Feasibility Study for the Installation of Photovoltaic (PV) Systems on Residential Roofs in the El Torito Community in Cayey, Puerto Rico

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Outline

Problem

PV Watts

Brisas del Torito Community in Cayey

Microgrid Design Toolkit Sofware (MDT)

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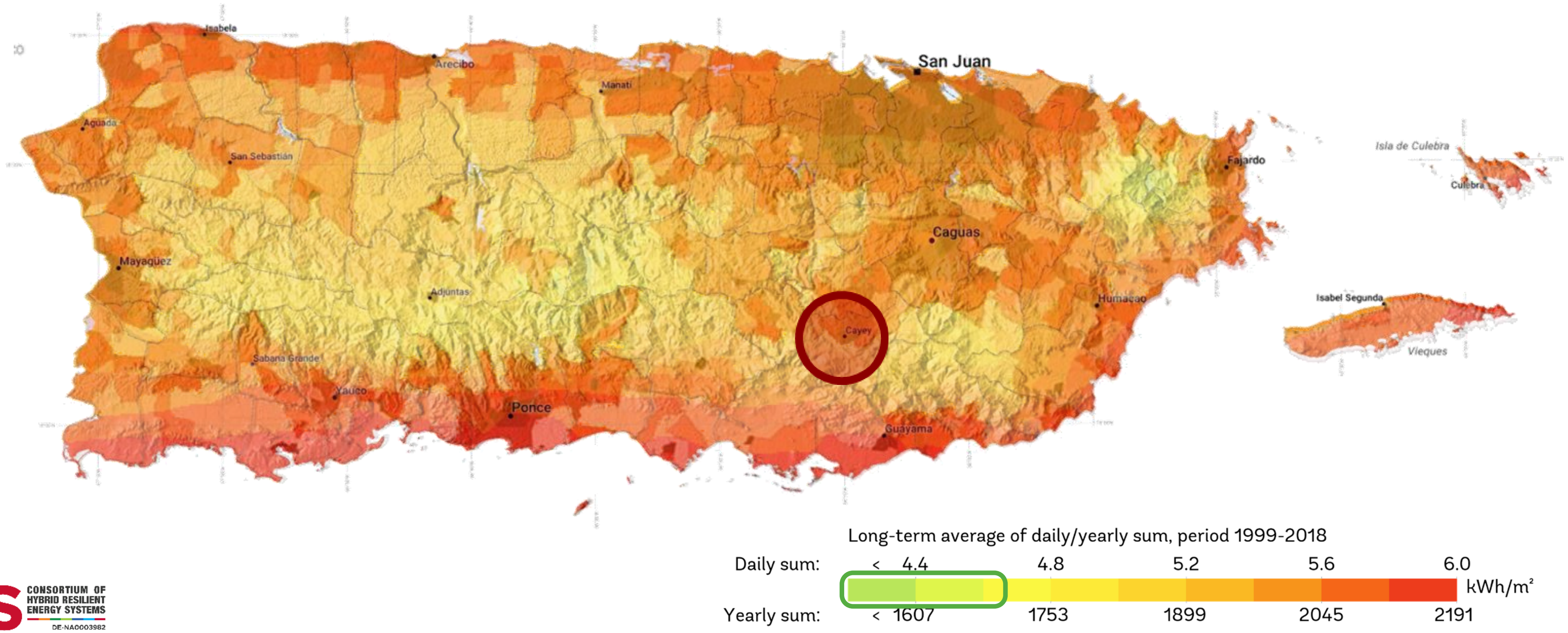
Problem

- The electric power system was devastated around eighty percent (80%) of the transmission, and the distribution network collapsed after the natural disasters in 2017.
- The earthquakes on the south affected the system even more and then the passage of Hurricane Fiona made the system worse.

