

Harnessing Weather Patterns to Identify Means to Optimise Households Energy Consumption by Town

Who am I?

- Data Analyst employed by a vendor hired by NEA to
- NEA needs to target 3-5 towns in Singapore that consumes the most amount of energy
- The final goal is to promote usage of energy efficiency across island

Problem Statement

Weather can potentially impact energy consumption as usage patterns in response to weather conditions.

By analysing the **relationship** between rainy days and energy consumption, we can identify **opportunities** to promote more efficient practices and optimise energy usage.

Methodology

Step 1 : Monthly weather **pattern** in Singapore

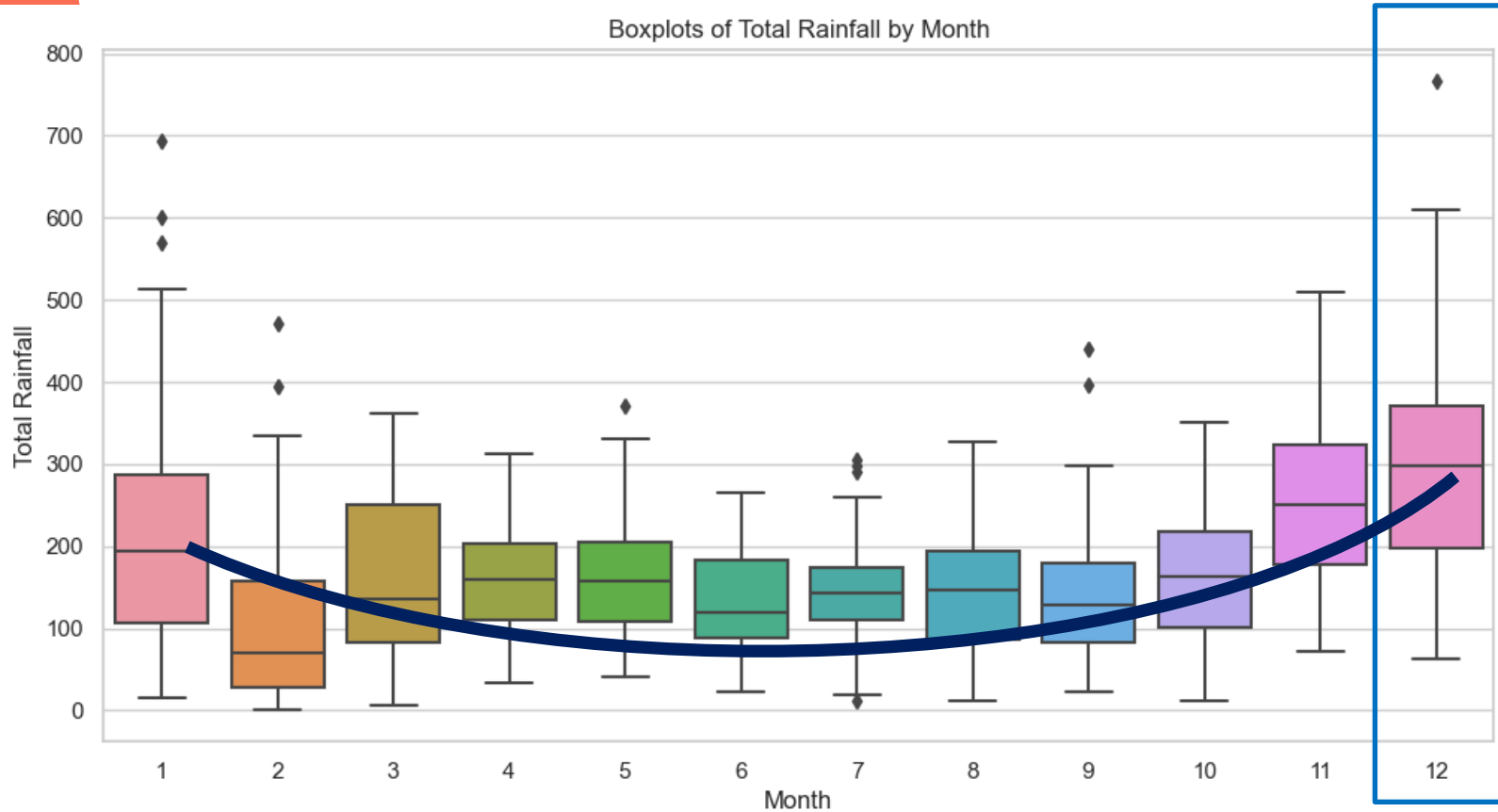
Step 2 : Relationship between various monthly weather data

