

Florida State University

Environmental Impacts of Energy Production Systems: Analysis, Evaluation, Training, and Outreach

Principal Investigator: Amy B. Chan-Hilton **Co-PIs:** Gang Chen (CEE), Wenrui Huang (CEE), Michael Watts (CEE), Ming Ye (Scientific Computing), and Paul Lee (Florida Department of Environmental Protection)

Students: Andres Lastra, M.S. Civil Engineering; F. Rios, M.S. Scientific Computing; Gustavo Munoz, B.S. Civil Engineering; Libo Cui, Ph.D. Civil Engineering

Description: The goal of this project is to develop tools and conduct research to objectively assess environmental and water resources needs and constraints while developing prudent energy strategies and policies. The focus of this research will be on fuel cycle and energy production systems. The objectives of this project were to analyze the environmental and water resources demands and potential impacts, specific to Florida's unique geographical challenges, of fuel cycle systems and develop an objective environmental impact screening and evaluation tool or decision support system for energy planning and policy making by Florida's industry, utilities, and government.

As Florida develops its long-term energy strategy, multiple efforts are ongoing to develop and apply a wide range of energy technologies that are sustainable and carbon-neutral. But pragmatic issues related to environmental impact and sustainability need to be addressed before these technologies may be implemented. This project directly addressed the FESC's Thrust 6 on "Energy systems and their environmental and economic impacts." This project also directly addresses IESSES's Objective 4 on unique geographical challenges and Objective 5 on sustainable energy engineering, science and the sustainable energy economy.

Budget: \$64,738

Progress Summary

A literature review of environmental impacts of energy production systems is complete. We conducted an extensive literature reviews on how biofuel production systems, with a focus on cellulosic ethanol, affect our environmental resources and quality. Approximately 400 journal papers,



Julie Harrington and Ming Ye at the 2010 FESC Summit. Ming Ye participated in the Project "Environmental Impacts of Energy Production Systems: Analysis, Evaluation, Training and Outreach."

reports, and permit applications were reviewed for this task to date. This includes impacts on the potential contamination of water, soil, and air, demands on water resources, ecosystem and human health, and emissions of greenhouse gases. We have found that the local impacts and downstream issues such as effluent and by-products from biorefineries have largely been overlooked in the literature. However, these issues are relevant and are significant when siting and permitting these facilities. Two manuscripts to peer-reviewed

Science, December 2009, declined; and Environmental Science & Technology, August 2010, published 2011. A spread-sheet based evaluation and decision support tool was developed. Also, a GIS-tool used to evaluate the impact of nutrients from point sources was developed. This helps in assessing the environmental impacts of feedstock growth and biorefinery processes from biofuels.

Funds Leveraged/New Partnerships

We will continue research on the environmental impacts of cellulosic biofuel production. In particular a Ph.D. candidate in Civil Engineering will conduct dissertation research on the development of an improved life cycle assessment methodology to include uncertainty analysis as well as expanded environmental impacts measures to evaluate biofuel production and aid in decision making related to biofuels. This will help technology developers, regulators, and industry develop sustainable plans for biofuel production.