Puerto Rico Global Horizontal Irradiation Map



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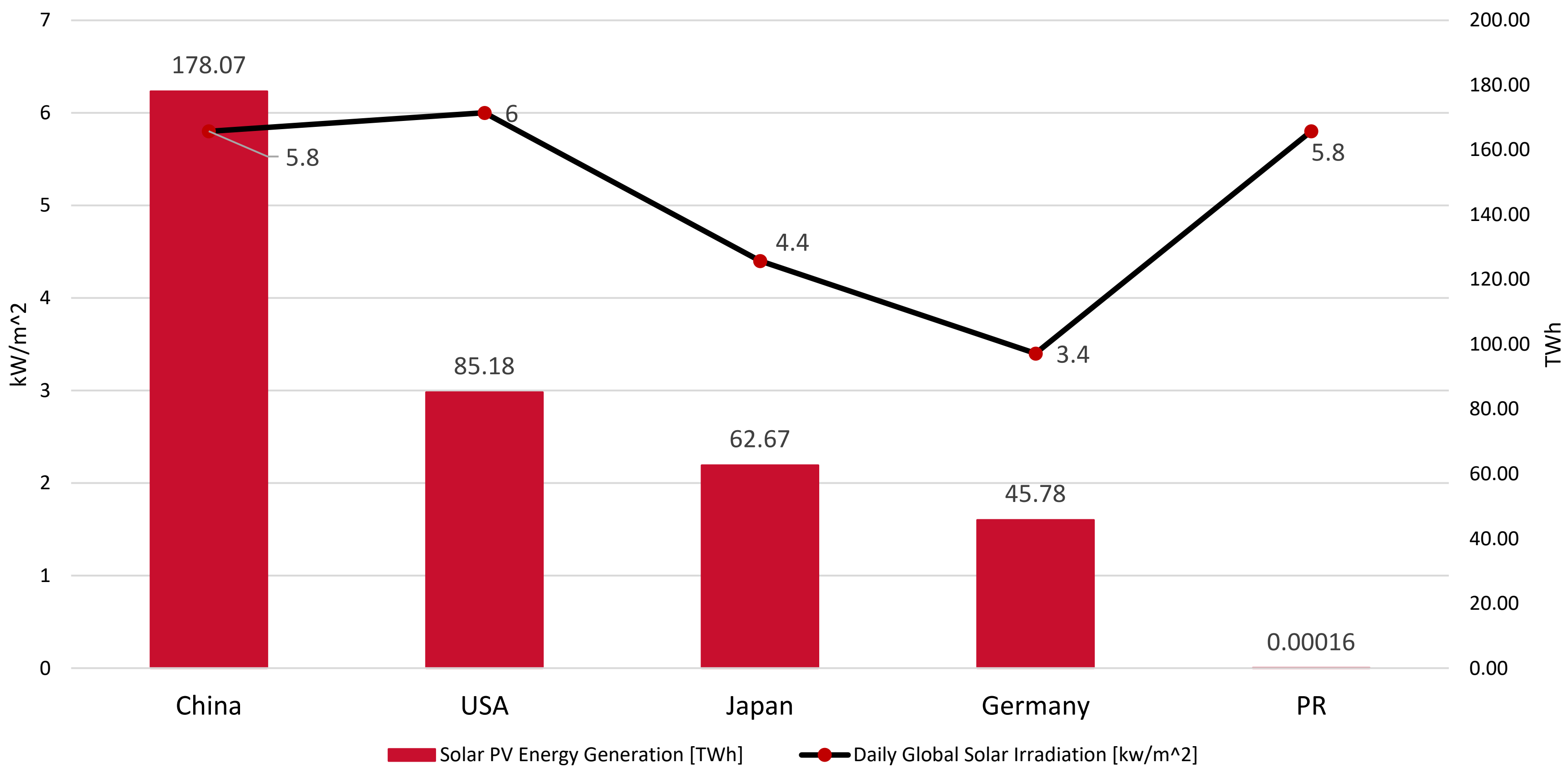
2018 Top Global Solar Productors



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Theory Review

The *daily energy* that needs to be supplied by the PV system to fully cover the load can be expressed as:

$$E_{PV} = \frac{E_{loads}}{\eta_{inv} \cdot (1 - SL)}$$

Where E_{loads} is the average daily energy required by the loads, η_{inv} is the inverter's efficiency, and SL is the total system loss.

The PV system capacity can be calculated as:

$$P_{PV} = \frac{E_{PV}}{PSH}$$

Where PSH (peak sun hours) is the average insolation available.

