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Introduction & Background Information

For the past few years, different groups of Ohio State University students have traveled to Honduras over spring break in order to implement engineering related projects. Typically, the group volunteers with an organization known as Montaña de Luz (MdL), an orphanage for children with HIV/AIDS located in a rural area on the state, El Paraiso. In order to expand the opportunities for students as well as to provide a broader impact to the community of Honduras, two students will be assessing a new area in southwest Honduras, known as Choluteca. This opportunity arose after partnering with Larry and Angie Overholt, who work with “Our World Gospel International.” Both Larry and Angie are OSU graduates, with masters in Human and Community Resource Development and Family Nursing, respectively. They have lived in the city for twenty-five years, and thus have excellent knowledge of the area.

The city of Choluteca hosts approximately 100,000 people and is typically extremely hot, though some rainy seasons do occur. It has elements of both rural and urban settings. Though there is still much to learn about the city, some key areas have been identified to further explore. These areas include: the clinic, vocational school, adobe houses, aquaponics, water quality, and energy efficiency. Since Larry works primarily with the vocational school and aquaponics, and Angie works mainly with the clinic, they will both serve as assets during our trip. This documentation provides explanations for the goals and plans of the assessment team during their 2010 trip to Honduras.
Overview of Goals

The main goal of the trip to Choluteca is to assess the city and determine what potential engineering projects can be further developed for a potential group of students during next year’s trip to Honduras. The following is a list of possible projects that are being considered. However, the suitability of these for future project development will be considered upon completion of the trip.

A) Clinic

The clinic in Choluteca is focused on preventative health care, mainly diabetes and women’s health. Though exact details are not known, three important questions need to be analyzed in order to determine the drawbacks of the clinic and the possibility for OSU students to help during a future trip. These essential questions include:

1) How can we make the electrical grid more stable?
2) How can we improve care quality to patients?
3) How can we make the tasks of the nurses and employees easier and less burdensome?

B) Vocational School

The vocational school has four different areas: auto mechanics, refrigeration, sewing, and computer certification. As of now, the auto mechanics department is the only area open. Again, further analysis needs to be considered to see what role students can play. In order to determine this, the following questions need to be addressed during the trip:

1) How can we help update the refrigeration, sewing, and computer areas so that they can be opened and put into use?
2) How can we play a role in the educational aspect of the school and help improve the quality of education?
C) Adobe Houses

The houses in Choluteca are primarily made of adobe brick, leading to no temperature control. In addition, the houses have limited plumbing as well as structural problems. To determine how students can play a role, the following must be questioned:

1) How can we make the buildings more structurally sound?
2) How can we control the temperature within the houses?
3) How can we conserve electricity within the houses?

D) Aquaponics

Aquaponics, creating an ecosystem between fish and plants, has been proven to be beneficial to many communities. However, the high energy costs from pumping and maintaining the water level has prevented further development. Further questions to assess this area include:

1) How can energy costs be decreased?
2) What areas are available for aquaponics development?
3) Who would be interested in maintaining such a system when students leave the area?

E) Water Quality

In many third world countries, poor water quality proves to be an issue of importance. Though not much information is known about the water quality in Choluteca, the following needs to be asked to determine if this is a problem worth tackling for next year’s group of students:

1) What areas, if any, are in need of water quality improvement?
2) How might we begin the process of improving water quality in a somewhat densely populated city?
F) General Questions & Observations

In addition to the specific questions addressed above, the team would like to better understand the needs of the people. First, the team plans on observing the community during their everyday lives to judge what struggles and challenges they deal with, i.e. transportation, work life, home life, etc. In addition, the team has basic questions to ask citizens in order to understand their hardships. These questions include:

1) What do you (the citizens) see as needing further advancement?

2) What chores or tasks are hassles in your lives?

3) What do you enjoy doing for fun?

4) What types of materials are easily available to you?
Detailed Plans

A) Clinic

From the information received from Angie Overholt, the clinic is fully stocked and in good condition for the kind of work typically performed there. Because of this, the team’s focus during this part of our trip will instead be on the conservation of electricity. With the Kill-O-Watt device, it has been planned to gather some data pertaining to the current electrical usage of the clinic. With this information, the team intends to locate any areas of high usage that could possibly benefit from a full energy audit and by practicing better conservation techniques.

