



Data Analysis of Singapore Weather Patterns to Identify Means to Optimise Households Energy Consumption by Town



Data Analyst of a vendor hired by
Government

Government wishes to promote
usage of energy efficiency across
island.

They will run pilot projects for 3-5
towns in Singapore and needs
some insights how to approach it.

Problem Statement

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

Analysing the **relationship** between Singapore weather and energy consumption across **town**, 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

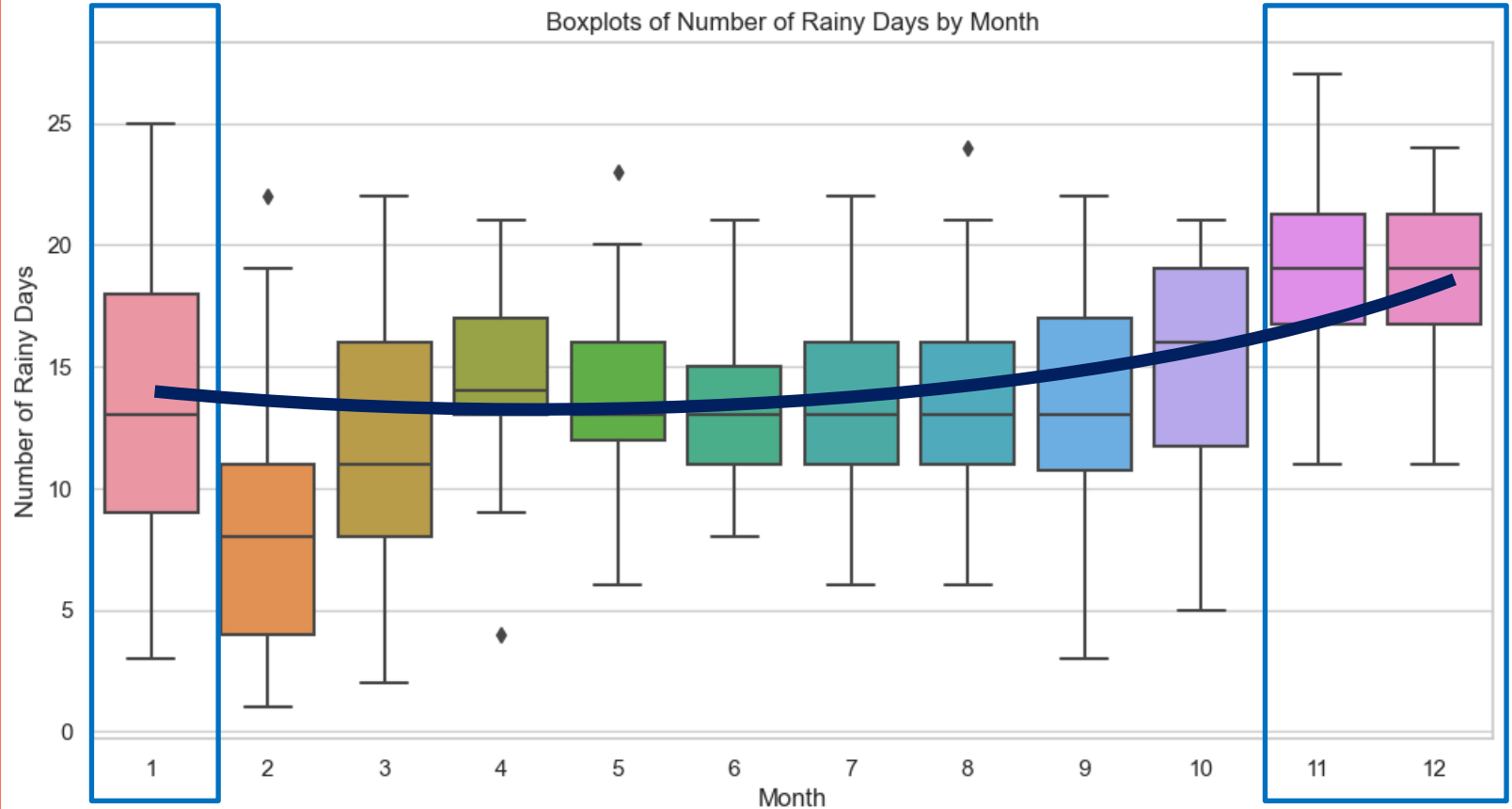
Step 3 : Energy consumption **pattern** per month across **town** in Singapore

