Final Report

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1 Introduction

Is the hourly electrical energy production in Germany correlated with the mean temperature of Germany? This question will be investigated in this project. Previously, an extensive data pipeline was described that retrieves data, such as weather data from various selected cities and the hourly electrical energy consumption of the entire country.

In this final report, the final data at the end of the data pipeline will be further analyzed and discussed. Firstly, the structure of the data used will be illustrated. Subsequently, an analysis to determine whether a correlation exists will be described. The time interval considered is from January 1, 2015, to December 31, 2023.

2 Data Used

In this section, we will briefly discuss the structure of the different tables in the SQL database and then place them in context.

2.1 Data Structure

The output of the data pipeline consists of nine tables. Each of the eight cities has a table with hourly recorded temperatures. Each table is named after the city where the weather station is located, as shown in Table 1.

For the energy production, a separate table exists. This table records hourly energy production. In addition to the total energy production, there are two columns that distinguish between conventional and renewable energy. Table 2 illustrates this structure.

MESS_DATUM	Temperature

Table 1: Column structure of each weather station table.

MESS_DATUM	Renewable Energy	Conventional Energy	Total

Table 2: Column structure of the energy production table.

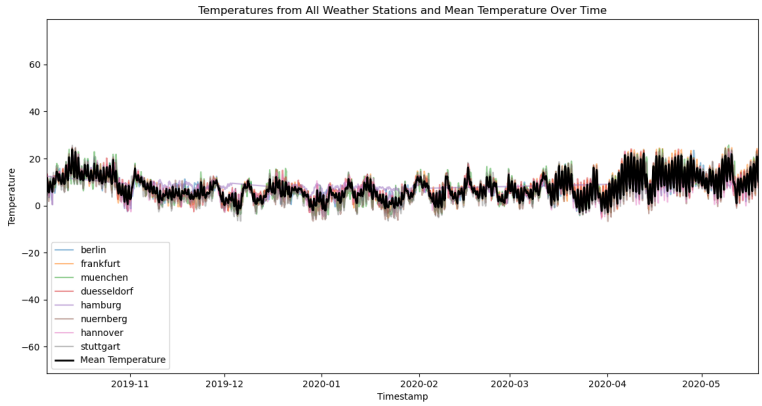

Figure 1: Comparison of mean temperature to all weather stations.

2.2 Data Meaning

The data is stored in different units. The temperature from the weather stations is recorded in Celsius, while energy is listed in megawatt hours. The time is saved in the `yyyymmddhh` format for all tables.

3 Analysis

Several steps were necessary for a brief analysis of the prepared data. Firstly, since the weather station data was not in the form of a mean but individual temperatures, the mean had to be calculated. Figure 1 shows a plot with all temperatures from a specific time interval. As seen, the deviation from the mean for each weather station is not too high, and there is generally no opposite trend that would diverge from the mean.

Additionally, examining energy production reveals different patterns. Figure 2 illustrates this for the year 2016. We can infer that the day and night cycle plays a significant role, as less electricity is needed during the night compared to the day. Furthermore, a seasonal pattern is notable: during the winter season, an increase in energy production is evident.

Next, we attempt to find any correlation between electrical energy production and temperature changes. Figure 3 illustrates this with a correlation matrix. The correlation matrix reveals several key relationships between the variables: mean temperature, renewable energy production (Erneuerbare Energie), conventional energy production (Konventionelle Energie), and total energy pro-

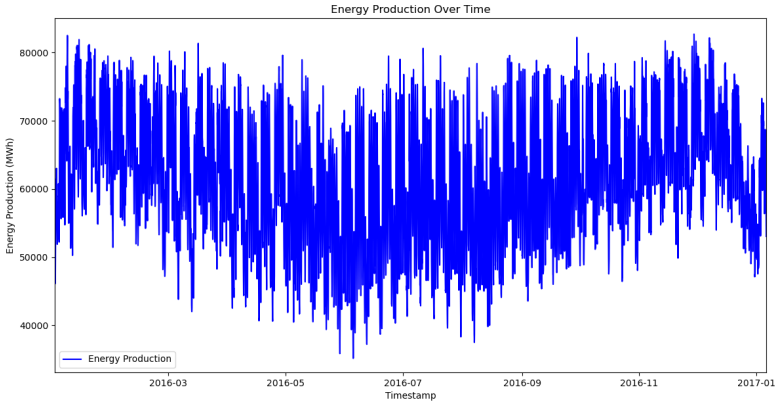

Figure 2: Energy production for 2016.

duction (energy_production). Renewable and conventional energy productions are moderately negatively correlated (-0.51), indicating that as one increases, the other tends to decrease. Mean temperature has a weak positive correlation with total energy production (0.16) and conventional energy production (0.12), while its correlation with renewable energy production is almost negligible (0.038). This suggests that temperature has a limited direct impact on individual types of energy production but may have a slight overall influence on total energy output.

4 Conclusions

From this brief analysis, we conclude that there is no strong direct correlation between the mean temperature of Germany and its electrical energy production. This suggests that other factors, such as the day/night cycle or seasonal patterns, have a greater influence on energy production.

Further investigation with greater detail would be more helpful to analyze whether weather and sudden weather extremes have a direct impact on energy production. It is suggested that more regional data evaluations be conducted for more precise results. Future experiments could use the energy consumption data of a major city and compare it to weather impacts. Additionally, defining temperature extremes prior as weather extremes and then inspecting if energy consumption increased during these events could be beneficial.

In conclusion, this project successfully gathered a vast amount of data, and the data pipeline can be deemed a success. However, due to the large generalization of data, in-depth analysis was challenging.

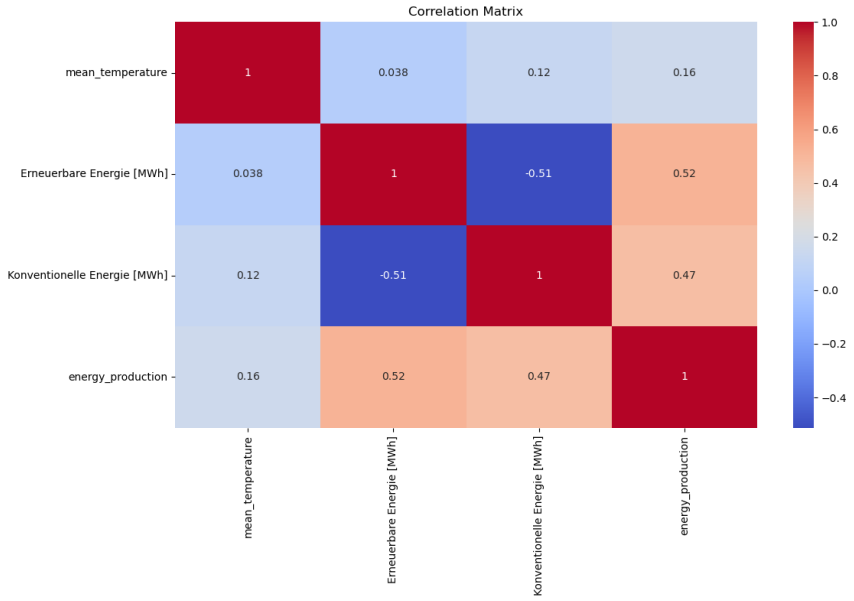

Figure 3: Correlation matrix of the mean temperature with the total, conventional and renewable energy production.