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The History of Solar Power in The United States

Solar power accounts for 11% of United States electricity generation in 2020; and with increasing concerns towards environmental degradation and clean energy, a majority of 84% of U.S adults continue to support expanding solar farms.[1] As one of the leading possibilities of future clean energy, it is critical to analyze solar energy's creation, public response, and certain controversies with its current usage. **In this paper, I will argue that the reluctance towards solar power in the United States is a consequence of the material power of fossil fuels, administrative and governmental policy, and controversy within environmental injustice. Overall, I will expand on this argument through the actions of support and disapproval of solar power in the past and present in order to truly have a comprehensive understanding of solar power.**

Section 1: A Brief History

In 1883, the first solar cell was created by Charles Fritts, an American inventor, in New York.[2] This type of solar energy was a simple, low-impact, photoelectric module. He did this by coating selenium with a thin layer of gold-leaf film. This produced a current that was "continuous, constant, and of considerable force"[2] and a source of energy he reported could compete with coal energy in the future. This report by Fritts was released only three years after Thomas Edison's first fossil-fueled power plants had been created.

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[1]Kennedy, Brian, and Alison Spencer. "Most Americans Support Expanding Solar and Wind Energy, but Republican Support Has Dropped." Pew Research Center. Pew Research Center, June 8, 2021. https://www.pewresearch.org/short-reads/2021/06/08/most-americans-support-expanding-solar-and-wind-energy-but-republican-support-has-dropped/.

[2] Perlin, John, and Amory B. Lovins. Let It Shine: The 6,000-Year Story of Solar Energy. Novato, CA: New World Library, 2013.

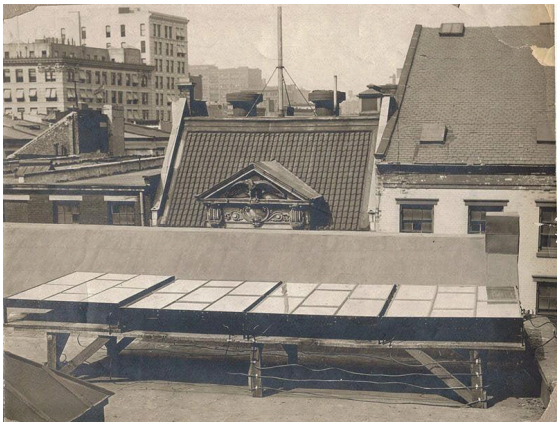

Image 1. *Charles Fritts first solar panels on New York City rooftop, 1884.*[3]

Fritts' invention was a low-impact solar cell, and it marked the start of American innovation in photovoltaic solar panels. Photovoltaic, the scientific term for converting light energy into electricity, was named after the Italian physicist, chemist, and pioneer of electricity and power, Alessandro Volta.[3] The introduction of solar energy came with both skepticism and approval. Werner von Siemens, a renowned German scientist, was sent one of Fritts' solar panels and was impressed. This led him to present the panel to the Royal Academy of Prussia, and praise photoelectricity to be "scientifically of the most far reaching importance."[2] However, many praises of the invention's importance for the future were paired with dismissal from the scientific community. Because the invention did not rely on the generation of heat, unlike all other energy sources at the time, it "seemed to counter all of what science believed at the time."[2] As a result, much of further scientific research into solar energy was slowed or halted for decades.

As a result, we can clearly see the effect uncertainty towards new technology has on scientific progress. Centering the human perspective rather than the scientific perspective can have a definite negative effect on new forms of technology that are deemed unusual or

[3] Magazine, Smithsonian. "A Brief History of Solar Panels." Smithsonian.com. Smithsonian Institution. Accessed May 7, 2023. https://www.smithsonianmag.com/sponsored/brief-history-solar-panels-180972006/.

unconventional. As argued by Timothy J. LeCain, an environmental historian, historical approaches are often human-centered. In particular, they are "dangerous overestimation[s] to understand and control the material things we partner with."[4] In order to properly understand solar energy and environmental history as a whole, it is important to understand the anthropocentric bias the scientific community initially had towards the power source.

Another important aspect that LeCain covers in "Against the Anthropocene: A Neo-Materialist Perspective" is the influence of agency and material power that fossil fuels have on human perspectives toward the appeal of a power source. Because of the usefulness, accessibility, and large power of fossil fuels, people are more likely to trust the efficiency of the power source in comparison to the developing and unusual science of solar power. LeCain argues that "when humans use things like coal or oil to generate social power, these things demand that humans conform to their material needs."[5] As a result, we can see that the human perception of fossil fuels as a material power creates its association with reliability. Coal and oil reliance shapes human need, and creates a society with a reluctance to an unusual and experimental power sources.