Step 3 : Energy consumption **pattern** per month across **town** in Singapore

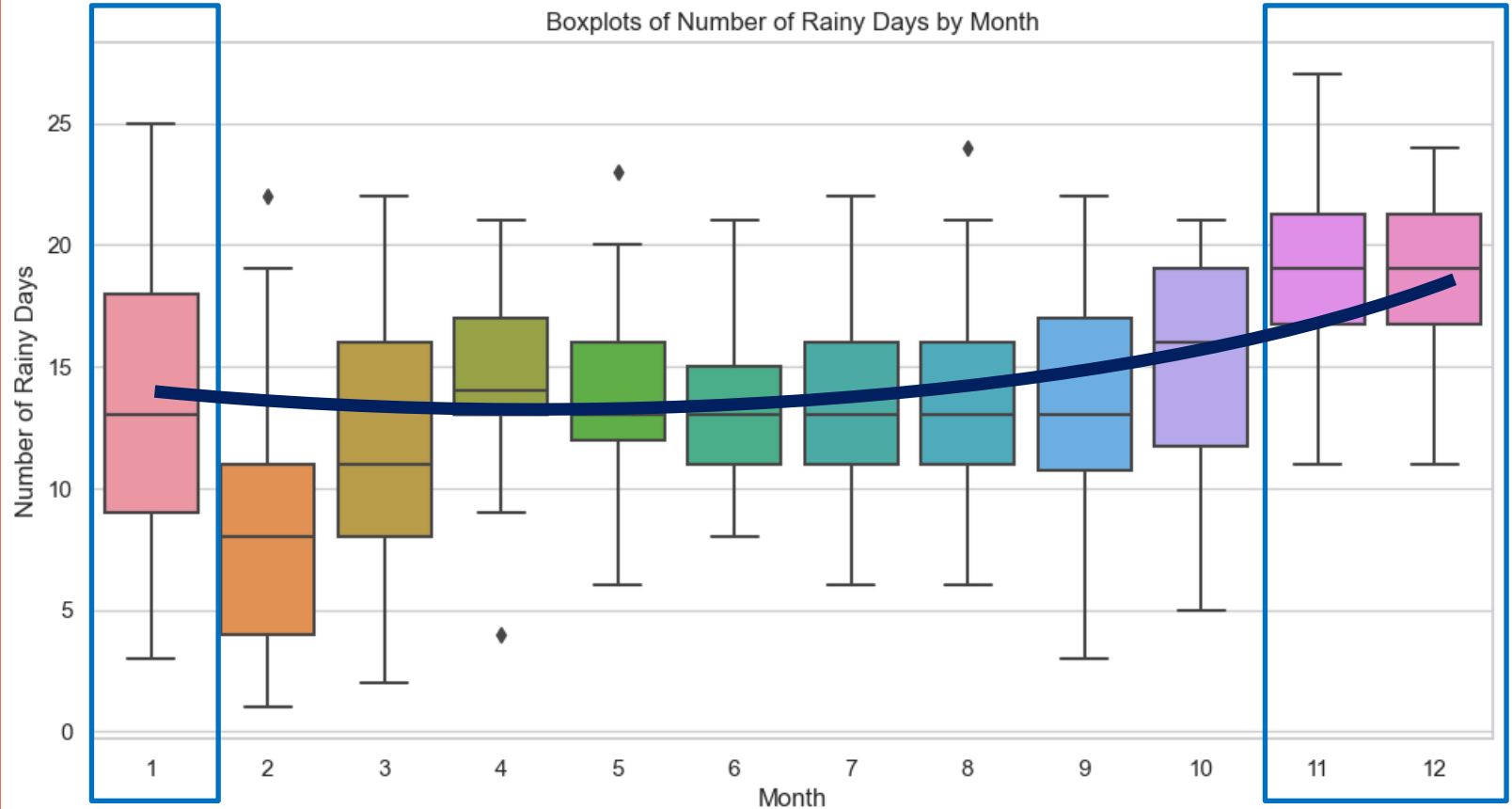
Step 4 : Relationship between various monthly weather data

Step 5 : Relationship between various monthly weather data and energy consumption across town

