



H_2O smotion

Nathaniel Hess

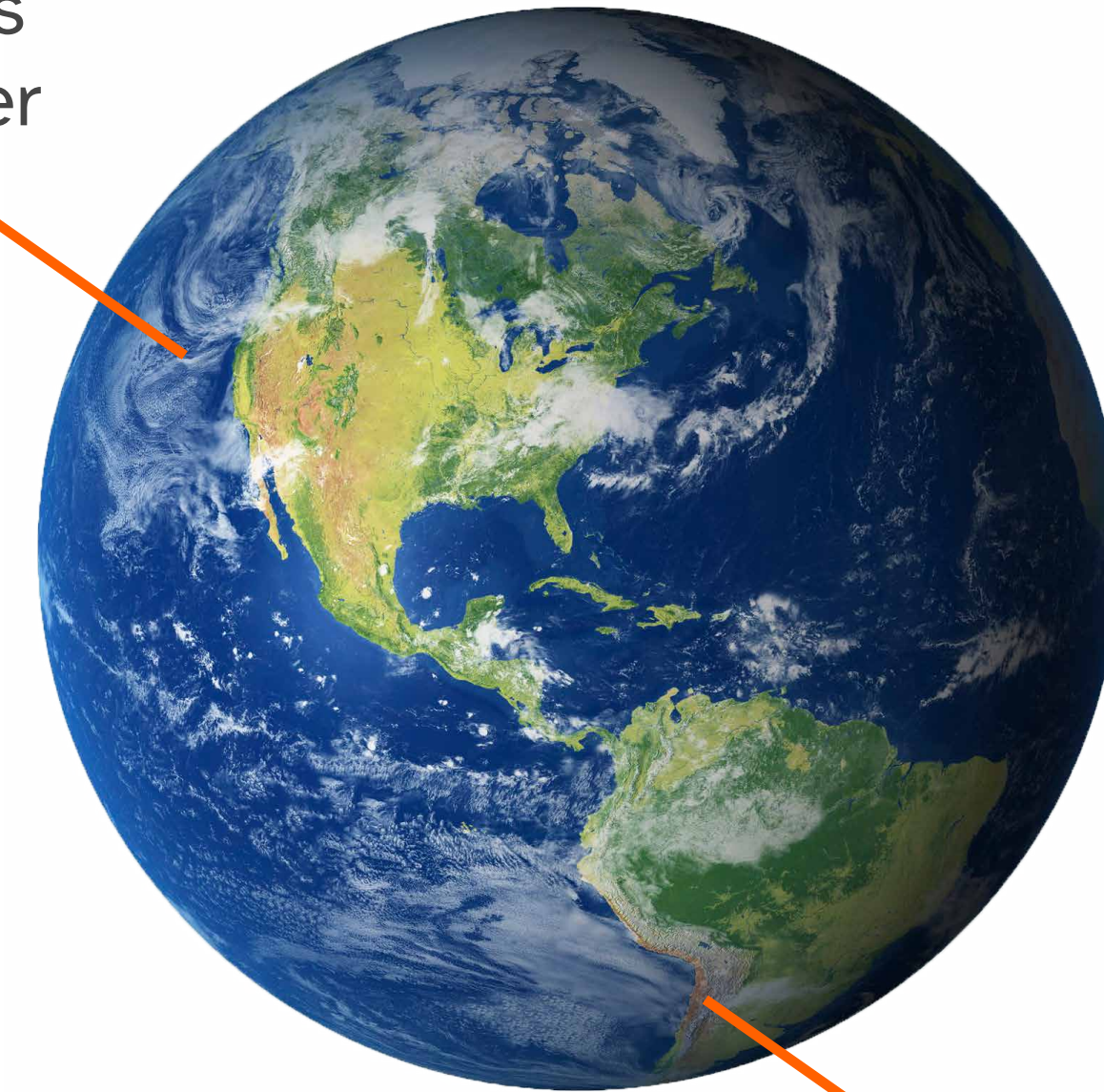
The Problem

Freshwater. It's what we drink everyday to function and yet it's a **quickly** diminishing resource.

By 2025 (est.) the planet will begin to experience severe and extreme drought, especially in coastal communities.

Hence, the need for *fresh water*.

Only 3% is
Fresh Water

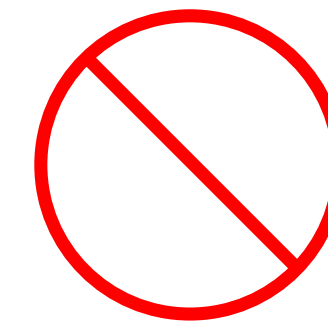


600 Million Coastal People

It's a Simple Solution, Right?



For much of the world,
desalination plants are the
solution.