However, solar energy sparked a new evolution in the 1900s. With the turn of the century, Albert Einstein published a daring paper with new discoveries on the properties of light. With this new information, stimulated scientists such as Calvin Fuller and Gerald Pearson from the Bell Laboratories created the first Solar Battery in 1954– consisting of an array of solar cells with improved efficiency. They proudly displayed the panel of cells that relied solely on solar power to run a 21-inch ferris wheel. After this, *The New York Times* stated on page one that it

[4] LeCain, Timothy J. The Matter of History: How Things Create the Past. Cambridge, United Kingdom: Cambridge University Press, 2017.
[5] LeCain, Timothy James. "Against the Anthropocene. A Neo-Materialist Perspective." International Journal for History, Culture and Modernity 3, no. 1 (2015): 1. https://doi.org/10.18352/hcm.474.

"may mark the beginning of a new era, leading eventually to the realization of one of mankind's most cherished dreams — the harnessing of the almost limitless energy of the sun for the uses of civilization."[2]

One of the largest ways solar energy began to get implemented in the United States was through solar powered heating systems. This is an important distinction, as solar thermal energy was different from solar photovoltaic energy. This brings up the question as to why thermal applications were more popular than photovoltaic sources– and efficiency plays an important role. While they are similarly effective, only thermal energy can store power, while photovoltaic energy must be used during the day.[3] American architects and engineers experimented with solar home heating from the 1930s–1950s, and solar homes were constructed all throughout the Midwest, Northeast, and Southwest of the United States. Architects collaborated with groups like the Ford Foundation to connect with foreign assistance groups and export solar technology as part of development initiatives in South Africa, Morocco, and India. As part of America's involvement with contemporary architectural styles, attempts to create solar-centered architecture arose after World War II. Utilizing novel materials, architects began to create complex and revolutionary homes utilizing a framework called "the solar principle."[6]

Three key design components made up the "solar house principle." First, the solar residences had a long, thin layout that allowed the majority of the living spaces to face south, maximizing solar exposure. In order to allow the sun's rays to efficiently heat and illuminate internal spaces, the southern façade was primarily made of glass. Additionally, the roof overhang was chosen by the architects to block the midday summer light when it was at its greatest, preventing interior rooms from overheating while allowing the most radiation and warmth from

[6] Barber, Daniel A. A House in the Sun Modern Architecture and Solar Energy in the Cold War. Oxford: Oxford University Press, 2016.

the lower winter sun to enter the home.[6] The Sloan House (1939) and the Duncan House (1941), two of the several solar homes created by Keck & Keck, serve as clear examples of the solar principle. Both the Sloan and Ducan House were famous for their “passive” design of solar energy, meaning they did not require additional mechanics to create energy.

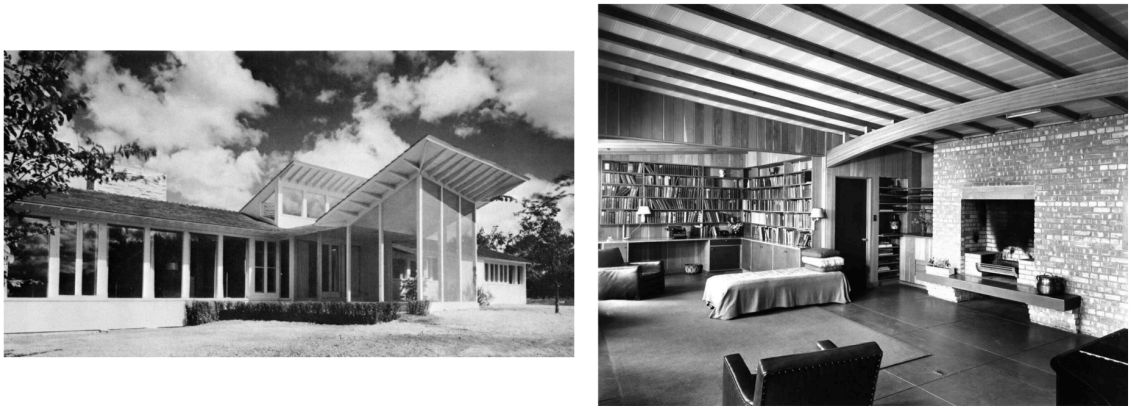

Image 2. *Sloan (left) and Duncan (right) House, 1939 and 1941.*[6]