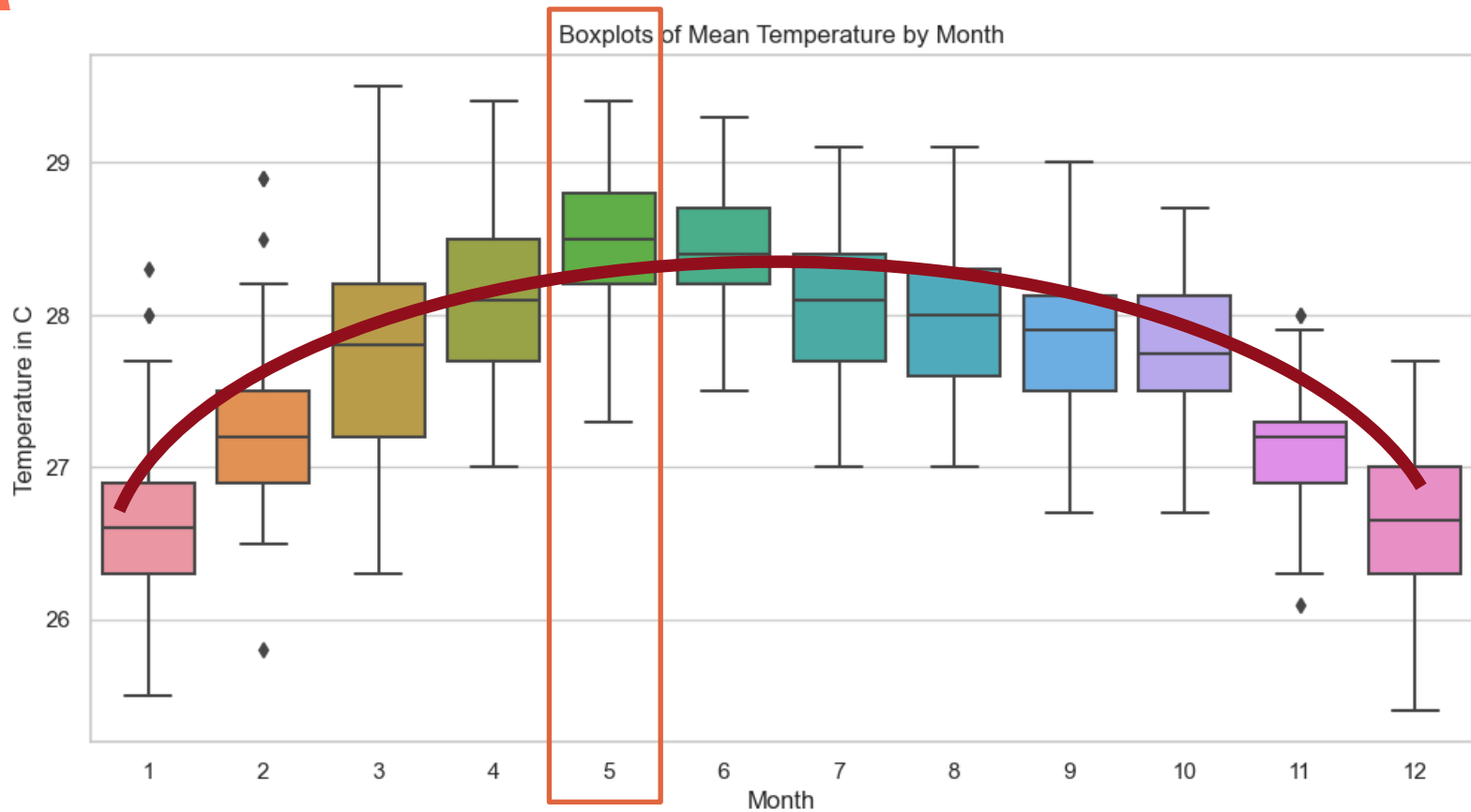
Dec is the wettest month.



Nov – Jan rains the most.



May is the hottest in Singapore



Step 2: Important Relationship between Weather Data

- (1) total rainfall in a month and maximum rainfall in a day have strong positive correlation ($r = 0.81$).
- (2) total rainfall and mean temperature have very **mild (less than expected)** negative correlation ($r = -0.51$).