B) Vocational School

The vocational school will be a heavy focus for this trip. Larry Overholt has a large vision for this school and thus there are many aspects to be considered. It would be ideal to be able to tour all four departments and understand what is keeping the refrigeration, sewing, and computer certification departments from being offered to the students. The team wants to understand what the curriculum is for the auto mechanics department and see if there is any room for academic improvement. If possible, asking the students to complete a survey (either written or verbal) pertaining to their view of the vocational school and what recommendations they have for improvement is a definite goal.

C) Adobe Houses

The typical structure of the adobe houses is currently unknown. It will be very important to get at least a rough estimate of the typical dimensions and layout of these houses. If possible, the team would like to get an understanding of both the electrical and plumbing layout of the typical adobe house. In addition, it would be educational to speak to the house owners and residents about how the house “performs” in various weather conditions (extreme heat, wind,
rain, etc). It is also important to survey these people about their perception of the houses and what could be improved.

D) Aquaponics

Larry Overholt is very interested in starting a small aquaponics project with the intent of future expansion, possibly to commercial levels. Larry has done much research into this field and is interested in incorporating several engineering students in assisting him in the design and construction of the system. There are many components to take into account when developing an aquaponics system. Because of this, it will be imperative that data is gathered on soil quality (both through typical crop yield and through available commercial soils and fertilizers) and water quality (discussed below). Learning about the typical weather patterns will also help future students decide what types of plants and what species of fish will prosper in the environment.

E) Water Quality

With a water testing kit, the team would like to take many water samples from the various locations visited, specifically the clinic, the vocational school, and the adobe houses. The data collected from the analysis of these samples will tell us if the water is safe for either human consumption or human use (cleaning, cooling, etc). If possible, it would be ideal to collect some data on the typical sicknesses that are occurring in Choluteca that might be water quality related (diarrhea, dysentery, etc). The water analysis will also help with the aquaponics project since the contents of the water must be taken into account to know what types of plants, soils, and fish will create an effective ecosystem to both purify the water and allow the plants and fish to prosper.
F) General Questions & Observations

As data collecting will be the most important portion of this trip, the team would like to survey random citizens about many categories from entertainment and goals to shortcomings and daily struggles. This data will assist the team in understanding who these people are as a whole. This is of significant importance because it is essential to understand and respect the cultural differences these people will show. We must take these differences into account when we develop future engineering projects. Having a visual representation of a location is very important when developing the specifics of an engineering project. Because of this, many pictures will be taken of all of the locations that will be visited. There is also a possibility that the team may have a video camera and this will also help future students to understand the areas they could potentially be working in. If possible, the team will document important measurements (distances, angles, temperature, etc) to go with specific pictures to provide future students with more useful data.

G) Sustainability

Since the trip to Choluteca is simply a fact finding assessment trip, there is no direct sustainability to implement. However, the idea and concepts of sustainability must be expressed and utilized when determining what projects could be proposed. It must also be present in the questions asked to both the hosts and the citizens spoken to. The readings and lectures from the service learning class have expressed, at length, the importance of getting clients involved rather than directly donating a service or project so that the client develops a sense of ownership and is more willing to keep the project alive after the team’s departure. Thus, the team must understand what the citizens are willing to do in order to ensure a project will survive after its implementation.
Objectives Achieved

A) Clinic

Due to the time constraint, the clinic itself was not viewed, but some basic information was gathered. Kathy Stone, a professor at Ohio State University, brings about 36 of her nursing students to the clinic every year. This year, the group was able to build model first-aid kits as well as an instruction’s manual with the following focuses: cuts/burns, broken arm/leg, diabetes information, exercise and nutrition, how to avoid parasites, and basic medicines used in the area. The group discovered that picture descriptions made the explanation process much easier. Dr. Stone also mentioned the lack of knowledge the community has on proper nutrition and health care, which is something that could definitely be further explored. In addition, Dr. Stone informed the team about “Hospital del Sur,” a public health hospital that has problems with high heat. Though the team didn’t see the hospital, heating/cooling systems, such as reflective paint, might be a possible solution.