Step 4 : Relationship between average energy consumption across **town**

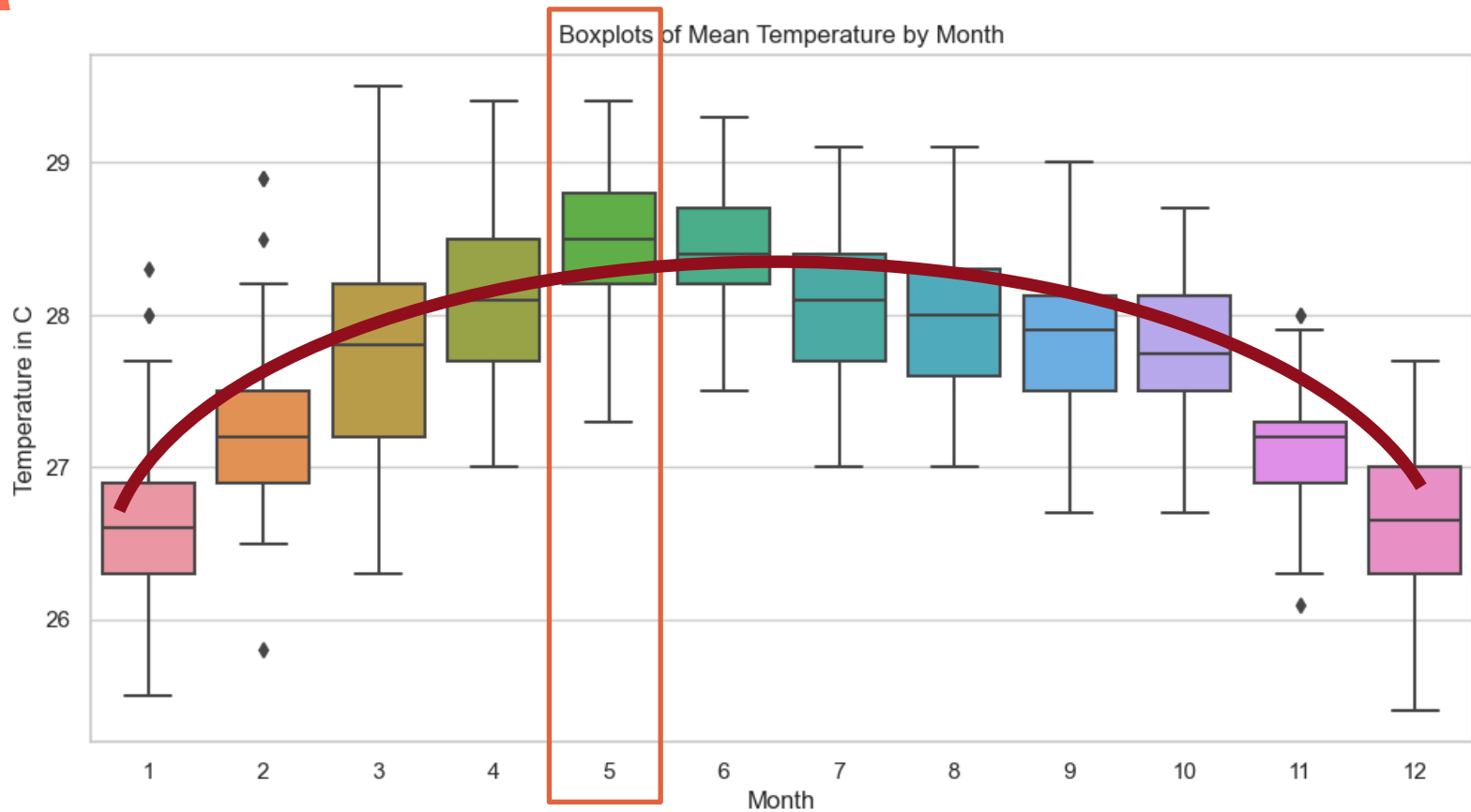
Step 5 : Relationship between various monthly weather data and energy consumption across town



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 ($r = -0.51$).

