Sunshine, biofuel & the tides, oh my!

Pacific Northwest National Laboratory

SAN FRANCISCO – Scientists from the Department of Energy's Pacific Northwest National Laboratory will present a variety of alternative energy-related research at the 2012 American Geophysical Union Fall Meeting [1], which runs Monday, Dec. 3 through Friday, Dec. 7 at the Moscone Convention Center in San Francisco. Topics to be discussed include improving solar power forecasting, measuring the resources needed to grow algae for biofuel and predicting the environmental impacts of ocean energy. Summaries of some of PNNL's noteworthy presentations are below.

Forecasting clouds to improve solar power

The sun's fleeting nature has limited our ability to turn sunshine into electricity. While we can easily foretell when the sun will rise and fall each day, predicting the intermittent daytime shading created by continually morphing clouds is much more difficult. Repeated appearing and disappearing acts by clouds lead to large fluctuations in solar power generation, which makes balancing supply and demand on the power grid a challenge. But now PNNL scientists propose using a new approach to predict clouds from 5 minutes to about an hour ahead of time, giving grid operators a chance to adapt before solar power ramps up or down. Initially created for climate research, the approach uses an instrument called a total/diffuse pyranometer. Depending on their size, shape and thickness, clouds can affect light coming from the sun in many different ways to produce varying amounts of sunshine. Total/diffuse pyranometers enable scientists to measure direct and indirect solar radiation, both of which are used in different types of solar power generation. Next, the new approach uses a PNNL-developed method to forecast the clouds that will appear in the near future, what properties those clouds will have and how much direct and indirect solar radiation will make it past the clouds and onto the earth's surface. PNNL's Chuck Long will present the research.

A24E-04: "Near-term forecasting of solar total and direct irradiance for solar energy applications," 5-5:15 p.m., Tuesday, Dec. 4, Room 3008, Moscone West.

Digging for details on growing algae for biofuel

Algae have been touted as a promising source of renewable fuel, but questions remain about whether the U.S. has the resources needed to grow it on a large scale. Ongoing PNNL research indicates that algal biofuel's sustainability can be increased by carefully analyzing the resources available at specific growing sites. Current efforts are building on earlier PNNL research [2], which involved developing a detailed map of the nation's freshwater and land resources to calculate algal biofuel production potential. PNNL researchers are digging deeper by also examining alternative water sources such as seawater, the nutrients needed to grow algae,

real estate prices and costs to transport algal oil to existing refineries. The combined information will help determine the financial and environmental bottom lines of U.S. algal biofuel. PNNL's Mark Wigmosta will present a poster that describes early results, including that the Gulf Coast region generally has the nation's best water supplies and climate for growing algae.

H53H-1632: "A high-resolution national microalgae biofuel production and resource assessment," 1:40-6 p.m., Friday, Dec. 7, Hall A-C, Moscone South.

Modeling tidal power's environmental effect

Extracting energy from the natural ebb and flow of the ocean's tides could help wean the world off of greenhouse gas-producing fossil fuels. But, with very few tidal power projects in existence, it's difficult to know how such efforts could affect the marine environment. To help answer that question, PNNL scientists developed a detailed, 3-D computer model of a hypothetical bay where seawater enters through a coastal channel. They added tidal turbines to the digitized channel and ran simulations to find out how water flow could be impacted. They found that installing large numbers of turbines can decrease the flushing rate — the amount of time it takes to replace the bay's water with new ocean water. The longer it takes to flush out a bay, the longer it takes to remove contaminants from river runoff and human activity. This could worsen the conditions of bays already experiencing low levels of dissolved oxygen. On the other hand, simulations also showed turbines increase mixing in the water column, which could breathe more life into a bay's lower waters by transporting more oxygen from the surface. PNNL's Taiping Wang will discuss the computer model and some of its simulation results.

OS53D-07: "A Modeling Study of In-stream Tidal Energy Extraction and Its Potential Environmental Impacts in a Tidal Channel and Bay System," 3:10-3:25 p.m., Friday, Dec. 7, Room 3024, Moscone West.

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