

FA 541 - Applied Statistics with Applications in Finance Project Report

Statistical models for Electric load and
electric price prediction for 5 Spanish cities.

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Fall 2022

Introduction

The rapid shift to an electrical infrastructure based on renewable sources in Spain is one of the areas where statistical analysis has the biggest leverage contribution. Data for Spain's four years (2015-18) of electricity use, generation, price, and weather are included in this dataset. A public gateway for Transmission Service Operator (TSO) data called ENTSOE was used to obtain consumption and generation statistics. The Spanish TSO Red Electric España provided settlement pricing. For the five major cities in Spain (Valencia, Madrid, Bilbao, Barcelona, Seville), weather information was obtained from the Open Weather API as part of a personal initiative and compiled into two datasets. Here I used both of them which is also available in Kaggle.

Data

From the Kaggle dataset we got 2 csv files containing weather info and electric data on 5 cities. So, after

1. Inner merging both tables
2. Removing 7 null columns
3. Combining redundant columns

I got data of 37 columns(attributes) with 178396 rows (parameters).

But these columns had following null values.

generation biomass	95
generation fossil brown coal/lignite	90
generation fossil gas	90
generation fossil hard coal	90
generation fossil oil	95
generation hydro pumped storage consumption	95
generation hydro run-of-river and poundage	95
generation hydro water reservoir	90
generation nuclear	85
generation other	90
generation other renewable	90
generation solar	90
generation waste	95
total load actual	180
generation wind	90

So, I filled them with their median values.

Distribution of Data

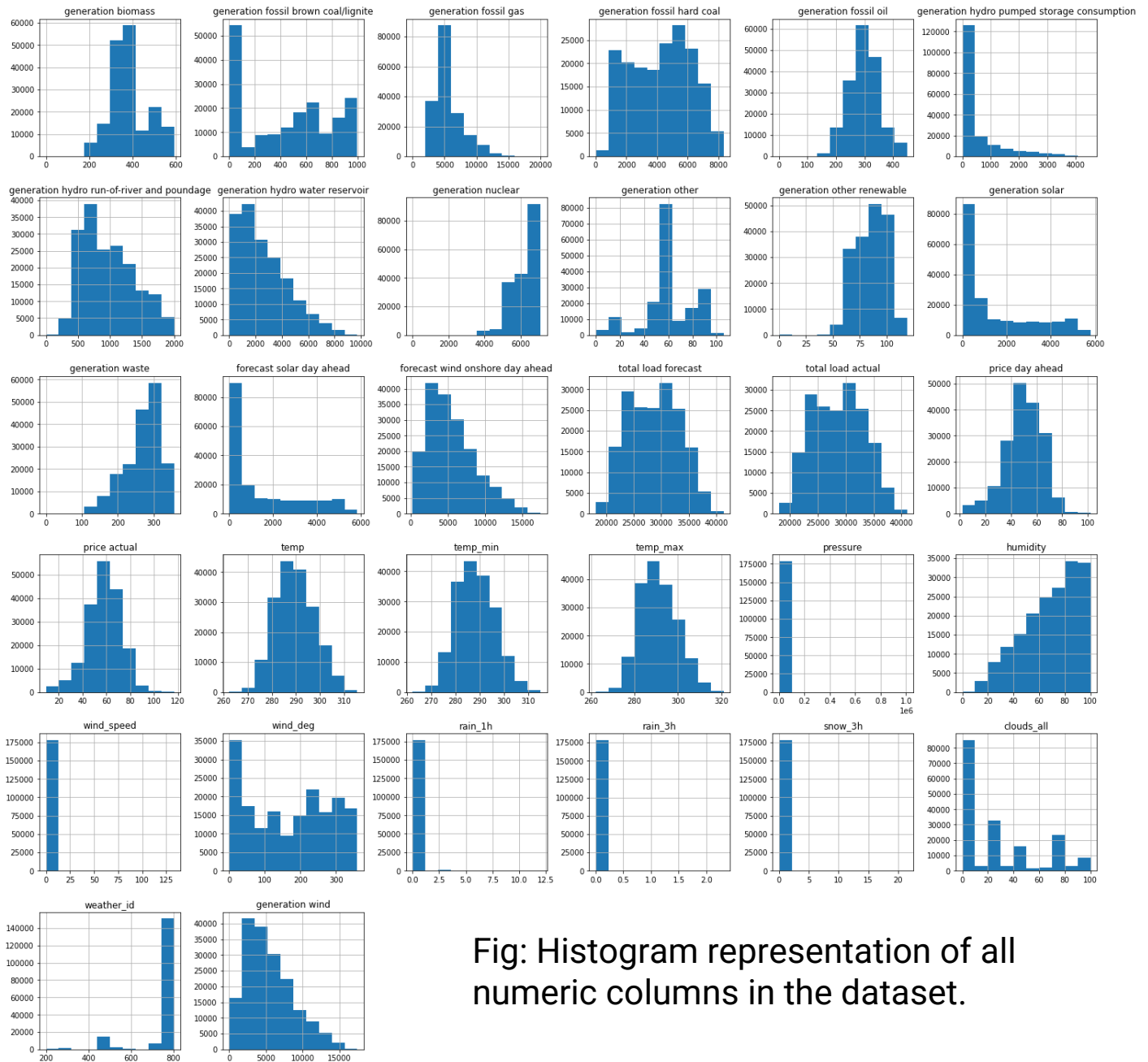
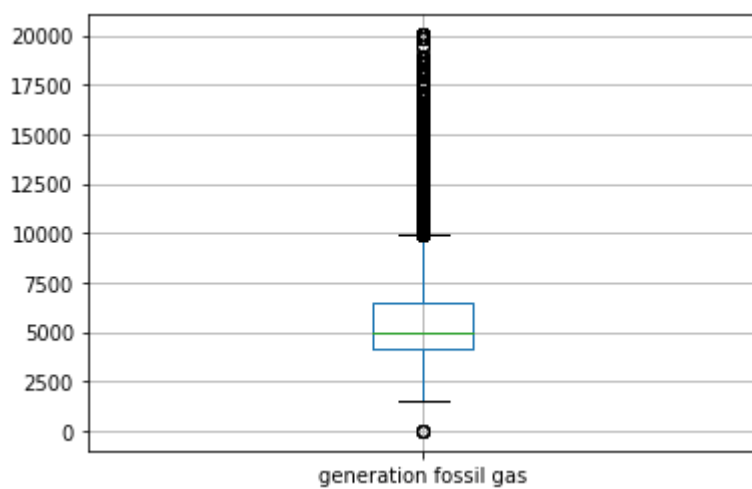
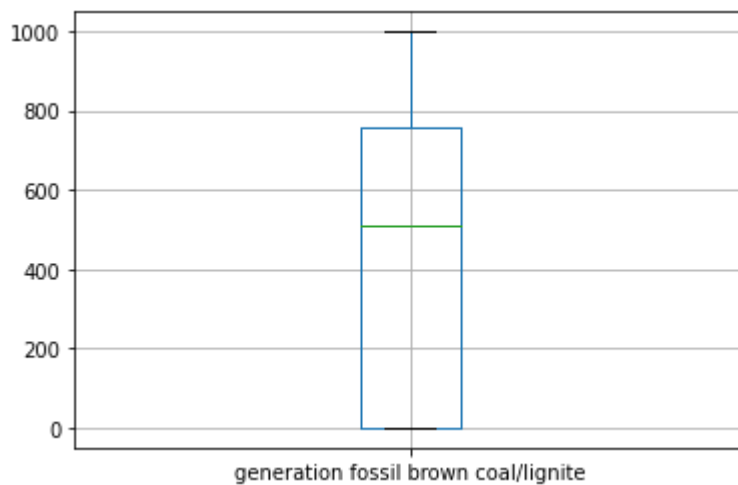
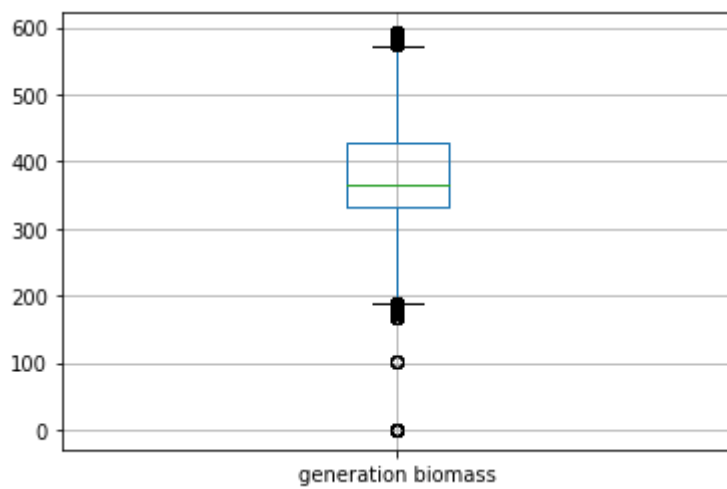
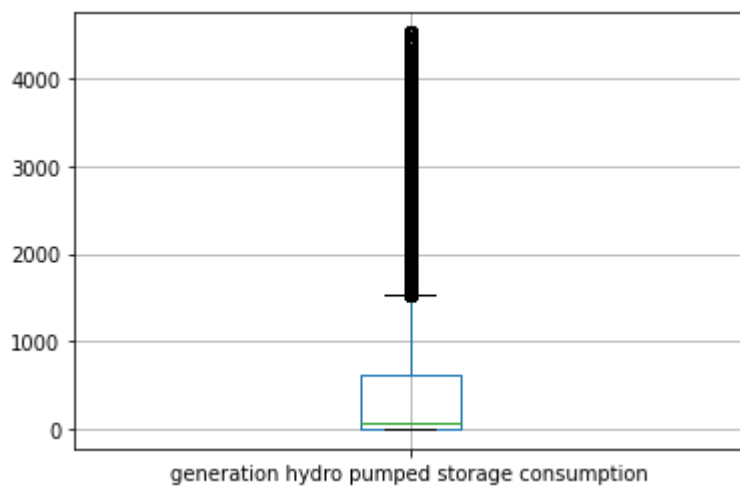
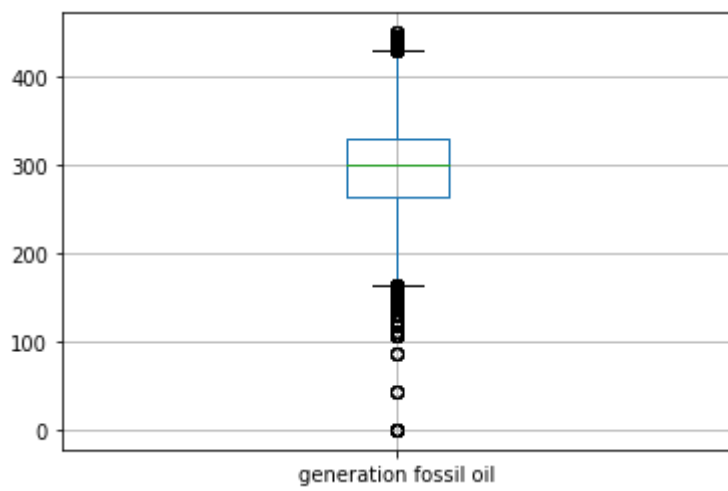
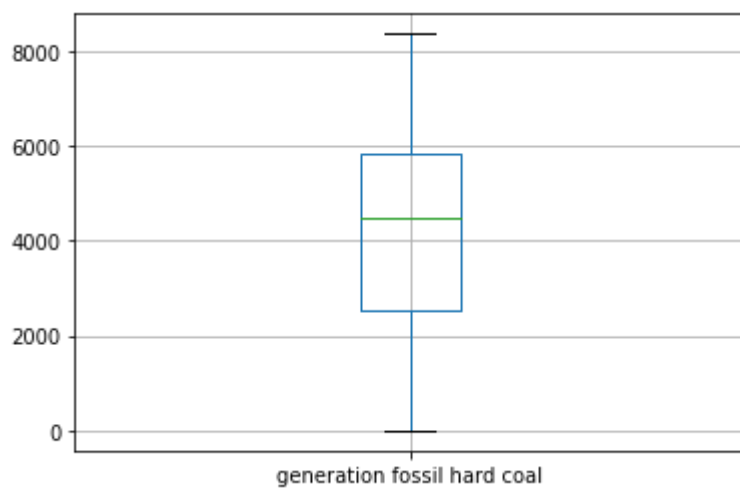
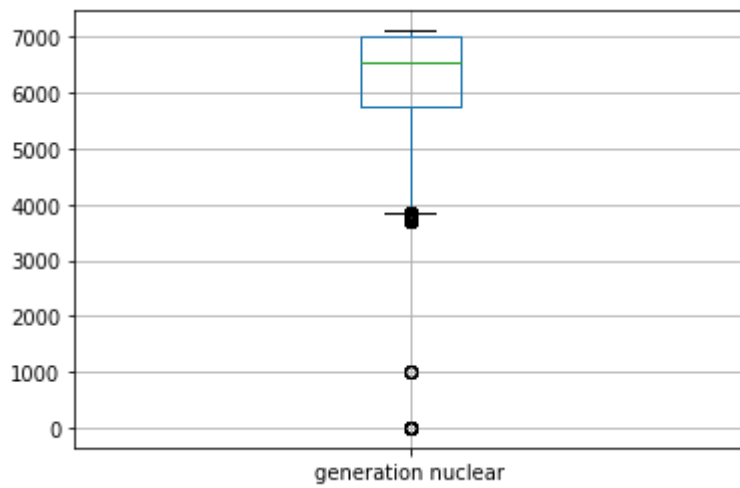
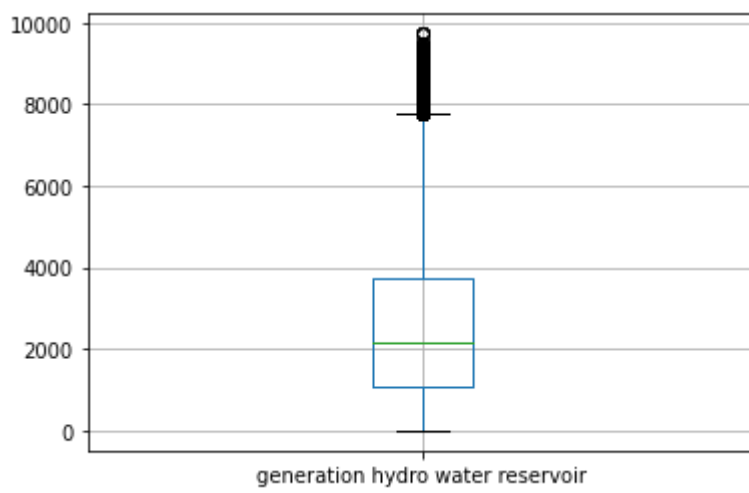
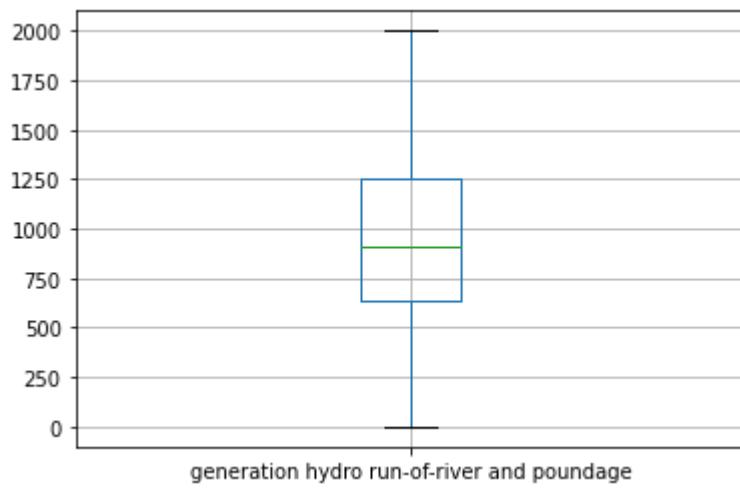


