

Modular Desalination System

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Background

A lack of clean drinking water is a growing concern in many regions of the World. As our population grows, the need for clean water becomes greater. Only 3% of the World's water supply is fresh and in order to make the other 97% drinkable it has to go through a desalination process. Several different methods of water desalination currently exist including: multi-effect distillation, reverse osmosis, and shock electro-dialysis.

Client Expectations

Our client, Brian Rurik, had three main deliverables: marketing plan, business plan, and technical models. The expectation for the marketing plan was to provide a detailed competitive analysis based on market research. The second deliverable, business plan, was expected to provide the client with a rough draft of what his company would look like. The final deliverable was a technical design of what the desalination system would look like and how it would function.

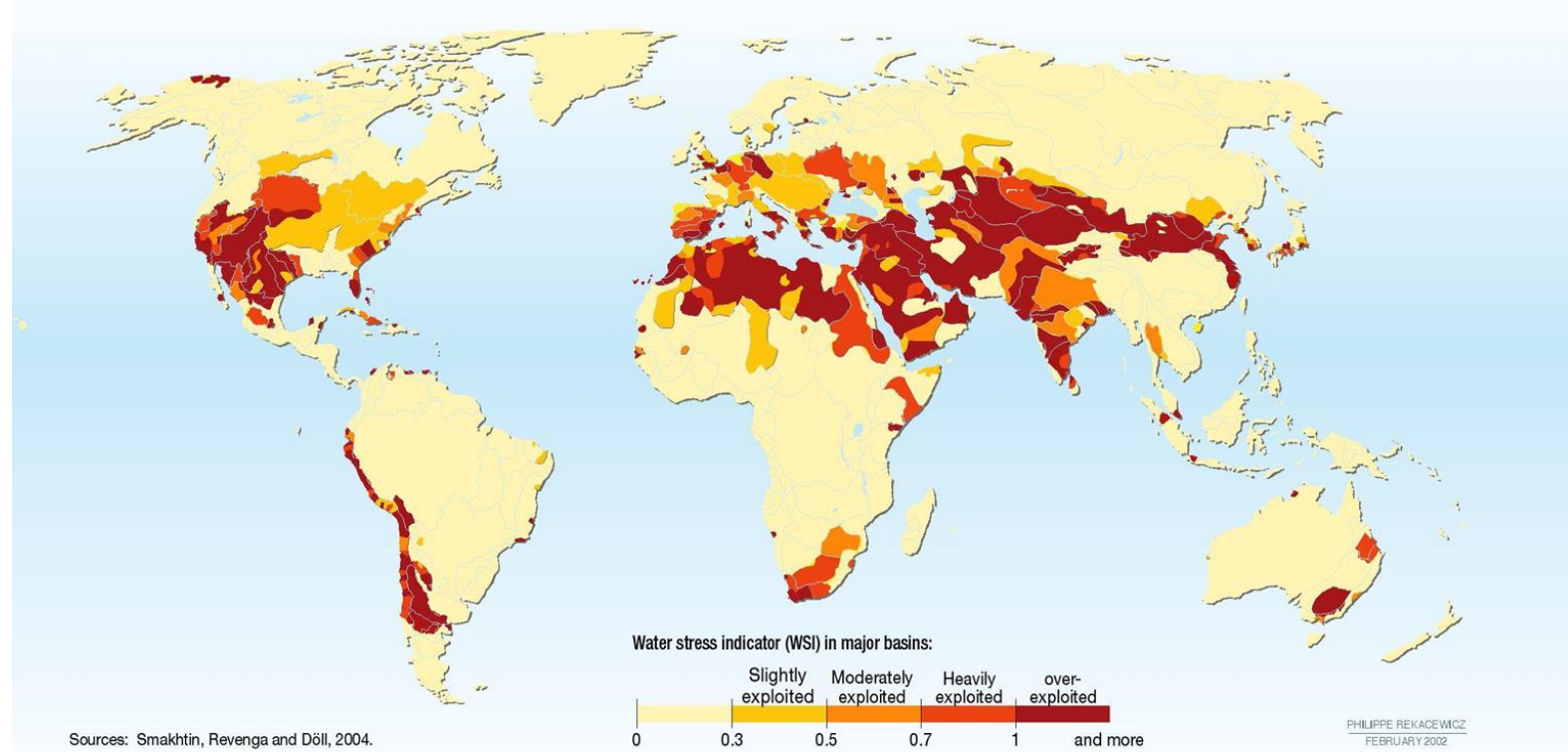


Figure 1. Water scarcity throughout the world.

Conceptual Designs

1. Reverse Osmosis (RO)

This system forces salt water through a membrane with holes small enough to only let water through.

