

The green-energy landscape just keeps changing

Experts debate renewable options and why oil still holds sway

Alan Boyle, MSNBC, 8-16-10

Today there's a whole menu of options for going beyond the petroleum era, from biofuels and next-generation nuclear power to solar-powered syngas production. But which option will be the "magic bullet" for America's next energy era? It turns out that every energy alternative has its pluses and its minuses, just as oil, coal and natural gas do.

The current renewable-energy debate focuses on how to strike the right balance using all those alternatives — and avoid getting burned in the process.

Some of the emerging solutions for the world's energy woes are outlined in a series of reports appearing in the current issue of the journal *Science*. Usually, *Science*'s articles are available only by purchasing the magazine, or looking it up at the library. But *Science*'s editors at the American Association for the Advancement of Science believe the energy issue rates so highly in the public interest that they're making the reports in their special section freely accessible for the next two weeks. (Free registration is required to access some of the reports.)

Science's editor emeritus, Donald Kennedy, observed in an editorial that future energy solutions won't be as simple as buying a plug-in hybrid electric vehicle, or putting biofuel in your tank, or buying a woodstove. He says the 21st century's fossil-fuel crisis will be nothing like the oil crisis of the 1970s.

"The contemporary challenge is not that there isn't enough oil; there is far too much of it," Kennedy writes. "Oil has produced environmental devastation on Gulf shores, more of the same in Amazonian forests, emissions from transportation systems that endanger public health, and supplies managed by nation-states that threaten global security. The abuses that result from an overdependence on oil amount to a national crisis, and its resolution will depend on cooperative actions taken by government, industry and the public."

Here are some of the intriguing possibilities outlined in the *Science* special report:

- Huge solar-power farms are being built to feed gigawatts of electrical power into the global grid — but how do you get the power from sunny climes to places where the sun doesn't shine? As outlined in Daniel Clery's report for *Science*, one of the world's most ambitious projects in this field is the multibillion-dollar DeserTech venture, which aims to build solar farms in Africa and the Middle East, and transmit much of that power to Europe. The project has been compared to the Apollo space program, but it's not without precedent. Concentrated-solar-power (CSP) facilities are also operating in California and Spain. But such facilities have sparked debate over their impact on the environment.
- German researchers report that electricity isn't necessarily the only payoff from concentrated solar power. CSP systems can also be used to desalinate seawater, or drive chemical reactions that can turn water and carbon dioxide into hydrogen fuel. If the temperatures are high enough, the H₂O-CO₂ mix can be turned into hydrogen gas and carbon monoxide (which would go through further chemical conversion). Tests of such technologies are being conducted at the Plataforma Solar de Almería facility in Spain. But much more research and development will be needed before you can put solar synfuel in your tank.

- Five years ago, cellulosic ethanol - produced from humble grasses and wood waste — looked as if it could be a "simple solution to pain at the pump." But in Science's special report, Robert F. Service says the federal government's plan for ramping up cellulosic-ethanol production is in "deep trouble" because the economics of ethanol don't make as much sense as folks thought they would back then. Technically, it's still tougher than expected to convert cellulosic feedstock into fuel than it is to use American corn or Brazilian sugar cane. The market for ethanol is limited because most automobiles can use only a 10 percent ethanol blend. That situation could change, however, if automakers give an extra push to cars that can take in 85 percent ethanol (known as E85). In other reports, researchers note little attention has been paid to determining which crops make for the best biofuels ... or how America's energy infrastructure will have to change to accommodate those biofuels.
- Experts say the "most promising" sources for biofuels include some of the world's smallest organisms: microscopic algae. We've talked about algae power previously, but in the journal Science, Dutch researchers provide a progress report on advances in the field. They also say more work will be needed to harness all that (literally) green power — including genetic engineering to maximize the organisms' production of fatty acids, and systems engineering to maximize the extraction of fuel from those super-algae. They say "10 to 15 years is a reasonable projection for the development of a sustainable and economically viable process for the commercial production of biofuels from algal biomass."
- Wind power is the renewable-energy technology that's closest to prime time as a significant contributor to the electric grid. Right now, about 2 percent of U.S. electricity is generated by wind turbines, but energy planners want that figure to rise to 20 percent in the next 20 years. Science's Eli Kintisch, author of "Hack the Planet," says the biggest obstacle to that is a "not in my backyard" syndrome, fueled by environmental and aesthetic concerns. The siting problem applies to other renewable-energy technologies as well, ranging from solar to geothermal.
- Some experts see nuclear power as the only realistic near-term alternative to fossil fuels for large-scale energy generation. It's not "renewable power," as that term is usually defined, but British engineers Robin Grimes and William Nuttall foresee a "two-stage nuclear renaissance" that eventually includes safer techniques for reusing spent nuclear fuel. One of the ventures taking this approach is TerraPower, which has generated buy-ins from venture capitalists and buzz from green-power pundits. Will nuclear power eventually be seen as a green-power option?

The bottom line from the Science special report is that the transition to the next energy era will be more complex and take longer than many of the proponents of renewable energy probably think. It will take decades, even if you subscribe to futurist-inventor Ray Kurzweil's view that solar power will bail us out by the 2030s . The long lead time shouldn't be surprising, though. Science's Richard A. Kerr points out that it took more than half a century for humanity to make the transition from wood power to petroleum power.