Lo, a Smart Grid!

The Left's energy miracle turns out not to be that

WILLIAM TUCKER

"We will build the roads and bridges, the electric grids and digital lines that feed our commerce and bind us together," President Obama promised in his inaugural address. "We will harness the sun and the winds and the soil to fuel our cars and run our factories."

He wasn't kidding. The stimulus package adopted last week included: $8 billion in loan guarantees for wind and solar projects, $4.5 billion for "smart grid" upgrades, $6.5 billion to help the Bonneville and Western Area Power Administrations upgrade their grid to ferry renewable energy from remote regions, and $600 million to help the Department of Defense convert facilities to wind and solar. We're on our way.

Modernizing our electric grid to accommodate a future built on "renewable" energy has become a favorite cause of environmentalists. Al Gore's "Repower America" plan says the key to creating a "green America" will be a "unified national smart grid" that will enable "clean electricity generated anywhere in America [to] power homes and businesses across the nation." In his current bestseller, *Hot, Flat, and Crowded,* Thomas Friedman longingly imagines that, 20 years from now, grid updates in California will have "made large-scale renewable energy practical for the first time ever. . . . Southern California Edison [will derive] more than half of its power from two vast renewable energy sources — wind and solar."

Environmentalists are right that there are problems with our current grid, and not just in terms of delivering wind and solar electricity. But they often misrepresent what it would take to solve the problems. They speak of the "smart grid" as if it were a panacea, but it will only install computers in every home to measure electricity use, the better to match supply with demand. Several additional technologies would be required to make large-scale wind and solar energy a reality, not to mention investments in the windmills and sunlight collectors themselves. Once all of these costs are taken into account, grid upgrades are much less attractive — and nuclear energy, coupled with some solar power, looks like a much more reasonable cure for the nation's energy ailments.

The first problem with the current grid is that it cannot balance the intermittent power supply from wind and solar energy with Americans' shifting electricity demands. A grid is not a machine for cranking out electricity, but a highly tuned instrument; because electricity travels at the speed of light, it must be consumed as it is generated. If electricity drops more than 5 percent, brownouts or blackouts may occur. If it surges by an equal amount, it can damage electrical equipment. (That's why you have a "surge protector" between the wall outlet and your computer.)

On the supply side, the wind doesn't blow all the time, and the sun doesn't shine all the time. On the demand side, people need different amounts of electricity depending on the time of day and the weather. This mismatch wreaks havoc on the system, and that's why Friedman's "half" figure is sheer fantasy: The best estimates are that the grid can tolerate no more than 20 percent wind without becoming overwhelmed by fluctuations. Solar, at best, could handle another 10 percent of our consumption.

The second problem stems from the fact that wind and solar facilities — because of their staggering land requirements — are best located in remote places. The upper Midwest is being billed the "Saudi Arabia of wind." Huge solar installations are planned for southwestern deserts. This means the grid has to ferry electricity over long distances to urban centers, which our current setup cannot do efficiently.

The computerized smart grid's main task will be to help match supply and demand. Meter readers will no longer come to your house — everything will be recorded at some central information station. This will enable utilities to tweak prices hour by hour, raising rates at times of high usage. The hope is that people will postpone chores such as washing dishes or drying clothes to off-peak hours, thereby leveling the daily fluctuations.

This will not *solve* the supply-and-demand problem, however: If the wind dies down, power disappears, and even the smartest grid can't transmit electricity that doesn't exist. To increase the proportion of electricity coming from wind and solar to anything like Friedman levels, a vast network of electrical storage will also be required.

At present there is only one established technology for storing commercial quantities of electricity, "pumped storage." At night, such a system uses extra electricity to pump water uphill. During the day, when demand is high, the water is released, and the power is re-collected via turbines. There are about 30 pumped-storage plants around the country, with a total capacity of approximately 20,000 MW — 3 percent of our total consumption. All the good sites are gone, and there will be no more.

A second method is to use excess electricity to fill underground caverns with pressurized air, but this is not yet in wide use. There is also talk of employing a national fleet of electric cars as a network of storage batteries, but that is far in the future.

The second problem, that of transporting wind- and solar-generated electricity to population centers, requires a completely different solution. Our 345 kilovolt (kV) transmission lines cannot transport electricity more than 300 miles without excessive losses to heat and friction. The only way to reduce line loss is to upgrade to 765 kV. That means building an entirely new national grid — at a time when our current grid has fallen into disrepair because no one wants transmission lines built near his neighborhood. The cost will easily surpass $1 trillion.

That won't be the end of the matter, however — these updates will address the *distribution* of electricity, but not its *generation*. To supply more wind and solar energy, we'll need windmills and sunlight collectors on an almost unimaginable scale. In his testimony before the Senate Foreign Relations Committee in January, Gore downplayed the cost this would impose, claiming that all of America's electricity needs could be provided by a southwestern solar facility "100 miles on each side" (10,000 square miles). To support this assertion, he referenced a January 2008 *Scientific American* article.

But the article, "A Solar Grand Plan," actually says "46,000 square miles of land would be needed for photovoltaic and concentrated solar power installations." That's one-third of New Mexico, the fifth-largest state. The article also calls for a national network of pressurized-air electricity storage. The solar collectors would easily cost $1 trillion, the storage system a second trillion, and the rebuilt transmission grid a third. A trillion here, a trillion there . . .

But despite its expense, is this course of action best over the long term? In 2008, the Electric Power Research Institute in Palo Alto, Calif., released an enthusiastic report, "The Green Grid," exploring every conceivable angle by which updates like these might save energy. One was that, with electricity use smoothed out, voltage in residential neighborhoods could be shaved from 120 V to 114 V, since household appliances would rarely require full power. Another was that computerized substations could constantly adjust voltage, reducing transmission and distribution losses. The study even factored in the gasoline that utilities would save if meter readers didn't have to visit every home.

Yet EPRI's best estimate was that, even with all possible improvements, electricity use by 2030 would be only 7 to 11 percent lower than it is currently projected to be. The drop is so small, the report noted, in part because *redistributing* electricity use from peak to off-peak hours is not the same as *reducing total* electricity use. Compared with the investment, the savings in lower electric costs would be trivial.

So here's a better suggestion. It comes from Larry Kazmerski, head of solar-photovoltaic research at the National Renewable Energy Laboratory in Golden, Colo. "We think the solution is a combination of solar and nuclear," he says. "Nuclear power can handle the base load. Then you can meet your peak demand with photovoltaics. That's solar's greatest advantage — it peaks exactly when it's needed, on hot summer afternoons."

The most remarkable aspect of this solution is that it wouldn't require a new grid. *W*ithout the need to import electricity from North Dakota or the Mojave Desert, the present system would work just fine. In fact, electricity generation could become very local indeed, because while renewables have been getting bigger, nuclear has been getting smaller: Hyperion Power Generation, Inc., a New Mexico company, just introduced a reactor the size of a gazebo that can power 20,000 average-size homes.

Who would have thought nuclear would be small and green?

Mr. Tucker is the author of *Terrestrial Energy: How Nuclear Power Will Lead the Green Revolution and End America's Energy Odyssey.*