

Spain Electricity Shortfall

Pinnacle Data Solutions

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Our Company

About us

Pinnacle Data Solutions is a new leading technology company founded in 2022.



We are a proudly **African company**.



We have experience across multiple industries.



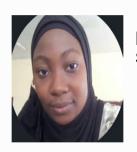
Meet the Team



Thepe Mashala Technical Project Manager



Sibusiso Mashabela Senior Data Scientist/Engineer



Maryam Ojulari Senior Business Architect



Ereshia Gabier Lead Data Scientist/Engineer



Sibusiso Sibiya AWS Cloud Specialist



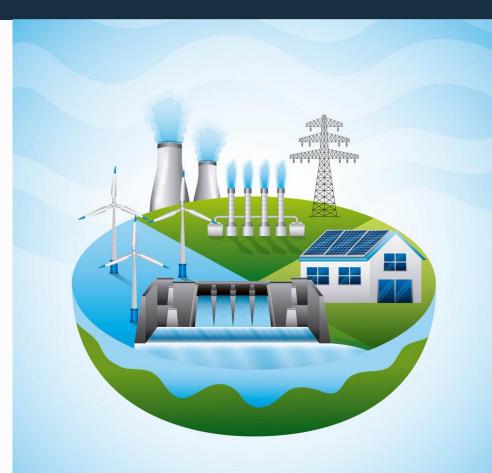
Overview

Introduction Overview

Fossil fuels power economies by currently supplying >80% of world's energy.

Address the impacts of climate change on health and to reduce pollutants.

Renewable energy is the key to address sustainable living.

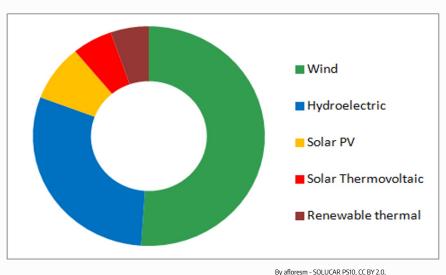


Advancement of any developmental economy.

Spain's **2030 emission reduction** target is 23%.



The **aim** is to provide a solution that would guide in decision-making on infrastructure development for renewable energy sources.



https://commons.wikimedia.org/w/index.php?curid=2821733

Dataset



Data source: Spain Electricity Shortfall Challenge 2022 on Kaggle



Exploratory Data Analysis

Exploratory Data Analysis

Training Dataset

- 8763 rows (observations)
- 49 columns (features).



Categorical Features - 3 features (Object)

Numerical Features - 46 features (int64 and float64)



Features with missing
Values 1 feature

Test Dataset

- 2920 rows (observations)
- 48 columns (features)

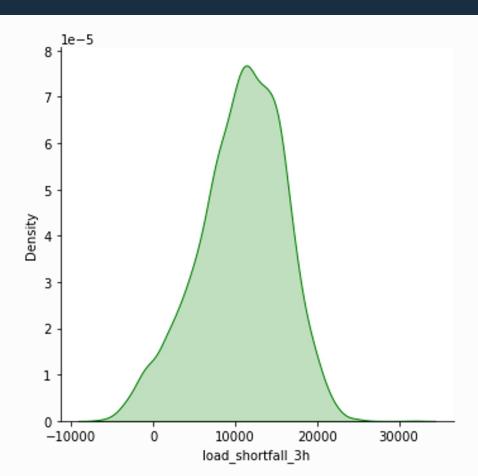


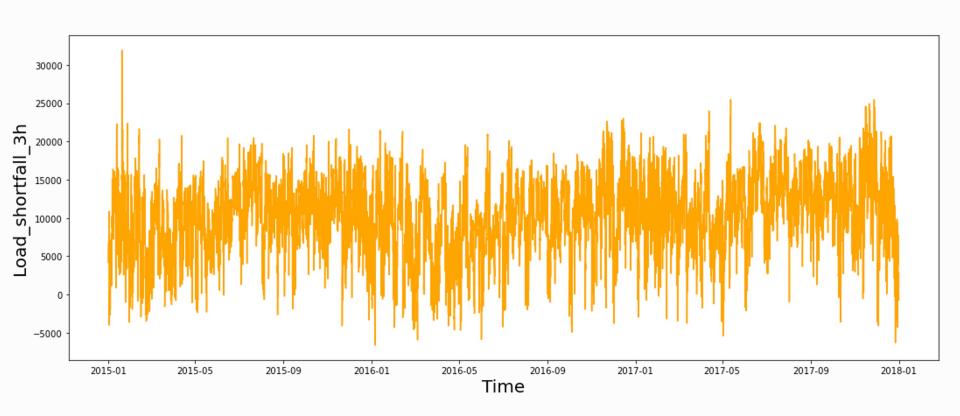
Categorical Features -

3 features (Object)

