Documentation of Dashboard

Data

The energy data chosen is supplied by Swiss Federal Office of Energy (SFOE). The Swiss Federal Office of Energy (SFOE) is the country's competence centre for issues relating to energy supply and energy use at the Federal Department of the Environment, Transport, Energy and Communications (DETEC). Specifically, 3 datasets were chosen:

1. Electricity Price Spot Market "Day Ahead" Base Switzerland
2. Electricity production Swissgrid
3. Nation and Final Electricity consumption

Data Preparation

The first dataset has been consumed as is. The other 2 datasets required some preparation steps which have been described below.

Electricity Production Data - Pivoting Rows to Columns

- As one can see in Figure 1, the original dataset used 1 row per date per energy type to list the electricity production. As a result, the dataset was abnormally long (in terms of number of rows).

Preview **ogd104_stromproduktion_swissgrid** 4 fields

		#	Datum	Abc Energietraeger	# Produktion_GWh
2	···	1	01/01/2015	Flusskraft	22.6
3	···	2	01/01/2015	Kernkraft	79.6
4	···	3	01/01/2015	Photovoltaik	1.2
5	···	4	01/01/2015	Speicherkraft	38.7
6	···	5	01/01/2015	Thermische	10.4
7	···	6	01/01/2015	Wind	0.1
8	···	7	02/01/2015	Flusskraft	22.9
9	···	8	02/01/2015	Kernkraft	79.6
10	···	9	02/01/2015	Photovoltaik	0.8
11	···	10	02/01/2015	Speicherkraft	46.8
12	···	11	02/01/2015	Thermische	10.4
13	···	12	02/01/2015	Wind	0.5
14	···	13	03/01/2015	Flusskraft	25.4
15	···	14	03/01/2015	Kernkraft	79.5
16	···	15	03/01/2015	Photovoltaik	0.5
17	···	16	03/01/2015	Speicherkraft	31.3
18	···	17	03/01/2015	Thermische	10.4
19	···	18	03/01/2015	Wind	0.5

Figure 1.

- A rows to columns pivot was performed such that each energy type was transformed into a new column with corresponding values of electricity produced. This shortened the length of the dataset since now each date corresponded to only 1 row.

