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Saratoga Hydrogen Fuel Cell

— Our Goal

- 01 Create a more efficient hydrogen generator
(Alkaline Water Electrolysis)
- 02 Store latent energy from renewable energy

Hydrolysis Basics

- We use an potassium hydroxide as an electrolyte to conduct electricity over water, which will split it into hydrogen and hydroxide.
- Then the hydrogen and oxygen are separated with a semi-permeable membrane made of nylon

What do we account for?

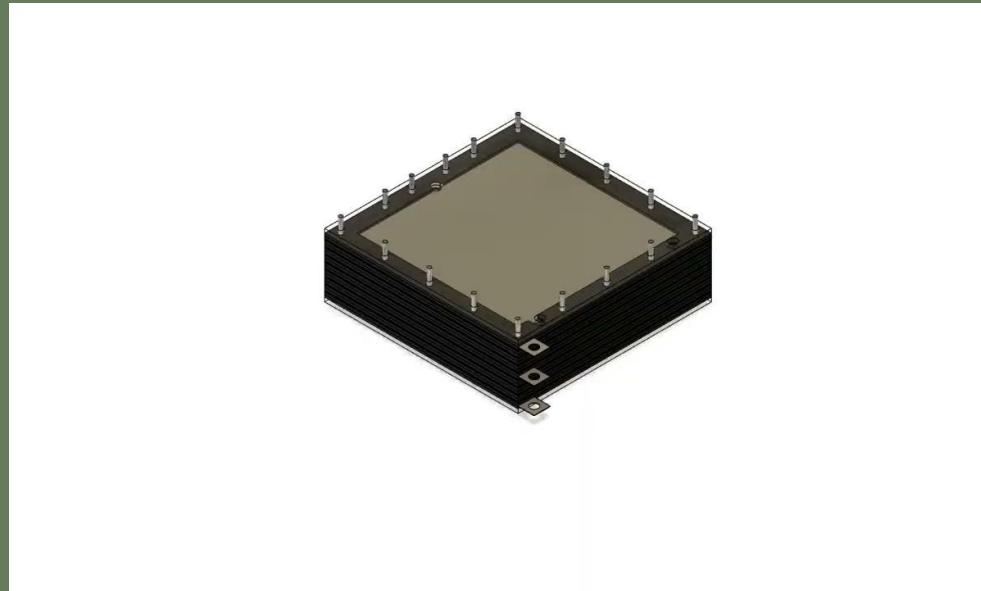
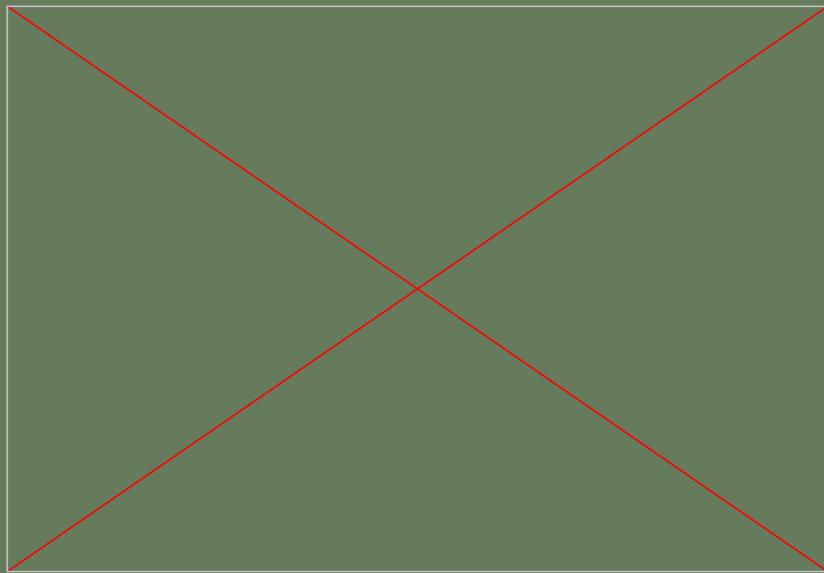
Cost Efficiency vs Output Efficiency

- Contaminants
- Temperature
- Humidity
- Conductivity
- Gas Purity
- Water pressure
- Voltage
- Cost
- Maintenance

Our main focus is creating a testbed prototype so we can begin to find the ideal balance of these values.

Prototyping

Prototype Iterations



Parts List

Part	Quantity	Link	Cost
Copper 110 22 gauge	36" x 37", 0.0270" Thick	https://www.mcmaster.com/catalog/8963K13	
Nylon	12x12 sheets (x10)	https://www.amazon.com/Kimb	\$18.99
6mm acrylic sheet	12x24 (x1)	https://tamu.estore.flywire.com	\$8.00
threaded rods m6x1.0 10 pack	2 packs (20rods)	https://www.amazon.com/Awcl	\$23.98
nuts m6x1.0		https://www.amazon.com/Serra	\$8.99
Insulator	6mm ID 10 feet	https://www.amazon.com/Quick	\$13.99
epdm or tpu 3d printable material (gasket)	12x12 (x18)	https://www.amazon.com/dp/B0	\$66.99
KOH	2lb flakes	https://www.amazon.com/Potas	\$24.97
3/8 npt tap		https://www.amazon.com/Drill-	8.99
Copper Wiring 18 GA		https://www.amazon.com/TYUI	\$0.00
marine caulk		https://www.amazon.com/gp/pr	\$23.99
caulk gun		https://www.amazon.com/Newt	\$11.98
Water Tank	2 Tanks	Container	
Rubber lines 3/8 ID	10ft	https://www.amazon.com/Silico	\$10.99
Male 3/8 NPT to Male Barbed fitting 3/8	x10	https://www.mcmaster.com/521	\$18.61

