OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

* 1. Type of Submission:
  - ☐ Preapplication
  - ☐ Application
  - ☐ Changed/Corrected Application

* 2. Type of Application:
  - ☐ New
  - ☐ Continuation
  - ☐ Revision

* If Revision, select appropriate letter(s):

* Other (Specify)

* 3. Date Received:

4. Applicant Identifier:

5a. Federal Entity Identifier:

* 5b. Federal Award Identifier:

State Use Only:

6. Date Received by State:

7. State Application Identifier:

8. APPLICANT INFORMATION:

* a. Legal Name:

* b. Employer/Taxpayer Identification Number (EIN/TIN):

* c. Organizational DUNS:

d. Address:

* Street1:
Street2:
* City:
County:
* State:
Province:
* Country:
* Zip / Postal Code:

e. Organizational Unit:

Department Name:

Division Name:

f. Name and contact information of person to be contacted on matters involving this application:

Prefix:

* First Name:

Middle Name:

* Last Name:

Suffix:

Title:

Organizational Affiliation:

* Telephone Number:

Fax Number:

* Email:

OMB Number: 4040-0004
Expiration Date: 01/31/2009

Application for Federal Assistance SF-424

Version 02

9. Type of Applicant 1: Select Applicant Type:

Type of Applicant 2: Select Applicant Type:

Type of Applicant 3: Select Applicant Type:

* Other (specify):

*** 10. Name of Federal Agency:**

11. Catalog of Federal Domestic Assistance Number:

CFDA Title:

*** 12. Funding Opportunity Number:**

* Title:

13. Competition Identification Number:

Title:

14. Areas Affected by Project (Cities, Counties, States, etc.):

*** 15. Descriptive Title of Applicant's Project:**

Attach supporting documents as specified in agency instructions.

Add Attachments | Delete Attachments | View Attachments

Application for Federal Assistance SF-424 Version 02

16. Congressional Districts Of:

* a. Applicant [ ] * b. Program/Project [ ]

Attach an additional list of Program/Project Congressional Districts if needed.

[ ] Add Attachment | Delete Attachment | View Attachment

17. Proposed Project:

* a. Start Date: [ ] * b. End Date: [ ]

18. Estimated Funding ($):

* a. Federal [ ]
* b. Applicant [ ]
* c. State [ ]
* d. Local [ ]
* e. Other [ ]
* f. Program Income [ ]
* g. TOTAL [ ]

*** 19. Is Application Subject to Review By State Under Executive Order 12372 Process?**

☐ a. This application was made available to the State under the Executive Order 12372 Process for review on [ ] .

☐ b. Program is subject to E.O. 12372 but has not been selected by the State for review.

☐ c. Program is not covered by E.O. 12372.

*** 20. Is the Applicant Delinquent On Any Federal Debt? (If "Yes", provide explanation.)**

☐ Yes ☐ No Explanation

21. *By signing this application, I certify (1) to the statements contained in the list of certifications and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)**

☐ **- ** I AGREE**

** The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

Authorized Representative:

Prefix: [ ] * First Name: [ ]

Middle Name: [ ]

* Last Name: [ ]

Suffix: [ ]

* Title: [ ]

* Telephone Number: [ ] Fax Number: [ ]

* Email: [ ]

* Signature of Authorized Representative: [ ] * Date Signed: [ ]

Application for Federal Assistance SF-424

Version 02

*** Applicant Federal Debt Delinquency Explanation**

The following field should contain an explanation if the Applicant organization is delinquent on any Federal Debt. Maximum number of characters that can be entered is 4,000. Try and avoid extra spaces and carriage returns to maximize the availability of space.

Form Approved OMB No:2030-0020 Approval Expires 04/30/09

KEY CONTACTS FORM

Authorized Representative: *Original awards and amendments will be sent to this individual for review and acceptance, unless otherwise indicated.*

Name: ____________________
Title: ____________________
Complete Address: ____________________
____
Phone Number: ____________________

Payee: *Individual authorized to accept payments.*

Name: ____________________
Title: ____________________
Mail Address: ____________________
____
Phone Number: ____________________

Administrative Contact: *Individual from Sponsored Program Office to contact concerning administrative matters (i.e., indirect cost rate computation, rebudgeting requests etc.)*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
____
Phone Number: ____________________
FAX Number: ____________________
E-Mail Address: ____________________

Principal Investigator: *Individual responsible for the technical completion of the proposed work.*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
____
Phone Number: ____________________
FAX Number: ____________________
E-Mail Address: ____________________
Web URL: ____________________

ADDITIONAL KEY CONTACTS (use as many sheets as needed)

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
____
Phone Number: ____________________
FAX Number: ____________________
E-Mail & Web Address: ____________________

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
____
Phone Number: ____________________
FAX Number: ____________________
E-Mail & Web Address: ____________________

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
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Phone Number: ____________________
FAX Number: ____________________
E-Mail & Web Address: ____________________

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name: ____________________
Title: ____________________
Mailing Address: ____________________
____
Phone Number: ____________________
FAX Number: ____________________
E-Mail & Web Address: ____________________

ADDITIONAL KEY CONTACTS (use as many sheets as needed)

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

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FAX Number:
E-Mail & Web Address:

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name: Buck Wilcox
Title:
Mailing Address: 3161 NE Flintlock Pl, Corvallis, OR 97330

Phone Number:
FAX Number:
E-Mail & Web Address:

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name:
Title:
Mailing Address:

Phone Number:
FAX Number:
E-Mail & Web Address:

Major Co-Investigator: *Individual responsible for the completion of major portions of the proposed work.*

Name:
Title:
Mailing Address:

Phone Number:
FAX Number:
E-Mail & Web Address:

Contents

Executive Summary

NCER Assistance Agreement Project Report Executive Summary

March 31, 2008

EPA Agreement Number: SU833535
Project Title: Sustainable Biofuel Systems for Undeveloped Regions
Faculty Advisor: Dr. David Hackleman, Linus Pauling Chair of Chemical Engineering
david.hackleman@oregonstate.edu
Institutions: Oregon State University, Corvallis, Oregon
Student Team Members, Departments and Institutions: Samantha C. Lewis, Tyler W. H. Backman, Buck Wilcox, Lucas C. Friedrichsen, Nikhil Prem, Jessica Varin, Chris Bates; Chemical and Environmental Engineering, Mechanical Engineering, Cell and Molecular Biology, Zoology, Physics, Anthropology, Business
Project Period: September 2008-August 2010

Description & Objective of Research:

The lack of sustainable alternatives to petroleum fuels is a critical global concern. Although several alternatives exist, severe technical challenges as well as lack of acceptance by industry and the public have stunted widespread adoption of these innovations in the US and abroad. Several high GDP countries, including the US, have made significant strides towards implementing alternative fuels. In research and infrastructure development, the developing world is often neglected. Renewable fuels have the potential to immediately impact environmental quality. We cannot hope to protect our physical environment and preserve biodiversity if climate change is perceived as the domain of the wealthy.

Addressing the economic conditions and technical challenges of the developing world requires innovation. Our Phase I P3 Proposal aimed to study the feasibility of vegetable-oil based fuels, however our Project Team ultimately explored the implementation of several non-vegetable-oil based energy sources that were deemed promising. The project was completed as a case study that could be adapted to different geographic and cultural regions.

Through an Oregon State University (OSU) alumni now working for the Peace Corps, we established a relationship with the village of Narukunibua in Navua District, Fiji. The village represents a real location in the Namosi province with particular limitations representative of those in most remote, “undeveloped” areas. The primary use of fuel in the village is a diesel generator that provides the only electricity. The goal of the Phase I P3 Project was to explore the feasibility of implementing alternative energies within the unique social, economic and environmental conditions of these regions. We identified obstacles to renewable energy implementation that are specific to developing nations, investigated which alternative will work best in the model environment, developed sustainable methods of production that work within the limitations, and incorporated traditional knowledge of the target community in production methods.

Summary of Findings:

We evaluated our findings based on the level of integration of sustainable methods, feasibility of implementation within the target community, and the quantity of energy produced in relation to community needs. Particular emphasis was placed on development of a production method that is viable beyond the initial project period. This project has proven to be valuable as an educational tool, providing a rare opportunity for students to meld the technical, environmental and cultural elements to system design.