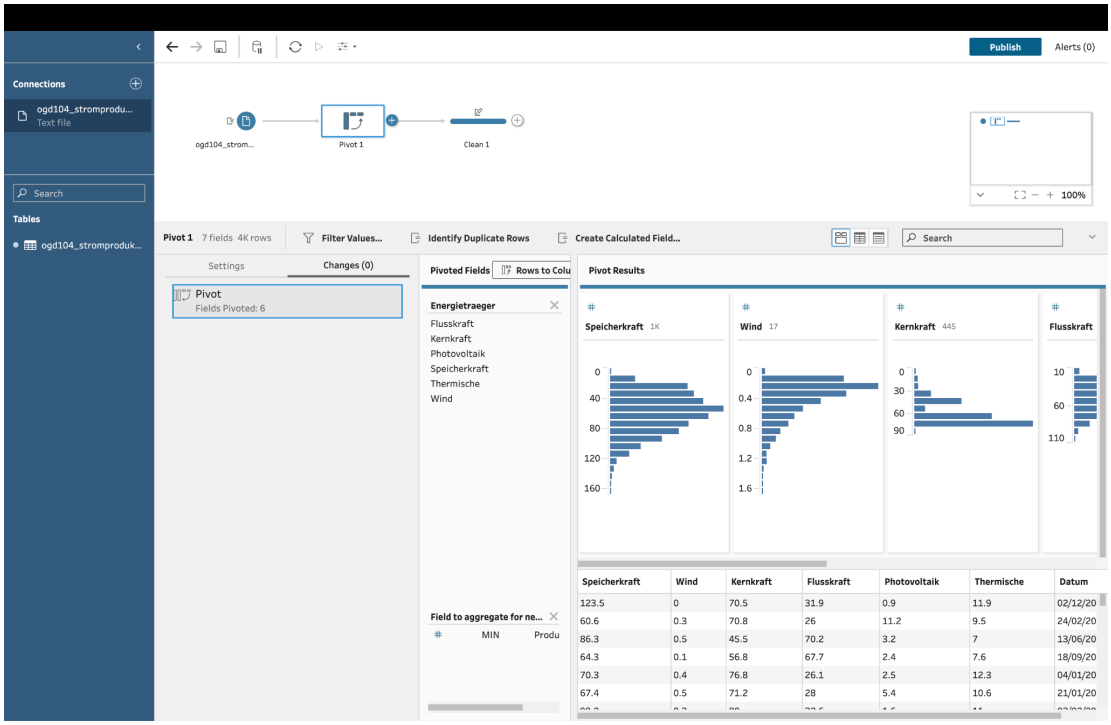


Figure 2.

- Finally, the columns were renamed from German to English since the final dashboard will be created in English.

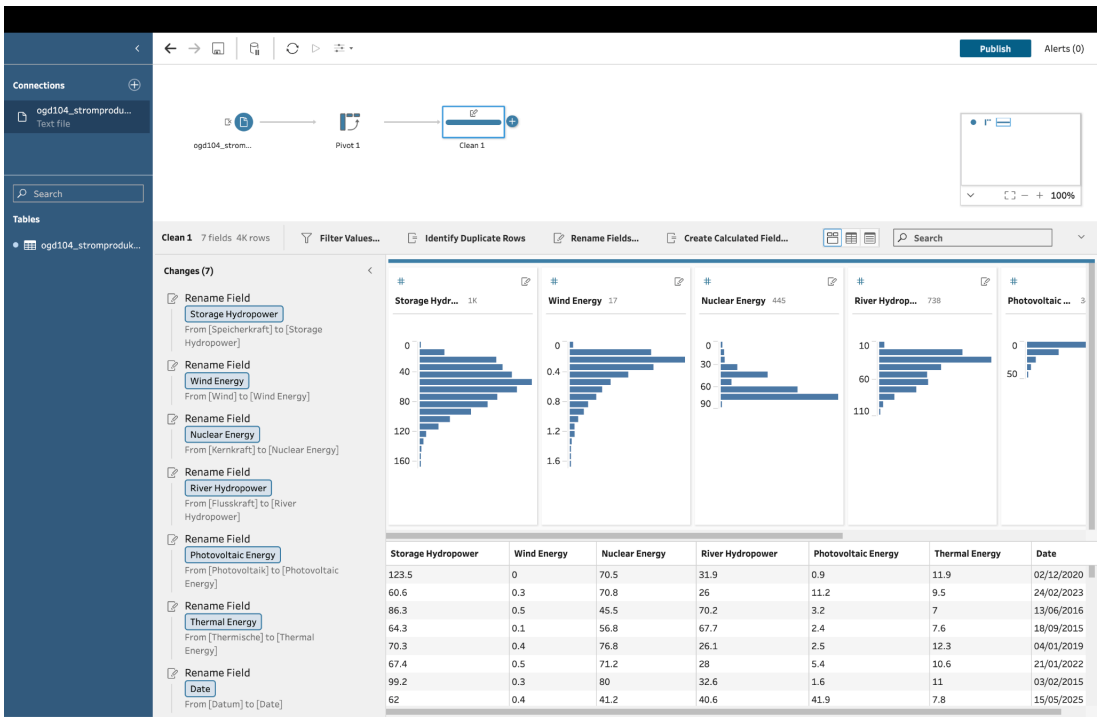


Figure 3.

Electricity Consumption Data - Handling Null and Duplicate values

- This dataset consisted of a few rows containing null or duplicate values i.e. multiple rows with the same data value were present.
- The null values were handled in the first *Clean* step. 3 rows containing *NULL* values were excluded. Furthermore, the column names were renamed from German to English.

Also, a new column “Federal Consumption” was created and its values computed as a difference of the other 2 columns. The calculation is expressed in Figure 4.

