Professor of materials/physics chemistry discusses Tesla's Powerwall for home energy storage

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Last month Tesla CEO Elon Musk unveiled a grand plan for home energy storage, and preorders for the system have already sold out until mid-2016. The Powerwall home battery unit comes in two options: a 7 kWh version designed for daily use at $3,000 and a 10 kWh version designed as a backup supply for $3,500, plus installation. It would charge using electricity generated from solar panels—or when energy rates are low—and would also serve as an alternative to using the utility grid and as a backup in case of a power outage. Powerwall's lithium-ion battery is geared toward homeowners and is based on the technology used in Tesla vehicles.

Sanjeev Mukerjee is a professor of materials/physics chemistry and director of the Northeastern University Center for Renewable Energy Technology, where he and his team pursue a range of innovative energy research projects in areas such as energy storage, transportation, and alternative fuels. Here, Mukerjee weighs in on the Powerwall announcement and the greatest challenges in energy storage currently facing researchers and industry.

What was your initial reaction to the Powerwall announcement?

Having a bank of batteries at home is not a new idea. Anyone can buy 12-volt batteries and combine them to provide a backup storage solution

at home. But where Elon Musk comes in, and where he's been very smart, is looking at scalability. The lithium batteries used in Tesla cars have a high degree of tolerance, or reliability. As I mentioned, a hobbyist can put a home battery like this together, but most people in this country aren't hobbyists. They just want to know if they can go out and buy a ready-made solution.

The Powerwall home battery also appears to include software and switching solutions that allow for integrating it with a solar panel. All of this will be packaged together, which will make it much easier for the average person to adopt.

Musk has also proposed building a mega lithium-battery manufacturing facility here in the United States. The main countries that currently make these batteries are China, Japan, and South Korea, and this would represent a disruption to those countries' monopoly in the market.

Do you envision Powerwall having a major societal impact on the home storage and renewable energy landscape?

The price of solar panels has been dropping steadily. Right now solar panels are below $1 per watt, or $1,000 per kilowatt. That's pretty amazing considering a few years ago they were $5,000 per kilowatt. This solar technology is approaching an age in which an average homeowner can get payback on a solar panel for an average home in three or four years.

However, the biggest impact would be primarily in the southern parts of the country in cities such as Los Angeles or Santa Fe, New Mexico. What is preventing adoption right now is that solar can power things in the daytime, but not at night during peak demand when people are

coming home and turning things on. That's when you don't have power coming in, so you need to store it someplace. If you can imagine having about eight hours of decent solar radiation available during the day you'd produce about 80 kilowatt hours of energy and using the 10 kWh unit, you'd be able to use part of this energy in a stored fashion. So essentially you're producing eight times more energy than you can store in one of these home battery units. It's still a very expensive solution. It will help mitigate the costs in some places, but it is not for everybody.

I think this is a very good first foray, and they will likely sell a lot of these units. But it's not the ultimate solution either. An important next step for wider dissemination will be to bring down the cost.

What are the greatest challenges in energy storage currently facing researchers and the industry?

I'd put this in two categories: small-scale storage in cell phones and other small devices, and storage at the home and community level. For the latter, these solutions are resigned to bringing down costs. Lithium batteries will be difficult to scale to that cost structure. There are other battery options but there are some technical hurdles to getting them to work as viable solutions. Some examples are metal air batteries and hydrogen bromine batteries. Our research group is exploring and making strides in both of these areas. We've also just filed a patent on the lithium battery side as well, developing a new material that maintains a battery's high rate capability, which refers to how much capacity you retain when you draw a battery down faster than normal. These types of batteries are typical for power tools like drills and saws and cordless vacuum cleaners that demand a high degree of torque, which draws down the battery very fast.

Provided by Northeastern University