It is simple economics: when there is a greater demand for a product, there is a resulting greater supply of that product. Industries develop from a cycle of demand for products and services that meet the changing wants of a population and the satisfaction of these wants by the companies most efficiently able to do so. The energy production sector is no exception. With more than twice the number of people currently living in the United States compared with its population in 1950, energy use has increased significantly; indeed, the present rate of energy consumption is three times more than the rate in 1948 ("U.S. Energy Production," 2016; United States Census Bureau, n.d.). While use of fossil fuels has dropped by nearly ten percent over the past eighty years, energy harvested from renewable sources has doubled over the same period (Morris, 2018; "U.S. Energy Production," 2016). Of these alternative forms of energy—including wind, hydroelectric, and biofuel—solar faces a glaring obstacle due to the inefficiency of solar panels at nighttime, despite the resource's potential to provide all of the energy used by Americans (U.S. Department of Energy, 2012, pp. 4-5). Furthermore, if the solar power industry fails to develop an effective means of storing energy, it will be unable to compete commercially with other renewable resources and its full development will continue to go unrealized.

Today, renewable energy production in the United States accounts for nearly one-fifth of all energy generated nationally. This observed growth has been made possible by government mandates and incentive programs combined with private sector investment in renewable technology development ("Who Pays for Science," n.d.). Motivating this shift in where our energy comes from is a national focus on lowering carbon emissions in order to combat climate change and increase environmental sustainability (Bidwell, 2016, p. 746). From this trend, one can see a number of economic principles at work. According to the economic law of demand, a population's level of want for a product or service is directly related to how economically competitive it is. Unsurprisingly, then, the most popular renewable resources used today are the most technologically and economically efficient in their harvesting of energy. These energy sources consist of mainly wind, hydroelectric, and biofuels ("Renewable Energy Explained," 2019).

At this point, it is crucial to understand why renewable energy development has been growing so rapidly and has not been outcompeted by use of cheaper, more accessible sources of nonrenewable energy, a large player being natural gas (Union of Concerned Scientists, 2015). The answer lies in the economic concept of substitutes, or goods and services that people consider to be interchangeable (Corporate Finance Institute, n.d.). Recall the main goal behind developing renewable energy technologies: by relying less on environmentally harmful energy sources, human-induced climate change can be slowed, ultimately leading to a more sustainable environment for future generations. Although natural gas produces considerably less carbon dioxide than coal and oil, it is still a nonrenewable resource in limited supply (Union of Concerned Scientists, 2015).

Consider the reasoning made by businesses and individuals when deciding to use or produce renewable, rather than nonrenewable, energy sources. At present, the cost per kilowatt-hour of natural gas is half that of wind power, yet production of both energy sources increased at almost equal rates in 2018 ("U.S. Natural Gas," 2019; "EIA Forecasts," 2019). Furthermore, companies choosing to develop renewable technologies are interested in making investments that are sustainable over the long term, rather than making an immediate profit, given natural gas reserves are expected to be depleted within the next eighty years ("How Much Natural Gas," 2020). Therefore, while both natural gas and renewable resources generate cleaner energy, they are not equivalent from a perspective oriented toward sustainability. In this way, consumers and suppliers do not have reason to view the two sources of energy as substitutes. The same line of reasoning can be applied to other clean forms of nonrenewable energy.

Thus, the main sources of competition that solar energy faces are other renewable resources. While this particular resource is growing in its contribution to energy production each year, it remains well behind other sources of renewable energy, each of which continues to grow as well ("U.S. Renewable Electricity," 2019). According to several reports, a solar farm occupying approximately one-half of a percent of the land area in the United States would have the capacity to supply enough energy for the entire country, even at harvesting efficiency levels available today (Center for Sustainable Systems, 2019). Today, however, solar energy contributes to less than a third of the annual generation in the United States relative to the individual production of wind, hydroelectric, and biofuels ("Renewable Energy Explained," 2019). Beyond the comparatively small size of its current use, of more concern is the potential that solar energy production could reach a point where it would be inefficient to further rely on it.

Other renewable energy sources are able to operate during any point of the day, but solar plants can only collect energy when sunlight is available. Certainly, the amount of wind energy that can be produced is limited by the somewhat intermittent presence of wind, although an efficient means of storing energy collected by wind turbines exists, permitting the steady dispatch of energy to a population (Taylor, 2009). Conversely, energy that is collected throughout the day by solar panels may exceed a region's need for energy during that time interval, but with few feasible means of storing this excess collected energy, it may then be lost without being used. There will also be a demand for energy during the evening and at nighttime, a period when little or no energy can be produced by solar panels (Office of Energy Efficiency, 2019). As a result, the amount of energy available to areas that are heavily reliant on solar power will be limited every night, and these areas will need to rely on other sources for much of their energy generation, especially given that evenings are the time of greatest electricity use (“Demand for Electricity,” 2011). In light of these restrictions, the American populace will likely opt for another renewable resource without the same major drawback.

The most salient challenge faced by solar power is evident: for this source of energy to compete with other renewable resources, it must be able to effectively store energy harvested during the day for use during the night. Unfortunately for this industry, the few methods of storing collected energy from solar panels are highly cost prohibitive (Office of Energy Efficiency, 2019). To elaborate, the large costs associated with creating and testing batteries functional for commercial solar farms have inhibited the degree to which this experimentation can be performed (Weaver, 2019). Most forms of solar energy storage are still in their infancy—whether the batteries are made from molten salt, lithium, or a variety of other elements—and have yet to be deployed for use in full-scale solar plants. Moreover, each of these methods introduces another layer of inefficiency as a result of their inability to completely retain the initial amount of energy transferred into the storage units (Office of Energy Efficiency, 2019).

There is a clear need to create new electrical mechanisms that enhance the versatility of solar panels, but significant amounts of capital will first be required. This situation raises the question of who will provide the money, time, and labor to make these much needed innovations a reality. For companies with products and services in most demand, a greater influx of investment allows for a greater level of development in their products. For those businesses not as well established or only recently experiencing rapid growth, however, the same access to funds necessary for further growth is not always available. During 2018, while financing for large-scale wind power operations reached almost twenty-five billion dollars, that for solar power totaled less than half the funding for wind (BloombergNEF, 2019). In such a way, the full potential and use of solar energy have been stymied by a lack of effective storage technologies that would make greater reliance on this renewable energy source economically competitive on a national scale. Until these technologies are developed, the growth rate of solar energy generation may remain stuck between two cycles, one that keeps the industry unable to adequately compete with other renewable resources and another that has the potential to redefine how Americans receive their energy.

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