# Market Analysts Position - Recruitment process:
# Example tasks

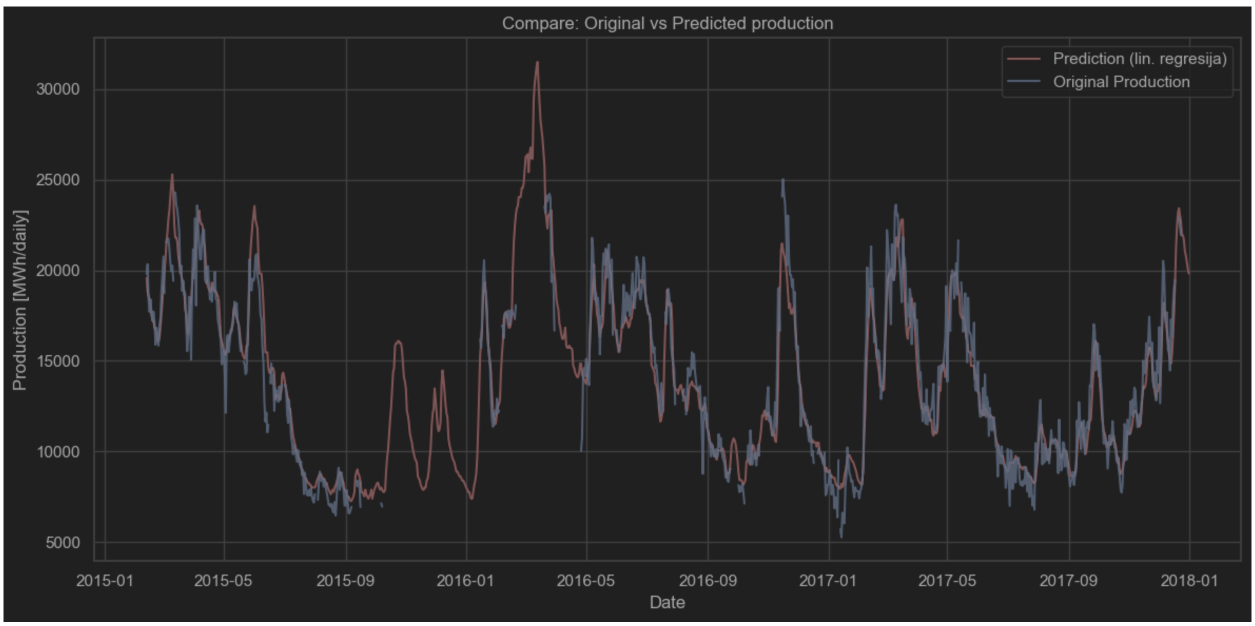
## 1. Hydro Production Forecast Model

*In a given dataset 'Hydro.xlsx' one can find realized production of Iron Gate hydro power plant which is located on the Serbian and Romanian border (Wiki) and river inflow just before the power generators on a daily resolution.*

*Build a linear numerical model which describes the relationship between river inflow and electricity production.*

$y = f(x) = k * x + n$, *where* $x$ *– is river flow [m3/s] and* $y$ *– realized daily energy production [MWh/day]*

***Answer: Linear numerical model for describing the relationship between river inflow and electricity production:*** $\boldsymbol{y = 2.4841 * x + 1935.0854}$




*Based on your model determine what will be daily energy production at river inflow of 4000 [m3/s] and 11000 [m3/s]?*

***Answer:***

**Production [MWh/daily] with river inflow of 4000 [m3/s] would be 11871.36**
**Production [MWh/daily] with river inflow of 11000 [m3/s] would be 29259.83**

*Can you develop a non-linear model that would better describe the relationship between river flow and energy production?*

***Answer:***

**Yes, we can develop a non-linear model (e.g., polynomial regression or neural network) that slightly improves performance. However, the improvement in accuracy is minimal compared to the increased model complexity. Given the current features, the linear model already captures the relationship well, and more complex models do not provide significant gains in predictive power. Thus, the linear model remains the most efficient and interpretable choice for this problem.**

*Hydro production model has now been built on historical data of measured/realized river flow. Think about a daily forecasting process, what would an analyst need to forecast daily energy production for a few days ahead? Which data would be needed and how would you get it? Present your idea in a short paragraph.*

**Answer:**

**To forecast daily energy production for a few days ahead, an analyst would need reliable short-term forecasts of river flow, which depend heavily on weather conditions. Therefore, access to meteorological data (e.g., from local weather stations or numerical weather prediction models) such as precipitation, temperature, and snowmelt forecasts would be essential. The analyst could either build a model to predict river flow based on this data or directly use existing hydrological forecasts. Additionally, using more extensive historical time series data would allow for the development of autoregressive or sequence-based models (e.g., RNN, LSTM) that can capture temporal dependencies. Combining these approaches would enable more accurate and robust short-term predictions of hydro energy production.**

