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## MED - Multi Effect Distillation.

### The economical and technological advantages over MSF – Multi Stage Flash

AquaSwiss AG has acquired the world's leading technology in desalination more than a year back. This includes the leading Low Temperature Multi Effect Distillation (LT- MED) technology.

On a technical review we believe the cost and economical advantage that MED offers ( of 30% or more) compared to MSF, on smaller and medium sized projects will scale up to large and very large sized projects also.

In general, the technological advances of the LT-MED, which result in reliable, durable and economical desalination plants producing high purity product water, are as follows (1):

- 1. Development of a unique design of a falling film horizontal tube evaporator/condenser with high heat transfer coefficient, utilizing only latent-heat transfer, avoiding sensible heat pick-up.
- 2. Superior thermodynamic efficiency (compared to MSF) and very low pressure drops at high volumetric vapour flows, as prevailing in low temperature operation. This enabled the optimization of the process for operation at a maximum brine temperature of 70 °C.
- 3. The low temperature operation has made possible the utilization of economical and durable materials of construction such as aluminium alloy for heat transfer tubes, plastic process piping and epoxy-painted carbon steel shells which show a better resistance when matched with aluminium alloy or titanium.
- 4. The economy of using aluminium tubes for heat transfer as compared with copper alloy tubes, which are essential for higher temperature plants (used by other distillation manufacturers), enables the increase of the heat transfer area per ton of water produced in the desalination plant for the same investment costs.
- 5. The significant increase in heat transfer area, in addition to the thermodynamic superiority of MED over the MSF process, results in a very low temperature drop per effect (1.5 2.5 °C), enabling the incorporation of a large number of effects (10 to 16) even with a maximum brine temperature as low as 70 °C, consequently resulting in very high economy ratios (product to steam).
- 6. Possibility of using low-cost/low-grade heat available through cogeneration schemes to minimize the energy cost component.
- 7. Minimal requirements for intake and pre-treatment systems.



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### **Comparative Capex and Opex Calculation**

There are real savings due to water production and considerable power generating gains when employing the LT-MED technology instead of alternative thermal process such as MSF. These savings and gains are in addition to all the qualitative advantages pinpointed at the previous sections. The following table summarizes a typical comparison of two thermal technologies envisaging a 100,000 m3/day production. However the economics is scalable for large and very large projects also of the size 500,000m3/day.

## Typical Comparative Calculation: 100,000 m<sup>3</sup>/day MED vs. MSF Thermal Technologies

		MED	<u>MSF</u>
Plant Configuration		5 x 20,000	2 x 50,000
Daily Production	m³/day	100,000	100,000
Availability	%	95%	94%
Annual Production	m³/yr	34,675,000	34,310,000
Interest rate	%	6%	6%
Contractual Period	years	20	20
Capital Cost: Desalination Equipment	MUSD	85	95
Capital cost: Erection and Balance of Plant	MUSD	21	19
Total Capital Investment	MUSD	106	114



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Amortization		MED	<u>MSF</u>
Total Capital Investment	MUSD	106	114
Amortization	USD/m <sup>3</sup>	0.27	0.29
Operating Costs (excluding steam consumption)			
Electricity Cost	USD/kWh	0.05	0.05
Electrical Consumption	kWh/m <sup>3</sup>	1.2	3.5
Electricity Cost	USD/m <sup>3</sup>	0.060	0.175
Chemicals	USD/m <sup>3</sup>	0.050	0.070
Spare Parts <sup>(1)</sup>	USD/m <sup>3</sup>	0.031	0.050
Labour <sup>(2)</sup>	USD/m <sup>3</sup>	0.015	0.015
Operating Costs (excluding steam consumption)	USD/m <sup>3</sup>	0.156	0.310
Desalted Water Cost (excluding steam consumption)	USD/m <sup>3</sup>	0.42	0.60
Savings due to water production	USD/m <sup>3</sup>	0.18	
Contractual Period savings due to water production	MUSD	123	
Gain in electricity production			
Steam Conditions (Typical)			
Pressure	ata	0.35	2 - 3
Temperature	С	70	120 - 132
Enthalpie	Kcal/Kg	588	647 - 680
Economy Ratio (Desalted Water Product/Steam)	ton/ton	8	8
Steam Consumption	Ton/hr	521	521
Steam turbine Efficiency (STE)	%	80	
Electricity Gain [ 521t/h x (665 - 588) kcal/Kg / 860 kcal/kW			
x STE ]	MW/hr	37.31	
Hours of Operation (@ 95% availability)	hrs/year	8,322	
Yearly savings due to Electricity Production	MUSD/year	15.52	
Contractual Period savings due to electricity production	MUSD	310	
Total Contractual Savings due to water and electricity	MUSD	433	

### Notes:

(1): 1%/1.5% of Capital Cost for MED/MSF respectively

(2): 13 workers for both MED and MSF, @ \$40,000/year each