FESC Florida Energy Systems Consortium

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At the USF UNIVERSITY OF SOUTH FLORIDA

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KEY FESC RESEARCH

INSIDE THIS ISSUE:

FESC Researches Gulf Oil Spill

Ocean Expert Weisberg Testifies on Gulf Oil Spill Science Shortcomings

By Vickie Chachere, USF.edu News Manager

WASHINGTON (June 15, 2010) – Robert Weisberg, a USF Distinguished Professor of physical oceanography, testified Tuesday before the U.S. House of Representatives on gaps in the nation's scientific capabilities to respond to the Deepwater Horizon oil spill crisis, calling for greater cooperation among agencies in sharing of scientific data that would expand scientists' capabilities to monitor the spill and its effects.

Weisberg, whose advanced modeling systems have allowed officials to track the oil's movement through the Gulf and led fellow researchers to find vast underwater clouds of oil in the depths of the gulf, testified before the House Natural Resource Committee's Subcommittee On Insular Affairs, Oceans And Wildlife. The subcommittee called the hearing on the question: "Ocean Science and Data Limits in a Time of Crisis: Do NOAA and the Fish and Wildlife Service Have the Resources to Respond?"

Weisberg is one of the world's leading ocean circulation experts and models created by USF's Ocean Circulation Group have been watched worldwide as more than 1.7 million gallons of oil have poured into the gulf each day since the April 20 well explosion.

He told members of Congress that academic scientists might have had greater capabilities to track the spill and the large underwater clouds of degraded oil had ocean monitoring systems not been cut in recent years. Furthermore, there needs to be a greater exchange of information between government agencies and marine scientists to allow those who have developed specific systems which can be used to track the spill be more effective.

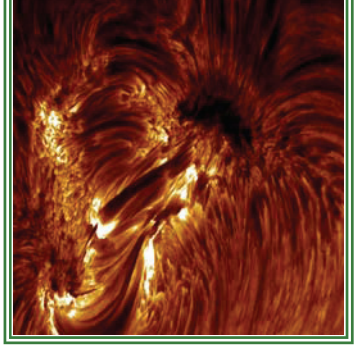
Of particular concern, Weisberg said, is the subsurface oil clouds - more commonly known as plumes. Last month, USF College of Marine Science researchers followed Weisberg's models to an area northeast of the ruptured wellhead where they discovered large areas of degraded oil suspended more than a quarter-mile down.

"Ocean circulation and the whole organization of ecology is a three-dimensional problem," Weisberg told the subcommittee. "We know the region of the continental shelf break, where the depth drops into the abyss, is sensitive for our reef fish. If there are contaminants in high levels to impact those communities, we need to know about it.

"The worst thing we can do is wipe out the fundamental habitat of our reef fish. Just because we can't see it doesn't mean it's not a threat. It may be a worse threat than what we can see." Responding to questions from Rep. Gus Bilirakis, R-Palm Harbor, regarding the exchange of data between government agencies and academic scientists, Weisberg said there are data gaps which are hampering a more complete understanding of the spill.

Continued page 2 "Spill"

Energy of the Future



FESC Universities

Florida Energy Systems Consortium

The Florida State University System provides the backbone of renewable energy expertise for the Florida Energy Systems Consortium. Member universities include:

- University of Florida
- Florida State University
- Florida Atlantic University
- University of Central Florida
- University of South Florida
- University of West Florida
- University of North Florida
- New College of Florida
- Florida International University
- Florida Gulf Coast University

Renewable energy and energy efficiency can reduce U.S. carbon emissions 60-80%, and generate millions of jobs.

Spill *(continued from pg. 1)*

While the Ocean Circulation Group has been providing other agencies with forecasts and model reports, Weisberg said there are important pieces of information he needs from the agencies to produce more specific, long-term forecasts. That data has not been available, he said.

"I am frustrated that I think I can do a better job of what I am doing if there was an information flow to me," Weisberg said. "And that has not occurred 57 days into this tragedy. That's a pretty strong statement, but I think it's an important one to make."

"No single model is adequate. This is a universal problem and we have to begin approaching it in a comprehensive manner."

This is the second time Weisberg has been called to Washington since the explosion of the Deepwater Horizon drilling rig set off the nation's largest environmental catastrophe. Last month, Weisberg was called to Washington to brief members of Congress on the movement of the oil through the gulf, including the entrainment of oil in the Loop Current which travels from the northern gulf toward the Florida Keys, through the Straits of Florida and up the state's Atlantic coast.

Gulf Oil Trajectories

The USF College of Marine Science website provides information on the Gulf Oil Spill trajectories. The model-based, oil spill trajectory forecasts are updated daily with new wind forecasts and new satellite derived oil location re-initializations. See: http://ocgmod1.marine.usf.edu/WFS/ and http://ocg6.marine.usf.edu/~zheng/

FESC Research Portal for Renewable Energy

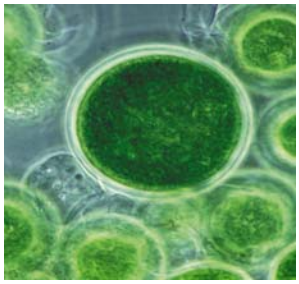
In April, FSU-FESC launched the Renewable Energy Research Portal which makes available research generated by participants in the Florida Energy Systems Consortium and collaborative groups at the Florida State University. The portal's goal will provide information to Florida researchers, businesses, investors, decision makers and citizens to enable them to accomplish statewide energy goals. For more information see: http://energyportal.cci.fsu.edu/

USF FESC RESEARCH

Sustainable Micro-algal Biofuels

USF FESC has awarded seed grants for promising cutting-edge renewable energy research. The Engineering team of Sarina Ergas, Qiong Zhang, James Mihelcic and John Wolan have created an interdisciplinary team integrating microalgal biofuel production with wastewater treatment and carbon recycling. Microalgae are productive at utilizing CO_2 and can generate biomass for production of biodiesel, methane, or other fuels as well as valuable co-products (e.g. animal feeds, polymers). Algal biofuel production can be more profitable and sustainable when combined with wastewater treatment and CO_2 utilization from electric power generation facilities.