Total Cost:
\$240.47

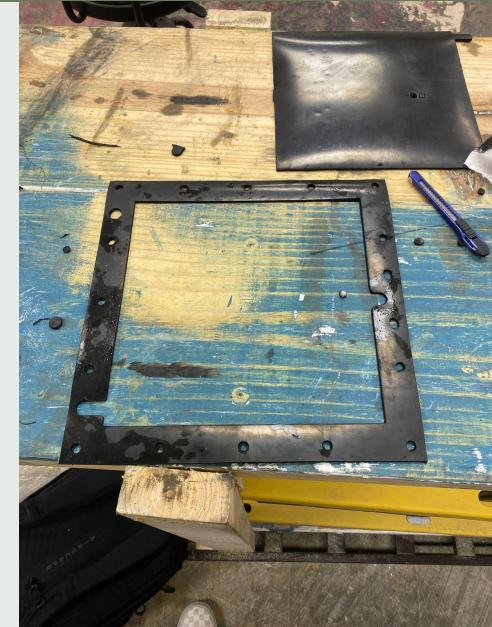
The Finishing Process

Starforge Makerspace



Gaskets

- Quantity: 18
- Laser Cut Outline
- Cut out by hand



Membranes

- Quantity: 8
- Each membrane is set between alternating gaskets
- They are glued using marine caulk to withstand the strong alkaline solution.



Electrodes (304 stainless steel)

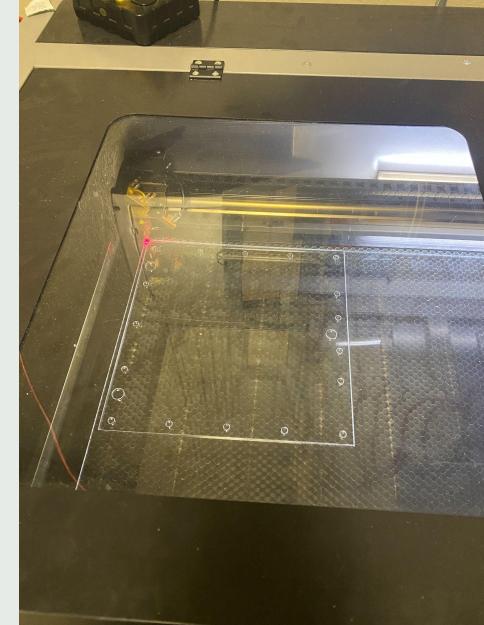


- Quantity: 9
- Acid Bath
(0.5 molar HCl)
- Wire Wheel
(removes slag)
- Polishing
- Nickel/Chrome
Plating (future)



Acrylic End Plates

- Quantity: 2
- Completely laser cut
- Originally 4mm thick
but now 6mm to
withstand a higher
pressure seal.



Current Design

Advantages

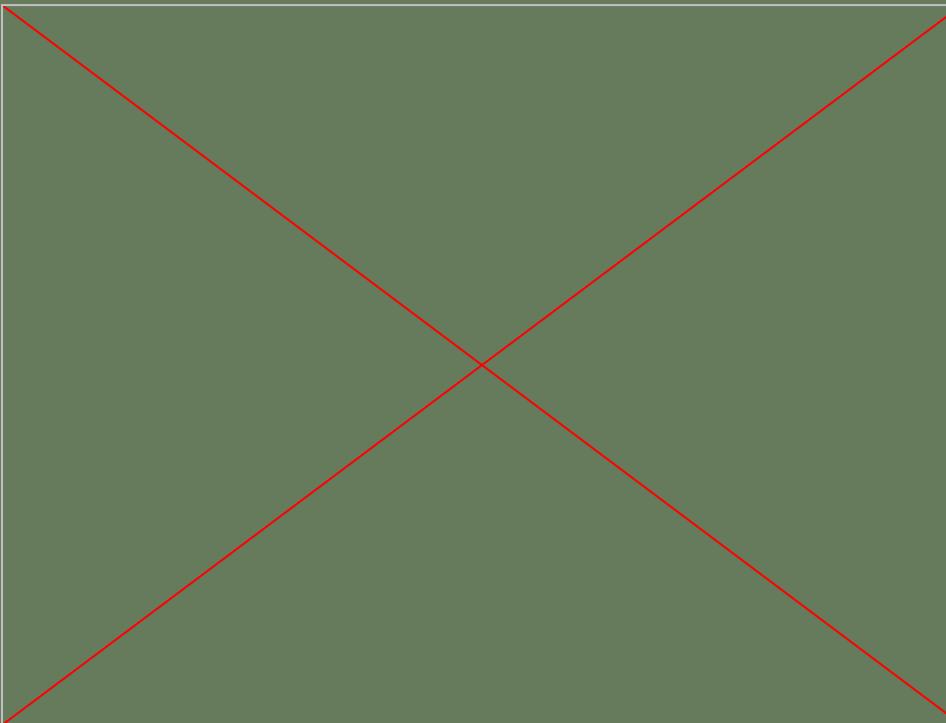
- Compact
- Can handle different voltages
- Modular to fit power needs
- Easy to manufacture
- Cheap to mass produce

Setbacks

- Still not tight enough for a perfect seal.
- Needs more power than we can currently supply.



— How It Works



What's Next?

What's Next?

- Identify ideal variable values for optimal cost and energy efficiency
 - Surface area
 - Spark gap
 - Heat
 - Plate material
- Redesign the generator based on these new parameters