Mutated organisms may hold key to hydrogen production

Researchers at the National Renewable Energy Laboratory are working on a novel way to use green algae to produce hydrogen directly from water and sunlight. Green algae produces oxygen during photosynthesis but oxygen inhibits the function of algal hydrogenase, the enzyme that allows the release of hydrogen gas. Under normal conditions such as sunlight, the alga cannot sustain hydrogen production for more than a few minutes. NREL researchers are addressing this issue by screening for naturally occurring organisms that are more oxygen tolerant and by creating new genetic organisms that can sustain hydrogen production in the presence of oxygen. Further research will determine if the modified enzymes will lead to the most-cost-effective, efficient route to hydrogen.

[Sarah Holmes Barba, 303/275-3023; sarah_barba@nrel.gov]

Nanoprobe boosts ability to detect

The ability to detect chemicals, explosives, drugs and other substances of interest has been enhanced by a detection technology developed by a team at DOE’s Oak Ridge National Laboratory. The nanoprobe is an optical fiber tapered to a tip measuring 100 nanometers with an extremely thin coating of nanoparticles of silver, which induces the surface-enhanced Raman scattering (SERS) effect. The resulting probe, based on the SERS light scattering technique, can detect substances at a theoretical single-molecule level without sample preparation and on any surface. The nanoprobe is far more selective and accurate than conventional competing technologies.

{Ron Walli, 865/576-0226; wallira@ornl.gov}

Computer code can help build better fluidized beds

DOE’s National Energy Technology Laboratory has developed a computer program, known as MFIX, that will help scientists, engineers and industrial plant designers better understand fluidized-bed combustion (FBC) systems. Multiphase Flow with Interphase eXchanges will eventually allow engineers to operate FBCs under wider ranges of conditions, thereby facilitating moving them from pilot-scale to commercial-sized plants. The MFIX solves mathematical equations generated through capture of FBC physical behaviors. These resulting numerical solutions are then interpreted as graphics, which allow scientists to visualize the inner workings of fluidized beds and the fluid dynamics of flue gases.

[Otis Mills, Jr., 412/386-5890; mills@netl.doe.gov]
Researchers at DOE's National Renewable Energy Laboratory have combined HOMER, the micro-power optimization model that can assist with designs for off-grid and grid-connected systems, with advanced automated mapping techniques that uses Geographic Information Systems (GIS) to identify the best sites for wind, solar and hybrid renewable energy systems in developing countries.

NREL recently applied these advanced wind and solar mapping and database development techniques to provide maps and databases of the amount and distribution of wind and solar resources for Sri Lanka. NREL collaborated with several agencies to gather climate and weather data that would be useful for resource assessment integrated GIS information with HOMER to discover the best ways to use these resources in developing energy systems.

Using HOMER, NREL analysts simulated the operation of possible micropower systems for every hour of the year and calculated the total cost of each system or combination of systems, and ranked them to identify the optimal system for a particular scenario (such as high solar resources or high wind resources). Most often these energy systems are renewable energy systems, but sometimes HOMER recommends diesels or hybrids that combine renewable resources with diesel.

Last summer, a new version of HOMER debuted, which also can look at grid-connected systems. HOMER can now be useful for examining applications such as cogeneration and has the capacity to analyze additional resources and systems, such as hydrogen fuel cells.

The wind-mapping results for Sri Lanka showed many areas that were estimated to have good-to-excellent wind resources and helped identify prospective areas for wind energy applications. For Sri Lanka and other parts of the world, innovations in both HOMER and resource mapping can be combined to a powerful end, a truly integrated assessment of resources and systems. For more information on Homer, visit http://www.nrel.gov/homer.

Submitted by DOE's National Renewable Energy Laboratory