Our Team developed a sound methodology to assess the environmental and social impacts of several alternative fuels based on the concept of an Environmental Impact Assessment (EIA). Ultimately we narrowed the list of feasible fuel technologies to three: biodiesel (using vegetable oil produced by algae), compressed methane gas from the villages' solid waste, and straight vegetable oil (coconut oil). The villages' diesel generator may be altered to burn any of the three alternatives. We found that direct micro expelling of coconut oil provides the easiest method of fuel production and sustainability for the village. Excess oil also produces a useable commodity for the community- it can be used in cooking or traded for goods.

In addition to sustainable fuels, our team evaluated other energy potentials such as wind and solar. Many have the perception that providing sustainable technology involves the use of only one appropriate technology. Case studies have shown that in many environments, a combination of technologies serve as the most adequate form of clean energy. Our goal in this project is to provide Narukunibua the most sufficient energy package, not necessarily the most appropriate technology.

Conclusions:

The planned technology of use will be the currently used diesel engine. We will be adapting the engine so that we can use coconut oil as an energy source. With our research, we found this set up to be most appropriate due to the high price of ethanol and unavailability of necessary catalysts to produce biodiesel. This project will require at least three trips to Fiji for site assessments and construction operations. The project will also involve intensive design and prototype development here in the United States prior to the construction in Fiji.

We also determined that it would be most appropriate to use coconuts as an oil source since village members know the crop very well, allowing the technology to blend into the current culture with little changes to the lifestyle of Fijians living in Narukunibua.

Proposed Phase II Objectives & Strategies:

We propose a second phase of this project containing five stages:

1. Reconnaissance (2 weeks). A visit to the actual project site for planning and assessment of previously unforeseen factors.
2. Fine-tuning (12 weeks). Modification of the design we produced through our research, identification of suppliers in the region of the project site and acquisition of materials.
3. Construction (2 weeks). Return to the project site and construct a sustainable fuel system.
4. Continued Involvement and Maintenance (52 weeks). Maintain contact with the model community for a one-year period after the system has been implemented, ensure that the project objectives have been met, and make any necessary repairs or corrections to the system.
5. Modular Development (26 weeks). Use what we have learned from the P3 experience to develop educational and implementation tools that will aid other institutions and communities in developing and building their own sustainable fuel systems in undeveloped regions.

Three people total will be required for the reconnaissance trip including an engineer/mechanic, an environmental expert, and a cultural/education expert. The second trip will consist of the same three people, plus two additional people with engineer/mechanic skills, and a professional engineer (our PI). After one year of operation, the third trip (consisting of the same 3 people as the reconnaissance trip) will be made to ensure that the project objectives have been met.

By completing this project in the next two years, the village will successfully switch from a petroleum based fuel to coconut oil. This project meets P3 requirements since it offers the unique possibility of filling the economic need for renewable fuel production, the environmental need of reduced greenhouse gas emissions, and the social needs of environmental education and stabilization of fuel dependency.

Publications/Presentations:

Focus of the Nation Presentation (OSU): Talked about biodiesel potential and the Fiji P3 project.

OSU Engineers Without Borders General Meeting: Presented in front of a group for project recruiting and making an official partnership official.

OSU Engineers Without Borders Board Meeting: Presented in front of the board to draw interest in P3 project.

Supplemental Keywords:

Keywords: biodiesel, vegetable oil, pollution prevention, renewable fuels, petroleum, economic barriers, social barriers, technology transfer, coconut oil, oil extraction, methane, environmental education.

Relevant Websites:

OSU Biodiesel Initiative: http://biodiesel.oregonstate.edu/
OSU Engineers Without Borders: http://groups.engr.orst.edu/ewb/

Summary of Phase I Results

Background and Problem Definition:

Energy dependency in the rural third world has many socio-economical and environmental problems. Due to the high cost of petroleum based fuels and shipment requirements over long distances, petroleum fuels are inadequate for powering villages. The adoption of sustainable alternative energy sources in rural regions will make significant improvements to the local environment, the rural economy, and to the global climate status quo. The specific objectives of the project were to:

1. Identify obstacles to renewable energy implementation that are specific to developing nations.
2. Investigate which alternative will work best in that environment.
3. Develop sustainable methods of production that work within the limitations.
4. Incorporate traditional knowledge of the target community in production methods.

We evaluated various energy options based on several factors including the level of integration of sustainable methods, feasibility of implementation within the target community, and the quantity of energy produced in relation to community needs. In addition, particular emphasis was placed on development of a production method that is viable beyond the initial project period. Our Team developed and implemented a sound methodology to assess the environmental and social impacts of several alternative fuels based on the concept of an Environmental Impact Assessment.

An Environmental Impact Assessment may be defined as: "The process of identifying, predicting, evaluating and mitigating the biological, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made."(Institute of Environmental Assessment). The Environmental Impact Assessment assures that the various energy sourcing schemes were sufficiently investigated, that the most appropriate energy technology has been selected, and that the assumed impacts of the selected technology is tractable while causing no immediate or long-term negative impacts within the implementation community.

We also developed what we call the technology matrix, a visual method of comparing the advantages and disadvantages of each technology. Ultimately we used these techniques to narrow the list of feasible technologies to one: straight coconut oil, which the villages' diesel generator may be altered to burn. We found that coconut oil obtained via the process of direct micro expelling provides the easiest method of fuel production and sustainability for the village. Excess oil also serves as a useful commodity for the community- it can be used in cooking or traded for goods.

This project thus far has proven to be extremely valuable as an educational tool, providing a rare opportunity for students to meld the technical, environmental and cultural elements of system design. OSU undergraduates in the College of Engineering, College of Science, Honors College and other programs were able to come together to facilitate deeper thinking on energy issues and sustainability while emphasizing creative problem solving. Team members with expertise in anthropology aided in the design of a comprehensive stakeholder analysis, while science and engineering majors evaluated the various alternative technologies we considered for the model site. Our Project Team also organized community outreach events, such as an all-campus Student Sustainability Fair, giving students an opportunity to inform others about this project and related sustainability concepts.

Purpose, Objectives and Scope:

Alternatives to petroleum fuels meet P3 objectives because they offer the unique possibility of filling the economic need for renewable fuel production, the environmental need of reduced greenhouse gas emissions, and the social needs of environmental education and stabilization of fuel dependency. Our Phase I purpose was to develop a sustainable energy system for a remote undeveloped region that would be derived from a readily available, cheap and renewable source while incorporating local cultural knowledge and environmental education in production methods.

We limited the scope of the project to developing a system applicable to a small village of less than 200 people, i.e. the size of the model village. While larger villages exist in the Namosi Province of Fiji, we believe that the size of Narukinubua is such that we can implement our system while still being able to interact with all community members and receive their input as the project progresses. Several other groups, including research universities and non-profit organizations such as the Global Sustainable Energy Island Initiative, have previously explored implementing liquid biofuels on a large scale in the Pacific Islands. While these organizations can positively influence the implementation of sustainable practices at the national level, our project is unique in targeting the rural villages that are cut off from Fijis' few industrialized centers.

We addressed the initial research from three different angles: anthropological, environmental, and technological. We split into two student teams (one technical and one environmental/anthropological), identified key questions that would shape system development and set about answering them. Sample questions include:

EIA Group (Environmental/Anthropological)

How will the implementation of an alternative fuel system impact the daily lives of target community members? What are their needs? Is it enough to transition to a more sustainable energy production system or should we increase the amount of energy available for their use? How will this impact the community structure, politics and gender roles? What is the current attitude of the community towards environmental conservation?

What is the carbon footprint of the village and how will it change with our various proposed systems? In what ways will our system impact the environment? How will we measure the impact (air quality, water quality, etc)? What natural resources are available? How sustainable is our proposed system?

Technological

Is it possible to supply all electricity currently used with sustainable sources? How will we get materials to the site? How do costs and benefits compare between various solutions? Is there physical space for the proposed system? How feasible will it be to maintain after the project period? What level of continued involvement will be required?

