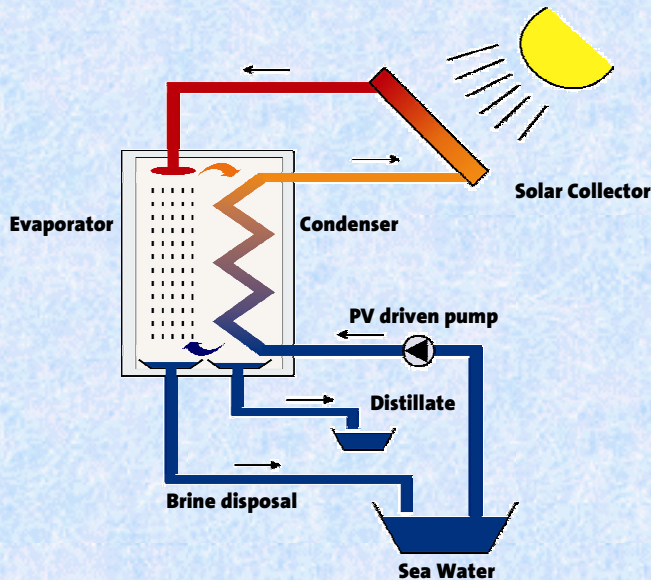
- Low temperature waste heat, e.g. from diesel generators or gas burners
- Solar energy supplied by solar thermal water heaters
- LNG-Burners applying low cost gas from bottles or pipelines where available.

All these components are supplied to you optionally in a well tuned configuration meeting your individual demand. Just let us know it!

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Short description of the TiNOX - MAGE MEH Desalination Method



Facts about the process – your advantages using MEH-Technology:

Low temperature heat of 85°C is used for evaporation

- No moving parts within the distillation chamber ensure low maintenance demand
- The self-controlling natural convection loop enables best energy recovery ratios of up to eight
- Sophisticated geometrical design allows easy maintenance and optimum performance at the same time
- No pre-treatment of raw water is needed. The process is insensitive to high salt contents.
- Modular set-up, available sizes comprise units with 1000, 5000 and 10000 litres per day capacity

The TiNOX-Mage Watermanagement desalination process is based on the evaporation of salt water and the subsequent condensation of the generated steam. The steam is completely clear and does not carry any solvents. After condensation, you gain clear, healthy and sweet fresh water.

Sea water is heated by the sun or by waste heat - transferred by highly corrosion protected heat exchangers. It enters an evaporation chamber made from high-grade corrosion free materials – very important for reliable long term operation. Herein the seawater evaporates from efficient antibacterial fleece surfaces.

The generated humidity is fed into the condenser in a second step – completely without any additional energy demand. Like in nature, natural convection enables the best performance in the water production process - optimized by the well engineered geometric collocation of surfaces within the module.

During condensation, the main part of the energy used for evaporation is regained applying materials with extremely low heat flux resistance.

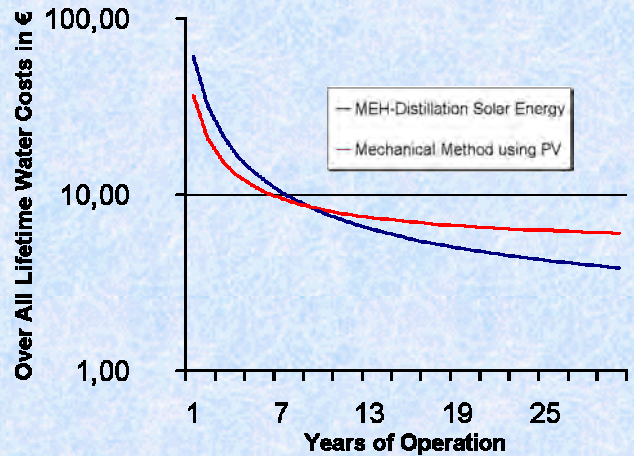
What about the quality of the produced fresh water

The product is fresh water in its cleanest form: Distillate without any dissolved solids and free of bacteria or organic contaminations.

For human consumption, the water can be blended by good fresh water or re-mineralised with a simple cartridge process using marble stones. For irrigation or household use, blending or adding of fertilizer solutions is possible.

Apart from the distillation unit, our water-management solution for you comprises the following optional accessories:

- Blending apparatus to enable re-mineralization of the product with raw water
- Re-mineralization unit for proper adjustment of salt content using marble bed cartridges
- UV-disinfection unit for safe storage of the produced water over a longer period (prevents re-contamination with bacteria or viruses)



What does it cost - in the end

Strategies for reducing water costs are manifold – but not all of them are sustainable.

With our equipment, we reach low life time water-costs by enabling low operation costs. The application of natural convection and the avoidance of technically complex components as vacuum pumps, valves or blowers in the desalination unit needs higher investment in large, well designed mass transfer surfaces. By that, condensation and evaporation is enhanced dramatically. Your advantages are

- low maintenance demand,
- cheap spare parts and
- long maintenance intervals.

The use of free solar energy or waste heat keeps the overall operation costs very low. In the end you reach lower water costs by the tremendously reduced operation costs compared to similar systems applying different technologies.



Water Management

Autonomous Desalination Modules and System Components of MAGE Watermanagement Desalination Systems



Autonomously operating Multi-Effect-Humidification units in three modular sizes. All desalination modules include the patented, clever designed arrangement of corrosion free condensation and evaporation subunits enhancing best energy recovery ratios. All components in contact with salt water are made from corrosion free materials. Condenser / Evaporator are made of taste-free, beverage-conform PolyPropylene material. Casing of the humidification chamber and collection basins are made of highly graded stainless steel.

Configurations and system components		MiniSal™ 1000	MidiSal™ 5000	MegaSal™ 10000
Designed Production rate per day		1000 Liter fresh water	5000 Liter fresh water	10000 Liter fresh water
	Casing of Desalination unit	5" container base area 2,44 m x 2,35 m	20" CSC container base area 2,44 m x 6,06 m	40" CSC container base area 2,44 m x 12,19 m
	Solar Thermal Collector (Slimline) applying highly selective TiNOX® solar absorber	40 m ² absorber area, net area demand app. 60 m ²	175 m ² absorber area, net area demand app. 250 m ²	350 m ² absorber area, net area demand app. 500 m ²
	Tubular Solar Collector (for rough climates) applying highly selective TiNOX® solar absorber	38 m ² absorber area, inclination with respect to location of setup	160 m ² absorber area, inclination with respect to location of setup	320 m ² absorber area, inclination with respect to location of setup
	Alternative Heat source: Connection – Kit for CHP using Generator waste heat	Min. el. Power 15 kW , e.g. Cat Olympian GEL 17,5 cooling Temp. 83/78 °C	Min. el. Power 30 kW e.g. Cat Olympian GEP 30 cooling Temp. 83/78 °C	Min. el. Power 60 kW e.g. Cat Olympian GEP 65 cooling Temp. 83/78 °C
	Alternative Heat source: Gas burner using liquid or public gas	9 kW Varion®9	28 kW Varion®28	40/70 kW Varion®68
	Drinking Water conservation unit by UV-radiation	For health care, we are offering re-mineralization and disinfection devices adapted to the demand of the applicant. If the produced water is used for drinking and needs to be stored for more than 4 hours, we recommend this optional package.		
	Photovoltaic modules for providing pumping energy	1.5 kW_{peak}	3.5 kW_{peak}	5.5 kW_{peak}
If electrical grid supply is not available, pumps can be operated by PhotoVoltaic system				