Transparency Platform and Eurostat energy data comparison

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The objective of this work is to compare the energy data provided by the ENTSO-E Transparency platform with the data that can be found on the Eurostat Data Browser website. The energy indicators that have been used for the comparison are :

- Electricity imports and exports

- Installed capacity per production type (ICPPT)

- Installed capacity per production unit (ICPPU)

- Actual generation per production type (AGPPT)

- Actuel generation per production unit (AGPPU)

For the first provider the data was extracted using the entso-py python client. While this client is very useful and allows for a more efficient extraction of data, this client is not directly provided by ENTSO-E. We need to keep this in mind because it created issues that we will detail in the analysis of some of the previously mentioned indicators. The data browser from Eurostat enables data set customization and extraction directly from the source.

For each indicator, the comparison will first be done across all countries. Eurostat will be considered as the reference point. Then we will compare the data for some individual cases for a longer period of time depending on the available time frame. The associated excel files and python scripts are available here : github.com/valentin-daab/artemis-tutored-project and can be used to dynamically change the graphics and check the source files.

1 Electricity imports & exports

For both imports and exports the comparison is done monthly for the year 2021 and by countries. The data from ENTSO-E is available in MWh and was converted to GWh to enable comparison with the Eurostat imports and exports data.

1.1 Imports
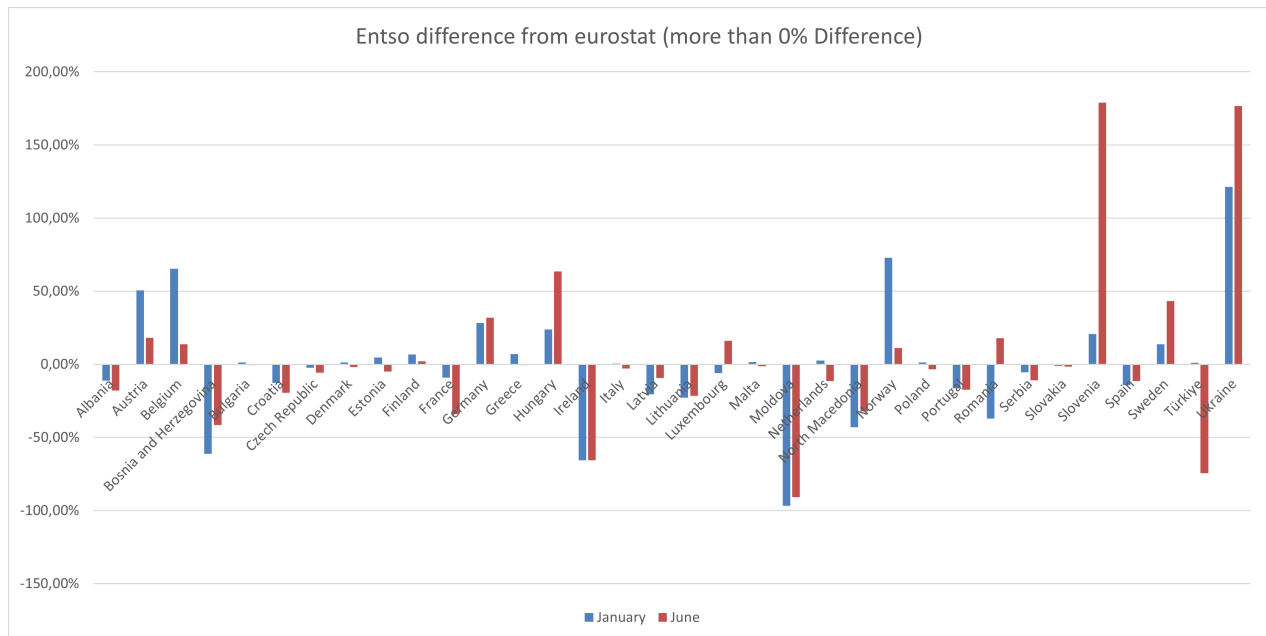
Difference	Countries
> 75%	Moldova, Slovenia, Ukraine
> 50%	Austria, Belgium, Bosnia & Herzegovina, Hungary, Ireland, Norway, Turkey
> 25%	France, Germany, North Macedonia, Romania, Sweden