Numerical Features -

45 features (int64 and float64)





Features relationship Heatmap

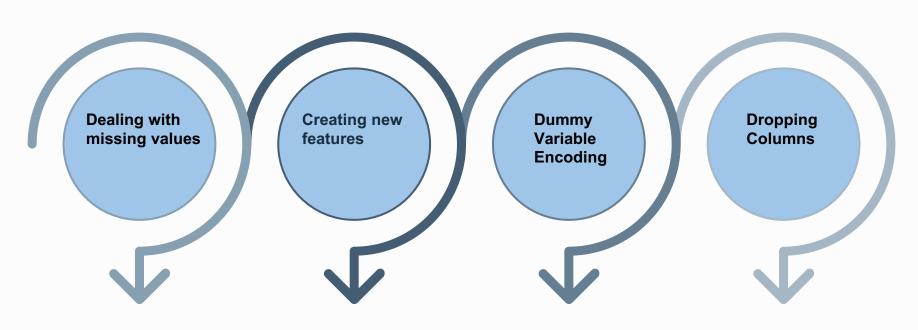
Exploratory Data Analysis

																											H	-																	
Madrid_pressure	0.39 -0.14	4 -0.	3 -0.16	4.1		-0.14							-0.14			-0.14			-0.01			0.09	0.03	1 0.4	0.06	5 0.8	0.28	1	0.11	0.088	0.26	0.15	0.014	0.06 0	072 (.092 (0.011 0	0.0097	0.092	0.068	0.18	0.038	0.055	0.014	1093
Valencia_temp_max	0.087 0.13	-0.1	4 0.066	-0.65	-0.71	0.0026									-0.12		3-0.02	9-0.06						7 -0.1	19 0.1		0.77	0.11	1	0.99	0.11	0.9	-0.4	0.95	1.92	0.92	0.91	0.84	0.85	0.85	0.84	0.89	0.91	0.86	0.14
Valencia_temp	0.14 0.13	-0.1	3 0.072	-0.66	-0.71	0.0003									-0.11		2 -0.02	30.0-8						1 -0.1	7 0.1		0.75	0.088	0.99	1	0.11	0.89	0.41	0.99	0.9	0.92	0.91	0.85	0.85	0.87	0.83	0.89	0.92	0.87	0.17
Bilbao_weather_id	0.19 -0.20		6 -0.2	-0.11	-0.14	-0.54									-0.074	-0.11		9 -0.05		6-0.00		34 0.1								0.11	1														0.15
Seville_temp	0.043 0.09	1 -0.1	7 -0.008	-0.74	-0.74	-0.095						-0.24			-0.11		5 -0.04		1 -0.09	91 -0.0				4 -0.1	11 0.1		0.91	0.15	0.9	0.89	0.19	1	-0.28	0.85	1.87	0.92	0.85	0.82	0.84	0.78	0.83	0.96	0.92	0.87	0.16
Valencia_humidity	0.024 -0.2		0.41	0.46	0.38	-0.13	-0.28			-0.25			-0.22			-0.048	8 -0.00				29-0.01	9 -0.09	97-0.09	6 -0.0	28 -0.1	3 -0.02	-0.21	0.014	-0.4	-0.41	0.11	-0.28	1	0.41	0.22	0.26	0.25	-0.27	0.26	0.27	-0.24	-0.3	-0.26	-0.25	1.043
Valencia_temp_min	0.19 0.12	-0.1	2 0.076	-0.66	-0.69	0.0038					-0.23	-0.19			-0.11	-0.09		7 -0.05	9 -0.0	64 -0.0	56-0.03	7 0.08	4 0.04	6 -0.1	16 0.1		0.69	0.06	0.95	0.99	0.096	0.85	0.41	1	0.86	0.89	0.89	0.83	0.83	0.88	0.81	0.87	0.9	0.86	0.2
Barcelona_temp_max	0.047 0.06	2 -0.1	6 -0.041	-0.61	-0.69	-0.034						-0.24			-0.11	-0.08	8 -0.03	4-0.04						8 -0.2	22 0.1		0.74	0.072	0.92	0.9	0.15	0.87	0.22	0.86	1	0.91	0.97	0.85	0.87	0.89	0.84	0.86	0.9	0.85	0.16
Madrid_temp_max	0.093 0.09	1 -0.1	5 -0.022	-0.71	-0.8	-0.048						-0.28			-0.13	-0.084	4-0.01	6-0.04						7 -0.1	14 0.1		0.77	0.092	0.92	0.92	0.15	0.92	-0.26	0.89	.91	1	0.9	0.87	0.87	0.84	0.85	0.92	0.99	0.94	0.18
Barcelona_temp	0.068 0.08	-0.1	4 -0.021	-0.62	-0.68	0.023						-0.22			-0.099			3 -0.04	2 -0.0		43-0.02			9 -0.2	23 0.1		0.69	0.011	0.91	0.91	0.13	0.85	0.25	0.89	97	0.9	1	0.87	0.87	0.96	0.83	0.87	0.9	0.87	0.18
Bilbao_temp_min	0.029 0.07	7 -0.1		-0.61	-0.64											-0.08			1-0.0					3 -0.2	27 0.1		0.65	0.009	0.84	0.85	0.14	0.82	-0.27	0.83	0.85	0.87	0.87	1	0.98	0.83	0.93	0.85	0.88	0.85	0.17