1. Multi-effect distillation (MED)

This system is a process that consists of multiple stages. At each stage the water is heated and the pressure drops causing some of the water to evaporate. The thermal energy from the steam is then used to heat the water in the next stage as it condenses.

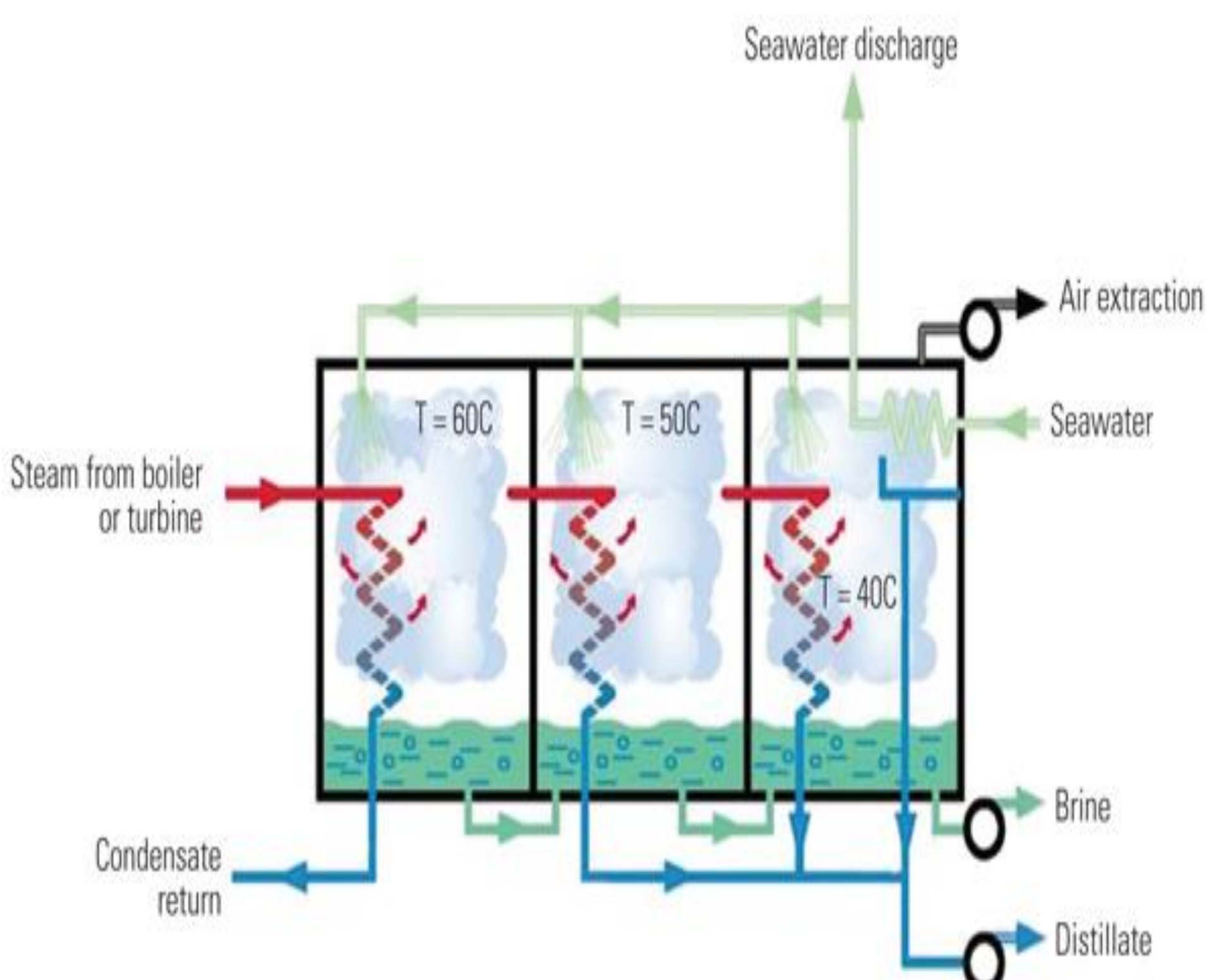


Figure 2. Diagram of Multi-Effect Distillation Process.

