

A large industrial facility, likely a refinery or chemical plant, is visible in the background under a dark sky. In the foreground, a massive array of solar panels is installed on a metal frame. Overlaid on the image is a network of glowing blue lines forming a grid-like pattern, suggesting connectivity or data flow between the different parts of the facility and the solar panels.

# ENERGY CONSUMPTION IN AUSTRALIA

PROJECT #2 - APRIL 2021

# SUMMARY OF CONTENTS

OUR MAIN  
TOPICS FOR TODAY

Project Overview  
Our Coding Approach  
Project Structure  
Visualizations  
Final Considerations



# PROJECT OVERVIEW

## THE BEGINNING OF OUR STORY

This project looks at energy consumption trends in Australia and compares them with the Gross Domestic Product, as well as the main sectors of the Australian economy.

Energy consumption depends on demographic variables, such as population, number of households, etc. and these variables are also important to explain the Australian consumer market at a local level.

Information is available to the foreign investor via our interactive website.

# DEMOGRAPHIC

Demographic, macroeconomic, and sectoral analysis have a fundamental role in determining the dynamics of energy consumption, with direct implication in the behaviour of various market indicators.



# INDUSTRY

In the industrial sector, energy consumption tends to impact not only the national economy, but also macroeconomic trends, depending on the export segments, in the case of Australia, mining, agriculture and tourism

# ENERGY CONSUMPTION AUS

## QUESTIONS TO ANSWER

### ENERGY CONSUMPTION (PJ)

measures the amount of energy used in the Australian economy. It is equal to domestic production plus imports, minus exports.

### ENERGY PRODUCTIVITY (\$/PJ)

is a measure of the economic benefit we receive from each unit of energy we use.

### ENERGY INTENSITY (\$/GJ)

is a measure of the energy inefficiency of an economy. It is calculated as units of energy per unit of GDP.



# OUR CODING APPROACH

The raw datasets were obtained from Australian Bureau of Statistics (ABS) website as a CSV file and saved in the main GitHub repository.

Period Selected - 2000 to 2019 for Energy consumption/production, Population and GDP data.

After establishing our data sources and dependencies, the ETL and Web Design was implemented.

Data was cleaned and successfully loaded to the PostgreSQL database.

Visualization was done using D3, Plotly & Charts.JS Libraries

# Project Structure



## WEB DESIGN

JavaScript, HTML, CSS and  
Bootstrap



## DATABASE

PostgreSQL, Jupyter Notebook,  
& Python "Flask" App



## VISUALIZATION

D3, Plotly &  
Charts.JS Libraries

# EXTRACT, TRANSFORM, LOAD

The image shows a Jupyter Notebook interface in Visual Studio Code with two notebooks open, and a pgAdmin window displaying a database schema and data.

**Jupyter Notebook 1 (Left):**

- File Edit Selection View Go Run Terminal Help
- energy.ipynb - Energy-Consumption-Australia - Visual Studio Code
- Trusted Jupyter Server: local Python 3.8.8 64-bit ('PythonData': c)
- 10
- Population dataframe - Ref. table-B - Australian population, GDP and energy consumption, by state and territory.
- Energy dataframe - Ref. Table-F Energy con
- [1] # import dependences  
import json  
import pandas as pd  
from pytrends.request import TrendReq  
import pandas as pd  
from sqlalchemy import create\_engine  
from sqlalchemy import inspect  
import datetime as datetime
- [2] # Read individual sheets to dataframes:  
population\_au = pd.read\_csv("Resources/population.csv")  
population\_au\_df = pd.DataFrame(population\_a

**Jupyter Notebook 2 (Right):**

- File Edit Selection View Go Run Terminal Help
- energy.ipynb - Energy-Consumption-Australia - Visual Studio Code
- Trusted Jupyter Server: local Python 3.8.8 64-bit ('PythonData': c)
- 10
- [18] # Create database connection and add tables/data to sql database  
engine = create\_engine('postgresql+psycopg2://postgres:9102@localhost/energy\_consumption\_db?port=5432')
- [19] energy\_final.to\_sql(name='energy', con=engine, if\_exists='replace')
- [20] population\_data.to\_sql(name='population', con=engine, if\_exists='replace')
- [21]