Unfortunately, this is not the
case for coastal, low income
people who are desperate for
clean, freshwater on demand.

Target Market: Coastal Communities

Profile:

Low-Medium Populations
Low Income

Locations (600M ppl):

California (94M ppl)
Mexico
Middle East
Africa
Australia
Asia

Requirements & Desired Outcomes



Source of water

Independent/
Off Grid

Irrigation

Low Cost

Users Groups

Makah Tribe, Neah Bay, WA USA



Men from 10 different Makah tribe families

Pop: 1,500 approx

Subsistence resources from marine life.

Freshwater degradation especially during summer.

Weather factors include humidity, cold weather, rain, wind and ocean salinity.

Ejido Erendira, Baja California Mexico



Alejandra (19), her two siblings Jose (6) and Enrique (9)

Approx. 2M ppl lack access to fresh water. 5-11" of rain per year in coastal areas.

Weather factors: heat/sun, ocean salinity, dirt/dust and wind.

Water crisis levels expected to be reached by (or before) 2030.
60% less rain expected 2100.

Varsoli Beach, Alibaug, Maharashtra, India



Bhim Rao (25), his two children and neighbor with child (L-R)

Approx. 170M ppl live in coastal communities in India.

Access to clean water is already at crisis levels within the country due to unsanitary water conditions & overuse.

Weather factors: humidity, heat/sun, pollution, rain, wind & ocean salinity.

How might we...

Design a product that can provide freshwater using an approach that is that impacts the environment minimally at a low cost.



Overview of Research Methods

Project Description

A desalination device powered by local resources for coastal communities.

Interviews

Mike Rinker, DOE & PNNL
Molly Grier, DOE
(Upcoming)
Hayden Shram, Waterways

Literature Review

Academic Research
Publications

User and Market Specs

Users Groups
Ergonomic Considerations
Competition Analysis

Literature

Powering the Blue Economy (DOE 2019)

Energy Sources: Wave, Tidal, Wind, Solar

Direct Energy Transference (NREL Report)

Approx. \$4.5B Cap Ex (2020) for Desal

800 - 1,000 lbs PSI (55-69bars) for RO

National Alliance for Water Innovation (Aug 2021)

APRIME - Automous, Precise, Resilient,
Intensified, Modular, Electrified

Pipe Parity

Water Undervaluation

Electrocoagulation Desal

Academic Publications

Electro-Thermal Desal Using Boron Nitride

Co-Axle Electrospun Nanofiber Membrane

*Direct Electrosynthesis of Sodium
Hydroxide and Hydrochloric Acid from Brine*

*Waste to Energy: Biofuel from Kelp
Harvesting and Fish*

World Water Forum (2015)

