

# Project 4: Red Feather Thermal Energy For Homes

Team Members: Jake Shaw, Will Legrand,  
Edwin Beraud, and Jeff Macauley

Client: Mark Hall



# Project Description

- Create a sustainable heating solution for homes on the Navajo and Hopi reservations
- Goal is to cut down the burning of coal and wood - finite resources
- Red Feather works in Flagstaff to develop sustainable housing solutions to people on the reservation
- Need to find the right balance between health factors, heating efficiency, cost

# Black Box Model

<b>Materials In</b>	Cold Air	<b>Heat Home</b>	Hot Air	<b>Materials Out</b>
<b>Energy In</b>	Solar Thermal Energy		Energy Transfer as Heat	<b>Energy Out</b>
<b>Signal In</b>	Setting Thermostat		Change Home Temperature	<b>Signal Out</b>

Figure 1: Inputs, outputs, and main function of the design

# Functional Decomposition

- Assuming the system consists of a solar furnace, solar PV panel, small fan, and battery system

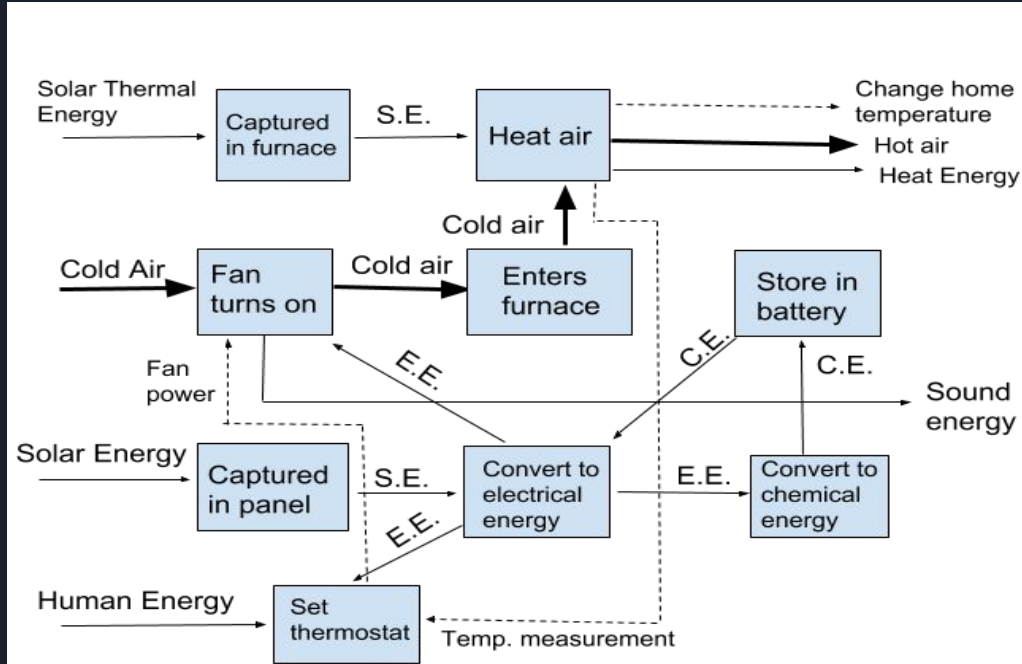


Figure 2: Break down of subfunctions and energy conversions

# Concept Generation: First Design

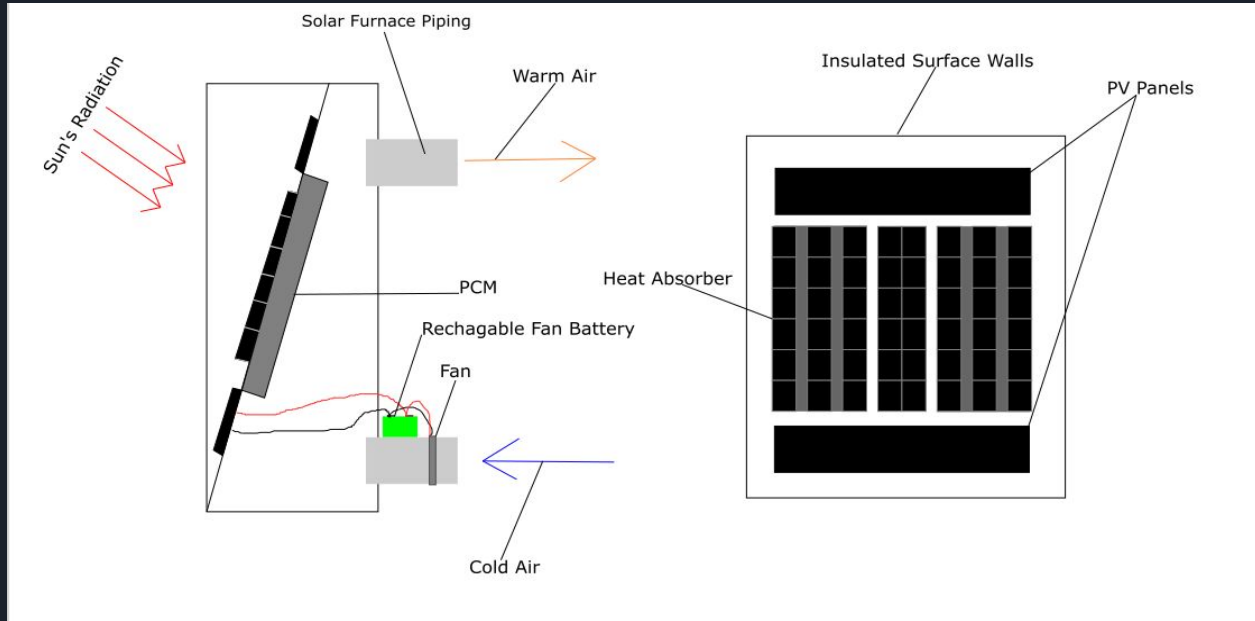


