CASE 1
SOLAR PARKS

MAY 4, 2022 | USE SUSTAINABILITY CHALLENGE | TSC-C91d

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SUSTAINABILITY CHALLENGES AND SOLUTIONS

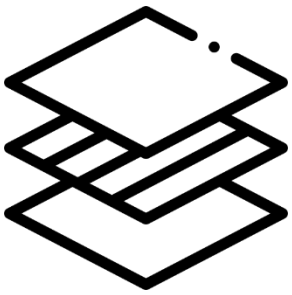
Sources describe the need for engineering innovation to develop a system that can capture, transform and store sunlight efficiently in order to increase the use of renewable energies. Currently, solar energy share represents less than 1% of the total energy market, contrasting 85% of the fossil fuels. (Make solar energy economical, 2008)

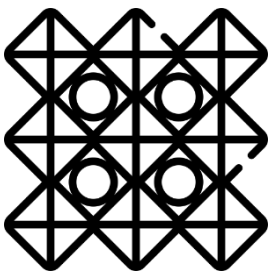
The sources also highlight the need to improve the efficiency of solar cells to lower their production costs to be able to compete with other energies that can produce electricity at a price around 3 to 6 times lower than solar energy. (Make solar energy economical, 2008)

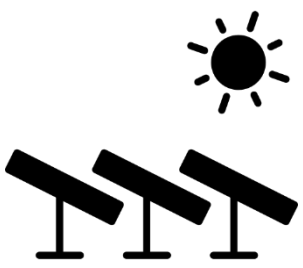
As much as solar-oriented cells are making progress in creating energy economically and productively, there remains a major limit to the utilization of the sun's energy: Shady weather and fog difficult the access to solar energy. Therefore, when daylight is abundant, the energy must be captured and stored for future use.

To improve the efficiency of solar panels and decrease production costs, various companies are developing new techniques. One of the most essential things they are looking at is the use of new and less pricey materials. Using these novel materials, many research groups are striving to enhance the efficiency percentage of regular silicon cells, which is now about 10 to 20 percent, to 30 percent. Some of the experimental cells were even able to achieve a 40 percent efficiency rate. (Make solar energy economical, 2008) In addition, they are also researching nanocrystals, which *"enhance the chance of releasing a second electron rather than the heat, boosting the electric current output."* (Make solar energy economical, 2008)

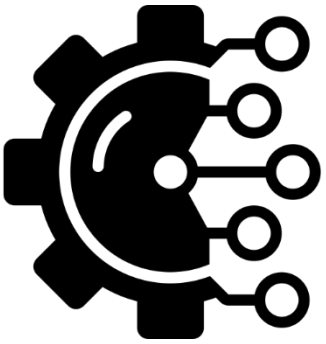
Solar energy storage is also actively being developed by a number of firms, by testing various sustainable storage techniques, such as the use of special materials and looking at how plants store/use sunlight. (Next-generation solar power, 2020) Finally, several Dutch companies are also looking at *"tandem structures, in which several types of solar cells are combined."* (Next-generation solar power, 2020) These are aiming to increase efficiency and reduce costs and space requirements.







NON-TECHNICAL SOCIAL GROUPS AND ISSUES



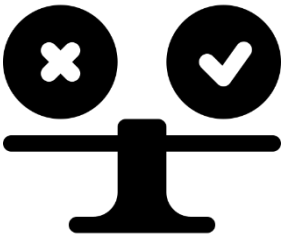
Concerning the non-technical aspects of this challenge, there are some social issues arising around solar energy involving the stakeholders (governments, consumers, manufacturers, etc.) and their role in the sustainability challenge. More specifically, the economical part regarding fabrication/manufacturing costs of energy surely impacts society. As mentioned in the article (Make solar energy economical, 2008), the solar cell designs require high-purity and expensive materials, and therefore, the consumers prefer other types of non-renewable energy sources such as fossil fuels. In order for solar energy to be considered economically competitive and become an attractive alternative, engineers and designers must lower the costs by making improvements in the efficiency of the cells.

However, in the last decade, the cost of manufacturing costs have decreased to a great extent making them affordable and often cheaper compared to other forms of electricity. Solar Photovoltaics (PV) installations can supply electricity on a commercial scale, in smaller configurations for mini-grids or personal use making electricity accessible to people in developing countries who do not live near power transmission lines. As mentioned in the article about EERA (Eera, n.d.), the PV sector has grown and turned into a 100 billion$ sector and it is likely to expand by an added factor of 10 over the next 2 decades. The solar energy industry has undoubtedly improved leading to an increase in employment supplying many new jobs. On the other hand, the industries of non-renewable will be affected since the dependence for foreign oil would be diminished if more households and companies use solar energy to generate electricity. Moreover, in densely populated areas, energy demand is high but space is limited. Solar parks require a lot of space which raises concern for environmental organizations because the power plants can potentially impact land, water and natural habitats.

MORAL ISSUES

As mentioned before, manufacturers try to lower the cost of solar panels in many different ways to be able to get more people to use solar energy. As the development continues, cheaper materials are implemented. But that is not the only part of the manufacturing process where the costs are kept as low as possible.

As with many other new technologies, the manufacturing eventually moves from Europe to Asia, where the costs, including wages, are much lower than in Europe (IndustryWeek, 2011). China is now the largest solar panel manufacturer in the world, producing almost 80% of all solar panels (Reuters, 2020). The raw material polysilicon, needed to produce solar panels, is mined in the region of Xinjiang, in the north west of China. The region has a 45% market share over the solar-grade polysilicon industry. (Mackinac Center for Public Policy, 2021)



To keep the costs even lower, the Uyghur people, who are native to the region, are being forced to work in these mines, but also in other factories around the country. This ethnic minority is being detained and abused in camps. (Mackinac Center for Public Policy, 2021) While the Chinese government denies these claims, inevitably, disruption of this supply chain would heavily influence future innovation and progress of solar energy technology. The United States has decided to ban these imports (Kaplan et al, 2021), but should we follow suit? In other words, how should we balance the prominence of social issues with an ever-growing concern for a changing climate?

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