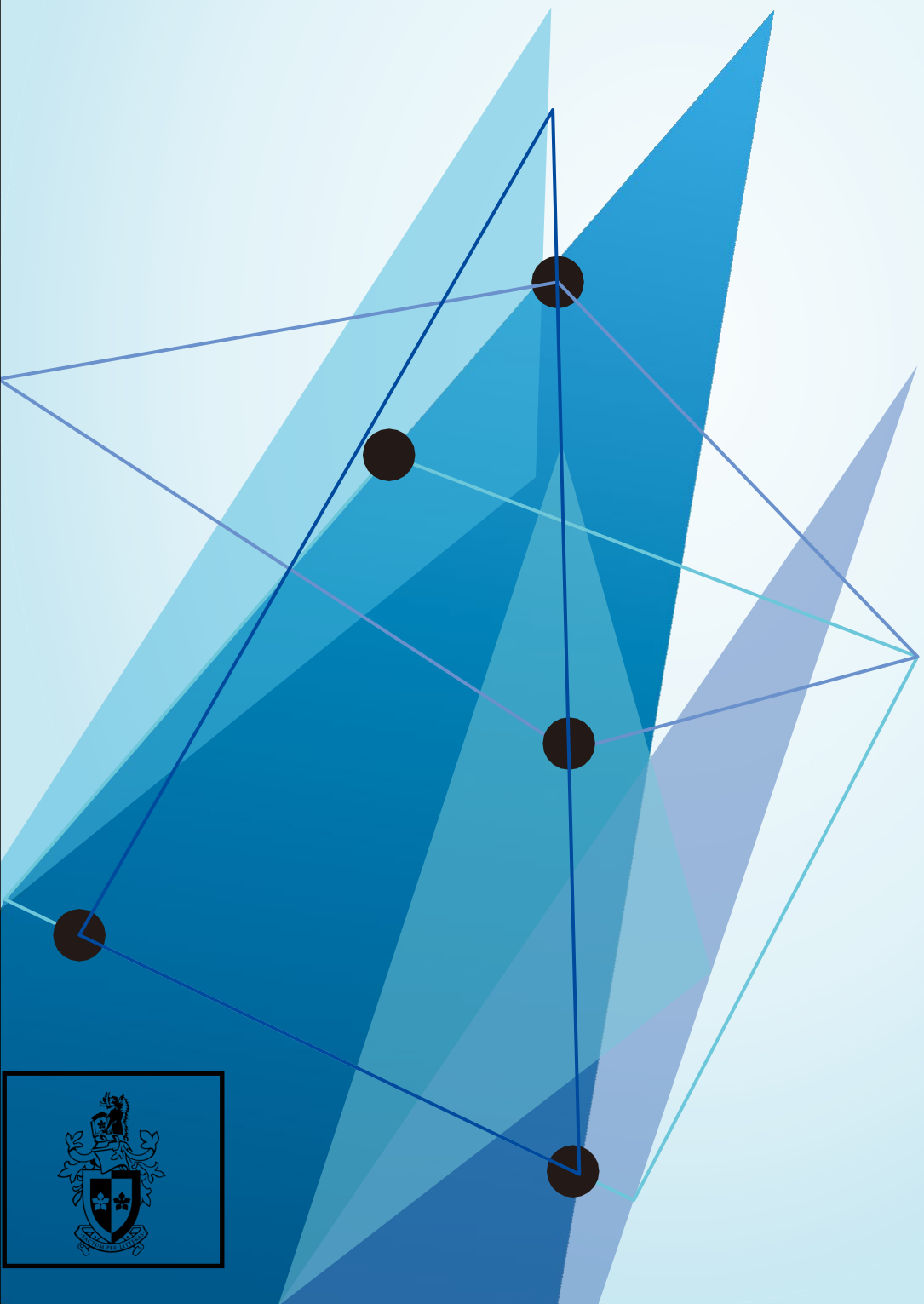
Renewable Energy in Australia



https://mercury.swin.edu.au/cos30045/s102871305/Project/main.html

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TUTORIAL: MON 10:30 A.M

YEAR 2, SEM 1

WORD COUNT: 1561

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Introduction

Background and Motivation

The evolution of electricity dated back to 1752 when Benjamin Franklin used a kite during a thunderstorm to prove that static electricity and lightning were the same things. Electric current is always part of nature, and we are slowly moving toward the age of generating through coal, nuclear power, and various way to evolve toward the modern day where we are heavily relying on electricity for our daily life. However, this convenience does come at a cost such as air and water pollution. In Australia, air pollution would be one of the major concerns of electricity generation. As we evolve, renewable power options have also become more viable and cost-effective options for many Australians. For our future generations, we need to acknowledge the climate emergency and start looking into more sustainable power options. Solar power is one of the very accessible options for the public with various government funds supporting reducing the cost of installations. The public needs to understand how much they could contribute and change the way power is generated. Besides reducing gas emissions from coal-generated power, using solar power also help saves money on power from renewable sources.

