

PROPOSAL NARRATIVE

(Maximum of 5 double-spaced pages, 1" margins, 12-point font)

I. Abstract

The Cal Poly National Electrical Contractors Association (NECA) Student Chapter proposes to participate in study through the NECA ELECTRI-International Student Passport Initiative that will fabricate and install four (4) photovoltaic systems in impoverished areas of Ecuador. Following the installation, the NECA student chapter will monitor the operation of the systems and perform a comparative study of the systems across the various ranges of geography, humidity, elevation and ecological conditions.

II. Introduction

The ELECTRI-International Student Passport Initiative is designed to engage students in service learning experiences in developing communities. The Cal Poly National Electrical Contractors Association (NECA) Student Chapter proposes to participate in the initiative partnering with Reach Beyond, a non-profit organizations established in 1931 devoted to assisting people improve their quality of life in impoverished countries (<https://reachbeyond.org/>). Over the past 82 years, Reach Beyond has provided mobile community healthcare clinics, counseling centers in war-torn areas, clean water projects and general hygiene training.

The Cal Poly NECA student chapter proposes to design, fabricate, and install four (4) photovoltaic systems in Ecuador that will serve as the primary source of energy for community water pumps.

In December 2013, SunPower donated 1000 photovoltaic panels to Cal Poly to provide students with the opportunity for students to gain experience with photovoltaic installations and become

involved with a global green perspective. We feel this is excellent opportunity and use of the photovoltaic systems that will not only benefit those less fortunate but also enable to make a scientific study.

III. Objective(s)

The objective of the project is to design, fabricate, and install four (4) photovoltaic systems in Ecuador that will serve as the primary source of energy for community water pumps. In addition, Cal Poly will be monitoring the energy generation and well production over time to create a comparative study across the multiple geographic environments. Each site will be equipped with a satellite monitoring system to capture and transmit data for recording. The proposed study will create four (4) locations allowing for a comparative study of photovoltaic systems across ranges of geography, humidity, elevation, and ecological conditions.

(1) Design - Each system will consist of Sunpower solar panels, Grundfos pumps, and a satellite monitoring systems which will be able to capture and transmit data back to the Cal Poly so that we will be able to compare performance across a range of geography, humidity, elevation and ecological conditions.

Four (4) locations have been selected to construct the comparative studies.

- 1) Iwia, Ecuador (a small jungle community of 100 people)
- 2) Wayusentza, Ecuador (a medium jungle community of 220 people)
- 3) Shell, Ecuador (Reach Beyond Base Camp)
- 4) Cal Poly State University

The first two installations will be located in the jungle communities of Iwia and Wayusentza, Ecuador. These sites serve a total of 320 people. Currently, these communities are not served by electric power. They are impoverished areas that have no means of

generating electrical power for pumping water. These communities bucket water from a natural reservoirs served by an underground spring.

The third site is located in Shell Ecuador at the Reach Beyond Base Camp. Although the town of Shell, Ecuador currently has electricity serving the community, the cost of electricity is very expensive and places strain on the operating budget of Beyond Reach. The installation of the PV system at the Reach Beyond Base Camp will reduce their operating budget and will allow Reach Beyond to utilize capital that previous paid for electricity for other means such as medical supplies and other beneficial services.

The forth site proposed will be located on the Cal Poly campus. The Cal Poly NECA Student Chapter will work with the Cal Poly facilities department to determine an acceptable location on the Cal Poly campus. Current locations for consideration include the following: Poly Canyon Village, O'Neil Green, or another approved site. Our concept is to create a functioning educational demonstration.

- (2) *Fabricate and Test* – Each of the four systems will be pre-fabricated and tested in the Cal Poly Campus Simpson Strong Tie (SST) Building. The Cal Poly NECA student will use the project as mechanisms to recruit new students to the student chapter.
- (3) *Transport, Install, and Commission* – Upon completing of the pre-fabricated systems, the systems will be packaged and shipped to their respective destinations. We travel to Ecuador and install and commission the systems.
- (4) *Monitor, Compare, and Document* – Following the installation each system will be carefully monitored and data will be recorded. Using the data collected a conference and/or journal paper will be produced comparing the performance across the four different systems.

IV. Methodology

Our methodology involves researching the design and installation practices of photovoltaic systems and selecting durable components suitable for deployment in the jungles of Ecuador. We will also be researching the most economical and durable satellite monitoring system to capture and transmit data for recording. SAS 9.1 statistical software will be used for all data analysis. Analysis of Variance (ANOVA) test will be used to analyze whether statistical significance exists in different groups.

V. Timeline

Our proposed timeline for the project is displayed in the table below. Upon authorization to proceed our first task, as required by the EI Student Passport Initiative program, will be to present our project plan to the Electri-International Task Force Committee.