How weather could potentially connect to energy consumption

Possibility 1

People stays at home more during rainy seasons

=> More household energy consumption

Possibility 2

Air-conditioner / Water Heater are used more during hot seasons

⇒ More household energy consumption

Major Source of Energy Consumption in Household



5-ticks AC
200 to 250 kWh
per month



Refrigerator
6 kWh per
wash/dry cycle

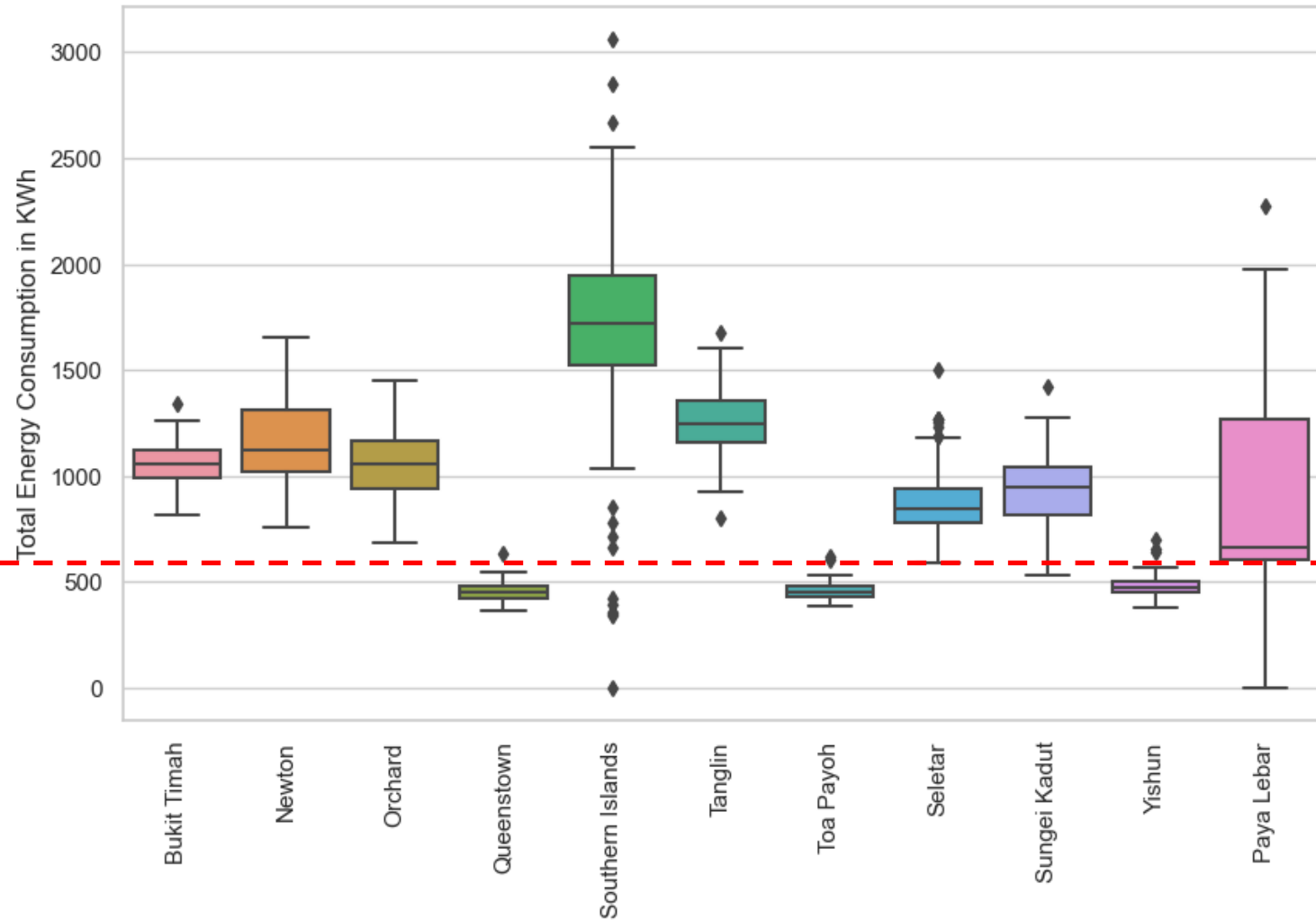


Water Heater
60 to 80 kWh per
month



Washer/Dryer
6 kWh per
wash/dry cycle

Boxplot of Total Energy Consumption by Singapore Per Month



mean
648 kWh
per month

Step 3: Energy Consumption Patterns

<div>Energy</div> <div>Area</div>	Average Household Consumption per Month (kwh)	Mean Household Consumption per Month (kWh)	Multiplier
Bukit Timah	1058	648	2x
Newton	1164		2x
Orchard	1063		2x
Paya Lebar	907		1.5x
Seletar	869		1.4x
Southern Island	1574		3x
Tanglin	1253		2x
Sungei Kadut	932		1.5x

Opportunities

Area	Multiplier	Possible Reason
Bukit Timah	2x	Landed Properties
Newton	2x	
Orchard	2x	
Tanglin	1.5x	
Southern Island	1.4x	
Paya Lebar	3x	Proximity to Airport
Seletar	2x	
Sungei Kadut	1.5x	Light Industrial Area

- The table below shows a collection of correlation coefficients (r) between the variables below.
- For example, Energy Consumption in Bishan is 0.726245 correlated with Bukit Merah.

	Bishan	Bukit Merah	Bukit Timah	Downtown	Geylang	Kallang	Marine Parade
Bishan	1.000000	0.726245	0.811978	0.613544	0.895236	0.914687	0.872386
Bukit Merah	0.726245	1.000000	0.641676	0.638045	0.730314	0.827337	0.804182
Bukit Timah	0.811978	0.641676	1.000000	0.529479	0.722889	0.776652	0.752140
Downtown	0.613544	0.638045	0.529479	1.000000	0.457717	0.602136	0.635288
Geylang	0.895236	0.730314	0.722889	0.457717	1.000000	0.946110	0.842965
Kallang	0.914687	0.827337	0.776652	0.602136	0.946110	1.000000	0.890666
Marine Parade	0.872386	0.804182	0.752140	0.635288	0.842965	0.890666	1.000000

Relationship between Energy Consumption across town

- (1) All the variables are closely related to one another.
- (2) Most of the numbers are strongly positively correlated (> 0.7) to each other.