Visualisation Purpose

The purpose of our visualisations Is to give the public a clear view of the increases in renewable energy throughout the last few years, and the cost-saving of having a solar system at home. We will also have a visualisation of the increases in cost from buying energy from retailers during peak and non-peak times, and how much it has increased over the last few years. Furthermore, correlating how much we reduced greenhouse gas emissions with the increase of solar power installed also gives the users a certainty that they are contributing to a more sustainable climate. Combining all the visualisations, we can see the benefits of using solar power not only reducing gas emissions but also reducing the electricity bills for many households. Eventually, many peoples have also learned to use and power their high electricity consumption electronics during the daytime when the solar panel is on the full run.

Project schedule

Week 3 – gathering data, information, and topics

Week 5 – start working on the introductions

Week 7- brainstorming how we going to code the visualisations

Week 9- starting to code the visualisation

Week 12- finalise the visualisations

13/06 – finalise the process book and the visualisations

Data

Data Source

We are gathering our data from various sources

For solar installations in Australia, we gather the data from Australia PV Institute and the data is in CSV

https://d3hysioybks0ok.cloudfront.net/attachments/analysis/10/monthly_analysis_data_4f10.csv

For greenhouse gas emissions data, we gather it from the department of science, energy and industry and the data is in. xlsl.

https://www.industry.gov.au/data-and-publications/national-greenhouse-gas-inventory-quarterly-update-september-2021

For the wholesale price of electricity, we gather it from the Australian energy regulator in CSV

https://www.aer.gov.au/wholesale-markets/wholesale-statistics/annual-volume-weighted-average-30-minute-prices-regions

For renewable electricity generation in each Australian state in csv

https://www.energy.gov.au/sites/default/files/2022-04/Australian%20Energy%20Statistics%202022%20Table%20O%20-%20Publication%20version.pdf

Data Processing

A few of our dataset comes with many states or more than 10 years, we will do a few data splitting and on extracting the data that meet our requirements

. As for the cost of electricity, we will display it with a bar chart. We will use a line chart to visualise the decrease in greenhouse emissions.

