

# A Net-Zero Electricity Home in Fort Worth, TX

**Authors:** Faculty Advisor:  
Daniel Ingram Dr Michaelides  
Cameron Vieck

## Abstract:

This project proposes the design and implementation of a net-zero energy home in Fort Worth, Texas, powered primarily through solar energy. The objective is to offset all annual household electricity consumption through on-site renewable generation. Based on average yearly usage, the average home requires approximately 13128 kWh of electricity per year. To meet the demands, the system incorporates a solar photovoltaic (PV) array sized to generate a sufficient amount of power to offset the full electricity usage per year, sending energy back to the grid when the amount generated exceeds the demand, and supplementing energy from the grid when the demand is higher than the supply. The design accounts for seasonal variation in solar irradiance typical of North Texas. This model demonstrates the feasibility of sustainable residential energy independence in the Fort Worth region.

## Conclusion:

A solar array sized to 23, 65x39 in<sup>2</sup>, 22% efficiency panels will adequately offset a typical Fort Worth home's electricity usage per year.

## Background

A Net-Zero home is a home that generates the same amount of electricity that it uses over the course of a year, essentially offsetting its footprint on the electric grid. The net electricity used will be zero with a properly sized solar array, but sometimes too much electricity will be generated and sometimes too little, in that case the home will interact with the grid, either sending excess power away or receiving supplemental power. This type of home accounts for the variation in both electricity usage and sunlight throughout the seasons, taking the average sunlight received and the average power used and sizing the solar array to those numbers.