B) Vocational School

Overall

The vocational school is located a short drive out of the main part of town. It was built in 2001 by INFOP, Instituto Nacional de Formacion Profssional, and exclusively funded by them for five years. In 2006 World Gospel Mission took over operational duty and some of the financial burden, but INFOP sill finances 60% of the expenses. The water supply for the vocational school is untreated, and it comes from a mountain supply nearby. There is a steady electrical grid and the area is expected to have internet capabilities within the next two months.
Auto-mechanics

The auto-mechanics department is currently a two year process, though Larry Overholt would like to extend this to a third year. The department is in need of more diagnostic equipment as well as additional study material in order to make that happen. The first year of the course is generally basic information. As the students learn more about the course, they are given a module that they learn at their own pace. Each student is given three attempts to pass the module. During the last three months of their second year, the students are given an internship. After completion of the two year course, they are given a certification. Most of the auto-mechanics students are very successful. Though they do need to take an entrance exam to be accepted into the school, the school itself is free of charge with the exception of uniforms and backpacks. Currently, only the first year portion is being taught, as the teacher for the second year is unavailable until approximately January of 2011. The auto-mechanics department is in need of more posters and visual aids in the classroom, as well as assistance with a basic English course they are taught for four weeks, pertaining to the materials in the classroom.

Sewing

The sewing department contains a lot of sewing machines or different varieties. There are twenty-five electric machines, twelve manual machines, five portable machines and one electric steam press. There are also two or three broken sewing machines that could be repaired or discarded. The room is set up so that each student would work with their own sewing machine and there is already enough material to start the department.

Currently, the sewing department does not have enough interest. Only eight to nine students are interested, and twenty must be present to make the class effective. Because the clothing industry is not booming, students do not find the need to further explore this area. The department, however, is very equipped with all resources that it needs. Larry Overholt plans on
starting a new program where the students study in the morning and work in the afternoon, in order to motivate more students to join. In addition, he would like to give students a $2/day stipend, in hopes that this will assist students in travel and food expenses.

**Refrigeration**

The main problem with the refrigeration department is the lack of development. In order to work in domestic settings, only six months of schooling is needed. However, many students would like to branch out into an industrial setting, needing more than one year of schooling. The process of developing this program is still underway.

**Computer**

The computer department contains thirty computer towers. Each is equipped with a functioning keyboard, mouse, CRT monitor and 60GB hard drive. Each machine currently runs Windows XP. This is required by the government department that will allow for federal certification for students taking this course. Each computer unit is set up on a desk/workbench with minimal excess space.

The main problem with the computer department is the lack of recognition by Honduran officials. It is required that each computer has 60 GB. Though each computer does have this amount, it only reads as 57 or 58 GB as some of it is used elsewhere, though 60 GB is present. Since this is not recognized, the classes cannot start. Furthermore, Microsoft Office is also needed, and the costliness of this holds back any progress. An instructor has already been established for the course, and Larry Overholt would like to teach students how to use and fix computers as the course develops. During the visit, it was also discovered that the internet would be available through the company, Catecho. In order to reach ten computers with 512 KB, the rate is $55 dollars a month and about 299 Limperias (approximately $1 is equal to 18 Limperias) for installation, laying the platform for a possibility of a wireless system.
Library

Larry Overholt mentioned the possibility of creating a library, with a focus on environmental issues.

C) Village Houses

Though initially the plan was to see an adobe house, Larry Overholt took us to a poorer home, representing approximately the bottom 10% of the community. Seven people lived in this house, with a base of only 12 by 12 feet, along with a wooden frame supporting most of it. The sides were made from random pieces of wood and metal, and the roof was made entirely of metal. The lady even commented that there was no difference between the inside and the outside of the house when it rained. The floor was entirely dirt, and the shower had a base of 3 by 3 feet, with a weathered tarp as a shower curtain. There was no latrine or other form of a bathroom, so the family had to use the woods as their bathroom. In order to obtain water and food, they had to walk or bike around one to two miles. Water could only be found at one centralized location, so the family only had around fifteen gallons of water every week. Furthermore, they received a 50 gallon barrel of water every eight days for showering and washing clothes. They do not know when the water will be coming, so they must leave their taps on at all times so they don’t miss the opportunity. In addition, the stove used causes asthma, as there is no way to release the smoke that fills the house. After meeting with the official/mayor of the town, it was said that thirty stoves would be put into place along with latrines serving thirty homes.
D) Aquaponics