Interviews

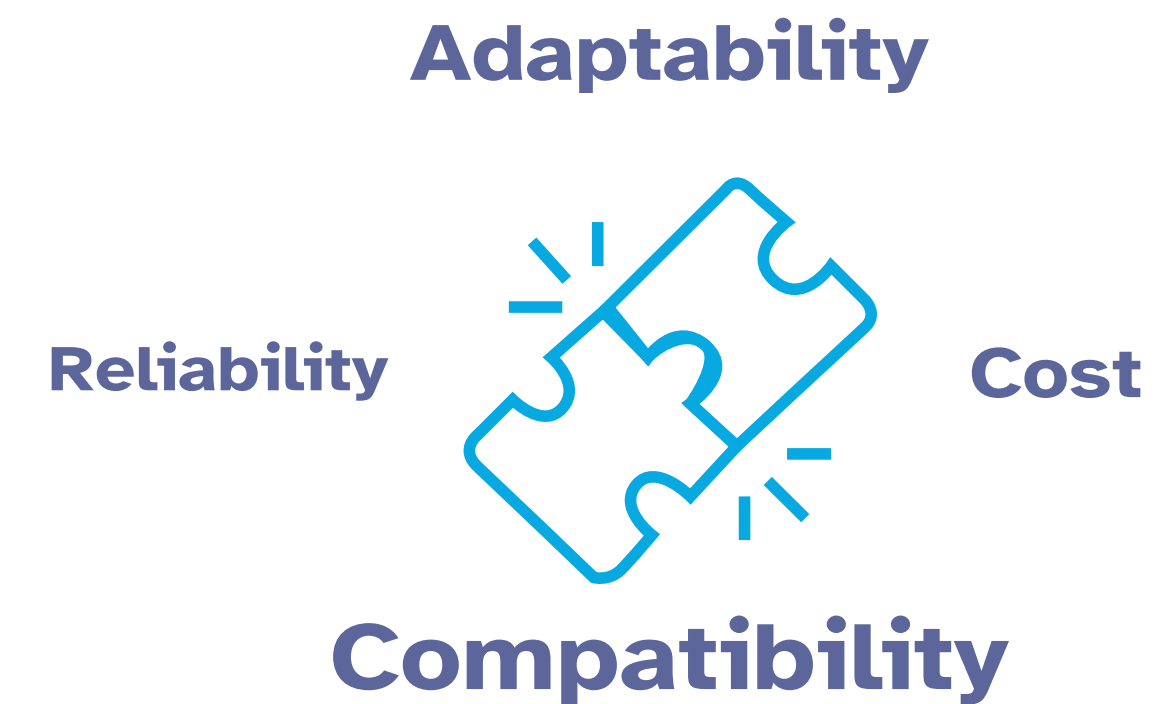
Interview & Research Considerations

Mike Rinker, DOE

Adaptable to Region

Permitting/Regs

Energy Input/Storage



Takeaways

4 Key Metrics (See Right)

Brine Waste (California especially)