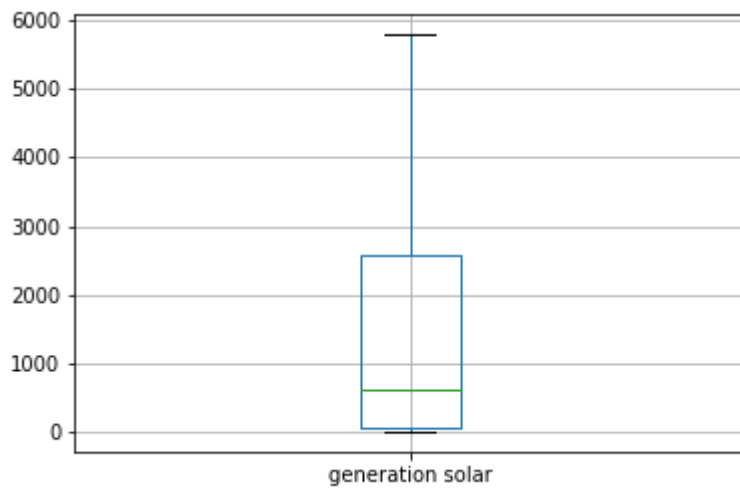
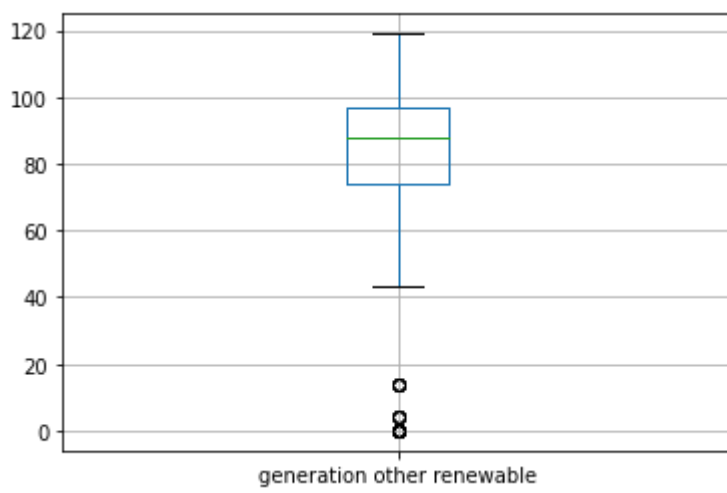
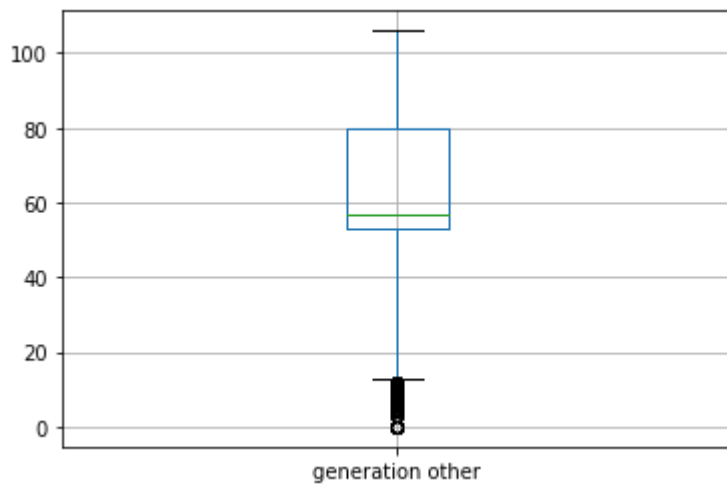
Fig: Histogram representation of all numeric columns in the dataset.

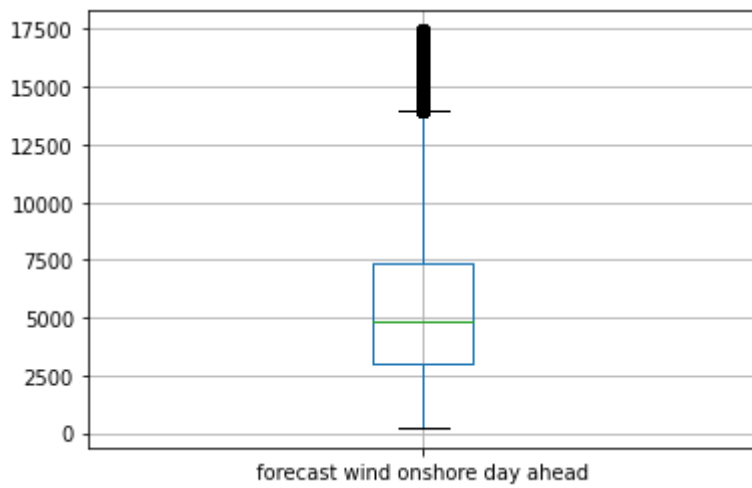
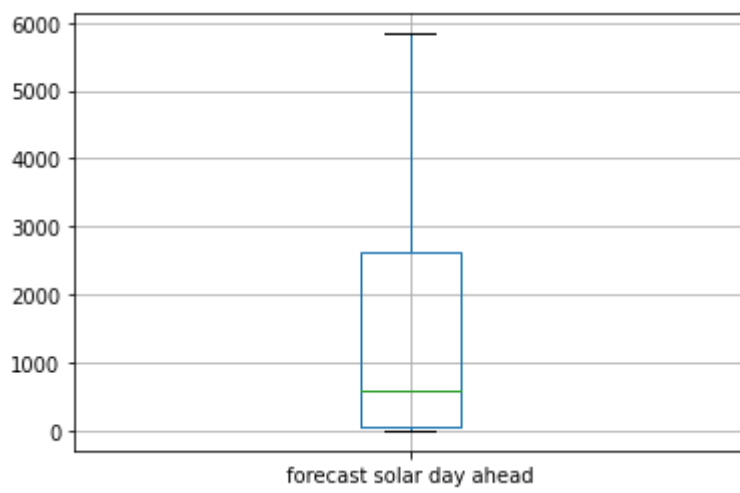
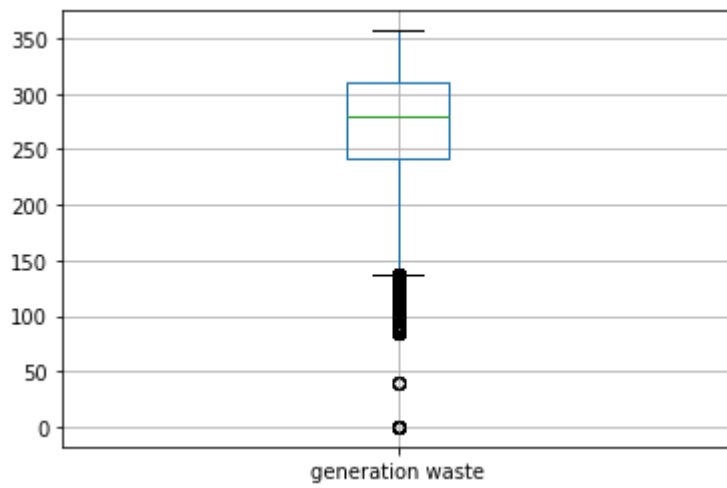
Dataset boxplots – To identify outliers and distribution

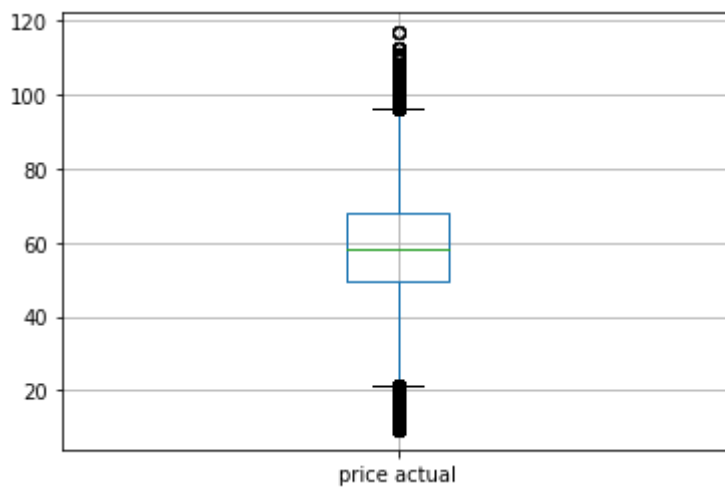
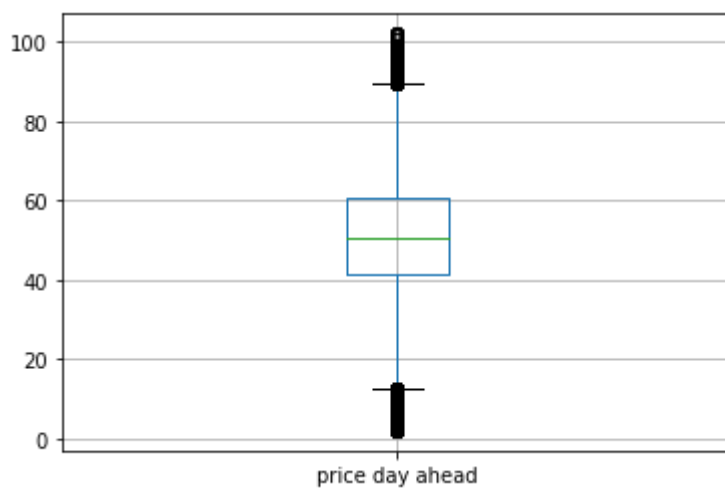
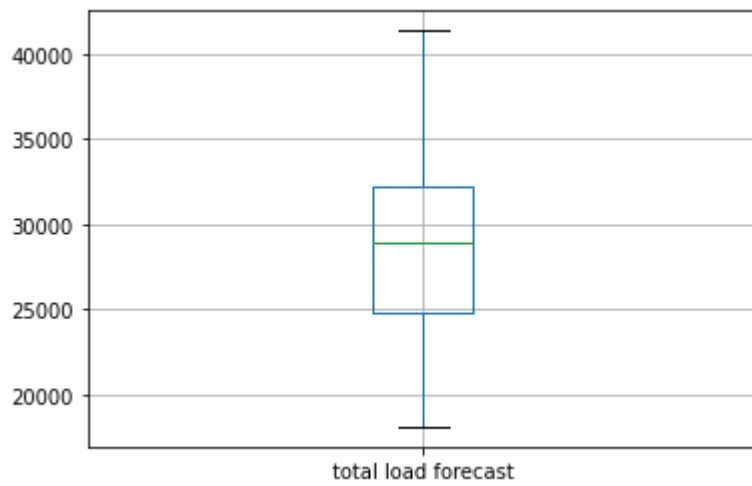


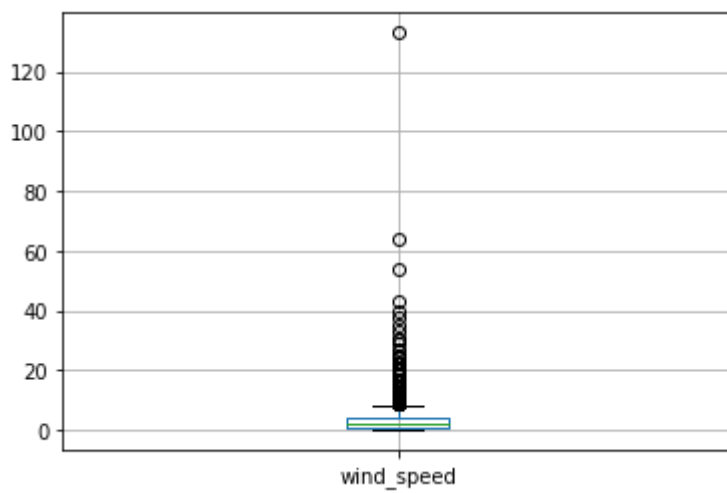
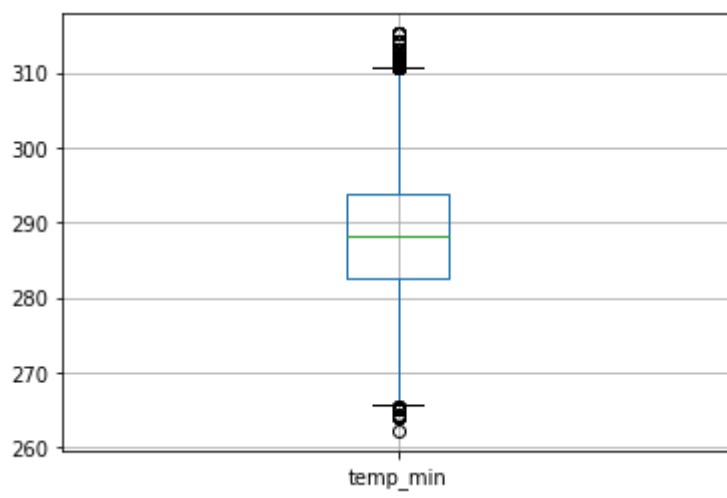
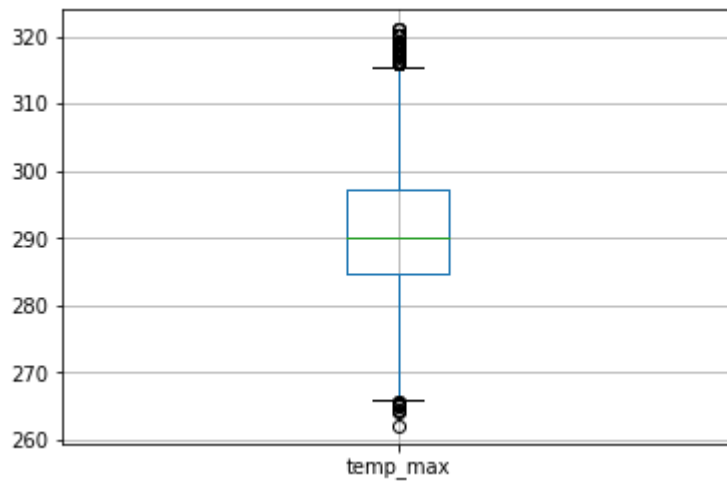


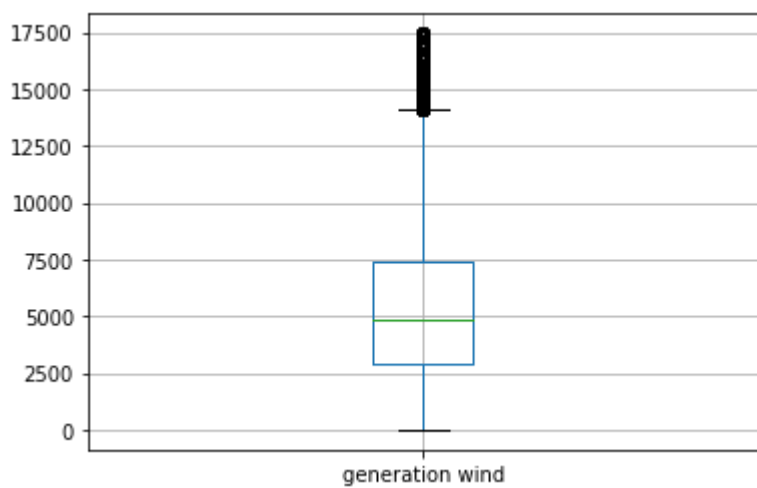
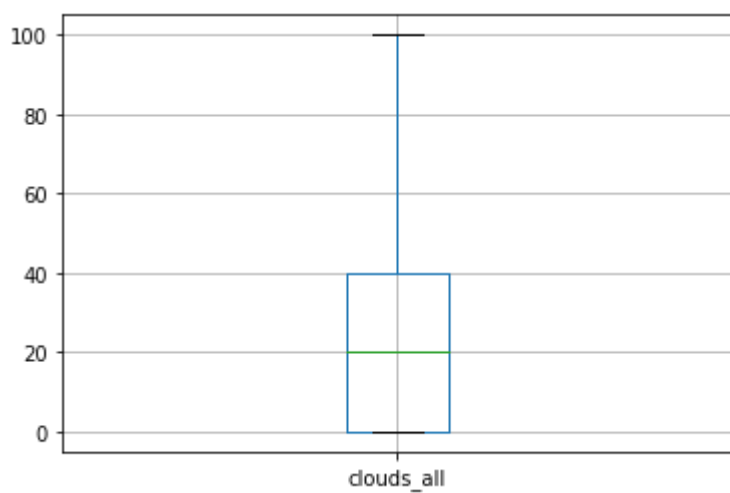
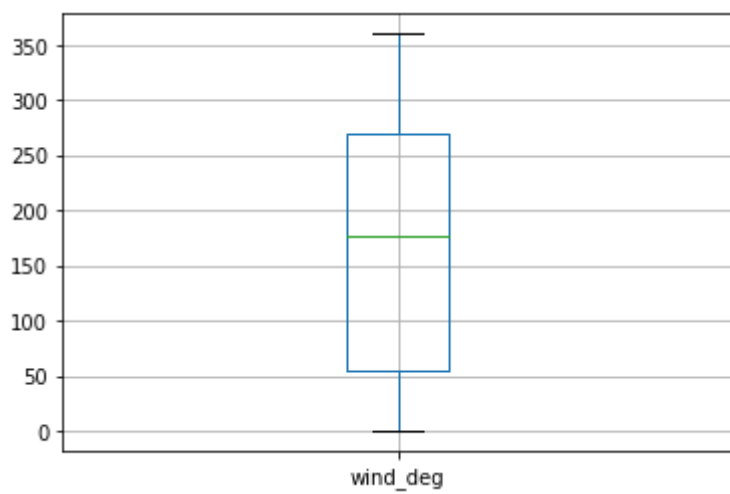




