The University of Florida International Engineering Program: Beyond the Classical Formats

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ABSTRACT

Today new engineers must have a broader education/vision of the world. At the University of Florida College of Engineering (UF-COE), we believe that this is strongly bounded to research, development, and the opportunity to participate in international projects.
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The UF-COE International Industrial Energy Management Consulting - Chile Program (IEP) aims to provide our students with an engineering consulting experience, but at the international level. In this work, we discuss the concept of internationalization of the curriculum, its importance, and connection with college education. The impact it has in our current students in and their future engineering careers as this experience puts them to a challenge that will make them very appealing to multinational companies. The difference between a hands on study abroad course and regular courses of this nature is also discussed. Finally some results are shown in terms of engineering energy savings recommendations, and the advantages of the program discussed.

Keywords
Study Abroad, Engineering Energy Consulting.

1. INTRODUCTION

The importance of Internationalization of Curricula in Universities around the globe is becoming a daily major priority. Their impact, however, has reached beyond its borders and has gone to Community Colleges, institutes, and even to High Schools. An example is the "People to People", started by president Dwight Eisenhower, after the second world war, and the "Youth for Understanding" programs [1], for example, that aim to stimulate the experience for internationalization for students, as well as ambassadorship.

So the question that arises is clear, why is the issue of Internationalizing the Curriculum in academia, at all levels now, so important ? Although the answer might appear simple, once one starts to look at situations, ideas, programs, and reasons it becomes clear that the answer gets cluttered with many issues, and details. Nevertheless, one thing is clear, its importance is very well accepted and recognized all over the world. Multinational companies recognize its importance when expressing their will to interview, and hire, engineering students that have had an international component in their education. At the University of Florida (UF) College of Engineering (COE) we believe that the common denominator is to implement avenues that will provide the needed international educational experience to our students, faculty and staff. The results will then naturally help a better understanding of the different cultures, for a better well being for everyone. Certainly one of the main goals is to

reduce the world problems through this exposure, understanding, collaboration, that will certainly end on respect for one another culture and beliefs.

In the next section we present a summary of engineering study abroad programs. In the third section we discuss what we believe should be the approach to create a study abroad engineering program and we show our experience with an International Industrial Engineering Consulting program in Chile. Then, in the fourth section we discuss the results that the program has had after seven years of life. Finally, in the fifth section we present our conclusions.

2. STUDY ABROAD PROGRAMS

At the UF-COE we believe that there are different ways of internationalizing the curriculum. Besides the intrinsic experience benefit of the different programs, like the advantage that the credits get transferred to UF and the student can continue with his/her program, offering a diversity of possibilities is a must. Among the many type of Study Abroad Programs, we would like to discuss the following:

a) **The Typical Study Abroad Program:**
It simply consists on students going to another country for a semester or less, and to take the same classes students will take in their university, but in a local visited country university. The advantage is that the credits get transferred to UF and the student can continue with his/her program. An extension of this opportunity is that the student gets the flavor of a different culture in that course(s).

b) **An International Class Module:**
To incorporate in the class a module that will bring an international component, in the form of a case study, for example. This will be of particular importance for students that in the education of students that otherwise will not have the opportunity to study abroad.

c) **Any Study Abroad Class:**
This courses are those that many students take because they allow them, more than anything else, to go abroad, get to know a culture, get some elective credits, and the experience. Most of these are not engineering courses, but Arts, History, etc. for example. Their interest is extraordinary, particularly if they are based in Europe. They are certainly very popular.

d) **Hands On / Consulting Programs:**
These programs, framed in the study abroad concept, concentrate on picking junior to senior students to do engineering work. Since this is suppose to provide an international experience, it is framed as a consulting engineering work. In this category, the UF-COE has only one program: the International Industrial Energy Management Consulting in Chile. We shall discuss in depth later on.

