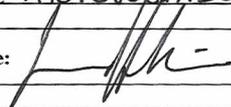


APPENDIX C

ANALYSIS OF SENIOR PROJECT DESIGN

Please provide the following information regarding your Senior Project and submit to your advisor along with your final report. Attach additional sheets, for your response to the questions below.

Project Title: CASA DE SALUD - COMMUNITY HEALTH CLINIC PHOTOVOLTAIC SYSTEM DESIGN		
Student's Name: JEREMY HOLLIMAN	Student's Signature: 	
Advisor's Name: TAUFIK	Advisor's Initials: T	Date: 11/17/10

- **Summary of Functional Requirements**
Describe the overall capabilities or functions of your project or design. Describe what your project does. (Do *not* describe how you designed it).
- **Primary Constraints**
Describe significant challenges or difficulties associated with your project or implementation. For example, what were limiting factors, or other issues that impacted your approach? What made your project difficult? What parameters or specifications limited your options or directed your approach?
- **Economic**
 - Original estimated cost of component parts (as of the start of your project).
 - Actual final cost of component parts (at the end of your project)
 - Attach a final bill of materials for all components.
 - Additional equipment costs (any equipment needed for development?)
 - Original estimated development time (as of the start of your project)
 - Actual development time (at the end of your project)
- **If manufactured on a commercial basis:**
 - Estimated number of devices to be sold per year
 - Estimated manufacturing cost for each device
 - Estimated purchase price for each device
 - Estimated profit per year
 - Estimated cost for user to operate device, per unit time (specify time interval)
- **Environmental**
 - Describe any environmental impact associated with manufacturing or use.
- **Manufacturability**
 - Describe any issues or challenges associated with manufacturing.
- **Sustainability**
 - Describe any issues or challenges associated with maintaining the completed device, or system.
 - Describe how the project impacts the sustainable use of resources.
 - Describe any upgrades that would improve the design of the project.
 - Describe any issues or challenges associated with upgrading the design.
- **Ethical**
 - Describe ethical implications relating to the design, manufacture, use, or misuse of the project.
- **Health and Safety**
 - Describe any health and safety concerns associated with design, manufacture or use of the project.
- **Social and Political**
 - Describe any social and political concerns associated with design, manufacture or use.
- **Development**
 - Describe any new tools or techniques, used for either development or analysis that you learned independently during the course of your project.

Analysis of Senior Project Design

Listed below are the responses to the attached sheet.

Summary of Functional Requirements

The purpose of this design is to provide adequate power to a health clinic in the community of Camilo Ortega, Nicaragua. This design provides one main design and two alternative designs; the first being a hybrid photovoltaic system design which utilizes both photovoltaic cells, generators, and batteries for energy storage. The two alternatives provide less costly but less sustainable options: the first provides an on-grid energy storage system that provides battery-backup when the utility goes out, and the second is a simple diesel generator-based power system.

Primary Constraints

The primary difficulty in this design was taking into account appropriateness of the design as it pertains to the community itself. Coordinating what was feasible and appropriate for the community and the non-governmental organization ATRAVES became a difficult task not only in monetary concerns but also in communication itself. It was also difficult to size components for a yet-to-be built clinic and the only factors used in computing the design had to be from the construction plans.

Economic

- The estimated cost at the beginning of this design was \$10,000.
- The quoted cost of the primary alternative, by ECAMI, is \$16,022.
 - 16 PV Panels: \$9,760
 - 16 Batteries 12VDC, 200AH: \$4,160
 - 1 Inverter/Charger: \$1,717
 - 2 Charge Controllers: \$300
 - 1 Voltmeter: \$85

Environmental

The ideal purpose of this design is to minimize net-impact of emissions onto the environment. The biggest impact on the environment will be the result of the diesel generator use. The ideal goal of photovoltaic design is to keep enough energy in the batteries to require little-to-no usage of the generator. For this reason the diesel generator option is widely rejected for emissions and noise volume.

Manufacturability:

Not Applicable.

Sustainability

The biggest challenge with keeping the design sustainable stems from the threat of vandalism or theft by members of the community who wish to turn the photovoltaic cells in for profit. This is one of the primary reasons that the NGO had to reject, at least initially, the photovoltaic design. Ideally, this design only uses a single sustainable and renewable energy source, the sun. In order to minimize the impact of diesel fuel usage, the generator runs for the minimum required amount of time to charge any deficit in the batteries.

Ethical

There are no ethical issues with this design.

Health and Safety

The largest concern with this design is the high-voltage that will be distributed to the loads. It is important that the implementation of the wiring, batteries, and panels. This is a clinic and may, at times, experience a high volume of traffic, so it is important that everything has been safely implemented by qualified electricians and engineers.

Social and Political

The implementation of this design is primarily for social implications, that is, to provide power to a health clinic for community members in Camilo Ortega, Nicaragua. This has a positive social impact with no foreseeable negative social impact.

Development

Not applicable.