



Introduction

- **Agrivoltaics** refers to the same land utilizing both Photovoltaics (PV Panels) and Agricultural Production (Hall,2023)
 - Human-made building materials reflect less sunlight and absorb more heat than natural surfaces contributing to the Surface Heat Island Effect in Urban Areas (EPA, 2022)
- Question:** What effect does the Agrivoltaics System on the Environmental Natural Resources 2 Building rooftop have rooftop heat island effect?

Site Layout

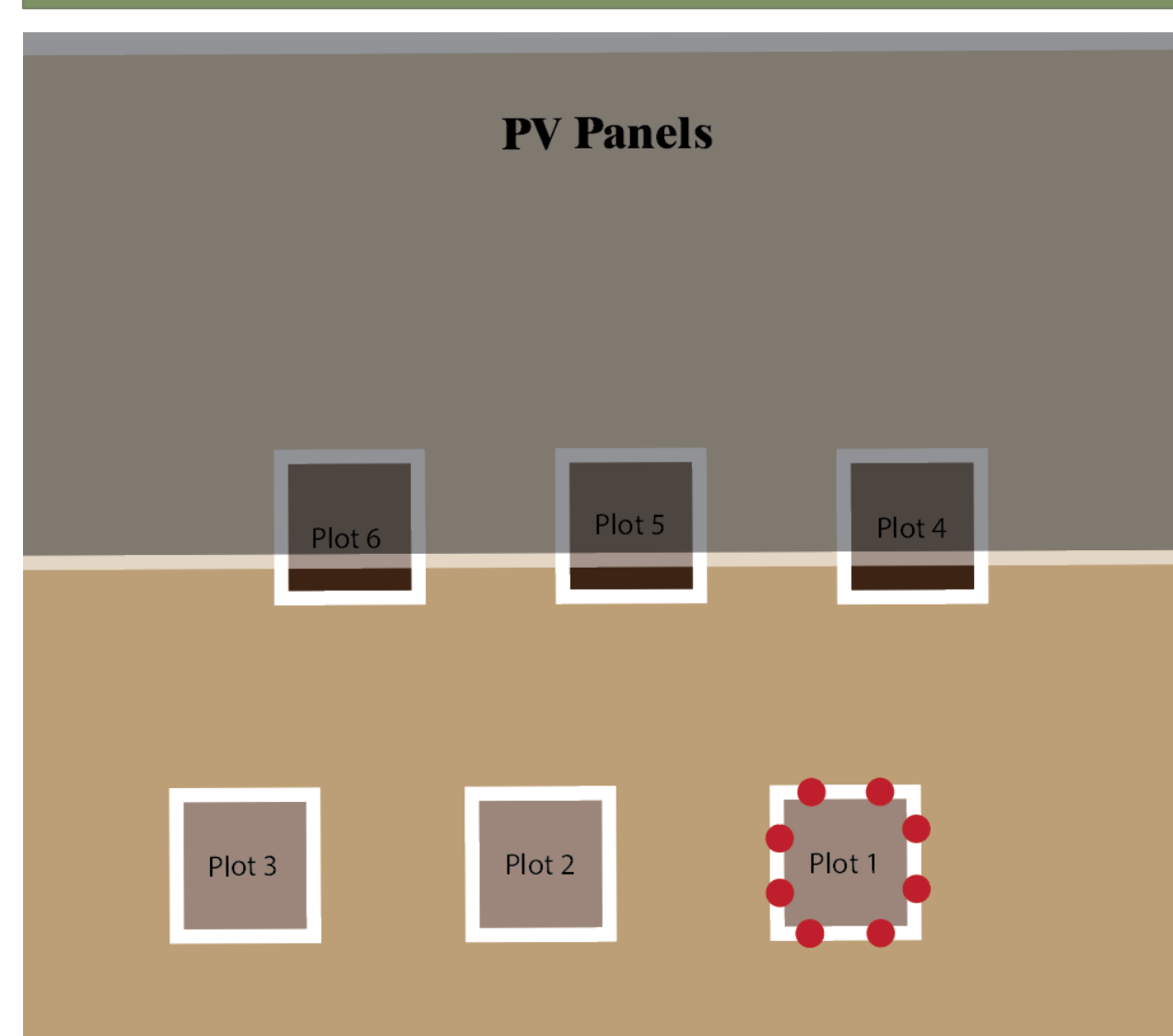


Image 1: ENR2 Plot Layout

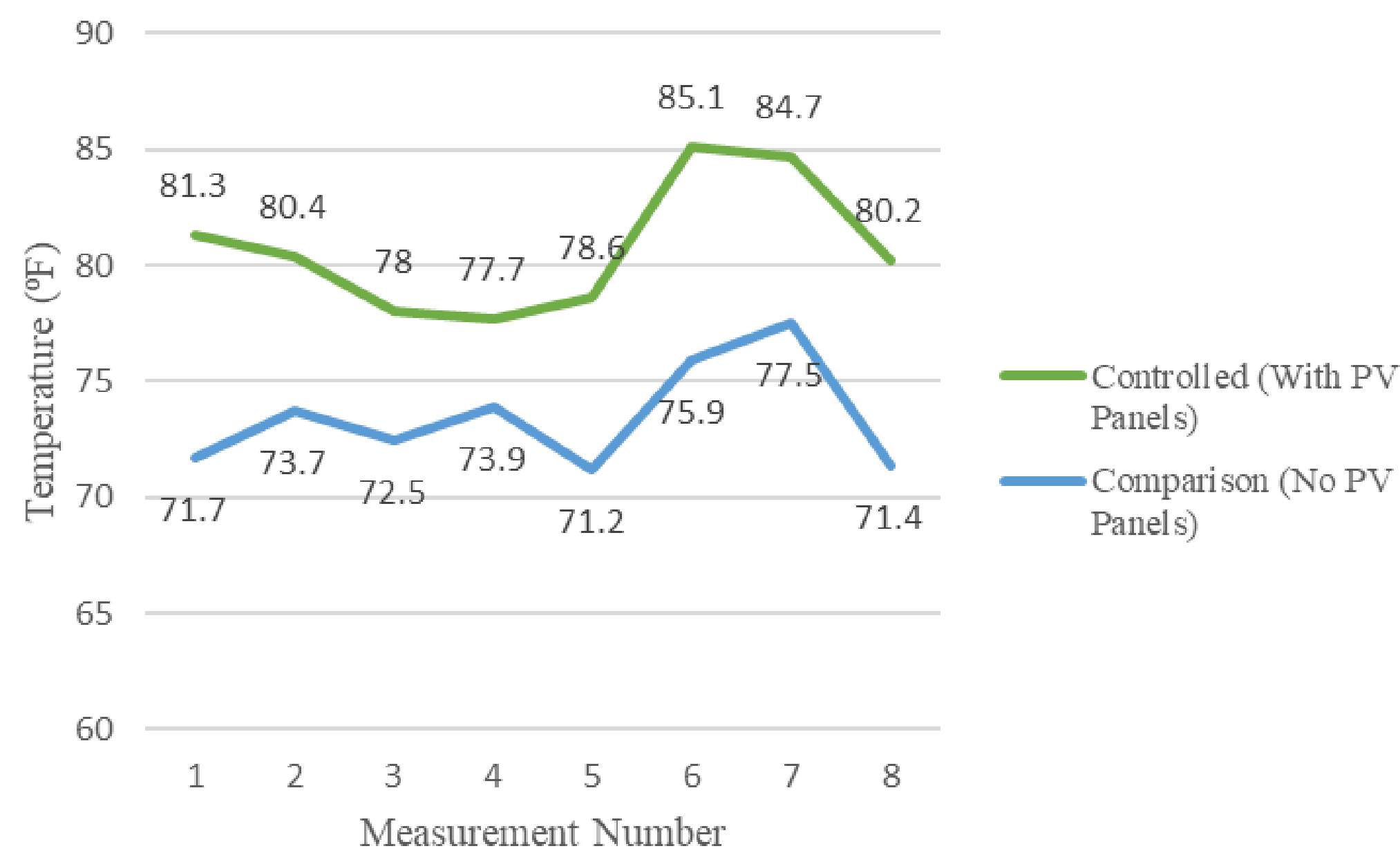


Figure 1: 16 Measurements of Ground Temperature

Methods and Materials

This study took three different measurements to aid in data collection:

- Measurement 1:** 16 IR heat gun ground measurements. 8 measurements on bed fully exposed and 8 measurements one bed under PV panels but fully exposed to sunlight
- Measurement 2:** 6 IR Heat gun Ground temperature, 6 IR Heat gun Plant temperature (Penstemon Perri) Averages
- Measurement 3:** Soil Moisture Level of 6 Plots

Results

- Measurement 1: 7.275 ° F average difference between (Fig 1)
- Measurement 2: Plant and Ground Temperature had a lower temperature difference on plots that were fully exposed to sunlight with no PV Panels (Fig 2)
- Measurement 3: No significant difference in soil moisture between PV plots and Non-PV Plots (Table 1)