Figure 1: Photovoltaic and Phase Change Material Integrated Solar Furnace

# Concept Generation: Selected Design

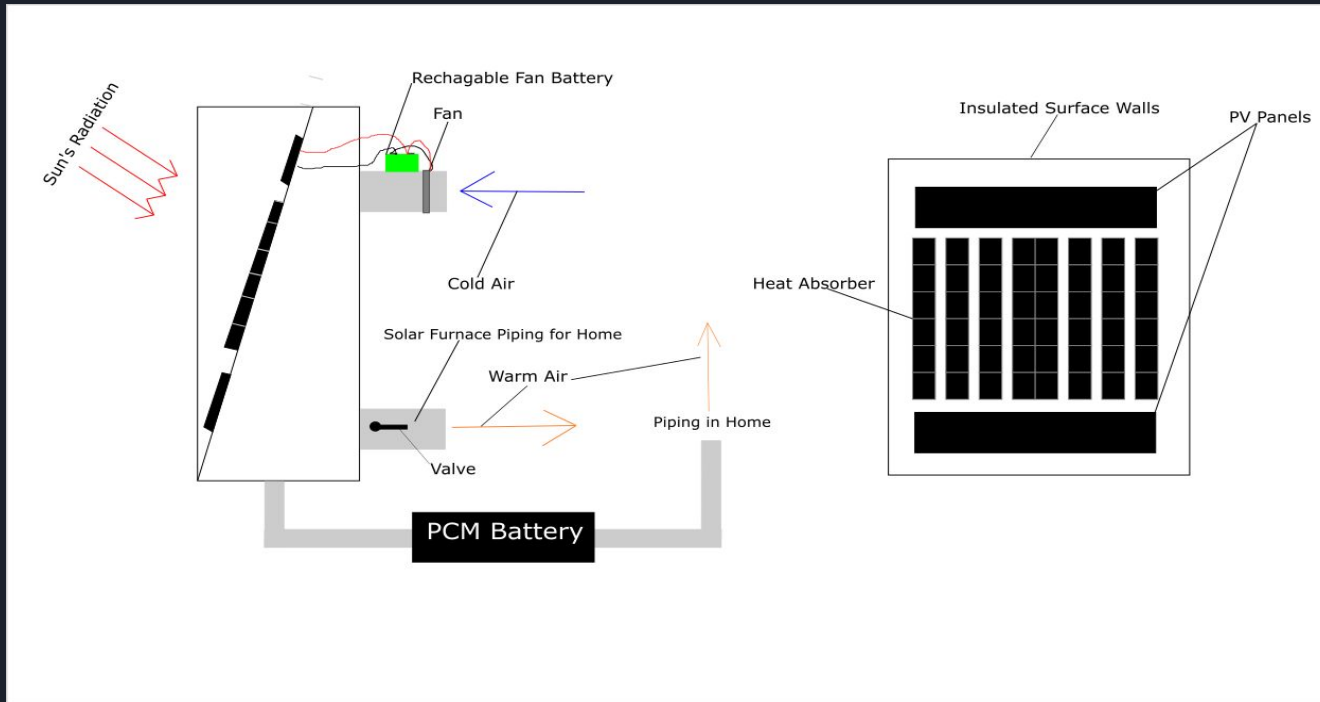


Figure 2: Photovoltaic Solar Furnace W/ Phase Change Material Battery

# Concept Evaluation

Concept Variants (Software Models)						
Criterion	Weight	Coal Stove	Coal Stove w/ Insulation	Coal Stove w/ Insulation and PCM	Solar Furnace w/ Insulation	Solar Furnace w/ Insulation and PCM
Safe	20	40/8	30/6	30/6	100/20	100/20
Affordable	25	100/25	90/22.5	70/17.5	80/20	70/17.5
Grid-Independent	20	100/20	100/20	100/20	100/20	100/20
Easy to Regulate Temperature	10	70/7	80/8	80/8	60/6	80/8
Reduces Pollution / Efficient	25	40/10	50/12.5	50/12.5	90/22.5	100/25
Total Weighted Score		70	69	64	88.5	90.5
Relative Rank		3	4	5	2	1

Figure 3: Decision Matrix







# Budget

- Prototypes will likely occur in the second semester of the project
- Anticipated expenses: software modeling and PCM samples
  - Sketchup and Equest
  - Equest is free to use
  - Sketchup costs \$55 per year for students
  - May need PCM samples for prototyping and testing
- Theoretical budget: \$1200 ± \$300 for the overall system



Questions?