

Solar Stove

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Goal:

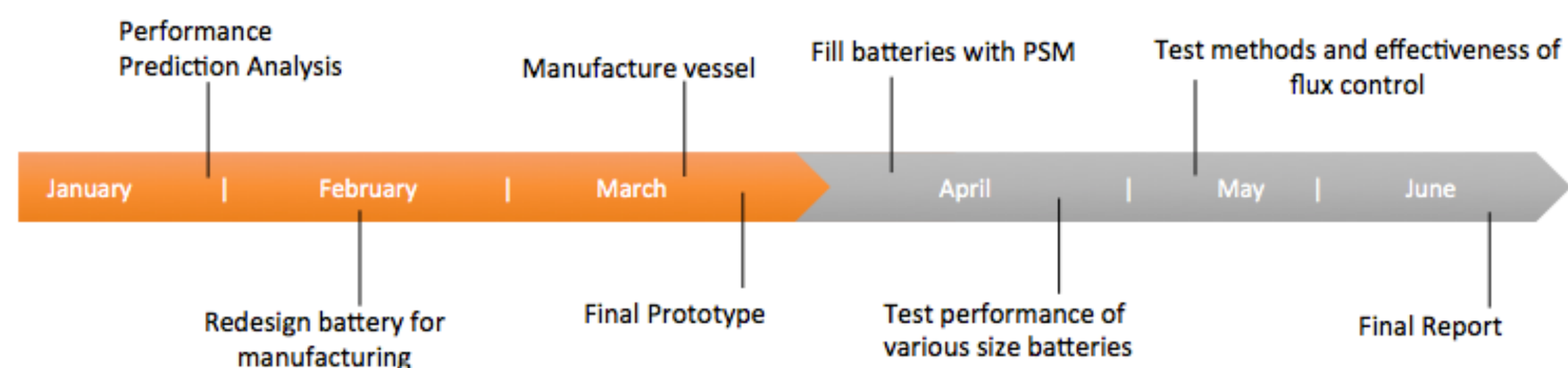
Prototype a working stove that utilizes thermal energy storage that can be used by rural women in India to improve health, reduce labor, and lessen environmental impact. This stove consists of modular heat batteries filled with phase change material (sodium nitrate) that charge in the sun. Once charged, this heat may be stored in an insulating vessel and be used for cooking when needed.

Benefits:

- Health - World Health Organization estimates 4.3 million deaths per year from indoor air pollution. Solar stove would eliminate exhaust fumes from biofuel that is harmful to health
- Time –Would reduce or eliminate 1-2 hours daily women spend collecting the biofuels utilized in traditional cookstoves (wood, dung, etc.)
- Environmental – Reduces deforestation and cook fire emissions

Solar Stove Tech Specs	Value
Weight	
1 battery of 6 in. height	4.14 lb (1.88 kg)
2 batteries of 3 in. height	3.3 lb (1.49 kg)
3 batteries of 2 in. height	2.52 lb (1.14 kg)
Max Cooking Surface Temperature	200 C
Heating Rate	350 W
Cooking Surface Diameter	4 in (10.16 cm)
Boiling Time for 1 L water	15 min
Simmering time for 1 L water (after bringing to boil)	45 min
Recharge Time in Collector @260 C	2 hours
Daily Storage Time	10 hours

