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Tesla's Home Battery—An Electricity Storage Breakthrough?

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Cost-effective electricity storage has long been a kind of "Holy Grail" for the electric power sector. Such storage technology could have multiple benefits for electricity consumers. It can serve as a temporary source of backup power to maintain on-site electric service in the event of a utility power blackout. It can be used to improve the availability of ("firm up") electricity generated from intermittent renewable sources such as solar and wind. It can also be used to shift end-user electricity loads from costly peak hours to lower cost off-peak hours, which can level regional generation profiles and lower customer electric bills. In pursuit of these benefits, many electricity storage solutions have been developed, and some have become commercially available—primarily at utility scale—but high costs and performance issues (along with key regulatory barriers) have limited their deployment. (See CRS Report R42455, *Energy Storage for Power Grids and Electric Transportation: A Technology Assessment*.) For example, banks of lead-acid batteries have been used to firm up generation from some renewable power installations. However, the economics and environmental characteristics of these batteries are unlikely to provide a long-term answer. Lithium ion batteries, another mature technology, have a better energy density and higher cycle life compared to lead-acid batteries, but they are much more expensive to manufacture. Other advanced battery technologies and kinetic and chemical-based energy storage systems are also being pursued.

On April 30, 2015, Tesla Motors announced plans for a suite of Tesla Energy lithium-ion batteries scalable for use by homeowners, commercial end-users, and electric utilities. A key offering will be the Powerwall battery pack, a modular system offered in a seven kilowatt-hour (kWh) and 10 kWh configuration, priced at $3,000 and $3,500, respectively. While the 10 kWh battery is "optimized for backup applications," it can also be used for load shifting and, thus, appeal to customers seeking to take advantage of time-of-use electricity rates. Both batteries also target residential customers with solar photovoltaic (PV) installations to store power and extend usage beyond daylight hours.

To bring economies of scale to lithium ion battery production, Tesla Motors embarked on building the Tesla battery Gigafactory in Reno, NV. While the company's initial focus was on electric vehicle batteries, the opportunity existed to address electricity storage more generally. At the price points announced by Tesla, the economics of electricity storage would markedly improve. Including installation and other equipment costs, the estimated cost of a 10 kWh Powerwall system installed could rise to $5,000. Even so, this would be less than half the cost of estimates for similar battery storage technology, which range in price from $1,000 to $1,250 per kWh. An average U.S. residential customer with a 3kW solar PV system could conceivably recover the cost of a Powerwall in four years. Nevertheless, it remains to be seen if the Tesla Powerwall and other products will be able to overcome historical price barriers to adoption and meet customer expectations for battery performance.

In addition to its potential consumer benefits, Tesla battery systems could help the United States achieve certain public policy goals. For example, the U.S. Environmental Protection Agency's Clean Power Plan aims to further reduce atmospheric emissions from coal-fired power plants, and suggests increasing levels of renewable generation. (See CRS Report R43621, *EPA's Proposed Greenhouse Gas Regulations: Implications for the Electric Power Sector*.) Utility scale deployment of Tesla batteries could facilitate renewables deployment while reducing the need for fossil fuel-fired backup supplies and new transmission infrastructure. Widespread deployment of Tesla batteries among electricity consumers could also increase the overall reliability and resiliency of the electric grid by serving as sources of distributed electricity supply during power system emergencies. (See CRS Report R42696, *Weather-Related Power Outages and Electric System Resiliency*.)

Although the Tesla battery systems may represent a significant change in electricity storage economics, if not technology, they may face other industry and regulatory barriers. Many electric utilities have expressed concerns that state laws requiring net metering to encourage residential solar PV adoption may cause a loss of revenue and a shift of costs to lower income customers. (See CRS Report R43742, *Customer Choice and the Power Industry of the Future*.) Efforts are underway in several states to investigate the fairness of these policies. Other states are looking at the perceived value of distributed generation to utilities and society at large. Power quality, grid control, and information security are concerns associated with distributed power in any form. Time-of-use rates are not available in many utility service territories, limiting the opportunity for homeowners to capture load-shifting benefits through lower electric bills. Meanwhile, some in the utility industry may accelerate their efforts to remove or reduce federal incentives for renewable electricity which they see as unfair subsidies. (See CRS Report R43340, *Production Tax Credit Incentives for Renewable Electricity: Financial Comparison of Selected Policy Options*.) Congress is currently considering energy policy and infrastructure issues, and may introduce several bills and initiatives to encourage distributed generation as a way to diversify choices in power generation and improve electricity system resiliency.

The pricing and availability of the Tesla Powerwall and similar competing battery products may encourage further solar PV deployment, especially if current federal and state incentives continue. However, most of these potential customers are unlikely to generate all the electricity they consume, and will likely need to consider their overall electric utility costs versus the potential benefits of further investment in distributed generation and electricity storage systems.

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