PV Watts

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PV Watts: San Lorenzo

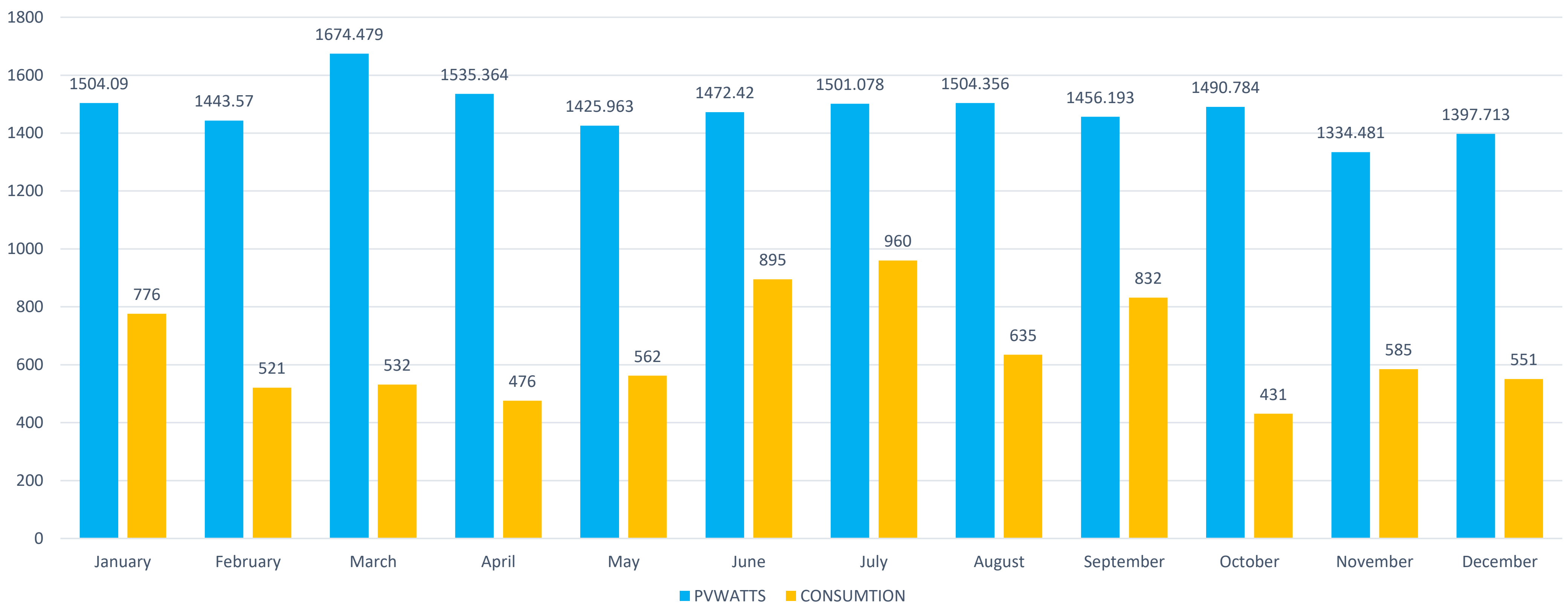
RESULTS

Print Results

17,740 kWh/Year*

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)
January	5.49	1,504
February	5.91	1,444
March	6.18	1,674
April	5.93	1,535
May	5.34	1,426
June	5.70	1,472
July	5.61	1,501
August	5.66	1,504
September	5.66	1,456
October	5.53	1,491
November	5.09	1,334
December	5.12	1,398
Annual	5.60	17,739

PV System Compared to Real Consumption (San Lorenzo)



