

Ultra Low Cost Solar Water Heater Progress Report

3/3/14

Saleh Alsadiq, Matt Beckham, Austin Chott,
Thomas Griffin, Chris Heine

Introduction

Design a low cost solar water heater that makes minimal sacrifices in efficiency which result in significant reduction in cost.

Objectives

- Heats water
- Weather resistant
- Low initial cost
- Quick financial return
- Easily integrated into existing system
- Safe
- Reasonable size

Testing Objectives

- These objectives were identified by our analysis from last semester and what we have learned building and testing so far.
 - Test parabolic vs. flat plate
 - Flat plate: Test glass vs. plastic
 - Parabolic: Test Copper Pipe vs. Galvanized
 - Parabolic: Test with and without turbulence induced inside collector
 - Parabolic: Test different reflective materials

Business Team Collaboration

- Once we provide absorption per area per dollar, and cost data they will provide the marketability and payback time.
- We provide ONLY collection system costs
- They have analyzed installation, tax credits, and other associated costs

Parabolic Collector



Chris Heine

Parabolic Collector

- Nelson's Guidance:
 - Parabolic collector must track, design tracking system but do not build. He will include this in Phase II of the EPA project.
 - We will simulate tracking by manually moving collector.
 - Find hose solution to achieve thermosyphon.
 - Build and test a flat plate design in addition to parabolic collector.

Parabolic Collector

- Thermosyphon achieved with 1 in diameter hoses
- Testing done before thermocouples arrived
- Thermosyphon confirmed pipe got about 200° F on the surface and then cooled when flow started to about 140° F

Parabolic Collector



Chris Heine

Flat Plate Collector



Saleh Alsadiq

Flat Plate Collector

- Much more viable now because it does not need to track.
- According to or theoretical analysis if the tracking systems costs more than \$120 total the flat plate will be the best design.
- We will test both a plastic sheet cover and a glass cover.

Final Design

- Based off of the absorption per area per dollar analysis the parabolic collector and flat plate will be compared.

Collectors	Absorption/Area/\$ (W/m²/\$)
Flat Plate	1.63
Parabolic Painted Galvanized	1.72

Data Acquisition



Software Analysis

- Data is written to excel file for analysis.
- Data is simultaneously taken at the inlet and outlet for comparable data.
- Graphing program included in data acquisition software.
- The player displays and analyzes data.
- The recorder provides the parameters to acquire the data.