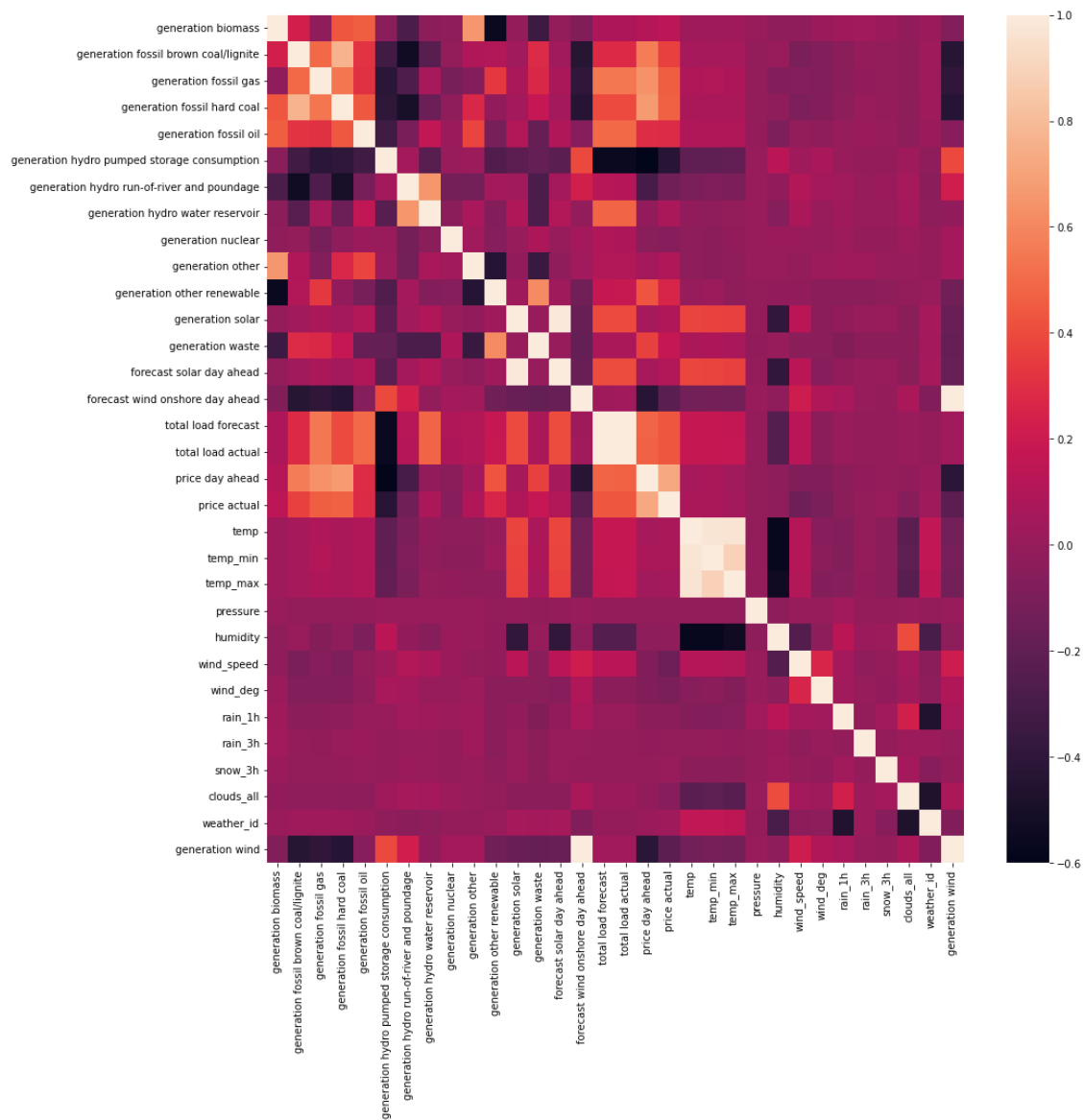




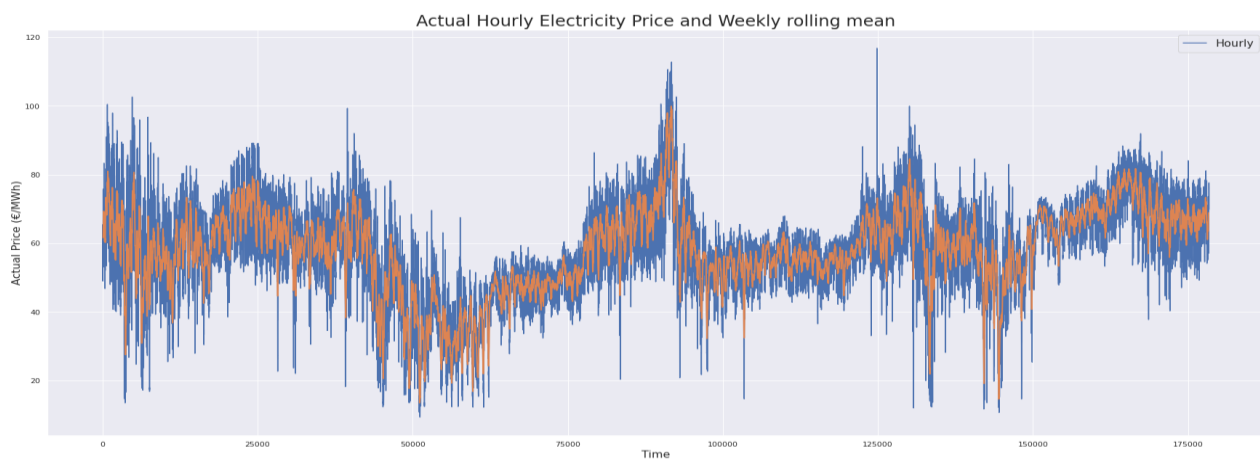




Correlation Plot:



Hourly Price of electricity with its weekly rolling mean



Statistics Analysis of all attributes:

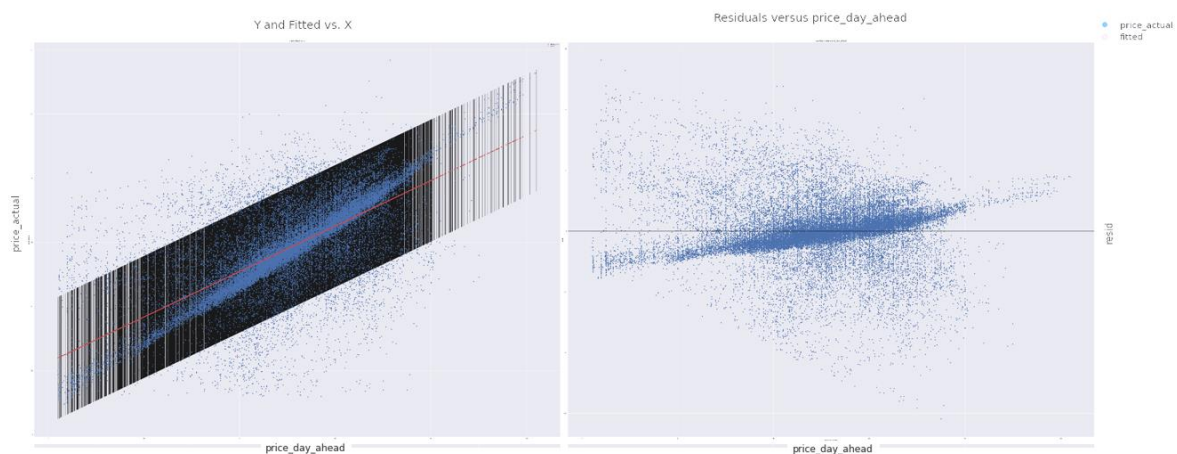
index	count	mean	std	min	25%	50%	75%	max
generation biomass	178396	382.9899493	85.23485025	0	333	366	429592	
generation fossil brown coal/lignite	178396	448.2875345	354.2108283	0	0	509	756999	
generation fossil gas	178396	5625.924359	2203.381137	0	4127	4972	643420034	
generation fossil hard coal	178396	4254.272747	1960.39488	0	2527	4473	58358359	
generation fossil oil	178396	298.1506368	52.45038036	0	263	300	329449	
generation hydro pumped storage consumption	178396	474.9038095	792.2442228	0	0	67	6154523	
generation hydro run-of-river and poundage	178396	972.9022512	400.8703165	0	638	907	12512000	
generation hydro water reservoir	178396	2606.543488	1835.494419	0	1079	2166	37589728	
generation nuclear	178396	6263.691994	839.7992613	0	5758	6563	70257117	
generation other	178396	60.15901141	20.207256	0	53	57	80106	
generation other renewable	178396	85.74563892	14.06867734	0	74	88	97119	
generation solar	178396	1428.02689	1676.231588	0	70	615	25625792	
generation waste	178396	269.7536492	50.07857899	0	241	280	310357	
forecast solar day ahead	178396	1435.289788	1674.115259	0	69	576	26215836	
forecast wind onshore day ahead	178396	5477.7593	3178.332767	237	2984	4861	736317430	
total load forecast	178396	28720.3853	4597.947283	18105	24796	28913	3227841390	
total_load_actual	178396	28706.32409	4576.704605	18041	24812	28916	3219941015	
price_day_ahead	178396	49.92122665	14.62588232	2.06	41.5	50.56	60.6101.99	
price_actual	178396	57.92347166	14.21025105	9.33	49.39	58.06	68.05116.8	
temp	178396	289.618605	8.026199276	262.24	283.67	289.15	295.15315.6	
temp_min	178396	288.3304418	7.955490927	262.24	282.4836016	288.15	293.730125315.15	
temp_max	178396	291.0912666	8.61245402	262.24	284.65	290.15	297.15321.15	
pressure	178396	1016.10091	12.06664763	931	1013	1018	10221048	
humidity	178396	68.4234568	21.90288754	0	53	72	87100	
wind_speed	178396	2.469267809	2.064353622	0	1	2	443	
wind_deg	178396	166.5911904	116.6119265	0	55	177	270360	
rain_1h	178396	0.075491827	0.398847347	0	0	0	012	
rain_3h	178396	0.000379765	0.007288445	0	0	0	02.315	
snow_3h	178396	0.004762915	0.222603842	0	0	0	021.5	
clouds_all	178396	25.073292	30.77412921	0	0	20	40100	
weather_id	178396	759.8319021	108.7332226	200	800	800	801804	
generation wind	178396	5470.740672	3214.627363	0	2941	4856	740617436	
temp_C	178396	16.47151001	8.027044665	-10.9	10.5	16	2242.5	

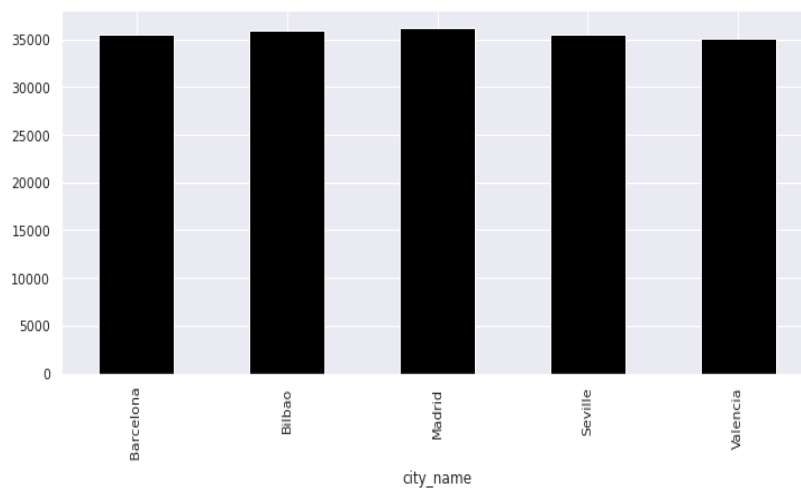
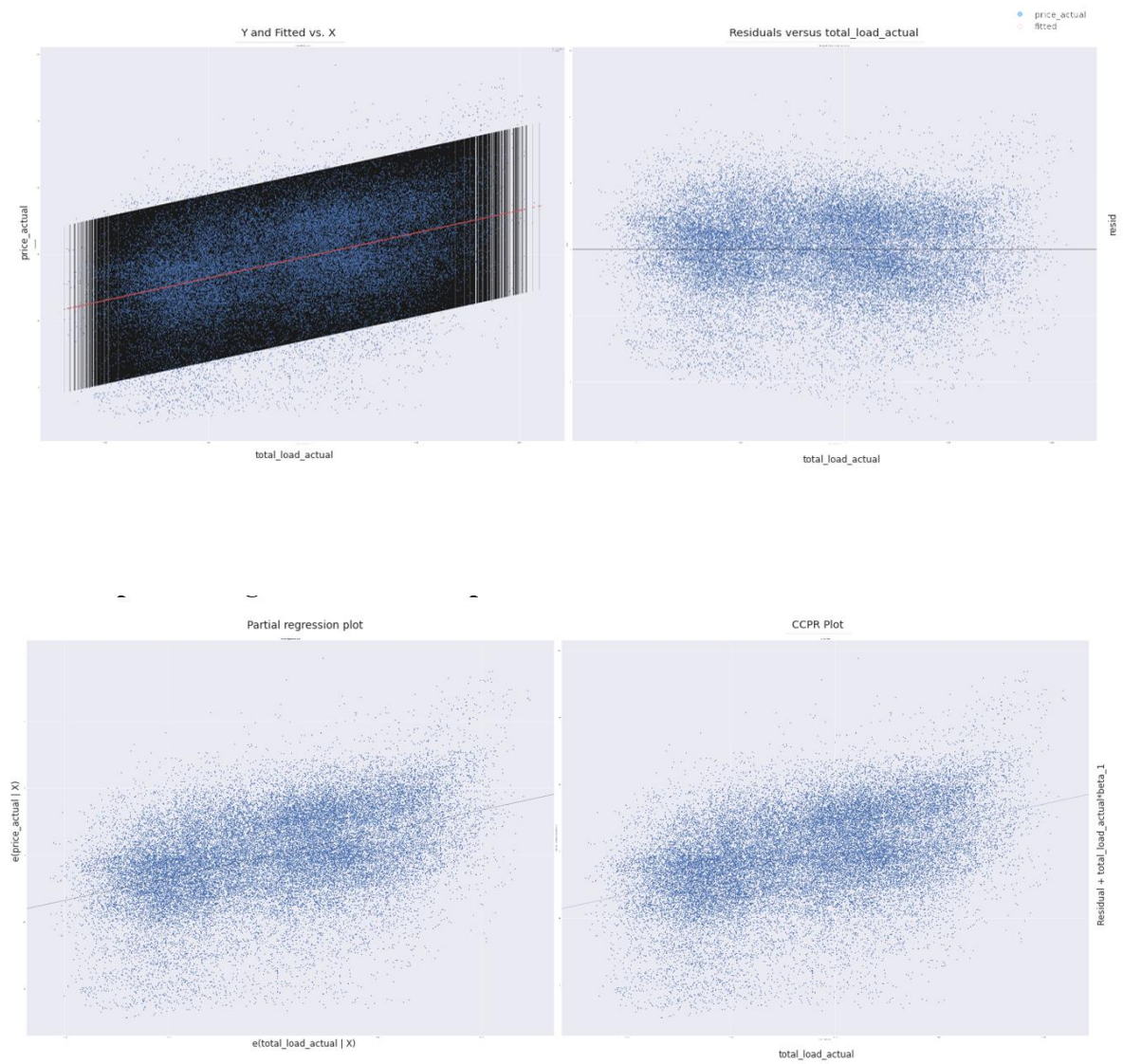
Analysis: Simple Linear Regression

So, I perform Ordinary Least Squares regression on actual electricity price with dataset's forecast price, but the results were not much satisfactory.