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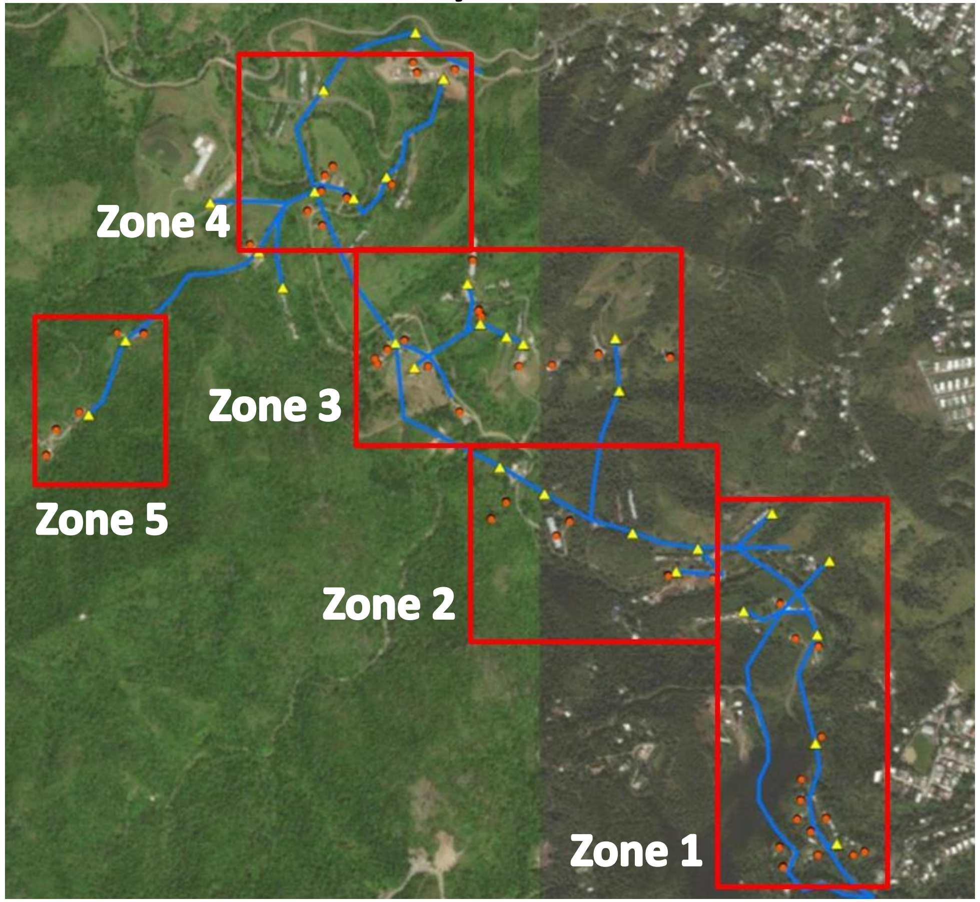
Brisas del Torito Cayey Community: Zone 5



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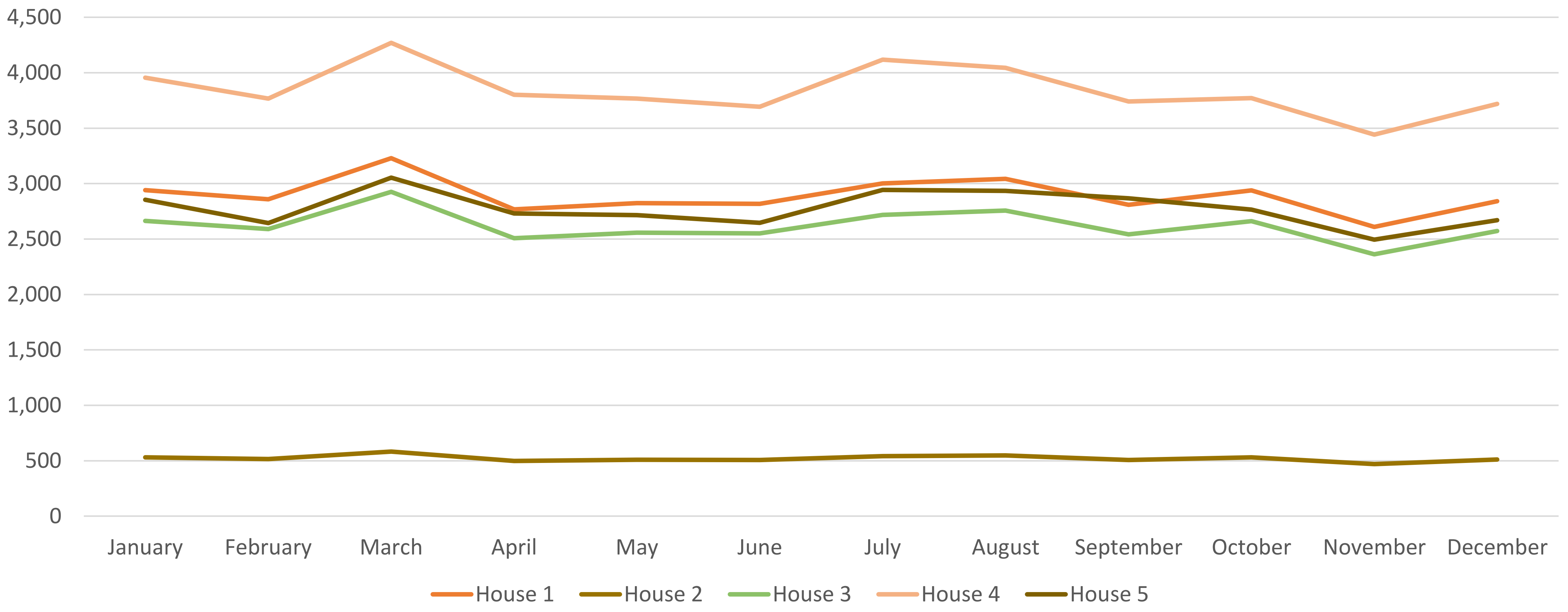
AC Energy (Kwh)