**pgAdmin:**

- pgAdmin File Object Tools Help
- Browser
- Properties SQL Statistics Dependencies Dependents energy\_consumption\_db
- Query Editor Query History
- 1 Select \* from energy;
- Data Output Explain Messages Notifications
- location industry fuels\_consumed date value
- text text text text double precision
- 1 aus Construction LPG 2000-01 0.2
- 2 aus Construction Naturalgas 2000-01 2.1
- 3 aus Construction Fueloil 2000-01 0.1
- 4 aus Construction Diesel 2000-01 25.3

# PYTHON "FLASK" APP

The screenshot shows the Visual Studio Code interface with the following details:

- File Explorer (Left):** Shows a project structure under "WEB-STUFF". The "js" folder is selected. Other visible folders include "static", "img", "templates", and "main.py".
- Terminal (Bottom):** Displays the command "main.py - Energy-Consumption-Australia - Visual Studio Code".
- Code Editor (Center):** The "main.py" file is open, showing Python code for a Flask application. The code includes database connection logic using psycopg2, data conversion to pandas DataFrames, and route definitions for "/home", "/about", and "/selector". It also includes a "mara()" function that returns a template named "plot\_mara.html".
- Code Editor (Right):** The "mara.js" file is open, showing JavaScript code that handles JSON data. It includes functions for "popGb()", which converts a DataFrame to JSON, and "popGb\_json()", which formats the JSON output.

```
130
131     #Create a variable called "selection"
132     selection = "SELECT * FROM energy"
133
134     #Psycopg2 will go and connect to the database
135     cursor.execute(selection)
136
137     #".fetchall()" will retrieve all the data
138     energy = cursor.fetchall()
139
140     #Convert the data obtained from above into a pandas DataFrame
141     # when the app route is built later
142     energy_df = pd.DataFrame(energy)
143
144     #Error handling
145     except (Exception, psycopg2.Error) as error :
146         print ("Error", error)
147
148     finally:
149         if connection:
150             cursor.close()
151             connection.close()
152             print("Connection closed")
153
154
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```

# WEB

The image shows a dual-screen setup. On the left, a screenshot of Visual Studio Code displays the file structure and content of `main.py`. The code implements a web application endpoint to return population data in JSON format. On the right, a screenshot of a web browser shows the homepage of the "Energy Consumption in Australia" application. The page has a dark red background with large white text: "ENERGY" at the top, followed by "ENERGY CONSUMPTION IN AUSTRALIA". Below this, a paragraph discusses the historical shift in energy consumption. A "Read More" button is visible at the bottom.

File Edit Selection View Go Run Terminal Help main.py - Energy-Consumption-Australia - Visual Studio Code

EXPLORER mara.js main.py M X

ENERGY-CONS... .ipynb\_checkpoints .vscode aroosa Data draft PS Resources web-stuff static css img js templates main.py M .gitignore app.py energy.ipynb Project 3 Proposal.pdf query.sql README.md