*There are various factors that affect electricity prices on wholesale exchanges. Apart of hydro production, what are, in your opinion, those factors that are influencing electricity prices on a daily basis? Do you expect any significant changes on electricity markets in the following years?*

**Answer:**

**Several factors influence electricity prices on wholesale markets. Besides hydro production, key drivers include demand levels (which depend on temperature, season, and economic activity), availability and costs of other energy sources (e.g., gas, coal, nuclear, renewables), fuel prices, $CO_2$ emission allowance prices, grid constraints, and cross-border energy flows. Market dynamics are also affected by policy and regulatory changes. In the coming years, significant changes are expected due to the growing**

**integration of renewable energy sources (solar, wind), increased electrification (e.g., EVs), decentralization (e.g., prosumers), and advancements in energy storage. These trends are likely to make electricity markets more volatile but also more flexible and responsive.**

## 2. Price value of electricity

*File data_1.csv contains the following data:*

- *Hourly price of power [€/MWh]*
- *Hourly production of solar power plants in Slovenia [MWh]*
- *Hourly production of hydro power plants in Slovenia [MWh]*
- *Hourly production of wind power plants in Slovenia [MWh]*
- *Hourly production of nuclear power plant in Slovenia [MWh]*
- *Hourly production of lignite power plants in Slovenia [MWh]*
- *Hourly power consumption of Consumer X [kWh]*

*Timestamp in the first column represents start of the hourly period. For example, line starting with 1.1.2020 00:00 represents the hour between 1.1.2020 00:00 in 1.1.2020 01:00.*
*Helpful definitions used in the questions:*

- *Baseload trading product represents equally distributed power each hour throughout the delivery period.*
- *Peakload trading product represents power between 8:00 and 20:00 from Monday to Friday (60 hours per week) in the selected period – equally distributed at each hour that meet the criteria.*

*What's the price value of*

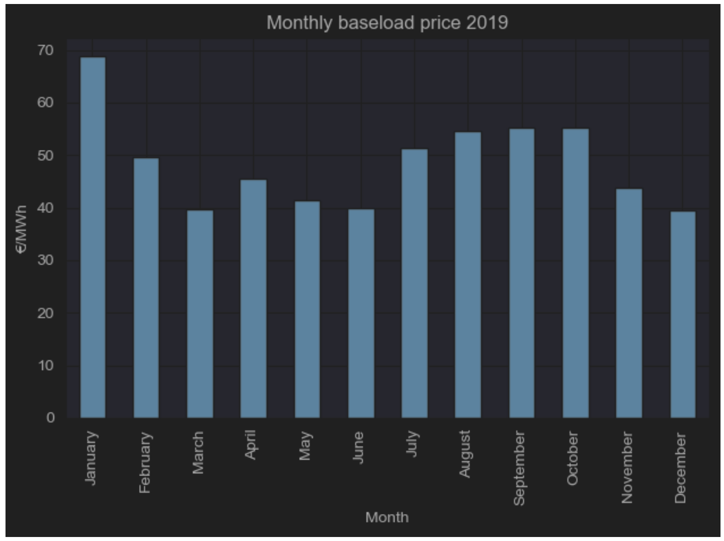
*baseload product for the whole year 2019 in €/MWh?*

**Answer: Baseload product avg price for 2019: 48.75 €/MWh**

*What about the value of individual months throughout the 2019 be?*

**Answer**:

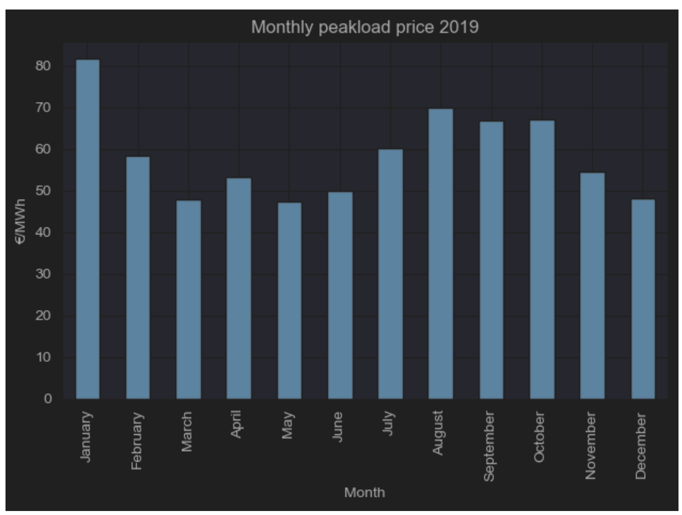
| | |
|---|---|
| **January** | **68.764946** |
| **February** | **49.704524** |
| **March** | **39.585491** |
| **April** | **45.614597** |
| **May** | **41.317473** |
| **June** | **39.970778** |
| **July** | **51.245188** |
| **August** | **54.588481** |
| **September** | **55.334889** |
| **October** | **55.216658** |
| **November** | **43.839569** |
| **December** | **39.512782** |