One of the earliest homes to be constructed with solar dynamics was George Fred Keck's 1939 Sloan House in Glenview, Illinois. All of the living spaces, including the bedrooms, living rooms, kitchen, and study, are fully south-facing due to the house's long, thin layout. The south façade is mostly made of glass, with panels alternating between operable, single-paned glass windows and insulated Thermopane units.[6] Keck spent three months tracking the seasonal and nocturnal movement of the sun with specialists at Chicago's Adler Planetarium in order to accurately extend the roof in a way that would shield sunlight in the summer, and let it in during the winter. Keck also created the Duncan home, located west of Chicago, in 1941. Long shadows in the photograph show how the low winter sun penetrates deeply into the living space. Additionally, during the sun-filled winter days, the concrete floor and brick walls absorbed heat, radiating it into the space at night.[6] These examples show the intricacies of solar energy

implemented in the domestic lives of the American people, as well as the limits of solar energy as they were relatively isolated project that didn't gain widespread popularity.

One of the ways these solar houses were integrated into the American lifestyle was through the Association for Applied Solar Energy. The association was a Phoenix-based organization founded in 1955 by proponents of solar energy, and they hosted a conference and exposition titled "The Sun at Work" with equipment and research from all over the world.[7] The Association organized a contest to create a solar home in 1957. The winning design, created by Peter Lee, comprised swimming pools that were covered and panels that moved with the sun to optimize solar radiation throughout the day. However, after being sold, the solar heating system was promptly removed for being too inefficient. This event brings into play the incredibly important role of efficiency into the history of solar energy: How reliable is this energy, and how much would it really cost to implement?

Image 3. *"The Sun At Work" Exposition, 1955.*[8]

[7] Strum, Harvey. "The Association for Applied Solar Energy/Solar Energy Society, 1954-1970." Technology and Culture 26, no. 3 (1985): 571–78. https://doi.org/10.2307/3104854.
[8] Barber, Daniel A. "The World Solar Energy Project, Ca. 1954." Grey Room 51 (2013): 64–93. https://doi.org/10.1162/grey_a_00107.

These experiments in the construction of solar homes emerged during a time of growing awareness and anxiety regarding the availability of post-war energy supplies. For a brief time in the late 1940s and early 1950s, solar heating appeared to be a possible method to reduce American energy needs without sacrificing quality of life. As stated in a 1949 article of the *Scientific Monthly*, fossil fuels were seen to be a "difficult task of mining and transporting coal" and questions arose such as "Is it necessary to rely on fossil fuel alone?"[9] In this article, solar energy was proposed as a possible alternative, which highlights the priorities and concerns of the American people of the 1940s in regards to renewable energy. However, the current solar power efficiency was not enough to reliably source power for the majority of American people. As a result, many novel solar designs were undermined by an increase in oil, coal, and natural gas production in the 1950s as well as a new fascination with nuclear power's potential. By the mid-1950s, the interest in solar power had shifted towards other energy sources. Oil was still the main source of power for America– but with the turn of the 1970s an oil crisis began, causing a surge in solar power interest and development.

Section 2: A Presidential Divide

October 1973, in protest of the United States' support for Israel in the Yom Kippur War, the Organization of Petroleum Exporting Countries (OPEC) made an announcement that they would reduce oil production and limit oil exports. President Nixon answered the energy emergency by establishing a severe rationing program.[10] Anxiety about reliance on foreign oil combined with developing worries of lowered supply. Subsequently, the increase in the market

[9] Telkes, Maria. "Space Heating with Solar Energy." *The Scientific Monthly* 69, no. 6 (1949): 394–97. http://www.jstor.org/stable/19584.
[10] Strum, Harvey, and Fred Strum. "American Solar Energy Policy, 1952-1982." Environmental Review: ER 7, no. 2 (1983): 135–54. https://doi.org/10.2307/3984497.

price of oil, decreases in supplies, and consequently oil shortages sparked a furthering of interest and development towards solar power.