Relationship between Energy Consumption across town



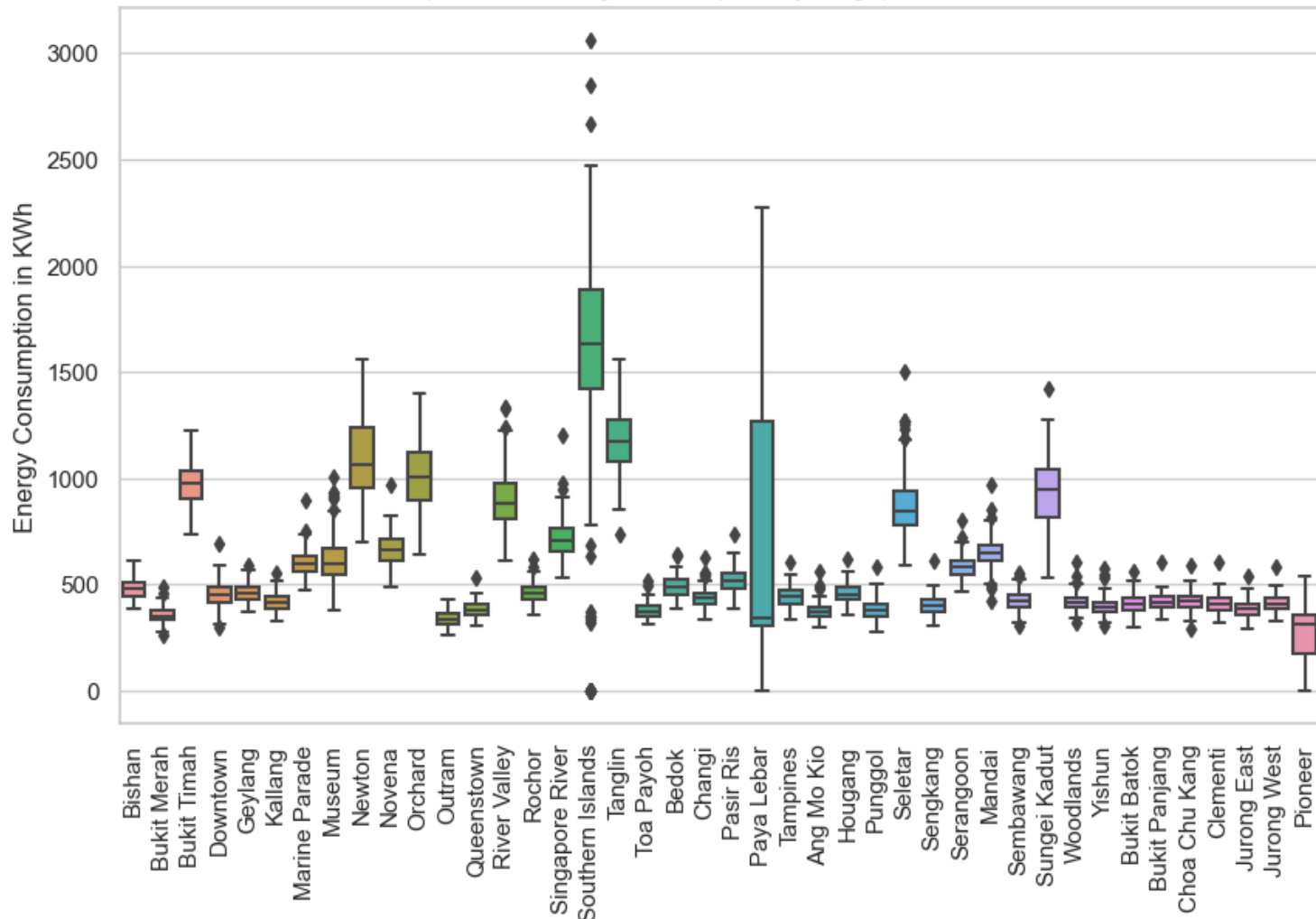
Summary of Insights

- (1) The recommendations from us will **not** be weather-dependent.
- (2) Bukit Timah, Newton, Orchard, Tanglin and Southern Islands are
 - **top** target audience for energy consumption campaign
 - the campaign will be **electricity** consumption focused
- (3) Any successful recommendations are expandable to all other towns due to the **high level of similiarity** between energy consumption patterns across areas.