```
193     #     popGb_json = json.dumps(parsed, skipkeys = True, allow_nan = True, indent = 6)
194     #     return popGb_json
195
196     # # @app.route("/plot_template")
197     # # def plot_template():
198     # #     return render_template("plot_template")
199
200     @app.route("/api/popGb")
201     def popGb():
202         #Extract the population dataframe and use the pandas ".to_json()" function to convert the
203         # dataframe into a json object
204         result = popGb_df.to_json(orient="records") ##orient="records" means that it will be di
205
206         #Parse the above to look like json format
207         parsed = json.loads(result)
208
209         #Apply formatting to return a better looking json
210         popGb_json = json.dumps(parsed, skipkeys =
211
212         #Display the JSON on the page
213         return popGb_json
214
```

ENERGY

Home About Explore Data

# ENERGY CONSUMPTION IN AUSTRALIA

Over the past 20 years, the life of Australians has changed a great amount and energy has formed a key part of that. As the world advances, so does the need for energy.

Read More

# ENERGY

[Home](#)[Explore Data](#)[About](#)

## ABOUT THE PROJECT

[Home](#) / [About the Project](#)

### WHAT IS THIS PROJECT ABOUT?

*This project analyses the energy consumption of Australian states from the 2000 to 2018 financial year and compares them to the GDP trends over this time period.*

Combining the strengths of the project members, this interactive dashboard thoroughly analyses the trends between energy consumption and GDP of Australia. Various graphs and plots will examine how energy usage has changed within the states of Australia and compare this with GDP data to evaluate any correlations

