Using Solar Charging Stations to Offset Kerosene Use in Off-Grid Navajo Communities: 2022 Project Report

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Image 1: Installed Skyhook Solar Station at a rural off-grid home outside of Cameron (AZ), October 2021. Photo: SkyHook Solar.

Project Overview

The Navajo Nation Solar Project was a pilot collaboration between Skyhook Solar, the Cameron Chapter of the Navajo Nation, and the Aspen Global Change Institute. The goal of this project was to evaluate how a solar charging solution could displace the use of kerosene for indoor lighting in rural off-grid households of the Cameron Chapter.

Kerosene lamps are widely used in off-grid communities of the Cameron Chapter for indoor lighting. This practice poses a fire hazard and a negative impact on human health. Kerosene combustion decreases indoor air quality by releasing toxic and carcinogenic gases, which may reduce lung function and increase the risk of asthma and cancer of building occupants. This practice also releases greenhouse gases into the atmosphere, contributing to climate change.

The LED lights used in this project can be powered by solar energy, providing a clean and safe alternative to kerosene lamps. A variety of rechargeable lights were chosen, all of which can be charged either by a Skyhook Solar Station (Image 1, and described below) or rechargeable battery packs.

Skyhook Solar is a company based in the Roaring Fork Valley of Colorado that produces and installs Solar Stations for off-grid energy applications. The Cameron Chapter, located in Northern Arizona, was recognized in 1955 by the Navajo Tribal Council. The Aspen Global Change Institute (AGCI) is an independent nonprofit that advances global change science and solutions by furthering interdisciplinary understanding and nurturing community to catalyze science-informed action. AGCI served as fiscal sponsor of the project.

Skyhook Solar proposed this project to their established contacts within the Cameron Chapter House, and it was approved in Fall 2020. Potential station hosts were then identified, and Skyhook's team met with them to evaluate their interest in participating. Once four host families were confirmed, the Solar Stations were produced and shipped to the Roaring Fork Valley, along with lighting equipment and battery packs.

Deployment of the solar charging stations took place November 13–17, 2020. Skyhook Solar chose to install a K2 Station Kit on each host family's property, and the family took ownership of the station upon installation completion. The K2 Solar Station was a good fit because it provides the right amount of power for a small-scale residential application, provides continuous electric availability, and is compatible with an internet modem for remote communications. Each station has 500 Watts of solar capacity, paired with a 2-kWh battery and 64 USB charging ports. Each family also received several LED headlamps, lanterns, string lights, key lights, and flexible lights, all of which can be recharged from the Solar Station or the rechargeable battery packs provided. An internet modem was installed in one of the Solar Stations.

After deployment, Skyhook Solar staff visited the hosts twice during 2021 to check on the stations and the lighting kit performance. In an October 2021 visit, AGCI and Skyhook Solar staff

met with the host families to assess the effectiveness of the program to reduce household kerosene use for indoor lightning, verify the condition of the stations, and conduct any necessary maintenance.

Interview Results

Based on interviews conducted in October 2021, several conclusions can be drawn from the first year of this project:

- **Diversity of uses:** While the stations were initially intended to power only LED lights, they were also used to power other devices, including cell phones, laptops, tablets, and an internet modem. This expanded the co-benefits of the project, since the Solar Stations facilitated increased telecommunications, access to the internet, and access to educational opportunities.

- **Station Reliability:** Despite the dry and windy conditions common to the area, all hosts commented that the stations never failed to charge their battery packs, lights, and cell phones during the first year. The host families noted that other energy sources they use, such as diesel/gasoline generators or a PV solar array, have malfunctioned at times, resulting in power interruptions.

- **Impact of generators on station usage**: Diesel and gasoline generators can be found in many off-grid households in the Navajo Nation. In this project, only one of the host families did not have a generator, and they used their Solar Station the most. In general, the more families ran generators, the less usage their Solar Station received. This is because families with generators used them to power their homes and installed lighting, instead of using the provided lamps. They also charged phones, tablets, and battery packs from electrical wall outlets. Still, at times when the generators were turned off, broken, or lacked fuel, the Solar Stations provided backup power to recharge battery packs, lights, and other devices.

- **Kerosene reduction**: Two of the hosts reported no longer using kerosene lamps after the stations were installed. A third host reported still using a kerosene lamp but about half of the time. The fourth host mentioned not using a kerosene lamp prior to the station installation.

Image 2: This photo shows seven generators beside one of the host homes. As generators fail, families need to replace them quickly in order to continue receiving critical energy services for their homes. Frequent generator failure, added to fuel costs, results in an expensive and inefficient home energy system. Photo: AGCI.

- **Station usage by neighboring households**: The Solar Stations were designed to be used by several neighboring families. Each station was equipped with 64 USB chargers divided into four equal compartments, each lockable with a separate lock and unique combination code (Image 3). This design allowed different families to use each station and lock their belongings (battery packs, cellphones, etc.) while charging. However, as host families explained, the stations were not used by neighbors. Factors that influenced neighboring households' lack of station usage included the Covid-19 pandemic and the risk of virus transmission among neighboring households, discomfort with neighboring families entering private property to access the station, and increased risk of potential vandalism. However, multiple households belonging to the same family and living on the same property used each station.

Image 3: Each station included four independent, lockable compartments for device charging. Photo: SkyHook Solar.

- **Usefulness of provided lights**: Host families identified the LED lantern as the most useful light they received, followed by the headlamp, with the string, key, and flexible lights tying for third place.

Selected Quotes from Host Families

“Our kids are doing remote school during the pandemic, and they would start the truck just for charging their laptops, tablets, and phones. Now they use the Solar Station instead.”

“The LED lights were useful for looking outside in the dark when coyotes or Mexican Gray wolves were close to our home.”

“I am very grateful to this project because I used to have headaches when I used my kerosene lamp indoors. I don’t use my kerosene lamp anymore, and the LED lights don’t give me headaches.”

“Our granddaughters use the stations all of the time.”

“The Solar Station provides us with a backup system, and that helps my family be more resilient.”

“We take the rechargeable battery packs with us so that we can charge our phones wherever we go.”

“We use the Solar Station all of the time, especially when more family comes over.”

Future Recommendations

The interviews with host families surfaced constructive feedback and important factors to consider when planning for future use of Solar Stations to displace kerosene use in off-grid communities.

While host families found the ability to charge battery packs, lights, cell phones, and tablets beneficial, they expressed a desire to be able to power other devices from the Solar Station. For example, while all hosts reported still using propane for cooking, they would use less propane if they could use the stations to power an induction cooktop, electric grill, or pressure cooker. Being able to power a small fan, small cooler, electric water boiler kettle, and other small appliances was identified as desirable to the hosts. Hosts also identified an interest in having the station located closer to the home, in order to plug these types of small appliances straight into the station’s battery.

Acknowledgments

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Image 4: Installed Solar Station (foreground) with power lines in the back. Although the power lines are located close to the rural host families in this project, transmission lines are not built to connect these households to the grid. Photo: SkyHook Solar.