The solar energy challenge: Saving up sun for a rainy day

Published Tuesday, Apr. 21, 2015, 10:25 am
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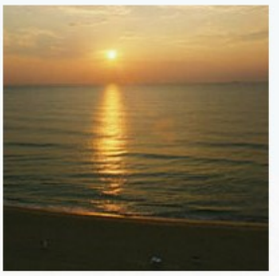
By Denis Hayes



In the run-up to a solar eclipse on March 20 of this year, European tabloids had a Y2K-style field day. In the middle of a bright, sunny day, European solar panels together produce about as much electricity as 90 large nuclear power plants. Germany, with the largest solar commitment, obtains as much as 50 percent of its electricity from the sun during the sunniest hours. The eclipse was scheduled to arrive in the middle of the day and panic was setting in.

Eclipses occur over very broad regions, so grid operators can't count on a sunny Spain to compensate for a cloudy Poland. Moreover, the decrease in sunlight (and the subsequent slingshot back to full sun) during an eclipse occur rapidly; grid operators have no experience managing such abrupt, sweeping shifts. Some predicted the eclipse would produce a catastrophe.

As with Y2K, there was no catastrophe. Europe experienced only a partial eclipse; much of Germany was fairly cloudy; and grid operators had had ample time to work out detailed contingency plans. But, as with Y2K, there had been legitimate reason for concern, and the experience offered a valuable lesson—if we are smart enough to absorb it. We need better ways to store renewable energy.

Renewable energy technologies are becoming increasingly competitive for a major share of the world's energy. In 2014, almost half of all new global investment in electricity generation was in renewables. China, at $83 billion, was the largest investor. Even excluding huge dams, the world generated 9.1 percent of all electricity from renewables last year—mostly solar and wind.

Solar and wind energy involve no greenhouse gases, no mountain top mining, no fracking, no radioactive isotopes, no oil spills. . . . But sometimes the wind doesn't blow. And sometimes the sun doesn't shine.

In the early years, the intermittent nature of renewable energy was thought to be of little concern. We could use

renewable electricity when available and switch back to conventional fuels when needed. But as renewable sources become a cornerstone of our energy mix, we will need to find ways to store power for those times when renewables are unavailable

Sunlight is, by far, the most abundant energy source on earth. But how do you store surplus electricity to use when you need it? Possibilities include batteries, ultracapacitors, and flywheels, all of which have important uses. One of the most attractive options is to use the sun's energy to make hydrogen; store the hydrogen until it's needed; then put it into a fuel cell to make electricity.

At the time of the first Earth Day in 1970, these technologies faced formidable challenges. Solar modules were ultra-expensive devices produced by a cottage industry whose only significant customer was NASA. Hydrogen was tricky to store and expensive to transport. Fuel cells required expensive catalysts like platinum.

Those did not appear to be monumental challenges for a species that had split atoms and gone to the moon. But gasoline was cheap and the oil industry was politically potent. Technical challenges are overcome only with ample funding, creative minds, and dogged perseverance. America's embarrassingly modest, start-and-stop federal support has been more of a tease than a sincere effort to build an industry.

The latest tease relates to hydrogen fuel cell vehicles. For no good reason, the federal tax credit for fuel cell vehicles ended last December while the incentives for battery powered cars continue to be in effect until each manufacturer has sold 200,000 such vehicles. Helping manufacturers achieve economies of mass production makes vastly more sense than cutting off incentives on some utterly arbitrary date.

Hyundai slowly began leasing Tucson fuel cell vehicles last year, and Toyota—the company that launched the hybrid vehicle revolution in 2000 with its Prius—plans to begin selling the Mirai fuel cell vehicle in America later this year. This is worst possible moment to remove the incentives for such vehicles!

Elon Musk, a very bright guy and the CEO of Tesla, disagrees, calling hydrogen fuel cell electric vehicles "mind-bogglingly stupid." But the arguments he uses against them mostly echo the same arguments that had been used against battery electric vehicles until Musk himself upended the paradigm. Of course, he might well be right—the multiple energy conversions, high cost of infrastructure, etc.—might prove to be the kiss of death. But this depends upon a long string of assumptions about the future. It is not self-evident to people who don't own Tesla stock that electric cars should receive rich subsidies while fuel cell vehicles receive none.

Ultimately, though, this is a bigger issue than which alternative vehicle will prove to be the long-term winner. One way or another, we need to have a way to store very large amount of sunlight for times when the sun isn't shining. And hydrogen—for fundamental reasons—has to be considered among the most attractive contenders.

Denis Hayes, organizer of the first Earth Day in 1970 and director of solar energy research under President Jimmy Carter, is president of the Bullitt Foundation and board chair of Earth Day Network.

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