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### Electrical and Materials Science Engineering in Making Solar Energy Economical

Solar energy is a growing multibillion-dollar industry, however, solar energy's share of the total energy market is still well below one percent of the total energy produced. Roughly 85% of energy still comes from oil, natural gas, and coal. These are not very reliable energy sources because of depleting resources and the harm being caused to the planet. For a long-term, sustainable energy source, solar power offers an attractive alternative. There are two main issues with solar energy and I have narrowed them down to two main points, those being the efficiency and the materials used.

The first issue is the efficiency of solar panels could be solved by electrical engineers at Texas A&M University. In the past solar energy has been expensive and relatively inefficient. Technological advancements have been made in the last 20 years to make them more efficient and a more affordable choice by making them less than half as expensive. Current solar cell designs require high-purity, more expensive, materials, because impurities block the flow of electric charge. This problem would be solved if charges only had to travel a short distance through a thin film but thinner films allow less energy to become absorbed. Electrical Engineers work to solve this problem by researching materials that better absorb light energy and convert it into electrical energy. The cell semiconductor material is defined by the difference in two energy levels, the valence band, and the conduction band. The lower level contains negatively charged electrons the higher level band is empty. An internal electrochemical potential separates

electron-hole pairs causing the flow of electrons and holes and creating an electrical current. One solution for this is an emerging technology called Concentrated PV systems which are similar to telescopes that contain lenses and curved mirrors which focus light on multi-junction cells. They also have solar tracking technology and a wide range of magnification. According to the National Renewable Energy Laboratory (NREL), CPV has the most efficient PV research. In 2014, Fraunhofer Institute for Solar Energy Systems successfully developed a CPV with 46% efficiency. The max efficiency of c-Si ever reached was 27.6% and only 15% in commercial usage. Considering cell efficiency, CPV has the potential to be the future technology since cell efficiency provides a lower unit cost and requires less surface area to generate the same amount of watts of electricity.

The second issue being the storage of energy can be worked on by Material Science Engineers graduating from Texas A&M. To create cheaper alternatives for the solar power plant to produce electricity, the turbines must operate at a very high temperature. By operating turbines at 1,382 degrees Fahrenheit or higher a solar power plant could turn heat energy into electricity more efficiently. Researchers in this field have been turning to seawater for chloride-based salts that can stay stable at higher temperatures. In a study published by Materials Today, a research group has demonstrated that calcium chloride-sodium chloride composition, is highly resistant to oxidation in ambient air at higher temperatures. The transfer of heat from molten salt through heat exchangers. In 2018, a paper in Nature revealed how heat exchangers made of a ceramic-metal composite material would withstand higher temperatures and pressures needed to generate electricity.

Both engineering disciplines could work to find solutions to making solar energy a more cost-effective and efficient. The material used in today's solar panels are expensive and not very

efficient. Electrical engineers can understand how these systems work and know what the materials need to do and the Materials Science engineers can find what the materials need to withstand to make solar energy economical.