Solar Autoclave for Rural Areas

Needs Assessment

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Overview

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Background

What is a solar autoclave?

- An autoclave is a device used to sterilize medical equipment.
- Many 'Westernized' designs currently use electricity to power the autoclave.
- A solar autoclave uses the sun's radiation to sterilize the medical equipment.

Western Design Autoclave

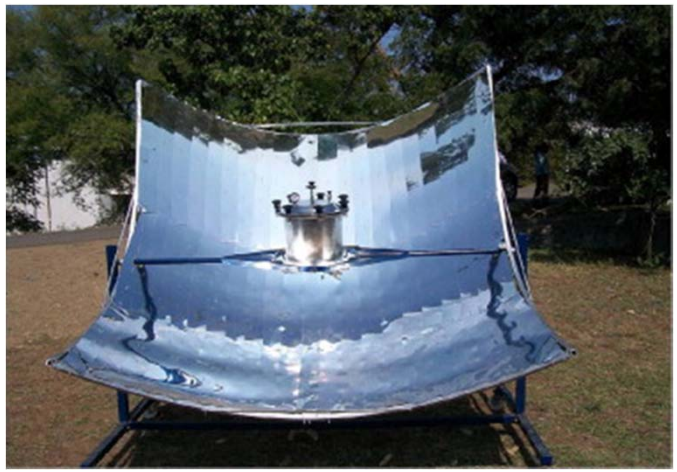


Figure 1 – Western Design Autoclave
Courtesy of SciVerse
http://www.sciencedirect.com/science/article/pii/S0195670112000230

Need Identification

- NEED STATEMENT: Certain developing areas around the world have limited availability to sterilized medical equipment.

- Many of these countries have limited access to grid electricity, making solar power a practical solution.

Define the Problem

- OUR GOAL: To create a solar autoclave that can be easily used at remote clinics in rural areas.

- SCOPE: Several regions around the world in need of sterile medical equipment, with ample amounts of sunlight to power the solar autoclave.

Objectives

- Provide remote clinics in rural areas with the means to sterilize medical equipment.
- Create a flexible design from location to location.
- Parts can be repaired/replaced from local, readily available materials.

Objectives

Table 1 – Table of Objectives

Objective	Basis for Measurement	Units
Provide remote health clinics with the means to sterilize medical equipment	Temperature & Pressure	°C & bar
Create a flexible design from location to location	N/A	N/A
Parts can be repaired / replaced with local, readily available materials	Cost	$

Constraints

- Temperature must reach and hold 121°C for at least 15 minutes.
- Pressure must reach and hold 2.05 bar for at least 15 minutes.
  - Water boils at 100°C.
  - In order for the phase change to occur, the water must be pressurized.
  - Pressure of 2.05 bar produces saturated steam at 121°C.

