OPEN FORUM | *Worldwide Energy Crunch*

Power to the people — and how to keep it coming

By Steve Chu

We live in a truly magical time. With the flick of a finger, the power of 10 horses flows from a small wire in the wall of our homes to clean our carpets. We go to the local market under the pull of hundreds of horses and fly across our continent with tens of thousands of them. Our homes are warm in the winter, cool in the summer and lit at night. We have the technology and the economic possibility to elevate the living conditions of much of humanity to heights well beyond the dreams of Roman emperors. We never had it so good.

Enjoying life as energy users has been made possible by our increasing ability to exploit abundant sources of energy. The worldwide consumption of energy has nearly doubled between 1970 and 2001. By 2025, it is expected to triple. The extraction of oil, our most precious energy source, is predicted to peak sometime in 10 to 30 years, and most of it will be gone by the end of this century. What took hundreds of millions of years for nature to make will have been consumed in 200 years. Natural gas will follow a similar fate. Other forms of fossil fuel (coal, shale oil, tar sands and methane hydrides) could last for another several hundreds of years.

There is, however, a catch. The cost of keeping the equivalent of a billion horses working for the world 365 days a year has a modern-day equivalent of cleaning the stables. The overwhelming consensus among scientists is that the Earth is warming, and the mostly likely cause is our emission of greenhouse gases such as carbon dioxide. Global warming has thus made new investments in conventional coal-burning plants questionable.

There appear to be no magic bullets to solve the energy problem. While efficiencies play a huge role in defining how much energy we consume, we must also have a diversified portfolio of investments to develop sustainable sources of energy that, in their creation and use, will result in no net emission of carbon dioxide.

What, then, should be our best investments for our nation's energy future? Fusion research must continue, but commercially viable fusion is not a certainty. Fission energy has significant issues: long-term waste storage and the potential proliferation of nuclear weapons materials. Despite these issues, it needs a second look, especially if radioactive waste can be greatly reduced by recycling and burning down long-lived radioactive products into shorter-lived waste.

Beyond nuclear energy, our most likely option is solar energy, such as solar cells and wind. Modern wind generation is becoming economically competitive, but it cannot supply the majority of our energy needs. Photovoltaic generation needs improvement in cost and/or efficiency before large-scale deployment can occur. If generation of electricity via wind or photovoltaics is to become a major component of our energy portfolio, it will be essential to develop efficient methods to convert electricity into stored energy that we can use on demand.

There is another approach. For billions of years, photosynthesis has turned the sun's energy into chemical energy. Learning to mimic biological systems may provide an eventual solution, while advances in molecular biology may offer a shorter-term answer. We should develop rapidly growing, self-fertilizing plants that convert carbon dioxide, sunlight, water and modest amounts of nutrients into biomass, such as cellulose, and more efficient means to convert the bio-mass and bio-waste into usable forms of energy. Nature has found ways to convert cellulose within the stomach of a termite and at the bottom of a swamp. A promising avenue of research is to improve these microorganism communities or develop biology-inspired enzymes that can replace existing, less efficient processes.

Among America's most serious concerns are national security (intimately tied to our energy security), long-term economic competitiveness and the dangers of global warming. Energy is at the center of all of these concerns, and thus is the single most important problem that science and technology must solve in the coming decades. New developments in science may lead to transforming technologies that will dramatically lower the cost of reducing carbon dioxide emissions.

At Berkeley Lab, this energy challenge has captured the imagination of some of our very best scientists. We are mounting a major, multidisciplinary initiative to create sustainable, carbon-neutral sources of energy. One of my hopes is that some of the most rapidly advancing areas in science, such as nanotechnology and synthetic biology, will transform industries, enabled by world-class facilities like Berkeley Lab's Molecular Foundry, now under construction, and the new West Berkeley Biocenter, a partnership with the University of California at Berkeley. I urge government and industry to more heavily invest in this nationwide quest to secure our energy future.

Steve Chu is director of Lawrence Berkeley National Laboratory and 1997 recipient of the Nobel Prize in Physics.

Learn more

What: "Managing Science and Solving the World Energy Crisis" — talk by Steve Chu, Nobel laureate and director of Lawrence Berkeley National Laboratory. Sponsored in conjunction with the Exploratorium's Nobel exhibit, on display till Oct. 2.

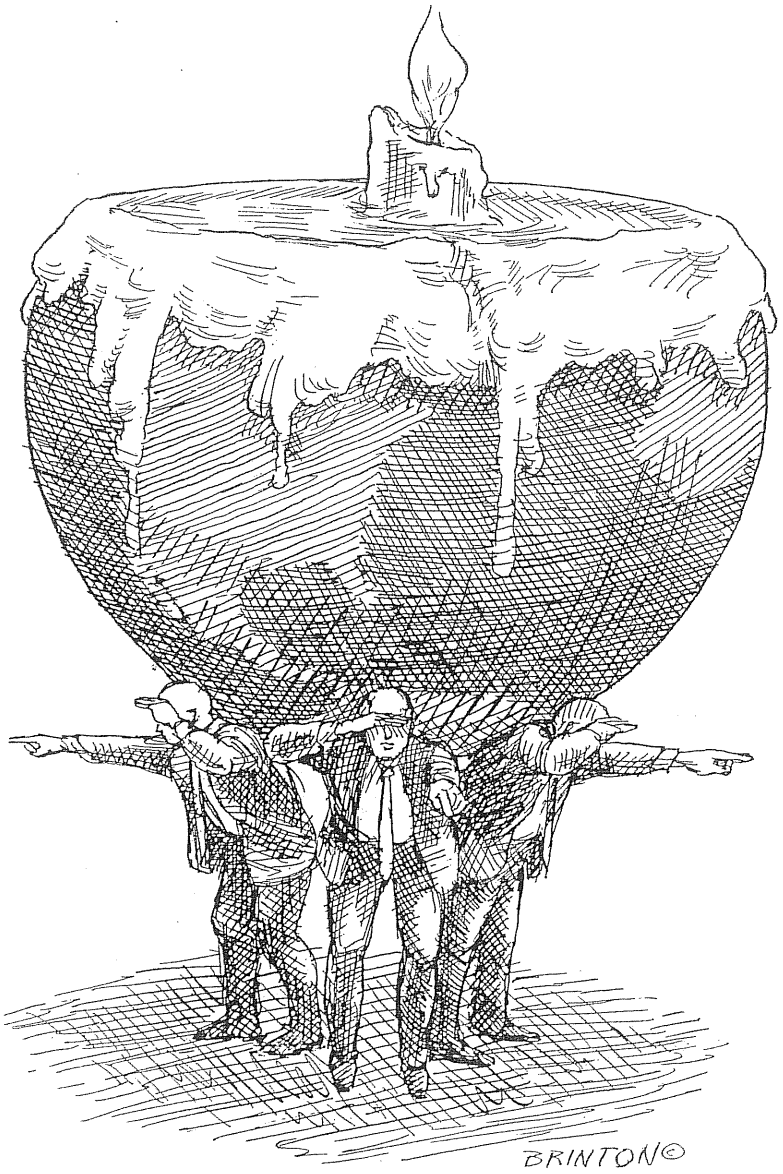
Where: Commonwealth Club, 595 Market St., 2nd floor, San Francisco

When: Thursday, 6:30 p.m. (reception at 6 p.m.)

Admission: $18 ($12 for club members)

Reservations: (415) 597-6700

More information: *www.exploratorium.edu/nobel*



TIM BRINTON / *Special to The Chronicle*