A Comparison between MSF & MED Desalination Technologies

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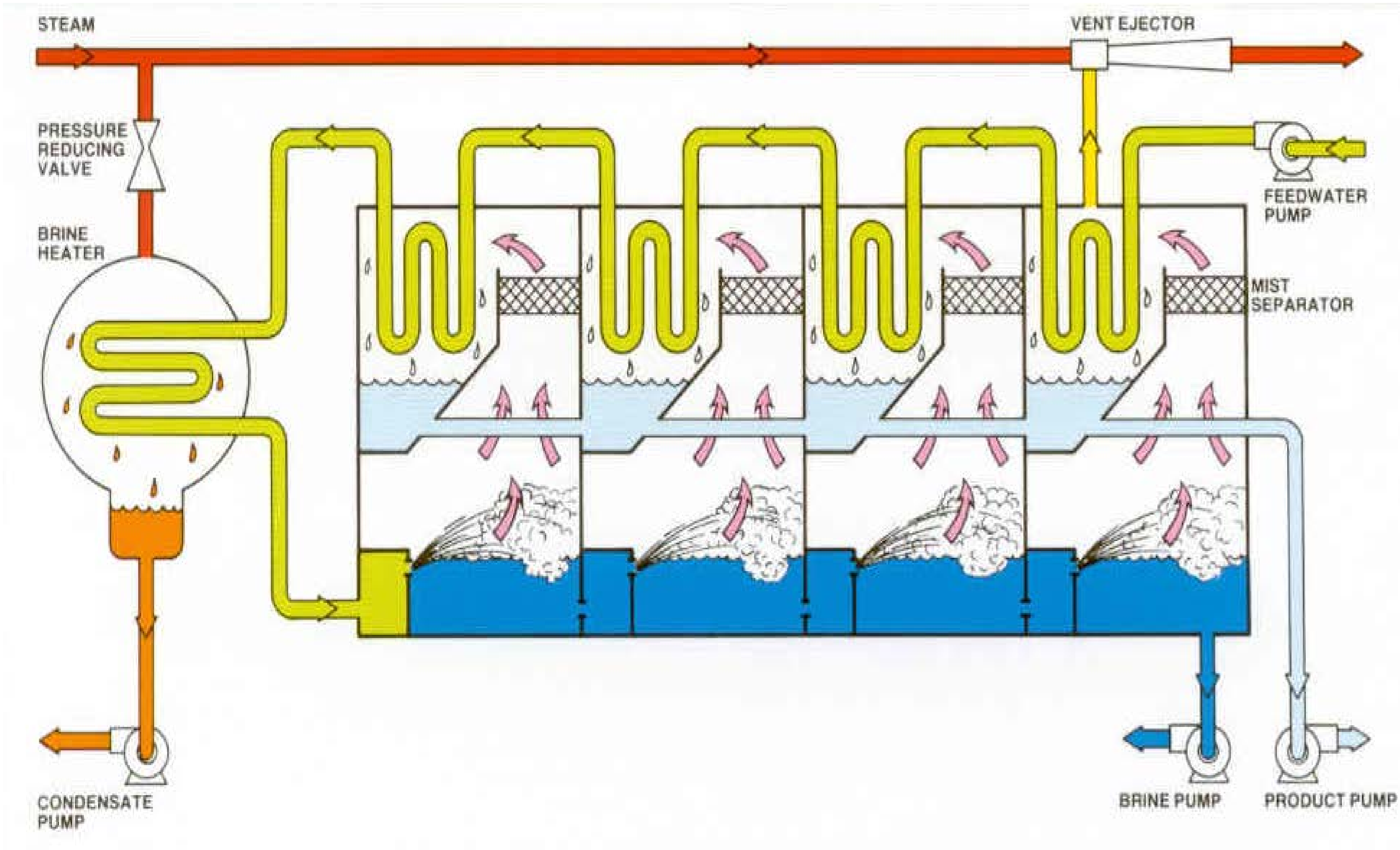
COMMON SEAWATER THERMAL DESALINATION PROCESSES