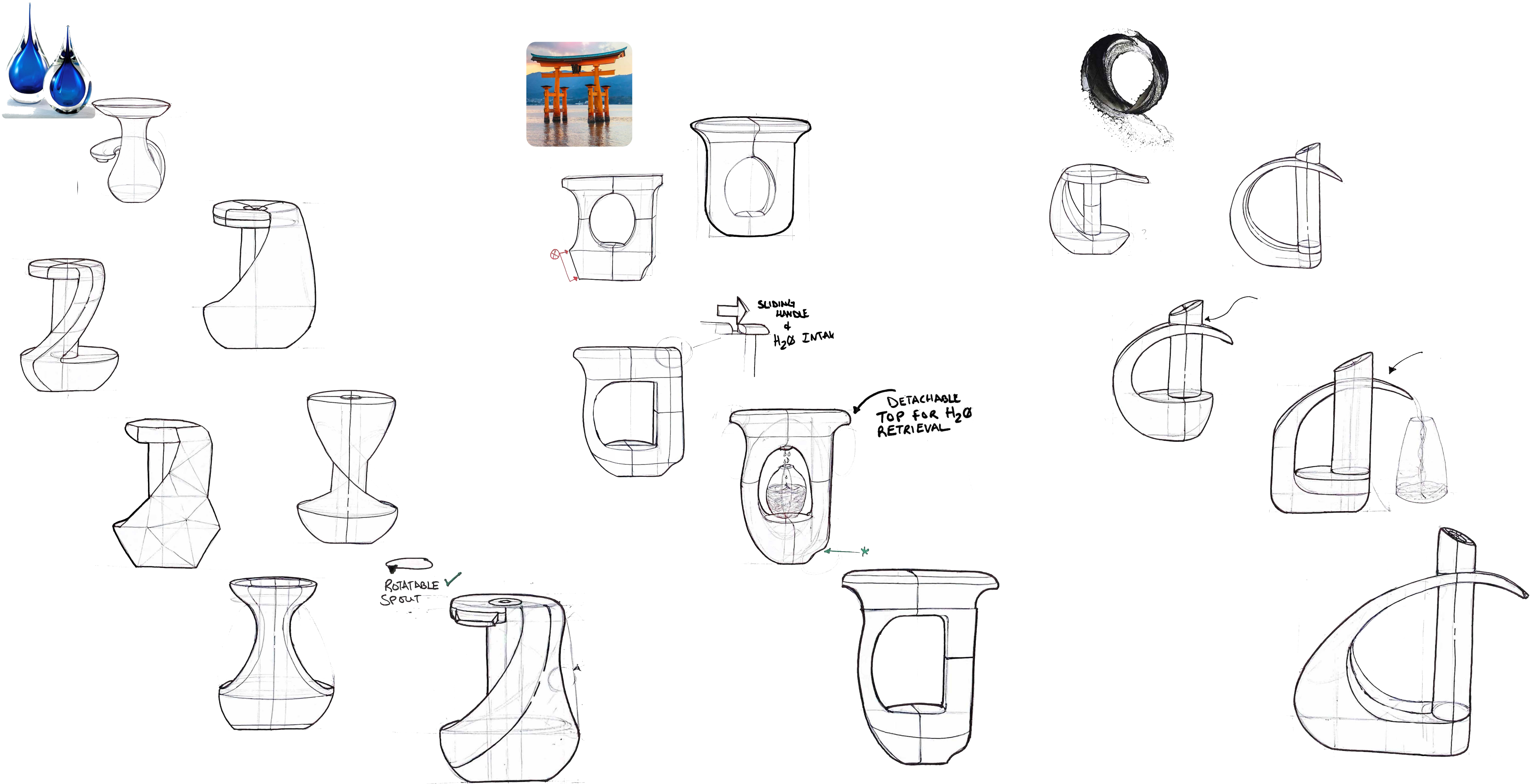
Pipe Parity

Sizable amount of energy as input

Competitive Analysis

		Name and Price	Materials and Manufacturing	Key Features and Takeaways	Years in Market	Limiting Factors
		Rainman Portable \$3,900 – \$6,000	- PPE, Nylon - Standard Manufactured Parts/Systems for Pressure and RO	- Extreme Reliability - Adaptable Energy Configurations - Produces 210 cups/hr (econ vers.) - Modular	2014 – Present	- Expensive - Custom typically - Made mostly for boats and not land - Ideal for 1-4 ppl
		Landfall Aquamate Solar Still \$240	- PVC, Various Plastics	- Distilled H₂O (reqs drop of ocean for minerals) - Inexpensive - Produces 1–7 cups/24hrs - Sun powered	Unknown (Tech has been around for 40+ years)	- Inexpensive - Sun req - Max 7 cups of distilled water - Emergency use generally (not reg)
		Katadyn Survivor Watermaker \$1,195 – \$4,270	- Stainless steel, PVC, Various Plastics - Manufactured Parts/Systems for Pressure and RO	- Manual Operation - Produces 24 cups/hr	1930 – Present (Desal Market)	- Ideal for 1-4ppl - Electric/Manual Only - Expensive
		Source \$5,500 – \$6,500	- PV Panels + Hydroscopic Materials - Steel/Powder Coating	- Passive Operation - No desalination required - Sun powered - Air Vapor - 15yr Maintenance	2015 – Present (Water Vapor)	- Freezing environments stop H₂O production - Solar Panels Req - Expensive

Sketching



Back to the Drawing Board (Literally)

Mockup models proved the design was just too literal.



Too Literal

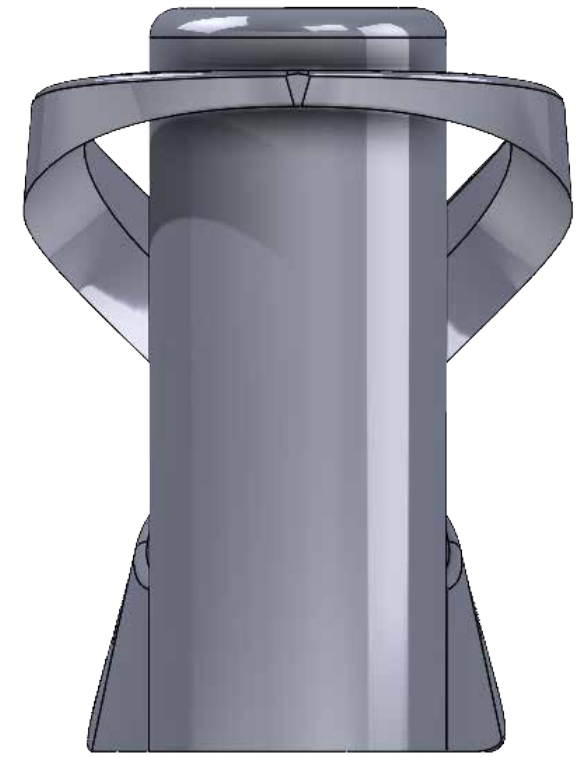


Clay was the natural next step
in the progression to get to a
more dynamic form.