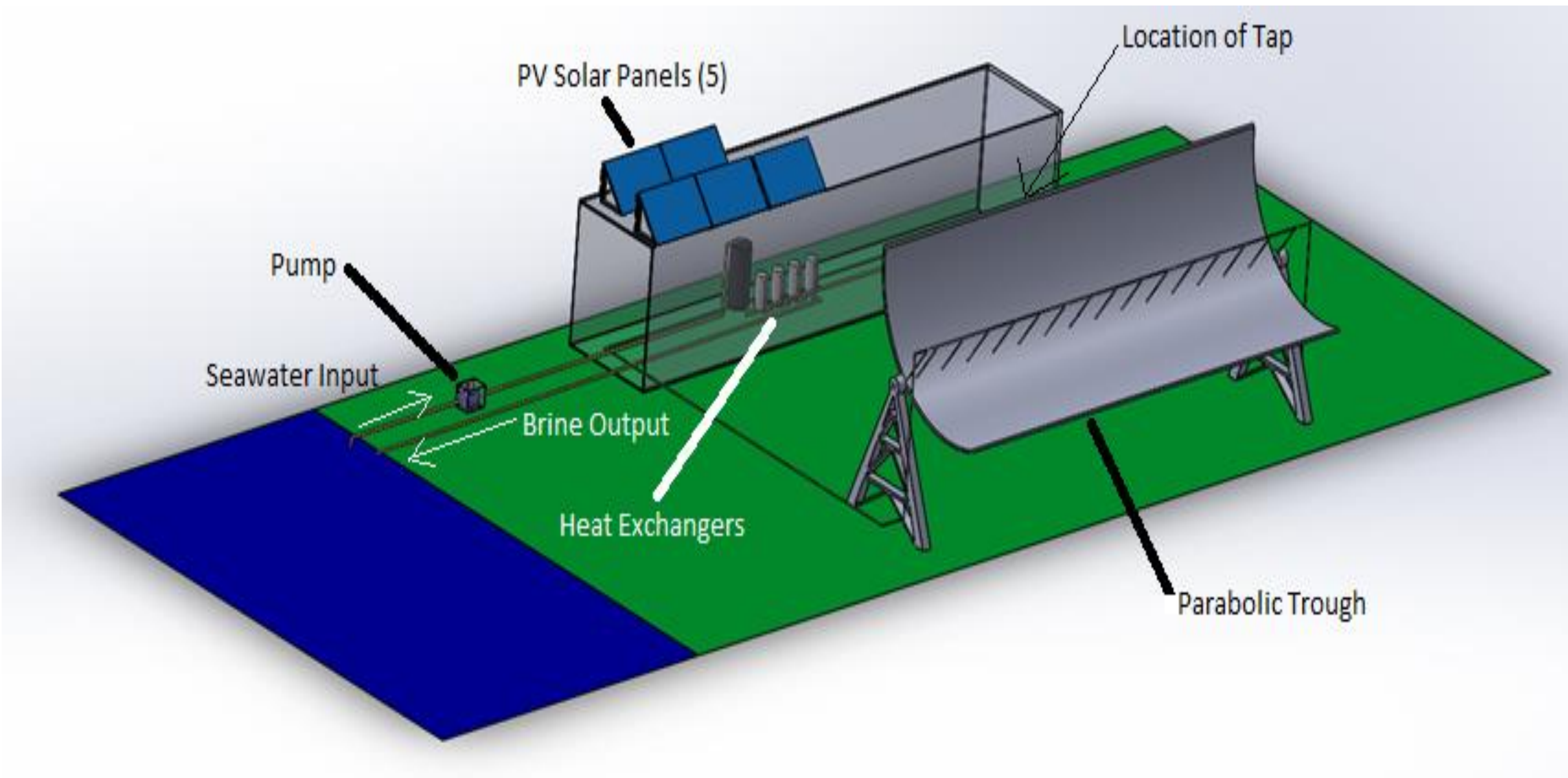


Figure 3. Schematic model of the system.

Technical Model

1. Schematic

Our client decided that Multi-effect distillation would be the most desirable for his application. The system was also sought out to be fully off the grid using solar power capabilities. We decided to use photovoltaic panels to provide the power needed for the pump and motor and use parabolic troughs to provide thermal energy to boil the saline water.

2. Macro

Included in the mathematical model was an interactive parametric system of equations that called a "Macro". This Macro linked all parts of the diagram so if one parameter was changed, all the outputs would be updated. It allowed for iterative "what-if" design analysis to be performed for the purpose of system optimization.



Figure 4. Parabolic troughs on an automated solar tracking system.

Final System Values	
Technical Values	
Number of Effects	3
Efficiency (Recovery Rate)	26.70%
Input Feed Water (kg/hr)	100
Total Distillate Output (kg/hr)	26.7
Financial Values	
Cost Estimate of Basic System	\$18,000
Estimated Cost of Simplified Power Scheme	\$35,000
Total Cost Estimate	\$53,000

Figure 5. Final MED desalination system values.

Business/Financial Plan

1. Business Plan

Ocean Blue Technologies started out as a simple question, "If we have such a problem with water shortage, why are we not using the ocean as our supply?" Our company believes that the answer to this question is a mid-scale desalination system utilizing solar powered MED technology. This technology will be synthesized together into a single, mid-scale desalination solution, able to fit inside a 40ft shipping container.