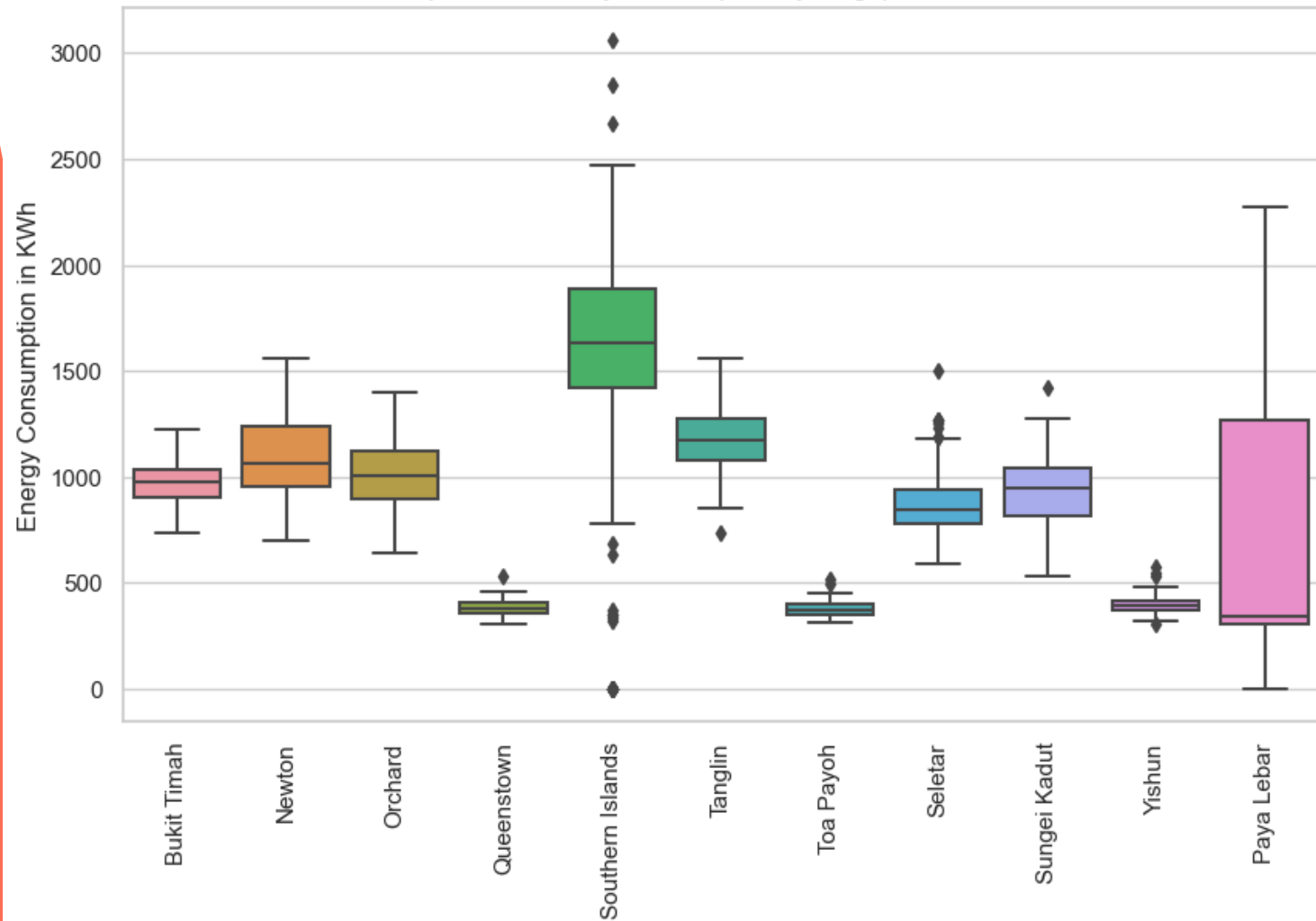
Appendix

1. Boxplot of Monthly Electricity Consumption across **all** towns
2. Boxplot of Monthly Electricity Consumption across **selected** towns
3. Boxplot of Monthly Gas Consumption across **all** towns
4. Boxplot of Monthly Gas Consumption across **selected** towns
5. Boxplot of Monthly Total Energy Consumption

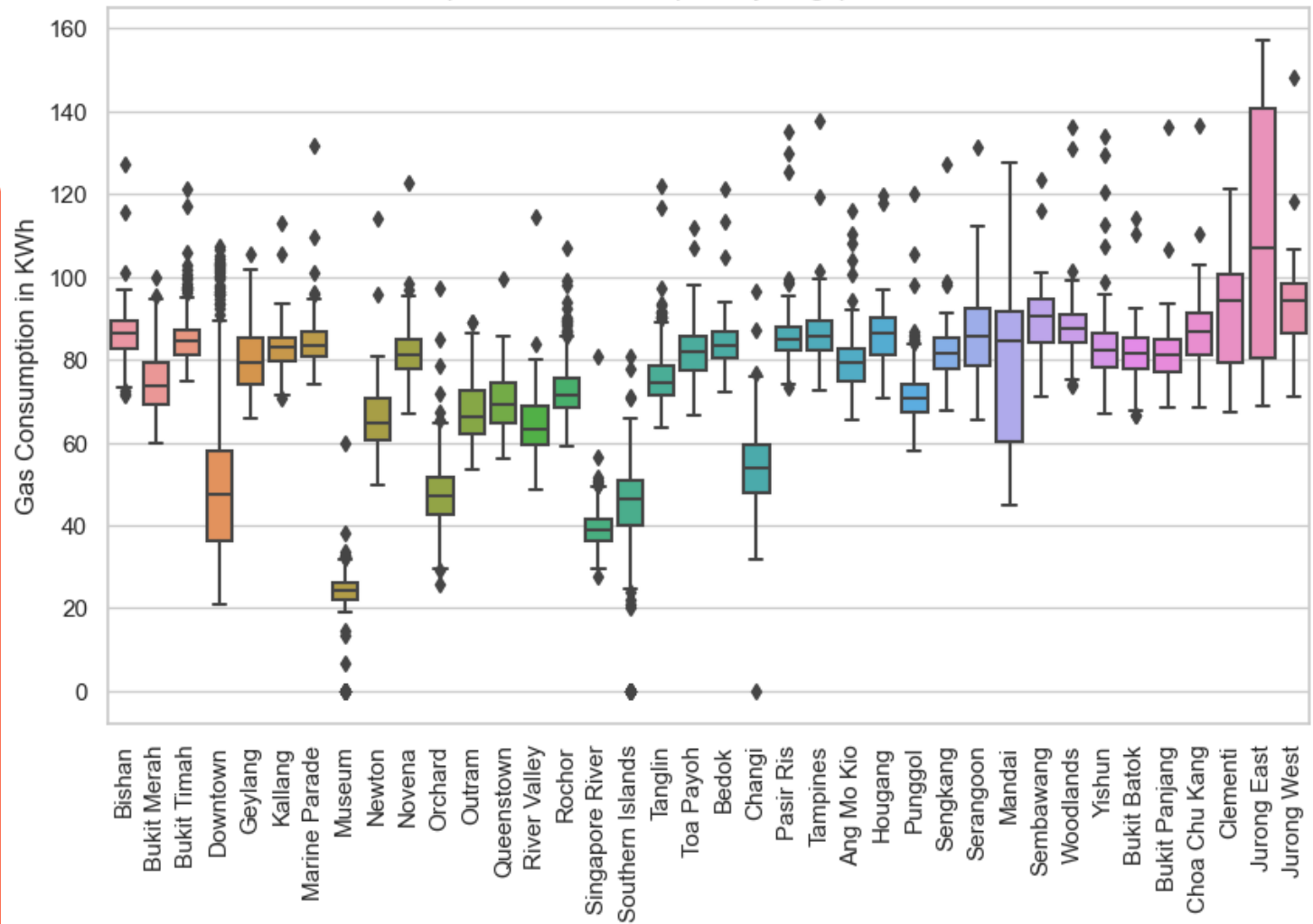
Boxplot of Electricity Consumption by Singapore Per Month