Major Source of Energy Consumption in Household



5-ticks AC
200 to 250 kWh
per month



Refrigerator
6 kWh per
wash/dry cycle

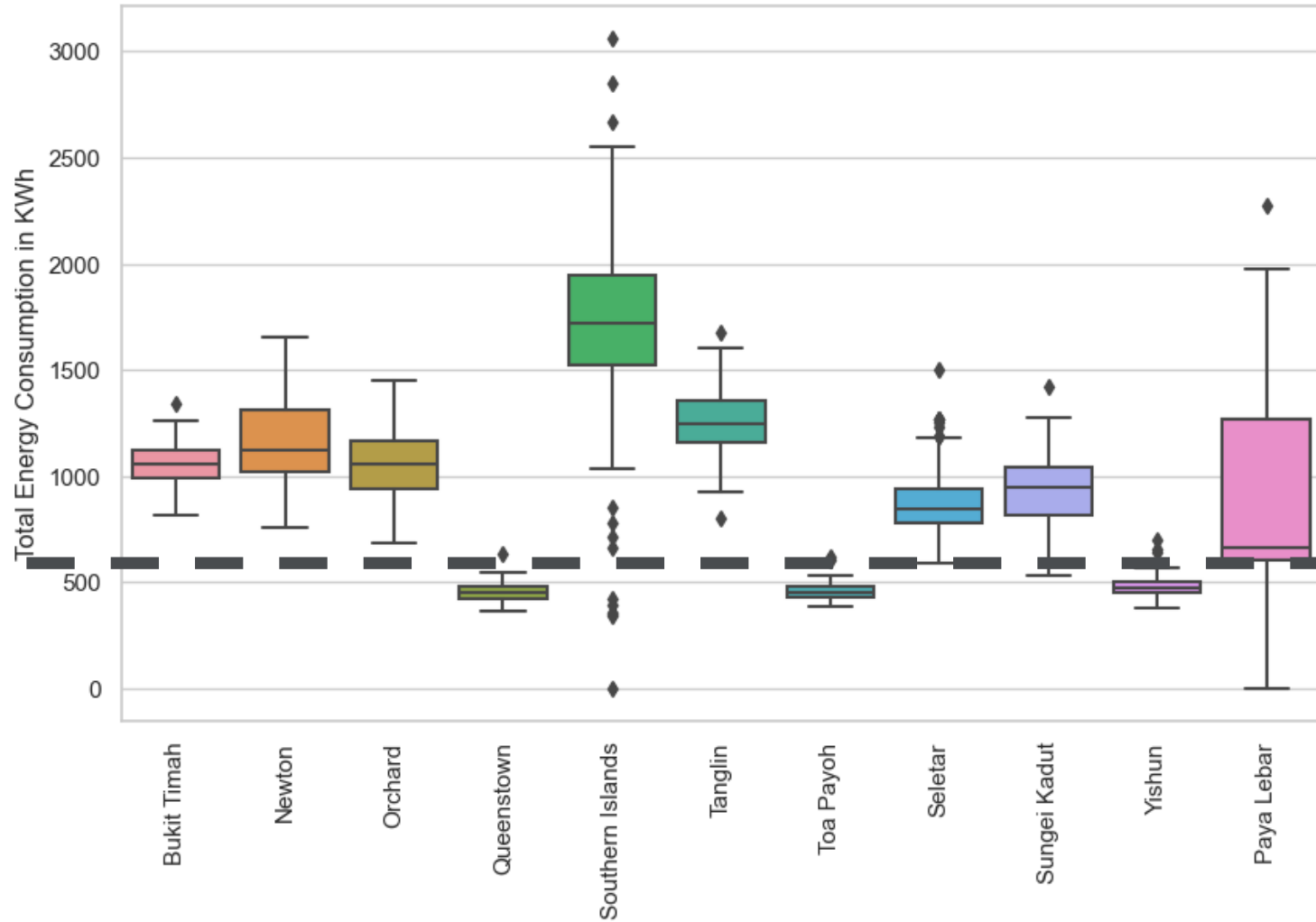


Water Heater
60 to 80 kWh per
month



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

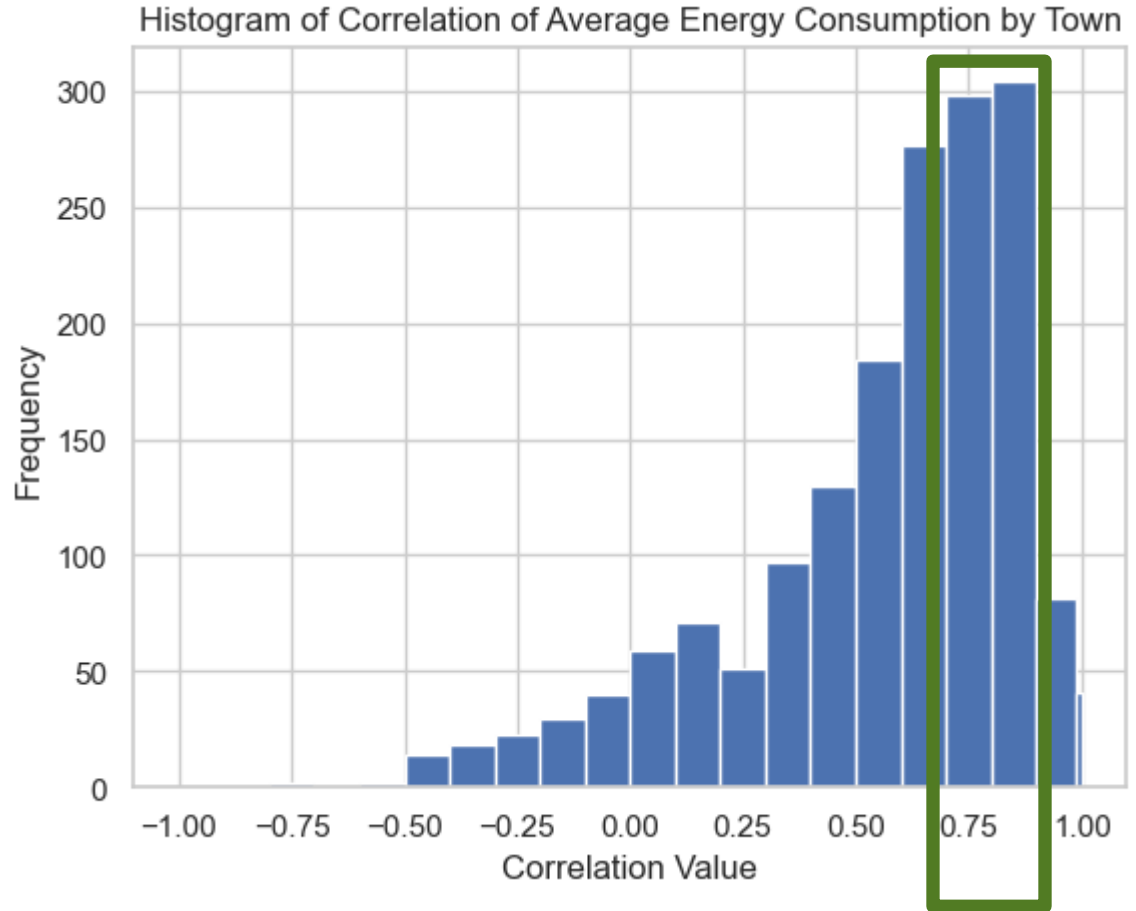
Area	Multiplier	Possible Reason and Potential Remedy
Bukit Timah	2x	Campaign that focus on Landed Properties
Newton	2x	
Orchard	2x	
Tanglin	1.5x	
Southern Island	1.4x	
Paya Lebar	3x	Campaign that focus on Landed Properties
Seletar	2x	
Sungei Kadut	1.5x	Campaign that focuses on Light Industrial Factories