# ENERGY

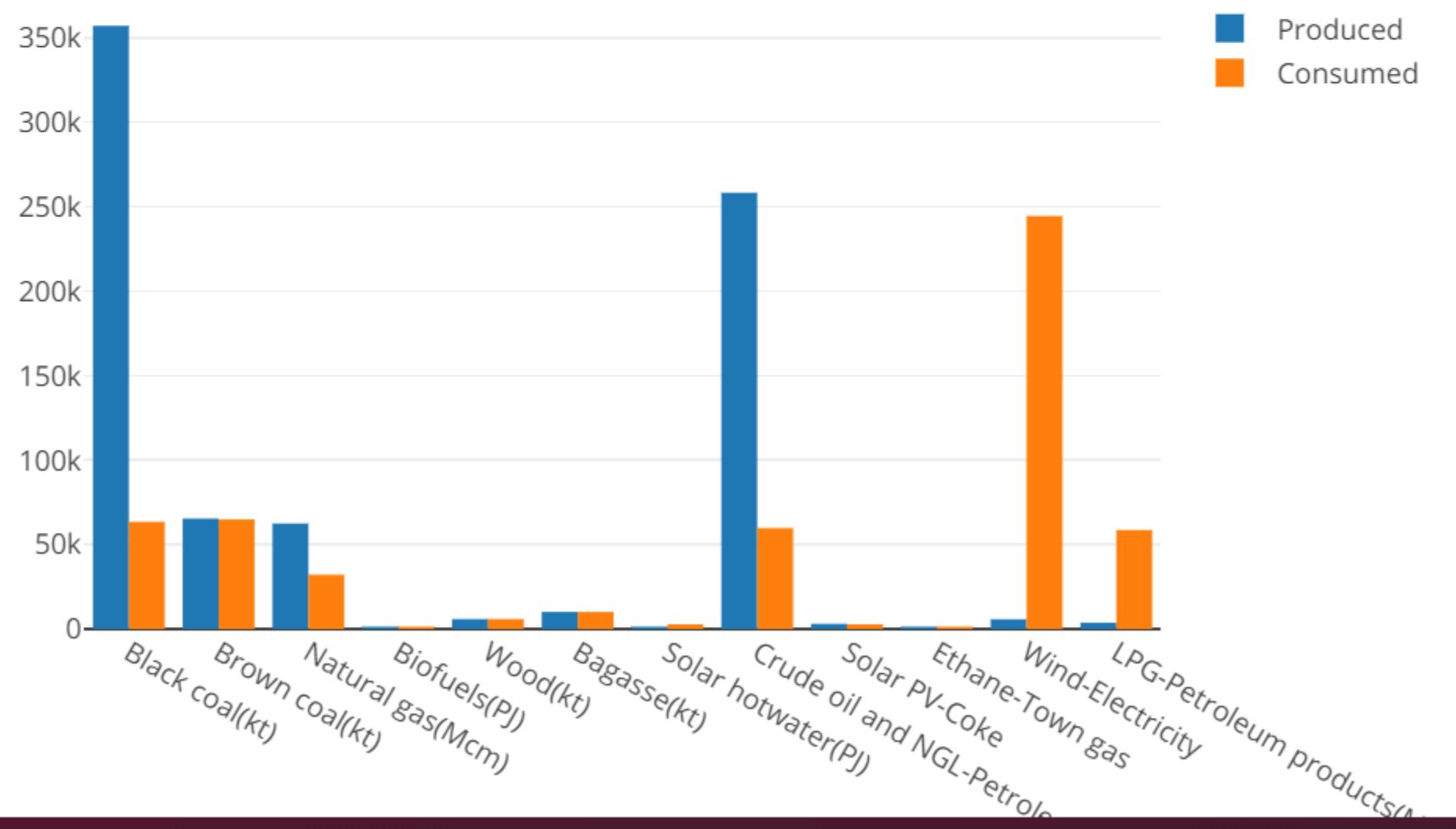
[Home](#)[Explore Data](#)[About](#)

## AUSTRALIAN ENERGY BALANCE – CONSUMPTION VS PRODUCTION

- Production: Australia is a substantial net exporter of energy, including coal and natural gas, Western Australia remained Australia's largest producer of natural gas.
- Black coal production grew by 2 per cent in 2018–19 and remained Australia's largest contributor to energy production.
- Australia has seen a long-term decline in production of crude oil and natural gas liquids in the last decade as mature fields decline, but the opening of new natural gas liquids production in the north west took Australian production back to the level seen three years ago.