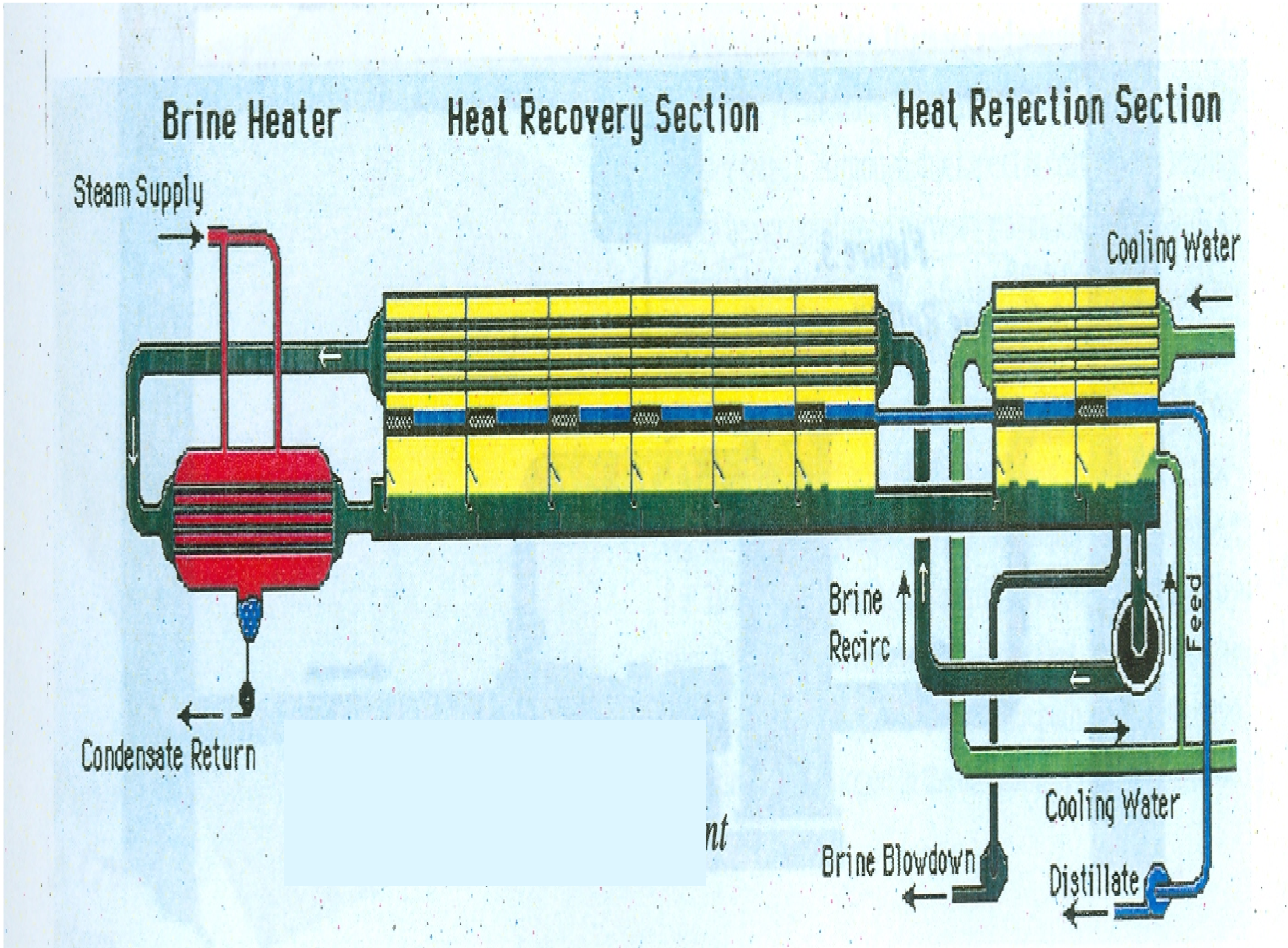
- MULTI STAGE FLASH (MSF) DISTILLATION
- MULTI EFFECT DISTILLATION (MED)