- 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

Step 4: Relationship between average energy consumption across **town**

A good portions of
correlation coefficients
are strongly positively
correlated (> 0.7) to
each other.



Relationship between Energy Consumption across **town**

The energy consumption patterns across towns are **similar**.



Push for one **successful** campaign in a town



Expand our campaigns to all towns

How weather could potentially connect to energy consumption

Possibility 1

People stays at home more during rainy seasons

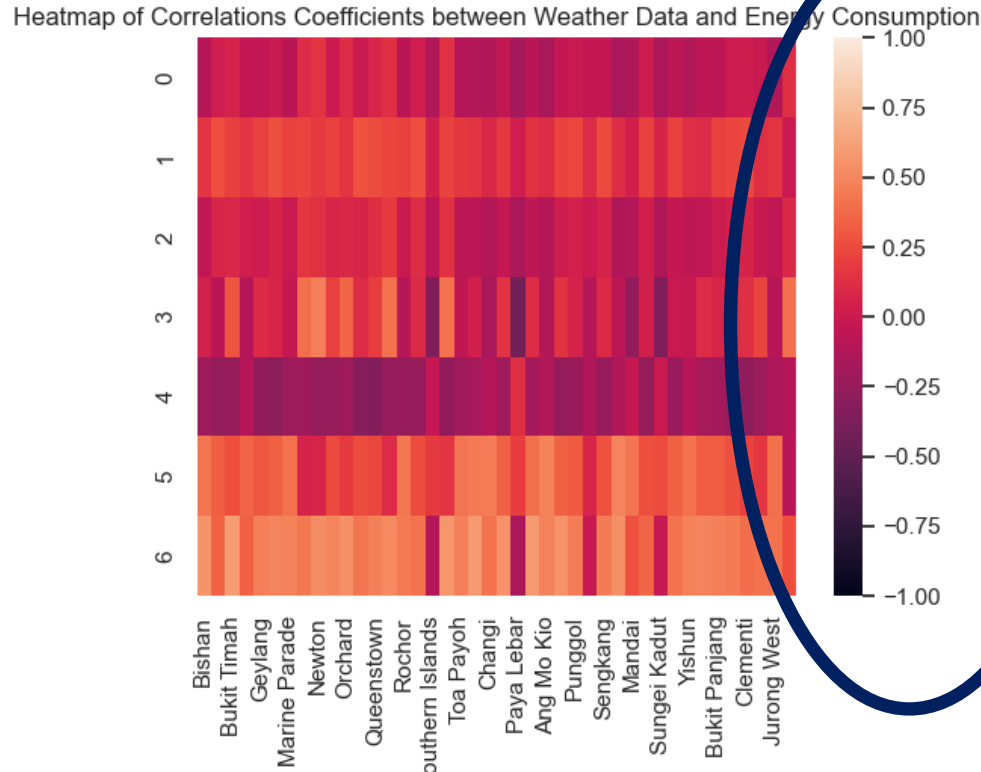
=> More household energy consumption

Possibility 2

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

⇒ More household energy consumption

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



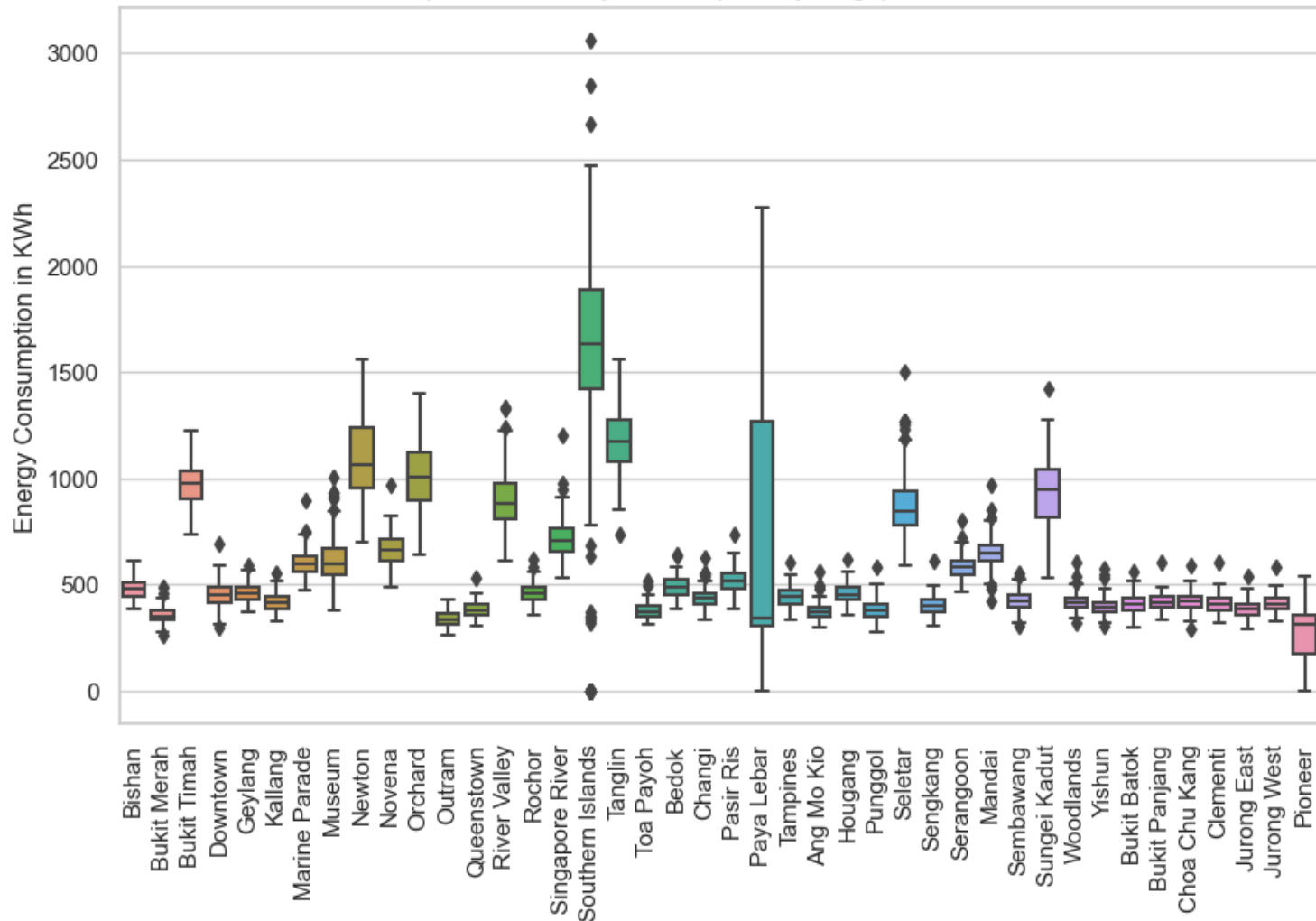
Summary of Recommendations

- (1) The recommended campaign 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.