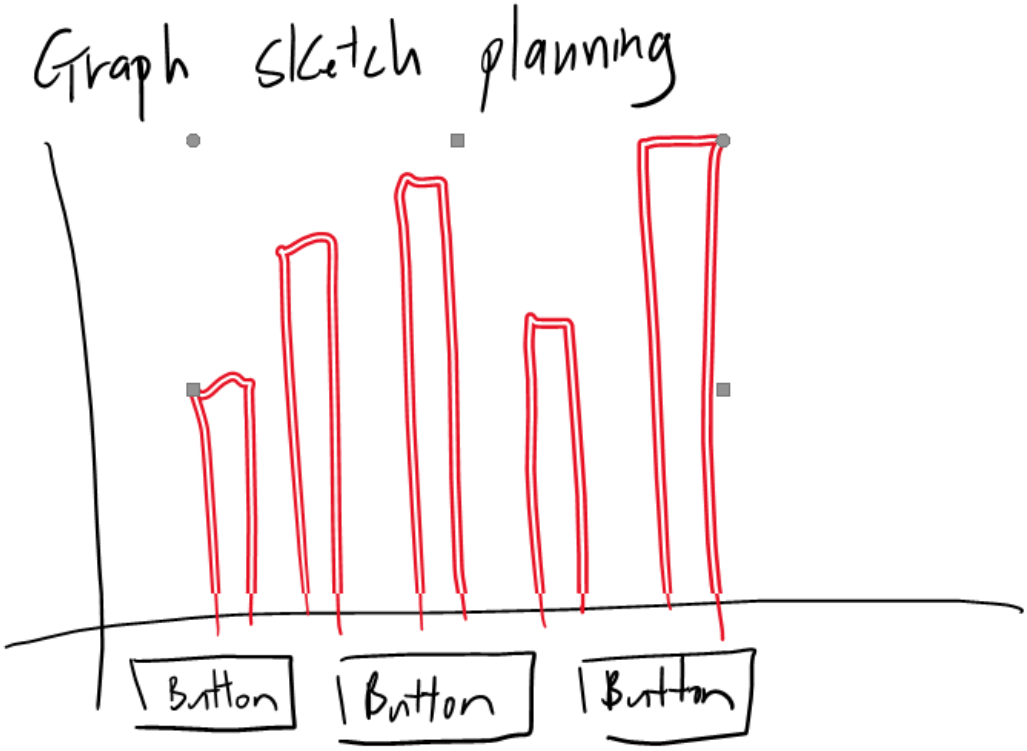

Figure 1. Bar Chart Sketch

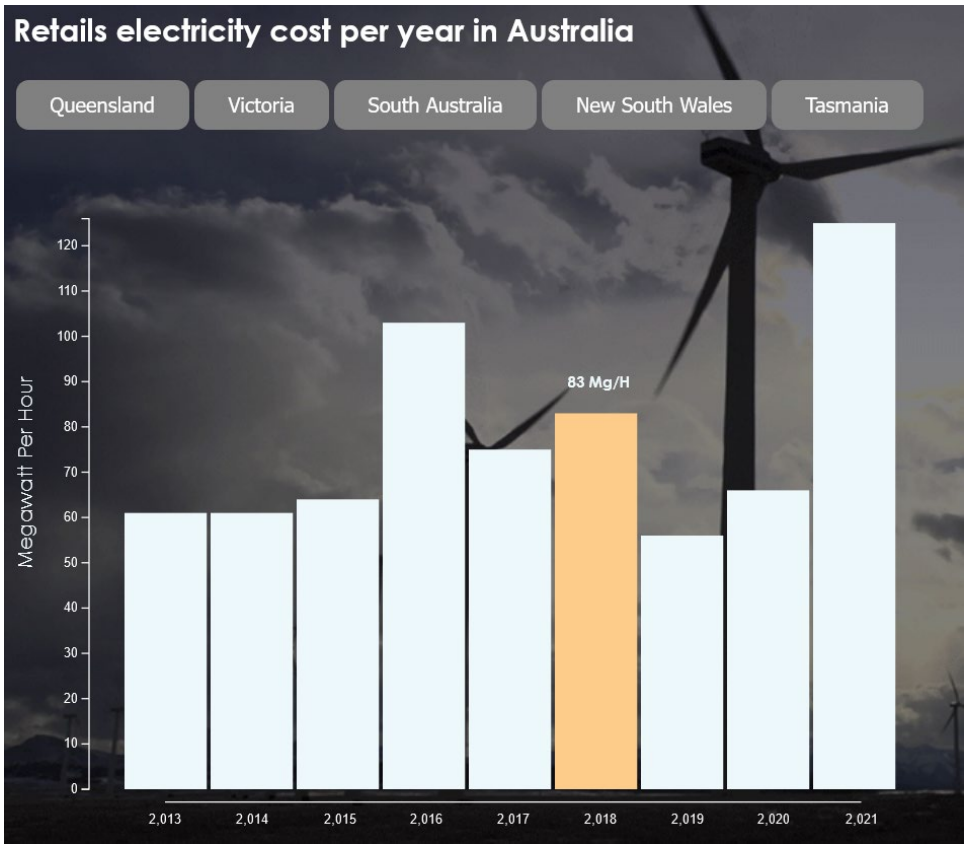

Figure 2. Bar Chart Describing the Retail Electricity Cost Per Year In Australia

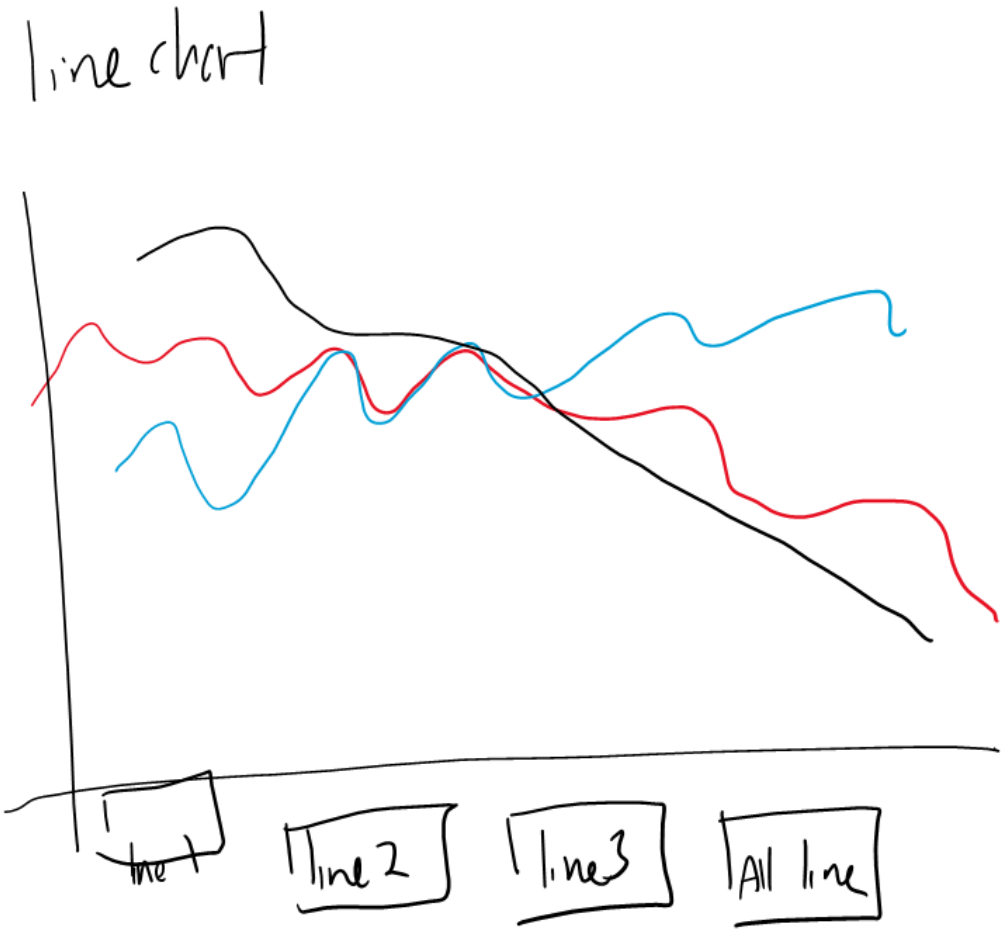

Figure 3. Line Chart Sketch

Figure 4. A Line Graph Describing the Green House Emission Level

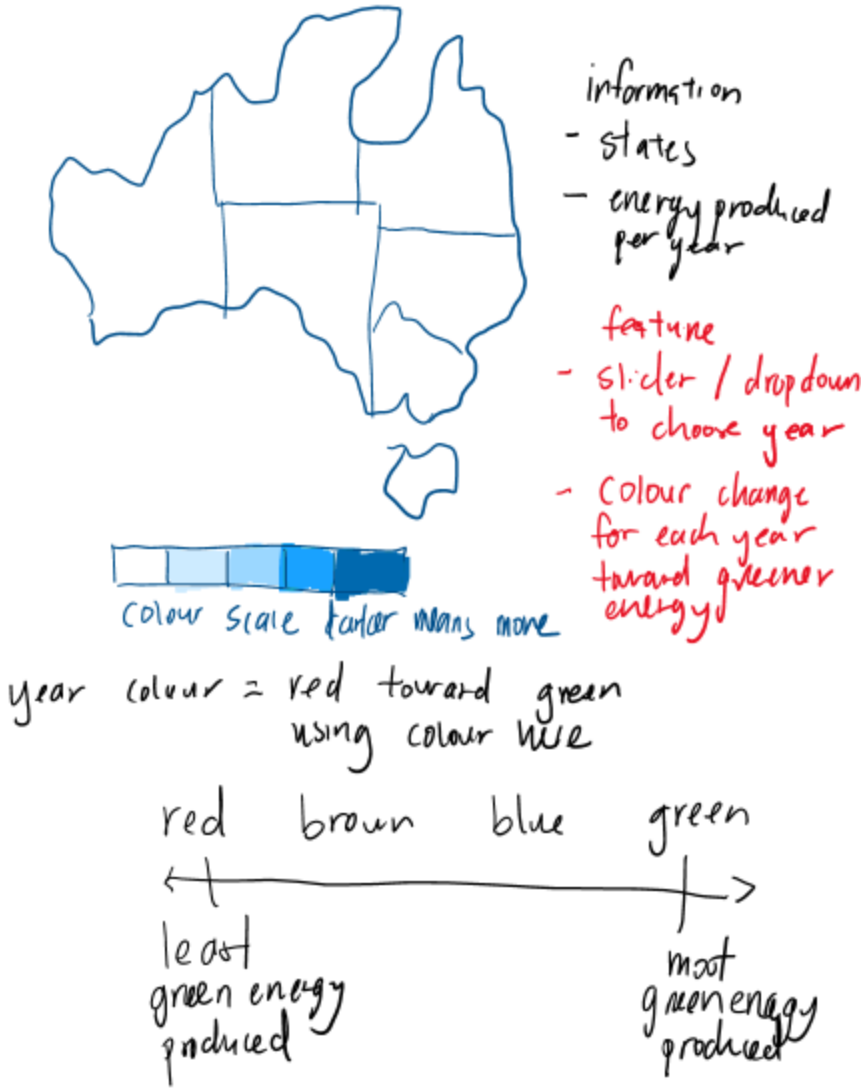

Figure 5. Preliminary Sketches of the Heatmap

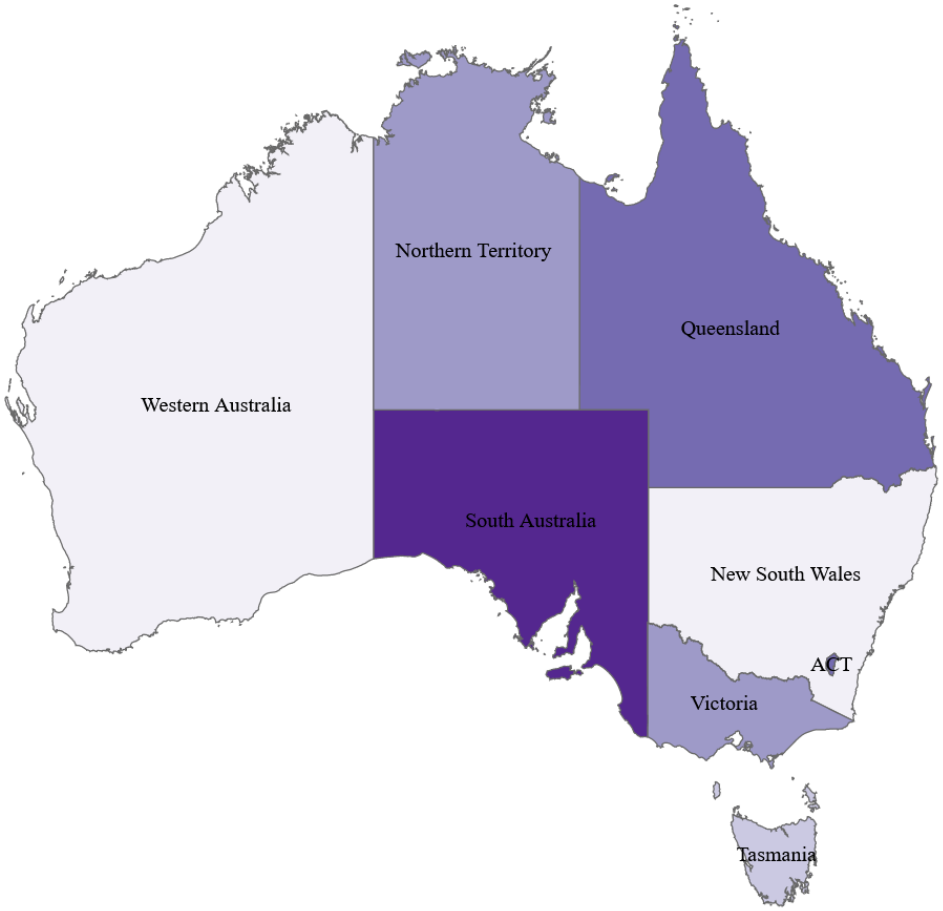

Figure 6. An Early Look at The Geo Map of Australia

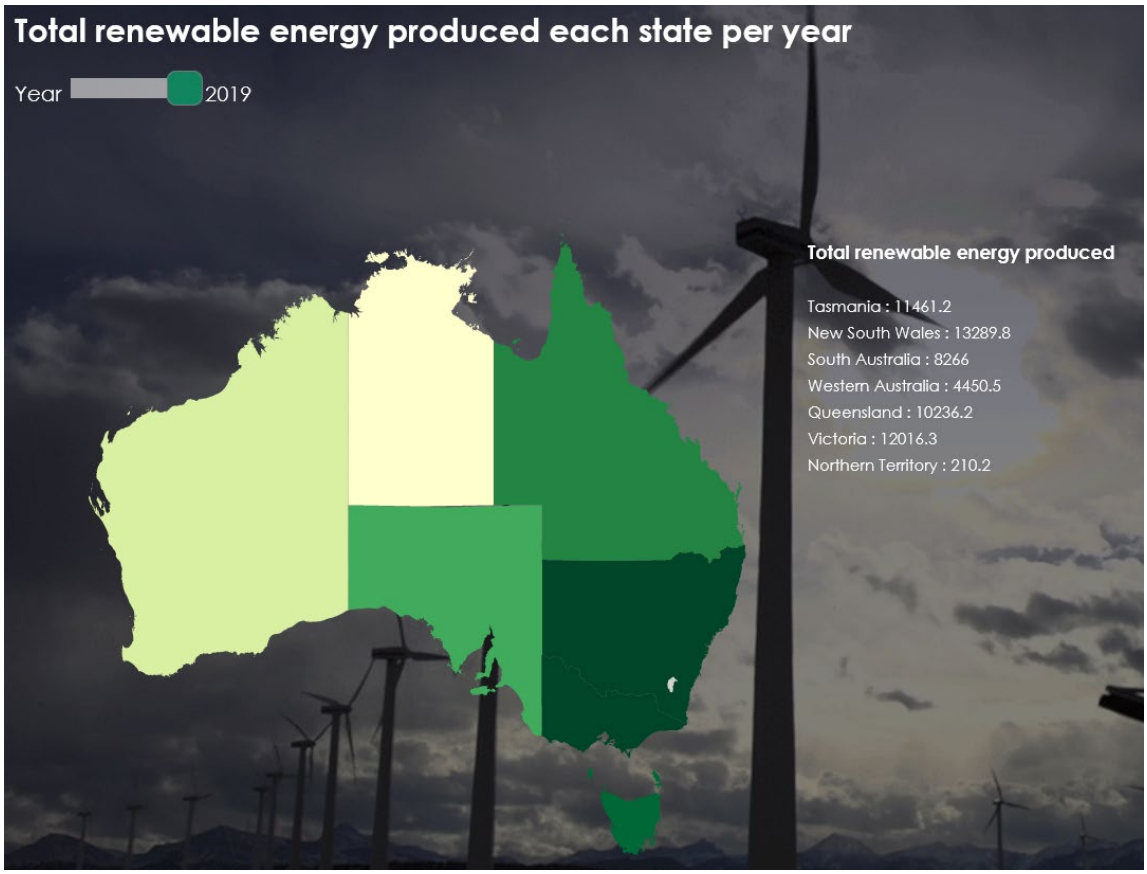

Figure 7. The Finished Heatmap of Australia

Progress

Initially, we planned to build a simple bar chart to showcase the data on the cost of electricity with buttons to choose from for different states. We improved the bar charts with hover to show the actual data when mouse over.

