WHAT IS THE PAYBACK TIME OF RESIDENTIAL SOLAR SYSTEM?

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SUMMARY

Solar payback time & investment

EDA: Annual energy analysis

Dataset:

solar generation & energy consumption
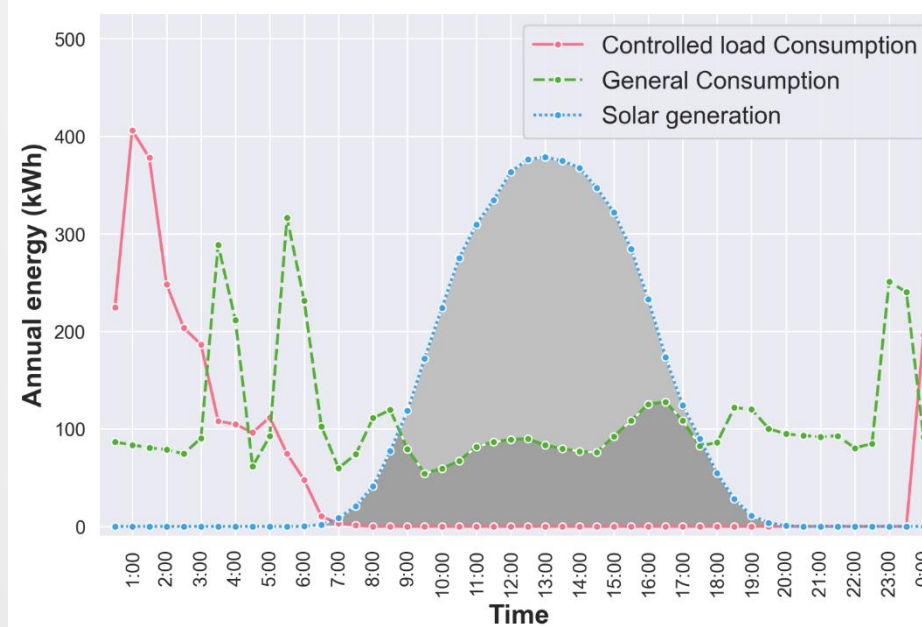
Cost model:

Panel cost

Feed-in tariff

Electricity rate

$

DATASET

Source :

- https://www.ausgrid.com.au/Industry/Our-Research/Data-to-share/Solar-home-electricity-data
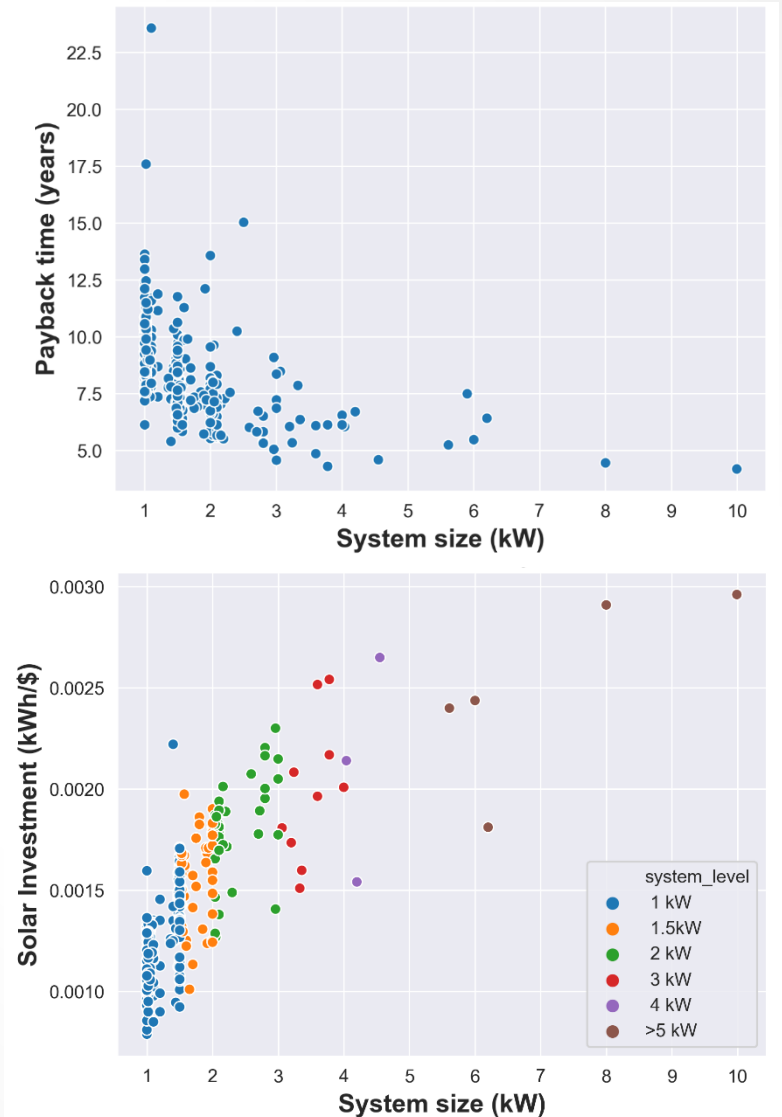
- One-year energy data (0.5hr interval) of 300 residential PV systems (2012-2013)

  - Solar generation

  - Household energy consumption

Statistics -

- Rows: 268557

- Columns: 54

  Index(['customer', 'generator_capacity', 'postcode', 'consumption_category', 'date', '0:30', '1:00', '1:30', '2:00', '2:30', '3:00', '3:30', '4:00', '4:30', '5:00', '5:30', '6:00', '6:30', '7:00', '7:30', '8:00', '8:30', '9:00', '9:30', '10:00', '10:30', '11:00', '11:30', '12:00', '12:30', '13:00', '13:30', '14:00', '14:30', '15:00', '15:30', '16:00', '16:30', '17:00', '17:30', '18:00', '18:30', '19:00', '19:30', '20:00', '20:30', '21:00', '21:30', '22:00', '22:30', '23:00', '23:30', '0:00', 'row_quality'], dtype='object')

ASSUMPTION

Cost:

Costs of solar panels and government rebates for different sized panels.[#]

System Size (kW)	Cost (A$)	Government rebate (A$)
1	4156	700
1.5	4774	1050
2	5712	1400
3	7503	2100
4	9529	2800
5	11487	3500

[#] These values are based on 2015 condition/rule.

Payback time:

Comparison of payback periods for various solar systems

Electricity rate (All time):