- Consumption: Wind and solar were the other major sources of growth contributing to renewable energy consumption.
- In 2018–19, petroleum products, natural gas and electricity accounted for more than half of Australia's final energy consumption.

## ENERGY BALANCE

Energy Produced vs Consumed(Avg) in Australia (2001-2019)



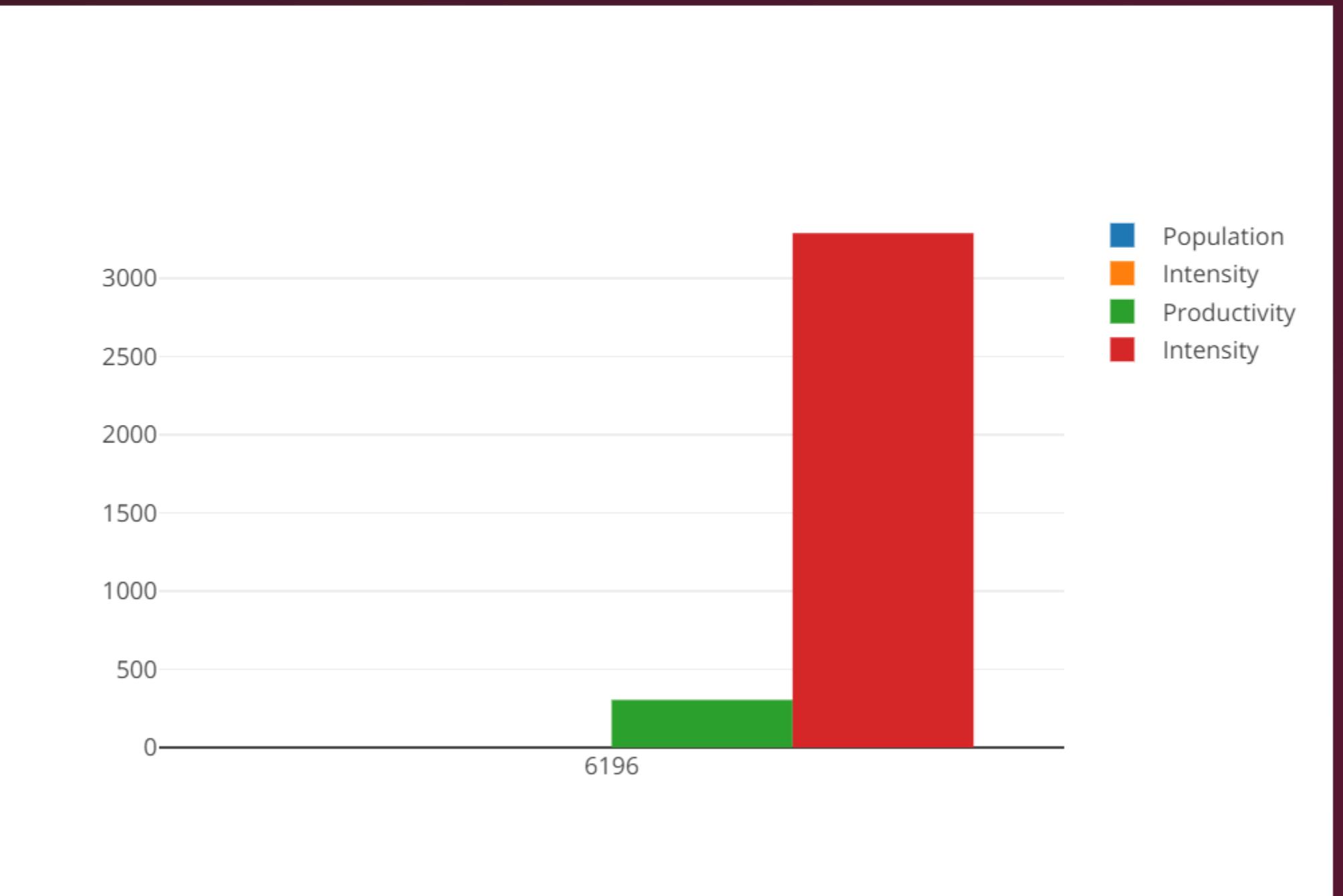
# ENERGY

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## ECONOMIC STATISTICS VS TOTAL ENERGY CONSUMPTION

GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.

This graph shows there is a continuous growth in population as well as GDP which indicates a good economy. Although the growth rate has been fluctuating but overall economy shows growth.

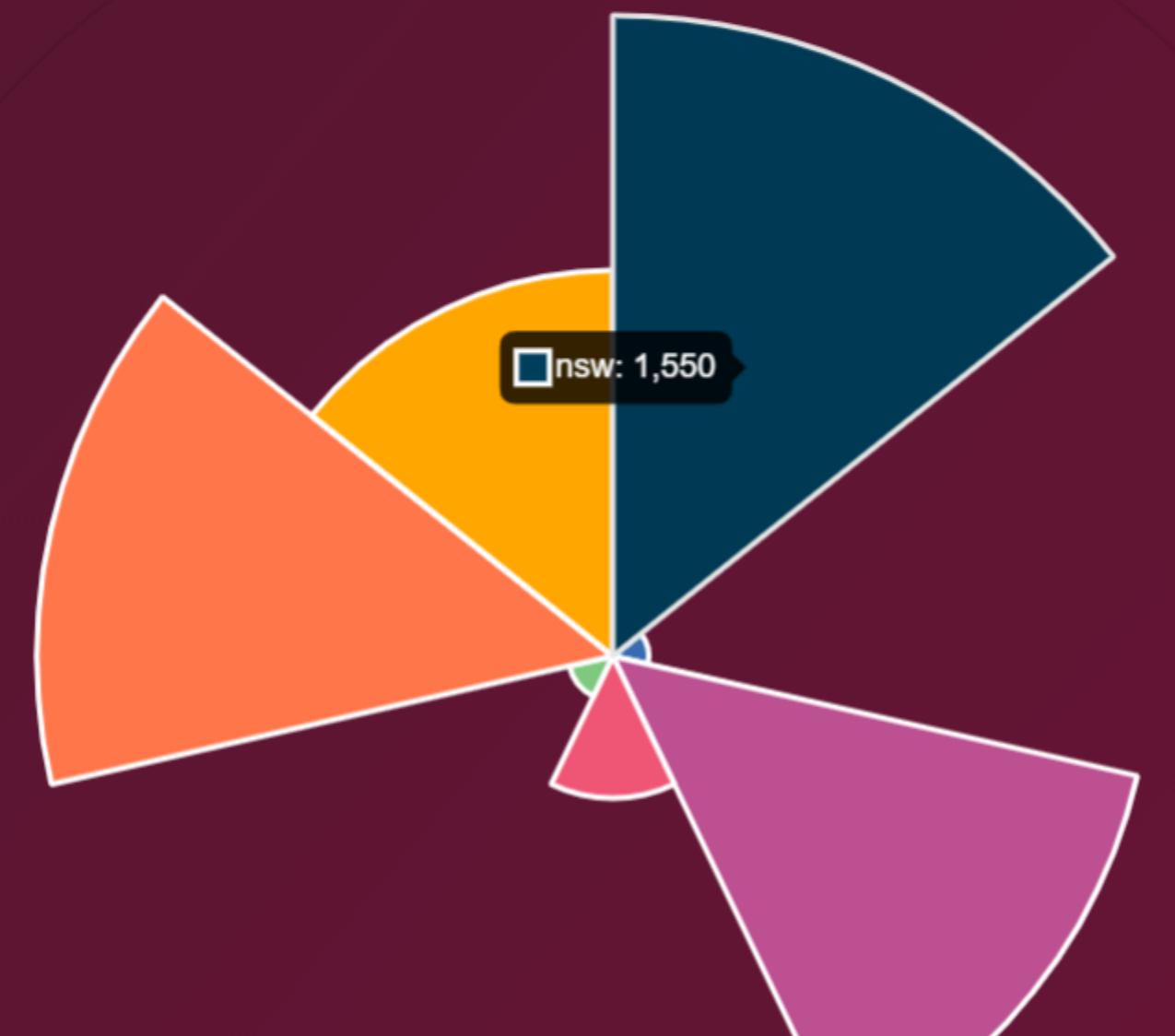


# ENERGY

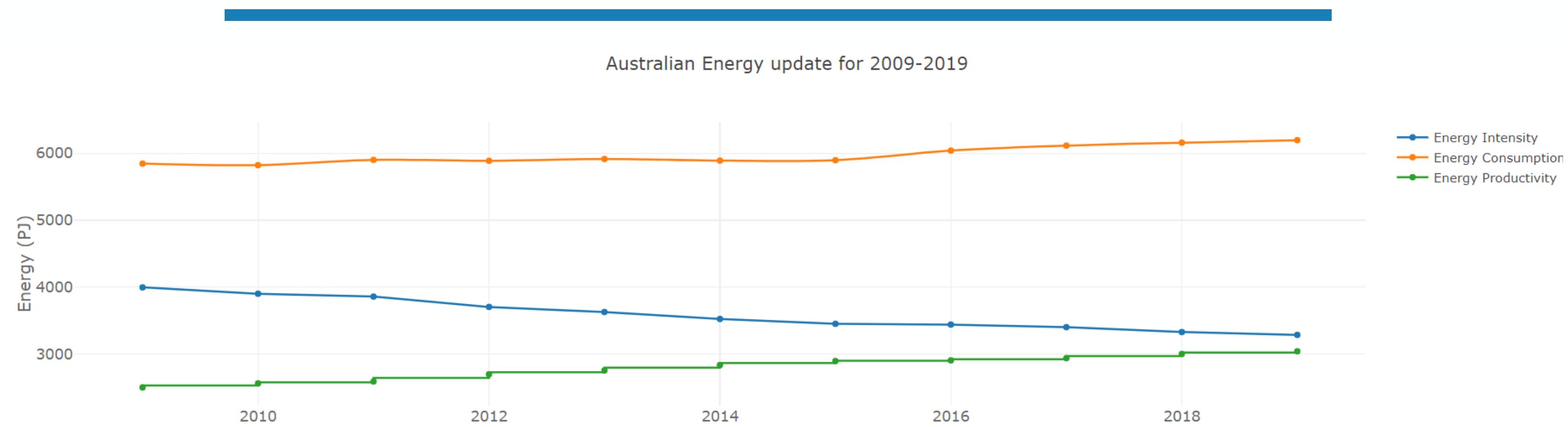
[Home](#)[Explore Data](#)[About](#)