We have improved our buttons for both the bar chart, and we have plans to add an active class on the buttons that we hover our mouse over. Further changes to the colouring of the labels will be made for better visibility.

Our plan to implement the line chart is to be able to have the trend line, emission line, and seasonal line using the data on greenhouse emissions. Initially, we thought of using a loop and splitting the data to output into a new CSV to clean the data before using it, but after consulting with our tutor, Afzal, we decided to focus more on the actual visualisation and clean up the data manually.

From

	A	B	C	D
1	Quarterly Update of Australia's National Greenhouse Gas Inventory | Figures and Tables for the September Quarter 2021			
2	Click here to return to contents page			
3				
4	Figure 1: Emissions, by quarter, September 2010 to September 2021			
5	Units:	Million tonnes of carbon dioxide equivalent	Million tonnes of carbon dioxide equivalent	Million tonnes of carbon dioxide equivalent
6	Quarter	Actual emissions	Seasonally adjusted and weather normalised	Trend
7	September 2010	151.1	148.6	148.8
8	December 2010	145.2	145.3	146.6
9	March 2011	143.0	145.1	145.5
10	June 2011	146.6	146.3	144.9
11	September 2011	147.2	145.2	144.4
12	December 2011	142.2	142.7	143.7
13	March 2012	141.3	143.2	143.0
14	June 2012	143.7	142.9	142.5
15	September 2012	142.7	141.1	141.8
16	December 2012	141.0	141.7	140.9
17	March 2013	137.8	139.6	139.6
18	June 2013	139.6	138.7	138.1
19	September 2013	138.4	136.9	137.3
20	December 2013	136.4	137.3	137.5
21	March 2014	137.0	138.7	138.0
22	June 2014	137.5	136.5	138.1
23	September 2014	140.1	138.4	137.4
24	December 2014	135.5	136.6	136.6
25	March 2015	134.0	135.6	135.8
26	June 2015	137.5	136.5	134.5
27	September 2015	133.4	131.6	133.5
28	December 2015	131.3	132.6	132.9
29	March 2016	134.4	136.3	133.1
30	June 2016	133.0	131.9	133.2
31	September 2016	135.7	133.6	132.5
32	December 2016	130.1	131.4	131.4
33	March 2017	130.1	131.9	131.2
34	June 2017	132.7	131.5	132.4
35	September 2017	138.1	136.1	134.3
36	December 2017	134.2	135.5	135.3
37	March 2018	132.9	134.9	135.1
38	June 2018	136.1	134.7	134.3
39	September 2018	135.7	133.9	133.2
40	December 2018	131.2	132.5	132.5
41	March 2019	129.6	131.4	132.0
42	June 2019	134.0	132.5	131.7
43	September 2019	132.1	130.6	131.3
44	December 2019	129.3	130.6	130.0
45	March 2020	128.4	130.2	127.6