e) **Double Degree**
Although this program is a long term one in duration, it certainly falls in the study abroad category. The difference being that it is for students abroad to come to UF-COE to obtain one of our engineering degrees. The required credits to be obtained at UF for this program is 60. The program is established to work in both directions, meaning that UF-COE can obtain an engineering degree in the country of our partner universities in Latin America.

f) **Faculty Exchange**
Through collaboration agreements, faculty teaches engineering courses to faculty, students, and professional engineers. From these additional collaborations are established, local students get interested in UF-COE. In this case, we have the chance to get very good students to pursue graduate studies at UF. In addition, academic

distinctions are given to faculty in recognition of their contributions to academia and research in Latin America. Our experience has been excellent in Chile, Peru, Ecuador, Colombia, and Venezuela.

Internationalization of the curriculum affects not only College of Engineering, but the university as a whole. These international programs do matter tremendously, because regardless of what UF students might do in their near professional future, they will be affected by the world beyond our borders. Internationalization and Globalization encompasses the main concepts of the new world that is coming for our students, and not only in engineering. The world is getting smaller and smaller due to communications, exchange of ideas, goods, etc, which are in a way eliminating the international borders, with greater impact. .

Our own development and success calls us for tearing down the walls of segregation, miss-communication, religion and political ideologies, isolation, and underdevelopment through one of the only means by which we human beings, have been able to sustain ourselves in the planet: Education. Education and collaboration, to get to know each other, to understand others that look and think different to us, not restricting our possibilities of growth. We need to work together, to prepare ourselves, especially to the leaders of tomorrow who are the students of today.

This is, universities, and even high schools are called today to provide a broader education to our younger citizens, and they must include in their curricula the word "Internationalization". Have we certainly heard all this before, sometime ago [2]:

"I am not an Athenian or a Greek, but a citizen of the world" *Socrates*

One thing is certain though, the meaning of internationalizing the curriculum is a broader concept than usually believed.

3. THE HANDS ON STUDY ABROAD ENGINEERING APPROACH

As we explored the different options for internationalizing the curriculum in the university of Florida College of Engineering, it is pretty clear though, that the preferences for a study abroad programs by students seems to be precisely the one to take regular courses abroad, and enjoy trip. At the UF-COE we want to take a much different approach.

Since it is clear what the preferences are, we consider that the objective of these international experiences should encompass a good equilibrium between these ideas and what is more important, an engineering hands on study abroad program. In this section we show some results of a study abroad program that goes precisely on these lines for the last 7 years.

3.1 THE COURSE DESCRIPTION

The set-up of the course is of that one of an Energy Consulting Engineering firm that does International Industrial Energy Management Consulting. The course, given every summer term at UF, has a capacity of 12 students (maximum), from all departments of the UF-COE, undergraduate and graduate, hence is very competitive. The Chief Executive Officer (CEO) of the firm is a faculty - the instructor (who has great experience in the field). The students are treated as engineers and the most is expected from them. The name of the course is "International Industrial Energy Management Consulting – Chile", since the class, the team, will actually fly to Santiago Chile to perform an energy assessment to a Chilean Industrial Manufacturing Facility. The course is divided in 3 parts:

Part I: The first 4 weeks are devoted to study the economic and energy environment in Latin America and the Caribbean. The study is then narrowed down to Chile. The facility to be audited is then studied in terms of the processes involved, and the energy (all types) usage.

Part II: The team moves to Chile for 2 weeks, and perform the energy audit. However, the trip is much more than just an energy assessment. Talks to professional engineers, faculty and engineering students are given in a special set-up in highly reputated, ABET accredited universities in Chile, as are Pontificia Universidad Catolica de Chile, Universidad de Viña del Mar, Universidad del Bio-Bio, etc. In addition, the group looks at the culture of the country, its food, music, arts and crafts, visit museums, dinner in a typical Chilean Folk restaurant (with Easter Island dances), etc. A detailed syllabus of the course is shown below in Table 1.