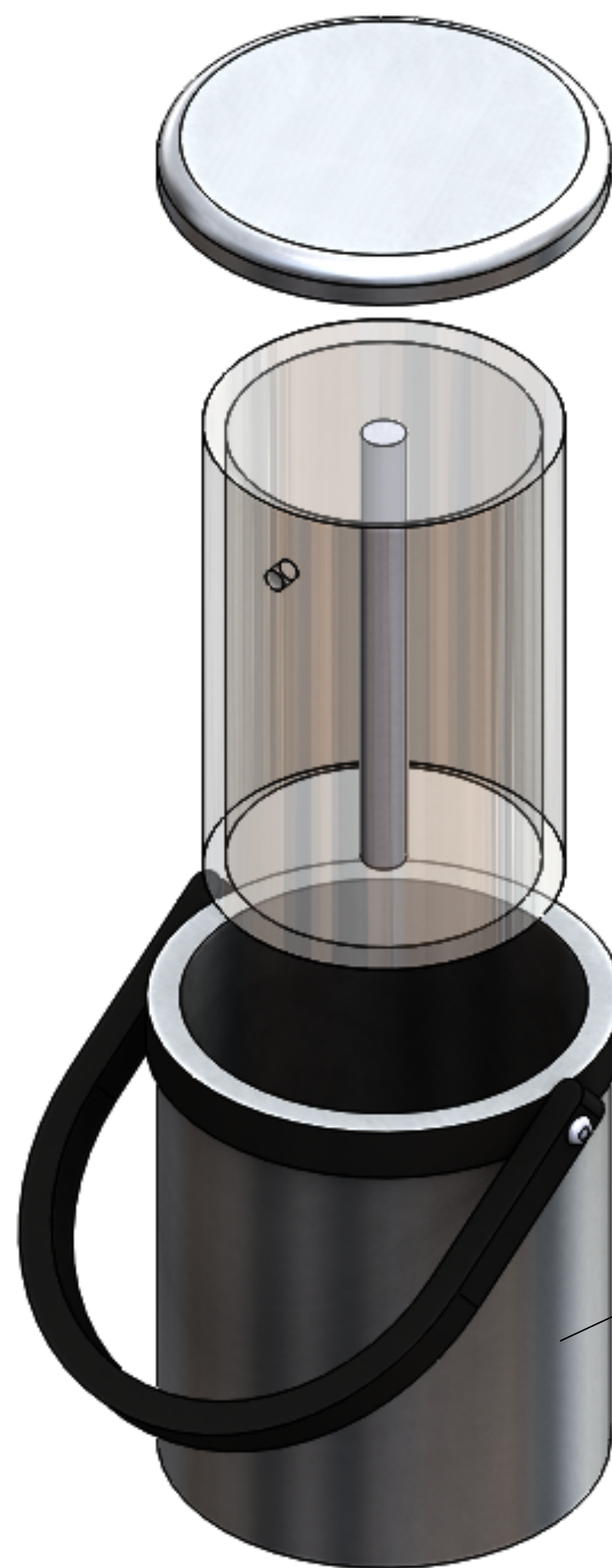
Timeline



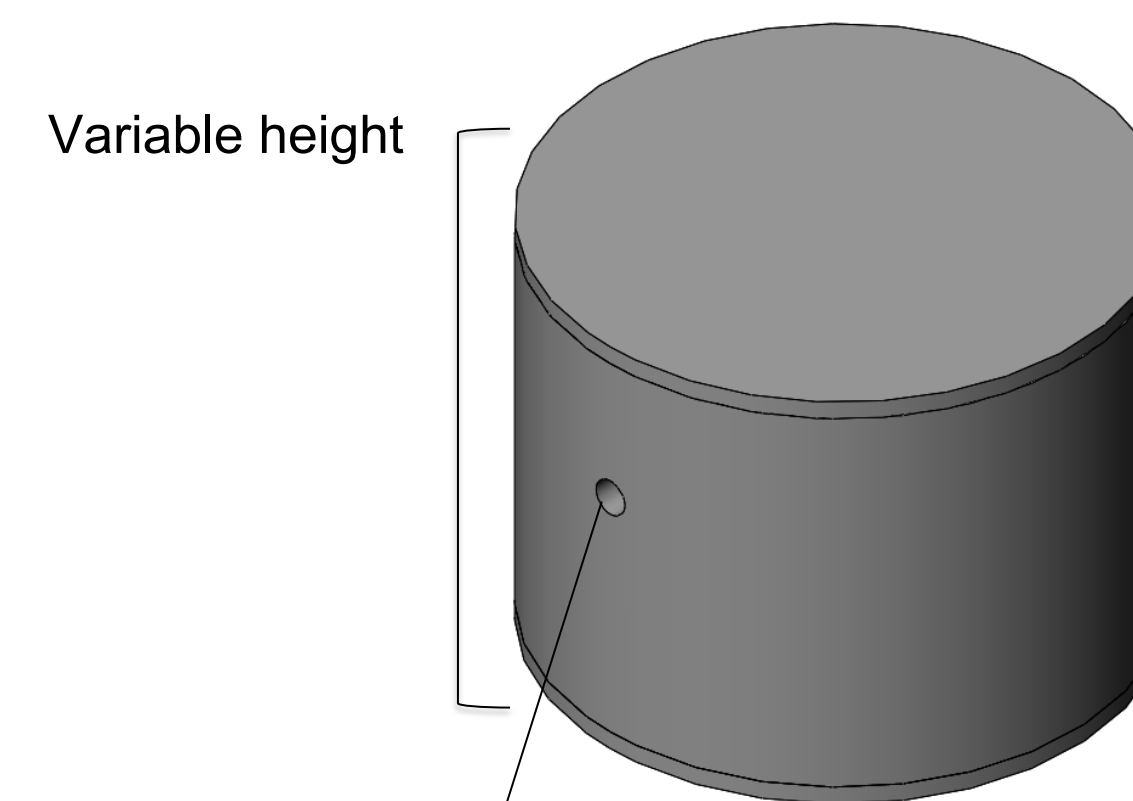
Collapsed View



Biomass stove, predominate cooking method in rural India

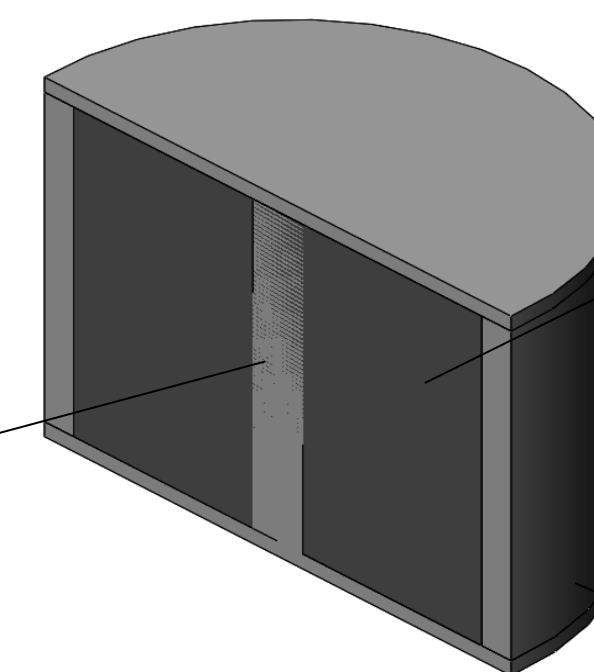


Exploded View



Heat Battery

Hole and plug to fill with phase change material in manufacturing process



Heat Battery Section View

Insulated double walled vessel

Single solid aluminum post for better heat distribution in PCM

Phase Change Material (Sodium Nitrate) stores thermal energy from sun

Aluminum casing

Budget Estimate			
Part Name	Quantity	Material Price	Labor Price
6" tall, 4" diameter battery	1	\$33	\$90
3" tall, 4" diameter battery	2	\$33	\$180
2" tall, 4" diameter battery	3	\$33	\$270
Stainless Steel Vacuum-Insulated Vessel	1	\$26	N/A
	Total:	\$125	\$540
	Grand Total:	\$665	

The Big Picture:

Prototyping this solar stove will be a step to improve health, save labor, and reduce stress on the environment through reduced biofuel use. This thermal energy storage may also have potential for multiple avenues of reduced biofuel use beyond the scope of cooking.

Current Status:

Thermal battery calculations are complete. Aluminum batteries are currently being manufactured.

Next Steps:

Fill batteries with phase change material. Test and analyze the solar stove's performance for improvements.

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