

dustry to develop the national wireless public safety broadband network—gave a more pointed reason: the companies bidding for the space wanted priority access to the D block space over first responders, even in times of emergency.

Without a proper suitor and with a new FCC chair, Julius Genachowski, confirmed only in late June, McEwen says the FCC has delayed bidding for the D block indefinitely. He plans to meet with Genachowski to

discuss the agency officials' options for the D block. "They can schedule another D block auction with the rule that the winner has to work with the PSST," McEwen says. "Or they can auction the block without restriction, which they are unlikely to do."

Although broadband data access is important during emergencies, some experts do not think that the delays in its implementation will seriously undermine public safety. Voice communication will continue

to be the most important lifeline among responders, Boyd states, which is why the Homeland Security's upcoming multiband pilot program is so important. "Data are not going to replace voice as the fundamental emergency communication, because voice is interactive in a way that text will never be," he notes as an example. "In environments where you have to use your eyes and hands for other things, you have to be able to talk."

Chlorophyll Power

Quantum details of photosynthesis could yield better solar cells **BY MICHAEL MOYER**

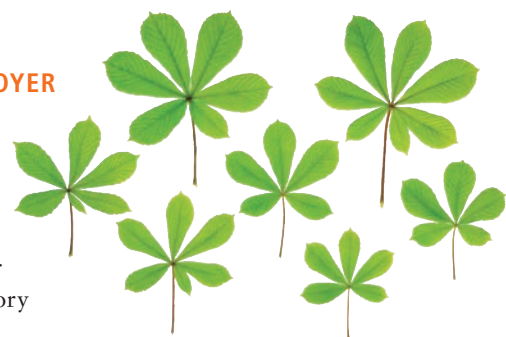
AS NATURE'S OWN SOLAR CELLS, PLANTS convert sunlight into energy via photosynthesis. New details are emerging about how the process is able to exploit the strange behavior of quantum systems, which could lead to entirely novel approaches to capturing usable light from the sun.

All photosynthetic organisms use protein-based "antennas" in their cells to capture incoming light, convert it to energy and direct that energy to reaction centers—critical trigger molecules that release electrons and get the chemical conversion rolling. These antennas must strike a difficult balance: they must be broad enough to absorb as much sunlight as possible yet not grow so large that they impair their own ability to shuttle the energy on to the reaction centers.

This is where quantum mechanics becomes useful. Quantum systems can exist in a superposition, or mixture, of many different states at once. What's more, these states can interfere with one another—adding constructively at some points, subtracting at others. If the energy going into the antennas could be broken into an elaborate superposition and made to interfere constructively with itself, it could be transported to the reaction center with nearly 100 percent efficiency.

A new study by Mohan Sarovar, a chemist at the University of California, Berkeley, shows that some antennas—

namely, those found on a certain type of green photosynthetic bacteria—do just that. Moreover, nearby antennas split incoming energy between them, which leads not just to mixed states but to states that are entangled over a broad (in quantum terms) distance. Gregory



Scholes, a chemist at the University of Toronto, shows in a soon to be published study that a species of marine algae utilizes a similar trick. Interestingly, the fuzzy quantum states in these systems are relatively long-lived, even though they exist at room tem-

perature and in complicated biological systems. In quantum experiments in the physics lab, the slightest intrusion will destroy a quantum superposition (or state).

These studies mark the first evidence of biological organisms that exploit

strange quantum behaviors. A better understanding of this intersection of microbiology and quantum information, researchers say, could lead to “bioquantum” solar cells that are more efficient than today’s photovoltaics.

Energy & Environment

Conflicted Conservation

Saving the earth might mean trampling indigenous rights **BY MADHUSREE MUKERJEE**

EVEN AS INDUSTRIAL CIVILIZATION REACHES INTO THE FARTHEST corners of the globe to extract resources such as oil, timber and fish, environmentalists are striving to mitigate its deleterious effects on the biosphere. Projects to reduce pollution, prevent climate change and protect biodiversity, however, are drawing criticism that they could drive indigenous people off their lands and destroy their livelihoods.

Conservationists have historically been at odds with the people who inhabit wildernesses. During the last half of the 20th century, millions of indigenous people in Africa, South America and Asia were ousted from their homelands to establish nature sanctuaries free of humans. Most succumbed to malnutrition, disease and exploitation, recounts anthropologist Michael Cernea of George Washington University. Such outcomes—coupled with the realization that indigenous groups usually help to stabilize ecosystems by, for instance, keeping fire or invasive weeds at bay—have convinced major conservation groups to take local human concerns into account. The World Wildlife Fund (WWF) now describes indigenous peoples as “natural allies,” and the Nature Conservancy pledges to seek their “free, informed and prior” consent to projects impacting their territories.

Recent incidents, however, have made some observers wonder. “They’re talking the talk, but are they walking the walk?” asks Jim Wickens of the advocacy group Forest Peoples Program, based in Moreton-in-Marsh, England. Wickens cites a “huge cry of concern” by 71 grassroots groups protesting a WWF effort to set up a certification scheme for shrimp aquaculture. Shrimp farms have often been established along tropical coastlines by cutting down mangroves, and their effluents have damaged neighboring fisheries and farmlands. The Mangrove Action Proj-

ect, an advocacy group based in Port Angeles, Wash., considers intensive shrimp aquaculture impossible to make sustainable.

The WWF counters that less than one third of shrimp manufacturers worldwide are currently achieving the standards that it hopes to set. As such, certification should “certainly make shrimp farming cleaner,” says Jason Clay, WWF’s vice president of markets. Geographer Peter Vandergeest of York University in Toronto worries, however, that the endeavor will falter unless the communities that are affected by shrimp farms have a say in setting standards and enforcement. Given the remoteness of many shrimp farms, he explains, auditors’ checks will be rare, and “you can easily put on a show.”

Perhaps more worrisome to advocates for indigenous peoples, however, are so-called carbon-offset schemes that seek to protect standing forests. Several of the large environmental organizations hold that the carbon saved by preventing deforestation could be sold as offsets, thereby generating funds for conservation and communities. A scheme referred to as REDD (reducing emissions from deforestation and

degradation) may be introduced this December into the United Nations Climate Change Convention, and it could be partly financed by offsets. The Nature Conservancy hopes that three billion tons of such credits, valued at \$45 billion, can be generated by 2020.

But Marcus Colchester of Forest Peoples Program comments: “We see a risk that the prospect of getting a lot of money for biodiversity could lead to indigenous peoples’ concerns falling by the wayside.” In particular, increasing the financial value of forests could lead to “the biggest land grab of all time,” claims Tom B. K. Goldtooth of the Indigenous Environmental Network, based in Bemidji, Minn. Interpol has warned that unscrupulous



THREATENED TRIBESMAN: The Melayu of Indonesia may lose fishing and hunting grounds to a forest-saving carbon plan.