Task/ Activities	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Presentation to NECA												
System Design												
Materials Procurement												
System Fabrication												
System Shipping												
System Installation												
Operation/ Monitoring												
Draft Journal/ Conference Paper												
Journal Paper Submission												

VI. Final Products and Dissemination

The final project will include the installation of three (3) photovoltaic systems in Ecuador and one (1) photovoltaic system at Cal Poly. The installation of the four (4) photovoltaic systems will ultimately result in the NECA student chapter being able to make comparative studies of photovoltaic systems across ranges of geography, humidity, elevation, and ecological conditions. The Cal Poly site will serve as an educational demonstration for the entire campus to observe and visit. We propose to create a website for the Cal Poly community to educate themselves on the project and observe the real-time data being collected from the four systems. Example of data to be collected includes the following: kW generated, gallons of water pumped, instantaneous pump flow rate. The NECA Student Chapter will work with Faculty Advisor, Dr. Thomas Korman, P.E., to publish the results of the project at an appropriate conference and scientific journal.

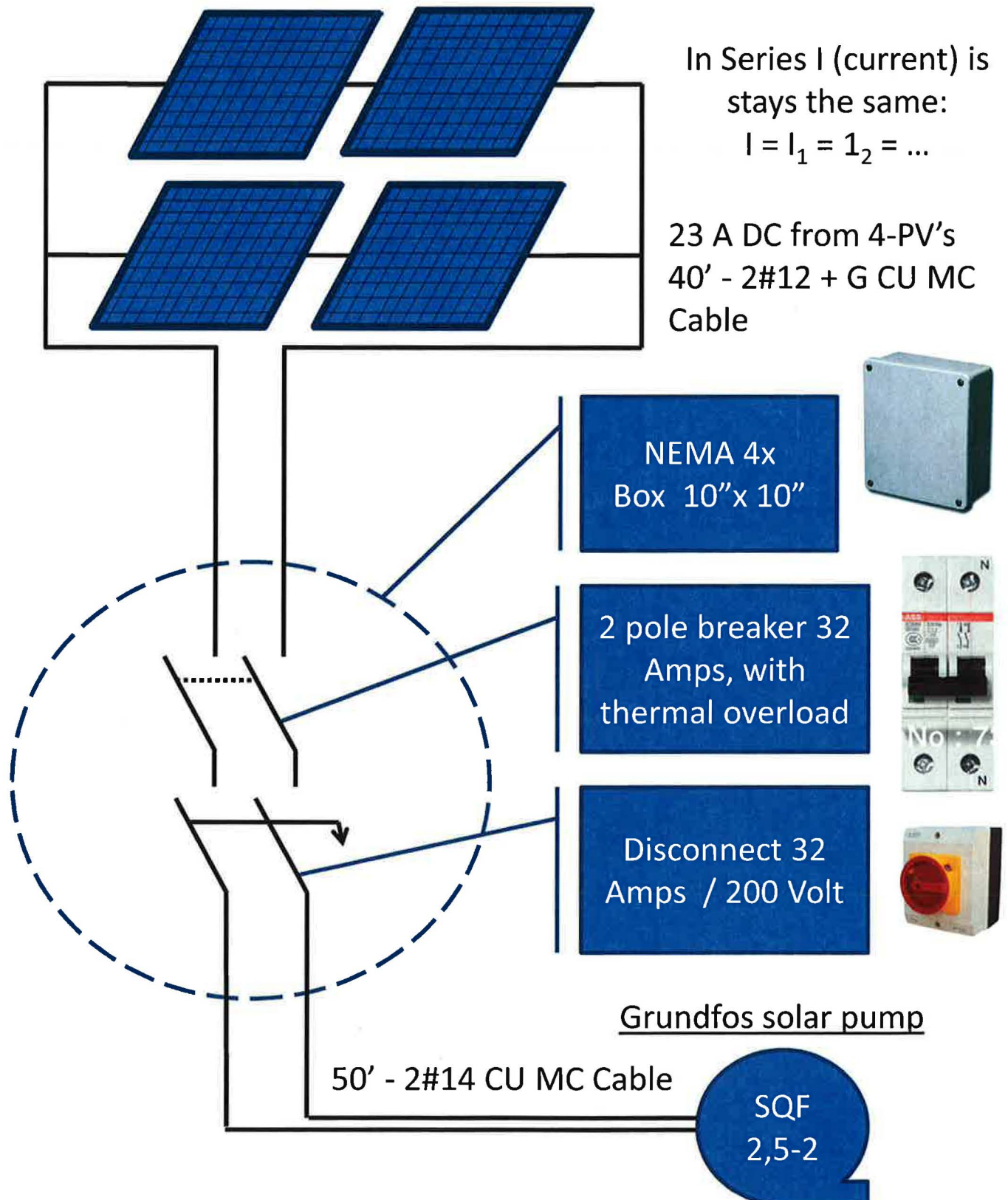
VII. Budget Justification

Due to the scope of the project, the total cost of the proposal project is estimated to be \$15,000. We are requesting \$5,000 from the Baker Endowment for travel to install the systems in Ecuador. Additional funding will be secured from the NECA Passport Initiative Program. We are already in possession of photovoltaic panels which have been donated by Sunpower and the remainder of the components required for the installation is being donated from Sprig Electric of San Jose, CA.