2. Financial Plan

To begin constructing our product we will rely on grants as well as venture capital funding from investors. We will be asking for funding in three stages: seed money, start up funding, and first stage funding. We project to sell 20 units in the first year. Once we increase our production capacity and efficiency we will sell 30 units in year two and 35 in year three.

Marketing Plan

The marketing plan developed for Ocean Blue Technologies focuses on two things: market research and brand strategy. Our team developed this marketing plan that will enable the newly branded Ocean Blue Technologies to understand the competition, industry, and the beach/island resort target audience. From here, preliminary strategies have been developed focused on branding.

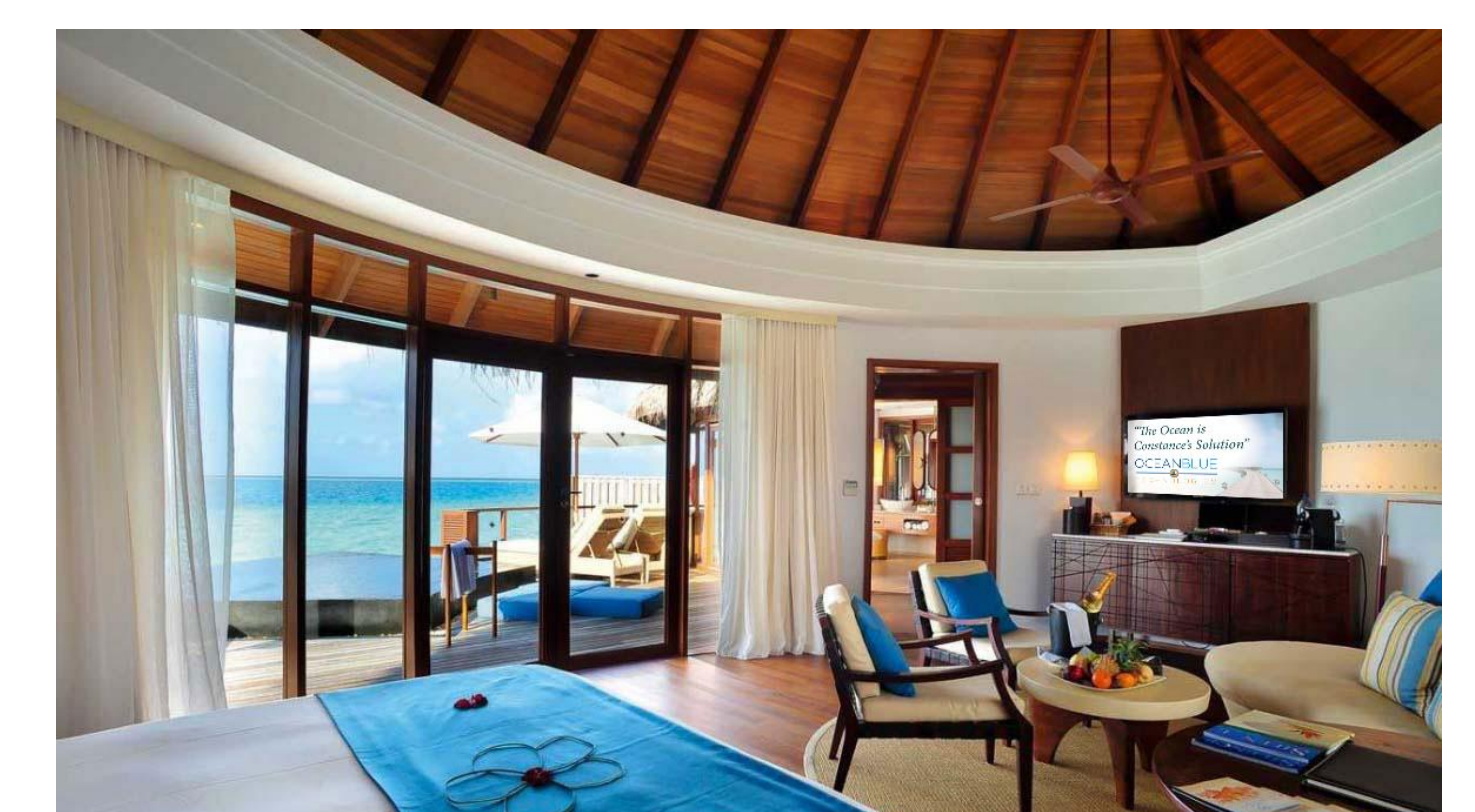


Figure 6. Sample marketing strategy for a resort market.

Deliverables

- Technical models
- Business plan
- Marketing plan



Right to left: Joseph Ackermann, Sierra McNeil, Vlada Wilson, Justin Dutton, Raeann Morelli, Terrance Haimoto, Jon Lathrop