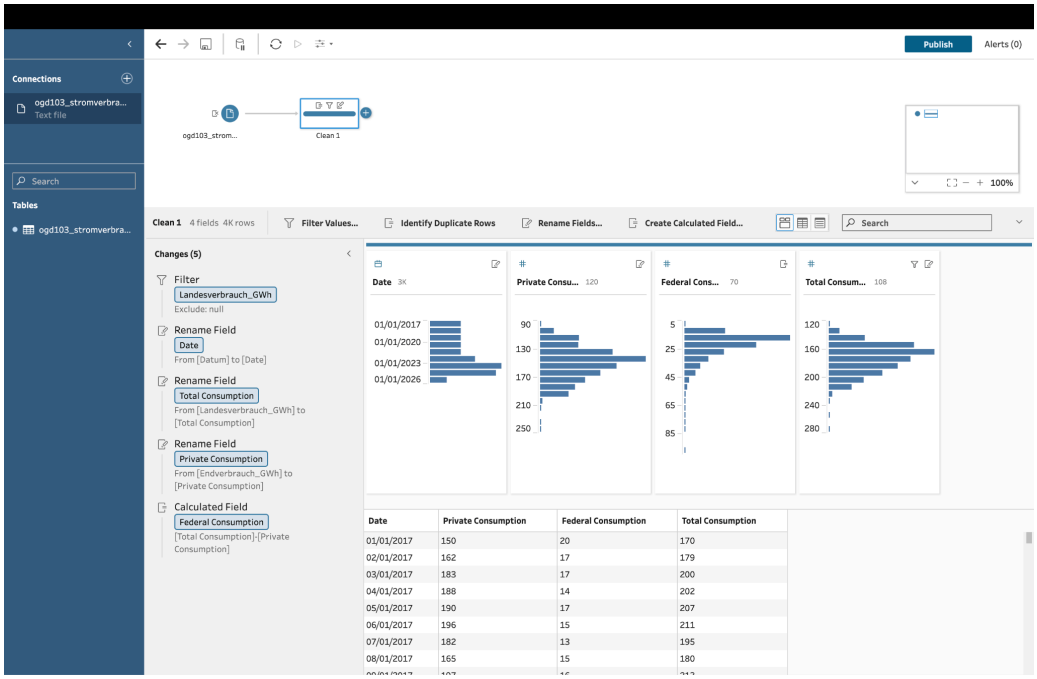


Figure 4.

- In the second *Clean* step, rows containing duplicate values in the Date column were excluded.

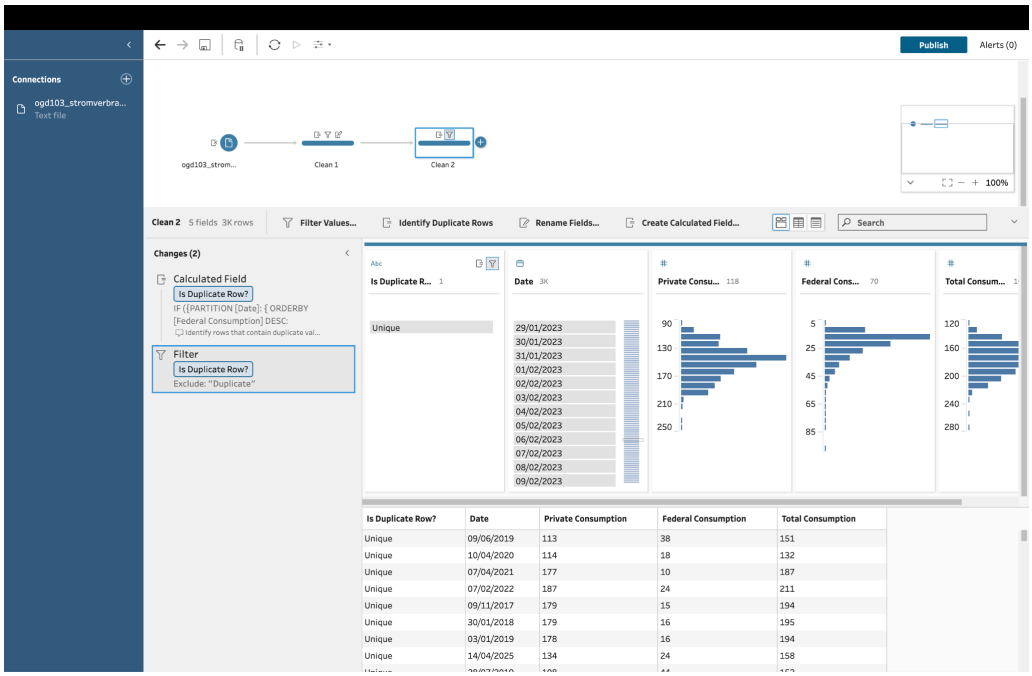


Figure 5.