PROPOSAL BUDGET

Student Applicant(s): Wesley McGuire, President Adam Poffenbarger, Vice President	
Faculty Advisor: Dr. Thomas Korman, P.E.	
Project Title: Comparative Analysis of Photovoltaic Systems across multiple environments	Requested Baker Endowment Funding
Travel <u>subtotal</u>	\$2,500
Travel: In-state	\$
Travel: Out-of-state	\$
Travel: International	\$2,500
Operating Expenses <u>subtotal</u>	\$ 2,500
Non-computer Supplies & Materials	\$1,500
Computer Supplies & Materials	\$
Software/Software Licenses	\$
Printing/Duplication	\$
Postage/Shipping	\$1,000
Registration	\$
Membership Dues & Subscriptions	\$
Multimedia Services	\$
Advertising	\$
Journal Publication Costs	\$
Contractual Services <u>subtotal</u>	\$
Contracted Services	\$
Equipment Rental/Lease Agreements	\$
Service/Maintenance Agreements	\$
TOTAL	\$5,000

4 – Panel System straight connection



System will be monitored with a
satellite uplink system



California Polytechnic State University
San Luis Obispo, CA 93407-0284
Construction Management Department
(805) 756-1323 • Fax (805) 756-5740

LETTER OF SUPPORT

April 16, 2014

To Whom It May Concern,

As the NECA Student Chapter Faculty Advisor, I fully support the NECA Student Chapter efforts to participate in the Electri-International Student Passport Program. The joint study with between the National Electrical Contractors Association (NECA) and Reach Beyond is an excellent opportunity for students to become involved in a service learning project that will benefit so many people. The installation will also benefit the learning efforts here at Cal Poly as the installation will serve as a living laboratory for current and future students to learn from as it will serve as a comparative study across multiple environments and provide students with a global green perspective.

The NECA student chapter has already secured possession of the photovoltaics from the donation that Sunpower made to Cal Poly in December 2013. The remainder of the components are being procured through donations from a Bay Area electrical contractor, Sprig Electric from San Jose, CA. The funding requested from the Baker Endowment will largely be used to support travel to install the systems.

Please contact me with any further questions. It is my pleasure to support this worthwhile project.

Sincerely,

A handwritten signature in blue ink, appearing to read "Thomas M. Korman", with a long horizontal flourish extending to the right.

Thomas M. Korman, Ph.D., P.E.
Associate Professor
Construction Management Department

April 1, 2014



Thomas M. Korman, Ph.D., P.E.
Construction Management Department
California Polytechnic State University, San Luis Obispo
Cal Poly, San Luis Obispo, CA 93407

Dear Dr. Korman,

Reach Beyond is non-profit organizations established in 1931 devoted to assisting people improve their quality of life in impoverished countries. Over the past 82 years, Reach Beyond has provided mobile community healthcare clinics, counseling centers in war-torn areas, clean water projects and general hygiene training. <https://reachbeyond.org/>

It is my pleasure to work with NECA Student Chapter on the ELECTRI-International Student Passport Initiative to install the photovoltaic systems to be located in Iwia, Ecuador (a small jungle community of 100 people) and Wayusentsa, Ecuador (a medium jungle community of 220 people), respectively to will be used to pump drinking water for the local communities.

The proposed study will create 4 locations allowing for a comparative study of photovoltaic systems across ranges of geography, humidity, elevation and ecological conditions.

We are excited to work together to on the planning, design, and installation of the systems as students will receive hands on experience with PV systems. This study will result in a comparative study across multiple environments and provide students with a global green perspective.

Sincerely,

A handwritten signature in blue ink that reads "Eric A. Fogg".

Eric Fogg
Program and Team manager

Student Passport Program



ELECTRI is sponsoring a new service learning competition for NECA Student Chapters who will compete for projects that advance efficient and sustainable energy solutions for rural, developing communities within the USA or internationally.

Student Passport Initiative Competition

The Student Passport Initiative encourages NECA Student Chapter members to engage in meaningful service learning experiences in developing communities.

Each year, the competition's winning Student Chapter Team will work to meet a critical need to provide new or upgraded electrical service in an underprivileged domestic or international location of their choice.

ELECTRI International has designed The Student Passport Initiative to promote the growth of sustainable colleges and university programs that advance the development of efficient and sustainable energy solutions and cultivate the professional development and personal growth of students.

Program Goals

- Encourage construction management and electrical engineering students to take an active role in improving access to electricity in rural, developing communities inside or outside the United States.
- Help young adults learn the value of "paying it forward" by taking their time to volunteer for projects that will make a difference in the quality of life for other people.