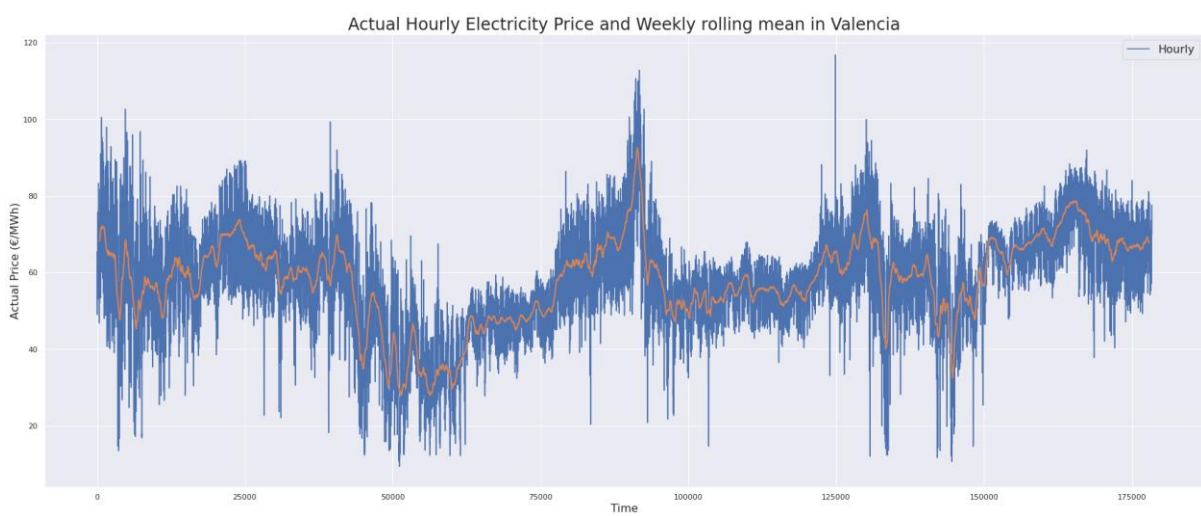
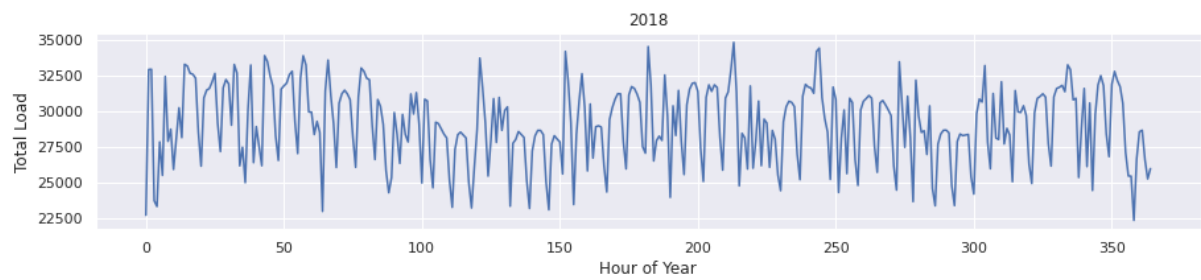
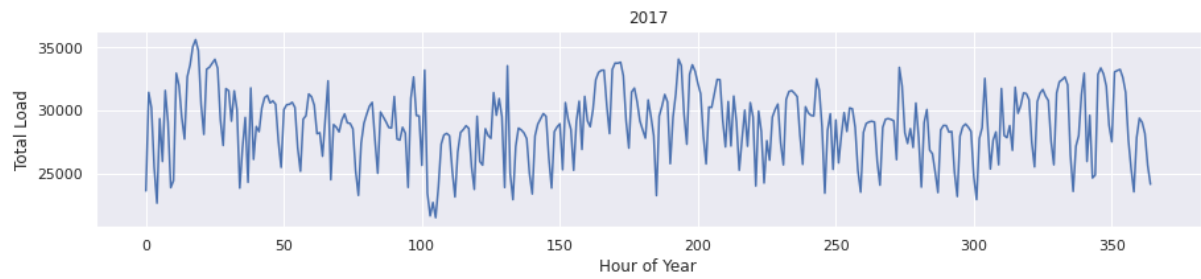
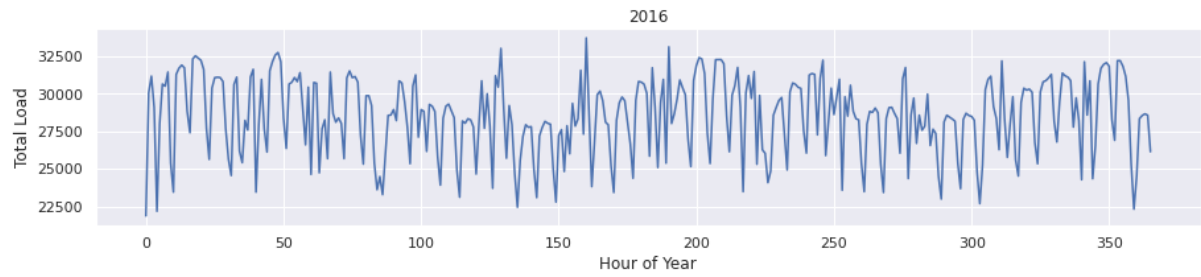
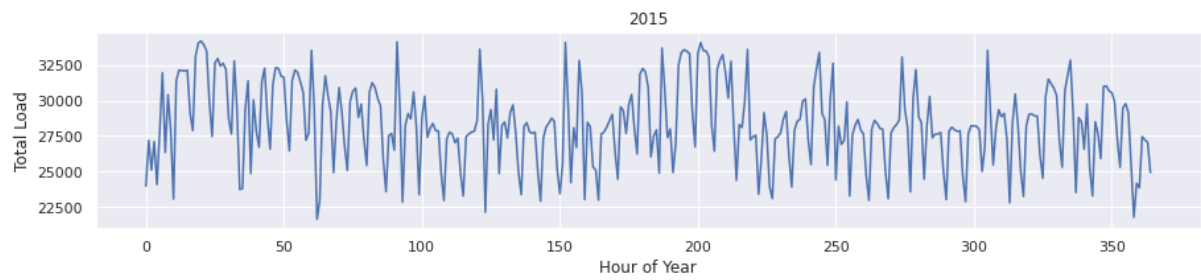
OLS Regression Results						
=====						
Dep. Variable:	price_actual	R-squared:	0.534			
Model:	OLS	Adj. R-squared:	0.534			
Method:	Least Squares	F-statistic:	2.043e+05			
Date:	Thu, 22 Dec 2022	Prob (F-statistic):	0.00			
Time:	14:01:03	Log-Likelihood:	-6.5851e+05			
No. Observations:	178396	AIC:	1.317e+06			
Df Residuals:	178394	BIC:	1.317e+06			
Df Model:	1					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

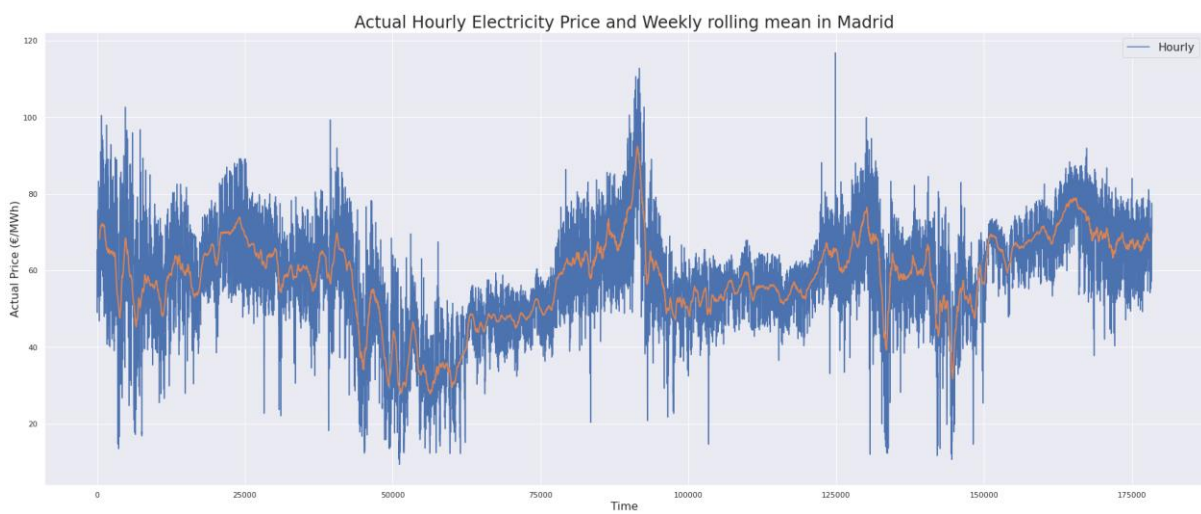
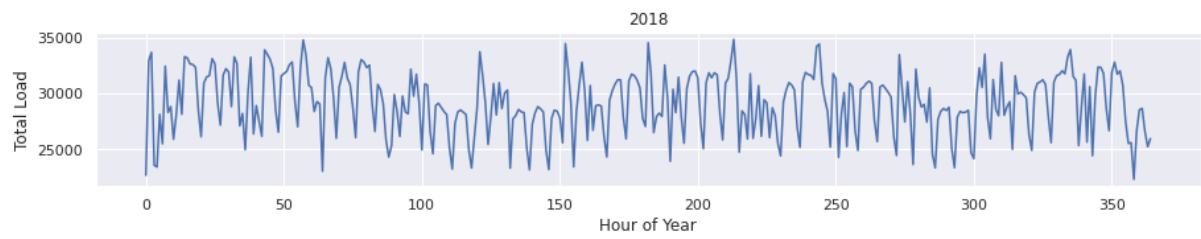
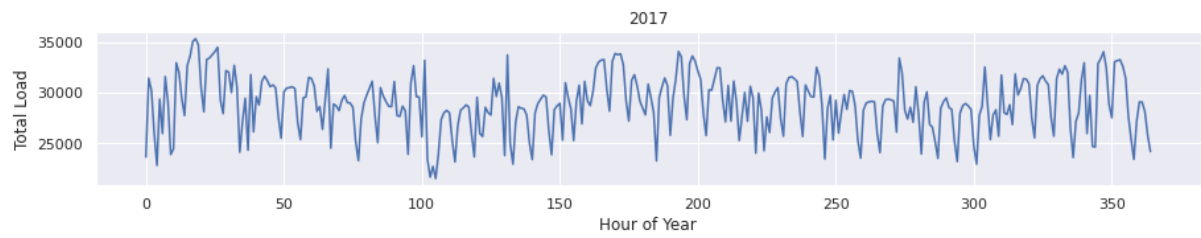
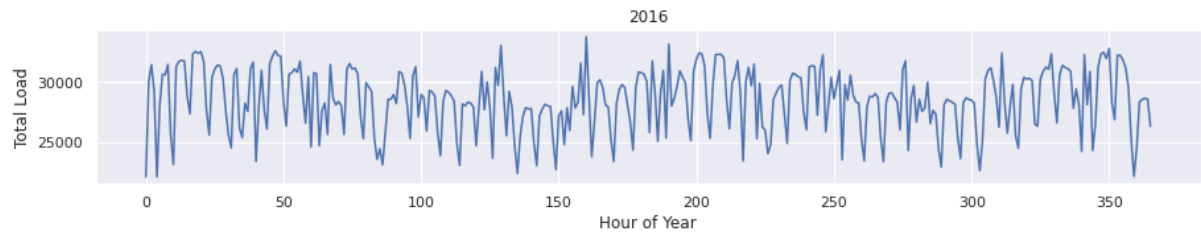
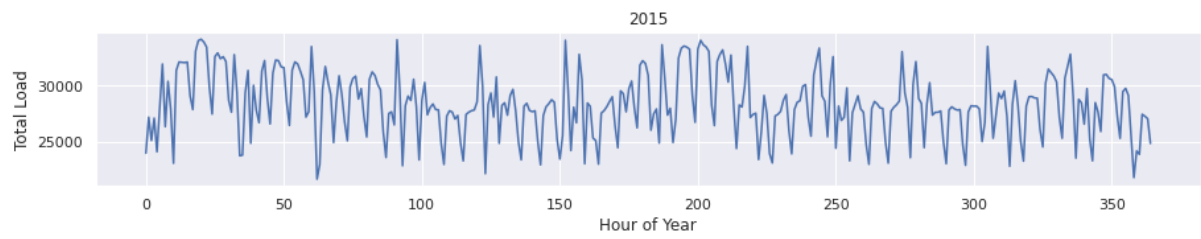
Intercept	22.4857	0.082	275.218	0.000	22.326	22.646
price_day_ahead	0.7099	0.002	451.979	0.000	0.707	0.713
=====						
Omnibus:	17203.241	Durbin-Watson:	0.015			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	112137.296			
Skew:	-0.220	Prob(JB):	0.00			
Kurtosis:	6.859	Cond. No.	185.			
=====						
Notes:						
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.						

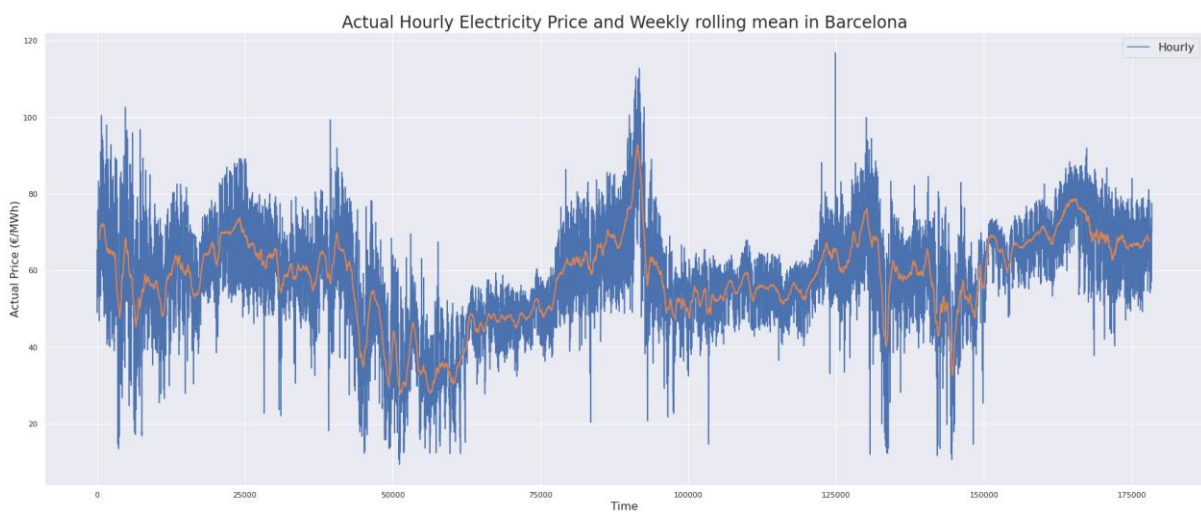
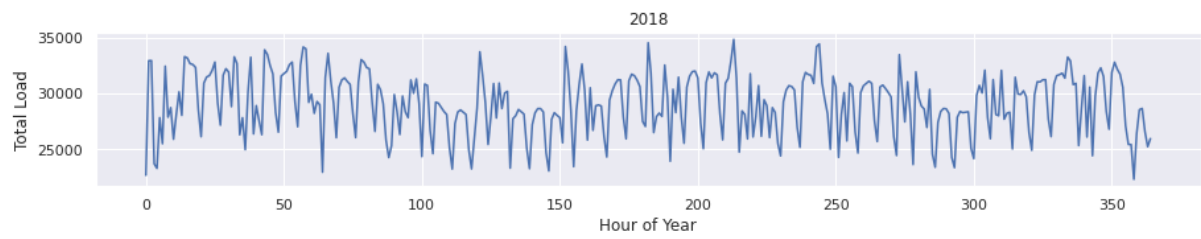
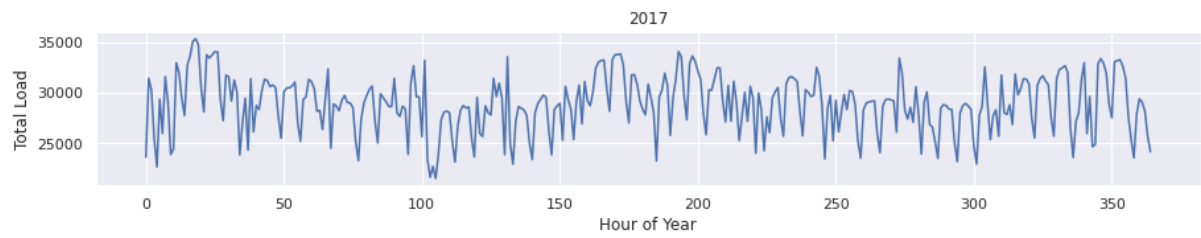
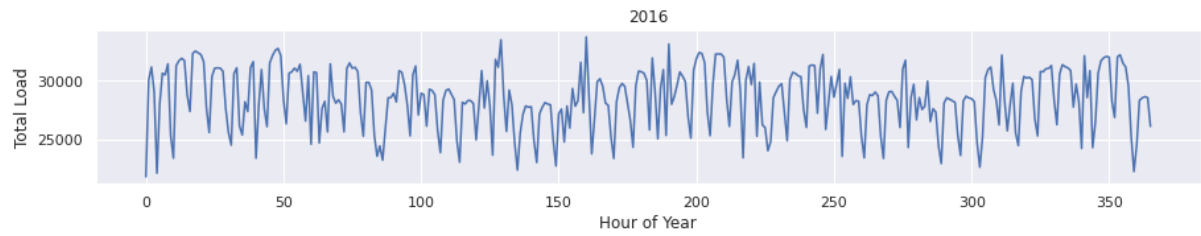
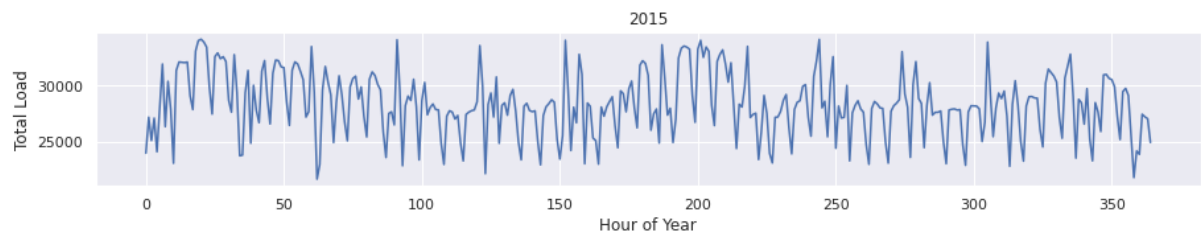