The majority of the anthropological questions were answered by administering a survey directly to those living in the village. These results facilitated the development of a "stakeholder analysis." We determined which person or groups of people have any connection to the project, then rated their attitudes towards the project, ranging from "strongly in favor" to "strongly opposed". In addition, we estimated the level of influence a person or group of people have on the project, ranging from "high" to "low." For example, the Village Chief was "strongly in favor" and "highly influential." Other Key Questions were addressed within the Environmental Impact Assessment and technology matrices.

Majority of the technological questions were answered using technology matrices which helped identify which energy resource would be most suitable for Narukunibua. Attached is an example of what the technology matrix looks like.

Objectives

The four general objectives we originally proposed in Phase I were broken down into manageable tasks as such:

1. Identify obstacles to renewable energy implementation that are specific to developing nations.
   - Perform stakeholder analysis.
   - Develop a comprehensive picture of the cultural environment through library research.
   - Develop a comprehensive picture of the physical environment (i.e. potential project site) through on-site alumni.

2. Investigate which alternative will work best in the model environment.

- Write Environmental Impact Assessment for implementation of a sustainable energy system.
- Create a Technology Matrix for each considered alternative energy source.
- Use matrices to perform an analysis of cost (monetary, environmental, personnel, etc) and sustainability for each alternative.
- Identify an alternative that is optimal, with regard to the Technology Matrix criteria.

3. Develop an implementation plan

- Begin design of the system, tailoring to the model community.
- Identify possible sources of necessary goods and materials.

4. Incorporate traditional knowledge of the target community in production methods

- Talk with the villagers and find out what related traditional knowledge they possess
- Incorporate that knowledge into the design to improve the suitability of the energy system to the particular village

Data, Findings Outputs/Outcomes:

We ultimately narrowed the choice of alternative fuel technology to three: biodiesel, methane and straight vegetable oil. We also included the analysis of wind and solar as potential alternatives or supplements to the overall project.

Biodiesel

While biodiesel is an excellent fuel and is a large focus for our organization, it is not the appropriate fuel for the Narukunibua village. The primary reason that biodiesel is insufficient is that it requires the use of a highly concentrated alcohol such as ethanol or methanol. These alcohols are very difficult to produce and require expensive energy intensive systems such as distillation columns or flash units, posing technical difficulties in the village environment. Local ethanol and methanol prices are very expensive, making it difficult to purchase. In addition to alcohol challenges, a catalyst such as sodium hydroxide or potassium hydroxide is necessary. These chemicals are difficult to find and are not readily available in the village.

Wind

Wind is an excellent clean energy resource that has solved many villages' energy problems around the world. From our research, we found that wind would be insufficient in Fiji due to the low wind speeds of about four meters per second (SOPAC). A wind project is a mechanical system that requires a highly trained engineer with relevant training and experience. Such expertise may be difficult to have at all times in the village The Fiji Department of Energy does not sponsor wind projects in rural areas, but instead sponsors diesel, solar, and hydro projects. Typhoons also pose threat to wind turbines which consistently pass through the region.

Solar

Solar is a great energy source since it is simply taking sun rays and converting it into electricity, having little impact on the planet. Unfortunately since the Namosi region (Narukunibua's Province) has about 3 meters of rain fall annually, the region gets little sunshine. Due to the unavailability of sunlight, solar will not be a sufficient energy source.

Methane

Anaerobic digestion of feces and organic matter (copra wastes) has proven to be a reliable method of production of methane gas for combustion and electricity generation in undeveloped regions. Compost of organic waste in a machine that limits access to oxygen encourages the generation of methane and carbon dioxide by microbes in the waste. This gas can then be burned as fuel to make electricity.

We investigated displacement style digesters due to their simplicity of operation and maintenance. In this scheme, methane would be gleaned from the top of the digestion container and compressed into storage tanks for on-site use or potential resale. The leftover "waste" slurry mixture is also a useful byproduct, as it is an ideal crop fertilizer. [Methane: Planning a Digester]

While methane digestion for generator combustion makes use of on-site materials, aids in rural waste management, provides fertilizers and is easy to implement, there are several negative balancing aspects to take into consideration that caused us to ultimately decide against implementing methane technology. This system design requires waste handling which increases the probability of spreading disease that many villagers are averse to. Additionally, diligent training is required for whoever will maintain the system. Gas collection and compression is potentially dangerous; when compressed methane suddenly comes into contact with oxygen it may become explosive. Finally, methane gas has a very low lubricity within diesel engines, thus requiring modification of the village diesel generator that is beyond the budget and expertise of our project team.

Coconut Oil

Coconut oil was chosen as the premier fuel solution for this region for a variety of reasons. Villagers currently utilize knowledge of coconut harvest, production and processing which translates into an easier transition to create coconut oil for fuel. Waste is also non-existent in this model as the coconut remnants (copra) are utilized for cooking, as fuel for drying the coconut meat or broken down into organic fertilizer. The coconuts are harvested from a close 50 acre plantation that is not currently utilized. Additionally, destruction of precious resources is not necessary to harvest coconuts and produce fuel for this project.

The Direct Micro Expelling process (DME) our Team recommends is a simple way for the villagers to extract the most from the coconut. DME is a process used to extract coconut oil from freshly grated coconuts. The process uses a cold pressing unit that extracts oil from finely grated, fresh, semi-dry coconuts. The process requires coconut meat to first be grated and then dried to a moisture level of 9-12% by using a surface-type drier. Virgin coconut oil is extracted with little effort and retains more nutritious components compared to other methods of processing. Since the village already uses coconuts for food, use of the DME process will allow them to more efficiently extract oil and coconut meat for both food and fuel.

Straight vegetable oil, coconut oil in this case, requires little additional processing to burn in a diesel engine. Filtering is accomplished by letting the oil sit for a week as the particulate matter sinks to the bottom. Heating of the coconut oil is required to lower the viscosity and avoid damage to the engine. Simply recirculating the waste heat from the generator's coolant through the coconut oil will raise the temperature sufficiently to promote complete combustion and engine protection. Overall, using coconut oil for this project proved to provide an efficient, simple and sustainable method of energy production.

Stakeholder Analysis

The stakeholder analysis is a method used to determine which person or groups of people have any connection to the project. It gives ratings on their attitudes towards the project, ranging from "strongly in favor" to "strongly opposed". In addition, it estimates the level of influence a person or group of people have on the project, ranging from "high" to "low". The qualitative analysis is based on technical deliberation and thought. Each reporting value has a paired confidence prediction, ranging from "fully confident" to "a wild guess". This estimates the accuracy of the prediction. (Example: We are fully confident that Stakeholder A is strongly in favor of the project)

The stakeholder analysis of this project can be found in the attachments. It shows that all people or groups of people connected to the Fiji project are strongly or weakly in favor of the proposed sustainable energy source. While we are off to a good start, it is essential that the project maintains these high attitudes through public relations with all the stakeholders. We concluded that to have continual support from our stakeholders, we must take the initiative. It was decided that the village chief is a high stake holder and should receive frequent updates on the project.

The Peace Corps is also a very important organization since it is the only group that we know financially capable to employ a full-time individual in that region to support our project. Thus, having and maintaining a strong relation with the Peace Corps region manager will prove to be not only beneficial, but essential. Since the church and priest have a strong influence in the region, during all trips to Fiji, the team should meet with church officials early in the visit as well as prior to departure. It will demonstrate our support and understanding of the local religion and recognition of their value in the community. Local government officials may also have a strong impact on the project. They could also be potential funders of the project, so it would be a good idea to contact officials and apply for any grants on alternative energies that may exist within Fiji.

Impact on Local Culture

Before introducing a technological change for energy production, it is critical to understand the culture of Fiji, in particular social and cultural characteristics of people living in the rural village of Narukunibua. It is important to consider the social priorities, identity formation, and the cultural ecology of the people. A key element in our efforts to learn about the culture is our informant, Isaac Sunderlund, as he has developed a rapport with people in the village. To triangulate our research design, we will consult published anthropological research on Fijian Culture and interview key informants from the village of Narukunibua. Our stakeholder analysis will contribute to understanding the people's values that surround the use of electronic media, energy, and the introduction of new technology.