Sustainable algal biofuels research is particularly relevant to Florida due to favorable sun exposure and temperature conditions and the large number of sites with proximity to fossil fuel based power plants and wastewater resources. Combining algal biofuel production with wastewater reclamation is particularly relevant to Southwest Florida, as control of nitrogen inputs to the Gulf of Mexico has resulted in stricter regulations for domestic, agricultural and industrial wastewater. The Ergas team is investigating the effects of gas transfer and mixing on biomass production and CO_2 and nutrient uptake in algal photo-bioreactors supplied with wastewater and combustion gases.



Both oil rich algal species and algae that grow well on wastewater will be investigated. Batch culture studies are being conducted with three different types of algae: *Chlorella vulgaris, Botryococcus braunii*, and a wild type culture harvested from clarifiers at a wastewater treatment plant. *C. vulgaris* is a green algae known to grow well on wastewater; *B. braunii* has a high lipid content and can be used for biodiesel production. The wild culture contains three different algae species. Measurements include biomass dry weight, chlorophyll, lipid content, total nitrogen, total phosphorous, ammonia, nitrate, phosphate, and chemical oxygen demand.

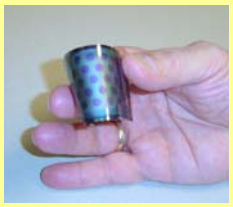
USF FESC RESEARCH

Photovoltaic Manufacturing

Establishing successful local solar photovoltaic manufacturing companies to produce clean energy products for use within the state and beyond will have the added benefit of generating jobs and the skilled workforce needed for them.

Thin film technologies have shown record efficiencies of 20%, and present tremendous opportunities for new Florida start-up companies. USF, UCF, and UF are collaborating to develop a pilot line facility for thin film solar technologies, which will serve as a test bed for making ongoing improvements in productivity and performance of solar modules, develop advanced manufacturing protocols, and help train a skilled workforce to ensure the success of new companies.

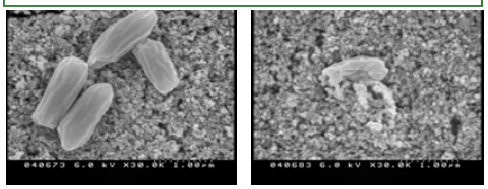
USF FESC researchers include Don L. Morel, Chris Ferekides, and Lee Stefanakos. External industry and research collaborators include NovaRay Solar, Bedford, MA; Brightwats, Inc., Ft. Lauderdale, FL; US Department of Energy, National Renewable Energy Lab.



Solar Detoxification and Disinfection

The CERC, led by Drs. Elias Stefanakos and Yogi Goswami, is conducting research to develop the 3rd generation photocatalytic technology. The thrust of USF's research in improving the photocatalytic disinfection technology is to enable its use against bioterrorism by reducing the time needed for complete oxidation to a fraction of a second. Another research objective is to develop new semiconductor photocatalysts that use visible light to increase the efficiency and decrease the system cost of an advanced photocatalytic air disinfection system.

Before and after examples of photocatalytic technology killing Serratia marcescens bacterium.



Conventional air filtration systems are inadequate to provide a satisfactory solution. Drastic measures, such as fumigation with Chlorine Dioxide have serious consequences. Dr. Goswami pioneered the development of the photocatalytic detoxification technology for air clean-up that overcomes these problems better than any other existing technology such as the Electrostatic or HEPA air filtration systems. Photocatalytic detoxification's ability to zap mites, molds, spores and many other pollutants has lead to its commercialization.

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The Clean Energy Research Center's mission is scientific research, technical and infrastructure development and information transfer. CERC is involved in fundamental investigations into new environmentally clean energy sources and systems: hydrogen, fuels cells, solar energy and energy conversion and biomass.

CERC Clean Energy Research Center

USF FESC EDITORIAL

Redistribution Strategy for Carbon Revenue

By, Prof. Tapas Das, FESC Researcher; USF Dept. of Industrial and Management Systems Engineering

It is not clear yet if the U.S. will finally put a price on carbon. Currently, things do not look very good. However, maybe in a few months, the environment (in Congress) will change and the chances of passing climate change legislation will increase.

My research team is wrestling with one of the most salient questions related to the emission control programs: *what is the optimal redistribution strategy for the revenue raised from either a carbon tax or the auction of allowances in a cap-and trade program*?

Economists have long advocated for redistributing the carbon revenue among i) households, in order to compensate for the likely increase of electricity prices due to the price on emissions, and ii) renewable-based generators, so that they can improve their competitiveness against fossil-fuel generators and increase their market share. However, there is no agreement as to how the revenue should be split among these market participants and the timing of the redistribution.

My research team is developing a social-welfare maximization-focused mathematical model to obtain revenue redistribution strategies for a planning horizon among households and renewable generators. The optimization model is founded on an Optimal Power Flow (OPF) problem and incorporates multi-period horizon, subsidies for households and renewable-based generators, and a set of constraints for the amount of revenue available for redistribution during each period.

The model will aid policymakers in proposing/evaluating revenue redistribution strategies that accompany emissions control programs. Currently, my team is testing the model with several sample problems and performing sensitivity analysis of the model parameters.