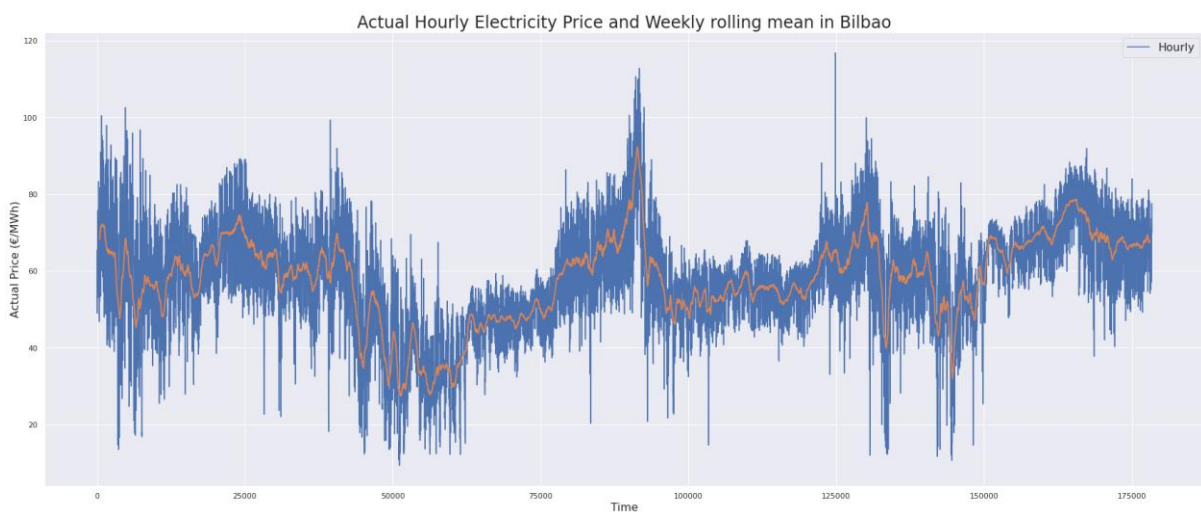
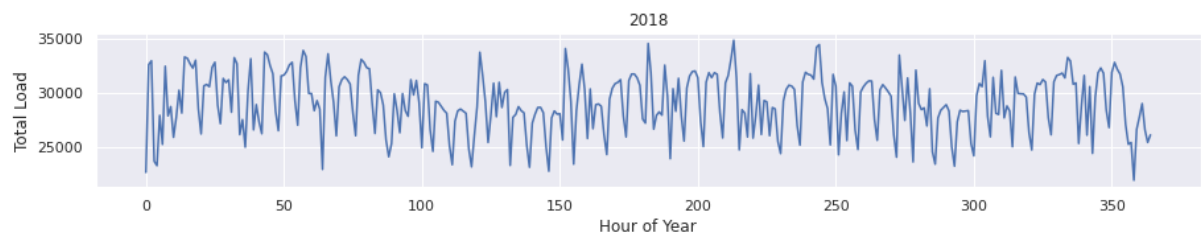
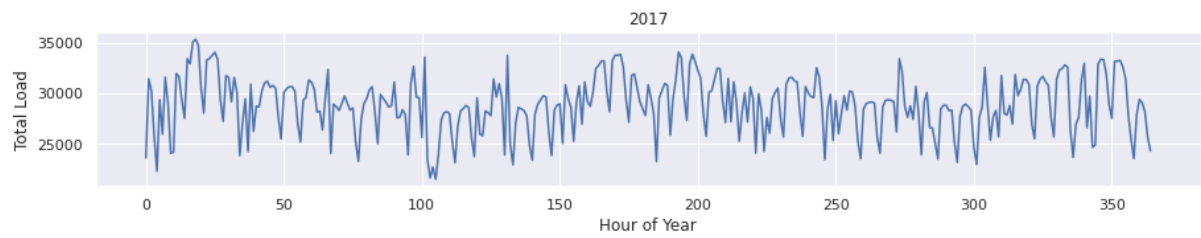
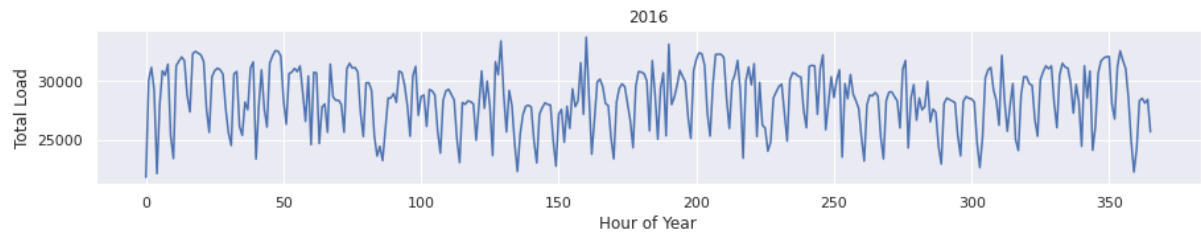
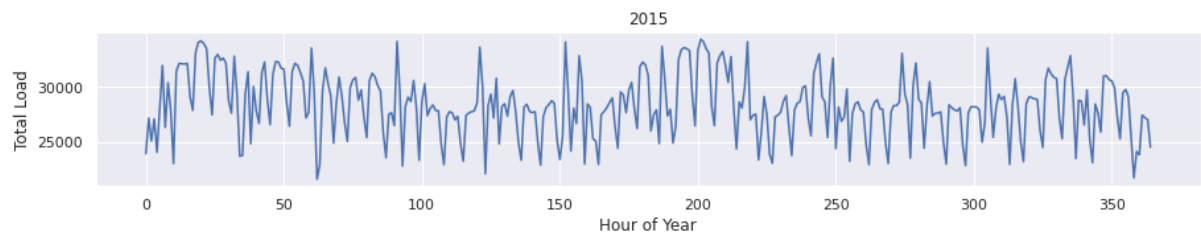


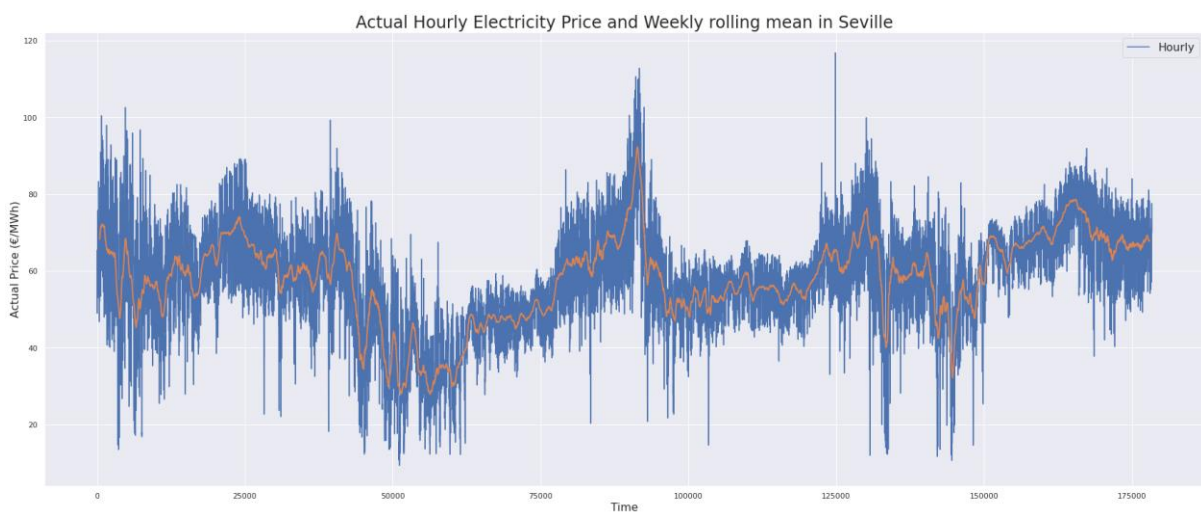
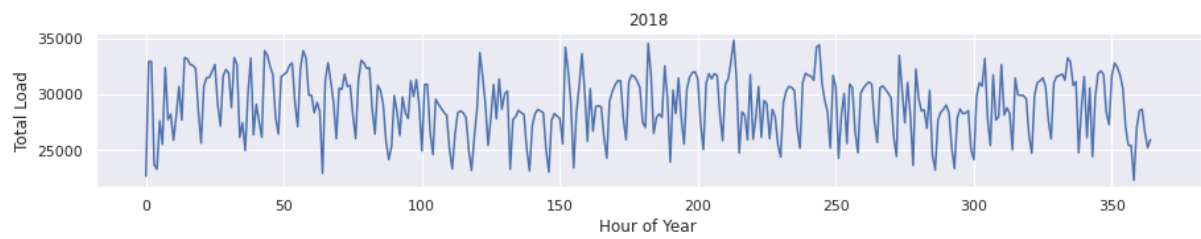
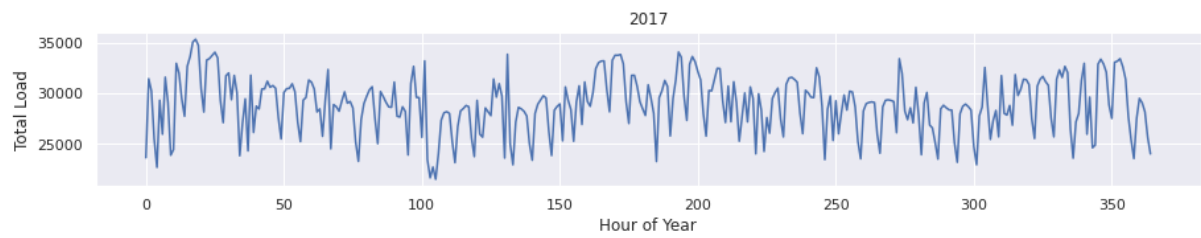
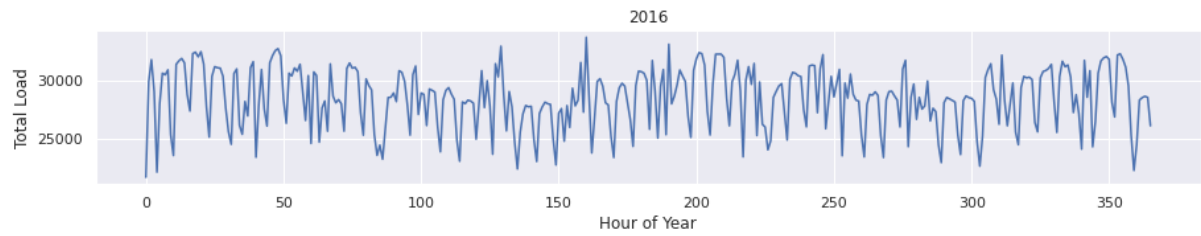
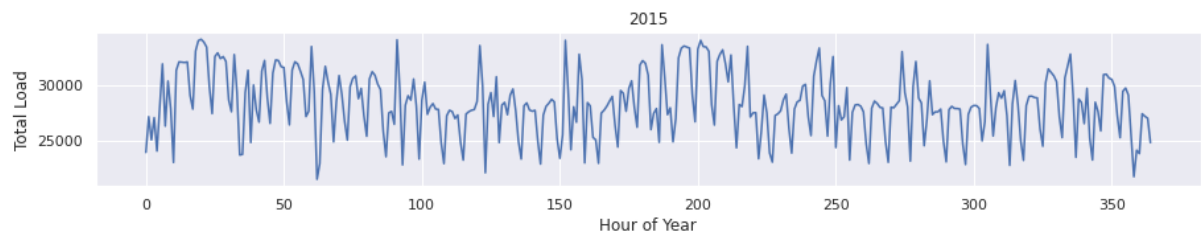
So, with unsatisfactory results, I grouped this dataset by the cities, and then performed multiple linear regression on it.