Regarding social priorities, Isaac has listed them for the people of Narukunibua as follows: 1) church (Catholic), 2) family/tribe/community, 3) education, 4) other. Due to the high importance of church influence, Isaac intends to work more closely with the local priest. The Catholic Church may serve as a networking hub if a biofuel is deemed an appropriate technology to introduce to the village. Still, this will depend greatly on how the people of the village identify with each other and their environment.

Generally, Fijian cultural identity revolves around serving the greater social good of the community that includes an attachment to the place and land as common property (Brison 2007; Miyazaki 2004; Becker 1995). As we proceed, we must be aware that the introduction of new technology, processes, or simply the increase in amount of energy may have unintended consequences that can negatively impact cultural identity. An increased desire for more energy could disrupt community unity by increasing the ability of individuals to use computers, televisions, and DVD's (which Isaac has reported are present in the village). An increase use of electronic media could detract from traditional social interaction. Whether or not the use of this media contributes to the adoption of new forms of social interaction will depend on feedback mechanisms (Harris 1979 and 1999). These mechanisms within the village's culture will select preferred social behaviors. Thus, it is important that the introduced technology promote and maintain the cultural identity and traditions of the village. If not, the willingness to learn the skills necessary to maintain a new technological system or provide the labor for a new technological process could be a barrier, too.

Understanding the cultural ecology (human interactions with their environment) of Fijian culture and Narukunibua is also critical before introducing a new technology. The Fiji Energy Proposal (2004) promotes rural electricity programs and independent producers. Yet, more energy will be required to appease an increased desire to use electronic media. If harvesting coconuts for energy oil and food surpasses the productive capabilities of the village's trees, this will have a negative impact on coconut ecology. Introducing micro-wind and solar to diversify and supplement the village's increased demand for energy can help to alleviate potential stress on coconut ecology and allow for a more consistent supply of energy. Still, barriers specific to Narukunibua must be considered. For instance, cyclones could make it difficult to establish and maintain a wind turbine or an extended rainy season could render solar panels ineffective for part of the year. To meet the village's desire for more energy, technology should be proposed that will support the environmental and behavioral infrastructure that shapes the village of Narukinubua. Because a system maintaining feedback will tend to preserve the existing infrastructure (Harris 1979 and 1999), it is critical for new technology to support that infrastructure to facilitate its adoption into the culture.

Our project was successful in that we were able to identify the inherent obstacles to implementation of alternative energy systems in undeveloped regions, develop a sustainable energy scheme that will replace village reliance on fossil fuels and incorporate the knowledge base and will of the community. However, the research aspect of the project took longer than expected and we were not able to perform experimental trials with coconut oil on our test generator. Our partnership with the OSU chapter of the Engineers Without Borders provided international expertise and allowed us to share skills and knowledge.

Discussion, Conclusions, Recommendations:

Since coconut oil and a diesel generator are already part to the village's existing infrastructure, these technologies are ideal starting points to introduce a renewable energy solution. Diesel engines require low viscosity (thin) oils for fuel. Most diesel engines will run well on any oil that is 20 cSt (centistrokes) or lower (thinner). At normal operating temperature, diesel fuel is under 5 cSt and biodiesel is under 6 cSt, making them both suitable fuels. Vegetable oil however is about 30 cSt, which can cause damage or prevent the engine from running. By heating the vegetable oil over 160 degrees F, it can be thinned enough to allow the engine to run flawlessly. One way to do this is to start the engine on regular diesel fuel and use the engine coolant to heat the vegetable oil through a heat exchanger as it warms up. Once the oil reaches a temperature where it is thin enough to use as fuel, the engine is switched over to the heated oil, and then switched back before shutdown so that it can start the next time on regular diesel fuel. This method still requires use of a small amount of diesel fuel for startup and shutdown, but eliminates the need for the equipment and supplies required for biodiesel production. Several members of the OSU Biodiesel Initiative have successfully designed, built, and used vegetable oil heating systems on diesel engines.

Proposal for Phase II

P3 Phase II Project Description:

Challenge Definition and Relationship to Phase 1

We evaluated our findings based on the level of integration of sustainable methods, feasibility of implementation within the target community, and the quantity of energy produced in relation to community needs. Particular emphasis was placed on development of a production method that is viable beyond the initial project period. This project has proven invaluable as an educational tool, providing a rare opportunity for students to meld the technical, environmental and cultural elements system design. Our Team developed and implemented a sound methodology to assess the environmental and social impacts of several alternative fuels based on the concept of an Environmental Impact Assessment. Ultimately we narrowed the list of feasible technologies to three: biodiesel (using vegetable oil produced by algae), compressed methane gas from the villages' solid waste, and straight vegetable oil (coconut oil). The villages' diesel generator may be altered to burn any of the three alternatives. We found that direct micro expelling (DME) of coconut oil provides the easiest method of fuel production and sustainability for the village. Excess oil also produces a usable commodity for the community- it can be used in cooking or traded for goods.

Although we determined the best method for sustainable fuel production, our team must refine the process before venturing to the target location. Phase II will permit our team to locally procure a DME press, hone the oil refinement process and test the feasibility of engine modifications. After completing these items and producing educational materials for the village we will implement our procedure at the target village in Fiji. Visiting the village permits our group to directly observe and analyze potential issues firsthand. The project is sustainable, local and educational, and provides economic opportunities though we are limited by coconut availability.

Innovation and Technical Merit

Our vegetable oil system design consists of 3 major components: coconut oil extraction, external oil collection, and engine fuel conversion. The coconut oil extraction system allows the village to obtain high grade coconut oil from coconuts using the Direct Micro Expelling (DME) process. The external oil collection system allows the village to transport coconut oil purchased elsewhere to their village using an existing vehicle. Lastly, the engine conversion system allows for the existing generator to be run on coconut oil, rather than diesel fuel.

We will derive the coconuts for our coconut oil from a local unused coconut plantation. DME will be used to extract oil from finely grated, fresh, semi-dry coconuts. The process requires coconut meat to first be grated and then dried to a moisture level of 9-12% with a surface-type drier. Surface-type driers are effective in Fijis' high ambient temperature, and in addition, coconut husks may be burned to heat the coconut flesh if necessary. The oil is then set aside for one week to allow particulate matter to settle out. The oil is then ready for use in the diesel generator. Before injection, the oil must be heated to reduce its' viscosity and allow appropriate combustion in the diesel generator. Heating of the oil can be accomplished several ways; however two options are tractable in this context. First, a coolant recirculation system that could circulate engine coolant around the coconut oil storage tank. This method will reuse the waste heat of the engine to raise the temperature of the oil to the appropriate level for use. The second method would utilize solar energy to raise the temperature of the oil. Either method would be equally feasible.

The DME process incorporates input from a variety of stakeholders. The Environmental Assessment Group and design team comprised of engineering, business and anthropology students collaborated to determine the feasibility of the design. The interaction included discussion about environmental impact, social impact, and technical feasibility. Additionally, the DME process promotes a large range of benefits over the standard copra making process. First, oil can be extracted faster, generally within 1-1/2 hours after cracking open the coconuts. Second, immediate pressing of the coconut meat reduces mold production generally associated with storing or transferring the coconut meat. Third, pressing through the DME process retains higher levels of nutritious free fatty acids, extra vitamins, anti-oxidants and promotes a longer shelf life.

DME has a few tradeoffs, most of which involve labor of the villagers. Fuel production would require someone to extract and grate the coconut meat, operate the manual or electric press to produce the oil, store and monitor the oil and finally manage the diesel generator. Management of the generator requires starting on diesel fuel for the warm up cycle, switching to vegetable oil for the majority the running duration and then back to diesel to shut down the generator.

All of these factors would be easily mitigated through education of the villagers. A low cost vegetable oil tank trailer will allow the village to collect coconut oil produced by other villages, or sell their own as a low cost commodity in nearby towns. The trailer will consist of a plastic tank safely mounted to a used small boat trailer frame. This trailer will also include a small hand-operated pump for transferring coconut oil between the on-trailer tank, and stationary oil tanks on the ground. Since the village has access to a light truck with towing capability (owned by the Chief), this trailer will provide a means to use an alternate source of coconut oil if the village experiences a temporary shortage of coconuts, or an equipment failure with the oil extraction system.