The multi-stage flash (MSF) desalination process

Typical Flow Diagram of Once-Through MSF Plant



A Brine Recycle MSF Plant



ADVANTAGES OF MSF FACILITIES

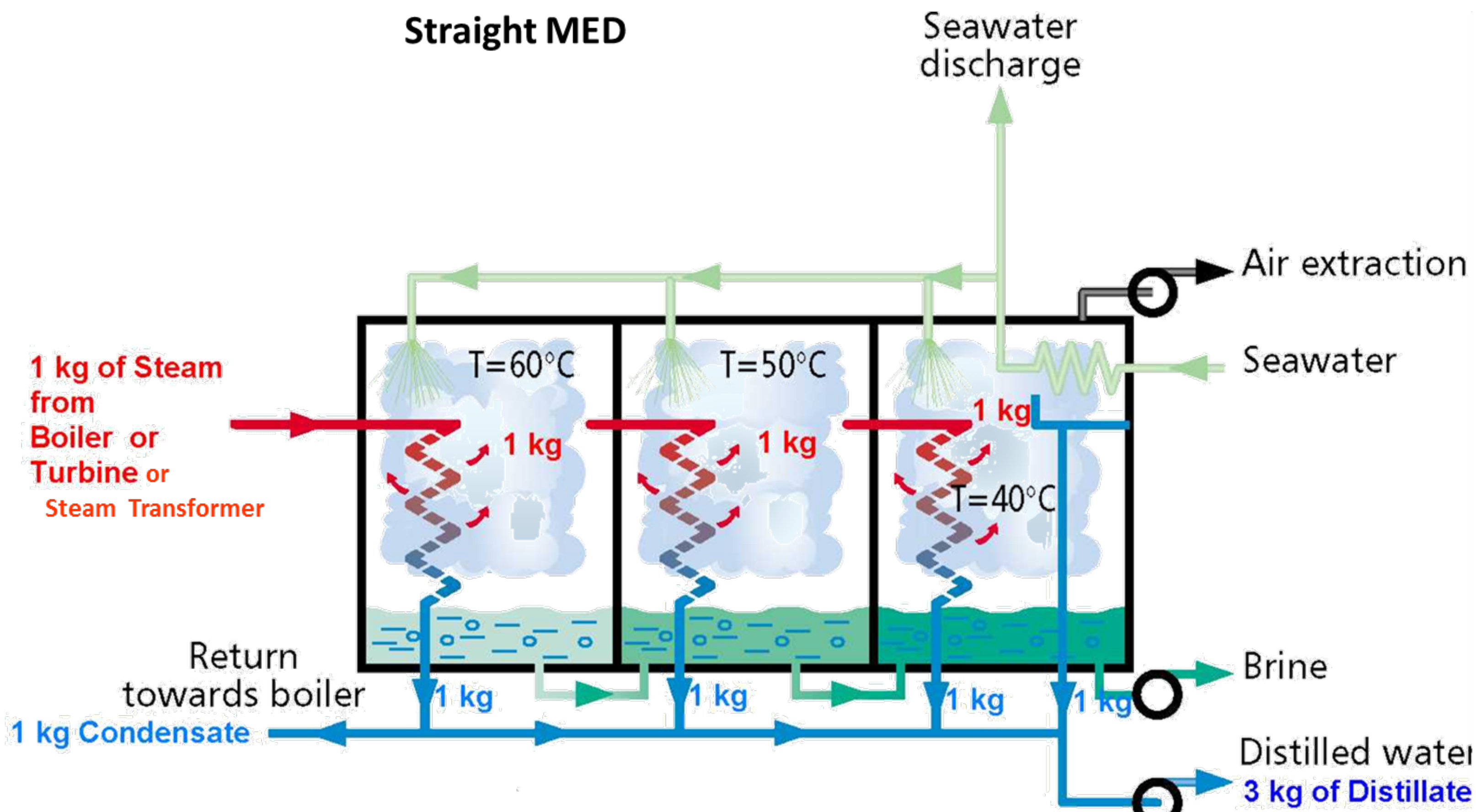
No.	ADVANTAGES
1	Process is insensitive to initial feed concentrations and the presence of suspended solids.
2	Well-proven technology. MSF plants are the oldest method of desalination in use and a lot of process improvement has been undertaken on this process.
3	Feed water salinity does not influence costs.
4	It produces a high quality product water.
5	Pretreatment requirements are minimal.
6	Readily coupled with steam turbine generating stations in "dual purpose plant" configuration.

