



# ENERGY GENERATION IN SPAIN

P Y T H O N   F O R   D A T A   A N A L Y S I S   I



# CONTENT TODAY

- **Answers to Predefined Questions**

Market Supply Study Conclusions

Recommended Investment

Team & Contact

## 5.1 COMPARISON BETWEEN GAS AND WIND WHEN WIND IS ABOVE AVERAGE

- Find means of gas and wind.
- New boolean columns to compare & filter high wind average.
- Mean of boolean when wind is above average and gas is also above its price.

**24%**  
Higher



## 5.2 PRICE COMPARISON OF PRICE VS ITS MEAN WHEN SOLAR GENERATION IS ABOVE ITS AVERAGE

- Find means of spot price and solar production.
- New boolean columns identifying high solar production and higher spot prices.
- Mean of boolean when solar is above average and spot price is above its average compared to the mean of spot price mean.

HIGHER



## 5.3 MONTHLY COMPARISON OF SPOT PRICE WHEN DEMAND IS ABOVE ITS MONTHLY AVERAGE

- Find means power demand & price of each month.
- New column to compare variables vs their monthly average.
- Filter for months where demand is above its average and compare spot price.

month_date	0_powerGen	averageQ5_power	0_spotPrice	averageQ5_spotPrice	result
January-2019	31420.319758	1.117663	61.959852	1.260144	HIGHER
February-2019	30040.113095	1.068567	54.020491	1.098672	HIGHER
July-2019	30624.640188	1.089360	51.464301	1.046684	HIGHER
August-2019	28710.512231	1.021272	44.951815	0.914233	LOWER
November-2019	28887.152639	1.027555	42.187181	0.858006	LOWER

## 6.1 CONTRIBUTION BY TYPE OF ENERGY

- Sum the total amount of each type and divide it by the total produced.

Nuclear energy is 27.23%.

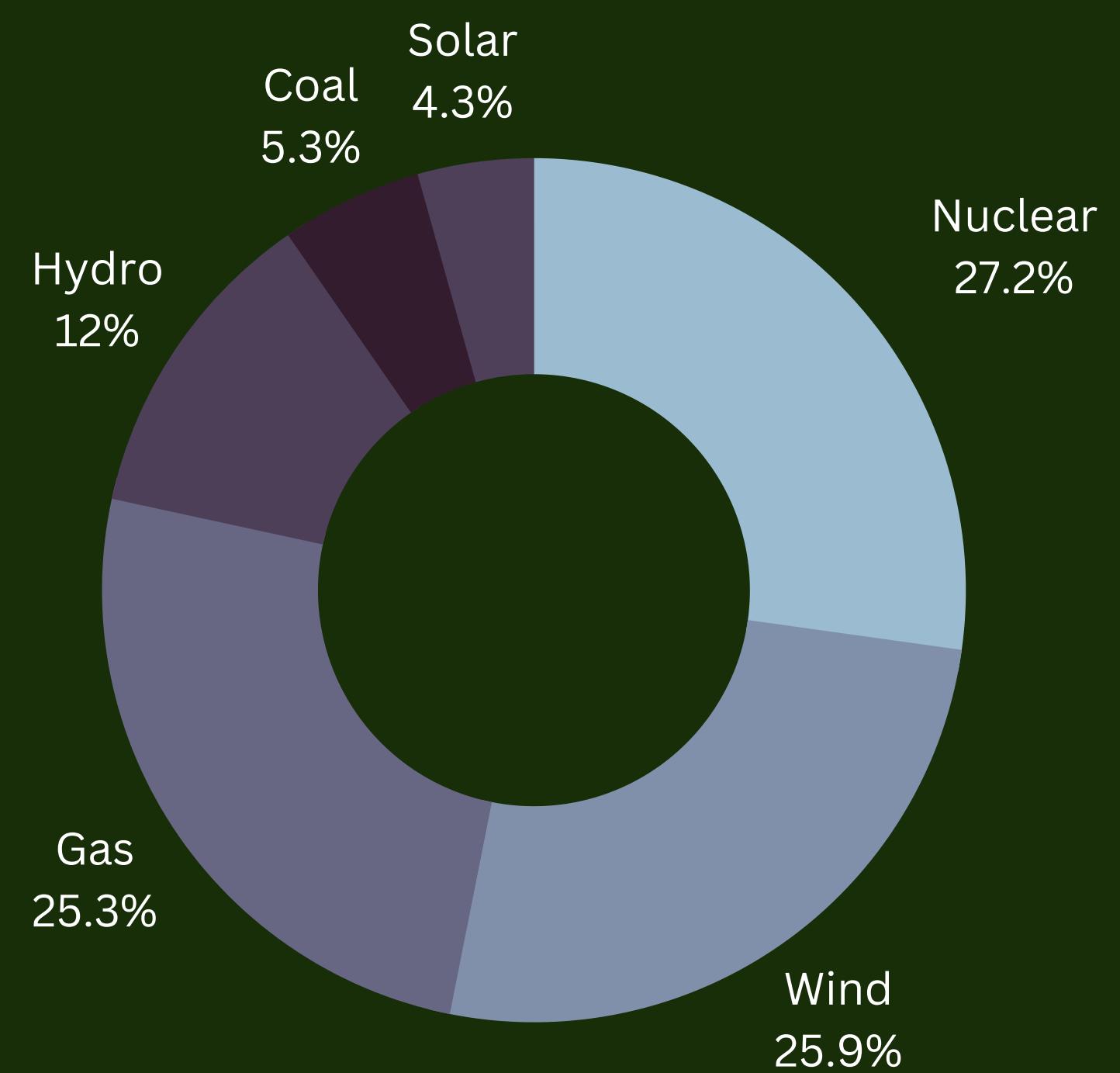
Solar energy is 4.34%.

