

FLORIDA STATE UNIVERSITY

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

PI: Amy B. Chan-Hilton (FSU) **Co-PI's:** Gang Chen (FSU), Wenrui Huang (FAMU), Michael Watts (FSU), Ming Ye (FSU), and Paul Lee (Florida Department of Environmental Protection)

Students (name/degree sought): Gustavo Munoz (B.S. Civil Engineering), Chandra McGee, Sandip Patil (Ph.D. Civil Engineering), Andres Lastra (M.S. Civil Engineering), (M.S. Scientific Computing)

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 addresses the FESC's Thrust 6 on "Energy systems and their environmental and economic impacts." This project also directly addresses the IESES's Objective 4 on unique geographical challenges and Objective 5 on sustainable energy engineering, science and the sustainable energy economy.

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 are to:

- 1 Analyze the environmental and water resources demands and potential impacts, specific to Florida's unique geographical challenges, of fuel cycle systems.
- 2 Develop an objective environmental impact screening and evaluation tool (i.e. decision support system) for energy planning and policy making by Florida's industry, utilities, and government.
- 3 Provide outreach to industry, utilities, government to allow for discussion and better-informed decisions on energy strategy, regulation, and permitting.
- 4 Provide training on "Energy and the Environment" to ensure environmental stewardship without sacrificing energy production.

Budget: \$87,417 (revised Feb 2010, total for 2-year period)

Universities: Florida State University, Florida A&M University

External Collaborators: Florida Department of Environmental Protection

Progress Summary

For the period November 2009 – May 2010.

Progress made in Tasks and Towards Deliverables:

- *Task 1: Analyze potential environmental impacts of energy production systems.* We have conducting extensive literature reviews on how biofuel production systems, with a focus on cellulosic ethanol, affect our environmental resources and quality. Approximately 500 journal papers, reports, and permit applications have been 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 (e.g. 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. We also have investigated how state and federal policies, regulations, and permitting processes can affect the progress of establishing biorefineries in different regions of the U.S., including Florida. Two manuscripts to peer-reviewed journals were submitted in December 2009 and May 2010.

- *Task 2: Develop evaluation tool for energy production systems.* During the Summer 2010, we are exploring how a tool developed to investigate nitrate in groundwater and streams developed in a current project funded by FDEP may be extended to a biofuel production scenario in Florida.

Seeking External Funding:

- IDR - Engineering Solutions for Sustainable Algal Growth on Municipal Wastewater Effluent, National Science Foundation (NSF), PIs: Michael Watts, Michael Wetz, Amy Chan Hilton, William Cooper, requested budget \$ 876,536, submitted December 2009, pending.
- DMUU: Collaborative Groups in Energy, the Environment, and Sustainability, National Science Foundation (NSF), PIs: Robert Isaac, Dmitry Ryvkin, Svetlana Pevnitskaya, Douglas Norton, Amy Chan Hilton, requested budget \$ 2,794,206, submitted July 2009, declined.

Publications:

- McGee, C. and A. Chan Hilton, Analysis of Federal and State Policies and Environmental Regulations for Bioethanol Production Facilities, submitted to *Environmental Science & Technology*, 2010, under review.
- McGee, C. and A. Chan Hilton, Anticipating local effects of cellulosic biofuel production, submitted to *Science*, 2009, declined.