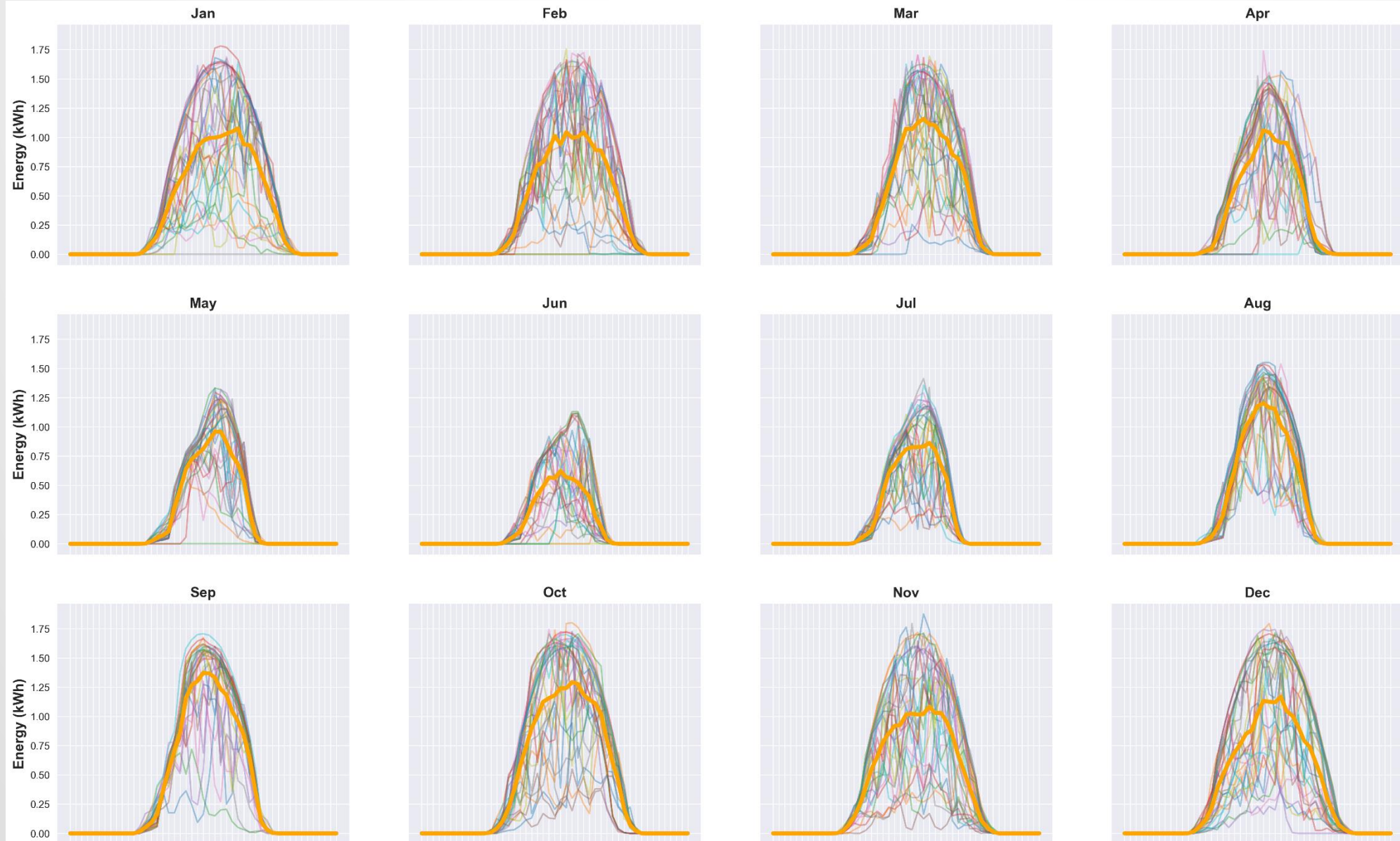- All time - $ 28c
- SmartHome: $ 52c (peak)
- $ 22c (shoulder)

Feed-in tariff:

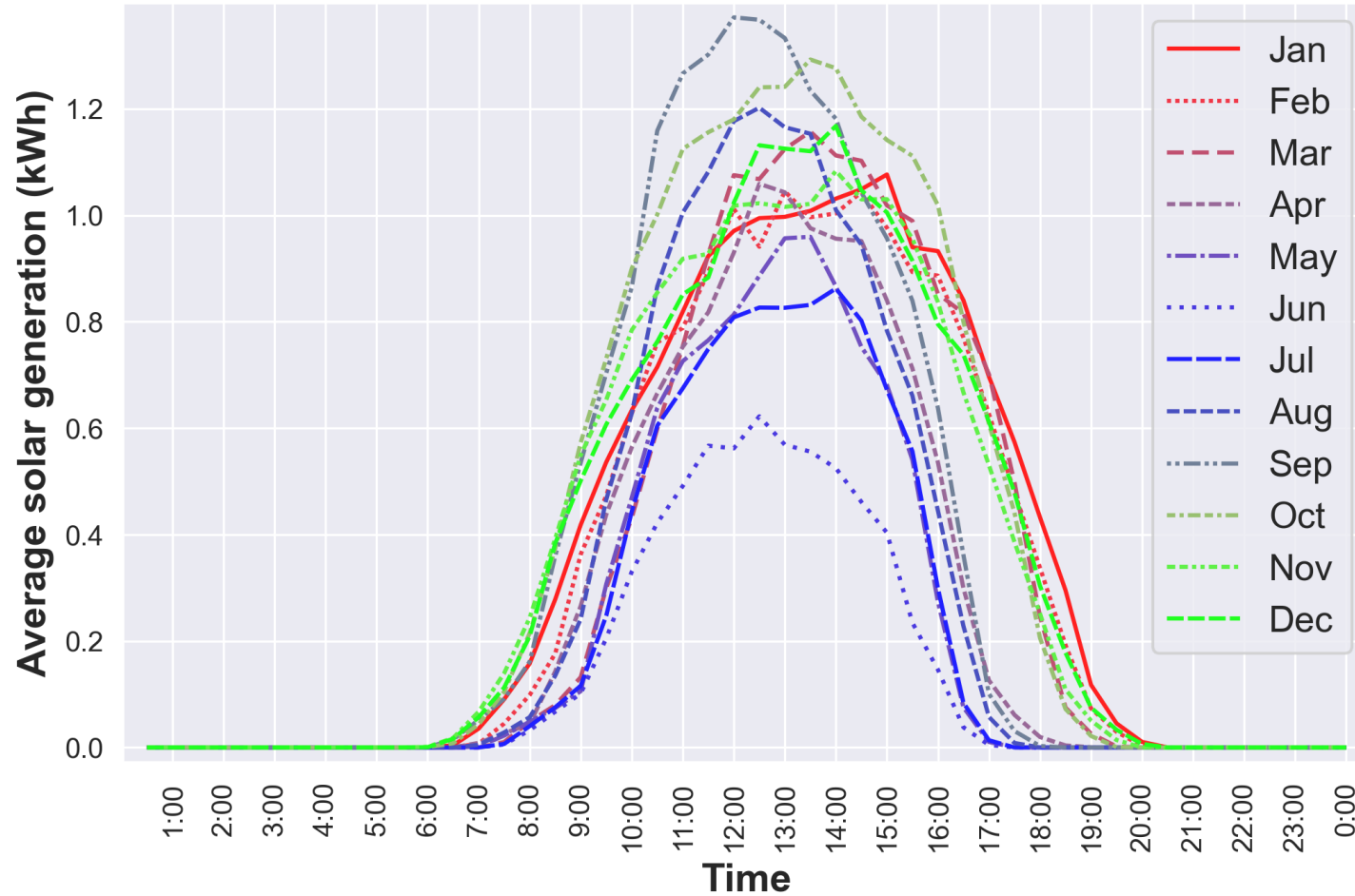- $20c – before 31 Dec, 2016
- $10c – after 1 Jan, 2017
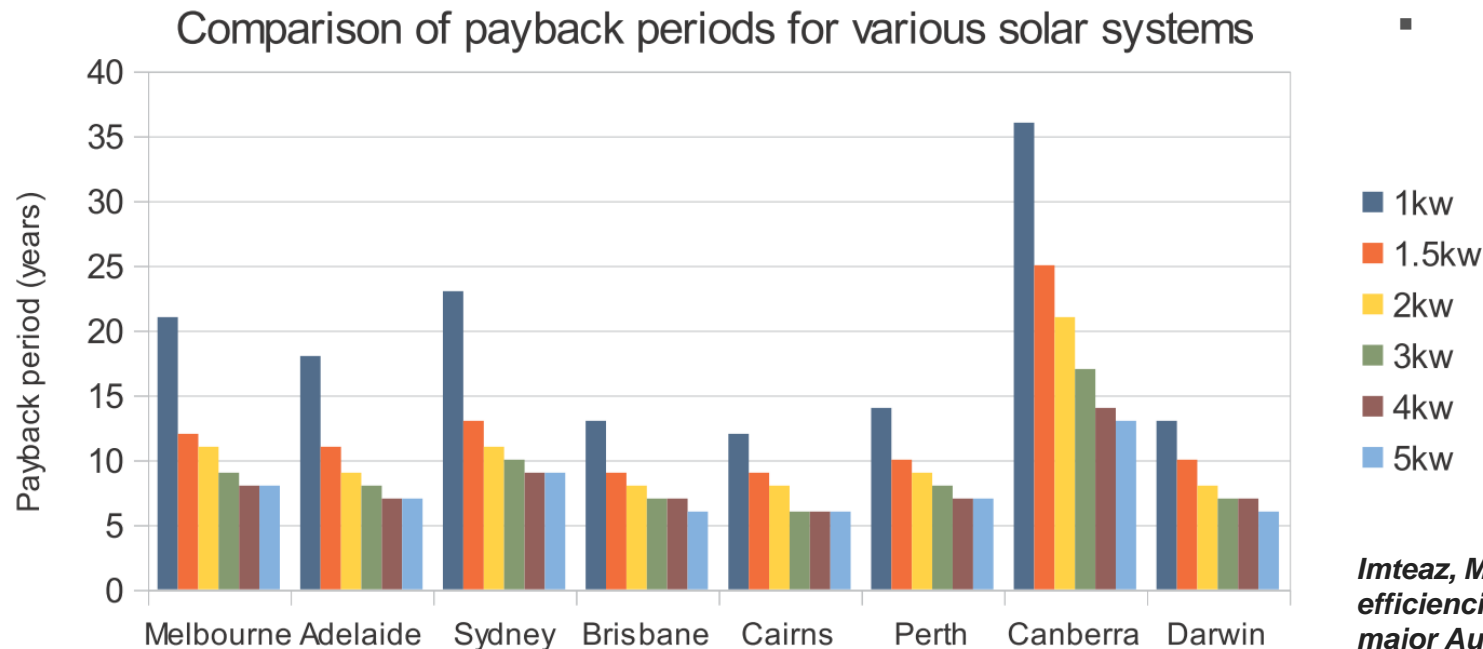
Imteaz, Monzur Alam, and Amimul Ahsan. "Solar panels: Real efficiencies, potential productions and payback periods for major Australian cities." Sustainable Energy Technologies and Assessments 25 (2018): 119-125.
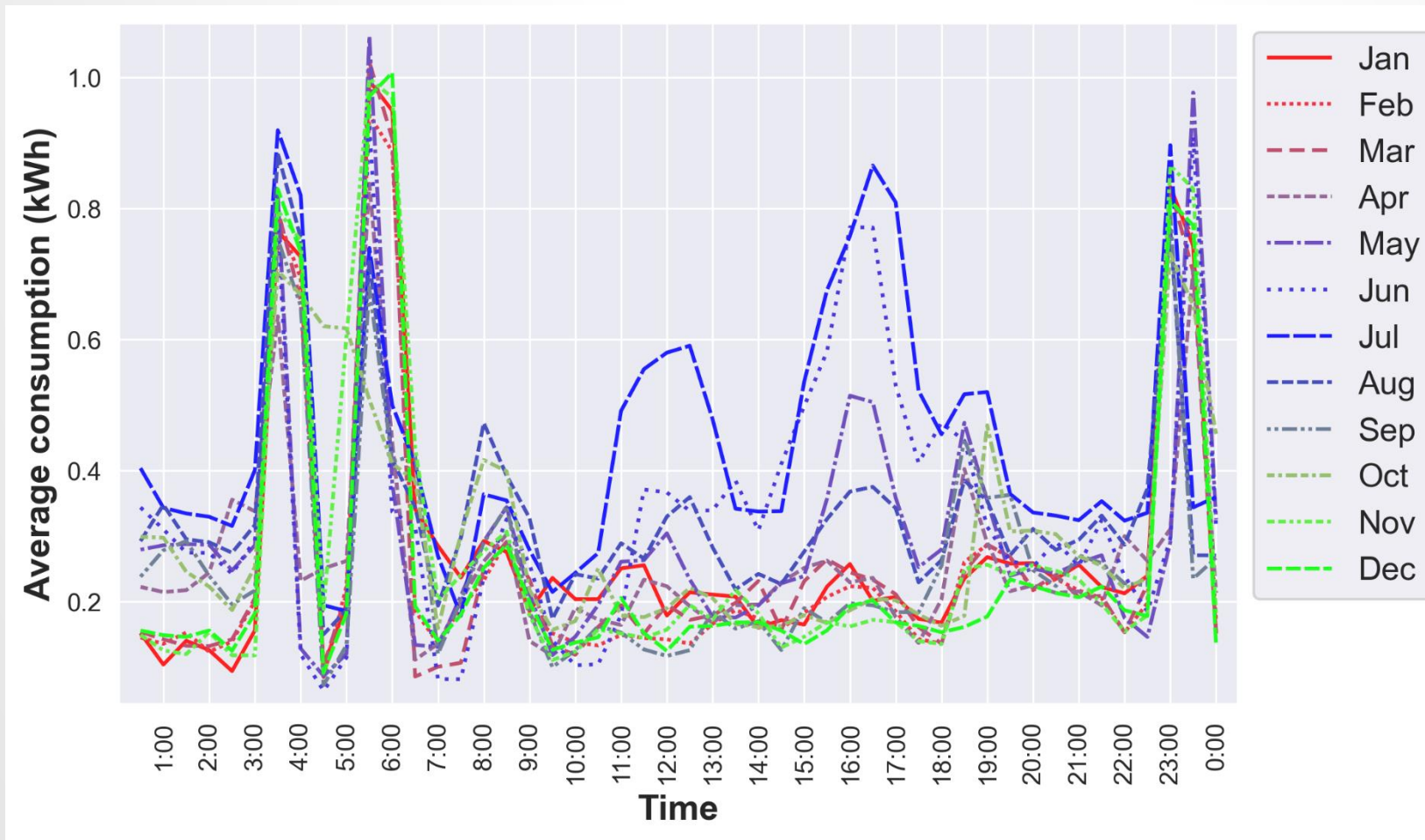
MONTHLY SOLAR GENERATION PROFILE