Criteria Tree

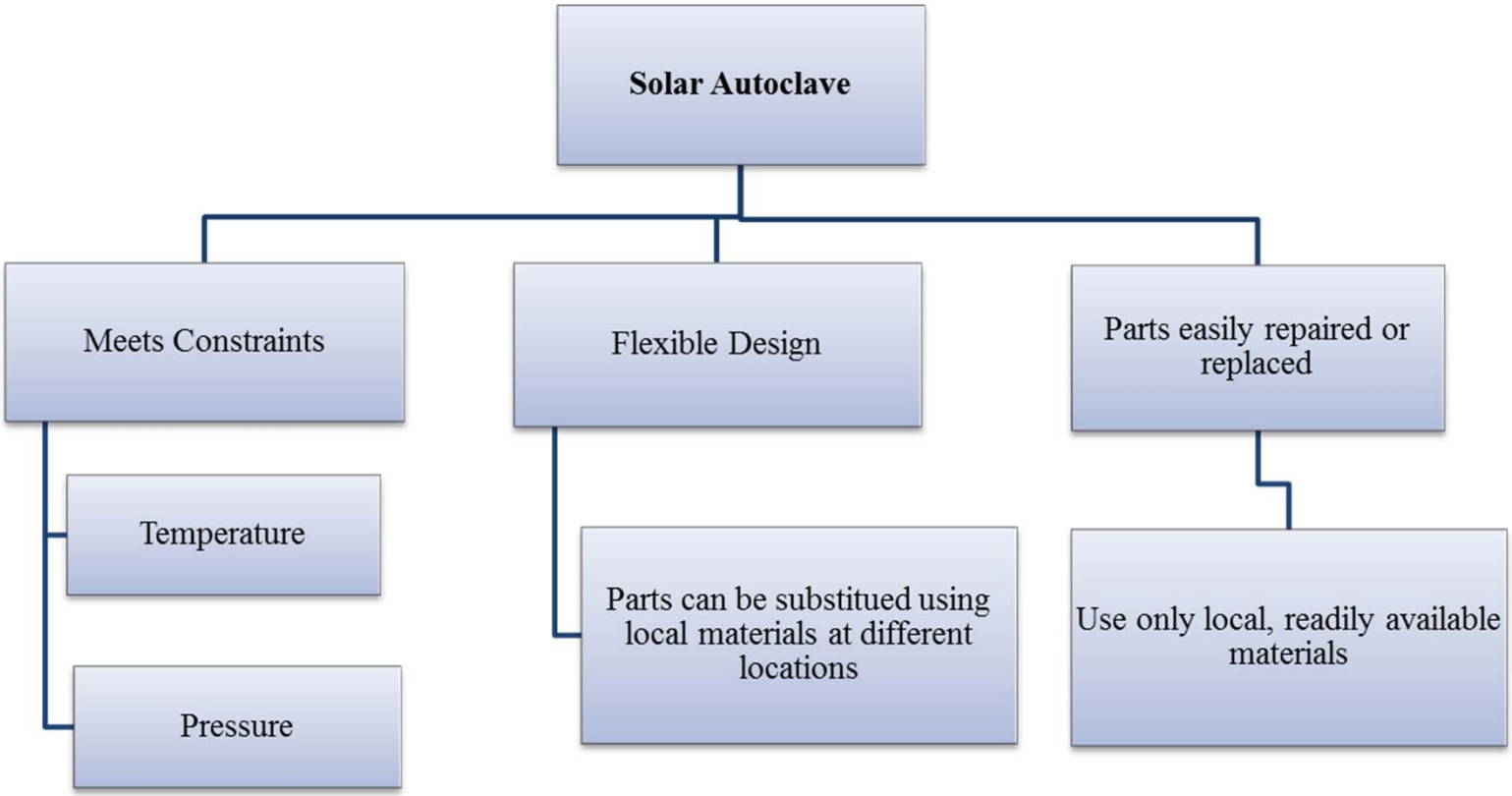


Figure 2 – Criteria Tree

Quality Function Deployment

		Engineering Requirements								
		Capacity for Medical Equipment	Cycles per Day	Minimum Temperature Requirement	Thermal Conductivity	Device Absorptivity	Housing Thickness	Efficiency	Pressure	Cost
Customer Requirements	Easy to use	X	X							
	Portable	X								
	Readily Available Materials				X	X		X		X
	Use Energy as efficiency as Possible		X		X	X		X		
	Durable						X			X
	Achieve the Required Internal Eviornment			X					X	
	Safe			X					X	
	Inexpensive	X					X			X
	Units	cm^3	min	°C	$W \cdot m^{-1} \cdot K^{-1}$	$W \cdot m^2$	mm	%	bar	$
				121					2.05	
		Engineering Targets								