Bilbao_temp	0.082 0.06	5 -0.1	8 -0.023		-0.63																			3 -0.2	25 0.1		0.7	0.092	0.85	0.85	0.19	0.84	-0.26	0.83	0.87	0.87	0.87	0.98	1	0.81	0.98	0.84	0.88	0.84	0.18
Barcelona_temp_min	0.1 0.09	-0.1	1 0.0014	-0.6	-0.64																		6 0.04	6 -0.2	23 0.1	-0.06	0.59	-0.068	0.85	0.87	0.098	0.78	0.27	0.88	0.89	0.84	0.96	0.83	0.81	1	0.76	0.83	0.85	0.84	0.2
Bilbao temp max	015 0.04	2 -0.2	2 -0.033	-0.58	-0.61	-0.16		-0.17			-0.15	-0.17	0.071			-0.11		2 -0.04	3 -0.0	68 -0 .0:	59-0.03	34 0.07		5 -0.2	22 0.1		0.73	0.18	0.84	0.83	0.24	0.83	0.24	0.81	.84	0.85	0.83	0.93	0.98	0.76	1	0.81	0.84	0.8	0.18
Seville temp min	0.037 0.11	41	2 0 003	-0.78	4.77	-0.077		402			-0.2	-0.25			0.11		6-0.03	3 -0 03	3-0 0	82 -0 O	12 -0.0	2 01		1 41	5 01	0.021	0.74	0.038	0.89	0.89	0.15	0.96	4.3	0.87	186	0.92	0.87	0.85	0.84	0.83	0.81	1	0.94	0.91	0.17
Madrid temp	0.088 0.11		4 -0.012					A 23	0.044		A 21	A 26			A 12		0.01	8.0.04	3.01	1 .00	4 .0 0	04 01	4 0.02	6 41						0.92	0.14			0.9	0.9	0.99	0.9	0.88	0.88	0.85	0.84	0.94	1	0.97	0.19
Madrid temp min	0.085 0.09							0.23	0.040		0.21	0.25			0.1		0.01	0 0 01	5 0 0		20.00									0.87	0.12			0.86	0.5	0.04	0.07	0.00	0.00	0.03	0.01	0.01	0.07		
	0.085 0.09	0 40.1	2 40.02	40.69	40.76	0.046			0.046		40.21	4.23			40.1		5-0.01	0.03	16 -0.0		29 40.00			0 40.1	6 01		0.67	0.014	0.86	0.87	0.12	0.87	-0.25	0.06	1.85	0.94	0.87	0.85	0.84	0.84	0.8	0.91	0.97		
load_shortfall_3h	0.19 -0.19	5 -0.1	5 -0.14	-0.17	-0.15	-0.13	-0.082	-0.092	-0.12	-0.1	-0.12	0.082	0.048	-0.057	-0.032	-0.033	2 -0.03	4 -0.03	3 -0.02	27-0.0	25-0.02	22 0.03	0.06	4 0.03	39 0.06	1 0.08	0.11	0.093	0.14	0.17	0.15	0.16	0.043	0.2	116	0.18	0.18	0.17	0.18	0.2	0.18	0.17	0.19	0.17	1
	amed: 0	rain 1h	g speed	umidity	umidity	lle spno	paads p	le_sbuo	ind_deg	g sbeed	ind_deg	lle spno	g sbeed	rain 1h	rain_1h	now_3h	xessare	rain_3h	rain 1h	rain 3h	mow 3h	ather id	ather id	vessure	atherid	xessure	mp_max	oressure	om_qn	ia_temp	ather_id	le_temp	umidity	mp_mim_	ф.	mp_max	a_temp	mp_min	o_temp	mp_mir	œш [*] du	uju du	id_temp	mp_min	rtfall 3h
	Unn Irid_winc	Bilbao	cia_win	Seville	fadrid h	ilbao_ci	oac win	eville_d	w oedlis	ons_win	elona w	adrid_cl	ille win	rcelona	3	Bilbao	celona	Seville	Madrid	rcelona	lencia s	drid we	ona we	Bilbao	ville we	encia_	wille te	Madrid	encia ter	Valenc	ow_oed	3	lencia_h	encia_te	lone te	adrid_tes	Barcelor	ilbao te	9	elona_te	lbao_te	eville te	Mad	adrid te	od sho
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Data Preprocessing and Feature Engineering