AVERAGE MONTHLY GENERATION

- Minimum in Jun
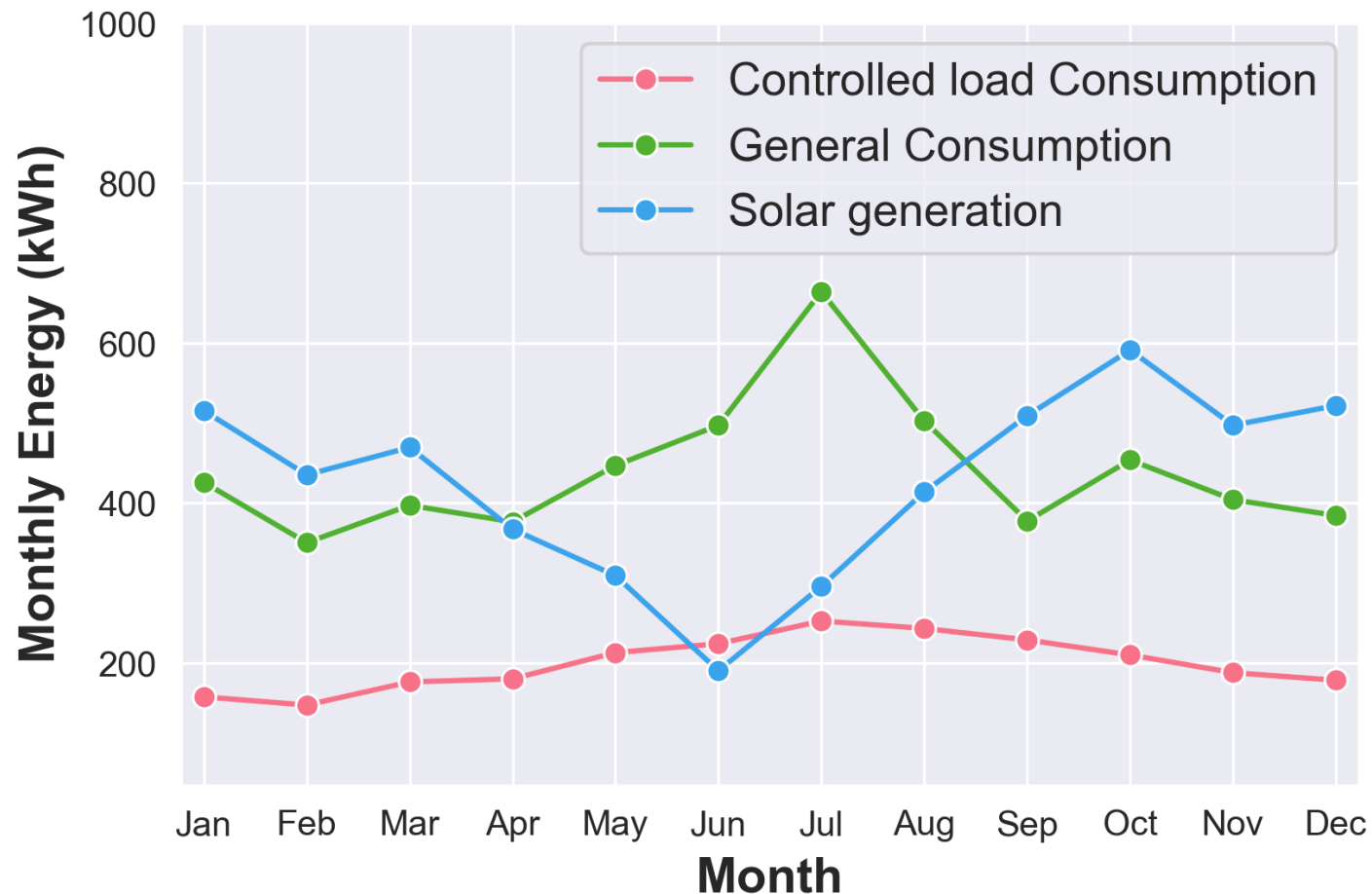- Maximum in Oct - Less cloudy/rainy days

AVERAGE MONTHLY CONSUMPTION

- Peak usage in early morning
- More afternoon consumption in winter
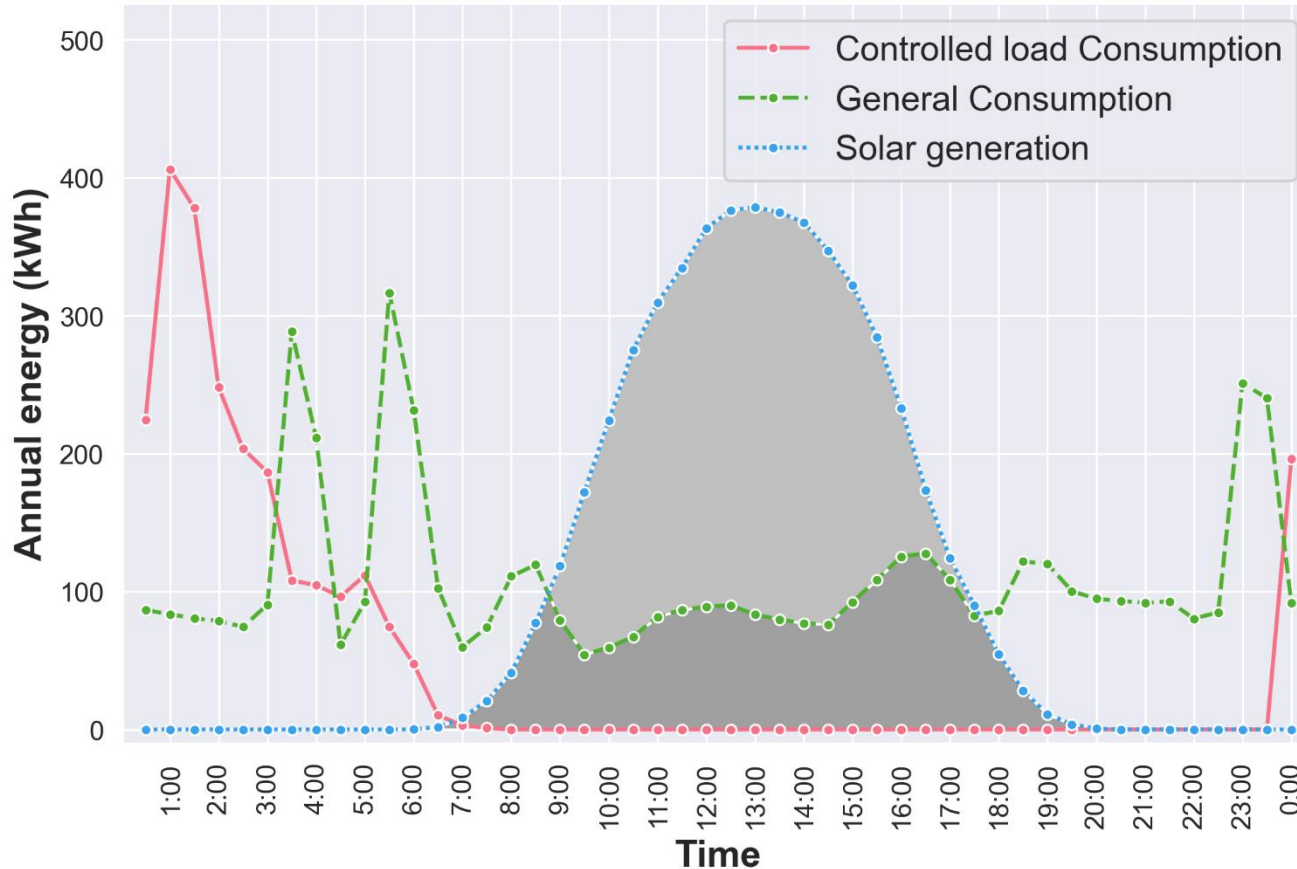
ANNUAL ENERGY - MONTHLY

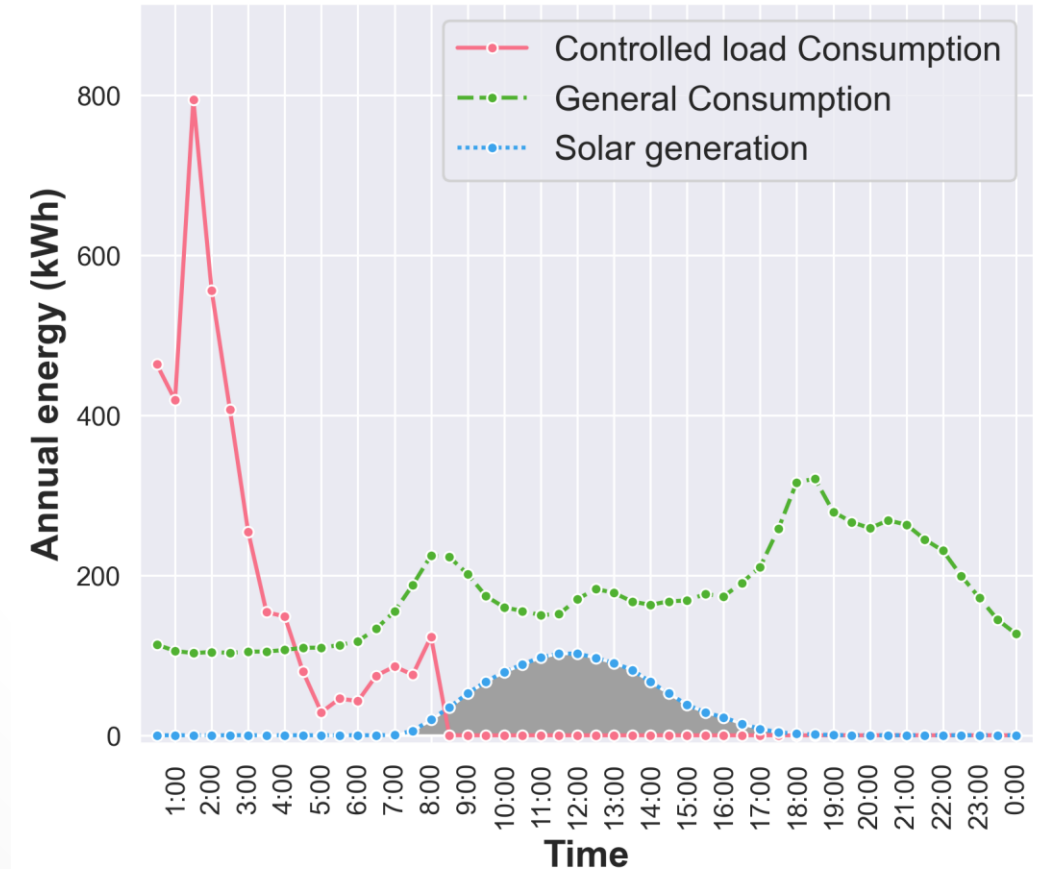- Peak solar generation in Oct
- Peak energy consumption in Jul