Visualizations

The Swiss Energy Dashboard consists of the following charts (from top right to bottom left in Figure 6):

1. and 2. Date vs Total Consumption/Production [in GWh] represented as an area chart. Certain relevant measurements namely the average, maximum and minimum values within the selected time period are represented by constant lines to give additional context to the data.

3. Date vs Exchange Price (in EUR per MWh) is represented as a line graph. The "day-ahead" electricity price shows the average price of electricity purchased on the exchange today for the following day. The graph also depicts so-called green and red zones (area beyond the first and third quartiles) to show when the price reached relatively extreme values within the selected time period.

4. Individual line charts depicting electricity produced by each energy type within the selected time period.

5. Individual line charts depicting electricity consumed categorised as either Federal or Private within the selected time period. In this data, federal consumption only refers to energy consumed by Storage Pumps + transmission and distribution losses. The private consumption is an indicator of the Swiss' efforts to save electricity.

6. And 7. Distribution of Energy Production and Consumption between different types within the selected time period represented as a pie chart.

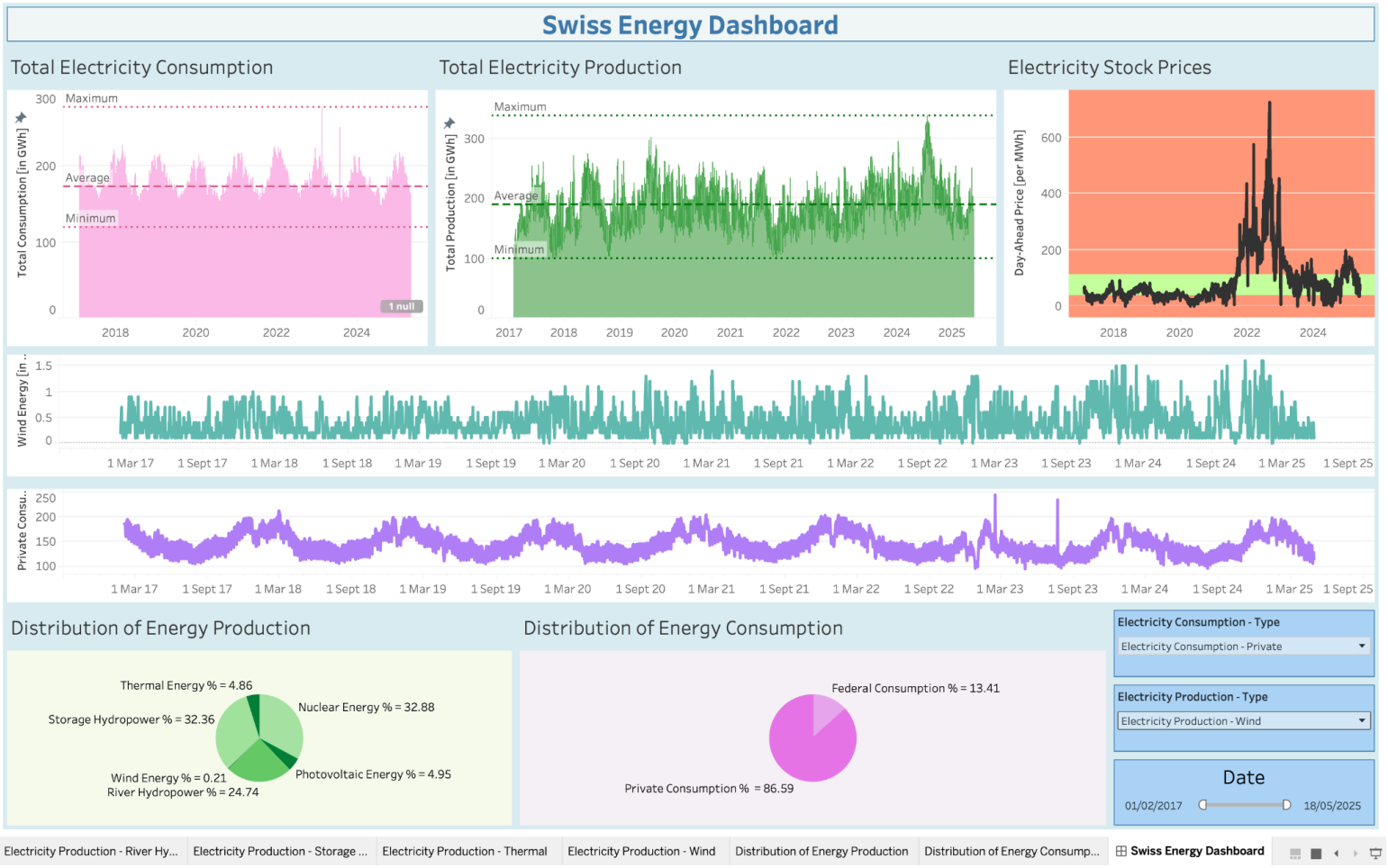


Figure 6.

Functionalities

1. The Date filter on the bottom right allows the users to select the time period for the entire dashboard. The visualizations as well as the computations are adjusted accordingly. The default is set to the entire time period for which data is available. This is helpful in spotting overall trends. The time period can be reduced to smaller ranges such as 1 year or 1 month to see a higher level of detail, as shown in Figure 7.

2. There are 2 drop down menus from which the user can select the specific type of Energy Production and Consumption data to be displayed in the charts directly above.

3. Hovering over any point in the dashboard will display a tooltip showing the exact value of the datapoint (along with the dimension unit) and clicking it will select the specific entry.