The average light truck or mid-sized car has a safe towing capacity of around 1,400kg, while the estimated dry weight of the fuel trailer is around 200kg, leaving 1,200kg for coconut oil. Coconut oil has a density of about 0.925 Kg/L giving an overall trailer capacity of about 1,300 liters. Since the estimated coconut oil consumption of the village is 300 liters per month, a single trailer load would provide over four months worth of fuel. This makes the trailer system potentially useful even in villages without a vehicle, if they were able to borrow or hire one once every four months.

The viscosity of fuel is a critical characteristic which affects both the longevity of a diesel engine, and it's ability to start easily. Previous research shows that nearly any diesel engine can operate reliably on straight vegetable oil, provided that the oil is heated to a sufficient temperature, such that its viscosity is similar to that of diesel fuel (tickell). While several existing designs for vegetable oil engine conversion systems exist, none simultaneously meet our criteria of low cost, and high engine reliability, necessitating a new design.

We have designed a novel system that will allow for quick and simple conversion of the village owned diesel powered generator into a dual fuel engine capable of running on both diesel fuel and coconut oil. Our system will be a self contained device that can be installed on nearly any diesel generator in a few hours. The system uses a microcontroller which continuously monitors the temperature of the vegetable oil and fuel, and automatically switches the engine to run off regular petroleum diesel for brief periods while the engine is warming up and cooling down. This protects the engine from possible damage caused by starting the engine cold on coconut oil.

Existing vegetable oil conversion systems utilize a heated fuel tank to gradually heat the fuel using excess heat from the engine. Our system uses a small volume coolant to fuel the heat exchanger in conjunction with electric heat produced with recycled diesel glow plugs. By heating only a small volume of fuel at a time, the fuel will reach much higher temperatures in significantly less time, reducing the amount of petroleum diesel required for engine warm up and cool down cycles. While the system requires petroleum diesel (or biodiesel) for starting and shutdown, it uses a very small volume each time the engine is started or shut down. With a coconut oil consumption of 300 liters a month, we estimate that no more than 10 liters a month of biodiesel or petroleum diesel will be required for daily cold starting and shutdown.

We will develop several revisions of the self-contained engine conversion device before installing the final device for the village. We have a small diesel test generator, donated by the US Coast Guard, which will allow us to perform a long term reliability test on the final device before installing it for the village. The donated generator is nearly identical in design to the one utilized in the village and in other remote areas around the world. We have already begun constructing a prototype device for tests.

To ensure that other villages will be able to utilize our design for converting their diesel generators, we intend to publish the plans for reproducing the device in the public domain, with easy to follow instructions. Some organizations previously made plans that require tools and technical skills that many villages do not have. Our plan will use more basic tool and skill requirements so that the project can be successful anywhere. Once installed, the device should have a service life significantly greater than the generator itself, and will not require any additional maintenance. If the device were to fail, the design is such that the generator can continue to operate on petroleum diesel or biodiesel (but not vegetable oil) until the device is repaired.

Relationship of Challenge to Sustainability

The environmental footprint and protection of the environment of this project is paramount. Protection is accomplished through the use of fuel produced locally instead of fuel transported from another continent, reducing waste in transportation. Coconuts are harvested from a close plantation that is not currently utilized and destruction of precious resources is not necessary to harvest coconuts and produce fuel for this project. Waste is also non-existent in this model as the coconut remnants are utilized for cooking, as fuel for drying the coconut meat or broken down into organic fertilizer. Using biofuel based products, such as pure coconut oil instead of petroleum based products will reduce harmful emissions. A reduction of non-renewable resources such as petroleum based diesel is also realized by using a renewable biofuel based solution.

Accomplishment of economic prosperity is five fold. First, the villagers save money by not purchasing petroleum diesel. Second, excess coconut oil and coconut byproducts will become available for local village use or trade/resale to other villages. Third, increasing the skill set of villagers will provide more marketable skills for them to use on the island, allowing them to trade or barter for other items of use. Fourth, development and utilization of locally produced fuel for electricity will allow the village to use more electricity efficiently and ultimately meet their needs. Fifth, initial design costs, continued diesel generator maintenance and project costs were evaluated to ensure sustainability of the project.

Measurable Results (Outputs/Outcomes)

Metrics, crucial for any project, are especially important when the economic viability, human prosperity and world impact are considered. Goals and timelines for Phase II will be discussed amongst the design team after soliciting input from the faculty advisor and appropriate partners, including the villagers. Specific milestones will be established from these discussions to steer the direction and completion of the project. A project schedule complete with milestones will be established to hone the focus of the project teams. These goals will be achieved through the diligence of the team and completion of the milestones associated with the project schedule. Continuous collaboration with the Fijian government and villagers will be used to assess the level of completion against our own milestones.

Outputs of this project include:

1) Reduced greenhouse gas emissions from the transportation of petroleum based diesel from Australia to Fiji.
2) Reduction of non-renewable petroleum based fuel usage.
3) Increase in human prosperity through the reduction of petroleum based carcinogenic emissions from the local diesel generator.

4) Improved villager prosperity through education.
5) Enhanced knowledge and awareness of alternative fuel methods for community constituents, students and team members.
6) Provides another skill for villagers to master and potential economic benefit through the availability of coconut oil for trade/resale.
7) Development of a sustainable process for extracting coconut oil and use in a diesel generator.
8) Greater economic independence for the villagers due to local fuel production and.

Evaluation Method

The project's evaluation will be based off of the completion of tasks outlined in the schedule. In addition to completing tasks, the project will be considered successful only when the main objective is complete: the village of Narukunibua has a sustainable and cheap energy source that replaces diesel.

Demonstration/Implementation Strategy

The strategy that will be used was mentioned earlier in the document. It will involve three trips: a reconnaissance, construction, and a 2nd reconnaissance trip if needed. The trips and the time periods between the trips are outlined below.

1. Reconnaissance (2 weeks). Site assessment.
2. Fine-tuning (12 weeks). Modification of the design.
3. Construction (2 weeks).
4. Continued Involvement and Maintenance (52 weeks). Maintain contact
5. Modular Development (26 weeks). Document and publish work.

Integration of P3 Concepts as an Educational Tool

Educationally, the P3 project has provided many benefits to the team members and local communities. First, the Alternative Fuels Forum held on the Oregon State University campus last year was a huge success. Many community members and students attended for friendly discussion about positive change for our energy future. Localized fuel production was one of the highlighted topics utilizing research from the P3 project.

Second, team members expanded their understanding of energy balance, environmental impacts, economic factors and social implications of localized fuel production.

Third, collaboration amongst members with interdisciplinary backgrounds provided improved insights and enhanced the educational impact of all of the team members.

Fourth, the OSU Biodiesel Initiative provides educational tools and information to the local community during university events such as the OSU Beaver Community Fair. Students, faculty, staff and community members were educated about biodiesel, straight vegetable oil and the positive impacts on the prosperity of the planet. The OSU Biodiesel initiative will also continue to have a booth at the yearly Da Vinci Days in Corvallis, Oregon. This educational medium allows our Team to demonstrate our efforts throughout the P3 project to increase faculty, staff, student and community member's awareness of our sustainable fuels design model.

Further awareness will be provided through a website that will detail our entire project and the associated impacts on people, their prosperity and the impact on the planet. Phase II will further capitalize on the educational benefits of this project. Continued research and refinement of the oil extraction process will enhance team member's knowledge. This research allows our team the opportunity to pass this knowledge to our on-site project representative and the villagers of Narukunibua to allow sustainable local fuel production.

Modular Development

We plan to use what we have learned from the P3 experience to develop educational tools and curricula that will aid other institutions and communities in developing and building their own sustainable fuel systems in undeveloped regions. Specifically, we propose to write grade 9-12 level lesson plans for use in undeveloped regions and technical documents to facilitate system construction in other, similar communities. These lesson plans will help other groups who are implementing alternative energy schemes overseas to nurture the knowledge base of their target community and facilitate the transition from "external" to "internal" maintenance.

Additionally, wide distribution of these materials will allow rural communities worldwide to instigate the transition to sustainable energy sourcing independent of external programs. Fundamental to our project mission was that our research and conclusions benefit other rural undeveloped communities worldwide. We propose that these educational materials will allow our findings to be applicable in other contexts due to the high reproducibility of our system design. The project will be compiled in an easy to understand format and will be freely available to anyone that would like them through the internet. The OSU College of Engineering will host the necessary webpage and will pay for the web design and maintenance.