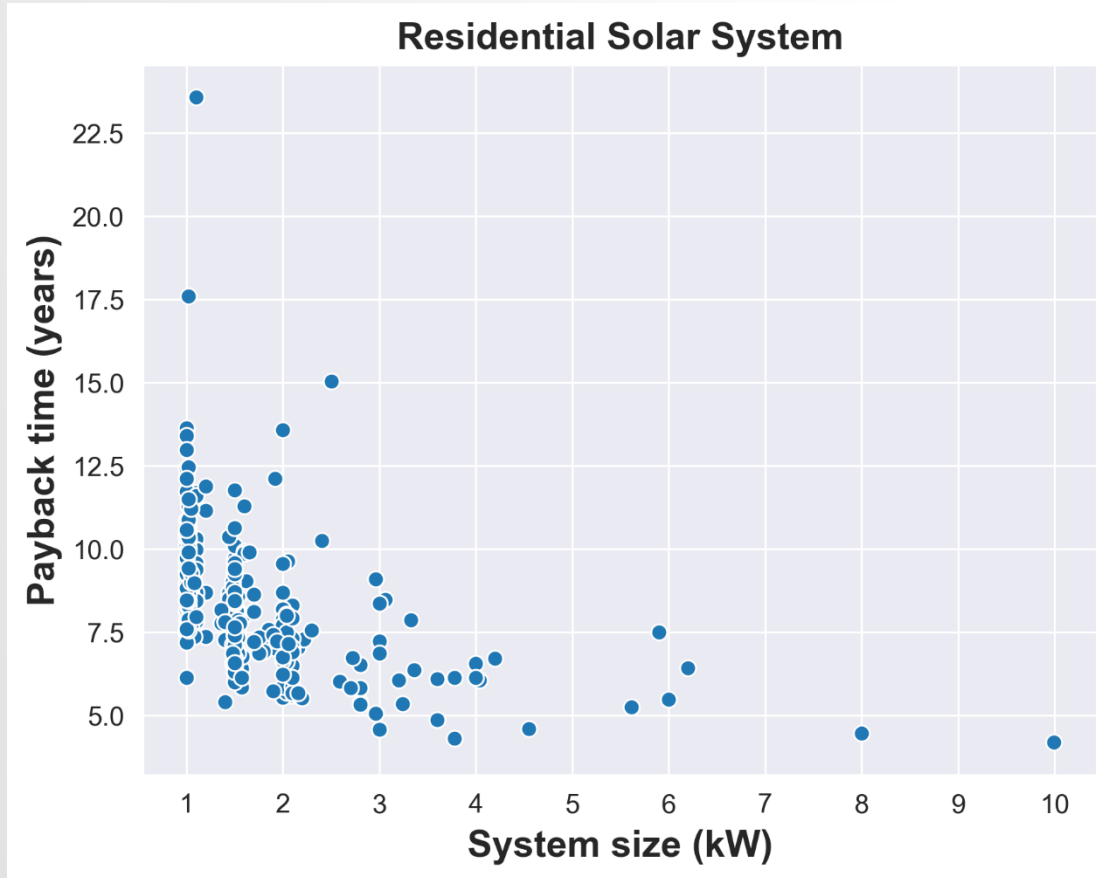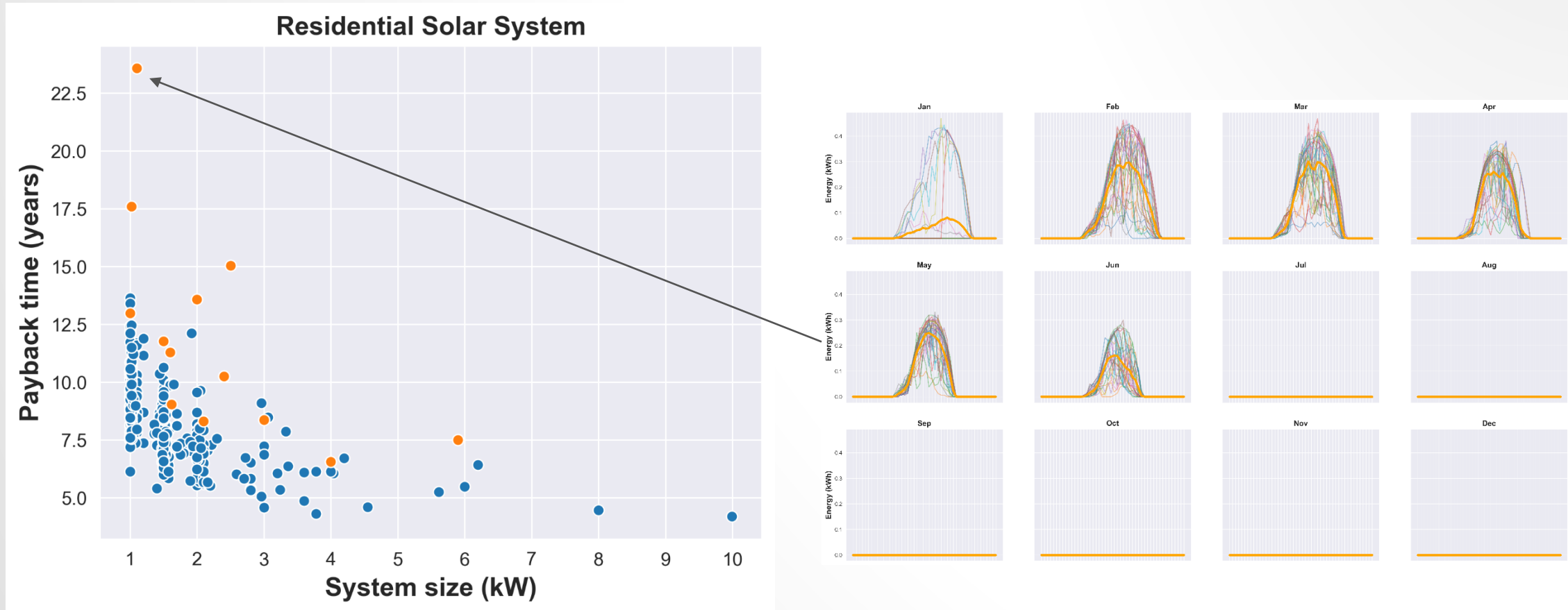# ANNUAL ENERGY - DAILY

Customer #1

Customer #6

- Below consumption   - savings @ electricity rate
- Above consumption - savings @ feed-in tariff

