Energy Storage

(1) A 2014 report by the International Energy Agency describes current global energy use as environmentally, economically, and socially unsustainable. Without a considerable decrease in our consumption of fossil fuels, most notably coal, oil, and gas, the current level of harmful carbon dioxide emissions will double by the year 2050, accelerating global warming. In addition, these fossil fuels are non-renewable and their supplies are limited, which creates competition for this precious resource. This competition, particularly in the developing world, is putting even more pressure on the global supply of fossil fuels, creating concerns over economic security and political stability.

(2) In the face of this pressure on traditional sources of energy, there has been considerable discussion of alternatives. For years, the public has heard about the promise of alternative energy sources, particularly of renewable energy, such as wind and solar power, and these sources have indeed become increasingly important, especially in Europe. For individual consumers, photovoltaic (PV) solar power, in particular, is becoming more accessible as the price of solar panels continues to drop. However, these renewable energy sources remain minor players in the market, accounting for just about 10 percent of global energy in 2012.

(3) What is holding back these alternative forms of energy from wider usage is no longer their availability; rather, it is the fact that our ability to store and use this energy on demand has lagged far behind our ability to produce it. Solar panels can provide substantial amounts of energy, but only when the sun is shining. When the clouds come out or the sun sets, consumers must once again rely on more traditional forms of energy. Furthermore, during sunny periods, the energy produced by solar panels often exceeds individual consumers’ immediate needs. Usually, this excess energy is simply wasted. In some areas, however, homeowners can sell energy back to the “grid.” The grid is the network of power production and distribution operated by governments or utility companies. Most consumers rely on the grid for their energy needs. Traditionally, the energy flows from the grid to the consumer, but in the case of PV energy, the direction may be reversed so that excess production is returned to the grid to be sold to other consumers. Although this allows consumers with solar panels that produce excess energy to reduce their energy bills, or in some rare cases, even make a profit, they do not yet have the option of storing the energy for their own use.

(4) Energy storage has been an ongoing challenge for governments and industry alike. At the industrial level, the most widely used form of energy storage is called pumped-storage hydropower. This technology is quite simple; it takes advantage of the energy that can be captured when water moves from one height to a lower one. In other words, the energy stored passively in water in a reservoir at the upper level can be released during the times of greatest need by letting it drop to another reservoir at a lower level, and then it gets pumped back to the higher level when demand is lower. Thus, although it is a net energy consumer, it has value because of its capacity to store energy. This value is limited, however, because this technology can only be used on a large scale and requires a specific physical setting. It is not a solution for integrating individual users of PV solar power into a national or global energy grid.

(5) Energy experts say this situation is about to change dramatically with the introduction of higher-capacity, lower-cost batteries. If these batteries live up to their promise, renewable energy sources will move from the margins into the mainstream of the energy market. In other words, they could be a game changer. Research into cheaper, more efficient batteries has been going on for years, particularly in the electric car market. In 2015, the automotive company Tesla announced a breakthrough in batteries, not for its cars, but for homeowners with solar panels. Tesla’s Powerwall measure 4.3 feet by 2.8 feet (1.3 meters x 0.9 meters) and provides enough power for homeowners’ energy needs for about 10 hours. And starting at USD $3,000, it is expensive but considerably cheaper than the USD $20,000 figure that many experts anticipated. In the near future, the cost of such batteries is expected to decrease to as little as 20 percent of the current figure and their capacity to increase as much as 500 percent.

(6) For some homeowners, batteries like the Powerwall will mean that they can live independently off the grid, collecting and storing all of the energy they need from the sun. For most users, however, it will provide a secondary source of energy, as well as allow them a greater degree of control over when and how they use solar energy. Residential power use reaches its highest level in the early morning and in the evening, when there is little or no sun. If residents could store power that is generated during the day when they are not home and use it when they need it most, this would be a huge leap forward in energy efficiency.

(7) Multiply this effect by the thousands of homeowners and businesses that currently use PV solar power, and it is not hard to see the magnitude of its impact. Solving the renewable energy storage problem could be another step toward reducing global reliance on fossil fuels, thereby bringing us closer to achieving energy security and reaching environmental goals.

*Passage taken from Making Connections 4, Teacher’s Manual, by Jessica Williams and Pamela Vittorio*