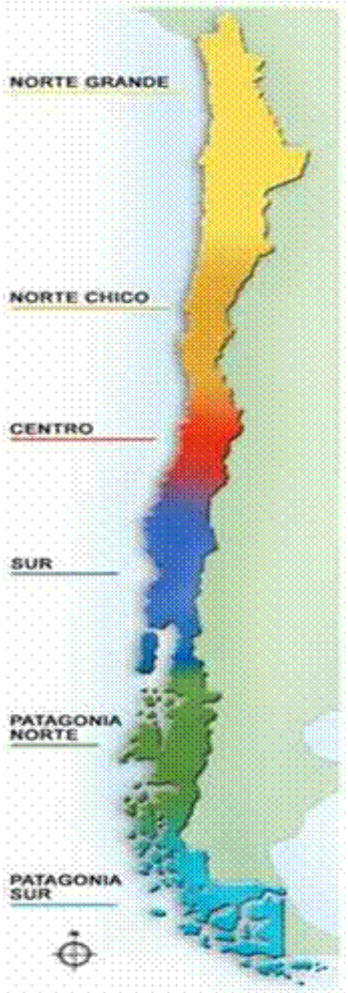
Part III: This encompasses 4 more weeks in which the students get together to write-up the final report to the client. A closing dinner and a final exam are the culmination of the course. The evaluation considers Participation, Report Writing, go in the Trip to Chile, and the Final Exam. Each one of these have the same weight (25%).

Table 1: The International Industrial Energy Management Consulting – Chile course Syllabus

1.- Introduction
2.- Industrial Energy Management Review
3.- The Energy Auditing Procedure Overview
4.- Companies to be Audited:
- General Background
- Energy Bills Analysis

5.- Latin America Economic Environment
6.- Energy Consumption in Latin America
7.- Chile, a New Member of NAFTA
8.- Geographic Influence: The Climate
9.- Preparing the Trip to Chile
10.- Local Industry
11.- Utilities and Incentives, Policies
12.- Industrial Energy Distribution/Consumption
13.- The Trip to Chile (June 13 – June 27, 2010):
- Safety Issues and Notes of Caution (clothing, equipment, etc.)
- Recommendations from UF International Center
- Interview and work with Faculty and students at PUC
- Visit to Local Utilities
- Auditing the Clients
- Getting Started with the Reports
- Environmental Effect – Pollution

14.- Work on Reports & Teleconference
15.- Final Reports submission
16.- Exam



3.2 TOPICS

The topics include mostly the following: Energy auditing, energy management, energy cost analysis, energy and electric rate structures, lighting, HVAC systems, motors and drives, boilers and steam systems, cogeneration, commercial and industrial applications, and alternative energy sources. Although shown here as a list, they certainly are visited at length.

3.3 COURSE DESCRIPTION

Study of the objectives, design, implementation and management of energy management and energy efficiency efforts. Scope includes energy efficiency, choice of energy sources, examination of new and improved equipment and technologies, examination of energy efficient processes, and alternative energy sources. Application areas include homes, institutions, businesses, large buildings and industry. Emphasis on energy efficiency applications. Thermodynamics, and/or Industrial Energy Management.

3.4 OBJECTIVES

The main objective is to allow the student to understand the basics of energy supplies and uses, and how energy can be used more efficiently in buildings and industries. To enable the student to review basic energy related sciences. To enable the student to understand the methods of energy management in homes, institutions, businesses, large buildings and industry. To enable the student to understand the realistic potential of renewable energy sources. To enable the student to develop overall energy awareness and an efficiency ethic which can be used to help themselves and the organizations they work for.

3.5 CONTIBUTIONS TO THE CURRICULA

Students will use higher level learning skills, bringing together material taught in lower division courses, and synergize it to be able to do preliminary consulting type work. The project is a key component of this effort, teaching students to work in teams, meet customer commitments, and provide cost-saving ideas to the client companies using the latest technologies in the energy management arena.