These oil shortages spurred a new form of interest in solar energy– political action. 1977 U.S. President Jimmy Carter began an important road towards the development and facilitation of solar energy. After his election, not only was solar energy supported, but all forms of renewable energy.[10] A new Solar Energy Research Institute in Golden, Colorado, invested government funds in solar research and spread information about solar energy with Denis Hayes, the lead organizer of Earth Day in 1970. Additionally, Congress passed the Energy Tax Act of 1978, which provided tax credits for homes that used solar powered systems, effectively stimulating advances in solar technology.[10] The Carter administration also promoted solar energy through various symbolic actions. One important example of this is President Carter's establishment of "Sun Day" as a national holiday in 1978. This day sparked various parades and gatherings of like-minded solar energy fans. In contrast, opposers within the Department of Energy claimed supporters were "a bunch of radical anti-nuclear activists."[10] Also, in June 1979, the Carter administration installed 32 solar panels on the White House for the purpose of water heating. At the installation ceremony, Carter stated, "I want our nation to derive 20% of all energy we use from the sun by the end of this century." He also declared, "Today, in directly harnessing the power of the Sun, we're taking the energy that God gave us, the most renewable energy that we will ever see, and using it to replace our dwindling supplies of fossil fuels.."[11]

[11] "Solar Energy Remarks Announcing Administration Proposals." Solar Energy Remarks Announcing Administration Proposals. | The American Presidency Project, June 20, 1979. https://www.presidency.ucsb.edu/documents/solar-energy-remarks-announcing-administration-proposals.

Image 4. *"Here Comes The Sun" parade to celebrate solar energy, 1978.*[12]

However, despite these incredible changes, solar energy was not as successful as the administration had planned. The increase in solar panels from 1977-1979 was mainly attributed to heated swimming pools rather than houses. In addition, the goal set by Carter to build 300,000 solar houses a year was never met. Sadly, despite presidential support, solar energy's cost ineffectiveness simply outweighed the benefits, and oil production continued to provide the majority of energy. In the early 1980s the Committee on Nuclear and Alternative Energy Systems rejected solar energy development as "uneconomical and requiring huge federal and private development subsidies."[10] This unsuccessful attempt at a solar energy revolution was further solidified by the policies made by Carter's successor Ronald Reagan in 1981.

After Ronald Reagan won the election in 1980, federal investment in solar power was drastically reduced. Reagan was in favor of developing nuclear power and domestic oil and gas. As a result, his administration reduced federal funding for solar research and development and

[12] Oregon, University of, and University of Oregon. Associated Students. "University of Oregon Libraries." 1978 Oregana. Oregana, January 1, 1978. https://scholarsbank.uoregon.edu/xmlui/handle/1794/12135.

allowed the federal tax credits for solar energy to expire. Under his presidency, the solar panels on the White House's roof were abruptly removed and never reinstalled. In addition to cutting funding for solar energy, Reagan increased funding for nuclear programs "indicating that the Reagan energy policy emphasizes nuclear development at the expense of solar research and conservation."[10]

Section 3: Current Controversy and Environmental Injustice

Currently, in the 21st century, solar power is generally regarded positively and supported as an alternative energy source from fossil fuels. However, in addition to understanding the creation and response towards solar power throughout American history, it is important to contextualize solar power through the lens of environmental justice. In doing so, it is essential to acknowledge two large injustices in the use of solar energy: forced labor and access disparities.

Image 5. *Ughur Muslims at a factory in China.*[13]

Polysilicon, 90% of which is produced in China, is an essential material in producing solar panels. Recently, reports of human rights abuse in the Xinjiang autonomous region in northwestern China-- where 45% of the global supply of polysilicon is produced-- have gained

[13] Byung-wook, Kim. "[Feature] Can Korea Ditch Xinjiang Polysilicon over Forced Labor?" The Korea Herald. The Korea Herald, April 29, 2021. https://www.koreaherald.com/view.php?ud=20210429000923.

media attention. The accusations report that the ethnic minority Uyghur, Kyrgyz, Kazakh, and Tibetan peoples are used in forced labor in order to produce silicon metal and polysilicon.[14] In addition, the dangerous nature of polysilicon production makes this an issue that sparked large amounts of outrage. In addition to forced labor, access disparities within communities of color pose a large issue within solar energy.

In addition to injustices overseas, solar panel creation creates negative impacts within the United States as well. In particular, solar project land has been known to impact important cultural resources for native american tribal communities.[14] The way that solar power affects indigenous groups and nations highlights the important issue of how communities that largely benefit from solar power may not be enduring many of the negative externalities of its production. One example of this is the flat-tailed horned lizard, a species essential to the Quechan Tribe's creation and culture, whose potential harm was the cause of a lawsuit from the Quechan Tribe against the Bureau of Land Management in 2010.[14] Additionally, recent studies on the cultural resources influenced by a solar project in the Ivanpah Valley's community discovered effects on the environment, "including cultural services to eighteen Native American ethnic groups."[14]

[14] Mulvaney, Dustin. “Solar Power and Environmental Justice.” Desert Report, August 2, 2022. https://desertreport.org/solar-power-and-environmental-justice/.