Project Schedule:

The team will follow a timeline to assure that adequate progress is made. The following Gantt chart and bulleted objectives will help outline our proposed schedule. We plan on having at least one meeting and one work session every week. The team will be split into 2 different groups: The Environmental Impact Assessment group and a design group. Our progress will be documented through the environmental impact assessment (EIA) paper and communication to the public will be maintained through website use and email distribution.

Project Objectives for Spring 2008: Prototype Construction

- Purchase a direct micro extraction coconut press and test for functionality to develop a formulated procedure of operation.
- Maintain Community involvement for publicity and support.
- Construct oil/mesh separation tray that has the capability to dry the mixture using a flame. The source for the flame will be the coconut shell remains.
- Maintain Community involvement for publicity and support.
- Purchase coconuts and begin testing the prototype.
- Get sponsorship from the Fiji Department of Energy and continue collaboration with the local village officials.
- Document a detailed description of the design and add it to the EIA document.
- Begin quality and cause-effect matrices for the EIA.
- Receive grant from P3 so that that the project can continue.

Project Objectives for Fall 2008: Trip Planning and Prototype Testing

- Analyze the quality of the oil that is produced using gas chromatography techniques.
- Maintain Community involvement for publicity and support.
- Set up the engine and begin testing the coconut oil for energy efficiency.
- Plan the site assessment trip for winter break.
- Evaluate environmental aspects of the full design with the engine and change any matrices in the EIA if needed.
- Begin predicting magnitudes of the impacts.
- At the site assessment:
- Verify EIA accuracy and update as needed.
    - Meet political leaders, diesel generator operators, and other members of the village to discuss the proposed plan in detail.
    - Verify coconut source and document its full potential.
    - Find where the required materials could be purchased within the village or nearby villages.

Project Objectives for Winter 2009: Site Assessment Follow-up

- Discuss outcomes of the first site assessment.
- Change design as needed.
- Maintain Community involvement for publicity and support.
- Begin the arrangements for purchasing and shipping materials.
- Finish the Environmental Impact Assessment.

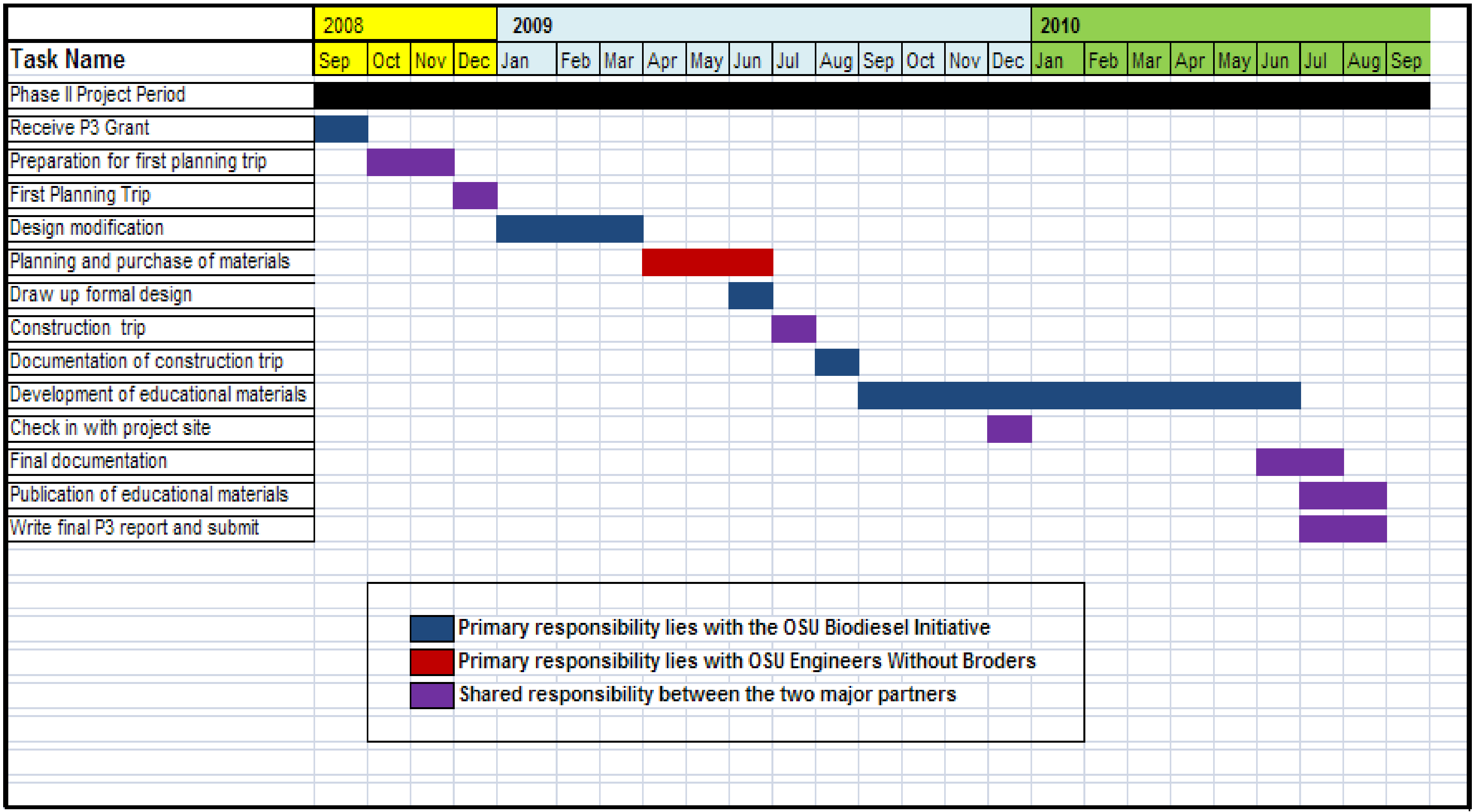
- Plan a second site assessment if needed.

Project Objectives for Spring 2009: Application and Training

- Update all documents and finalize procedure of operation.
- Practice training individuals by setting up a work shop for middle school children.
- Maintain Community involvement for publicity and support.
- Finalize shipment of materials.
- Plan summer trip and arrange travel.
- During summer trip:
    - Construct Coconut oil extraction system.
    - Test for functionality.
    - Finalize procedures of operation.
    - Train village members of operation.

Project Objectives for Fall 2009: Project Closure

- Analyze and document results.
- Keep contact with village officials and find out how beneficial the technology is.
- Maintain Community involvement for publicity and support.
- Plan a winter break trip to assess the functionality of the device and help troubleshoot any problems the village may have.
- Publish the document so that others can adopt our sustainable fuel project at other locations.



2008
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Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Phase II Project Period
Receive P3 Grant
Preparation for first planning trip
First Planning Trip
Design modification
Planning and purchase of materials
Draw up formal design
Construction trip
Documentation of construction trip
Development of educational materials
Check in with project site
Final documentation
Publication of educational materials
Write final P3 report and submit
Primary responsibility lies with the OSU Biodiesel Initiative
Primary responsibility lies with OSU Engineers Without Broders
Shared responsibility between the two major partners

Partnerships:

During winter of 2008, our organization (The Biodiesel Initiative) officially partnered with the Engineers without Borders (EWB) at Oregon State University, a non-governmental agency that plays a major role in international projects. EWB is a highly active organization on campus that has a current project in Al Salvador. The Al Salvador project aim is to provide clean drinking water to a local village. Every summer, winter and spring, the organization sends various students from all disciplines and professionals to Al Salvador to continue the project.

We believe that since EWB members have relevant experience and qualifications to international projects, they will be able to help guide our biofuels project in Fiji. With our technical skills and their international experience, both organizations will be able to successfully eliminate Narukunibua's foreign energy dependency status.

The organization currently provides no financial support, but has many of its active team members playing an integral part of the project. During the winter of 2008 we recruited many new participants from EWB who currently make up roughly a third of the team. The Biodiesel Initiative has a coordinator who maintains good communication and relations between the two organizations. He attends the meetings for both organizations and continually recruits new participants from the EWB organization.