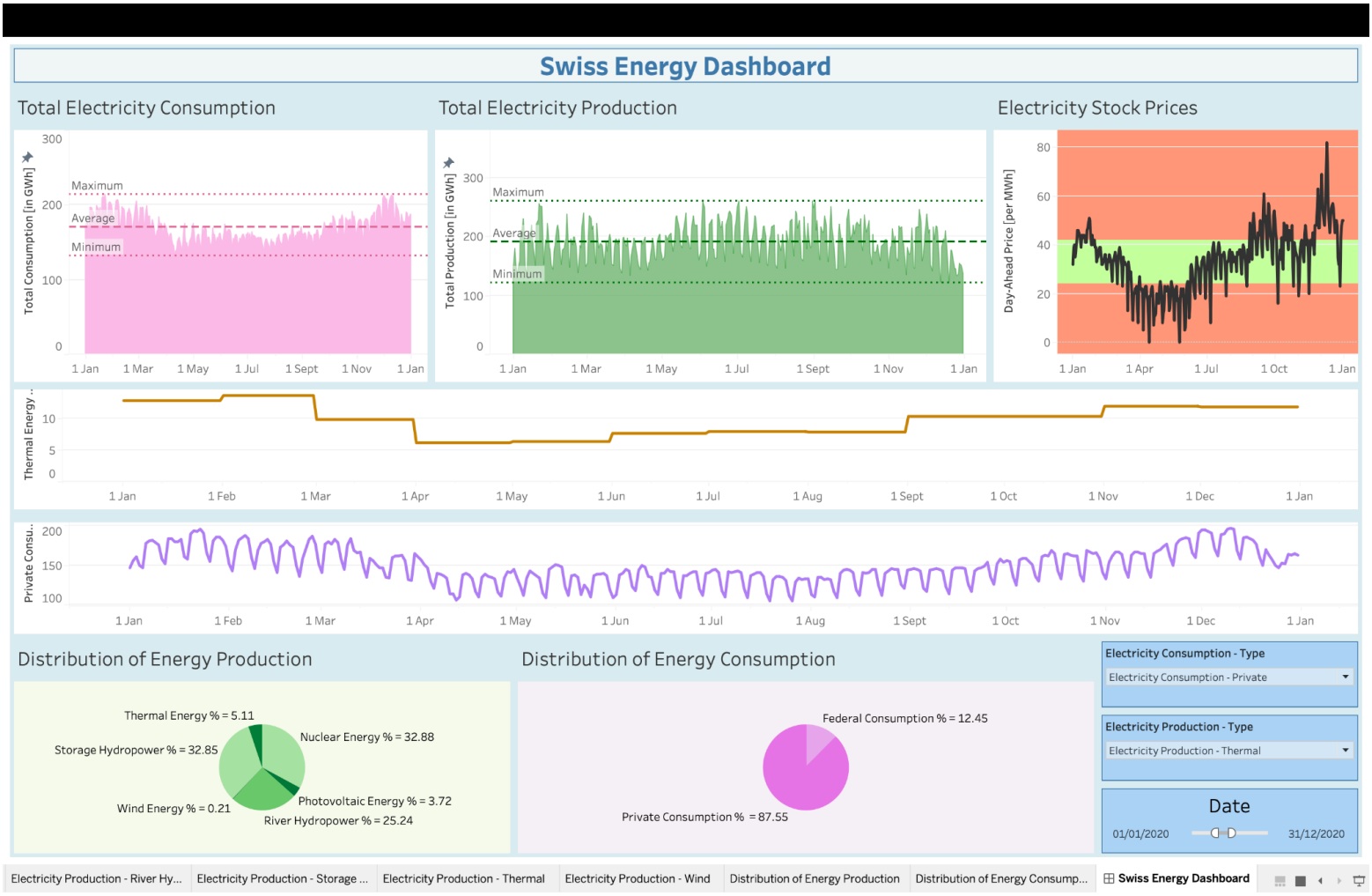


Figure 7.

Key Insights

There are many interesting observations that can be made from this dashboard that are also supported by other independent sources. The ones that I find most obvious and relevant are:

1. In Figure 6 it can be observed that the Total Electricity Consumption as well as Private Electricity Consumption follows a cyclic pattern. This yearly wave-like pattern makes

perfect sense considering Switzerland's climate. The most electricity is consumed in the months of December - February during peak winters when heating is required. The mild summers of Switzerland mean that less cooling is required hence electricity consumption is generally low.
The observed spike in July'23 can be attributed to an all-time high heat wave experienced in European countries. Supporting article: 2023-07-weeks-mediterranean-spain-switzerland-greece.html.
There is no long-term upward trend in Total Electricity Consumption or Private Electricity Consumption despite Switzerland's growing population and increased electrification. This suggests that energy conservation and efficiency measures being undertaken by the government and its people are proving fruitful. Supporting policy document: measures-for-increasing-energy-efficiency.html

2. The electricity stock prices remained more or less constant till 2022 (with a slight dip from 2020 to mid-2021 which can be attributed to the shutdown of industrial and commercial activities due to Covid-19). In 2022, the stock prices surged exorbitantly, reaching an all-time high of 725 EUR / MWh (more than 10 times the medial value of 61). This can be attributed to the Russia - Ukraine war which caused an energy crisis in Europe. Supporting article: energy-prices-and-security-of-supply with the excerpt:
Russia's war of aggression against Ukraine and use of energy as a political weapon had a devastating impact on energy markets. The energy crisis peaked in August 2022, when energy prices reached record highs. Exceptionally high energy bills hit hard on people and businesses across the EU.