Gas energy is 25.27%.

Hydro energy is 11.96%.

Wind energy is 25.91%.

Coal energy is 5.3%.



## 6.1 CONTRIBUTION BY TYPE OF ENERGY IN MOST EXPENSIVE MONTH

- Identify the most expensive month.
- Proportion is type/total.

Nuclear energy is 33.81%.

Solar energy is 0.04%.

Gas energy is 16.48%.

Hydro energy is 17.87%.

Wind energy is 21.37%.

Coal energy is 10.42%.

## 6.1 CONTRIBUTION BY TYPE OF ENERGY IN LEAST EXPENSIVE MONTH

- Identify the least expensive month.
- Proportion is type/total.

Nuclear energy is 23.79%.

Solar energy is 2.74%.

Gas energy is 14.98%.

Hydro energy is 25.37%.

Wind energy is 30.88%.

Coal energy is 2.24%.



## 7. EFFECT OF EACH TYPE OF GENERATION ON SPOT PRICE:

- Market based on demand and supply principles
- As market prices rise, every type of energy generator will produce given higher margins.
- Coal (0.6) and gas (0.35) have the highest correlations with spot price.
- Wind has a negative correlation





## 8. WEEKDAY VS WEEKEND

49.17

VS

44.04

- New boolean column to differentiate the day.
- Grouby and find the mean with pandas.



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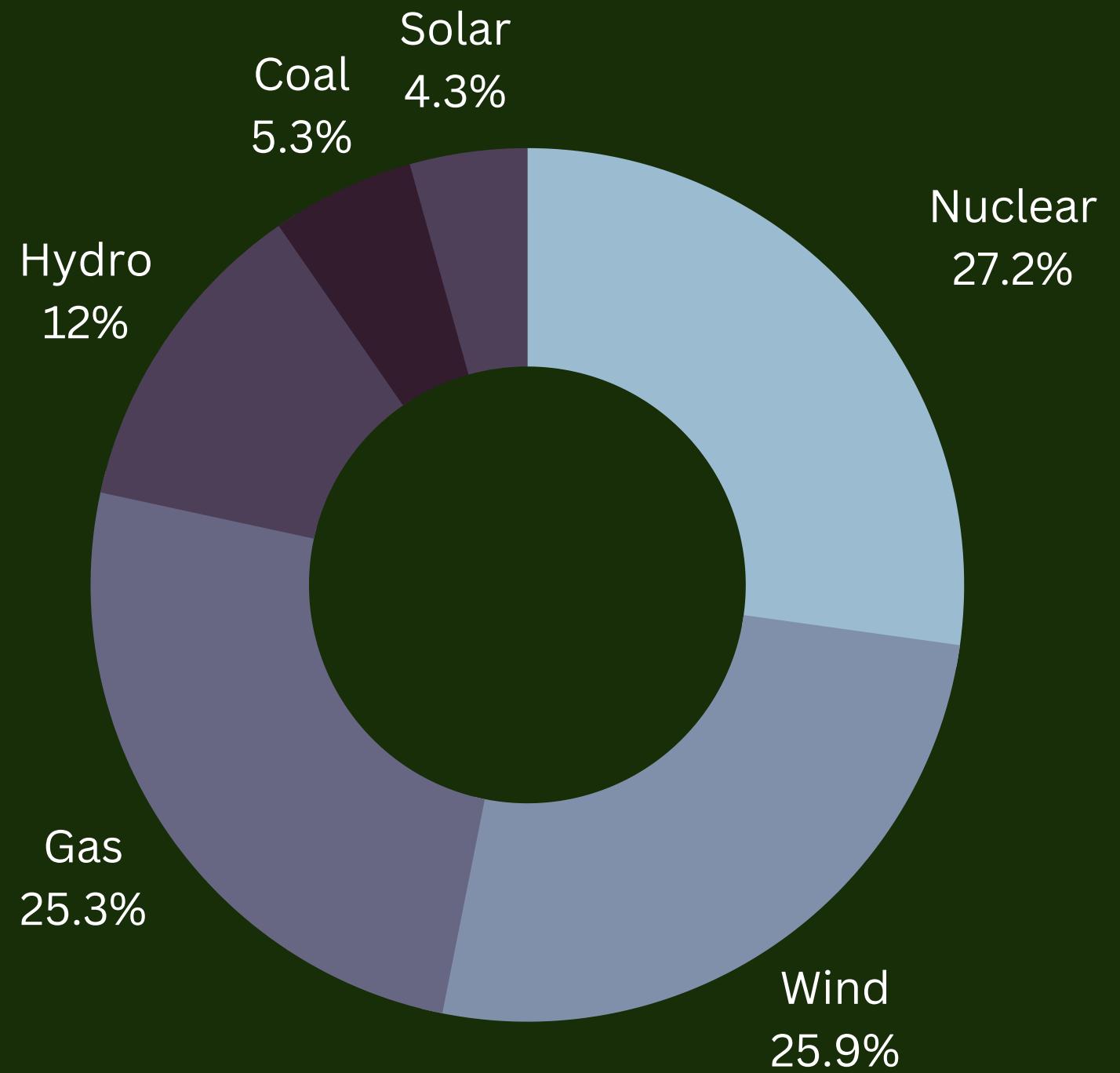
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# TOTAL SALES OF THE ENERGY INDUSTRY IN SPAIN