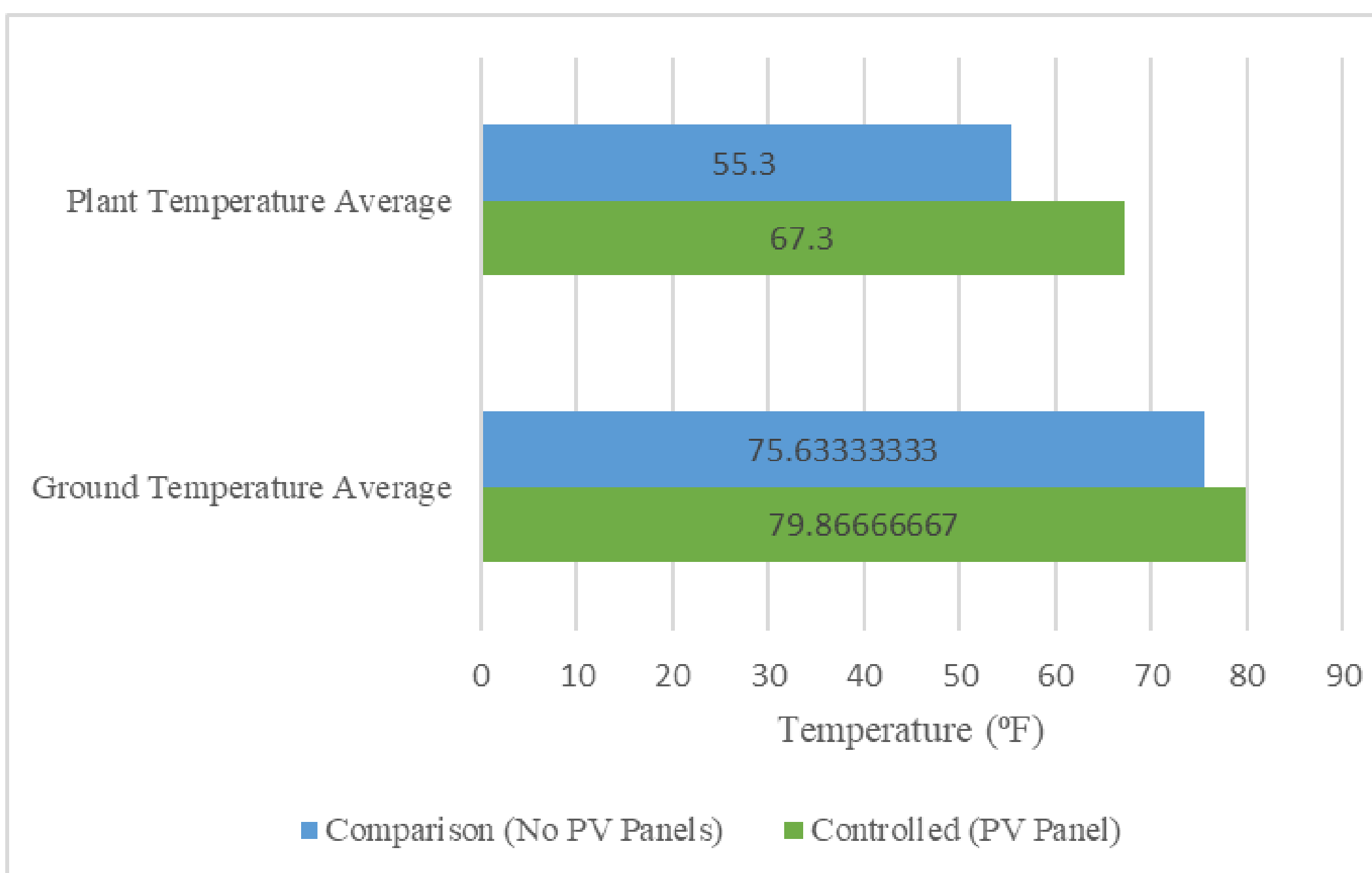


Figure 2: Average Ground and Plant Temperature

Controlled Site (With PV Panels)	Soil Moisture Level
Plot 1	6
Plot 2	5
Plot 3	7

Comparison Site (w/o PV Panels)	Soil Moisture Level
Plot 1	6
Plot 2	7
Plot 3	6

Table 1: Soil Moisture Level. Controlled and Comparison Site

Key:

- Dry: 0-3.5
- Moist: 4-7.5
- Wet: 8-10

Discussion

Plots 4, 5, and 6 revealed a pattern suggesting that the plots beneath the PV Panels had a higher temperature due to the PV panels holding warmer temperatures. With the PV Panels retaining higher temperatures from direct sunlight, these temperatures reduced the overall heat for Plots 1, 2, and 3 and had slightly more damp soil moisture.

Conclusions

- The findings of this study determined that the Photovoltaics and Agricultural production on rooftops have a reduction effect on the heat island effect on urban rooftops (Rui et al, 2022).
- The average overall **ground temperature** for plots fully exposed to the sun was **reduced by over 12° F**