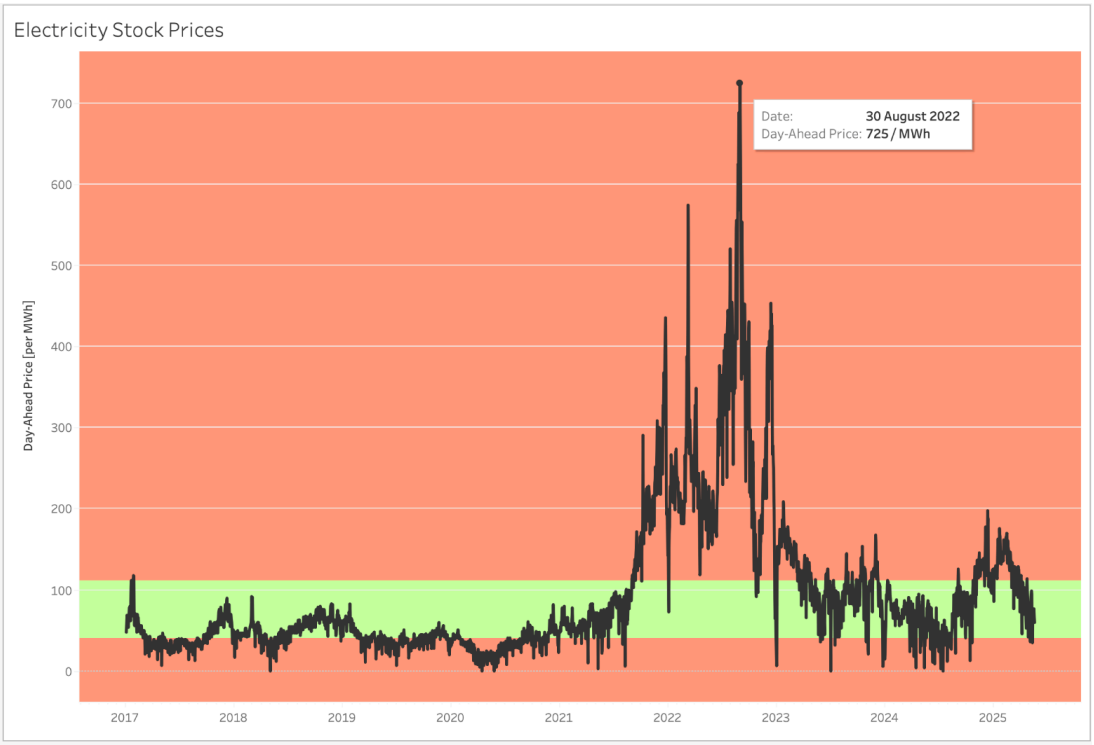


Figure 8.

3. In both figures 6 and 7, it can be observed that the Distribution of Energy Production between different types remains more or less constant throughout with Nuclear Energy having the highest contribution at 32.88%. Hydropower makes up 55% of the electricity produced in Switzerland. With thermal power only making up a modest 5%, Switzerland has a clean energy profile - relying highly on renewable sources.

4. Speaking of renewable sources, a very positive outlook is seen by the upward trend of electricity produced by photovoltaic (or solar) energy. It is steadily growing, with the latest peak in 2025 (45 GWh) being more than 3 times that of the peaks in 2017-2020 (13 GWh).