MSF CONSTRAINTS

No.	CONSTRAINTS
1	Energy intensive process. Heating of water is expensive due to the high specific heat of water and low recovery rates (less than 50%).
2	Inflexible. The plant cannot be operated below 70% of its design capacity.
3	Antiscalants are required as the high operating temperatures (110ºC) results in $CaSO_4$ precipitation .
4	The large production of brine due to its low process efficiency can cause waste disposal problems .
5	High operating and maintenance costs.
6	Experience with all systems indicated need for scale control, because :
7	Hot brines easily reached saturation with inorganic species ($Mg(OH)_2$, $CaC0_3$, $CaSO_4$, etc.)
8	Scale restricted flow paths, reduced heat transfer, caused outages.

The Multi-effect Desalination (MED) process

Basics on MED



GOR=3

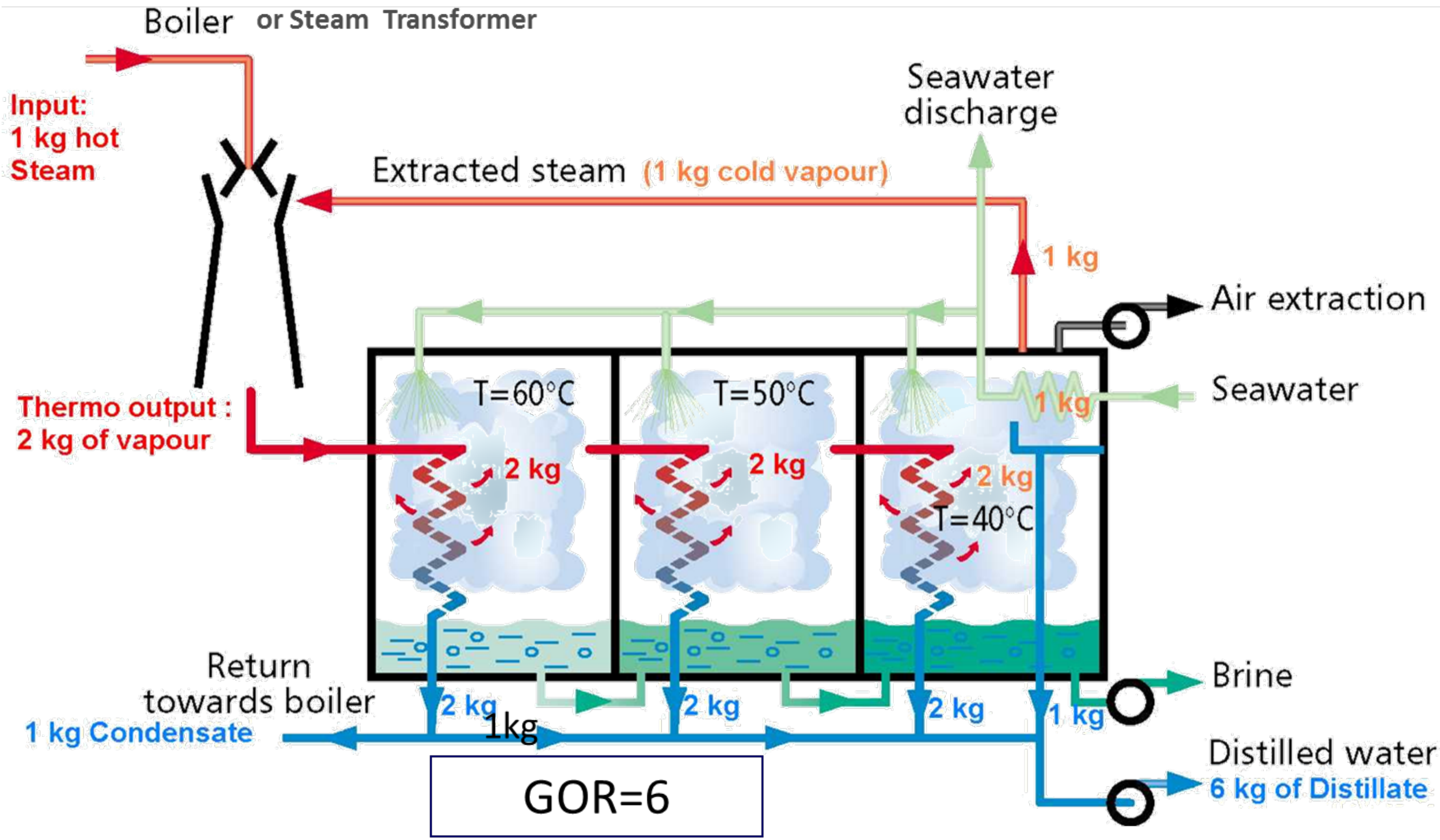
ADVANTAGES – STRAIGHT MED FACILITIES

No.	ADVANTAGES
1	Pretreatment requirements are minimal. Antiscalants are still required, however the lower operating temperature means they are less critical. It is also advisable to reduce suspended solids.
2	Product water quality is very high.
3	The technology is well proven and reliable.
4	Operating costs are dramatically decreased when waste heat sources can be used.
5	The costs of the plant are relatively insensitive to the level of salinity.

DISADVANTAGES – STRAIGHT MED

No.	DISADVANTAGES
1	The capital and energy costs are high (though lower than MSF).
2	Inflexible operation, as the plant cannot be operated below 70% of its design capacity.
3	Low recovery (at 35-40%) .

Basics on MED - TVC



MED/TVC ADVANTAGES

No.	ADVANTAGES
1	They provide higher overall heat transfer coefficients when compared to multistage flash (MSF) desalination systems.
2	MED does not employ recycling and are thus based on the once through principle and have low requirements for pumping energy.
3	The power consumption of MED/TVC plants is only around $2kWh/m^3$ as there are no requirements to recirculate large quantities of brine.
4	The combination of high performance ratio and low power consumption results in lower overall energy costs.