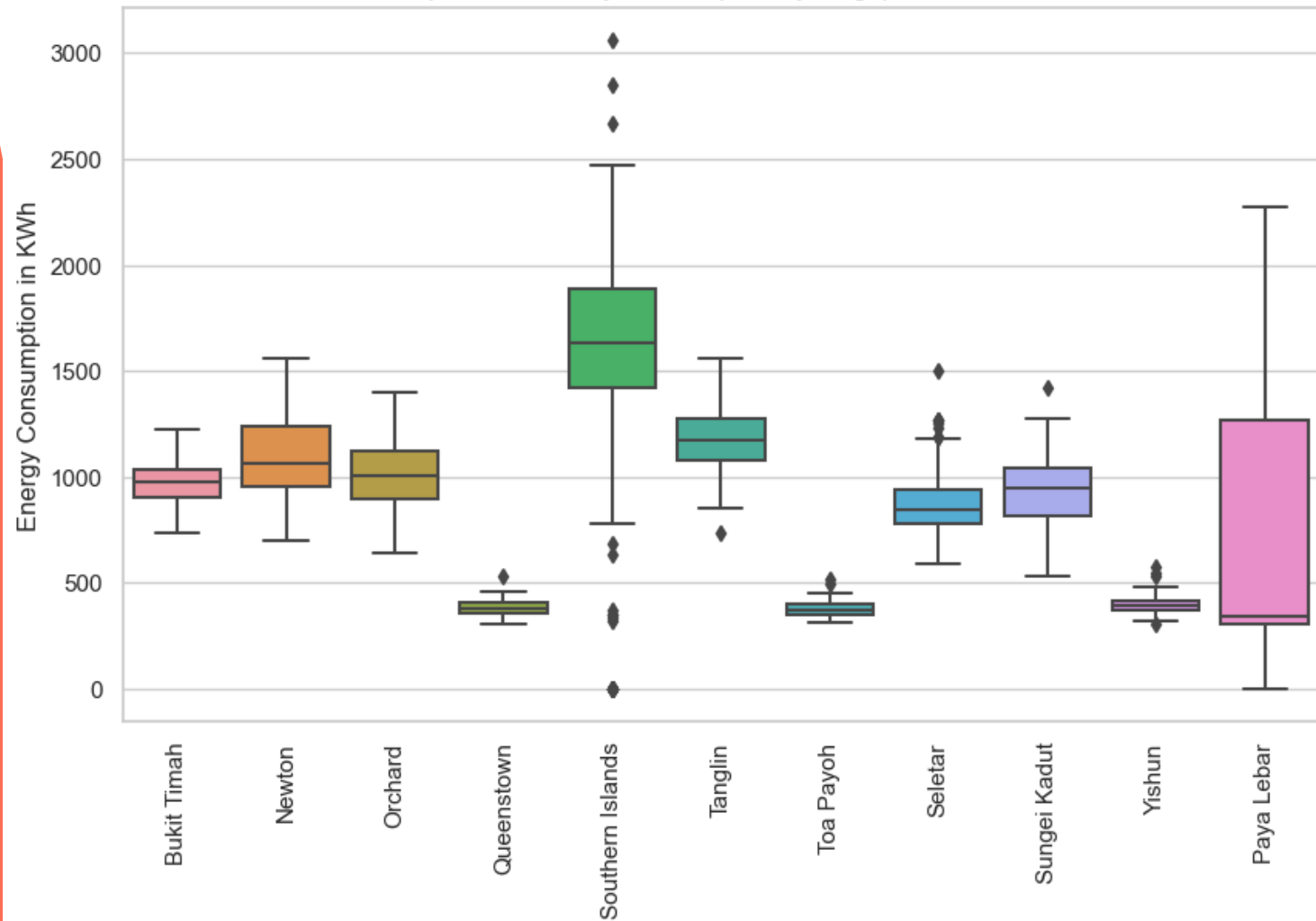
Appendix

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
6. Table of Housing Type by Percentage
