Electric power transmission lines span the downtown Los Angeles skyline. Some say a plan to create an underground power grid could decrease the nation's need for oil. (Nick Ut/AP Photo)

Powering Up

Researchers: National Power Grid Could Meet Increasing Energy Demands

By Lee Dye
Special to ABCNEWS.com

April 2

— If the United States had been able to do decades ago what a few experts are proposing that we start doing now, nobody would care much about the oil in the Middle East or beneath the Arctic plains.

We wouldn't need it.

Our economy would be based on hydrogen and electricity, delivered in prodigious quantities to our urban centers through a vast underground network of cables and pipes. Of course, that wasn't possible even a few years ago, but recent breakthroughs in science and technology have convinced a number of key players that there is no reason why it couldn't be done in the years ahead.

They are proposing something they call a "SuperGrid," which would carry hydrogen and electricity from distant points to major population centers and shift this country away from its dependence on petroleum.

Underground Network

The transcontinental SuperGrid was first proposed a couple of years ago by Chauncey Starr, founder and president emeritus of the Electric Power Research Institute. The proposal led to a seminal conference in Palo Alto, Calif., last November that brought together a number of experts from various fields to see if they could find any reason why Starr's bold concept wouldn't work.

"We didn't find any," says Thomas Overbye, professor of electrical engineering at the University of Illinois, Urbana-Champaign, an expert on the transmission of electricity over power grids and organizer of the workshop. "We didn't find any show stoppers."

Presentations at the workshop described tunneling techniques that would enable the placement of large cables and pipes and possibly even power plants beneath the ground, creating an invisible power grid that would serve the country's energy needs for many decades.

The beauty of Starr's vision is it represents a synergy of two energy sources, electricity and hydrogen, that will become even more critical in the years ahead. If hydrogen is ever to become a viable energy source, we will need far more capacity to generate electricity, because it takes electricity in enormous quantities to extract hydrogen from water. And if electricity is to be delivered to our cities in the quantities that will be needed in the future, we need some way to transmit far larger amounts than is currently possible.

To do that, we will need to resort to superconducting cables, which can transfer a huge amount of energy in a relatively small wire. But superconducting cables have to be super-cooled down to near absolute zero, and that's where the hydrogen comes into play. Hydrogen gas turns into a liquid at around 20 degrees above absolute zero, and it could be used to cool the superconducting cable.

Vast Undertaking

So here is the energy future as seen by visionaries like Starr:

Huge generating facilities, such as hundreds of square miles of windmills, or nuclear power plants, or coal, or some other form of renewable fuel, would generate electricity in remote areas. That electricity would be fed into a superconducting cable housed in a pipe with liquid hydrogen. The two would flow into our urban areas, where the electricity would power our homes and factories, and the hydrogen would be used to power fuel cells that would run everything from our laptops to our vehicles.

So we would get two energy sources for the price of one, and each would complement the other.

The cost, naturally, would be staggering, possibly in the $1 trillion range, but it would be spread over decades and is probably not much more ambitious than the construction of the interstate highway system, according to participants in the November meeting. The game plan is to begin small, most likely with a demonstration project at one of the national energy labs.

Paul Grant, who pioneered research in superconductors at IBM, is now with the Electric Power Research Institute and one of the primary promoters of the SuperGrid concept. Grant says he hopes one of the labs will do a demonstration project fairly soon to show that significant amounts of electrical energy can be transmitted through a superconductor over a distance of at least a few hundred feet.

The purpose of that project, he says, is to "find any land mines" that engineers may have missed in their analysis of the proposal.

If there are no show stoppers there, the next project would be a working superconductor that would smooth the flow of electricity through one of the "transmission grid bottlenecks" identified recently by the Department of Energy.

There's been no commitment on that yet from the department, but Grant is optimistic.

"There's a lot of buzz about this in the DOE and the national labs," he says. "I'm encouraged."

Growing Need

It's important go get going soon, according to the University of Illinois' Overbye, because it will take decades to complete such an ambitious project.

"Global oil production is going to peak, when nobody knows for sure, but not too far in the distant future," Overbye says.

There are a lot of technological hurdles that still have to be leaped, he says, and some of the decisions down the road won't be easy. The energy future as seen by Starr and Grant is powered largely by nuclear plants, and there is much public opposition to the use of that resource because of lingering questions about safety and what to do with radioactive waste that must be isolated for thousands of years.

Others are concerned about the safety of hydrogen, which is also used as rocket fuel.

But the problem, Overbye says, is there aren't many alternatives. Renewable energy sources, like windmills, appeal to many, but in most cases they require a lot of land.

"To replace one large power plant it might take 40 square miles of wind farm," he says. Still, there are lots of areas across the Great Plains "where you could put windmills on the land and still farm it, or still graze your cattle," he adds.

But it won't do any good to generate all that power unless you have some way to get it to the urban centers where the demand is greatest, Overbye says. And for that you need superconductors. And the best way to cool them is with liquid hydrogen.

Starr's vision — and at this point it's still only a vision — would deliver both. ■

Lee Dye's column appears weekly on ABCNEWS.com. A former science writer for the Los Angeles Times*, he now lives in Juneau, Alaska.*