Logging Player

File Settings View Help

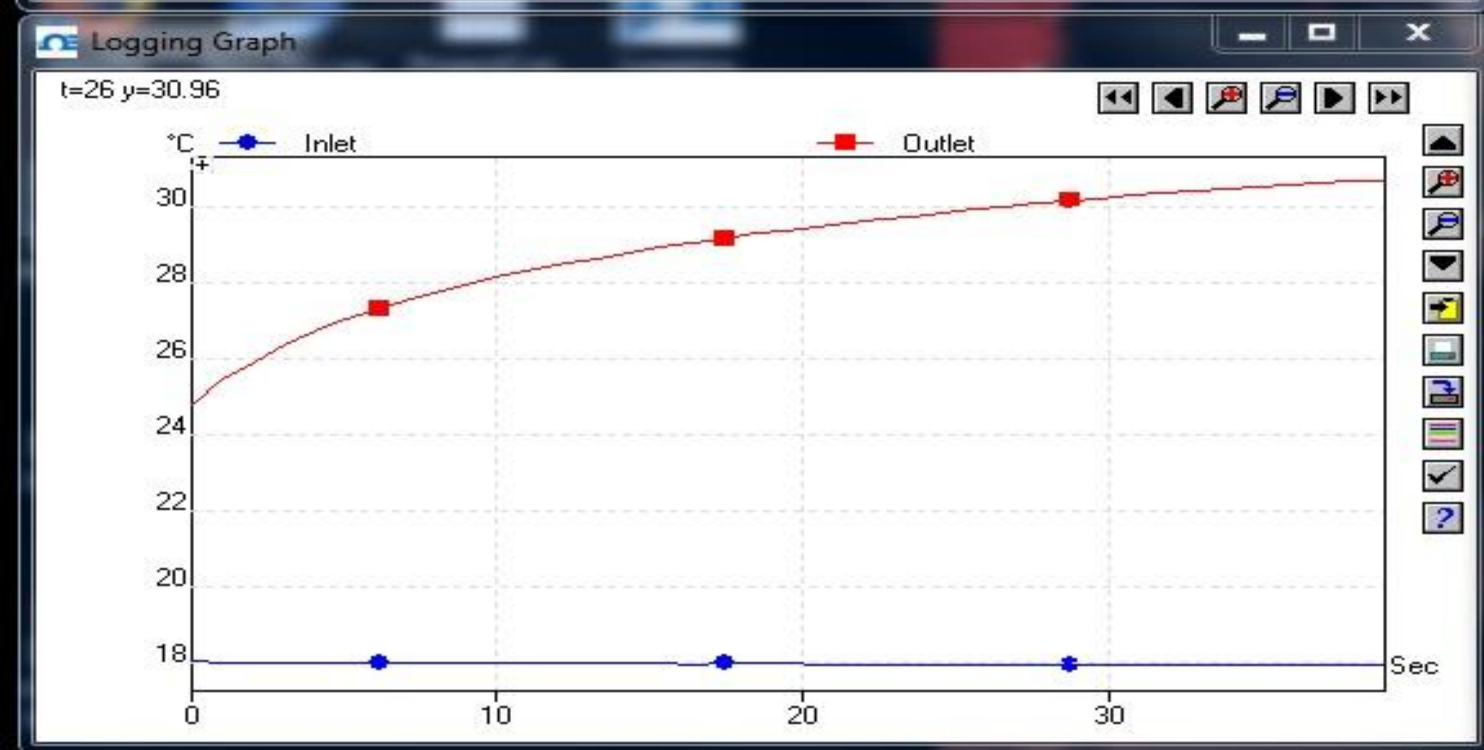
C:\Users\Thomas Griffin\Documents\Spring 2014\ME486C
test3.plw
3/2/2014 10:43:19
40 samples

Logging Recorder

File Settings View Help

C:\Users\Thomas Griffin\Documents\Spring 2014\ME486C
test3.plw
Stopped after 40 samples