7. Boxplot of Total Rainfall by Month

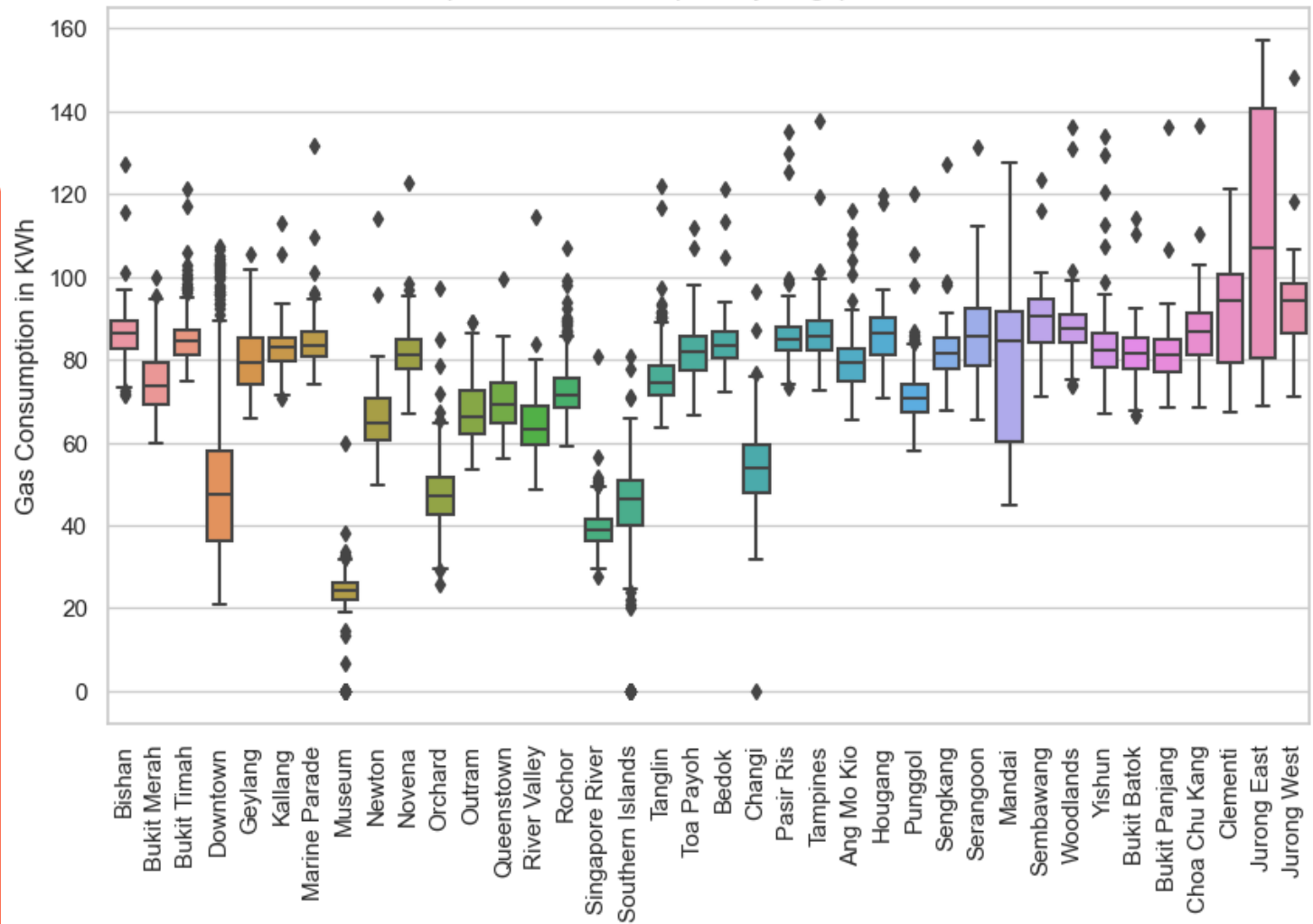
Boxplot of Electricity Consumption by Singapore Per Month