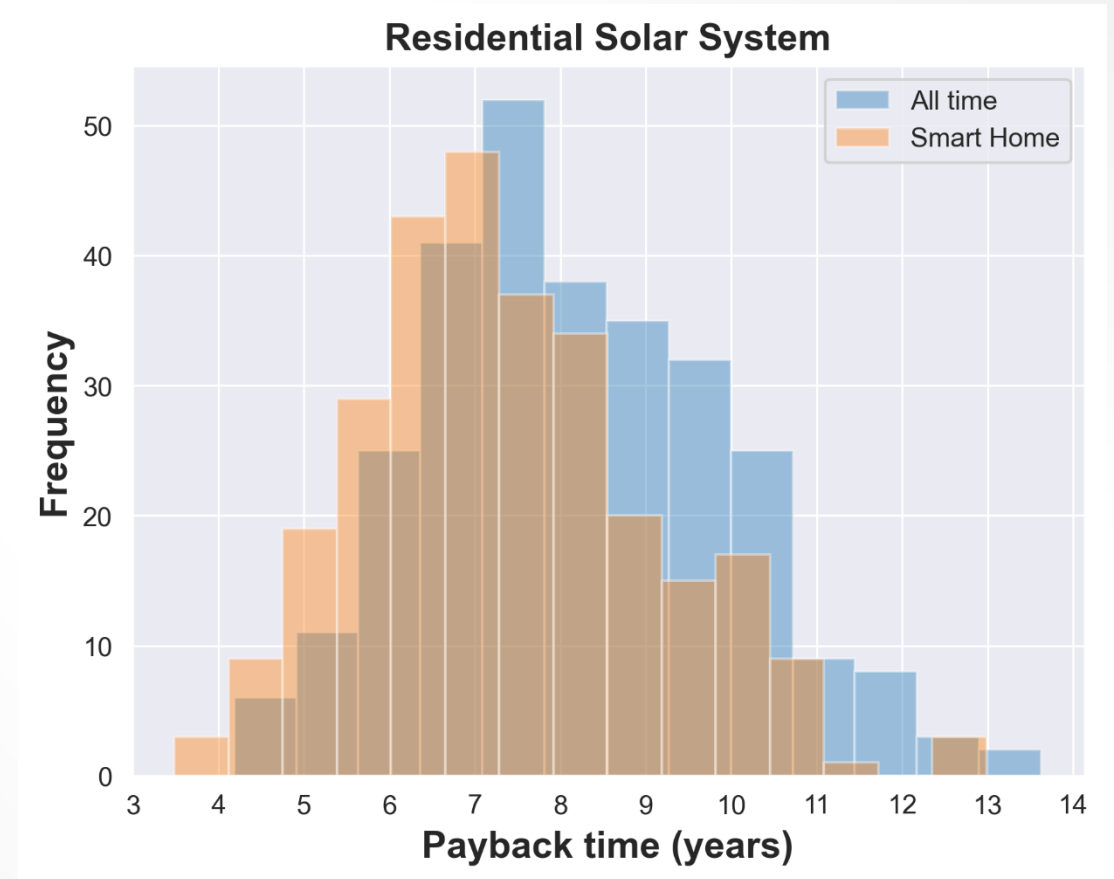# PAYBACK TIME – ALL CUSTOMERS
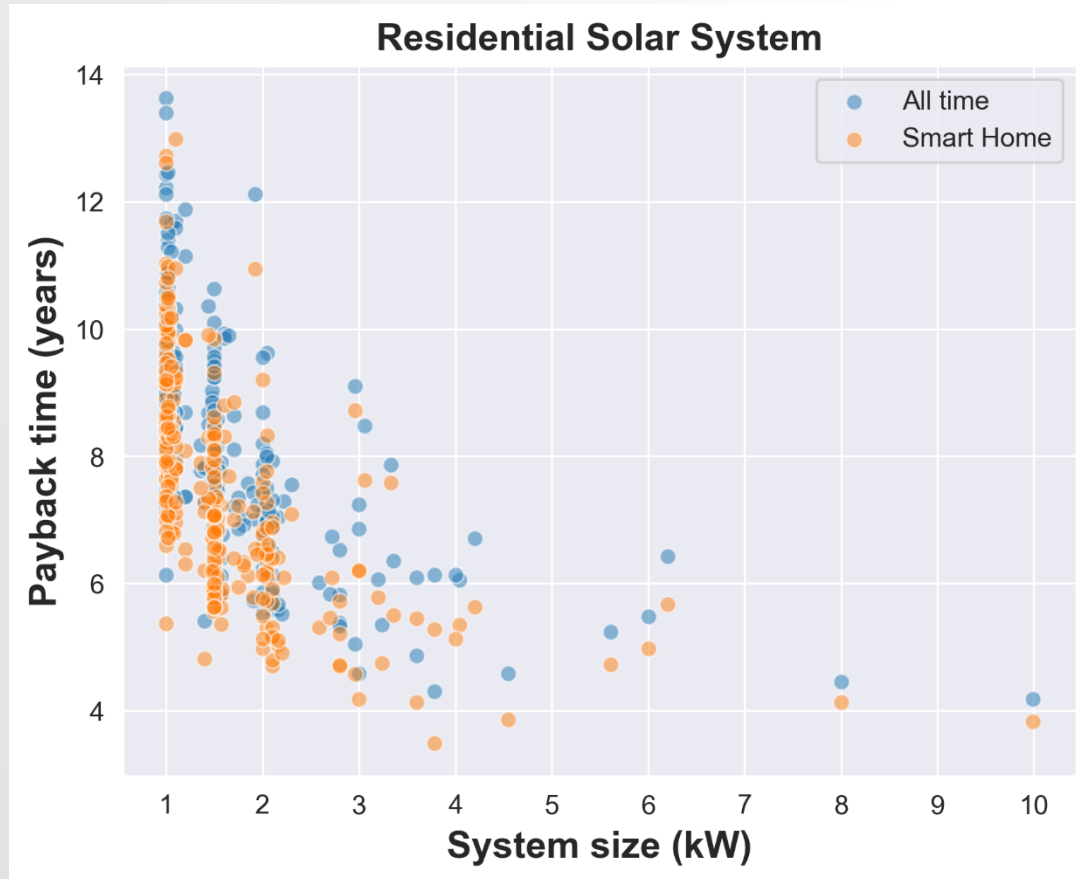

