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Boston must take the lead in energy R&D

MIT's new energy initiative is a move in the right direction, and other Boston-based institutions should follow its example.

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Boston is one of the world's leading centers for biomedical research and biotechnology, enjoying significant research funding and capital investment in recent years. Now it's time for Boston to become a leading center in the development of cleaner, renewable, and sustainable sources of energy and of more-efficient ways of storing, distributing, and using it.

Last month, a panel of MIT faculty members, the Energy Research Council, released a report, recommending that MIT launch a campus-wide, multiyear, multimillion-dollar energy research program and create within five years a permanent energy laboratory or center with central research space.

The panel also suggested several promising areas of research and development, including renewable energy (wind, solar, geothermal, waves, biofuels), electrochemical energy storage and conversion, and enabling technologies (superconductors, biotechnology, nanotechnology, etc.).

The MIT community is now providing feedback on the report. MIT president Susan Hockfield, a noted neuroscientist who in her inaugural address last year emphasized the need for MIT to focus on energy issues, says she plans to begin the implementation phase this fall.

We applaud this call as both visionary and urgent. MIT must take several crucial steps soon:

1) Energize and recruit the best faculty, students, and postdocs to tackle the problem in a focused manner;

2) Establish a special office to raise substantial and stable amounts of funding (hundreds of millions of dollars over 20 years and more) for the long term from many sources, including governments at all levels, foundations, private industry and investors, and visionary individuals;

3) Follow the example of MIT's Radiation Laboratory of the early 1940s, where researchers from many disciplines came together under one roof to design the radar systems that played such a major role in the outcome of World War II;

4) Encourage startups to rapidly bring new energy technologies to the marketplace;

5) Train future generations of students and researchers from a wide range of disciplines, including biology, chemistry, physics, engineering, and nanotechnology, to apply their knowledge and skills to energy problems.

Addicted to oil

Without reliable and affordable sources of energy, civilization as we know it could collapse. Our lifestyles and everything our society rests on—food production, commerce, transportation, technology, and health care—require cheap fossil fuels. There is an increasing realization that the era of "cheap" oil is coming to an end.

This will happen sooner rather than later, due to rapidly increasing oil consumption in many developing nations, including China and India, as well as the United States and its ever-growing demand for energy. Our fate would worsen should the developing countries follow the U.S. example of exponential growth in oil consumption. We need new and better solutions to solve this problem now. MIT's energy initiative is one step in the right direction.

Look to the sun

While we applaud the Energy Research Council's recommended approach of the parallel pursuit of multiple possible solutions, we believe that certain technologies, namely wind power, nuclear energy, ethanol fuel, silicon-based solar power, and the more exotic forms of alternative energies, are problematic in the face of rapidly increasing oil prices.

These technologies have high up-front energy and financial costs to produce the necessary hardware and materials, such as wind turbines, silicon solar panels, and enriched nuclear materials. Such high costs will become a prohibitive bottleneck if oil prices continue to climb.

Harvesting solar energy using the principles of photosynthesis is one way out. We and our colleagues have shown that a photosynthetic protein complex isolated from spinach leaves can be used to power electrical circuits. The efficiency of this kind of photovoltaic is currently about 30 times lower than silicon photovoltaics.

However, building a photosynthetic photovoltaic requires only natural molecular self-assembly processes, common equipment, and temperatures not exceeding 900 C. Why strive for 40 to 50 percent efficiency in silicon photovoltaics when the cost of silicon processing is high and will likely keep increasing along with the price of oil?

Regardless of what the best technology is, we must all aim to rapidly develop technologies that use the least amount of energy to produce and maintain the energy-harvesting devices of the future. While the next big thing in energy may not necessarily be the most efficient, it will have to be the most affordable.

We believe that harvesting the sun's energy using novel, low-cost materials is one of the most promising ways of reaching this goal. The sun provides 10,000 times more energy than we use, and we do not harvest even .001 percent of it.

It's up to Boston

Other Boston research institutions can and should follow MIT's lead. Harvard University, Boston College, Boston University, and other world-class universities and institutions in this area should realize that this problem is of Project Apollo–like importance.

Unfortunately, even after President Bush's latest State of the Union address, which called on America to break its oil addiction, and his call for more funding in "clean" energy research, solving the energy problem still has no leadership or organization of Project Apollo–like significance. Government grants for energy research are slow moving and mired in bureaucracy.

It is up to individual research institutions in Boston to realize that the energy issue is urgent and if ignored, potentially dangerous for national security and the well-being of our society. Local institutions must come together, formally and informally, and collaborate to come up with solutions.

Boston's famous biotechnology and nanotechnology knowledge base can make significant contributions to battery efficiency, nonsilicon-based photovoltaics, bio-based hydrogen harvesting, and many other areas. We must convince some of our biotech and nanotech people, as well as engineers and physicists, to work on the energy problem now.

Although biomedical research is important for prolonging our lives, energy research is vital for saving our civilization. With good biomedical research, one can potentially live to be 120. But realizing this benefit with our technology-based health care system requires cheap energy. Without it, we will look at the wonderful cures from biotech only as penniless window-shoppers.

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