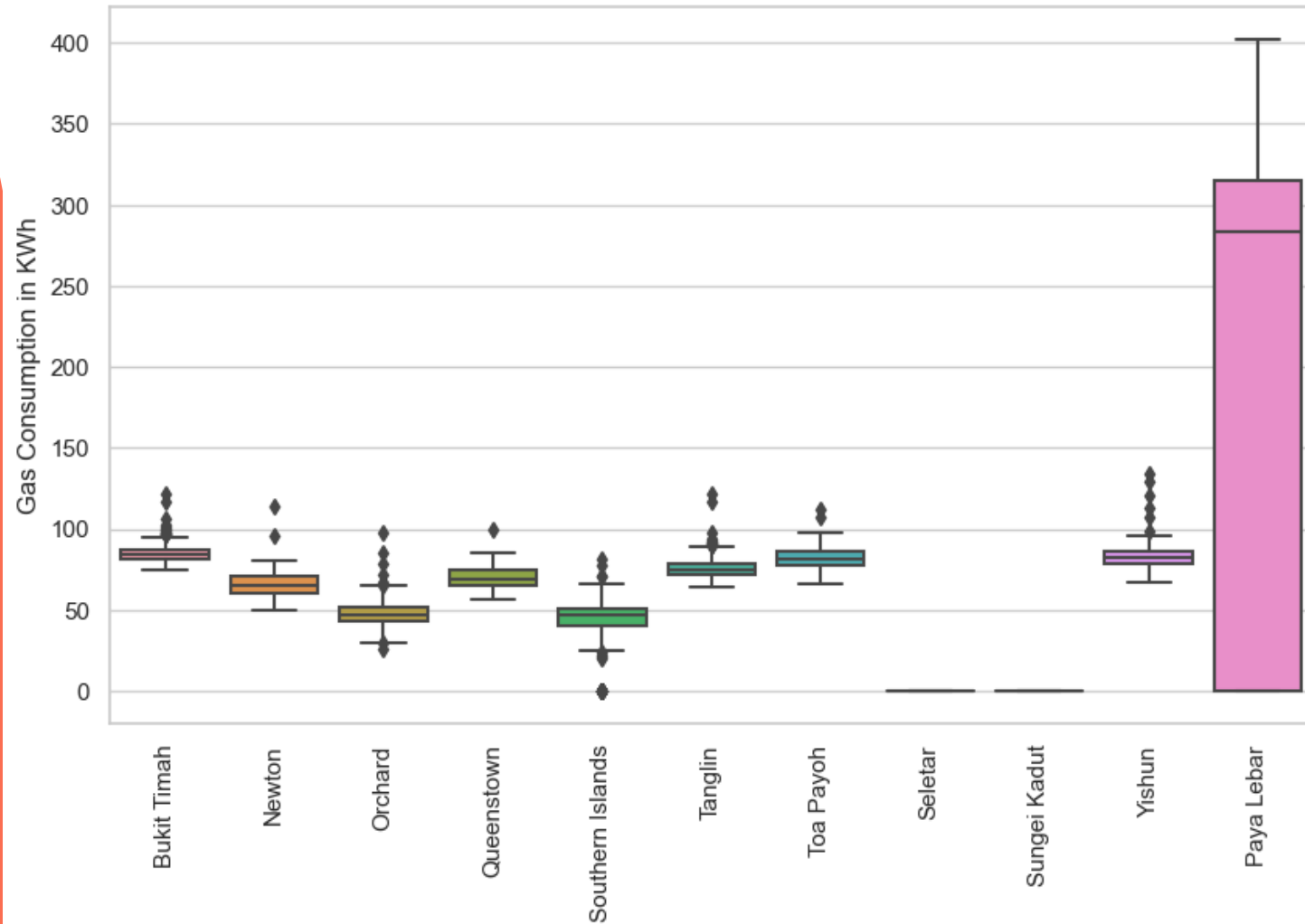
Boxplot of Electricity Consumption by Singapore Per Month