- The average **plant temperature** for plots 1, 2, and 3 had a **reduction of 4.234° F**. This furthers the idea that vegetation under the PV panels could be used to help reduce the urban heat island, effect on urban rooftops.
- Limitations to this study included weather and sun exposure which could have slightly influenced the measurements.

References:

EPA. (2022, September 2). Learn About Heat Islands. EPA. Retrieved May 2, 2023, from <https://www.epa.gov/heatislands/learn-about-heat-islands#:~:text=Surface%20Heat%20Islands,F%20warmer%20than%20air%20temperatures.>

Hall, S. (n.d.). Can crops grow better under solar panels? here's All you need to know about 'agrivoltaic farming'. World Economic Forum. Retrieved May 2, 2023, from <https://www.weforum.org/agenda/2022/07/agrivoltaic-farming-solar-energy/>

Jing R, Hastings A, Guo M. Sustainable Design of Urban Rooftop Food-Energy-Land Nexus. iScience. 2020 Oct 27;23(11):101743. doi: 10.1016/j.isci.2020.101743. PMID: 33225248; PMCID: PMC7663218.

Rui Jing, Jiahui Liu, Haoran Zhang, Fenglin Zhong, Yupeng Liu, Jianyi Lin, Unlock the hidden potential of urban rooftop agrivoltaics energy-food-nexus, Energy, Volume 256, 2022, ISSN 0360-5442, <https://doi.org/10.1016/j.energy.2022.124626>.