Residential Solar System
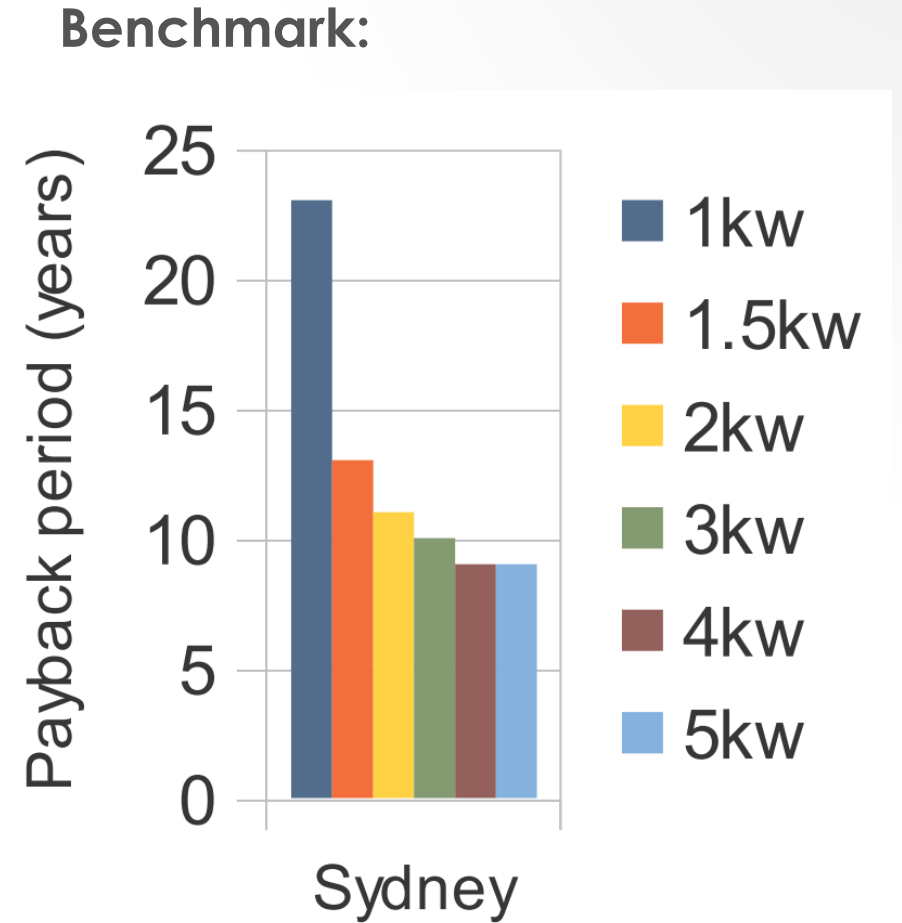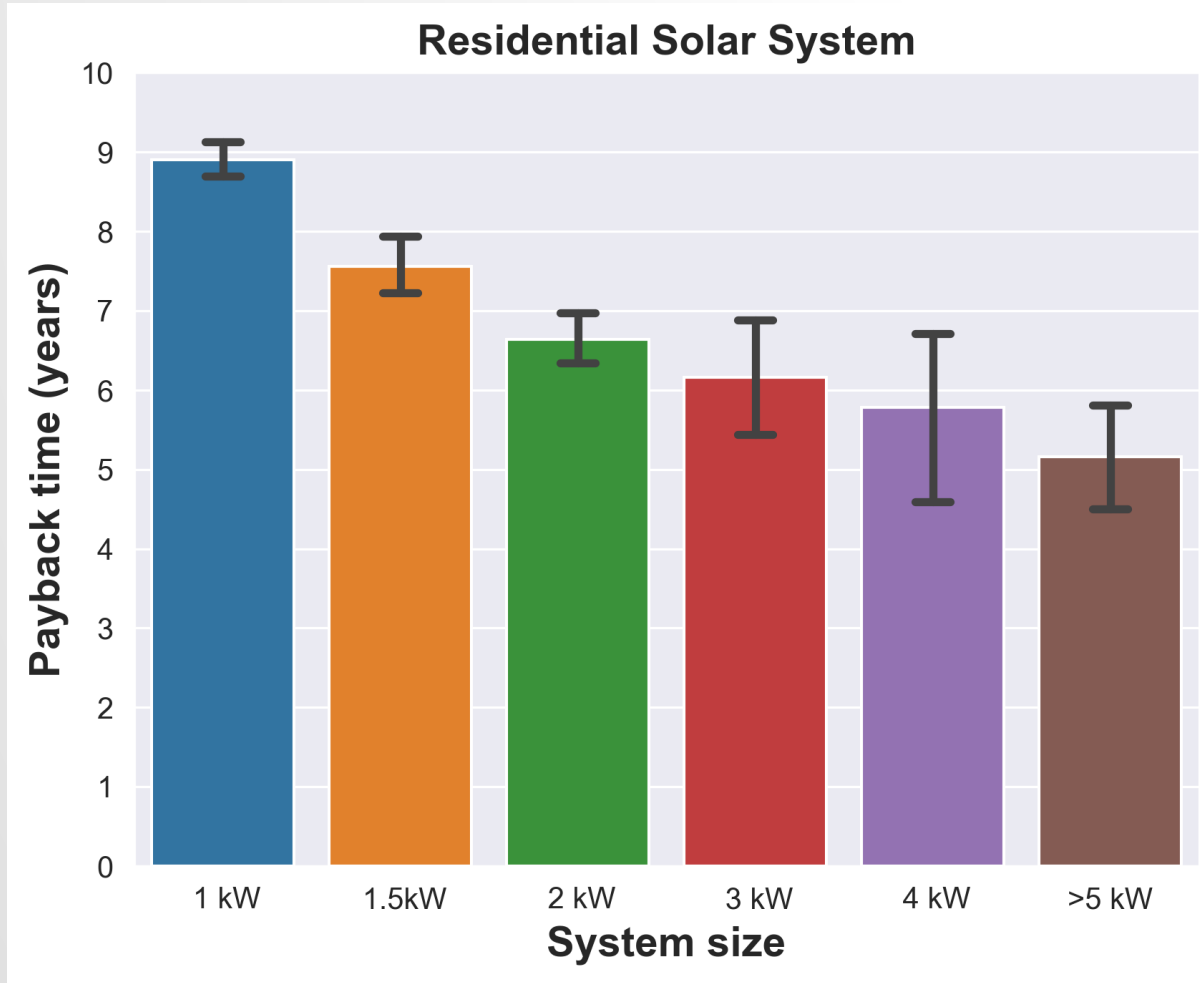
PAYBACK TIME – ERRONEOUS DATA

- 12 customers – missing solar generation data
- 1 customer – missing 81 days of data

PAYBACK TIME – ENERGY PLAN

- **Slightly lower payback time with Smart Home plan**

PAYBACK TIME – SYSTEM SIZE

Residential Solar System

Benchmark:

- Customers in the dataset have lower payback time than the benchmark
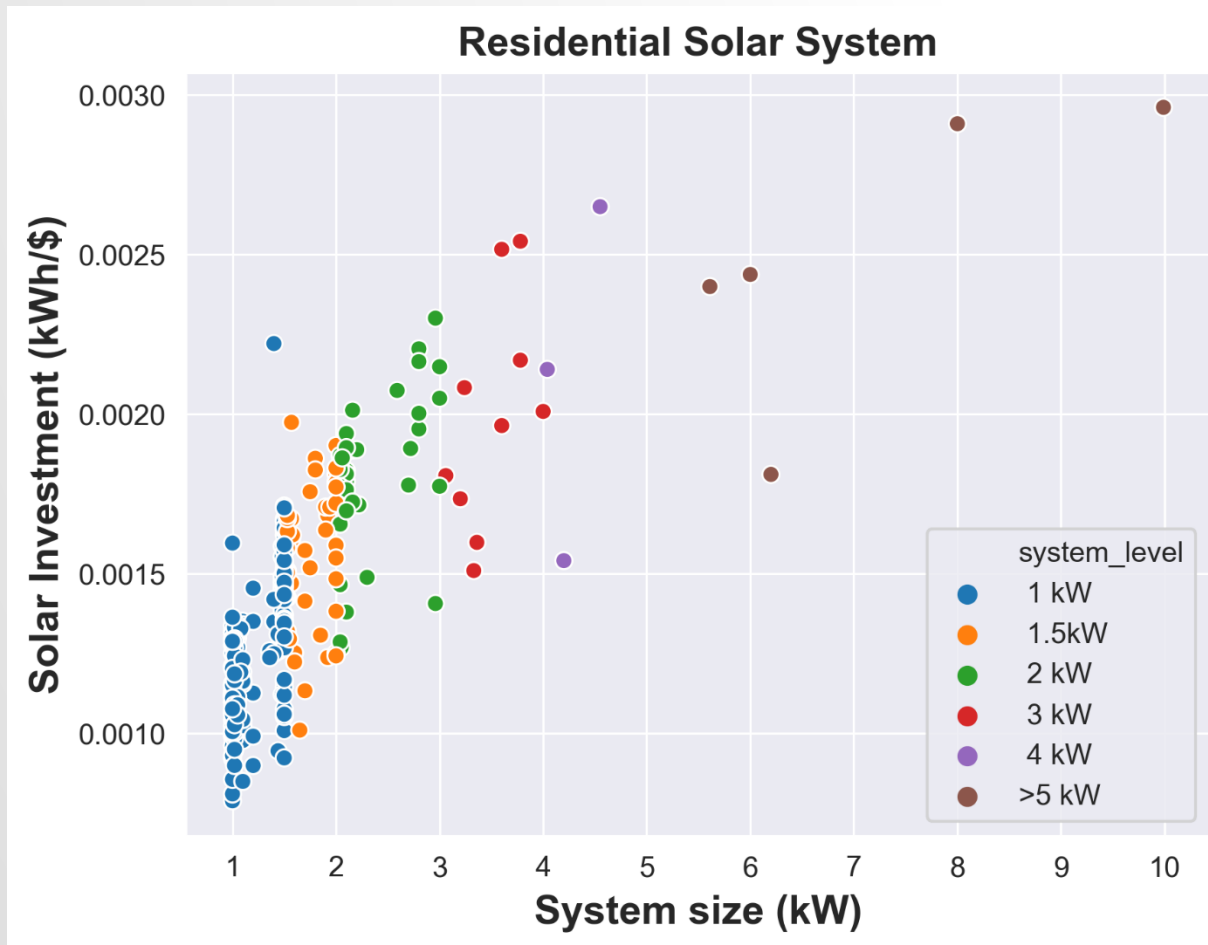
PEAK SUN HOURS (PSH)