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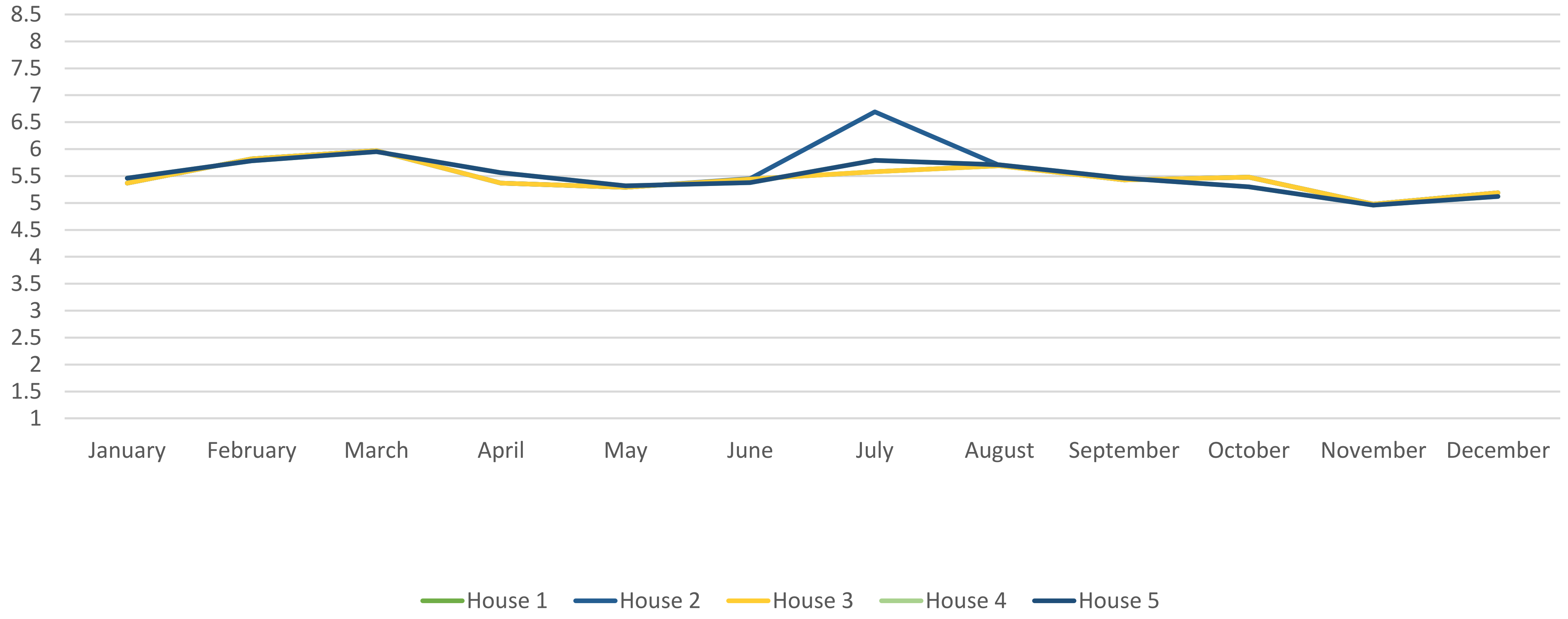
Solar Radiation



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Microgrid Design Toolkit (MDT)

- Used for the design and analysis of microgrids, which are local energy systems that can operate independently or connected to the main power grid.
- Provides a platform to simulate and optimize the operation of a microgrid, considering technical and economic aspects.
- It helps to address the challenges associated with the integration of renewable energy sources, increasing energy demand and the need for greater resilience in energy supply.