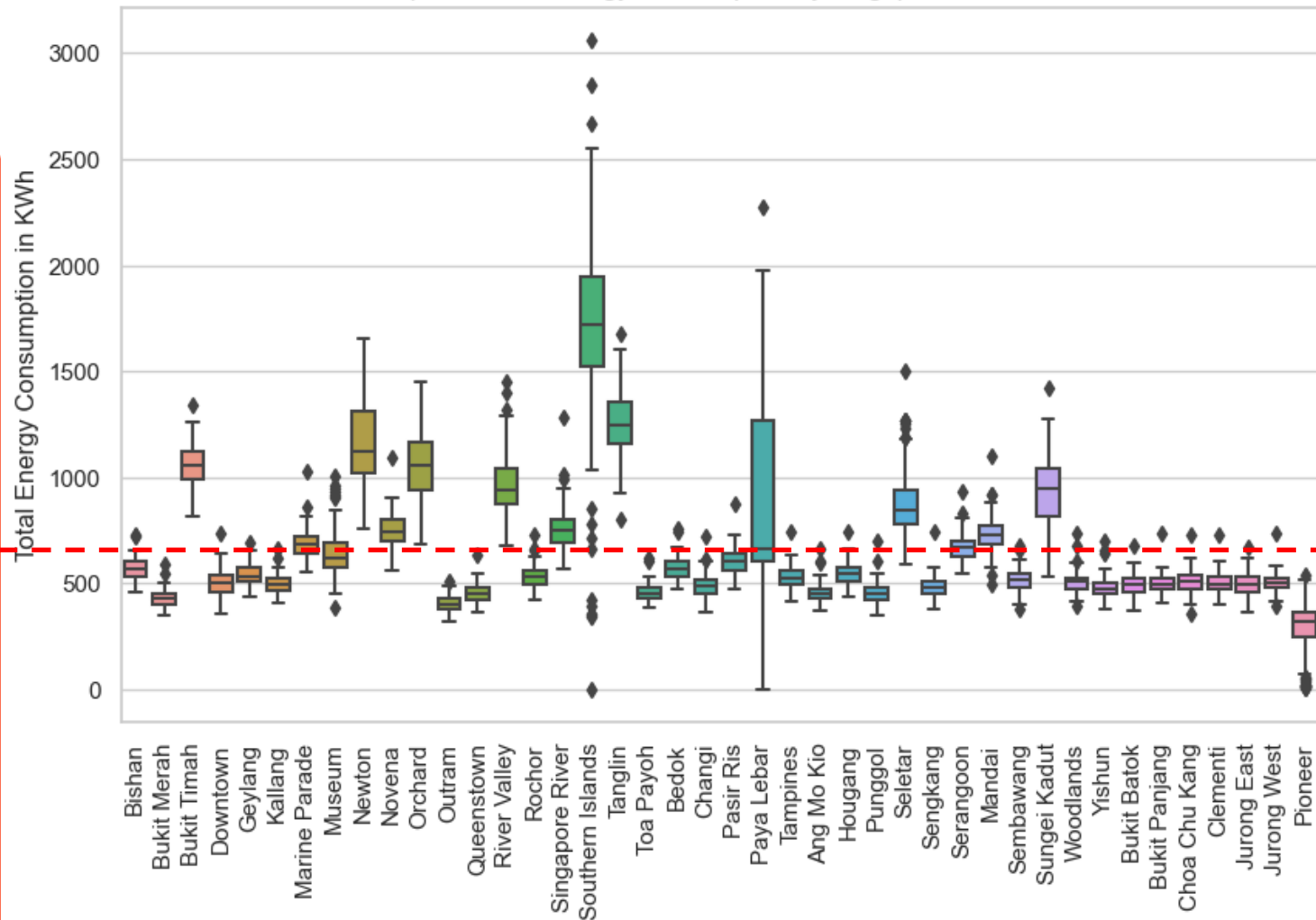
Boxplot of Gas Consumption by Singapore Per Month



Boxplot of Gas Consumption by Singapore Per Month



Boxplot of Total Energy Consumption by Singapore Per Month



mean
648 kWh
per month

Housing Type by Percentage

Items	Unit	Latest Period	Latest Data	% Change (Y-o-Y) <u>1/</u>	Previous Period Data	% Change (Y-o-Y) <u>2/</u>
Total HDB Dwellings	%	2022	77.9	na	78.3	na
HDB 1- & 2-Room Flats <u>7/</u>	%	2022	6.7	na	6.6	na
HDB 3-Room Flats	%	2022	17.2	na	17.5	na
HDB 4-Room Flats	%	2022	31.4	na	31.5	na
HDB 5-Room & Executive Flats	%	2022	22.6	na	22.7	na
Condominiums & Other Apartments	%	2022	17.0	na	16.5	na
Landed Properties	%	2022	4.9	na	4.9	na

Dec is the wettest month.