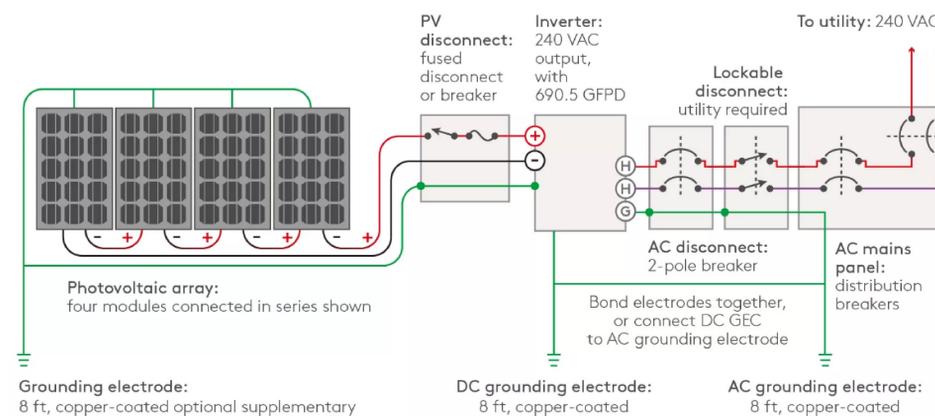
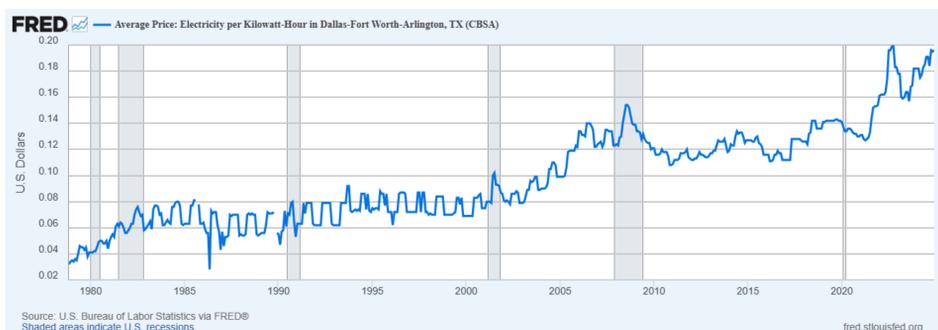
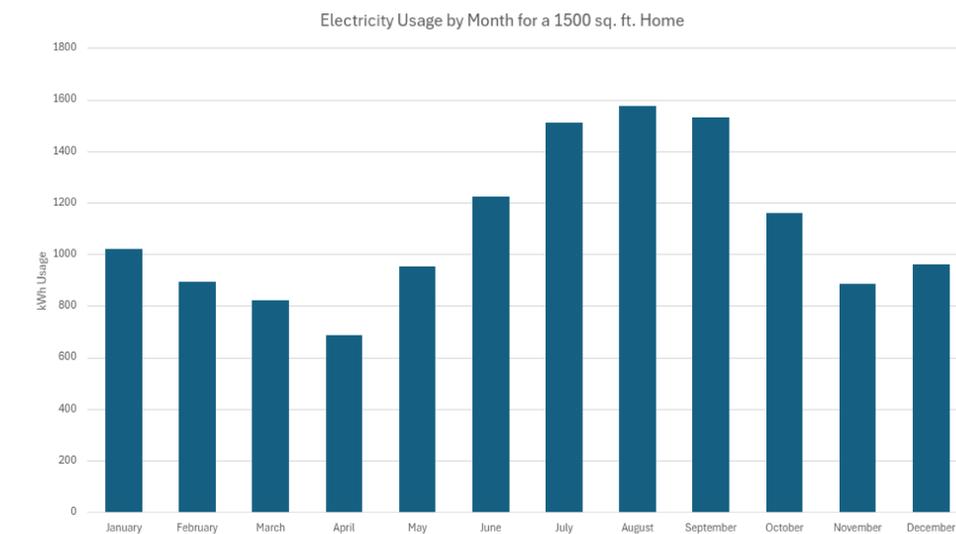
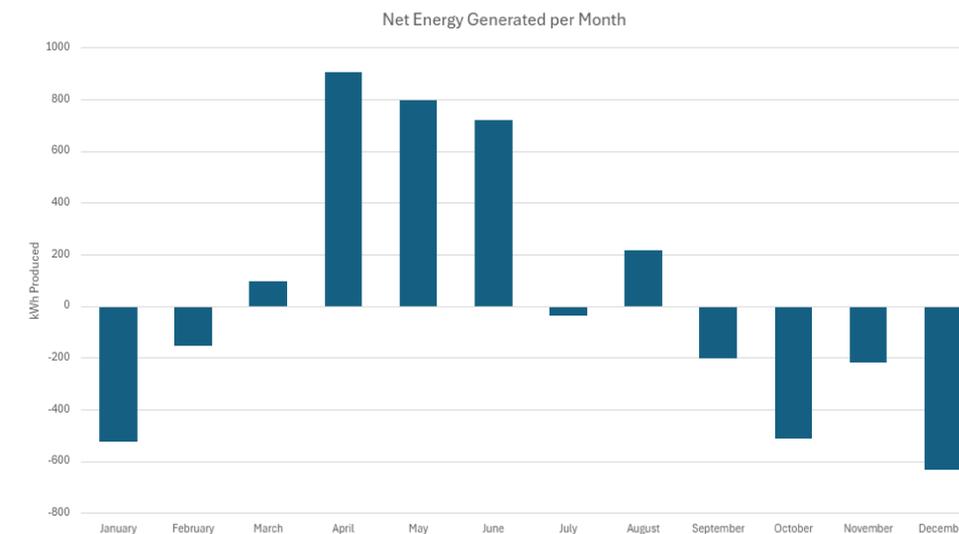
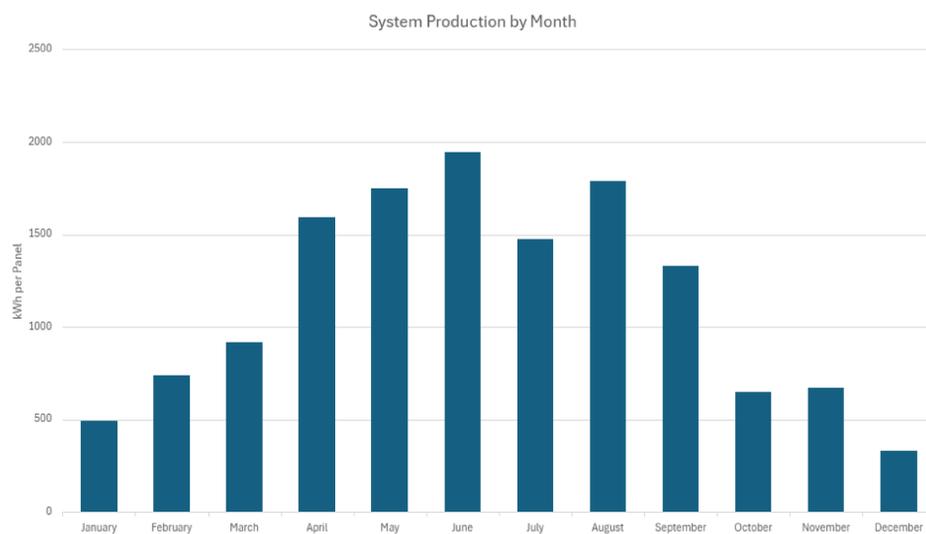
A 13,128 kWh/year home electricity usage is assumed as a representative average — this number is average for a ~1500 ft<sup>2</sup> house in Fort Worth, TX. The amount of electricity used will vary by household, primarily based on the size of the house due to cooling and heating causes.

We are assuming flat solar panels unobstructed by shade throughout the year.

## Methodology

The electricity generation per year plot was created by the following process: One year of GHI data was summed and multiplied by the area of a typical 65x39 in<sup>2</sup> solar panel to calculate the total solar energy received in a year, then multiplied by the solar power conversion efficiency to get the electricity generated by a typical 65x39 in<sup>2</sup> solar panel in a year, with this number we sized our panel array to cover the total yearly electricity usage of a typical 1500 ft<sup>2</sup> Fort Worth home.

The Fort Worth electricity cost data was sourced from the Federal Reserve Bank of St Louis.



## Conclusion

With the average power generated and consumed as taken over the course of several years of solar data (2022-2024), and with the number of panels assumed to be flat, A solar array sized to 23, 65x39 in<sup>2</sup>, 22% efficiency panels will adequately offset a typical Fort Worth home's electricity usage per year.

With our assumptions being very conservative, assuming no tracking or a southern roof mount as is typically preferred, and a modest efficiency, it is entirely possible to offset the grid with fewer panels. This study was done as an estimate for as typical a house as possible located in the Fort Worth region to help offset rising electricity costs and maintain some amount of grid independence without investing in expensive energy storage solutions.