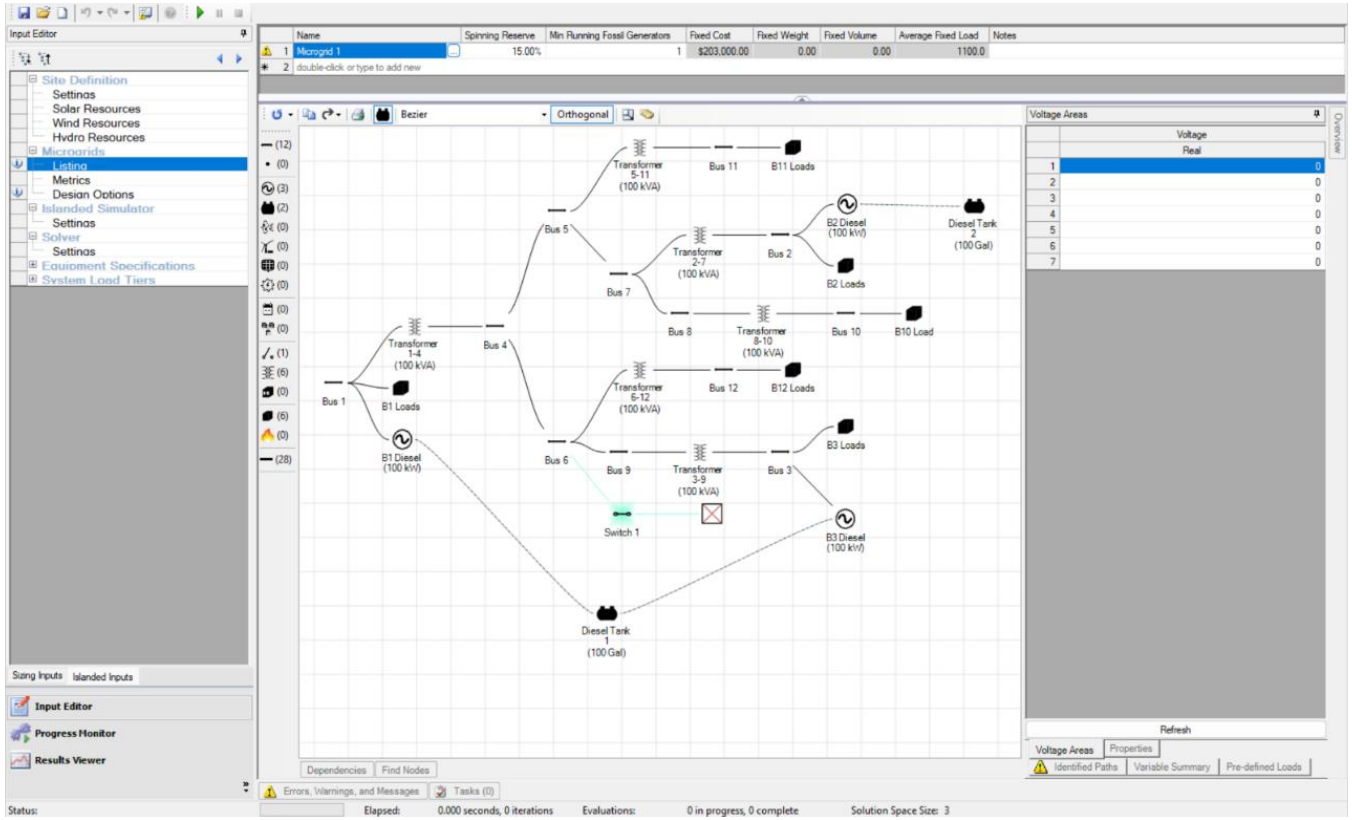
Microgrid Design Toolkit (MDT)

- Facilitates the efficient integration of renewable energy sources, such as solar PV and wind power, into the microgrid system.
- It helps determine the optimal renewable generation capacity and coordinate the interaction between renewable generation, energy storage and demand.
- Find solutions that minimize operating costs and maximize the economic benefits of the microgrid.
- Involves making decisions about generation, storage and energy consumption based on market conditions and energy policies.

