

A large industrial facility, likely a refinery or chemical plant, is shown at night. The facility is illuminated by its own lights and the sky is a deep blue. In the foreground, there is a massive array of solar panels, also illuminated from within. Overlaid on the image is a network of glowing white lines forming a complex web, with several bright light points scattered across the scene, symbolizing connectivity and energy flow.

# ENERGY CONSUMPTION IN AUSTRALIA

PROJECT #2 - APRIL 2021

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Aroosa - Presit - Mara - Praveena - Adeniyi

# SUMMARY OF CONTENTS

OUR MAIN  
TOPICS FOR TODAY

Project Overview  
Our Coding Approach  
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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

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

### ENERGY PRODUCTIVITY

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

### ENERGY INTENSITY

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 showing the resulting database structure and data.

**Jupyter Notebook 1 (Left):**

- Cells [1] and [2] show Python code for reading CSV files and creating dataframes:

```
# 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

# Read individual sheets to dataframes:
population_au = pd.read_csv("Resources/population.csv")
population_au_df = pd.DataFrame(population_au)
```

**Jupyter Notebook 2 (Right):**

- Cells [18], [19], [20], and [21] show Python code for creating a database connection and adding tables to a PostgreSQL database:

```
# Create database connection and add tables/data to sql database
engine = create_engine('postgresql+psycopg2://postgres:9102@localhost/energy_consumption_db?port=5432')

energy_final.to_sql(name='energy', con=engine)
population_data.to_sql(name='population', con=engine)
```

**pgAdmin (Bottom Right):**

- The pgAdmin interface shows the database structure:

  - Catalogs: cars\_api, energy\_consumption\_db (selected), Foreign Data Wrappers, Languages, Schemas (1) (selected).
  - Schemas (public): Collations, Domains, FTS Configurations, FTS Dictionaries, FTS Parsers, FTS Templates, Foreign Tables.

- The Query Editor contains the query: `Select * from energy;`
- The Data Output tab shows the following data:

	location	industry	fuels_consumed	date	value
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 a 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 (Top Right):** Displays the command "main.py - Energy-Consumption-Australia - Visual Studio Code".
- Code Editor (Main Area):** The file "main.py" is open, showing Python code for a Flask application. The code includes database connection logic using psycopg2, data conversion to pandas DataFrames, and various Flask routes like "/", "/about", and "/selector".

```
130
131     #Create a variable called "selection"
132     selection = "SELECT * FROM energy"
133
134     #Psycopg2 will go and connect to t
135     cursor.execute(selection)
136
137     #".fetchall()" will retrieve all t
138     energy = cursor.fetchall()
139
140     #Convert the data obtained from ab
141     # when the app route is built late
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")
```

```
#BUILDING APP ROUTES WITH FLASK
#Scroll to the last two routes to see how the pandas dataframes get converted into JSON objects

app = Flask(__name__)

@app.route("/")
def home():
    return render_template("index.html")

@app.route ("/about")
def about():
    return render_template("about.html")

@app.route("/selector")
def selector():
    return render_template("selector.html")

@app.route("/plot_mara")
def mara():
    return render_template("plot_mara.html")
```

```
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 t
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 = True, allow_nan = True, indent = 6)
211
212         #Display the JSON on the page
213         return popGb_json
214
```