Figure 8. Unprocessed Dataset of Greenhouse Gas Emission

to

	A	B	C	D	E
1	year	month	emissions	weather_normalise	Trend
2	2010	9	151.1	148.6	148.8
3	2010	12	145.2	145.3	146.6
4	2011	3	143.0	145.1	145.5
5	2011	6	146.6	146.3	144.9
6	2011	9	147.2	145.2	144.4
7	2011	12	142.2	142.7	143.7
8	2012	3	141.3	143.2	143.0
9	2012	6	143.7	142.9	142.5
10	2012	9	142.7	141.1	141.8
11	2012	12	141.0	141.7	140.9
12	2013	3	137.8	139.6	139.6
13	2013	6	139.6	138.7	138.1
14	2013	9	138.4	136.9	137.3
15	2013	12	136.4	137.3	137.5
16	2014	3	137.0	138.7	138.0
17	2014	6	137.5	136.5	138.1
18	2014	9	140.1	138.4	137.4
19	2014	12	135.5	136.6	136.6
20	2015	3	134.0	135.6	135.8
21	2015	6	137.5	136.5	134.5
22	2015	9	133.4	131.6	133.5
23	2015	12	131.3	132.6	132.9
24	2016	3	134.4	136.3	133.1
25	2016	6	133.0	131.9	133.2
26	2016	9	135.7	133.6	132.5
27	2016	12	130.1	131.4	131.4
28	2017	3	130.1	131.9	131.2
29	2017	6	132.7	131.5	132.4
30	2017	9	138.1	136.1	134.3
31	2017	12	134.2	135.5	135.3
32	2018	3	132.9	134.9	135.1
33	2018	6	136.1	134.7	134.3
34	2018	9	135.7	133.9	133.2
35	2018	12	131.2	132.5	132.5
36	2019	3	129.6	131.4	132.0

Figure 9. Processed Dataset of Greenhouse Gas Emission

We were planning to have 4 buttons where the first 3 buttons transform each line between “Emissions”, “Trend” and “Seasonal” while the fourth button display all 3 lines. I have tried using a select path with path id for a path to apply on mouse click but the

implementation outcome failed. Further research is needed to make it work.

The Choropleth is functional with the new geojson file (aust.json), but it is yet able to accept data inputs. Additionally, it is worth noting that the aust.json file is rather problematic to work with as it is old. However, a more up-to-date alternative has been found with the australian-states.min.geojson file. We are still trying to figure out how to work with it. More data would be useful for the geo map as our current datasets have proven to be rather incompatible with our vision of the heat map.

We have managed to get the choropleth to work using the new geojson file (states.geojson). We went back to the drawing board and studied the choropleth lab exercise carefully, so we attempted it again but this time following the guides of the lab exercise, with some tweaking it miraculously worked. We were also able to implement a slider to make everything more aesthetically appealing as well.

Validation

We have asked 3 students to test our website and give feedback. Erin Lim (102894517), an engineering student, said that our website was not too complicated or too simple, it was just right, and the visualisations look neat and minimalistic but the “about” page is too short. Malina Choun (103484897), an animation and design student, said that our website was intriguing, and the visualisations were intuitive especially the map because it has really nice colour schemes. Sokleng Bun (102395575), a computer science student, said that the visualisations seem to be a bit too stacked in one place, but the website looks good and straight to the point.

Conclusion

The project centres around this semester’s theme of energy. Therefore, we chose to analyse and visualise data that is relevant to renewable energy. This was done by two students, Joel Wyn Tan and Vuthy Yi, and they collaborated to find datasets, clean the datasets, and implement visualisations using d3 to make a website. The site consists of

3 sections, the homepage, the visualization page, and the about page. All the visualisations are stored on the visualization page. There are 3 visualisations, a bar chart that talks about the retail electricity cost per year in Australia, a line graph that talks about the greenhouse gas emission, and a choropleth that talks about the total renewable energy produced by state per year. Along with the d3 skills that were taught to us throughout the course, we have also learned how to make our website look more appealing to users and how to mix and match colours properly so that our visualisations do not look ugly and most importantly, we have learned to work as a team to help each other go through obstacles which have undoubtedly made the process of making the website a lot easier.