Benefits of the Microgrid Design Toolkit

- Allows engineers and planners to design and simulate microgrids with different configurations, including distributed generation, energy storage, and demand-side management.
- Helps optimize the sizing and operation of microgrid components to meet the specific energy needs of a community or facility.
- The software allows evaluation of system stability and reliability under normal conditions.
- Is important in areas prone to natural disasters or with less reliable electrical infrastructure, as microgrids can provide backup and maintain power supply in emergency situations.

Implementation



- Busses
- Nodes
- Diesel Generators
- Diesel Tanks
- Natural Gas Generators
- Wind Generators
- Solar Generators
- Hydro Generators
- Batteries
- UPSs
- Switches
- Transformers
- Inverters
- Load Sections
- Thermal Loads
- Lines

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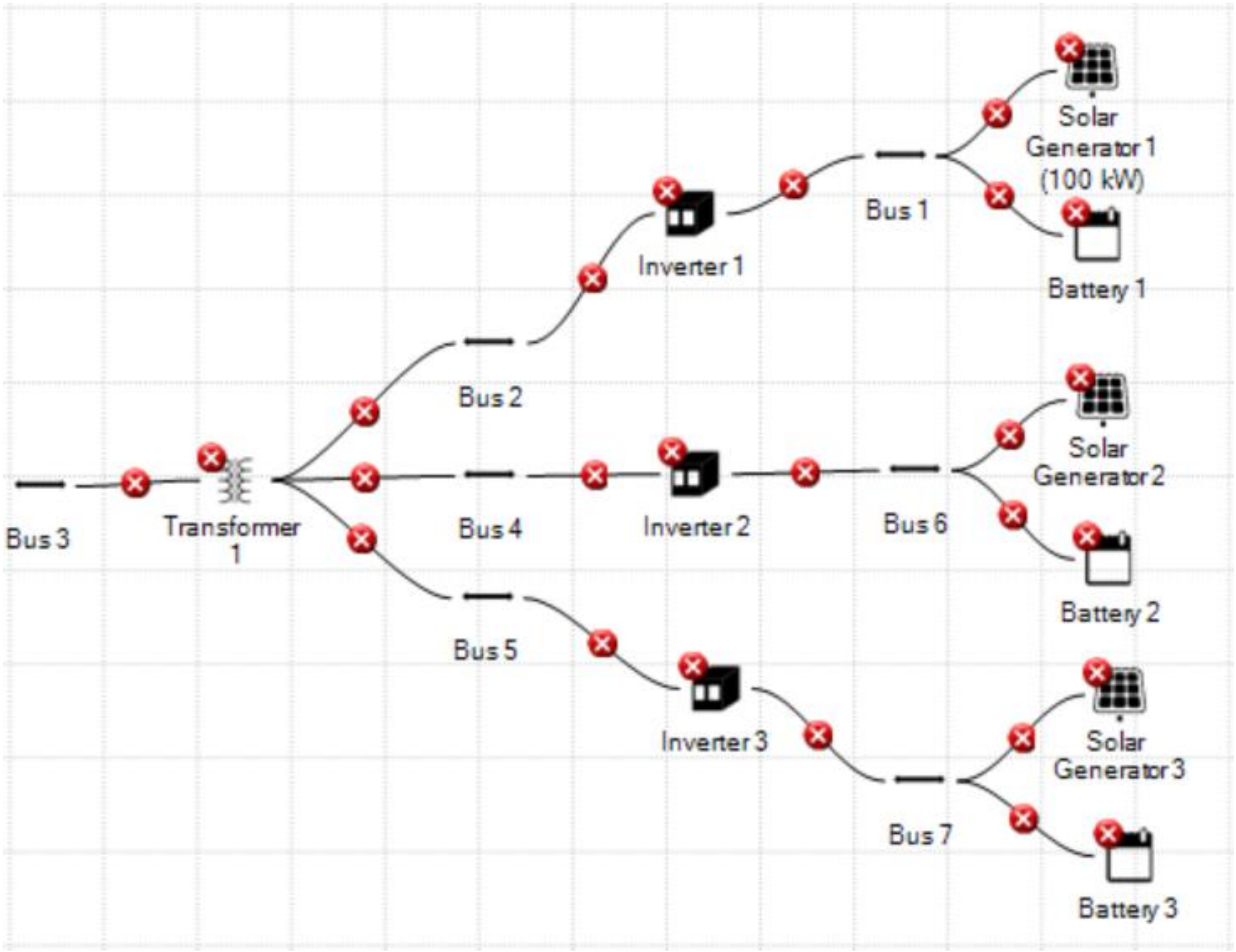
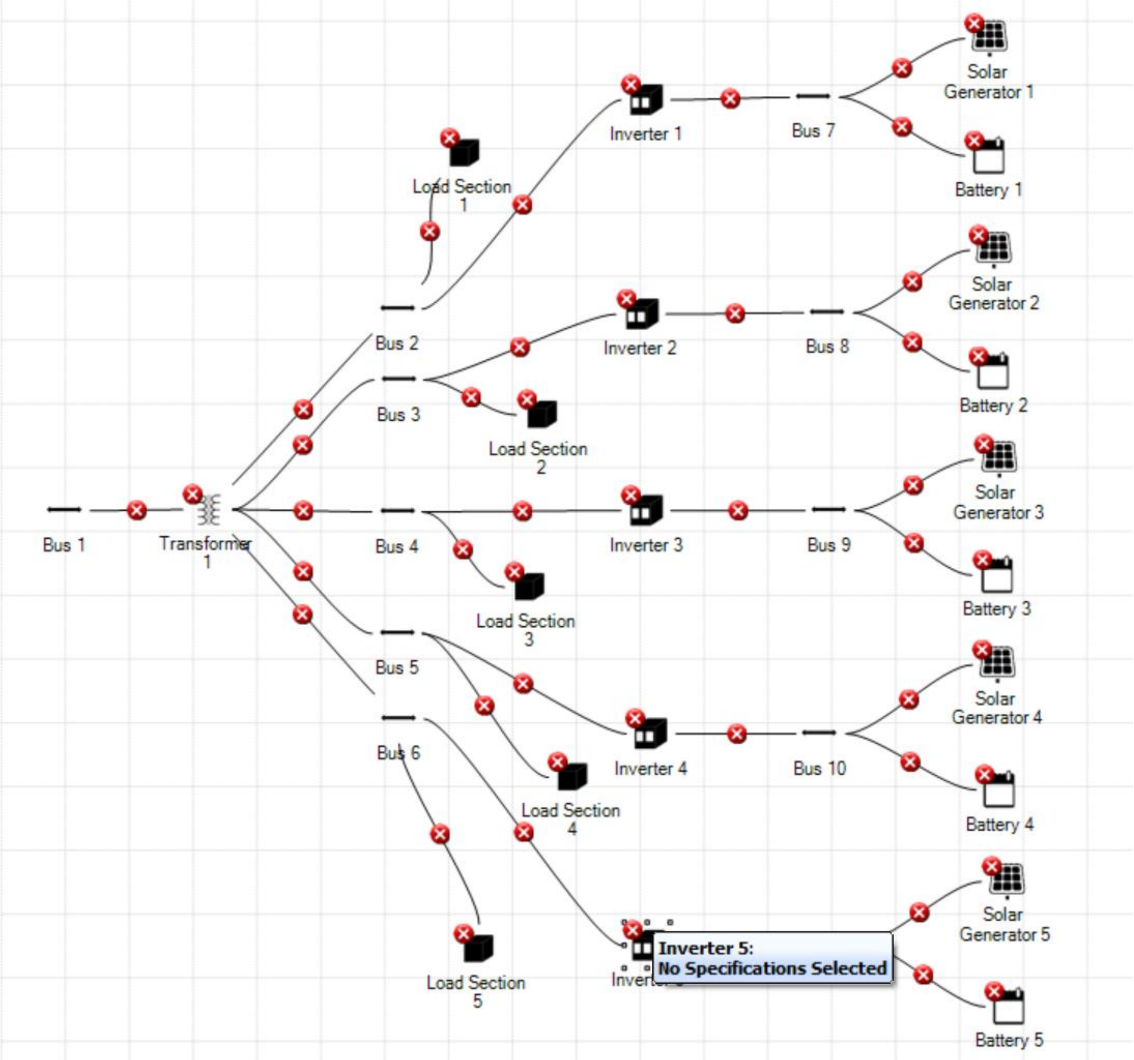


Microgrid Design



Microgrid Zone 5

Questions