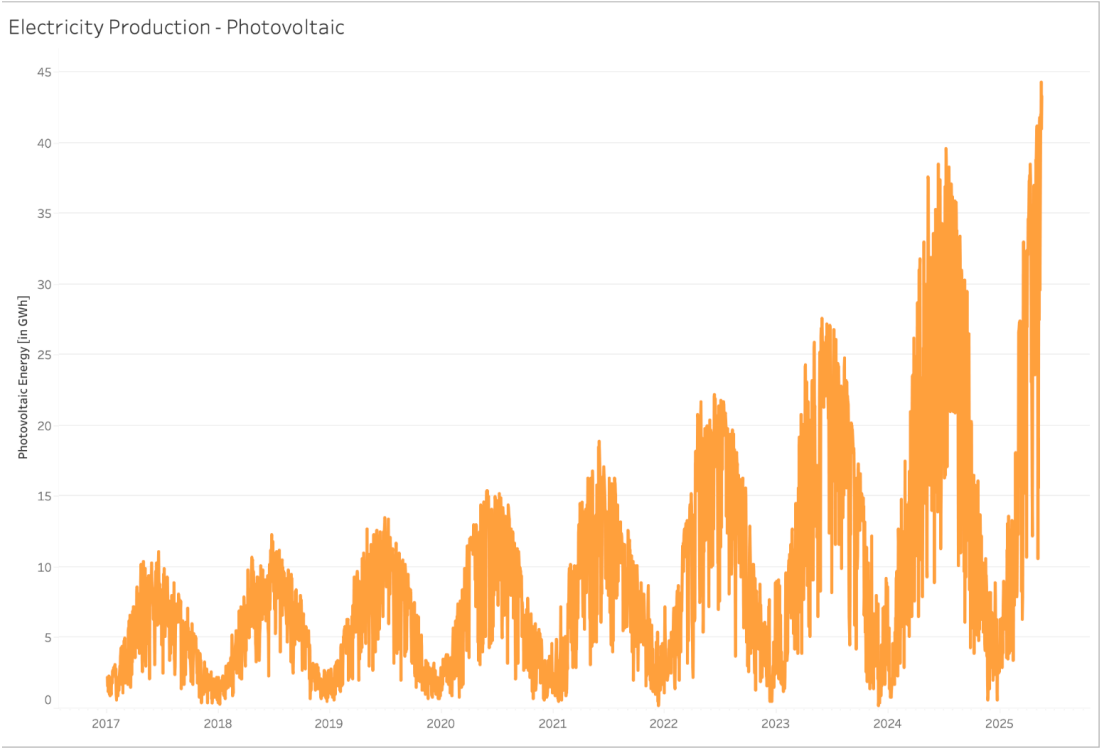
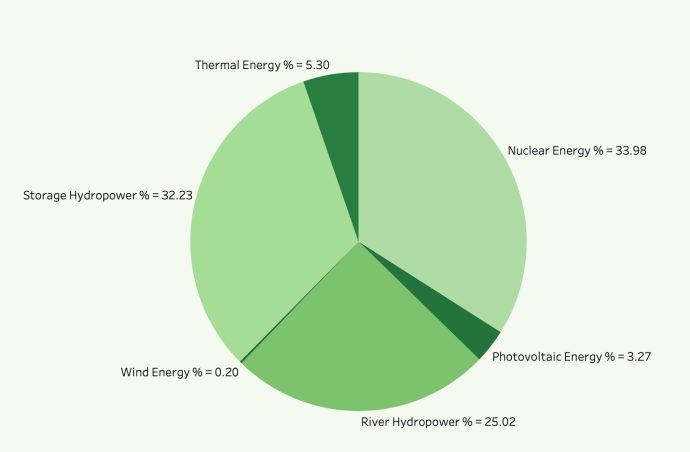
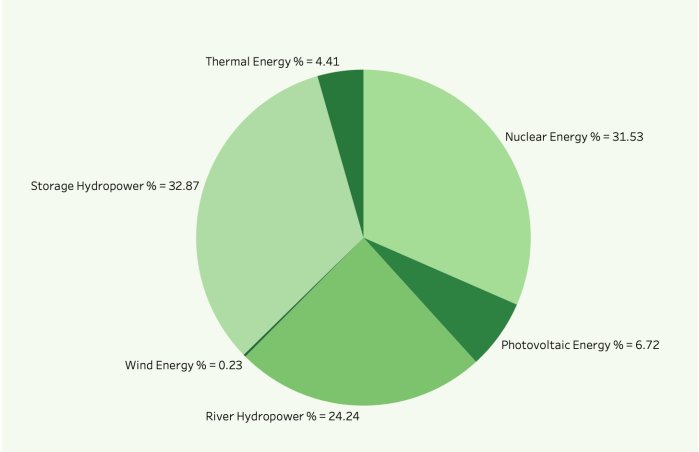


Figure 9.

Studying the distribution by energy types by splitting the entire time period down to 2 halves, it is clearly visible that while most other sources remain constant - contribution of solar energy has doubled further proving that Swiss authorities are heavily investing into cultivation of solar power. Supporting article: [switzerland-solar-energy-electricity-demand] with the excerpt:

As of 2024, Switzerland boasts an installed PV capacity of 9.2 GW, with solar systems generating 8.7 terawatt-hours (TWh) of electricity annually. This output currently meets 11% of the country's total electricity demand. With the energy transition accelerating, Swissolar predicts that by 2026, solar energy will address 14% of Switzerland's electricity needs.





Figures 10 and 11.