# 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

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```

ENERGY

ENERGY CONSUMPTION IN AUSTRALIA

Home About Explore Data ▾

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

# DEMO

LET OUR DATA TELL THE STORY

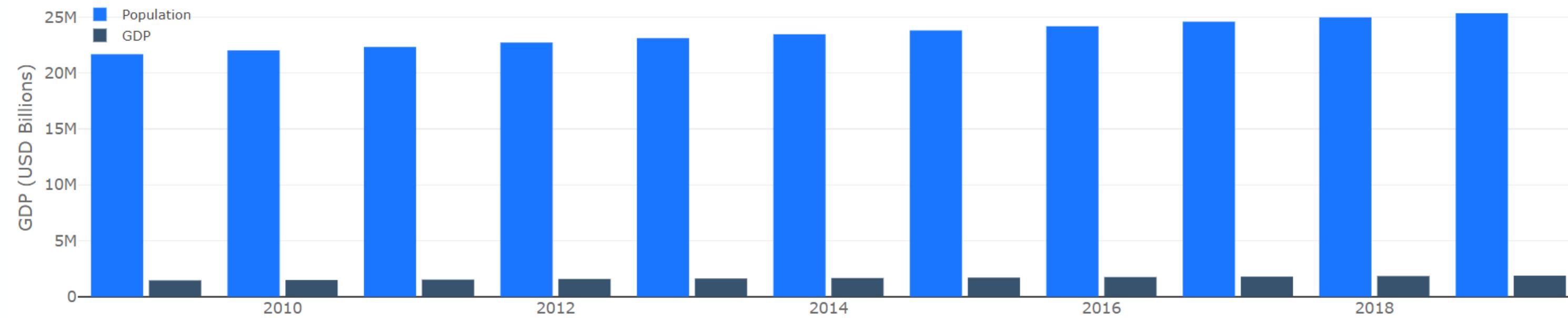
@GITHUB - presitkaur/Energy-Consumption-Australia

# 6.3%

Continued **population growth** for the  
period of 2010 - 2019

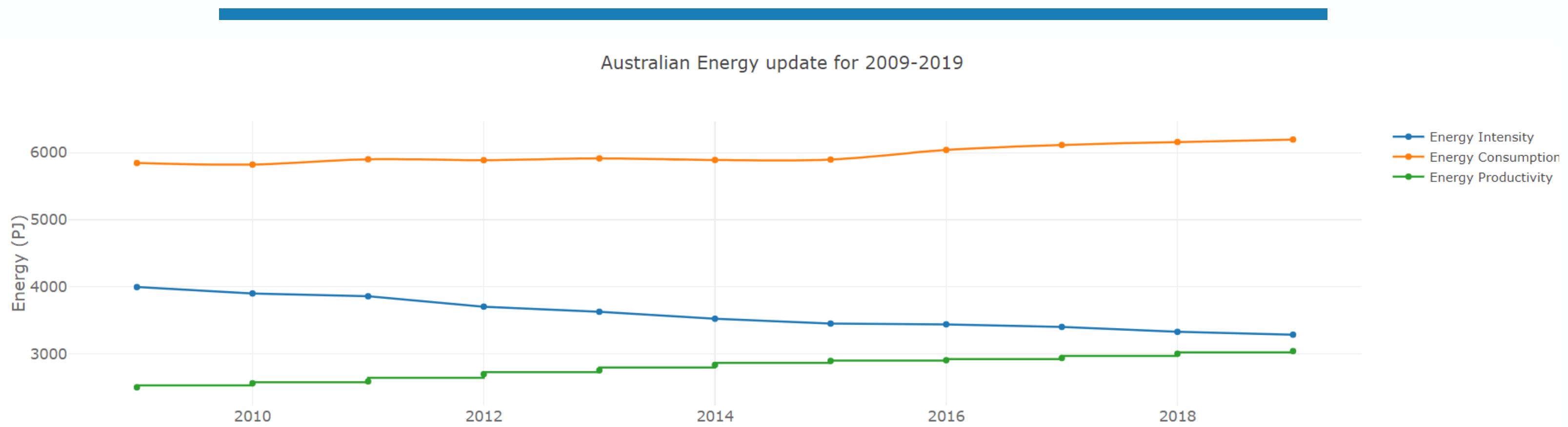
**4% decline** in GDP per capita for the  
period of 2018-2019