Image 6. *A member of the La Cuna de Aztlan Sacred Sites Protection Circle, who has filed three lawsuits against six fast-tracked solar projects.*[15]

The injustices inflicted on the indigenous community are important as they are motivated by the intention of creating a better and cleaner source of energy in comparison to fossil fuels. Michelle Raheja, the director of the California Center for Native Nations has said "There is this sense that there is this rush to renewable energy that's politically motivated and when tribes are consulted their concerns aren't being taken seriously."[15] **However, it is important to note that these responses are not exclusive to solar energy– in fact, many indigenous tribes support solar energy expansion, but within the consent of indigenous peoples.** For example, in an interview, David Harper, a spokesman for the tribal group's Mojave Elders Committee, stated, "We are not against solar power. We are against our ancestors' remains, funerary objects and cultural artifacts being dug up and carted away from their resting places."[16] Through these examples it is clear that solar projects are no exception to the negative effects that many other power sources have on both the ecosystem and culture of indigenous peoples in America, and brings to light an important question: What communities really benefit from solar panel production?

As cited in the *Scientific American*, a 2019 study indicates that even when income is factored into the comparison, communities of color have installed fewer rooftop solar energy sources than predominantly white communities.[17] The data is "among the first to show such

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[15] Schwartz, Noaki, and Jason Dearen. "Native American Groups Sue to Stop Solar Projects." The San Diego Union-Tribune, February 27, 2011. https://www.sandiegouniontribune.com/sdut-native-american-groups-sue-to-stop-solar-projects-2011feb27-story.html.

[16] "Native Americans Challenge Construction of Mojave Desert Solar Plant." Los Angeles Times, December 13, 2014. https://www.latimes.com/science/sciencenow/la-sci-sn-native-americans-solar-20141212-story.html.

[17] Hsu, Jeremy. "Solar Power's Benefits Don't Shine Equally On Everyone." Scientific American. Scientific American, April 4, 2019. https://www.scientificamerican.com/article/solar-powers-benefits-dont-shine-equally-on-everyone/.

inequality in access to clean energy" and highlights an important issue of access towards clean and renewable energy. Despite all the negative impacts from the production of solar panels that people of color face, white communities are more likely to experience the benefits of solar power. As a result, we can understand that solar energy is not a straightforward and strictly positive energy source. These examples emphasize the importance of the effect that perceived environmentalist causes may have on marginalized communities.

As argued by historians Derek H. Alderman and Robert N. Brown, minority communities can often be severely negatively impacted by policies and projects that are proposed to have a positive impact on the community.[18] Similar to how the Tennessee Valley Authority's megaprojects for hydroelectric dams created a racialized landscape and perpetuated Jim Crow laws, it is possible to see that the production of solar panels could have similar negative effects towards marginalized communities in China. This brings into consideration the idea that attention towards environmental injustice has difficulty gaining traction when the victims are not within close proximity to those perpetuating the issue. In order to properly understand the use of solar energy in America, we must also consider the energy source's effects and issues towards all people of different backgrounds and races.

Overall, solar power in the United States has had a history of reluctance from its creation to its current use. By analyzing solar power's intricate history, we can conclude three important points. Firstly, material power has an impact on the introduction of new and unusual energy sources. Second, the development of the energy source was swiftly and greatly impacted by the actions and policies of those in power, emphasizing the importance of a strong and decisive authority towards clean energy implementation. Third, the motivation for solar energy,

[18]Alderman, Derek H., and Robert N. Brown. "When a New Deal Is Actually an Old Deal: The Role of TVA in Engineering a Jim Crow Racialized Landscape." Engineering Earth, 2010, 1901–16. https://doi.org/10.1007/978-90-481-9920-4_105.

while being rooted in a search for cleaner energy, still creates negative impacts towards marginalized communities similarly to fossil fuels. In order to understand solar power as a whole, it is necessary to understand these three details– as it can allow us to properly implement new forms of energy including solar power into the American energy budget effectively, efficiently, and with consideration to the lives and cultures of all types of people.