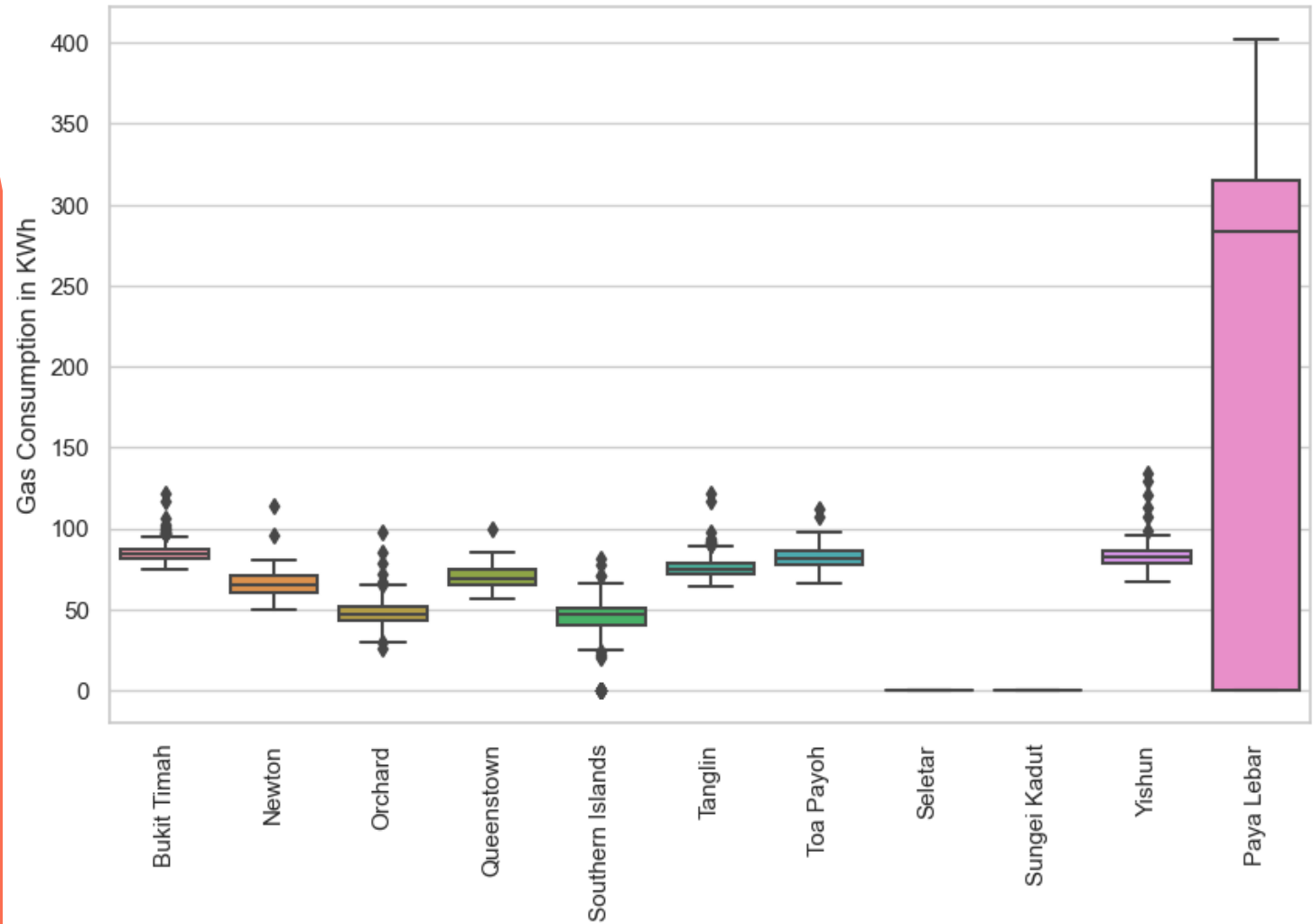
Boxplot of Electricity Consumption by Singapore Per Month