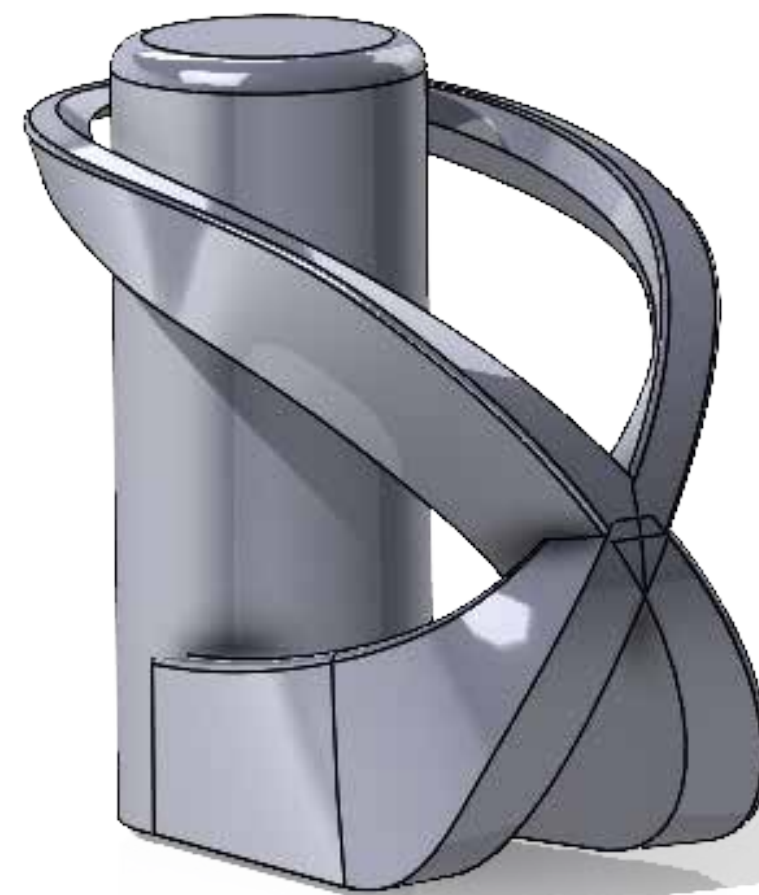
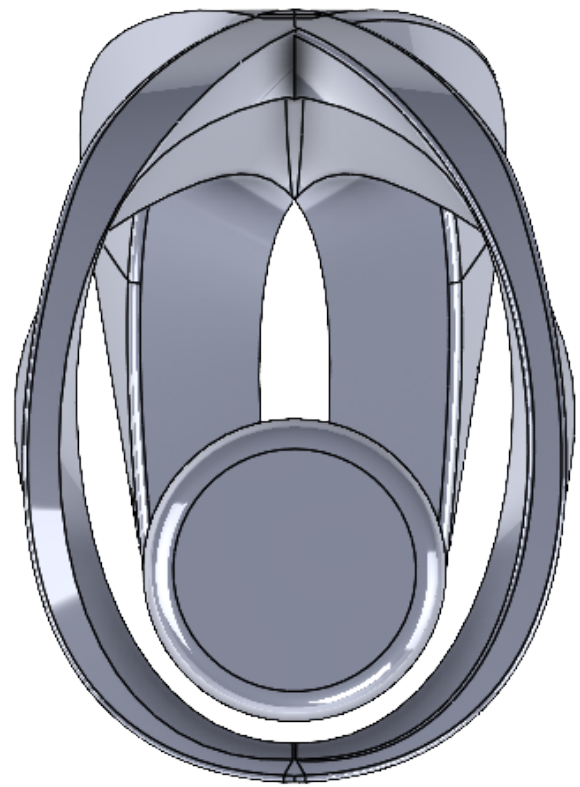
Prototype Development

