Problem Formulation and Project Plan

10/8/13

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Overview

• Introduction
• Need Statement
• Goal
• Objectives
• Timeline
• Quality Function Deployment
• House of Quality
• Conclusion
Introduction

• Client: U.S. Environmental Protection Agency (EPA)
  – P3: People, Prosperity, and the Planet Award
  – Research, design, and develop solutions to real world challenges involving the overall sustainability of human society
Need Statement

Current solar water heaters are too expensive and it takes a long period of use to make them financially sensible, therefore current solar water heater designs are financially impractical over a short period of use.
Project Goal

• Design a low cost solar water heater that is efficient enough to produce a quick financial return
OBJECTIVES

• Heats Water
• Weather Proof:
  – Systems typically outside
  – Withstands the elements to reduce cost
    • Average storms
    • Average exposure to elements
    • Water doesn’t freeze in the system
OBJECTIVES

• Low Initial Cost:
  – Current consumer SWH systems in the US $5000-$10,000
  – Focused on performance
OBJECTIVES

• Low Initial Cost:
  – Cost multipliers that will be considered:
    • Quality of materials used
    • Quantity of materials used
    • Complexity of the design
    • Difficulty of construction
      – More skill and tools required
OBJECTIVES

• Quick Financial Return:
  – Break-even Cost is met within reasonable time period (2 Years)
  – Minor sacrifices in performance in order to significantly reduce cost (%/USD)
OBJECTIVES

• Easily Implemented into Current Heating Systems
  – Works with gas and electric water heaters
  – Easily buildable and installable with do-it-yourself level knowledge of plumbing and construction
OBJECTIVES

• Low Maintenance Cost:
  – Simultaneously and easily maintained with the current water heating system
OBJECTIVES

• Safe operation:
  – Safe in home operations
  – Meets all governments safety requirements

• Suitable system size:
  – Reasonable system volume for implementation
Timeline

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<thead>
<tr>
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<th>Begin date</th>
<th>End date</th>
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<tr>
<td>Research</td>
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# Quality Function Deployment

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<th>Volume</th>
<th>Material Strength</th>
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<th>Weight</th>
<th>Heat Transfer</th>
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House of Quality

- °C (water produced)
- σ (allowable stresses on collector)
- $ (maximum cost installed)
- Years (maintenance interval)
- $ (yearly maintenance cost)
- Years (break even time frame)
- m² (system size)
Conclusions

• Need: Better SWH
• Goal: Quick Financial Return
• Objectives
• Timeline
• QFD
• House of Quality
References