## AVERAGE ENERGY CONSUMPTION BY STATE

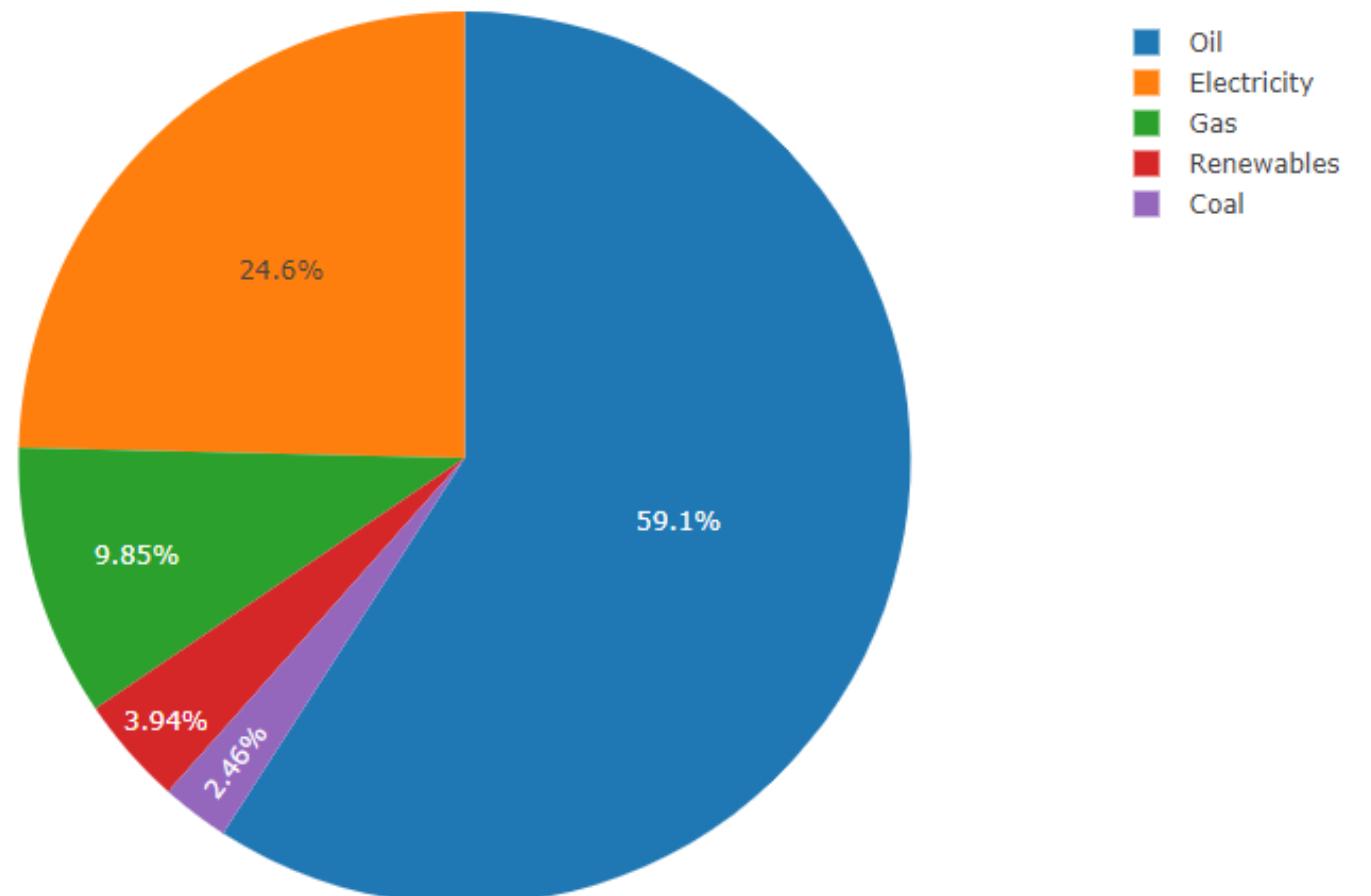
Australian Population as well as the Gross State Product (GSP) for each state have grown over the years, so has energy consumption



Australian economy has tended  
towards a lower energy intensity and  
higher **energy productivity** over the  
period of 2010 - 2019



**Black coal** production grew by 2% in 2018–19 and remained Australia's largest contributor to energy production. Western Australia remained Australia's largest producer of natural gas



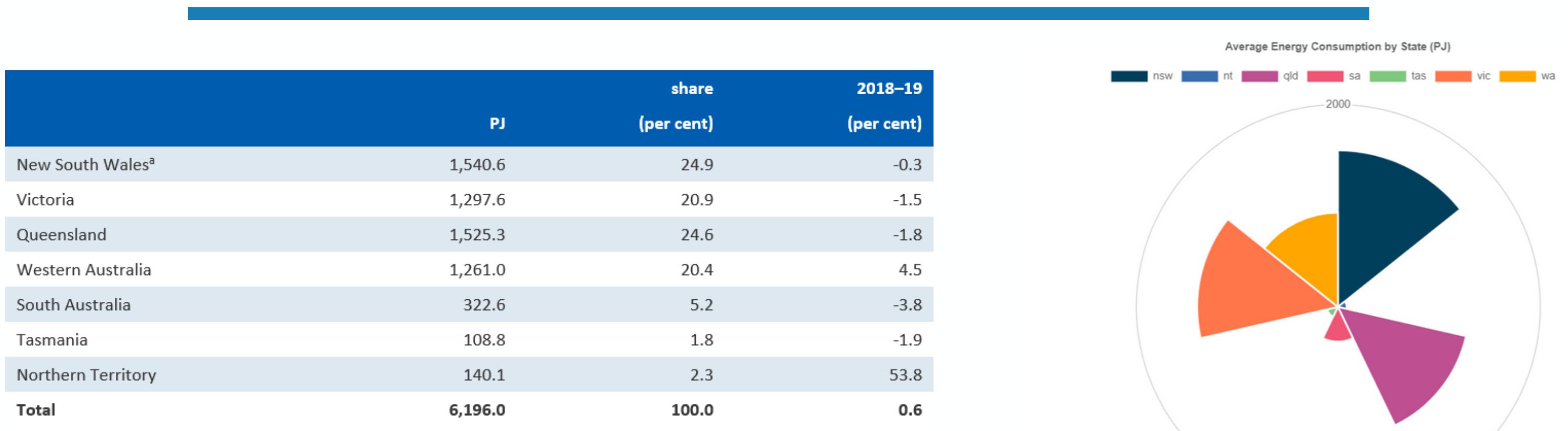
**Wind and solar** were the other major sources of growth contributing to renewable energy consumption.

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# 53%

Statewide, the greatest growth in energy consumption in the 2018-2019, was in **Western Australia** and **Northern Territory**



# FINAL CONSIDERATIONS



Australian Population as well as the Gross State Product (GSP) for each state have grown over the years, so has energy consumption.



The transport industry uses the most energy, closely followed by manufacturing and mining, while construction and agriculture consume the least energy.



NSW and QLD with the highest population also consume the most energy, while the NT and TAS consumes the least.

# QUESTIONS? COMMENTS?

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“

## THANK YOU

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Not everything that can be  
counted counts, and not  
everything that counts can be  
counted.

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ALBERT EINSTEIN

# SOURCES & REFERENCES

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