Problems Become Apparent Immediately

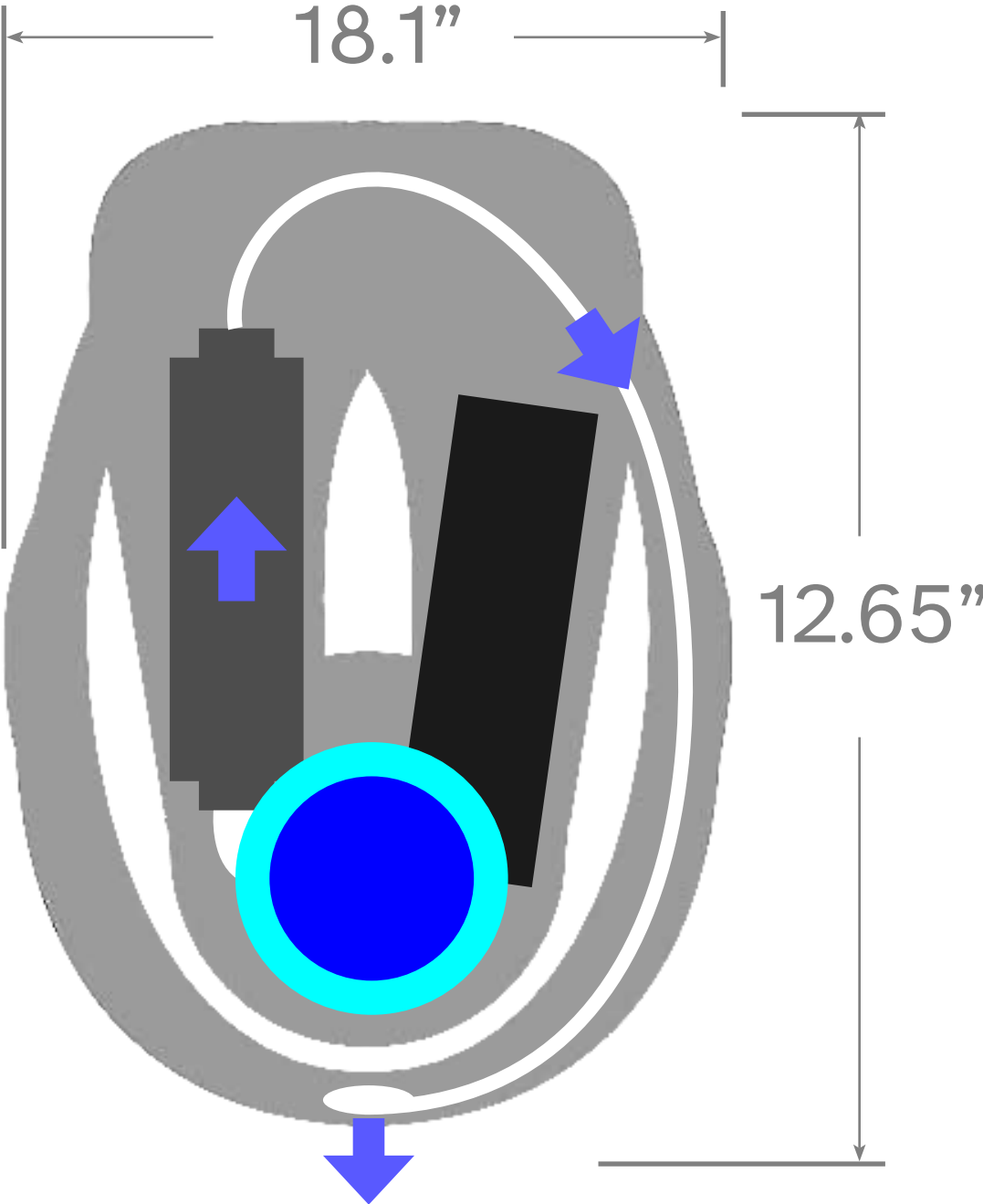
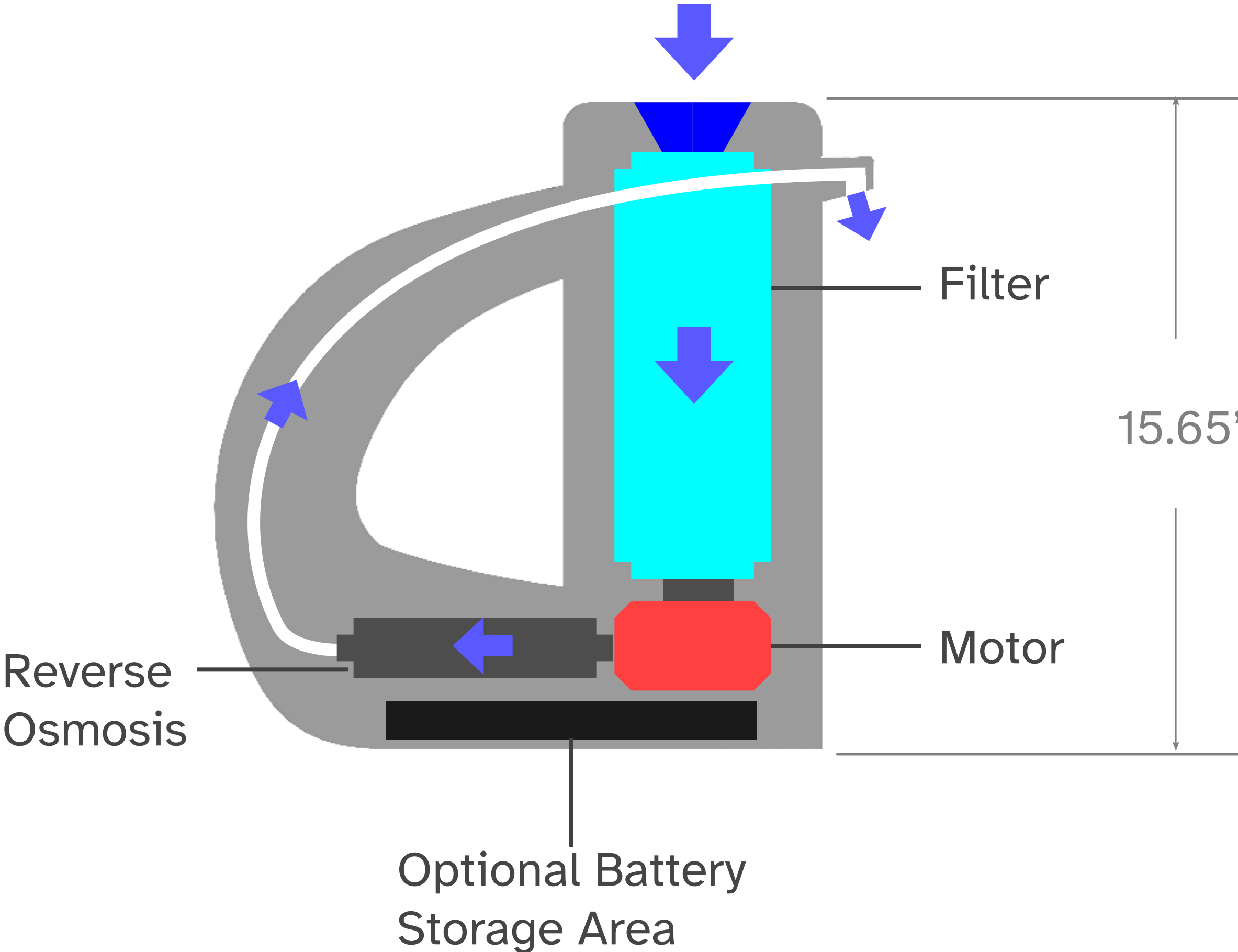


Water Intake and Output

Power Needs vs. Wants
Could it be manually
powered?