An aquaponics system has currently been placed in Larry Overholt’s backyard. There are four main elements to the system. The first is a circular pond, approximately 24 feet in circumference. This is attached to a small area for plant growth. These two systems combined are attached to two rectangular areas. The first area is 6.4 by 10.3 feet, with a cement surrounding, around 7 inches thick. The second rectangular area has the same measurements, but is about half as tall as the first rectangle. For the four foot deep system, Overholt is using a Tetra WGP 1000 which runs 80W, 120V, and pumps 1000 gal/hr at 60Hz. It has a 100% duty cycle and uses around 115KWh each month, this contributes to nearly 10% of the clinic’s energy consumption, as the pump is connected to the clinic’s grid.

His main objective is to create a similar type of system for either a family, or for a group of families as well as for the vocational school. Because the system would not be quite as big for family use, an electric pump of this magnitude would not be needed. Currently, approximately 150-200 tilapias are present, and all the fish are bought in Tegucigalpa. The only input of the process is fish food. The fish waste, consisting of nitrate and ammonia, is used to grow the plants. Some of the plants Overholt has used consist of tomatoes and cucumbers. Overholt suggests that a two to one ratio is used between plants and fish, respectively. All the water in the system is recycled, and the plants use marble sized gravel in order to filter the water at a fast rate as well as to stabilize the roots. The major problem with the system is the high cost of electricity. Because the pump that is being used for the system runs constantly, the cost to run it adds to the already high energy bill. A main solution is to look into either manual or solar powered energy to pump the water.
E) Water Quality

The team completed arsenic testing as well as E. coli testing on the water used in various areas. One of these areas consisted of the clinic area, which is the same water used in the community as well. For the arsenic testing, the unfiltered water, used for dishes, washing clothes, and showering, was approximately 30 ppb (parts per billion) while the filtered water was approximately 15-20 ppb. While 10 ppb is the ideal amount, 15-20 is still a safe area. The E. coli testing also came out negative, showing that no signs of it are present. The other area tested was the vocational school, which was also within the 15-20 range. Because a field test kit was used to determine these results, more accurate readings should be done in the future.

F) Energy Consumption

After viewing the Overholts’ bills, the following data in Table 1 was obtained, showing that while the flat rate for both their house and the clinic were similar, the amount of energy used in the house was much greater than that of the clinic.

<table>
<thead>
<tr>
<th>Date</th>
<th>KWH (kilowatt hour)</th>
<th>Total amount paid (Lempiras)</th>
<th>Lempiras/KWH</th>
<th>Dollars/KWH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/03/07-06/02/07</td>
<td>2201</td>
<td>5846</td>
<td>2.66</td>
<td>.148</td>
</tr>
<tr>
<td>12/03/07-01/03/08</td>
<td>1077</td>
<td>3,179.63</td>
<td>2.95</td>
<td>.164</td>
</tr>
<tr>
<td>08/03/09-08/10/09</td>
<td>433</td>
<td>1587.60</td>
<td>3.67</td>
<td>.204</td>
</tr>
<tr>
<td>02/04/10-02/18/10</td>
<td>735</td>
<td>2735.29</td>
<td>3.72</td>
<td>.207</td>
</tr>
<tr>
<td>House</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/03/07-06/02/07</td>
<td>4383</td>
<td>11,042.08</td>
<td>2.52</td>
<td>.140</td>
</tr>
<tr>
<td>12/03/07-01/03/08</td>
<td>3247</td>
<td>9,102.91</td>
<td>2.80</td>
<td>.155</td>
</tr>
<tr>
<td>08/03/09-08/10/09</td>
<td>1193</td>
<td>3747.55</td>
<td>3.13</td>
<td>.174</td>
</tr>
<tr>
<td>02/04/10-02/18/10</td>
<td>2305</td>
<td>7612.21</td>
<td>3.30</td>
<td>.183</td>
</tr>
</tbody>
</table>

*Table 1: Energy bill information*
In addition, the following list of items were found in the house and clinic showing the possible causes for the costliness. Table 2 below shows the different units for the house and Table 3 depicts the units for the clinic.