Upon completion of this course, students will be prepared to enter directly into energy management- related careers, or use the material to improve the energy management components of their professional job. The synergy of various engineering topics will allow them to get a comprehensive view of complex industrial systems, and enhance their practical skills in process improvement and economic analysis.

4. RESULTS

The program has enrolled started with 6 students in 2004, 12 students in 2005, 12 students in 2006, 12 students in 2007, 13 students in 2008, and 12 students in 2009. This gives a total of 67 students. Additional outcomes are the students exposure, the 3 credits they earn (as an elective), be ambassadors of their country, get a certificate of participation signed by the dean of the UF-COE, and the great experience. In addition, when the participating students are looking for a job they are very much in demand by companies that need to hire students with an international component in their education, particularly in industrial energy issues as is Siemens. The idea of the consulting is important as many of our graduates will somehow be involved with engineering consulting. They have found this course to be the perfect learning experience for it.

In Table 2 we summarize the number of participants and the amount of energy savings provided to the companies in Chile. There were many others, but in Table 2 we present an average of them, with the average savings. Most of them do repeat themselves from one facility to the other.

Despite the fact that these assessments are done by students, the implemented rating has reached over 20%. In other words, the implementation of the recommendations, in terms of costs, has reached this value. Furthermore, the savings comes from calculations over the involved premium over current manufacturing operations. This is very important because it tells us a great deal about our student's capabilities as engineers. It also shows the students that what they have learned at UF-COE can be applied anywhere in the world, and they just prove it during this course.

Table 2: Average Cost Savings per Audited Facility

ENERGY RECOMMENDATIONS	Cost Savings ($/yr)
Install High Efficiency Lighting	15,000
Turn Off Lights and AC	2,000
Install Hi/Lo System	3,000
Install Skylights and Sensors	12,000
Install High Efficiency Motors	33,000
Replace V Belts with Cogged V Belts	2,000
Repair Compressed Air Leaks	8,000
Reduce Compressed Air Pressure	14,000
Recover (Waste/Exhaust) Heat from Comps.	18,000
Install New Cooling Towers	13,000
Insulate Sections of Roof of Facility	5,000
Insulate Boilers and Condensate tank	**6,000**
Install Air Curtains	1,000
Turn Off Unused Equipment	5,000
Apply for Electricity Tax Incentive	42,000
TOTAL	**179,000**

5. CONCLUSIONS

We have presented and shown the results of our efforts and results on establishing a Hands - On Study Abroad Engineering program at the University of Florida College of Engineering. The results are very encouraging not only because of the number of participating students, but from the results obtained. The program is a real world consulting engineering program.

It is our experience that regular study abroad programs for engineers should consider hands on programs. Today, the number of students that wants to register per summer term in this International Industrial Energy Management Consulting - Chile program is greater than our capacity of 12 students, who have tasted the challenges of the real international engineering world.

The Latin American and Caribbean region faces many challenges in five main areas: Education, Social, Economics, Politics, and Ecology. Education is perhaps the most important one from our perspective since without it we will not be able to transform or prepare individuals and their communities. Our region has the highest indices of repetition and school desertion "in the world". To solve this we should start by investing in primary, middle and high schools. With this we will accomplish and provide hopes of success. Education certainly contributes to eliminate the Hyper-Ignorance cancer that affects the region [3].

"A country might have many oil wells, mines with precious metals and jewels, fertile lands, lots of ocean wealth, forests, and many other natural resources, but if the brains of its children are empty, that country has no future"

We can extend this fact with a dilapidating conclusion, if we don't generate our own strong higher education, and from there our own science, technology and industry, we will be always slaves of developed countries. These countries in turn do invest in education, science, technology, industry, health, etc.

We truly believe that it is conferences like the International Latin American and Caribbean Conference for Engineering and Technology, organized by LACCEI that sets the stage and open more possibilities of collaboration, for the benefit of our students and our society as a whole. In summary, *"Innovation and Development for the Americas",* is not a cliché, but it rather reflects the LACCEI participants spirit and concerns of today for the engineers of tomorrow.

References

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