During the previous few months, members from both organizations have been meeting at least once a week to discuss, research, and document technology options, Fiji culture and ecology, political history, demographics and more. The diagram below demonstrates the organizational layout of the partnership.

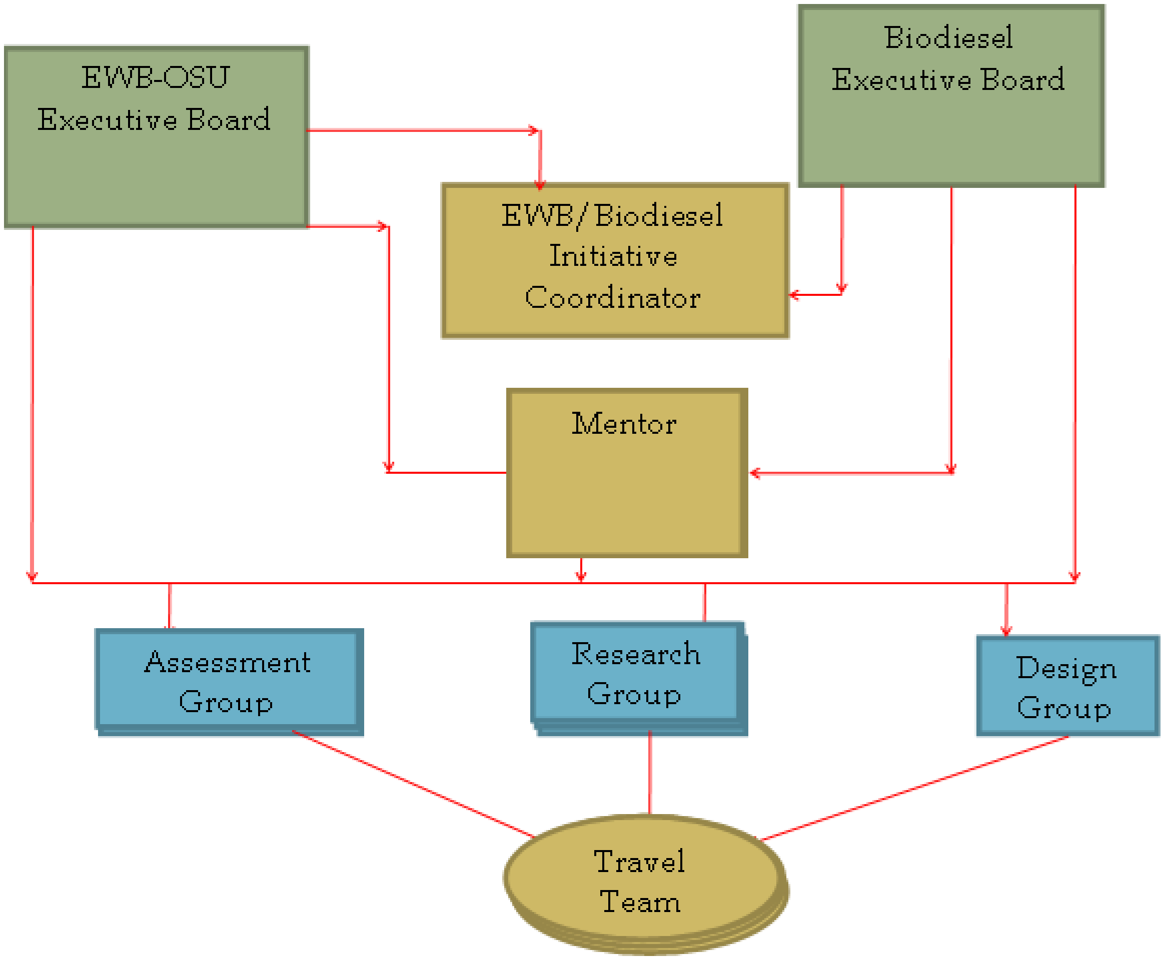

Figure: EWB/Biodiesel Initiative organizational layout

In addition to EWB, the Biodiesel Initiative has a partnership with the Peace Corps, which has assigned a graduate volunteer to the region. He will be our contact source in the region that will help maintain the progress of the project. Through this partnership, it will be easier for our organization to maintain relations with the local village representatives. It also makes our trips safer and more efficient since the volunteer will be able to coordinate the team's arrival and the transport of necessary equipment and supplies to the site.

We are currently working on building a partnership with the Fiji Department of Energy (DOE). We have already sent the DOE a letter (attached) that mentions our project, intentions and interest in working with the Fiji government. We believe that the DOE will be very supportive to our project and may even provide assistance since their organization strongly supports sustainable energy resources.

The Biodiesel Initiative wants to collaborate with all relevant organizations and clubs at OSU. Below is a list of other organizations that have smaller roles in the project.

- Student Sustainability Initiative
- Faculty Sustainability initiative
- Associated Students of Oregon State University- Environmental Affairs task force
- OSU Chapter- American Institute of Chemical Engineers
- Oregon State Alumni Assocation

Attached: EWB/Biodiesel Initiative Partnering Project Information From.

Important Attachments

References:

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<http://cptech.dost.gov.ph/Downloads/factSheet-Direct%20Micro%20Expelling.pdf
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SOPAC. Pacific Islands Applied Geoscience Commission. February 2008
<http://www.sopac.org/tiki/tiki-index.php>

Supporting Letters:

To: Fiji Department of Energy

OSU Sustainable Energy Intitiative
Oregon State University
Corvallis, OR 97331 USA
Contact: Wendy Peterman
wendybrddance@yahoo.com
541-971-1203

Hello:

I am writing on behalf of the OSU Sustainable Energy Initiative and Engineers Without Borders at Oregon State University to introduce you to our current overseas project. With the support of the US Environmental Protection Agency, we are working on a plan to help develop a more efficient, affordable and environmentally sustainable energy system to the village of Narukunibua in the province of Namosi, Fiji. Our team has been researching a variety of technologies to meet the energy needs of the village, including biodiesel for their existing diesel generator, pure vegetable oil combusters, wind generators, solar panels and methane burners. Through research and debate, we have come to the preliminary conclusion that a system that utilizes several of these technologies might be the best solution.

First, we propose making a simple modification to the existing diesel generators that would allow them to burn pure coconut oil. This way, the villagers could make their own fuel, using their own plantation of coconut trees and purchase additional oil domestically, which we project to be much less expensive than importing diesel fuel from Australia. We also recommend the diversification of energy production through the use of small wind generators that could be used to run lighting and possibly the village computer lab. Wind energy has minimal environmental impact, and is not dependent on the sun or fuel production. As a backup energy source and a possible element in the operation and production of the coconut oil generator, we also recommend the use of solar panels and storage batteries.

This “package” has been developed with the goal of minimizing the technical experience required to operate or repair the system while maximizing energy efficiency and long term sustainability of the fuel source. It is also intended to introduce low-pollution energy technology to a rural community.

The investment of the local community would be the production of some of the coconut oil that would be burned in the generator and a mechanic who can learn the basic maintenance of the modified generator. We are presenting these ideas to the villagers to learn what level of interest this proposal might hold for them and hear their thoughts about the implementation of such a system.

We would welcome your consideration and input regarding this project and its implementation in Fiji.

Thank you. Sincerely, Wendy Peterman

To Potential Donors:

To [name of organization],

The Biodiesel Initiative at Oregon State University is a group of students, faculty, and community members that meets regularly to discuss the use of biofuels in diesel-powered vehicles and generators with an emphasis on sustainable and environmentally safe products. The OSU Biodiesel Initiative needs your help to ensure success in our endeavor to bring sustainable biofuels to developing nations around the world.

Several countries including the US have made significant strides toward the implementation of alternative fuels through research and infrastructure development, however, areas of the world where these fuels would have the greatest immediate impact on environmental quality – less developed nations - are often neglected. The goal of our current project is to explore the feasibility of implementing vegetable oil based alternative fuels within the unique social, economic and environmental conditions of these regions.