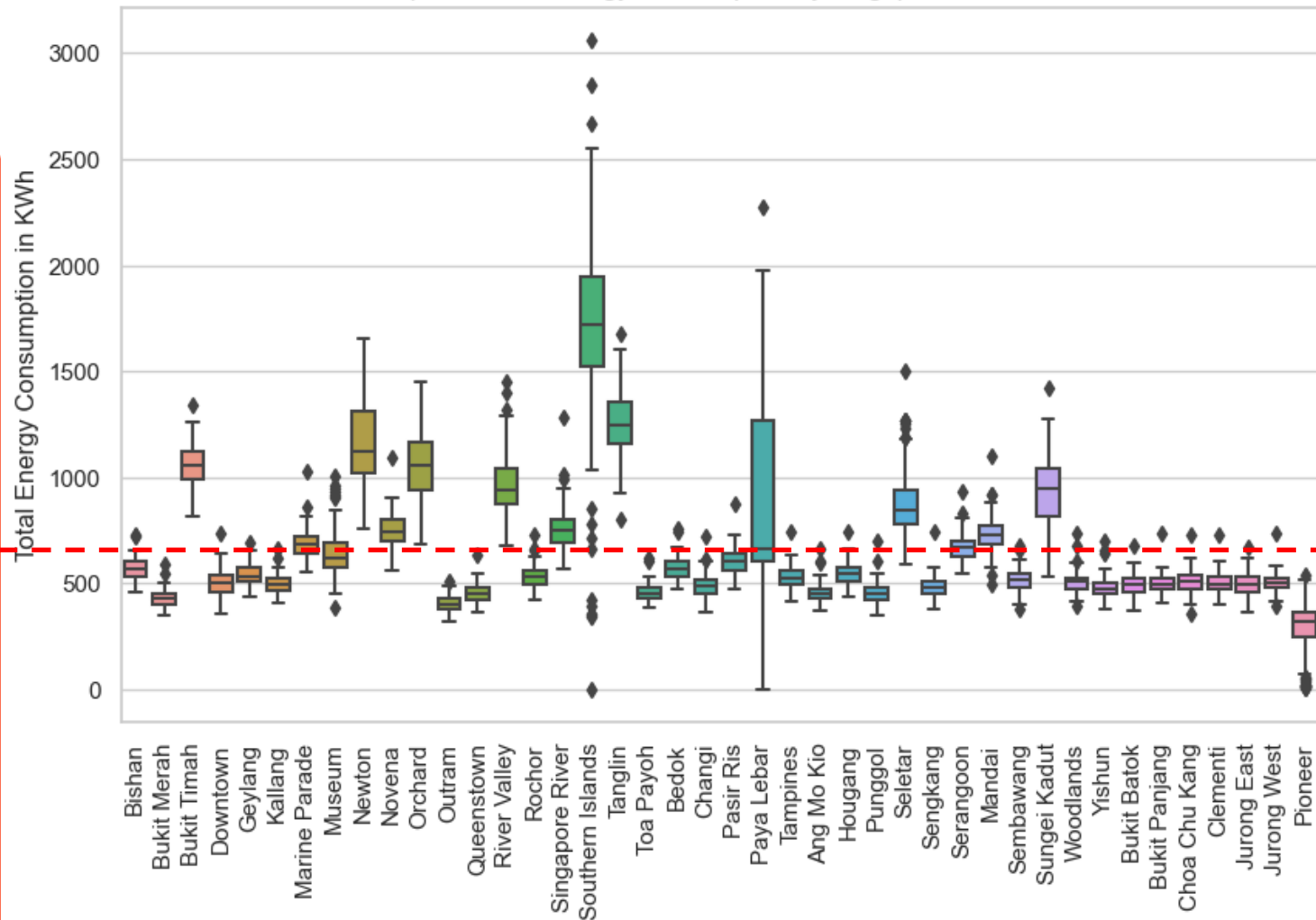
Boxplot of Gas Consumption by Singapore Per Month



Boxplot of Gas Consumption by Singapore Per Month



Boxplot of Total Energy Consumption by Singapore Per Month



mean
648 kWh
per month