Australia Population vs GDP

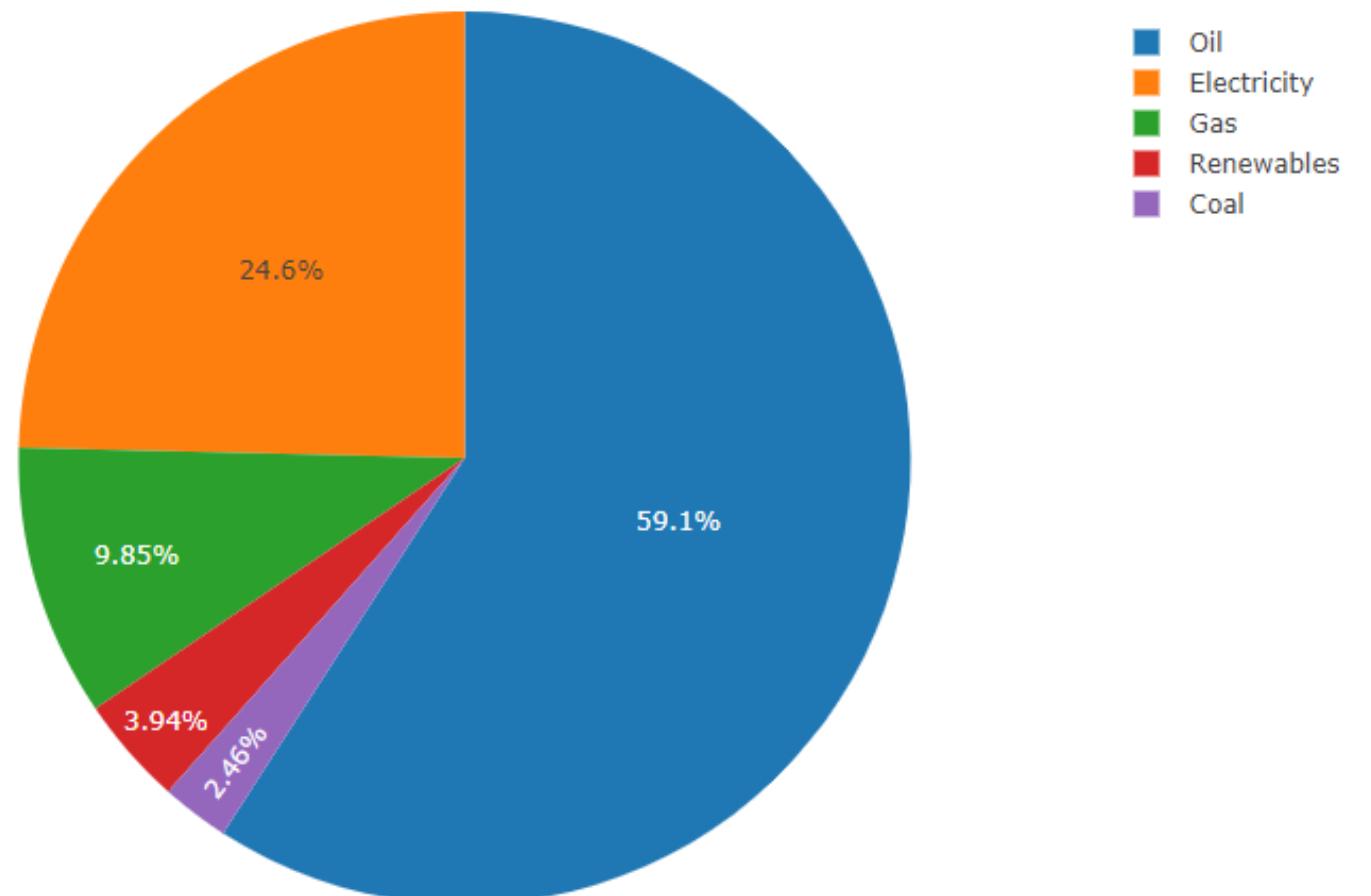


# 19%

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

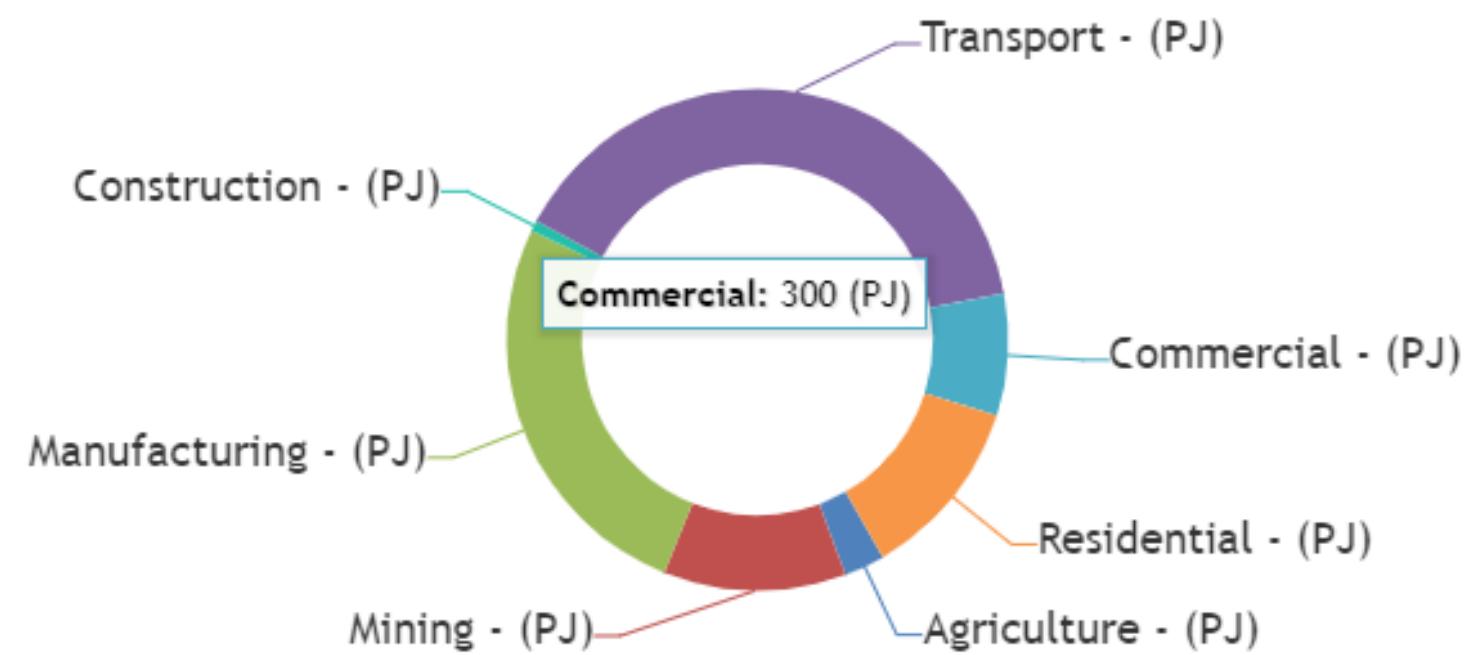


**Black coal** production grew by 2% in 2018–19 and remained Australia's largest contributor to energy production. Western Australia remained Australia's largest producer of natural gas



**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 2000-2018, was in **Western Australia** and **Northern Territory**

	PJ	share (per cent)	2018–19 (per cent)
New South Wales <sup>a</sup>	1,540.6	24.9	-0.3
Victoria	1,297.6	20.9	-1.5
Queensland	1,525.3	24.6	-1.8
Western Australia	1,261.0	20.4	4.5
South Australia	322.6	5.2	-3.8
Tasmania	108.8	1.8	-1.9
Northern Territory	140.1	2.3	53.8
<b>Total</b>	<b>6,196.0</b>	<b>100.0</b>	<b>0.6</b>

# 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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