In 2007 we applied and received an initial grant from the EPA to launch a project to bring biodiesel production capabilities to an impoverished village in Fiji. Currently the villagers import petroleum diesel fuel from Australia which is very expensive and polluting. We plan to give them the means to use local, sustainable natural resources to power their diesel generators which will improve their overall quality of life.

The specific objectives of this project are to:

1. Identify obstacles to renewable fuel implementation that are specific to developing nations.
2. Investigate which alternative fuel will work best in that environment.
3. Develop sustainable methods of production that work within the limitations.
4. Incorporate traditional knowledge of the target community in production methods.
5. Demonstrate that the method of choice will work with pilot-scale production.

Currently we are working on securing a second round of funding from the EPA to continue this work, but we need your contribution to the grant proposal for the second phase of this project. [Sentence about specific ways this organization can help]

Please help us make a difference in the lives of the people in Fiji by providing our group the means to continue researching and developing a viable energy solution. Many talented people are lending their expertise to this effort, and with your help they will have the means to make a profound difference for the people of Fiji.

Most Sincerely,
OSU Biodiesel Initiative

Biodiesel Initiative/Engineers Without Borders Partnership:

Partnering Project Information Form

This form is for chapters to complete when they are participating in projects in Partnership with other entities, agencies, and organizations.* EWB-USA will not accept liability for any projects, in partnership with other entities, agencies, or organizations. EWB-USA members must follow any and all rules, regulations, procedures and protocol established by the partnering entity.

EWB-USA Chapter Name: **Engineers Without Borders – Oregon State University**
Partnering Organization: **Oregon State University Biodiesel Initiative**
Contact Name at Partnering Organization: **Nikhil Prem**
Phone Number of Contact Name at Partnering Organization: **541-207-2960**
E-mail of Contact Name at Partnering Organization: **premni@engr.orst.edu**
Description of the Project: **Research, development, design, and implementation of a sustainable energy source (most likely biodiesel) that could be used in the remote village Naraukunibua in South Central Fiji. The renewable energy source will power the village and eliminate its need to purchase diesel from Australia. The technology would economically assist the village and promote sustainable technologies in the progressive 3rd world.**

Participating EWB-USA Travelers: (This portion is only necessary if travel is involved)

EWB-USA Travel Member's Name	Date Traveling	Date Returning
Undecided	Summer 2009	Summer 2009
Undecided	Summer 2009	Summer 2009
Undecided	Summer 2009	Summer 2009

* Projects undertaken in partnership with other entities, agencies, or organizations are assumed to be endeavors where EWB-USA members are acting as participants in the activities of the partnering entity. The partnering entity is assumed to be the lead, or governing entity.

Fiji Stakeholder Analysis:

GOALS					
Stakeholders	Attitude		Influence		Actions
	Estimate	Confidence	Estimate	Confidence	
Mr. Smith	+	?	M	?	Set up a meeting
BioDiesel Initiative	++	/	H	/	Build it
EWB					
OSU	+	?	H	/	Meet with OSU. Two weeks before deadline
EPA	+	/	H	/	Write an effective proposal
Peace Corp.	+	/	H	/	Build relation with Peace corp.
Chief	+	?	H	/	Make direct relation. Talk to him directly.
Chemical Engr OSU	+	/	L	/	Communicate, Press relation
Narukunibua Village	+	?	H	/	Setup meeting with village
Priest/Church	+	??	H	/	Meet with church
Fiji Government	+	/	H	/	Contact officials, apply for grants

Fiji Technology Matrix Example:

Technology		Vegetable (Coconut) Oil	Biodiesel	Methane
Feasibility		+	-	-
Energy Output		+	+	+
Cost		+	-	+
Availability of space		+	+	-
Availability of resources		+	-	+
Maintenance		+	-	-
Sustainability				
a. social		+	+	+
b. environmental		+	+	+
c. economic		+	-	+
Appropriate		+	-	+
Scope		+	+	+
	+	Met project mission and requirements		
	-	Did not meet project mission and requirements		

Itemized Budget for EPA STAR Grant Applications

COST CATEGORIES	YEAR ONE		YEAR TWO		YEAR THREE		YEAR FOUR		YEAR FIVE		TOTAL PROJECT	
	Federal	Cost-Share	Federal	Cost-Share	Federal	Cost-Share	Federal	Cost-Share	Federal	Cost-Share	Federal	Cost-Share
a. Personnel Principal Investigator (PI) Co-PI Graduate Students Other Personnel	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL PERSONNEL	0	0	0	0	0	0	0	0	0	0	0	0
b. Fringe Benefits _______% of __________	0	0	0	0	0	0	0	0	0	0	0	0
c. Travel Trip 1 Trip 2 Trip 3	7963 15924	0	7963	0	0	0	0	0	0	0	31850	0
TOTAL TRAVEL	23887	0	7963	0	0	0	0	0	0	0	31850	0
d. Equipment (items ≥ $5000) Item 1 Item 2 Item 3	0 0	0	0	0	0	0	0	0	0	0	0	0
TOTAL EQUIPMENT	0	0	0	0	0	0	0	0	0	0	0	0
e. Supplies Item 1 Item 2 Item 3	17599	0	1850	0	0	0	0	0	0	0	19449	0
TOTAL SUPPLY	17599	0	1850	0	0	0	0	0	0	0	19449	0
f. Contracts No. 1 No. 2 No. 3	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CONTRACTUAL	0	0	0	0	0	0	0	0	0	0	0	0
g. Other Item 1 Item 2 Item 3	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL OTHER COSTS	0	0	0	0	0	0	0	0	0	0	0	0
h. TOTAL DIRECT COSTS (sum of a – g)	41486	0	9813	0	0	0	0	0	0	0	51299	0
i. Indirect Costs/Charges 46.2% of 51299 (base)	19167	0	4534	0	0	0	0	0	0	0	23701	0
j. TOTAL PROJECT COST (sum of h & i)	60653	0	14347	0	0	0	0	0	0	0	75000	0
k. Total Requested From EPA	60653	0	14347	0	0	0	0	0	0	0	75000	0

Budget Justification

1. **Personnel:** No personnel costs are associated with this proposal.
2. **Fringe Benefits:** No fringe benefit costs are associated with this proposal.
3. **Travel:** Three trips will be made from Corvallis, OR to the village of Narukunibua in Navua District, Fiji. The initial trip will serve to collect data required for a environmental, and social impact assessment, as well as engineering requirements. Three people total will be required for this trip including an engineer/mechanic, an environmental expert, and a cultural/education expert. The second trip will be for actual construction and will consist of the same three people, plus two additional people with engineer/mechanic skills, and a professional engineer (our PI). After one year of operation, a third trip (consisting of the same 3 people as the first) will be made to ensure that the project objectives have been met, and make any necessary repairs or corrections to the system if they have not.
   - **Airfare:** Ticket costs were estimated from general figures found through online searches.
   - **Lodging:** Costs were estimated from general figures found through online searches. Students will spend two nights in a hotel in Fiji (once on the day of arrival, and once on the day of departure). Remaining time will be spent camping in the village for free.
   - **Ground Transportation:** Costs are based on one round trip shuttle ride from Corvallis, OR to the PDX airport, and rental of a passenger van in Suva, Fiji.
   - **Total per Student:** Three trips will be made, with 3, 6, and 3 people respectively. Thus all individual travel expenses are multiplied by twelve.
4. **Equipment:** No equipment costs are associated with this proposal.
5. **Supplies:**

Supply Category	**Cost $**
Coconut Solar-Thermal Dryer Components	1200
Oil Storage	2000
Oil Transportation	2000
Engine Conversion Components	4000
Coconuts	800
Generator Maintenance	500
Engine Repair Components	850
Project Supplies	1000
Computer Equipment	1099
Oil Extraction Components	6000
Total	19449

Costs were determined by consultation of lab supply catalogs, discussion with technicians of the Chemical Engineering Department, and online searches. All non-consumable equipment and supplies (including the computer equipment and oil press) will be given to the Village of Narukunibua in Navua District, Fiji after the project period has completed.

6. **Contractual:** No contractual costs are associated with this proposal.
7. **Other:** No other costs are associated with this proposal.
8. **Indirect Charges:** Indirect charges are based on the Oregon State University on-campus rate of 46.2% Modified Total Direct Costs (MTDC).