<table>
<thead>
<tr>
<th>House</th>
<th>Energy Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Unit #1</td>
<td>60 Hz, 1/6HP</td>
</tr>
<tr>
<td>AC Unit #2</td>
<td>Brand name: Comfort Star</td>
</tr>
<tr>
<td>AC Unit #3</td>
<td>Fedders C1024BBD1V, 220V, Single Phase</td>
</tr>
<tr>
<td>Well Pump #1</td>
<td>60 Hz, 2 HP, 230 V, PH1</td>
</tr>
<tr>
<td>Well Pump #2</td>
<td>60 Hz, 1/2 HP, 115/230 V, Single Phase</td>
</tr>
</tbody>
</table>

*Table 2: Energy information for the house*

<table>
<thead>
<tr>
<th>Clinic</th>
<th>Energy Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Unit #1</td>
<td>Brand name: Comfort Star</td>
</tr>
<tr>
<td>AC Unit #2</td>
<td>208-230 V, 24,000 BTU/h</td>
</tr>
<tr>
<td>Fridge</td>
<td>Unknown</td>
</tr>
<tr>
<td>Aquaponics System</td>
<td>1000 GHP, 500-1000 gallons</td>
</tr>
</tbody>
</table>

*Table 3: Energy information for the clinic*

The Overholts also have two solar panels located at their house that are currently not functioning. It is believed that the problem is either with the wiring from the inverter to the panels or the panels themselves. The system uses a Solar Controller Specs Sun Saver 20 SS20L 12VDC controller.

**G) World Gospel Mission**

World Gospel Mission is the mission group that Larry and Angie work for. WGM hosts groups of ten people (missionaries and students) approximately four to five times a year in Choluteca. They are typically housed in the nearby hotels (within a few blocks of their house). There is also one group of thirty-five nursing students (and occasionally dentistry students), that come from The Ohio State University, to work in the clinic and the community once a year.
WGM has offices in four sites throughout Honduras. Terry Hank is the WGM country coordinator and is based in the Tegucigalpa office. Mark Dunbar is an associate official with WGM and is also based in Tegucigalpa. WGM understands the secular nature of OSU and will respect this difference in any future partnership.

**Future Recommendations**

**A) Model Home**

Larry Overholt, as well as the mayor of the community in Choluteca, expressed a large interest in obtaining designs for a low price, energy efficient, and environmentally friendly house for the poorer citizens in the community to build. It is recommended that future teams work with Larry Overholt and the citizens of the community to come up with such a design that will be both affordable and socially accepted. It should be noted that the mayor of the community is working on getting thirty high efficiency stoves and thirty latrines to disperse throughout the community.

There are three main challenges that need to be taken into account: space, cooking, and weather adaptability. The typical family size in this area may be 4-8 people, with ages ranging from infant to elder and the house needs to provide ample living space to account for this. Depending on the cooking method used, it may be necessary to design some method to keep fire in a controlled space or filter smoke away from the occupants, as prolonged smoke inhalation can cause deteriorated health, as was observed with the woman who now suffers from asthma due to such a problem. A resource to consult is ECOS, who have done work with high efficiency stoves.

Since the community suffers from heavy rains, high winds, floods, and high heat amongst others, the building structure must be versatile to protect the occupants from the various elements. Currently, dirt floors become mud pits during heavy rains as tin and wood roof panels
provide little to no protection. One recommendation from WGM is the Bolt-a-Blok model home, which can be seen at www.boltabllok.com.

Environmental efficiency should also be extensively explored. Rainwater collection systems, passive cooling, natural cooling (ex. using trees and bushes to absorb heat), and solar heating (for cooking) are just a few such ideas that could be incorporated to make effective use of the environment. Important data to research should also include availability of materials in the region, as well as availability of labor, and current construction practices in the area. Incorporating elements of the “Honduran way” of construction as well as utilizing the locals input will help to ensure the houses are accepted and maintained, thus supporting the sustainability of the project.

