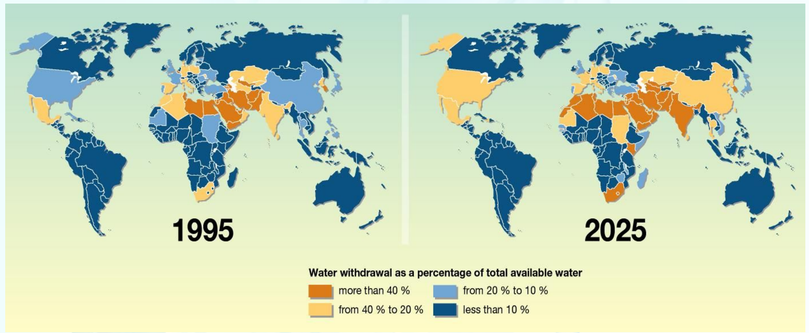
Vapor Compression Desalination Project

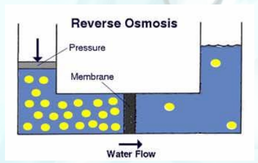
May 22, 2016: AIChE Projects – Prototype Showcase

Background

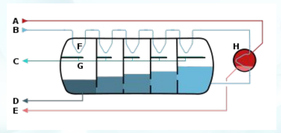
Half of all human chronic disease can be attributed to lack of clean drinking water. Economic and physical restraints have created a shortage of water for much of the world.



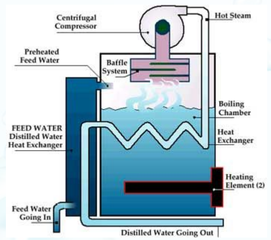
Common techniques for desalination include reverse osmosis, multistage flash distillation, and vapor compression distillation.



Reverse Osmosis



Multistage Flash

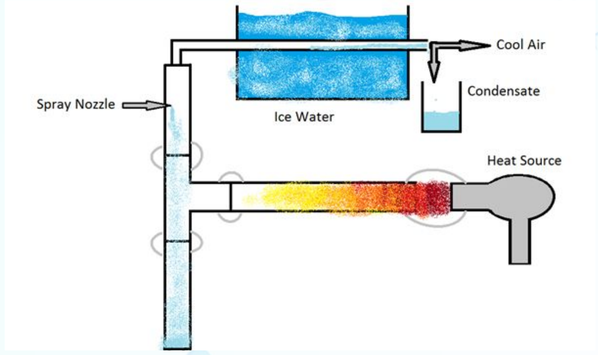


Vapor Compression

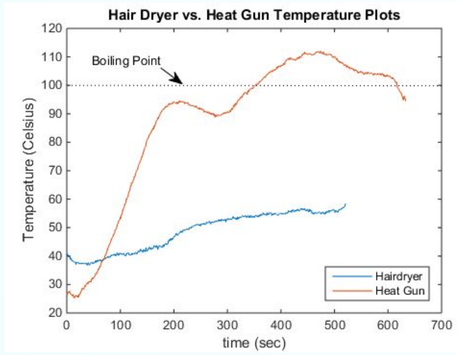
Goal

Engineer a system for the **efficient distillation of salt water** on a small scale.

Current Design & Results



The current prototype is designed to test the effectiveness of the misting delivery system and its potential for lowering the required operating temperatures of the evaporator.



Tests were initially run with a hair dryer heat source, but low yields necessitated the transition to a heat gun to operate at above the boiling point for water.

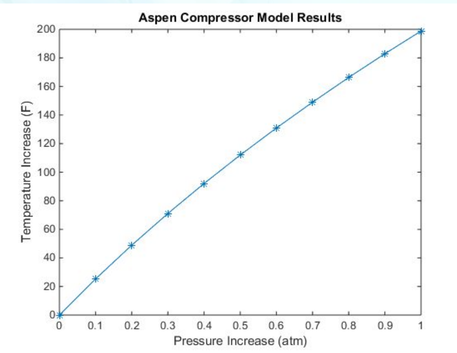
Above/Below Boiling Point	Misting Quality	Percent Yield
Below	Poor	trace
Below	Good	2.22%
Above	Very Poor	0.14%
Above	Good	???

Under the current design, the misters fail at temperatures approaching the boiling point of water.

Path Forward

- Consider a metal 3D printed design to address parts failures at the required operating conditions.
- Gather statistically significant data in order to create a responsive temperature control system driven by a mechanical compressor
- Run a continuous mist of saltwater through the misters to test for long-term resilience against corrosion.

Aspen simulations of steam fed into a compressor were run to demonstrate the ability to manipulate temperature through adjustments in the compressor output.



Quality Function Development (QFD) Table

	Importance (0-100%)	304 Stainless Steel	Aluminium	PVC	Copper Type K
Corrosivity	0.25	4	4	4	4
Cost	0.15	1	3	5	1
Temp/Pressure	0.4	5	4	1	4
Construction Feasibility	0.2	1	5	4	4
Total	**1**	**3.35**	**4.05**	**2.95**	**3.55**

Salt Removal Test Using Vinegar

Initial mister

Salt buildup on mister

After vinegar solution

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