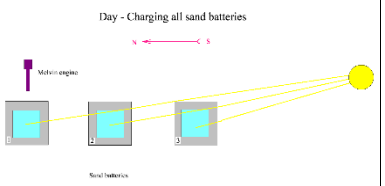
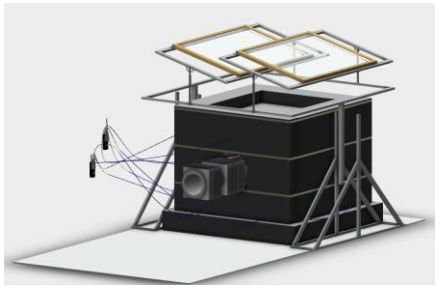
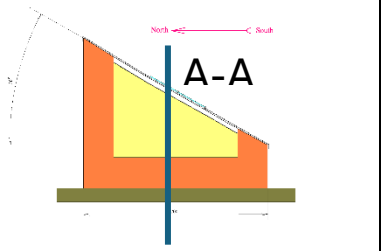
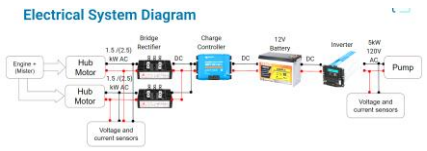
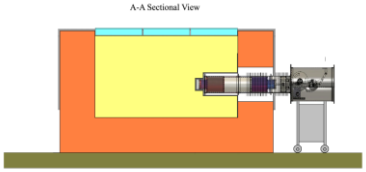
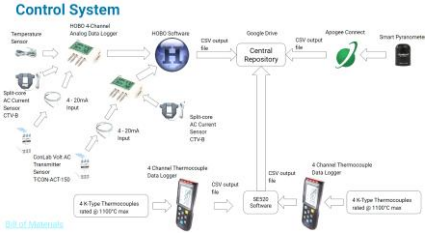
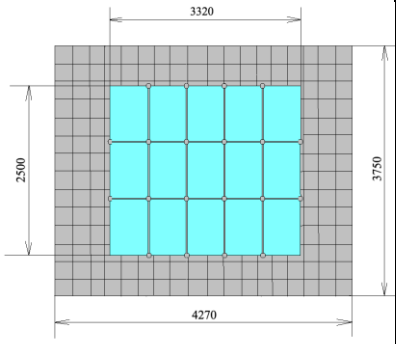
Fossil-Fuel-Free Irrigation Project Overview

Last update: 25 September 2025

Proof-of-Concept System		Subsystem	Proposed Final System	
	• 1 lens system • 2 Sheet-style Fresnel lenses (30" x 60") on adjustable frame that follows sun daily and allows seasonal orientation. • Capture area: 2.3 m^2. • Focal length: ~31" (787mm).	**Solar Capture**	• 3 separate lens systems • 15 arrays of 16x12 square lenses (830mm x 630mm) on fixed steel cover at permanent 30° angle to horizontal and facing south for each battery. • Capture area: 8.3 m^2. • Focal length: 93.5mm (~3.7").	
	• 600mm of rock wool board (ComfortBoard 110) for sides and bottom. • Double-pane ¼" tempered glass for daytime cover. • Rock wool for nighttime.	**Heat-Retention Strategy**	• 600mm of rock wool board for sides and bottom. • Fresnel lenses mounted in steel frame as daytime cover. • Rock wool for nighttime.	
	• 2.3 metric tons of sand. • 1.4 m^3 of sand. • Need to determine how to efficiently move heat through sand.	**Sand Battery**	• 13 metric tons of sand/system. • 7.2 m^3 of sand/system. • Need to determine how to efficiently move heat through sand.	
	• 1 5-kW "Melvin" Stirling engine. • High-pressure (40 psi) chamber with misting feature (needs to be perfected).	**Stirling Engine**	• 1 5-kW "Melvin" Stirling engine. • High-pressure (40 psi) chamber with misting feature (needs to be perfected).	
	• 2 hub motors in Melvin. • 12-volt DC battery to 'clean' output power. • Inverter to convert to 110V AC power.	**Electrical System**	• 2 hub motors in Melvin. • 12-volt DC battery to 'clean' output power. • Inverter to convert to 440V AC power.	
	• Cooling water initially provided by hose from faucet. • Closed system using air cooling of heated water.	**Cooling System**	• Cooling water siphoned from pumped irrigation water. • Open system with new irrigation water providing constant cool water.	
	• 8 Temp sensors in sand, sleeve and on 'cold' end of engine. • 6 voltage & current sensors on hub motors and inverter output • Pyranometer to measure solar.	**Control System**	• Temp sensors in sand, sleeve and on 'cold' end of engine. • Need to determine other sensor requirements.	