B) Aquaponics

The current problem with implementing any aquaponics system in the Third World is the high energy demand to run the pumps necessary to transport and aerate the water in to the various locations in the system. This, coupled with the high cost of energy and the inconsistencies of electrical presence, usually make running an aquaponics system not cost effective. However, the people of this community could benefit greatly from owning and operating non-commercial sized aquaponic systems. The nutrients from eating fresh fish and vegetables would greatly increase the health of the citizens. A good system could also produce a surplus of both fish and vegetables that could be sold to produce a profit. Larry Overholt has expressed an interest in obtaining designs for two aquaponic systems: one “family-size” unit and one “group-size” unit. A “family-size” unit would be owned and operated by a single family while a “group-size” unit would be owned and operated by a group of families (potentially 3 or 4). The benefit of the larger unit would be reduced cost by each family with the potential for a
larger yield of fish and vegetables. The current problem with a larger unit is that the shared responsibility could lead to disputes between co-owners that could hinder the effectiveness of the system. It is recommended that future students work with Larry Overholt and the citizens of the community to produce a cost-effective design for each sized unit. There should be a lot of research done into the environment of the community. Also, alternative powering methods should be considered (potentially solar or mechanical) to help keep the operating costs low. An additional benefit of this project is that the data gained through research could also be shared with the administrators at Montana de Luz, who also have expressed an interest in a new aquaponic system (via a Tilapia Pond).

Larry has also requested designs for a larger ‘presentation-size’ aquaponics system to be built at the Vocational School. Since the area is larger, the system could support a larger quantity of fish and thus produce more vegetables. There could also be an aesthetic quality to this system to help capture potential viewers’ attention. While electricity is more accessible in this area, there should still be an emphasis on cost reduction and alternative power methods could still be explored. Future teams should consult with Larry to determine the specifications he desires for this unit. Two websites that were recommended by Larry are www.backyardaquaponics.com and www.barrelponics.com.

C) Wireless System Implementation (Vocational School Computers)

In order to offer a third year of training at the Computer Department of the Vocational School, each computer must be able to access the internet. As stated above, there is an ISP (Internet Service Provider) available and the team has made recommendations to Larry about which service to purchase. While the services offered only allow for ten connections, a wireless system could be put into place to allow for the additional ten computers to also have internet
access. This would have Larry and the school money as they would not have to buy a second policy from the ISP. This system would be very similar to the wireless system implemented at Montana de Luz in March of 2009. It would involve connecting the router to an antenna that transmits the wireless signal to a receiving antenna that would be connected to a switch box which would be hardwired to ten computers, allowing each one to connect to the internet (please see Computer Team – Post-Trip Documentation for further details). Alternative methods should also be researched as should the cost effectiveness of simply purchasing another policy (this should include bandwidth limits and resource distribution, speed of connection, between the computers).

D) Computer Upgrades (Vocational School Computers)

If the national officials will not recognize the 60GB hard drives, then 80GB hard drives must be obtained and installed. Larry has stated that these pieces of hardware are obtainable, but are expensive. Future teams could look into obtaining used 80GB hard drives to donate to the school. Also, each computer must be running a certain version of Windows and contain specific software. The team currently believes that Windows XP (in Spanish) or newer is acceptable but Larry should be contacted, and possibly the officials, to obtain an up-to-date list of software and operating system credentials. Since Windows XP is now two generations old (Windows Vista and Windows 7), there may be a possibility to obtain donated versions of XP directly from Microsoft. This avenue should be considered, as the Bill Gates Foundation has been known to help causes such as these.

E) Energy Audit

Larry and Angie Overholt have requested a complete energy audit on their house and on the clinic (which sits beside their house). They would like to know why their house uses nearly
three times more energy as the clinic. It is recommended that future teams work with Roger Dzwonczyk, who has experience with an energy audit at Montana de Luz and has a working knowledge of the Overholt’s house, to devise an effective plan to gather ample data on KW/H used in the short time span available. Past energy teams at Montana de Luz have performed energy audits and their documents should be consulted as a starting point. The collected KWH data should be analyzed and recommendations should be made as to how to lessen the energy demand that Larry and Angie incur. Specific recommendations to consider could include switching to energy efficient light bulbs, passive cooling methods, and energy conservation techniques.