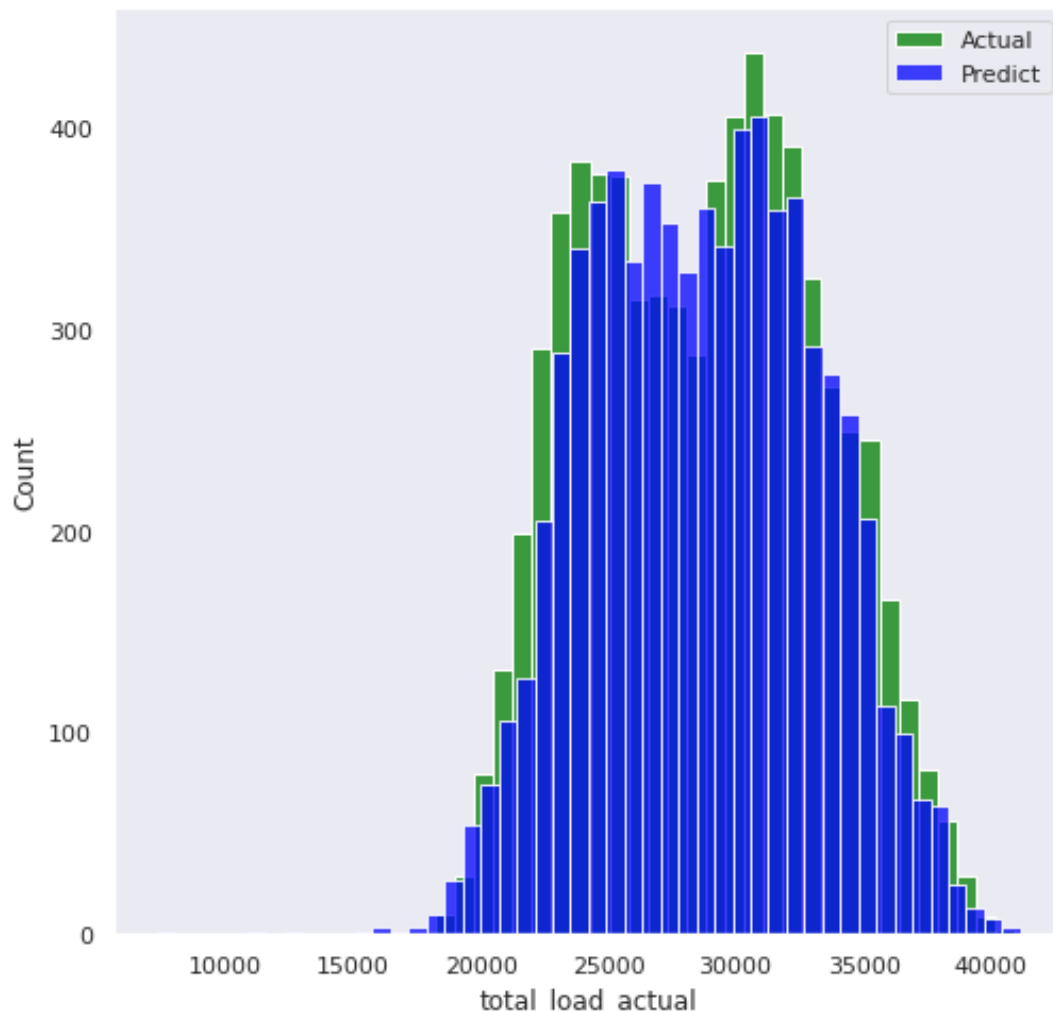






Statistical Analysis: Multiple Linear Regression

Load Prediction Visualization and Parameters for Valencia



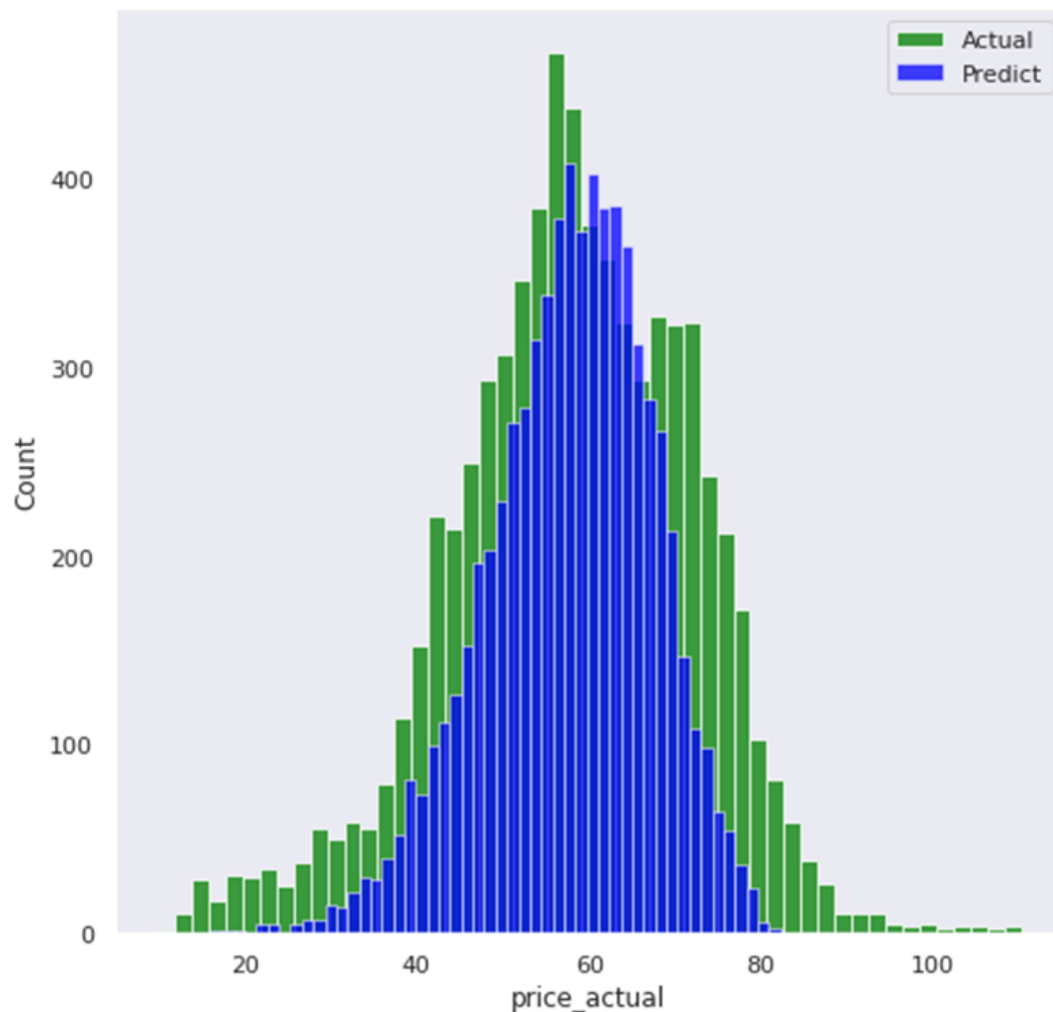
```
Intercept: -18898.035459253715
Coefficients:
[('time', 1.824975405037647),
 ('generation biomass', 0.9072956357896204),
 ('generation fossil brown coal/lignite', 0.7662057069063636),
 ('generation fossil gas', 0.7017037238243607),
 ('generation fossil hard coal', 7.3808034888920435),
 ('generation fossil oil', -1.335407465676324),
 ('generation hydro pumped storage consumption', 0.8192016296636481),
 ('generation hydro run-of-river and poundage', 1.0376299584997548),
 ('generation hydro water reservoir', 0.7662444645472544),
 ('generation nuclear', 1.7486630677965878),
 ('generation other', 27.006666478338378),
 ('generation other renewable', 0.21617628991760632),
 ('generation solar', 5.401608718543416),
 ('generation waste', 0.7044517928000069),
 ('forecast solar day ahead', 0.11432880474786015),
 ('forecast wind onshore day ahead', -38.047986712318426),
 ('temp', 30.88197792596278),
 ('temp_min', 15.997898939029024),
 ('temp_max', 16.868181062528816),
 ('pressure', 2.3267643223420698),
 ('humidity', 1.9940064839886686),
 ('wind_speed', -0.3801224497526669),
 ('wind_deg', 61.40985800682905),
 ('rain_1h', -5347.024178281798),
 ('rain_3h', -1275.8701469394825),
 ('snow_3h', 1.6079557298712692),
 ('clouds_all', 0.3421147841693915),
 ('weather_id', 0.6256587398779909)]
```

Mean Absolute Error:
1052.902664716613

Mean Square Error:
1953354.8347548505

Root Mean Square Error:
1397.6247117001226

Price Prediction Visualization and Parameters for Valencia



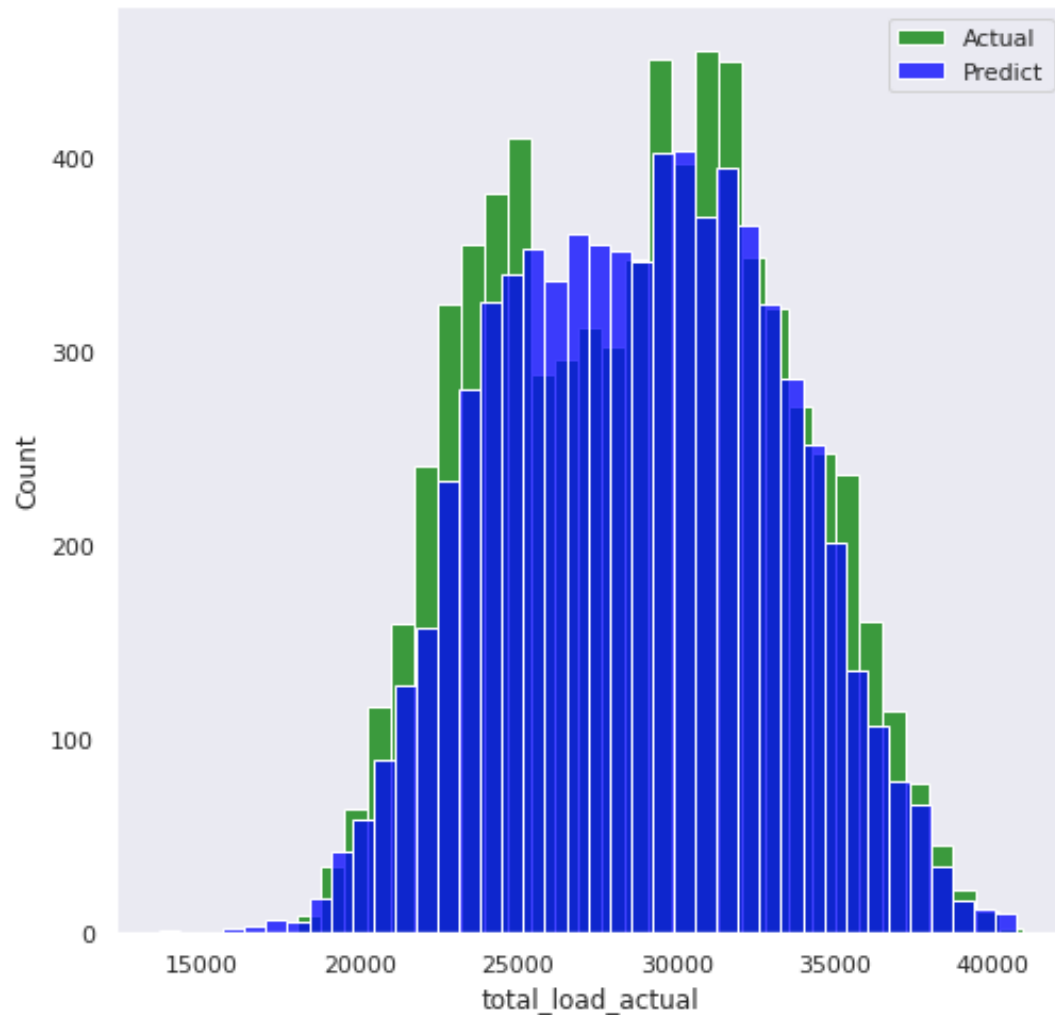
```
Intercept: -194.9493036573499
Coefficients:
[('time', 0.028256099931079488),
 ('generation biomass', -0.0006292474279855563),
 ('generation fossil brown coal/lignite', 0.0012570841100049978),
 ('generation fossil gas', 0.0023490617186080706),
 ('generation fossil hard coal', -0.01607122496033149),
 ('generation fossil oil', -0.0030950977357826555),
 ('generation hydro pumped storage consumption', 0.001471853659029186),
 ('generation hydro run-of-river and poundage', 0.0008234217808815829),
 ('generation hydro water reservoir', 0.00023636139692731443),
 ('generation nuclear', 0.038650181882374686),
 ('generation other', 0.25405204045810037),
 ('generation other renewable', 0.001280992562485465),
 ('generation solar', -0.01694988151426425),
 ('generation waste', -0.0003209487826957616),
 ('forecast solar day ahead', 0.00041056437658750877),
 ('forecast wind onshore day ahead', 0.4127252759508025),
 ('temp', 1.1949641684727728),
 ('temp_min', -1.3558656519165813),
 ('temp_max', 0.11838438876911385),
 ('pressure', 0.128205650352603),
 ('humidity', -0.6535056245208097),
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 ('rain_3h', 28.927473689665977),
 ('snow_3h', -0.0032642114009758653),
 ('clouds_all', 0.0025237610808914778),
 ('weather_id', 0.00034720299512324283)]
```

Mean Absolute Error:
8.230964392297272

Mean Square Error:
115.1089008793654

Root Mean Square Error:
10.72888162295425

Load Prediction Visualization and Parameters for Madrid



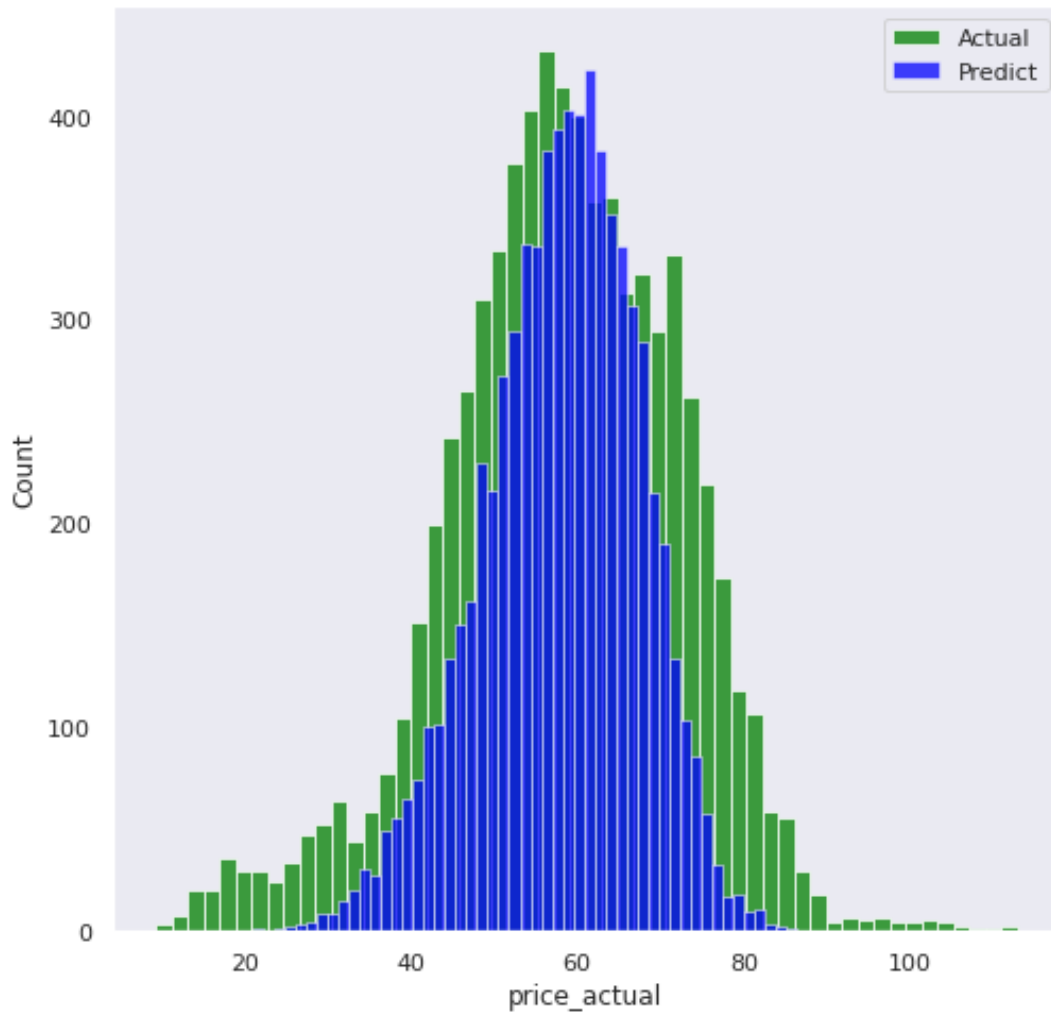
```
Intercept: -7665.354517779961
Coefficients:
[('time', 1.9303305092732108),
 ('generation biomass', 1.0188346812193265),
 ('generation fossil brown coal/lignite', 0.7626195271391043),
 ('generation fossil gas', 0.6963119204754494),
 ('generation fossil hard coal', 7.3212434436616345),
 ('generation fossil oil', -1.3472397010087491),
 ('generation hydro pumped storage consumption', 0.8355927384239982),
 ('generation hydro run-of-river and poundage', 1.0237063488378018),
 ('generation hydro water reservoir', 0.7622237450543269),
 ('generation nuclear', 1.5984300786377046),
 ('generation other', 25.37956627131593),
 ('generation other renewable', 0.1898457036322569),
 ('generation solar', 5.038319534780343),
 ('generation waste', 0.7221326627829598),
 ('forecast solar day ahead', 0.16804641775955487),
 ('forecast wind onshore day ahead', -47.690465275811555),
 ('temp', 13.86905566067803),
 ('temp_min', 38.52572305556877),
 ('temp_max', 7.9733411821491895),
 ('pressure', -0.2929945775795066),
 ('humidity', -18.900551238780004),
 ('wind_speed', -0.1444532722806465),
 ('wind_deg', 42.563786630824474),
 ('rain_1h', -386.6082922708906),
 ('rain_3h', 130.4811689091507),
 ('snow_3h', 1.9154723970287781),
 ('clouds_all', -0.3371964738807562),
 ('weather_id', 0.5721622021935406)]
```