MED PROCESS CONSTRAINTS

No.	CONSTRAINTS
1	Low temperature operation . Maximum operating temperature 65^{o}C. This results in the decrease of the difference between the TBT and last effect temperature which in turn increases the heat transfer area. It also limits the feasible number of effects
2	High frequency of acid cleaning. The configuration is not suitable for on-line ball .

Analogy between MSF & MED Desalination technologies

S.#	Parameter	MSF	MED/TVC
1	**Pretreatment requirements**	▪ Process is insensitive to initial feed concentrations and the presence of suspended solids ▪ Less feed water treatment	• Process is insensitive to initial feed concentrations • Presence of suspended solids is to be mitigated
2	**Energy requirements**	▪ energy intensive Thermal (fuel 38 kWh/m^3) Electrical (3.5 kWh/m^3) • Energy cost represents more than 40% of the total water production cost.	• energy intensive Thermal (fuel 38 kWh/m^3) electrical (1.5 kWh/m^3) • Energy cost represents more than 40% of the total water production cost.
3	**Product water quality**	high quality product water. TDS between 5 to 50 ppm.	high quality product water. . TDS between 5 to 50 ppm
4	**Reliability**	Robust long life and Highest reliability	• High • Long term reliability of units of large production needs to be verified
5	**Synergy with power generation**	Readily coupled with steam turbine generating stations in "dual purpose plant" configuration	Readily coupled with steam turbine generating stations in "dual purpose plant" configuration
6	**Economy of scale**	Very large capacity per unit (20 MIGD)	Medium-large capacity per unit (15 MIGD)
7	**Operation flexibility**	Inflexible. The plant cannot be operated below 70% of its design capacity	Same as MSF
8	**Water production cost**	Site specific . Dependant on energy cost +(0.7 $/m3)	Site specific . Dependant on energy cost
9	**Potential for further improvement**	Little	• Ability to decrease energy consumption by increasing GOR • Size is growing

Thank You

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