Alarm	Channel	Reading	Units
●	Inlet	16.95	°C
●	Outlet	17.97	°C



Test 3 - Microsoft Excel

File Home Insert Page Layout Formulas Data

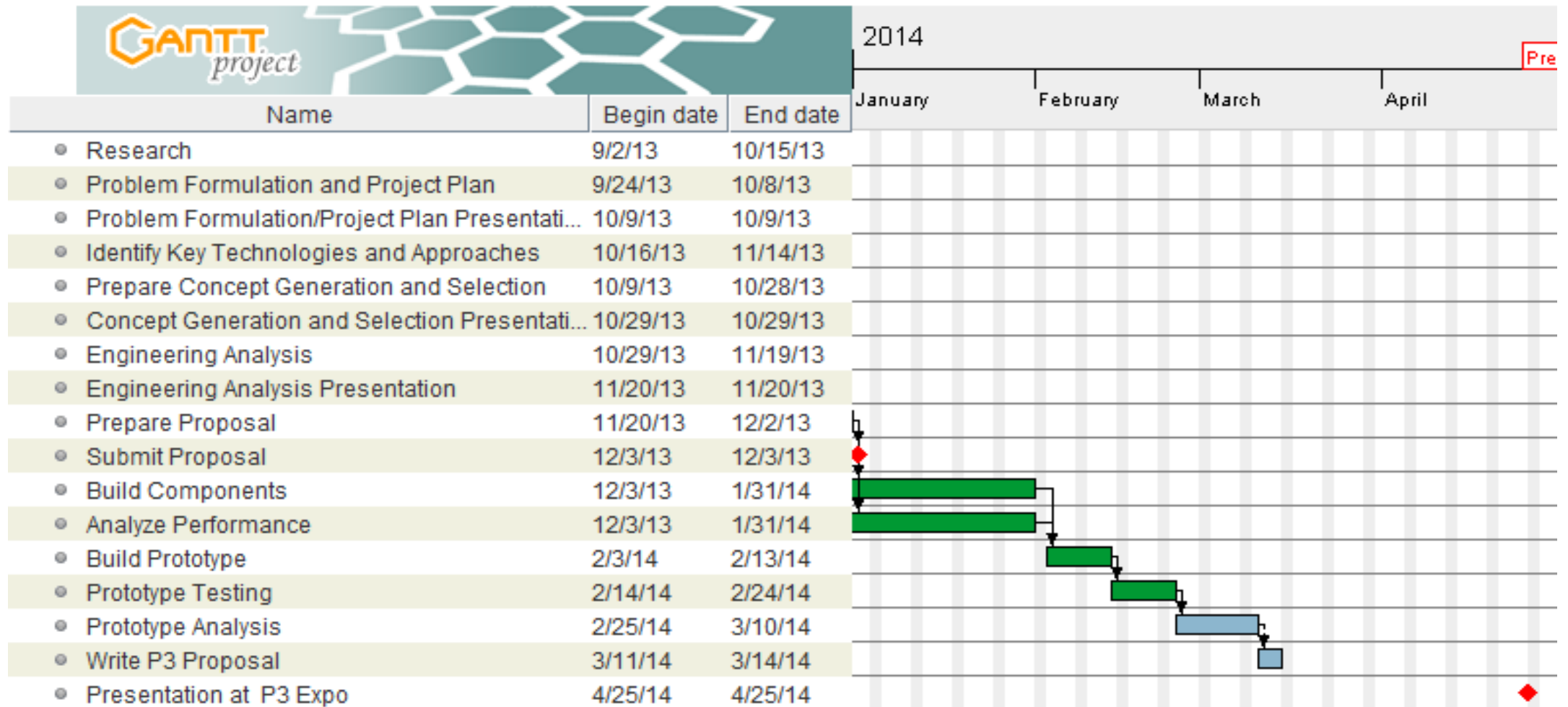
Clipboard Font Alignment Number

	A	B	C	D	E	F
1	Time	Inlet	Outlet			
2	Seconds	°C	°C			
3						
4	0	18.04	24.58			
5	1	18.04	25.02			
6	2	18.03	25.49			
7	3	18.03	25.91			
8	4	18.02	26.35			
9	5	18.01	26.73			
10	6	18.01	27.02			
11	7	18.01	27.31			
12	8	18	27.57			
13	9	18	27.8			
14	10	18	28.01			
15	11	18	28.18			
16	12	18	28.33			
17	13	18	28.49			
18	14	18	28.64			
19	15	17.99	28.79			
20	16	17.98	28.92			
21	17	17.98	29.04			
22	18	17.99	29.16			
23	19	17.99	29.28			
24	20	17.98	29.37			
25	21	17.98	29.49			

Sheet1 Sheet2 Sheet3

Ready

Project Timeline



Gantt Chart

January:

- Collect materials
- Begin building collectors
- Meet with MBA team/Dr. Nelson to discuss status and marketability

February:

- 3rd – 13th: Finish collectors, route plumbing
- 14th – 24th: Test components/system
- 25th – 28th: Compile/analyze data

March:

- Milestone: 10th – Complete data analysis for report
- 11th – 14th: Write report for P3 Expo

April:

- 25th – 27th: P3 Expo

Conclusion

- EPA P3 Program **Ultra Low Cost.**
- New collector built and ready to test.
- Testing objectives identified
- Gather and analyze data and complete proposal by March 15th.