*Calculate the price value of individual monthly peakload products for year 2019.*

**Answer:**

| | |
|---|---|
| **January** | **81.604638** |
| **February** | **58.295583** |
| **March** | **47.948611** |
| **April** | **53.210909** |
| **May** | **47.296341** |
| **June** | **49.836292** |
| **July** | **60.180036** |
| **August** | **69.953561** |
| **September** | **66.917103** |
| **October** | **67.110072** |
| **November** | **54.577698** |
| **December** | **48.133939** |

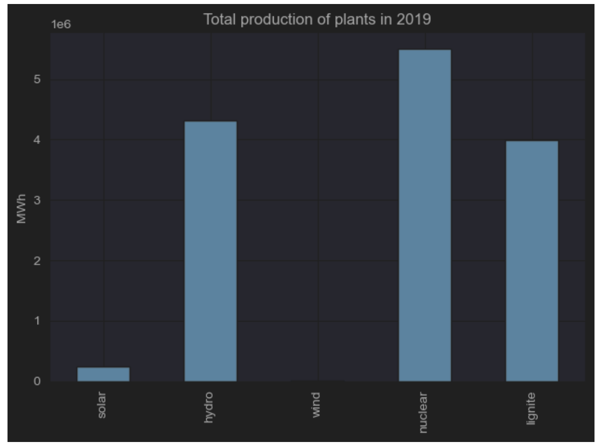


*How much of electricity in*

*MWh was produced by individual power plants in 2019 in Slovenia.*

**Answer:**

**solar 245268.0**
**hydro 4309297.0**
**wind 4636.0**
**nuclear 5499420.0**
**lignite 3997051.0**




*What was the total consumption of Consumer X in MWh?*

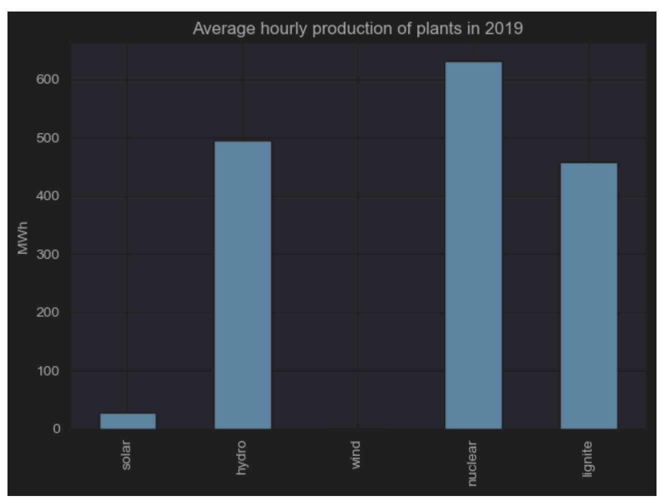
**Answer: Total consumption of consumer X in MWh for year 2019 was 8842.75 [MWh]**

*Calculate the*

*average value of power produced by power plant type in 2019.*

**Answer:**

**solar 28.005024**
**hydro 494.752813**
**wind 0.532262**
**nuclear 631.391504**
**lignite 458.903674**




*What is average value of power consumed by the consumer X?*

**Answer: Average Hourly consumption of consumer X in MWh for year 2019 was 1.01 [MWh]**

## 3. *Price scenarios

**This task is additional one and therefore optional.*

*Analyst has prepared 100 different scenarios of price movements of an unknown product and saved them in file data_2.csv. Unit used is €/MWh.*

*What is the expected value of the product on 1.4.2020?*

**Answer: Expected value of the product on 1.4.2020 is 48.14 €/MWh**

*Colleagues are preparing an algorithm that is going to trade with this product. Number of trades is not limited, but algorithm can own at most one unit of the product at the time. Algorithm is not allowed to sell more units than it has bought. Due to an error made during the creation of the testing environment, the algorithm knows the price of the following day, so it always makes the best possible trades.*

*Calculate the profit of the algorithm in scenario #77. Keep in mind that on the last trading day algorithm has to sell any purchased products that it has not already sold before. Profit is calculated as a difference between selling and buying price.*

**Answer:**
**Final absolute profit: 24.78 EUR**
**Final relative profit: 51.88 %**

*Calculate the profit of the algorithm for other scenarios as well. Which scenario would be the most profitable for the c) algorithm?*

**Answer: Most profitable Scenario is Scenarij_48 with total profit 39.81 EUR and relative profit 71 %**

*Our trading partner offers us a call option, which would give us the right, but not the obligation, to buy the product on 1.4.2020 at 55 €/MWh, regardless of the market price on that day.*

*Using the given price movement scenarios, calculate the value of the offered option product.*

**Answer: Value of call option with strike price 55 € on 1.4.2020 is 0.31 €/MWh**