An additional energy audit should be completed on a sampling of homes from the local community. It could be very helpful, for those locals that do have electricity, to learn energy conservation techniques to help keep their costs low. It is important to have a complete understanding of the Hondurans’ electrical usage practices before attempted to change their ways. The integration of new practices must be socially accepted in order for the practice to be sustained by the locals when the team leaves.

F) Water Quality Testing

While the team’s initial tests yielded an acceptable estimate of the current quality of the water in various areas of interest in Choluteca, it must be remembered that simple field testing kits were used for the analysis. It is recommended that future teams collect water samples from the areas of interest to be either tested again using a more accurate field testing kit or be returned to The Ohio State University for lab analysis. One recommendation is that the water be tested for other contaminants (in addition to the ones already tested). It is important to have an accurate number when talking about contaminants in drinking water. Since the field test kit indicated that
all three water levels were less than or equal to 30 ppb, and since no cases of contaminated water related illness have been reported, this project can be considered a low priority and the main purpose would simply be data collection.

G) Small Business Model (Aquaponics & Vocational School Sewing & WGM)

There is a lot of opportunity for the citizens of these areas to partake in business ventures. The people at World Gospel Missions (the mission group that Larry and Angie Overholt work for) expressed their interest in educating the Hondurans in these areas with skills that could help them create and operate a small business. This education should include information on the business laws in Honduras, investment in a project, how a loan (or microloan) works, effective management skills, and possibilities for conflict, among others. One specific application of these skills could be for selling excess tilapia and vegetables grown in an aquaponics system. Larry has also proposed a plan to have the students in the sewing department of the vocational school only attend classes for half of a day and spend the other half creating and selling clothing products. This would give the students hands on experience at creating goods and good insight on how to operate a sewing business.

H) English Lessons (Vocational School Automotive & Sewing)

The students at the vocational school are in need of English lessons. Larry Overholt told us that most of the manuals the students of the automotive department use are written in English. The students are currently required to take a four week course to learn English words and phrases specific to the automotive industry. The students of the sewing department will also be required to take a similar course specific to their area of study. It would be very helpful to Larry and to the students of the vocational school if a future team was able to help acquire or create posters and/or lesson plans to help assist the students of both departments. As stated in a previous
section, having pictures along with written descriptions appears to be a very successful tool.

There could also be a possibility for bilingual (or near bilingual) students to teach some of these classes during the time of the project. It would be beneficial for the students to be able to practice their English with an English speaking student.

I) Alternative Energy Sources (Choluteca WGM)

There are two alternative energy plants located just outside of Choluteca: one hydroelectric plant and one geothermal plant. Touring either of these facilities would make a fun and educational excursion trip while in Choluteca. Information gained from the hydroelectric plant could be beneficial in the creation of a much smaller scale hydroelectric generator. If such a device could be bought or built, the locals may be able to produce some quantity of electricity from the river and streams nearby. As a related task, biofuels, and their possible applications in this community, could also be researched. This was proposed by the members of the World Gospel Mission – Honduras Chapter and they should be contacted for further details. An additional project would be to fix the solar panels at the Overholts’ house and see if they could be incorporated in running the aquaponics system. The data gained from this project could prove useful when designing and implementing a similar system in the community.

J) Health and Safety Training (WGM – not Choluteca specific)

The members of the World Gospel Mission expressed the need progress to be made in the fields of health and safety. This was not specific to Choluteca, but certainly applies to the city. Recycling centers need to be built and procedures on how to safely handle recycled waste need to be taught. Ray Diaz, member of WGM, would be a great contact for more information on this project.
The water distribution system in the community in Choluteca could be analyzed and sanitation recommendations could be made. The collection system for each family that receives water through this system could also be taught how to collect and store the water in a more sanitary manner. Many families currently store water in old 55 gallon drums.

Additional safety and health information could be distributed to the people as well. This could range from simple first aid and signs of oncoming illnesses to more sanitary eating and waste disposal habits.

**K) OSU Service Learning Project**

It may be noted that many of the recommended projects are more labor intensive (in either/both the research and development or implementation stages) than some previous projects undertaken in the history of this course. Some recommendations, like the four week English teaching project at the vocational school, could require longer than the traditional Spring Break week to implement successfully. Other recommendations, such as the model home project, require more on-site research before an effective plan can be developed.