Data Preprocessing and Feature Engineering



Filled in missing values using the median.

We created 8 new features.

Valencia_deg and Seville pressure features.

Unnamed and Time features.



Model Development and Evaluation

1 Linear Regression

Assumes a linear relationship between the predictor variables and predicted variables.

2 Ridge Regression

This is a shrinkage method that reduces large coefficients.

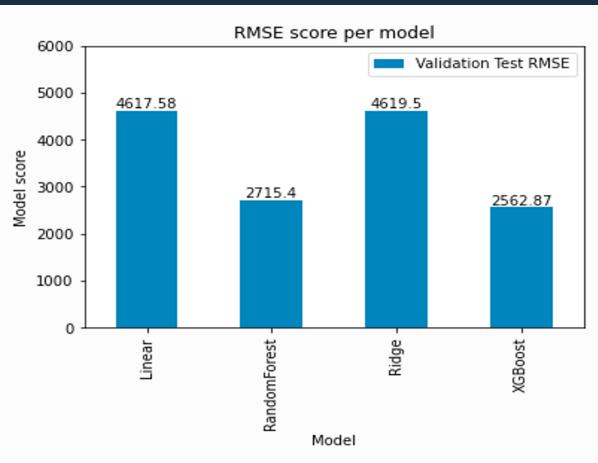
Random Forest

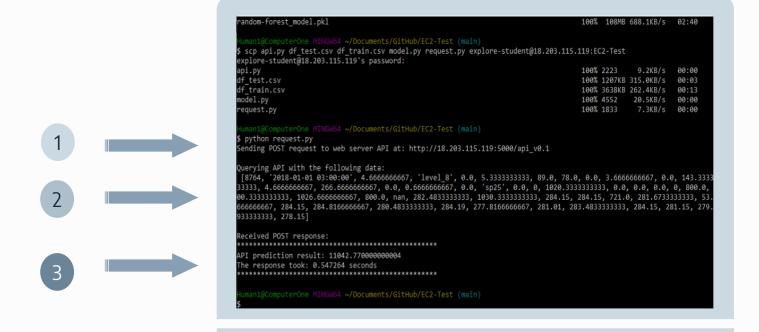
An ensemble method of decision trees for each feature in our dataset.

XGBRegressor

This ensemble model uses gradient boosting.

Root Mean Square Error (RMSE)







Conclusion

Conclusion

The Government of Spain should expand its energy mix by extending its use of renewable resources such as wind, solar and hydro power over and above the use of fossil fuels.

The deployed API would enable informed decisions based on the weather data from the cities.

Invest to improve or add renewable energy infrastructure.





Thank You