Prototype Internals



Most Significant Findings and Reminders

Pipe Parity Realities

- Ocean Water Tank should be located on the top of the device to create pressure for initial filter
- Brass containers are antimicrobial - hence their use in India
- Ocean Water Tank could be separable and carry-able via handle to dunk/retrieve water
- Energy inputs and salinities must be adaptable to region

Environmental Concerns

Transit of Brine results in CO² emissions

Evaporation of Brine is Probably Best

- Hand crank most environmental, followed by other forms of energy creation (bicycle etc.)

Economic

Majority of households are very low income or at poverty levels

Ergonomic Considerations

Compatibility means it must fit and function in a kitchen or preferred household area

No Taller than 40.64cm or 16"

No Wider than 30.48cm or 12"

Small and light enough to transport via one adult

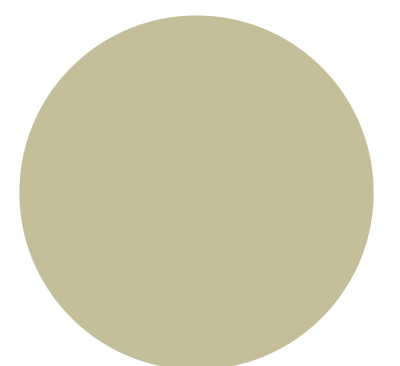
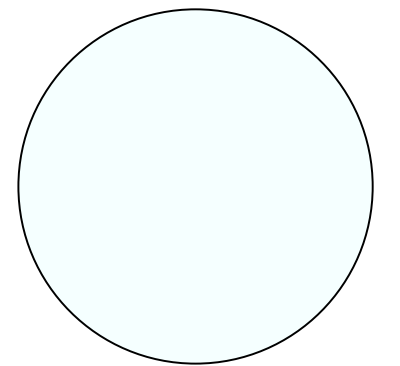
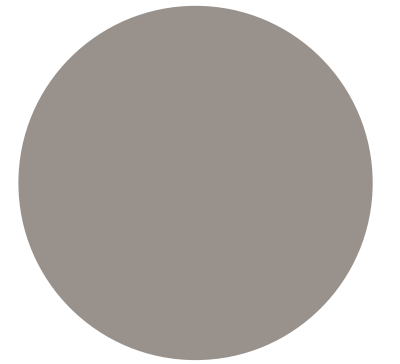
If using return pipe, must be located properly (marine life)

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An earth tone as well as off white color ways creates an atmosphere of global approachability, while the brass plated accents acknowledge the anti-microbial benefits.



