

# **International Education Through Engineers Without Borders**

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## Abstract

The University of Tulsa started a chapter of Engineers Without Borders – USA (EWB-USA) in the fall of 2006. EWB is a non-profit humanitarian organization established to partner with developing communities worldwide in order to improve their quality of life. This partnership involves the implementation of sustainable engineering projects while involving and training internationally responsible engineers and engineering students.

The EWB-USA project application process requires that the students educate themselves about their partner international community. The questions span a broad range. For example, the application requires them to list the positive and negative impacts (economic, environmental, social, cultural, and ecosystem) their project will have on the community. They must describe local construction techniques and what skills they have that the community does not have. The students must describe the beneficiary group(s) in terms of ethnicity, tribal and religious affiliations, spatial organization, primary occupations, current income, and decision-making structures of all the sub-groups. They need to know the local culture, customs, and hazards. The students must convince EWB-USA that they know enough about the area for EWB-USA to approve the project.

The processes of EWB-USA require the students to get an international engineering education—education about their specific international people group combined with engineering knowledge for their specific project.

## Introduction

Engineers Without Borders - USA (EWB-USA) is a non-profit humanitarian organization established in 2001 to partner with developing communities worldwide in order to improve their quality of life through sustainable engineering projects. The projects are joint efforts of the community and the engineers to share resources and knowledge in order to meet basic human needs and promote sustainable development in such areas as water supply and sanitation, food production and processing, housing and construction, energy, transportation and communication, income generation and employment creation. The stated mission of EWB-USA is “to partner with developing communities to improve their quality of life through the implementation of environmentally sustainable, equitable, and economical engineering projects. In the process of working to advance developing

communities, EWB-USA promotes the development of globally aware and internationally responsible engineers, students, and professionals.”<sup>1</sup>

The University of Tulsa chapter was established in the fall of 2006 by a group of students and faculty who had a strong desire to expand their work on interdisciplinary engineering projects to incorporate service learning and to provide opportunities for meaningful international experiences. Although a limited number of projects are available through EWB-USA, the University of Tulsa chapter selected projects with local ties. The chapter initially invited speakers to meetings to discuss past and present opportunities. From these presentations two initial projects were selected. One group is working with a micro-community in rural northeast China to develop sustainable energy resources. The other group is working with a rural community in northern Sierra Leone as it rebuilds from their long civil war.

#### The EWB-USA Technical Advisory Committee

EWB-USA has established a Technical Advisory Committee (TAC) to oversee all international travel. The TAC is composed of volunteer engineering professionals who review the technical aspects of each project as well as cultural and health concerns.

All new projects must be approved by the TAC. The application process for a new project ensures that all projects:

- 1) agree with EWB-USA’s mission;
- 2) benefit the community and do not discriminate against sub-groups;
- 3) involve the community;
- 4) have a well-defined scope of work;
- 5) are of reasonable cost for volunteers to fundraise; and
- 6) avoid serious safety concerns and do not involve travel to any country under state department warning.

The project application asks students to consider both positive and negative impacts to the economy, the environment, the culture and the ecosystem. The students must discuss the social and governmental structure of the local beneficiaries in terms of ethnicity, tribal affiliation, religion, spatial organization, current issues and decision making structures. Students must analyze potential construction techniques that will be used in light of their skills and those of the community.

Once a project has been accepted, then the group continues work on their technical plan until they are prepared for their initial assessment trip. The students must make a presentation to the TAC before the trip is approved. The purpose of the assessment trip is to gather information that will be helpful in the final implementation of the project. A checklist provided by EWB-USA suggests that teams focus on:

- Community Overview
- History of the Problem
- Logistical Support
- Environmental Aspects
- Socio-Cultural Aspects

- Outcome Assessment Questions
- Health Assessment for Benchmarking

For specific projects, other technical information may need to be gathered during this trip. Water quality testing and water supply analysis are generally recommended for all communities.

Following the assessment trip, the students submit a report on this trip and prepare a presentation to the TAC for their implementation trip. At this stage the technical design and construction plans must be finalized. The students must address transferability of the project in terms of teaching those in the community the construction methods as well as teaching them to maintain and take ownership of the project. The implementation trip may also serve as an assessment trip for follow up projects with the community. Ideally, the EWB chapter will develop a relationship with the developing community that lasts for several years. This allows the group to ensure that their projects are performing as designed and provides opportunities for long-term health assessments which may demonstrate the impact of their project on the people.

### EWB at The University of Tulsa

The University of Tulsa has taken on two projects. Students working on either project are entitled to earn 1 hour of “seminar” course credit for each semester of involvement. An accumulated 3-4 hours of course credit may be used as one technical elective. Other students have taken on a larger design role and used their portion of the project for senior design courses. The dean, department chairs, and the University of Tulsa curriculum committee believe that these experiences not only give the students an opportunity to apply their technical education as well as providing hands-on education of how to manage a large project in an international context.

