

## **EAO-Trip Report**

The Professional development journey to the European Academy of Otzenhausen EAO, Germany provided me with the expected opportunity for exposure to the world as a whole, and for finding/learning more sustainable ways to connect with those that share our common humanity. As a global citizen, my chances to begin to identify as part of a conscious emerging community whose actions contribute to building and sustaining this community values and practices, is being enhanced. I now feel instinctively connected to others around the world that are facing similar global challenges. It does appear that this trip demonstrates that sufficient support, resources and tools to act on these instincts, abound, and can be mobilized. It is therefore my strong conviction that the EAO Perspectives on Global Initiative Workshop has helped me, in very substantial and sustainable ways, to learn how others are achieving usable solutions. So, now, I begin my journey to replicate these sustainable practices, first by sharing my experiences through this Report, and by designing and infusing Sustainable Concepts, based on **Product Life Cycle Management PLM** into all my Courses in Fall 2019 (Research & Teaching Module). After this has been well tested and assessed, it will then be possible to scale and encourage a Departmental, and hence a college-wide consideration, for adoption. Two basic strategies will be used to address this question. 1) *A Course Content Redesign to inculcate lessons learned* and 2) *Utilization of Lessons Learned to impact Directed Studies Research that is currently being conducted here at Southern Polytechnic College of Engineering and Engineering Technology (SPCEET).*

### **Course Content Augmentation or Redesign.**

The values for our common global existence have obvious positive consequences. Such values include, but are not limited to, *Environmental Protection, Renewable Resources, Sustainable Economies, Gender Equity, Human Rights, Religious Pluralism, Alleviation of Poverty, the Rule of Law, Prevention and Cessation of Global Conflicts, the Total Eradication of Weapons of Mass Destruction, Preservation of Diversity of Cultures, Sustainable Technologies,* and so on.

There is no doubt that efforts have been initiated by the Global Community, including KSU, to develop institutional policies and structures that can support these emerging values. I have returned from this workshop with content and renewed energy that would allow me to advocate at the local level for, 1) policies and programmatic solutions that can address local problems; 2) participate in decision-making processes of global governance; 3) adopt and promote changes in behavior that help to protect our environment; 4) contribute to humanitarian relief efforts and 5) continue to grow the **Renewable Energy Directed Study Courses** that have been initiated at SPCEET, in multi-disciplinary ways, given the opportunity and support. Specifically, I would like to continue my tradition of inculcating **Product Life Cycle Management PLM** understanding into the Courses that I teach, which ensures that students learn that, until an assessment has been made, completely analyzed and understood what will happen to the materials at the end of their life cycle, for any Engineered Component, it should not be built. In more than one of the courses that I teach, such as **EE4701-Professional Practice**, the attention of students are always being drawn to the study of Engineering Materials. In this course, topics such as **Product Manufacturability, Material identification, Material Processing and Commercialization, including the important aspects of the life cycle management of the Final Product are elaborated upon.** For all intense and purposes, students are encouraged to design for what happens to say, **Copper Pipes** that become scraps on the old site, when new construction is being developed. In this particular scenario, students are trained to answer the following Questions:

1. **Will the old used Copper be recycled?**
2. **Will it be buried in the Fields?**
3. **Will it be sold on EBay?**

Sustainability is meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. So, I plan to teach students to pay attention to the:

- Examination of methods of conserving energy and water resources
- Looking for opportunities to recycle or reuse existing materials
- Selecting Renewable Resources when practical
- Considering the end use (landfill, recycle, etc.) of a material as part of the design process.

The EPA defines Green Engineering as “*the design, commercialization, and use of processes and products which are feasible and economical, while minimizing the generation of pollution at the source and risk to human health and the environment*”. **Product Lifecycle Management is the key!** This will ensure that we can Conserve and Improve the Natural Ecosystems, while protecting human health and well-being; Use life cycle thinking in all engineering activities; Ensure that all material and energy balance inputs and outputs are inherently safe and as benign as possible; Minimize depletion of natural resources; Strive to prevent waste; Develop and apply engineering solutions while being cognizant of local geography, aspirations, and cultures; Cultivate engineering solutions beyond current or dominant technologies; Improve, Innovate, and Invent (technologies) to achieve sustainability; and Actively engage communities and stakeholders in the development of engineering solutions

## 2. **Renewable Energy Research**

It is generally known that the amount of energy that can be captured using a Wind Turbine is a function of the *Air Density, Wind Speeds and Rotor cross-sectional area*. This is because the rotor area determines how much of the available Wind Energy the turbine is able to harvest from the source. The literature on Windmill designs reveal that an annual wind speed of about 12 miles per hour is necessary for a source location to be considered as a ‘Great’ location. The types of Turbines that the above refers are essentially for normal operating conditions for applications to existing grid. For Ultra-Low speed applications, as are desired in this effort, more carefully designed Blade profile and Rotor cross-sectional areas are needed. This study is investigating the *comparison of a 2-Bladed, 3-Bladed, 4-Bladed and 5-Bladed Rotor design performance, including the Golov and Fibonacci Profiles, in very low Wind speeds for Modular applications*. This research focuses on the design, modeling and testing/verification of a Horizontal-Axis Sub-Sonic Wind Turbine. Students begin with a broad set of requirements for a NACA 0012 Blade Design and are researching the specifications from NREL, NASA & JPL, to create an electrical, and functional design to meet the requirements. They will then proceed to implement the design to include 3-D Printed applications available in the laboratory.

## 3. **Broader Impact - Collaborative Efforts (Greenhouse Accelerator – Bernie Burgener)**

As recommended by the office of the Provost, the **Executive Director of Greenhouse Accelerator, Bernie Burgener** was invited (**College of Engineering & Engineering Technology**) for a Tour and conversation on work done so far in infusing some engineering course with **Sustainable Decision-Making Topics/Content** for our EE students. He was very impressed and promised to come in on a set date to address the class and make that a seasonal event on our Campus.