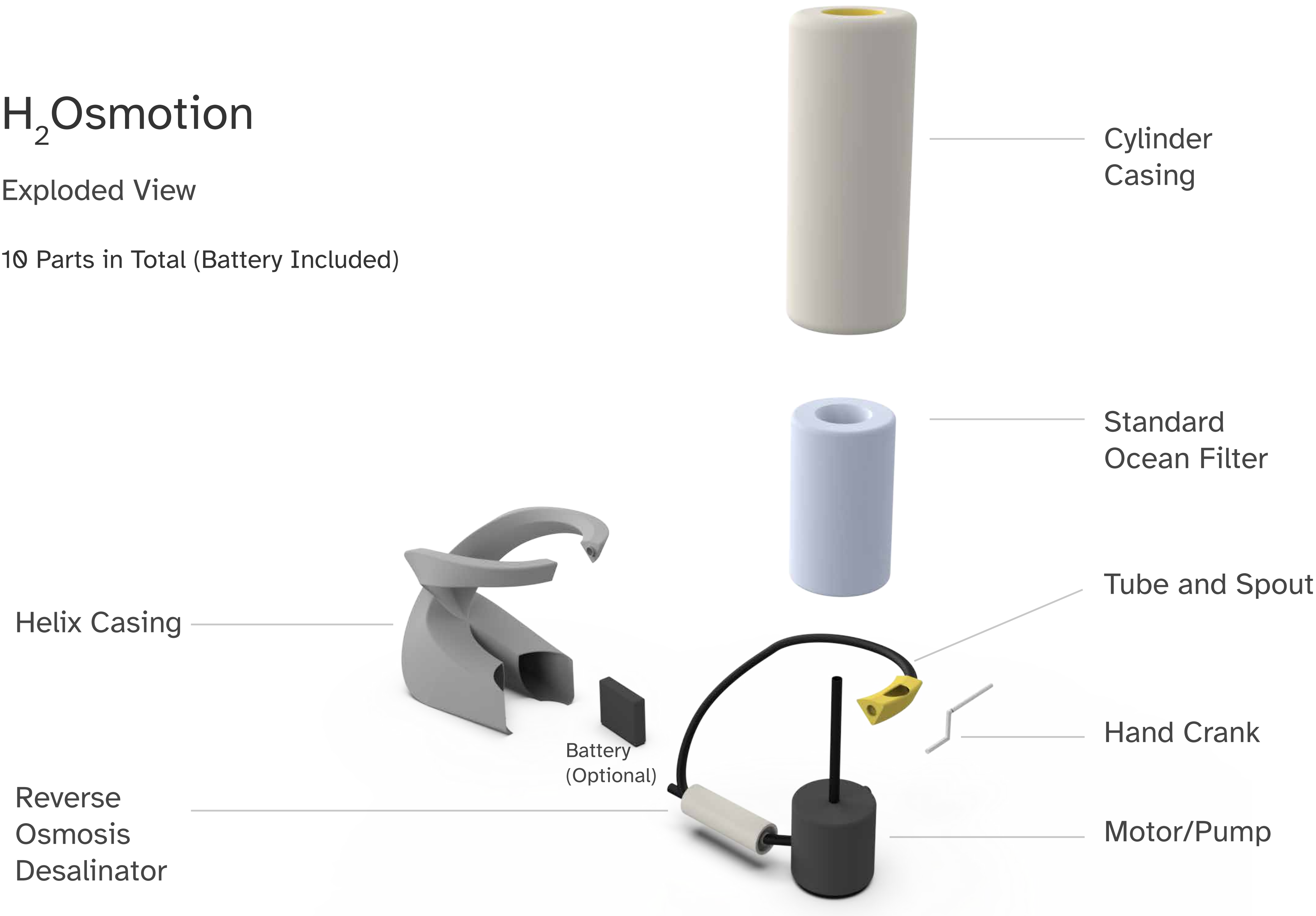
To turn On/Off, users rotate the spout down and the desalination process begins automatically once ocean water has been poured into the top.



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Exploded View

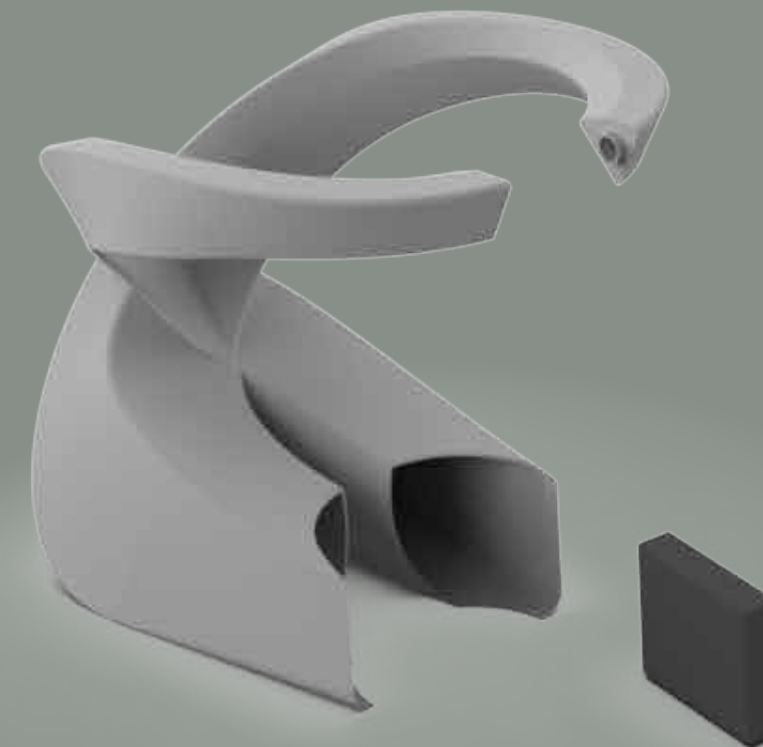
10 Parts in Total (Battery Included)



H₂Osmotion

Materials

Arboskin
Injection
Molded
Renewable
Plastic



Silicone
Tube



Brass Plated
Spout



Aluminum Crank







The H₂Osmotion

Fresh Water On Demand,
Anywhere There's An Ocean.

In Partnership With



H₂Osmotion

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