Reference

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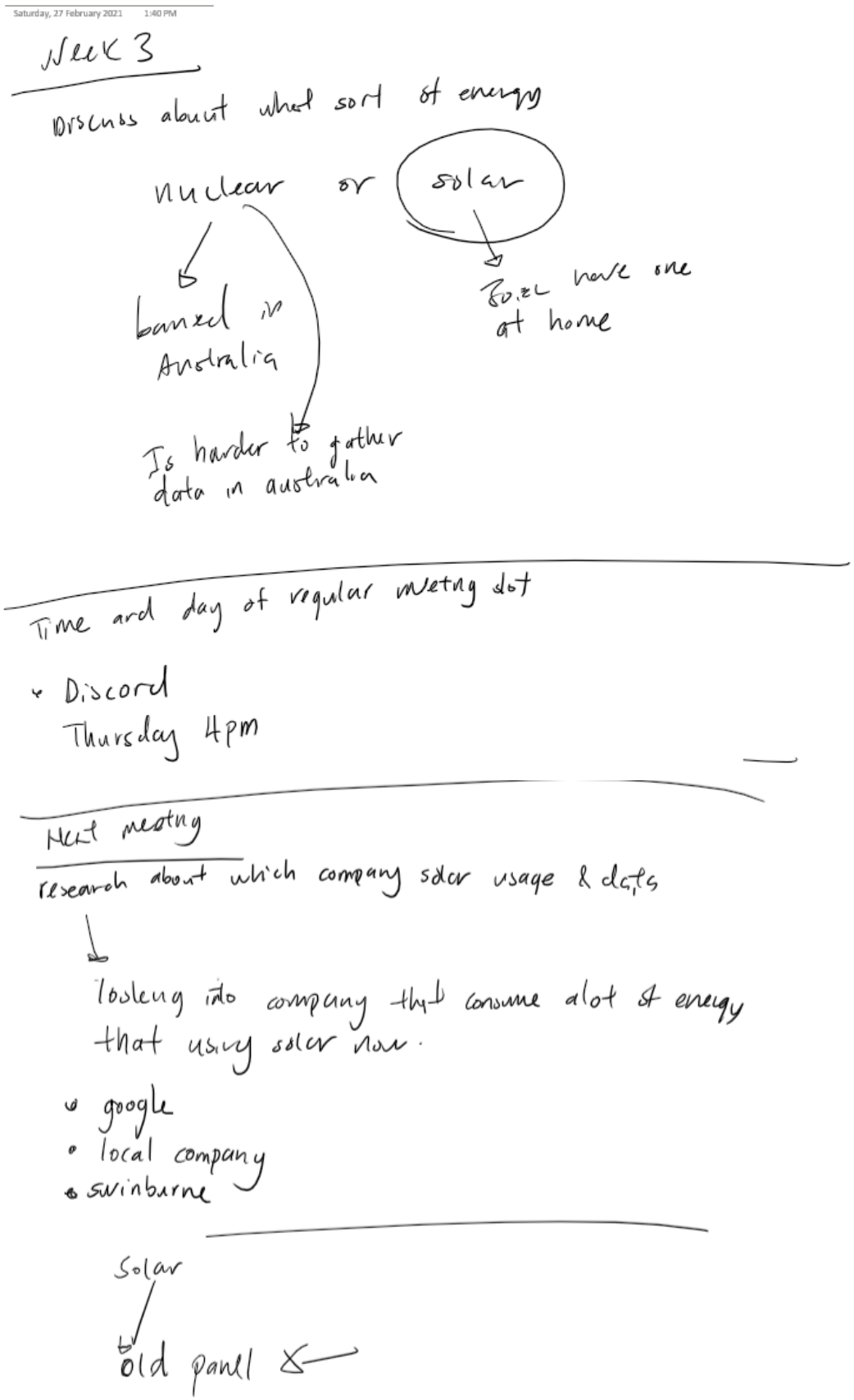
Appendices


Saturday, 27 February 2021 1:40 PM
Week 3
Discuss about what sort of energy
nuclear or solar
banned in Australia
Is harder to gather data in australia
Both have one at home
Time and day of regular meeting dot
Discord
Thursday 4pm
Next meeting
research about which company solar usage & data
looking into company that consume alot of energy that using solar now.
google
local company
swinburne
Solar
old panel

Visualisation

- Visualisation of Australia with heatmap of renewable energy use.
- Total energy produce (renewable vs non renewable)
  - pie chart
- do we have to code the map ??
- comparison to SE ASIA
- selling harvested renewable energy to other country

maps:

- divide into different states
- use heat maps to highlight the difference

Week 4

Gather data : 5 or more years

+ Irena's data : find out the efficiency of energy generation (Installed capacity Vs energy generation)