**Interdisciplinary Exercises in the Use of Local Resources for Transportation Energy in the African Context**

Use of locally available and renewable resources is an important approach to sustainability for those processes and resources. Although many resources, from consumer goods to food to fuel, can be readily obtained from distant locations, this is facilitated by dramatic inequalities in standards of living actually requires the consumption of artificially “cheap” transportation resources. Transportation resources have enormous geoscience relevance, and include the costs of fossil fuels (primarily petroleum distillates) as well as road, rail and shipping infrastructure. Less developed communities, and African countries in particular, are frequently burdened with inadequate transportation infrastructure, which makes the effective cost of consumer goods disproportionately higher than in high-income Western countries. In countries that do not produce or refine petroleum, fuel costs dictated by international markets are beyond the control of local communities or national governments. Further, poor transportation infrastructure hinders export of products from African countries, particularly perishable agricultural commodities.

Using natural resources from agricultural communities to generate biofuels onsite could enhance independence for rural communities and add to transportation infrastructure. **Biodiesel** is a diesel engine-compatible fuel made from renewable vegetable or animal fats. Biodiesel consist of fatty acid esters made by chemically reacting biological oil with an alcohol. American biodiesel hobbyists often use potassium hydroxide catalyst to react waste vegetable oil (from restaurant fryers) with methyl alcohol, which is used in antifreeze and is available automotive accessories stores. **Dumpong Biofuels** was a non-profit biodiesel project set up by a team of Americans in July 2007 in the Eastern region of Ghana to demonstrate and instruct farmers in the production of biodiesel. They used the “Open Source” approach to construction and operation of a 55-gallon biodiesel production plant from steel drums and plumbing materials, and they posted detailed specifications for their process on their Web site (<http://dumpongbiofuels.org/>).

We set out to engage African and Diasporan students in using a low-cost DIY engineering approach to building and running village-scale biodiesel production plants. The Pan African Student Summit (<http://www.panafricanstudentsummit.org/>), organized since 2000 by the Sankofa Educational Foundation of Ghana, has provided students from Africa and the African Diaspora with a forum to discuss issues, inspire ideas that promote action for the progress and development of Africa. This event was inspired by the desire of independent co-founders Masao Meroe (owner of Sankofa Beach House) and Earl Caldwell to recreate, for today's youth, experiences in Africa that shaped their careers. The Morehouse Pan-African Global Experience (MPAGE) program allows US students to study (for academic credit) and experience contemporary cultures of Africa from multidisciplinary perspective (<https://www.morehouse.edu/academics/soc/mpage/index.html>). This program grew out of afaculty initiative to promote study abroad supported by the Salzburg Global Seminar (to Cynthia Hewitt, Professor of Sociology, Morehouse College). The two programs met in Langma, a fishing village 40 Km from Accra, Ghana, for program called **"The Sustainable Village"** from July 18-21, 2012. Participants included 1 student each from Togo and Sierra Leone, 4 from Benin, 11 from Nigeria, 13 from Ghana and 10 from the US. The keynote session was moderated by Allotey Bruce Konuah (lecturer at African University College of Communication, and Member of the Dumpong Biofuels NGO) and included talks by the late Steve Madojemu (former oil Executive and author of "The Crude, the Barrel & the Very Ugly :Corruption of Oil and the Entrapment of Africa") and Dr. Myron Williams (Chemistry Professor, Clark Atlanta University). Following the addresses, Williams and Bruce-Konuah led a hands-on workshop on biodiesel production that included experiments testing different raw materials, and completion of a small-scale processor. Materials for the workshop were donated by the group leaders. The conversation continued over the next 2 days with discussions led by speakers from a variety of sectors including solar and technology-based business, entrepreneurship, business plans and financials, as well as historical, cultural and educational dimensions of sustainability. The students, who were studying a diversity of Social Science, Natural Science, and Creative disciplines, exchanged definitions of sustainability in African languages Yoruba, Igbo, Ogwaui Aku, Fante and Krio, and several expressed interest in developing biodiesel businesses.

Although the project did not immediately yield a successful commercial operation, our experiments and attempts at creating a business plan has led to other initiatives and project questions. One outcome was the realization that methanol, the alcohol typically used for biodiesel production in the US, is 1) produced from fossil fuel, and 2) was imported to Ghana and not sold in the small quantities needed for our project. To compensate for this we reasoned that we could use ethyl alcohol from a local country-distilled spirit, called “Akpeteshi” in Ghana, in place of methyl alcohol. However, the country stills are inefficient and Akpetishi comprises ~ 50% water, which interferes with conversion of oil to biodiesel using hydroxide catalysts and results in contamination of the product with soaps. This has led to additional literature research and student investigation in my laboratory on the water tolerance of various catalysts for biodiesel production.

Further development of this project for international and interdisciplinary education and enterprise development will depend upon collaboration of stakeholders and commitment of financial resources from various sources to bring students together and working materials.