Figure 3 – Quality Function Deployment

House of Quality

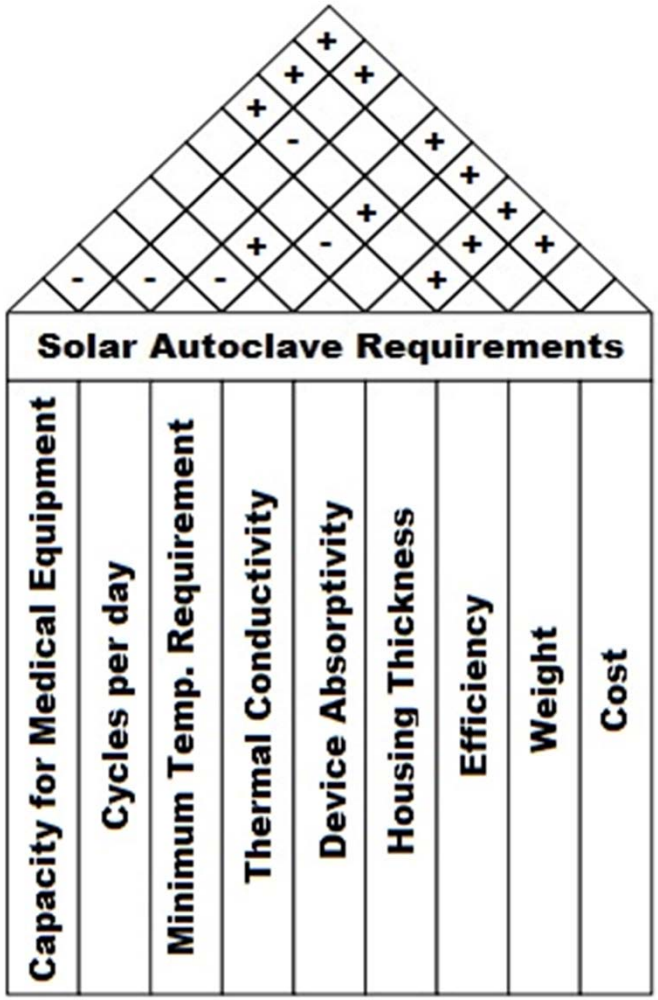
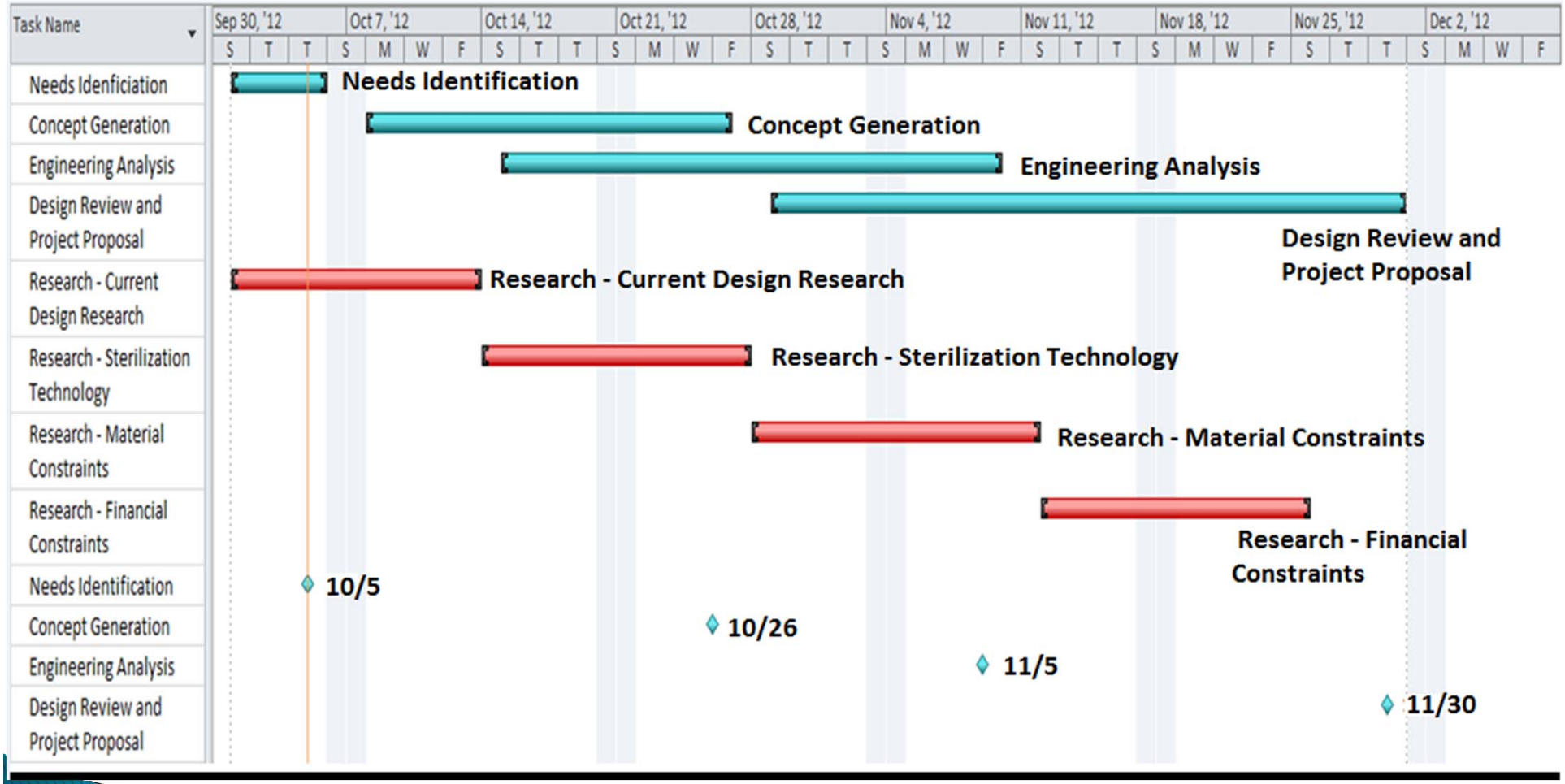


Figure 4 – House of Quality

Project Plan Gantt Chart



References

- Sponsor: Dr. Brent Nelson
  Brent.Nelson@nau.edu
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- http://www.who.int/en/
- www.heartware.nl/rsrch.html
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Questions?