- **The solar irradiance on the solar panels varies with time, day, month & location, orientation, tilt angle**

- **Peak sun hours is the equivalent hours that the solar panels operate at the rated power.**
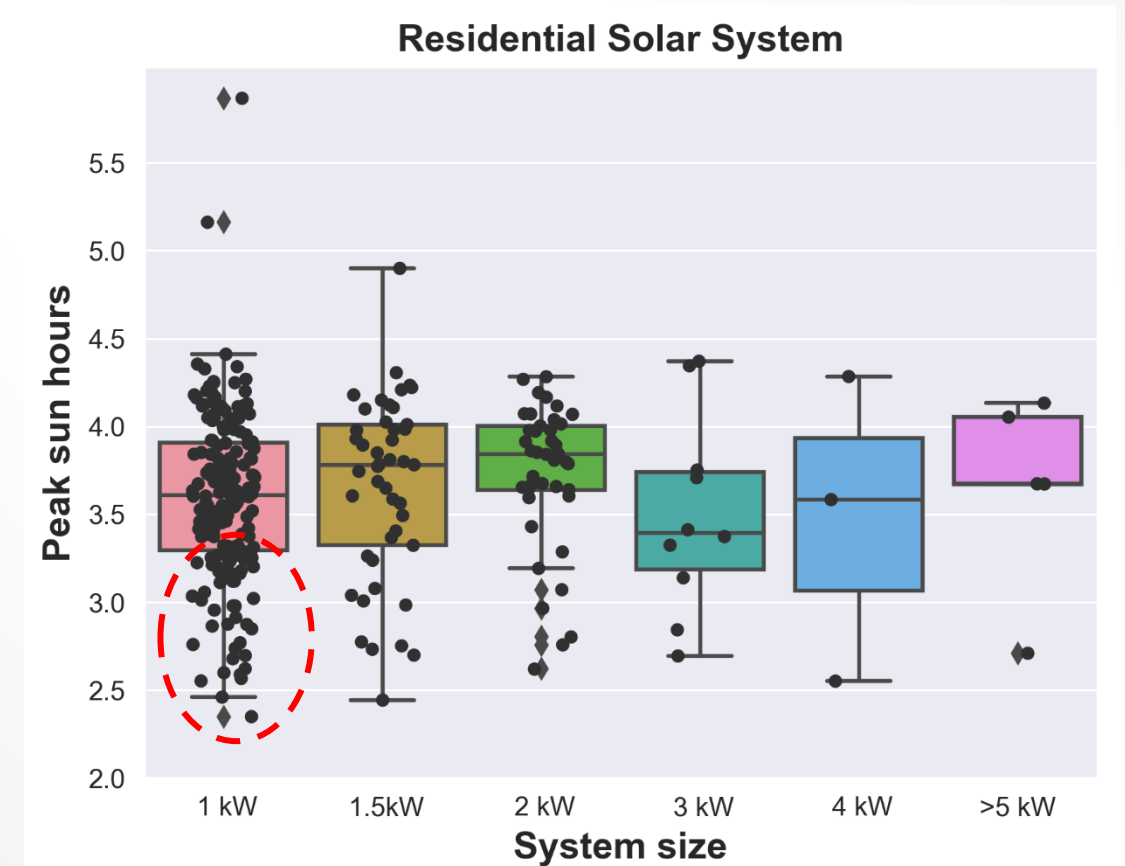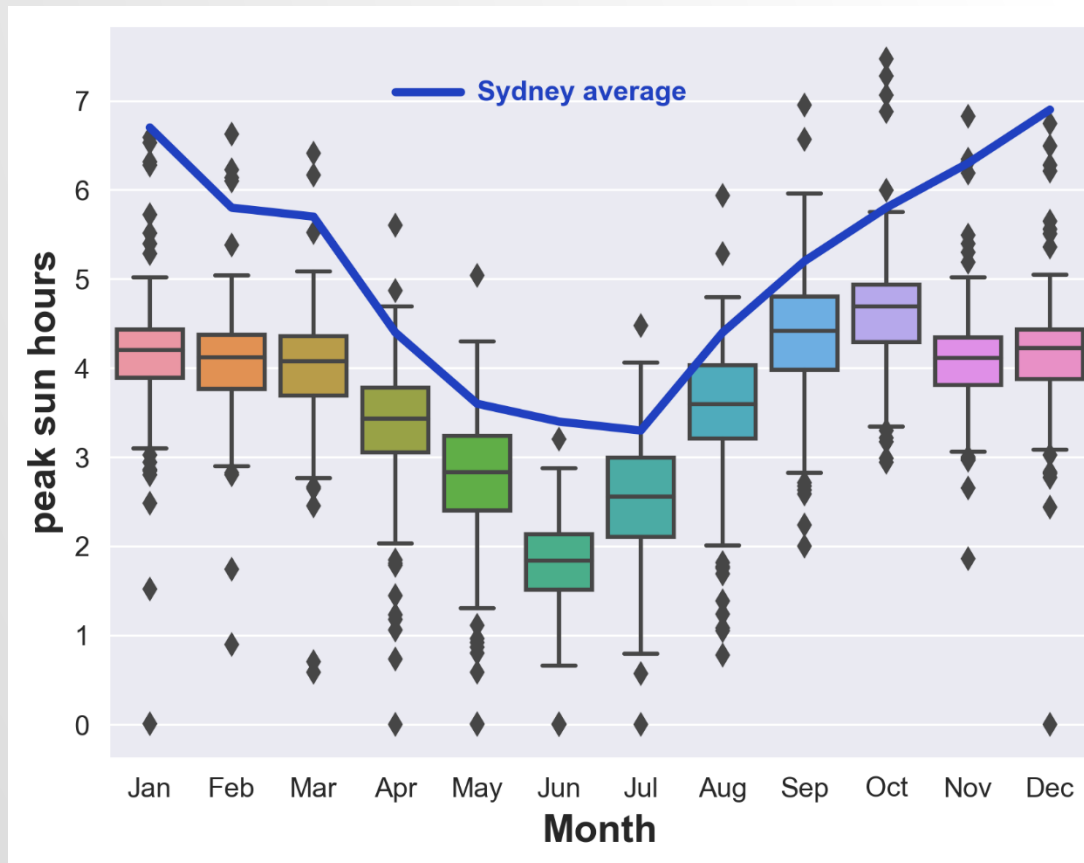
SOLAR INVESTMENT

$$Solar\ investment = \frac{peak\ sun\ hours}{system\ cost\ per\ kW} \qquad \left(\frac{kWh}{\$}\right)$$

Residential Solar System

Solar investment increases with the system size

SUMMARY

- The average payback time is 9.2 and 8.5 years when the energy plans is all time and smart home, respectively.

- The payback time is inversely correlated to the system size.

- Solar systems performed comparably in terms of peak sun hours.

- Go for large system when the rooftop space is permitted.

- Good system design is crucially important.