### Tulsa Project 1: Sierra Leone

The project for Sierra Leone will take the students into a community that was one of the first destroyed by the civil war that spanned more than a decade. The residents are beginning to return to this farming community and rebuild their lives. A United Methodist missionary will be working in the community to rebuild the boarding school that once existed. She will be the Tulsa group’s link to the community as we develop the project. The Tulsa students will not undertake their first assessment trip until she is in country (late 2007).

Based on the limited information available right now, it is anticipated that immediate needs will be to provide safe drinking water and adequate sanitation. Therefore the group is conducting experiments to evaluate the effectiveness and feasibility of various water purification methods such as those developed by Potters for Peace.<sup>2</sup> The team is also practicing construction of a kiln using primitive methods at a local Girl Scout camp. Group members are avidly learning all they can about the culture of Sierra Leone in anticipation of filing the project application and assessment trip presentations.

## Tulsa Project 2: China

The second University of Tulsa project targets a rural community in northeast China that is very near the borders of both Russia and North Korea. A non-governmental organization from the US, Micro-Community Development (MCD), is currently working within this community. We maintain contact with both the community and this group. The residents of this small farming community are the obvious target for any project; however, the ultimate target is the North Korean refugees that stream through the area.

The community has requested assistance with developing independence from governmental electrical systems. As a result, our team has been developing methods for creating small, sustainable power plants that might include solar, wind, geothermal, and micro-hydro techniques. Although the MCD group is willing to fund the purchase of manufactured equipment, the Tulsa group is emphasizing methods that can re-use materials from scrap yards such as old car batteries and alternators. These methods may be taught to poor refugees as they settle into their new homes.

In June, 2007, the first group of students went on an assessment trip.<sup>3</sup> The group was able to learn about the community and assess the health and energy needs of the residents. Because they had been experimenting with methods for solar and wind power generation, they were able to make improvements to an existing wind turbine in the area. The students also installed instruments that will collect weather data and automatically upload that data to the web so they can better plan for next summer's implementation trip.



**Figure 1. University of Tulsa students construct and install a wind turbine in China**



**Figure 2. A commercial wind turbine provides the electrical power to this small farmhouse in rural China**

The plan for the next implementation trip will be finalized once more meteorological data has been collected. The group anticipates adding more wind turbines and solar collection panels during this trip. The community has also asked for assistance with construction of a biomass converter for methane production.

### Summary

Students who have been involved with EWB have had very real opportunities to extend their engineering education to solve problems in communities with genuine needs. Although these projects are fairly new, the students have already experienced that decisions appropriate for a project at home may be inappropriate in other communities. The students are learning that their engineering education is not just a means to a large future salary, but also can be used to improve quality of life for people across the globe. The students are establishing friendships across international and cultural boundaries as they become stakeholders in the problems facing their partner communities. As one University of Tulsa student wrote:

After attending the EWB meetings this semester, and reading about EWB in general and other organizations that have the same vision, I realized that we were forgetting one important aspect, professionalism. I don't mean professional in the way of providing services, in fact we have people who have been working on humanity issues for decades. I personally know a wealthy man who has been living in a small town in Africa for few years to get to know the community even more and be able to provide the help they really need. I mean professional in the way of bringing their knowledge and education into action. . . I've learned from this project

[that] I will be very happy knowing that I will use my education to improve other's way of life and have a positive impact on other communities.<sup>4</sup>

#### Bibliographic Information

1. Engineers Without Borders Website, [www.ewb-usa.org](http://www.ewb-usa.org) accessed June 26, 2007.
2. Potters for Peace Website, [pottersforpeace.org](http://pottersforpeace.org) accessed June 26, 2007.
3. Maria Holland's blog of the assessment trip to China, [maria-holland.livejournal.com](http://maria-holland.livejournal.com) accessed June 26, 2007.
4. Personal communication from Ahmed Al-Mohannadi, 4/29/2007.

#### Biographical Information

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Dr. Patton is Applied Associate Professor of Chemical Engineering at The University of Tulsa. She received her B.S. in Chemical Engineering from Texas A&M University and her M.S. in Applied Mathematics and her Ph.D. in Chemical Engineering from The University of Tulsa. She is currently involved in applying fuel cells and reformers to hybrid-electric vehicles.

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Dr. Ford is an Associate Professor of Chemical Engineering at The University of Tulsa. She earned chemical engineering degrees from Oklahoma State University (B.S.) and the University of Illinois at Urbana-Champaign (M.S. and Ph.D.). Her research is in dry etching of metals and metal alloys. She is involved in outreach activities and the American Institute of Chemical Engineers.