Since this is the first time in the program’s history that the client is no longer a single group (MdL), but an entire community (this area of Choluteca), it is recommended that the director’s of the Honduras Service Learning class consider expanding the course portion to multiple quarters (or semesters as the case may be) and the in-country portion to multiple weeks or multiple trips per year. This would allow more time for the students to consult their clients, research and develop their projects, and implement their projects with more time to make last minute adjustments and allow for proper testing of their systems. It would also allow time for teams to provide training sessions, as necessary, to their clients to help improve the sustainability of the projects.
A Word on Sustainability

In all projects and relationships that we may develop for the people of this community, it is of the upmost importance that the beneficiaries of our projects are involved at every stage. Their voices must be heard and their ideas and concerns taken into account when the project is being developed. Both groups should agree on the final design and the process of its implementation. The beneficiaries should even be encouraged to help with the design and implementation to ensure a certain degree of ownership in the project is gained. This is the most important part of implementing sustainability. If the recipients feel as though they were a part of the project, then the possibility that they will maintain the project after a team leaves is significantly higher. This is vital for the success of the project and will ensure good relationships continue to flourish between the team and the community.

Acknowledgements

*Larry and Angie Overholt* – The team would like to thank the Overholts for their hospitality and for providing transportation to and from Choluteca, as well as within the city. In addition, they helped answer several questions both through e-mail prior to the trip as well as during the trip.

*Roger Dzwonczyk* – The team would like to thank Roger Dzwonczyk for advising the Choluteca trip and for his help before and during the trip, particularly with the energy audit portion.

*Dr. John Merrill & Brad Doudican* – The team would like to thank Dr. Merrill and Brad Doudican for their guidance before, during, and after the trip.

*World Gospel Missions* – The team would like to thank Terry Hank and Mark Dunbar for their recommendations and for the opportunity for future partnerships.
References


"OSU Assessment Team for Choluteca.” Message to Larry Overholt. 6 Feb. 2010. E-mail.


NOTE: Many natives were also interviewed during the trip, but exact names were not documented.
Appendages

Appendix A – Team Agreement

Team Members:
Sriya Parthasarathy                   Michael Jewitt

Team Project Expectations:
- Show up to all meetings on time
- Be prepared for class
- Use constructive criticism
- Share the workload equally

Team Member Roles and Responsibilities:
- Research in Effective Assessment Tactics – Sriya and Michael
- Compilation of Assessment Questions – Sriya and Michael
- Computer Background-Michael
- Spanish Knowledge-Sriya

All members should actively participate in discussions and meetings.

Team Meeting Ground Rules
- Discuss and be accepting of all opinions and ideas
- Stay on topic
- Allow team members to share their thoughts
- Be flexible
- Be awesome and have fun!

Team Member Signatures

1. _____________________________  2. _____________________________
Appendix B – Packing/Materials List

Below is a list of the items that need to be taken to Honduras:

1. Camera
2. Notepad
3. Water Quality Testing Device
4. Energy audit equipment (kilowatt)
5. Donated Computers
6. New LCD Monitor

Appendix C – Useful Spanish Words

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<th>English</th>
<th>Spanish</th>
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<tbody>
<tr>
<td>Camera</td>
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<td>Video Camera</td>
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<tr>
<td>Notepad</td>
<td>El cauderno</td>
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<tr>
<td>Pencil</td>
<td>El lápiz</td>
</tr>
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<td>La enfermera</td>
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## Appendix D – Timeline

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<th>Thursday</th>
<th>Friday</th>
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<tr>
<td>Excursion</td>
<td>Diagnostic on computers</td>
<td>Leave for Choluteca (early morning)</td>
<td>Continue assessment throughout entire day</td>
<td>Finish assessment by early morning</td>
<td>Continue fixing problems with the computers</td>
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<td></td>
<td>Diagnostic on wireless system</td>
<td>Arrive in Choluteca (afternoon)</td>
<td></td>
<td>Leave for MdL</td>
<td>Continue fixing problems with the wireless system</td>
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<tr>
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<td>Fix what can be fixed</td>
<td>Start assessment</td>
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<td>Return to MdL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Create a task list that other teams may be able to implement while we are in Choluteca</td>
<td></td>
<td></td>
<td>Continue computer fixes if time permits</td>
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