Mean Absolute Error:
1067.398643815028

Mean Square Error:
1833561.0212909752

Root Mean Square Error:
1354.0904775128488

Price Prediction Visualization and Parameters for Madrid



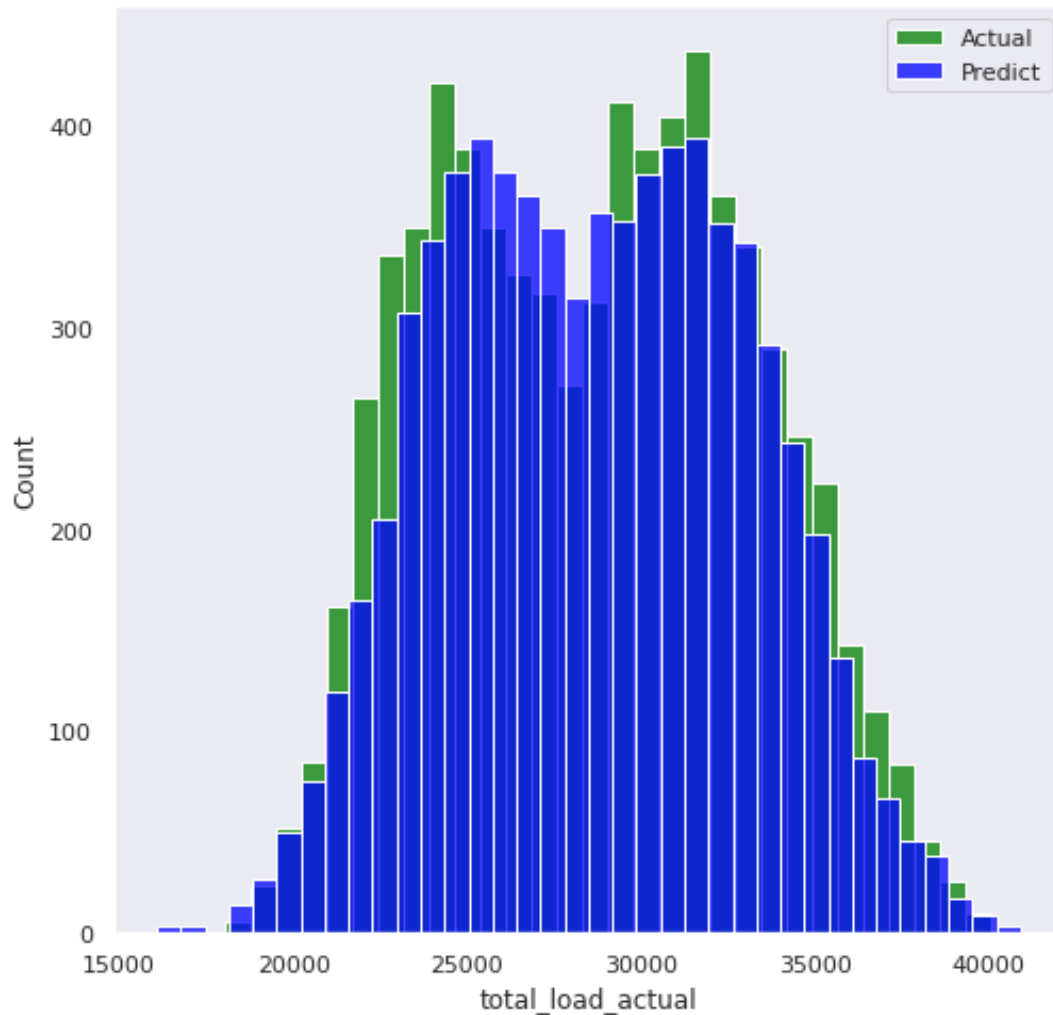
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Intercept: 11.894260276844655
Coefficients:
[('time', 0.024181654207563085),
 ('generation biomass', 0.0001644581464978233),
 ('generation fossil brown coal/lignite', 0.0012640790571589902),
 ('generation fossil gas', 0.002157992523730713),
 ('generation fossil hard coal', -0.01175548475337805),
 ('generation fossil oil', -0.0033012829296573992),
 ('generation hydro pumped storage consumption', 0.001844192120781705),
 ('generation hydro run-of-river and poundage', 0.00047061940410166676),
 ('generation hydro water reservoir', 0.00015693808344528318),
 ('generation nuclear', 0.03508246940910179),
 ('generation other', 0.299052465246851),
 ('generation other renewable', 0.0008982637192364982),
 ('generation solar', -0.009932384914090054),
 ('generation waste', -0.00031029787171190585),
 ('forecast solar day ahead', 0.000551217174972176),
 ('forecast wind onshore day ahead', 1.1964933842729557),
 ('temp', -0.653821884591373),
 ('temp_min', -0.46563125844295256),
 ('temp_max', -0.02584217512176704),
 ('pressure', 0.03278142157422632),
 ('humidity', -1.6873589086121707),
 ('wind_speed', 0.0007008229006082173),
 ('wind_deg', -1.3201370160634336),
 ('rain_1h', -54.57952284990432),
 ('rain_3h', -12.779601363896079),
 ('snow_3h', -0.018493684751690158),
 ('clouds_all', -0.0033856287898219877),
 ('weather_id', 0.0002448354050448703)]
```

Mean Absolute Error:
8.310743562696842

Mean Square Error:
117.06963239502228

Root Mean Square Error:
10.819872106222988

Load Prediction Visualization and Parameters for Bilbao



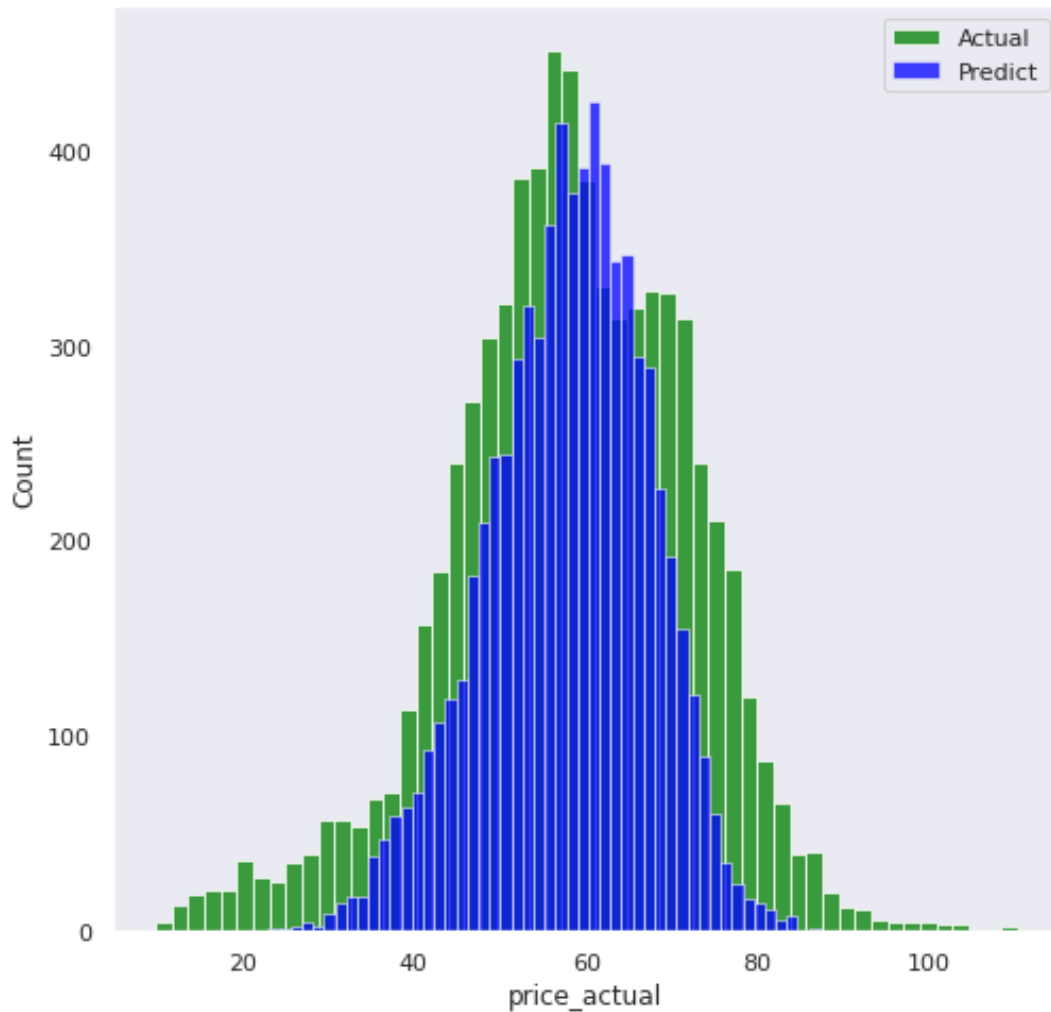
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Intercept: -7933.322846177267
Coefficients:
[('time', 1.6474434754173328),
 ('generation biomass', 0.9079996067360601),
 ('generation fossil brown coal/lignite', 0.77087723797032),
 ('generation fossil gas', 0.6951284046868617),
 ('generation fossil hard coal', 7.5111744398834634),
 ('generation fossil oil', -1.340796241584494),
 ('generation hydro pumped storage consumption', 0.8570374253812696),
 ('generation hydro run-of-river and poundage', 1.0183867533463635),
 ('generation hydro water reservoir', 0.7771692918471154),
 ('generation nuclear', 2.637818128077632),
 ('generation other', 26.0944999382093),
 ('generation other renewable', 0.15492166873645075),
 ('generation solar', 5.171449925398985),
 ('generation waste', 0.7429177367282157),
 ('forecast solar day ahead', 0.2030246034326004),
 ('forecast wind onshore day ahead', 48.4003266859989),
 ('temp', -43.202182499285094),
 ('temp_min', 7.138199269600862),
 ('temp_max', 5.574074310005712),
 ('pressure', -1.8083670671114924),
 ('humidity', 13.988481535146823),
 ('wind_speed', -0.1592223011161117),
 ('wind_deg', -26.260149846913095),
 ('rain_1h', -593.8906534032648),
 ('rain_3h', -55.901679134313994),
 ('snow_3h', 0.8290461517914213),
 ('clouds_all', 0.1388188936304404),
 ('weather_id', 0.5273551570000025)]
```

Mean Absolute Error:
1052.883956648994

Mean Square Error:
1760538.623695371

Root Mean Square Error:
1326.8529020563549

Price Prediction Visualization and Parameters for Bilbao



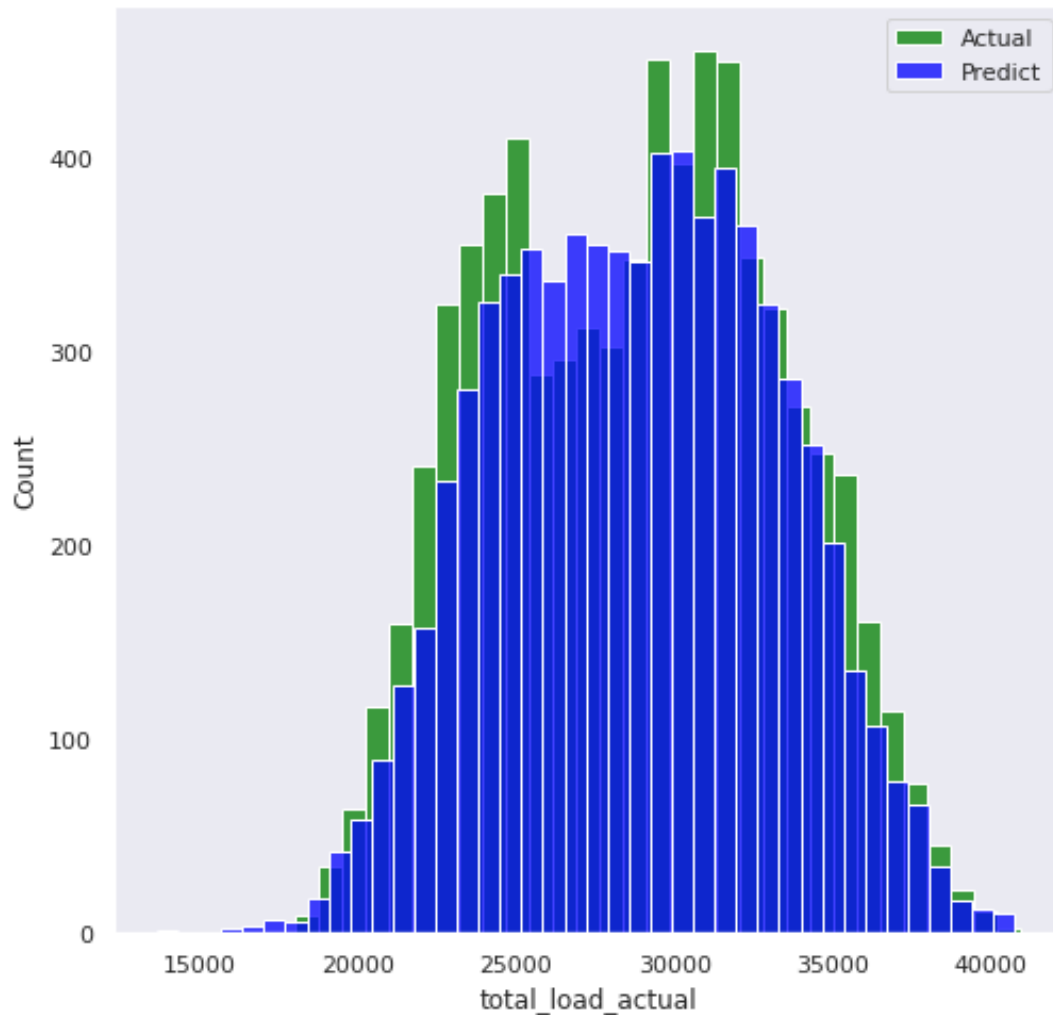
```
Intercept: -264.9875160927302
Coefficients:
[('time', 0.02421273006812835),
 ('generation biomass', 0.0001700130610189402),
 ('generation fossil brown coal/lignite', 0.00129333705866412096),
 ('generation fossil gas', 0.0023086580338388713),
 ('generation fossil hard coal', -0.017115213066513018),
 ('generation fossil oil', -0.0030332053922834017),
 ('generation hydro pumped storage consumption', 0.0012964612572199277),
 ('generation hydro run-of-river and poundage', 0.0007505640148763152),
 ('generation hydro water reservoir', 0.00023856889222044912),
 ('generation nuclear', 0.036744656780580316),
 ('generation other', 0.30323502540897634),
 ('generation other renewable', -0.00013286647413291697),
 ('generation solar', -0.009887163355384592),
 ('generation waste', 0.0007955293760423441),
 ('forecast solar day ahead', 0.0004668837186271891),
 ('forecast wind onshore day ahead', -3.565411079389566),
 ('temp', 1.9664285715314622),
 ('temp_min', 1.7531777643809239),
 ('temp_max', 0.21736222059556556),
 ('pressure', 0.0886701951037559),
 ('humidity', -0.8778154530083097),
 ('wind_speed', 3.367266694289205e-05),
 ('wind_deg', -0.8577859810807632),
 ('rain_1h', -1.9235547960301158),
 ('rain_3h', 1.0244348722570833),
 ('snow_3h', -0.055106636685623295),
 ('clouds_all', -0.001170692586786625),
 ('weather_id', 0.0003540764210886261)]
```