- Sales by type of energy

Nuclear	\$3,729,101,259.84
Wind	\$3,548,156,008.67
Gas	\$3,461,763,541.28
Hydro.	\$1,638,046,910.02
Coal	\$725,920,455.74
Solar	\$593,765,843.26
<b>TOTAL</b>	<b>\$9,866,725,250.21</b>



# MARKET SUPPLY STUDY CONCLUSIONS

**1.000**

Range of Nuclear Production, each generator or plant produces multiples of 500 or 100 units of power.

**\$40**

Coal Production increases drastically when price is above 40.

**Below \$10**

Hydro and wind generation is the preferred type when prices are low.

**5.100**

Average deficit of energy produced in the country– there is clear demand for new infrastructure.



“\$2,249,102,046”

*Yearly Market Opportunity based on  
deficit of energy produced in 2019.*



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# MARKET OPPORTUNITY WITH UNSATISFIED 2.2 BILLION MARKET

- High Industry Growth- Renewable Energy Market is valued at **888 Billion with a CAGR of 8.4%**
- Investment **subsidies** and **Tax Benefits** provided by local governments targeting **clean energy generation**.
- High energy prices should continue given Russia - Ukraine conflict.



## **WIND IS THE FUTURE, RENEWABLE MARKET WILL DOUBLE IN NEXT 8 YEARS FOR A TOTAL OF 2 BILLION**

- Free, renewable source of energy
- Clean and nonpolluting
- May be used on cropland
- Low operating expenses
- Creates and provides new jobs for the economy.
- Advancements in technology make it more efficient and profitable



## POSSIBLE RISKS

- Wind is intermittent.
- Good sites for wind farm may be distanced far from electrical power grid.
- Could disrupt wildlife habitats
- High initial cost; difficult to build and transport.



# DISADVANTAGES OF INCREASED INVESTMENT IN HYDROELECTRIC ENERGY PRODUCTION

When compared with production of wind energy:

- Extremely limited amount of areas for implementation
- High initial costs and high maintenance costs
- Potentially disastrous effects on the environment
- Lower return on investment, generally
- Can take years to build and become fully operational
- Can cause displacement of large groups of people





# EXPECTED RETURN

POWER GENERATION



INTERNAL RATE OF RETURN



NPV of USD 800.232 per million invested  
discounted at a 10% rate

Wind generation is unpredictable, with 75%  
power generation IRR will be above 65%

\*\*Pre-Tax Return.





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# MEET OUR TEAM

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+20 Years Experience in Energy  
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# SOURCES

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- Allied Market Research: [https://www.alliedmarketresearch.com/renewable-energy market#:~:text=The%20global%20renewable%20energy%20market,sources%20that%20are%20constantly%20replenished](https://www.alliedmarketresearch.com/renewable-energy-market#:~:text=The%20global%20renewable%20energy%20market,sources%20that%20are%20constantly%20replenished).
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