Mean Absolute Error:
8.186147227315615

Mean Square Error:
111.90468597854891

**Root Mean Square
Error:**
10.57850112154595

Load Prediction Visualization and Parameters for Barcelona



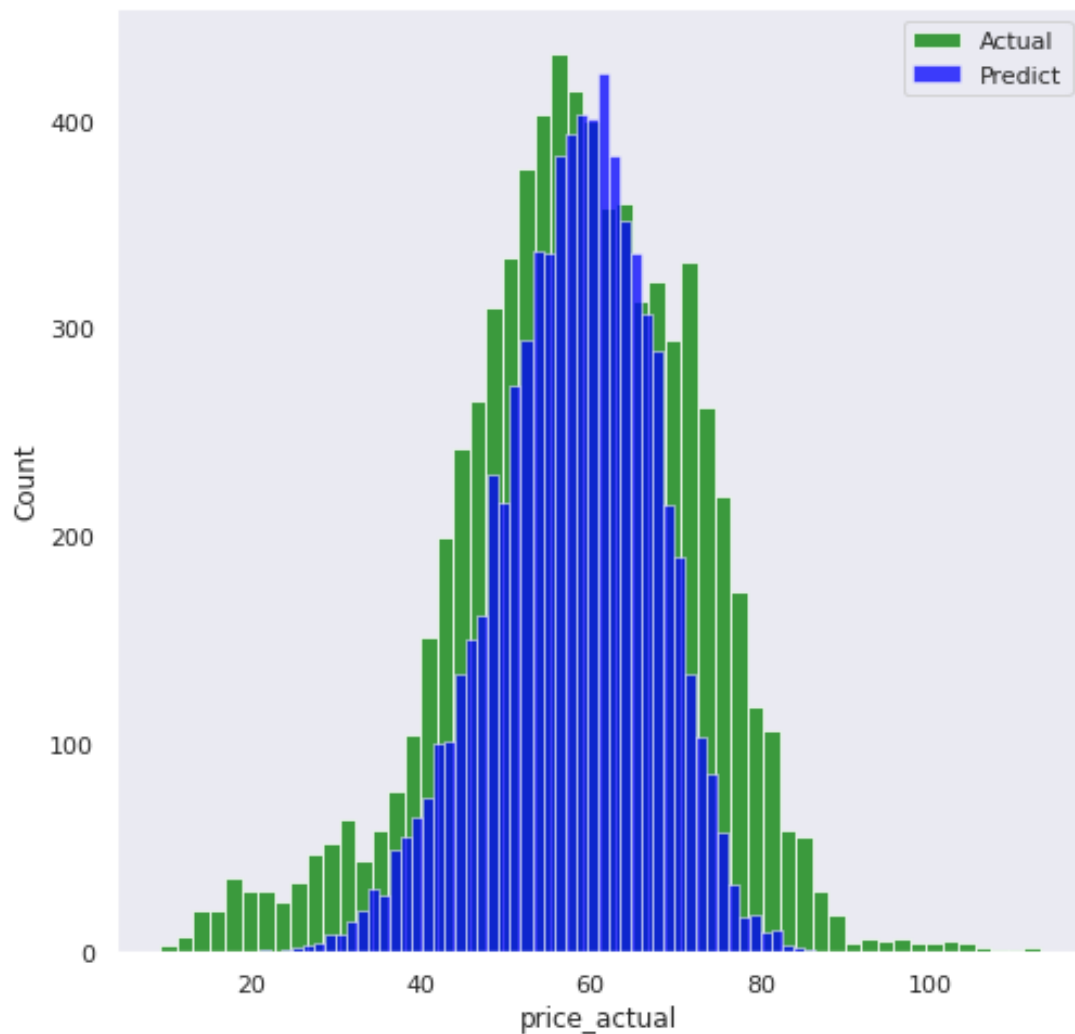
```
Intercept: -15794.508683589855
Coefficients:
[('time', 1.7984637378468995),
 ('generation biomass', 0.9189573418759472),
 ('generation fossil brown coal/lignite', 0.7739446136778058),
 ('generation fossil gas', 0.6910802887460649),
 ('generation fossil hard coal', 7.404484420291515),
 ('generation fossil oil', -1.3383670104402208),
 ('generation hydro pumped storage consumption', 0.8305560984441042),
 ('generation hydro run-of-river and poundage', 1.0232366421894712),
 ('generation hydro water reservoir', 0.7769761822997941),
 ('generation nuclear', 1.306669174279282),
 ('generation other', 26.726362261630058),
 ('generation other renewable', 0.12983199286945446),
 ('generation solar', 5.40653547990435),
 ('generation waste', 0.7644260086478123),
 ('forecast solar day ahead', 0.14851970990581595),
 ('forecast wind onshore day ahead', -49.028429051429974),
 ('temp', 33.5422490907212),
 ('temp_min', 26.730986069559435),
 ('temp_max', 13.648631655224372),
 ('pressure', -2.5956401201292656),
 ('humidity', 13.34686505369809),
 ('wind_speed', -0.09336028364662075),
 ('wind_deg', -22.73328176871438),
 ('rain_1h', -1823.8008571636244),
 ('rain_3h', 7.975842208907125e-11),
 ('snow_3h', 0.3347391805704546),
 ('clouds_all', 0.11409568675570757),
 ('weather_id', 0.5870993957810768)]
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Mean Absolute Error:
8.230964392297272

Mean Square Error:
115.1089008793654

Root Mean Square Error:
10.72888162295425

Price Prediction Visualization and Parameters for Barcelona



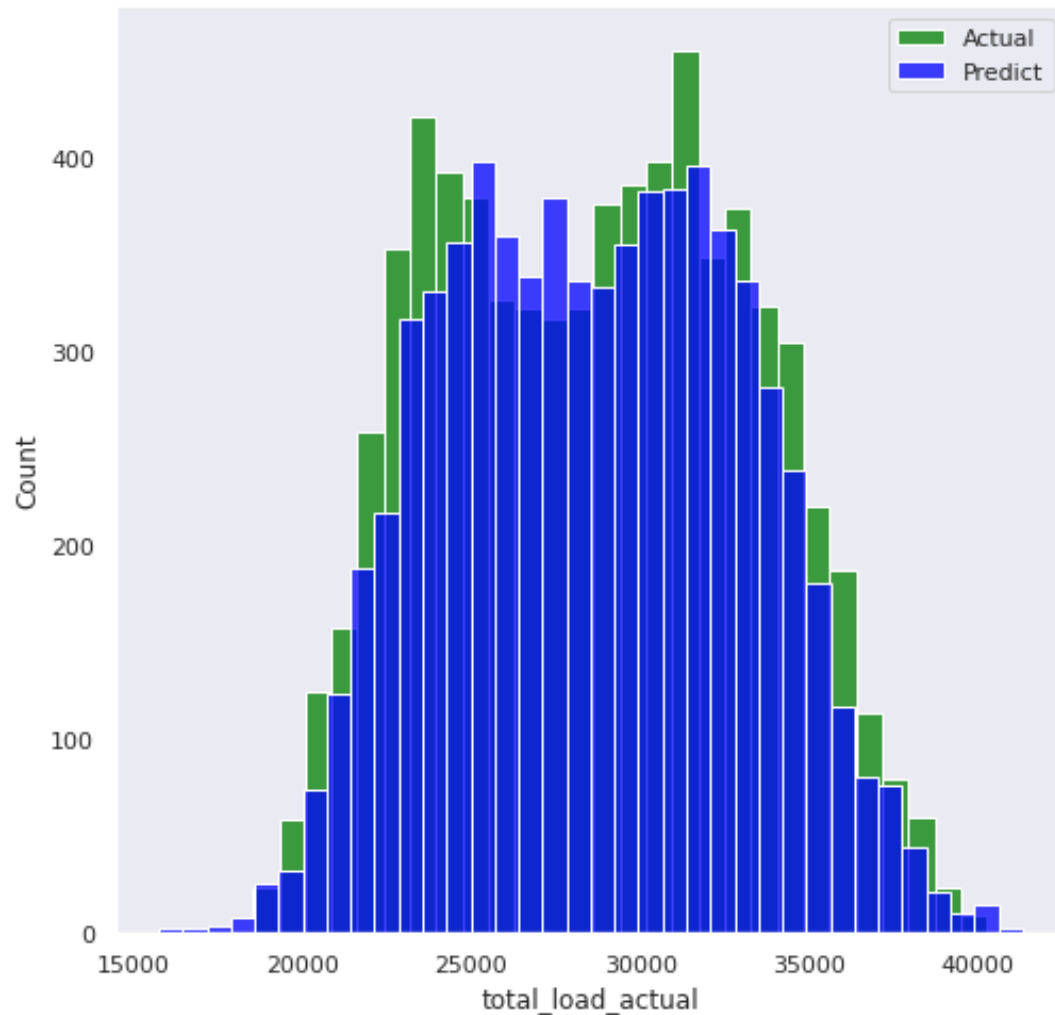
```
Intercept: -448.95003699297274
Coefficients:
[('time', 0.03057483939529687),
 ('generation biomass', -0.0005822524438395003),
 ('generation fossil brown coal/lignite', 0.001404730376090587),
 ('generation fossil gas', 0.002244976054453624),
 ('generation fossil hard coal', -0.01534952766804469),
 ('generation fossil oil', -0.002878849295928543),
 ('generation hydro pumped storage consumption', 0.002780287959480518),
 ('generation hydro run-of-river and poundage', 0.000535429722261983),
 ('generation hydro water reservoir', 2.8887106540253785e-05),
 ('generation nuclear', 0.04062669785113812),
 ('generation other', 0.3126739585522758),
 ('generation other renewable', -0.00028526739783860073),
 ('generation solar', -0.008147526970560889),
 ('generation waste', 0.0008666958644143154),
 ('forecast solar day ahead', 0.0007355943381520448),
 ('forecast wind onshore day ahead', 0.2895573395667164),
 ('temp', -0.1081828602650385),
 ('temp_min', -0.07675877768447446),
 ('temp_max', 0.4124531079341597),
 ('pressure', 0.030562431086032717),
 ('humidity', -0.7102242563568172),
 ('wind_speed', -0.0029553410659568925),
 ('wind_deg', -0.33881347685359986),
 ('rain_1h', -46.01625908522218),
 ('rain_3h', 2.014083344548112e-12),
 ('snow_3h', 0.001293966837924975),
 ('clouds_all', -0.00267762586427006),
 ('weather_id', 1.44159620988685e-05)]
```

Mean Absolute Error:
8.310743562696842

Mean Square Error:
117.06963239502228

Root Mean Square Error:
10.819872106222988

Load Prediction Visualization and Parameters for Seville



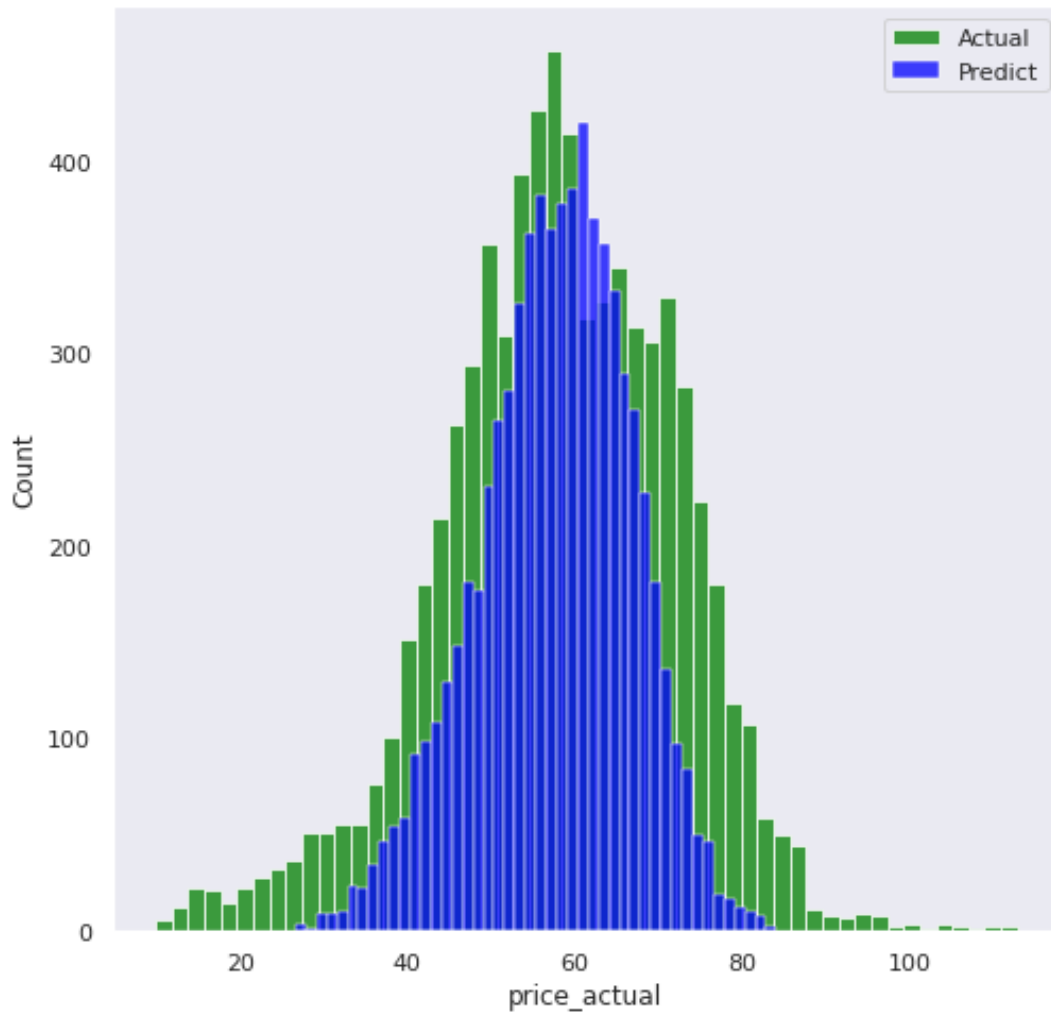
```
Intercept: -12708.654339301142
Coefficients:
[('time', 1.8160269180669004),
 ('generation biomass', 0.8721716122937437),
 ('generation fossil brown coal/lignite', 0.7801368680014107),
 ('generation fossil gas', 0.6887963545932493),
 ('generation fossil hard coal', 7.524274790465727),
 ('generation fossil oil', -1.3481578283632358),
 ('generation hydro pumped storage consumption', 0.8676414460133622),
 ('generation hydro run-of-river and poundage', 1.0076145292712182),
 ('generation hydro water reservoir', 0.7609457310240898),
 ('generation nuclear', 1.5612921728022495),
 ('generation other', 28.161328595990316),
 ('generation other renewable', 0.14293326514828536),
 ('generation solar', 5.596701355382088),
 ('generation waste', 0.755195733445089),
 ('forecast solar day ahead', 0.23103417249248848),
 ('forecast wind onshore day ahead', -48.061422709441885),
 ('temp', 16.570391689047764),
 ('temp_min', 41.093884714842574),
 ('temp_max', 11.17312945573103),
 ('pressure', -0.1200546876108164),
 ('humidity', 44.03741235770867),
 ('wind_speed', -0.2962781914960852),
 ('wind_deg', -138.13094176435504),
 ('rain_1h', 4898.2630763939405),
 ('rain_3h', 1.9750245883187745e-10),
 ('snow_3h', -0.7314869349273376),
 ('clouds_all', -0.5960554752479827),
 ('weather_id', 0.49950399615043994)]
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Mean Absolute Error:
1054.1179983221664

Mean Square Error:
1791182.334841933

Root Mean Square Error:
1338.3506023617028

Price Prediction Visualization and Parameters for Seville



```
Intercept: -189.4458610086408
Coefficients:
[('time', 0.026896431515526537),
 ('generation biomass', 0.00018858841199097297),
 ('generation fossil brown coal/lignite', 0.0012976550547483387),
 ('generation fossil gas', 0.002138638254168848),
 ('generation fossil hard coal', -0.015239068825691489),
 ('generation fossil oil', -0.0032456073496385093),
 ('generation hydro pumped storage consumption', 0.0017022713609854737),
 ('generation hydro run-of-river and poundage', 0.0005452712275025811),
 ('generation hydro water reservoir', 4.090694559544252e-05),
 ('generation nuclear', 0.0428444775466713),
 ('generation other', 0.3064037095143871),
 ('generation other renewable', -0.00035059697817467104),
 ('generation solar', -0.009983196364704437),
 ('generation waste', 0.0006601986599199617),
 ('forecast solar day ahead', 0.0006045192034256605),
 ('forecast wind onshore day ahead', 1.0068885095830666),
 ('temp', -0.39126915569162246),
 ('temp_min', -0.5143678679141891),
 ('temp_max', 0.16348496420452893),
 ('pressure', 0.018818287047441234),
 ('humidity', -0.39760492638232164),
 ('wind_speed', -0.011932269192350603),
 ('wind_deg', 0.4740569696379207),
 ('rain_1h', 39.85933200651268),
 ('rain_3h', 1.6062151608764452e-12),
 ('snow_3h', -0.02427675190395124),
 ('clouds_all', -8.91819943912544e-05),
 ('weather_id', -2.6105485432233678e-05)]
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Mean Absolute Error:
8.38514986264404

Mean Square Error:
117.95103877590937

Root Mean Square Error:
10.860526634372265