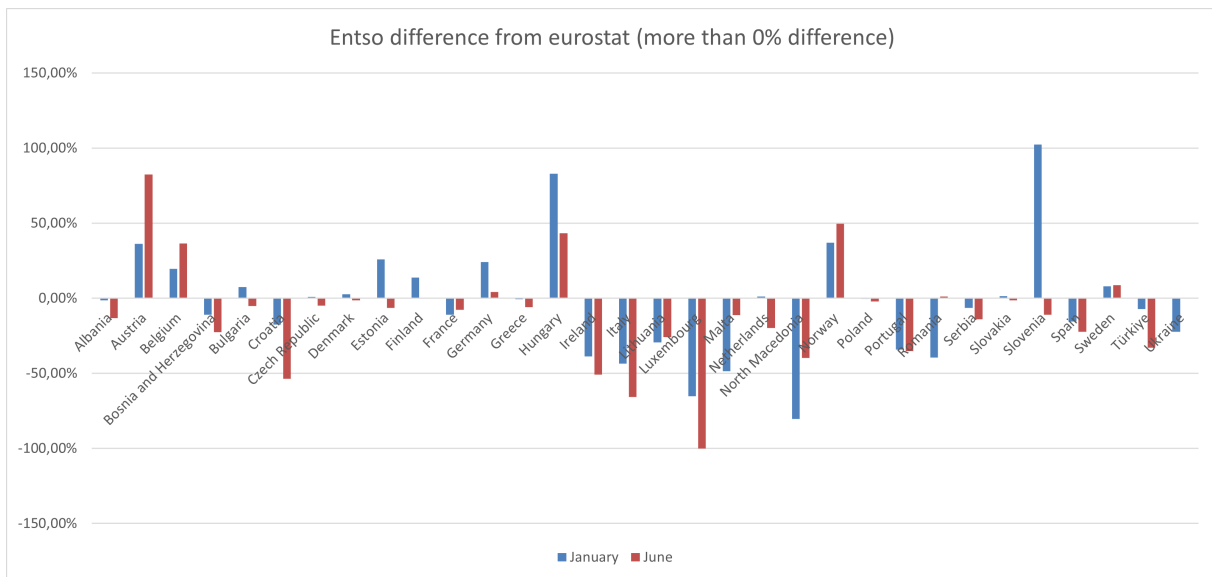Table 1: Biggest differences between ENTSO-E and Eurostat (Imports)

For the general comparison we can see that for 15 countries out of 34, the ENTSO-E import data values are more than 25% higher or lower in January or in June compared to the Eurostat import data values. For these countries the values don't seem to improve from January to June, and there is no trend of ENTSO-E data difference being constantly positive or negative.

Now for each of the different categories listed in the table above, let's check individual changes overtime :

For all of the countries that we have selected even if there is a difference in values between ENTSO-E and Eurostat, we can still observe the trends that appear overtime. For instance, even if the ENTSO-E values from Slovenia are very different from those provided by Eurostat, the spike of imports is still visible in April 2021.
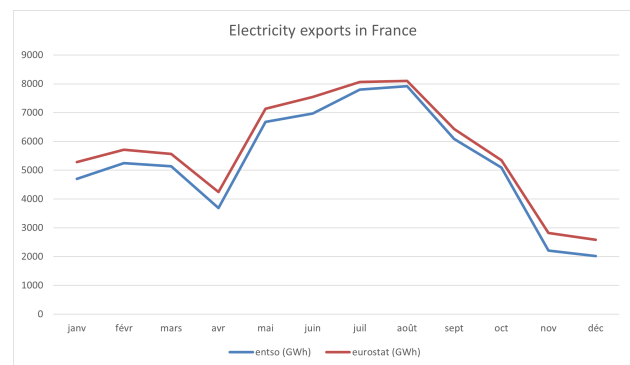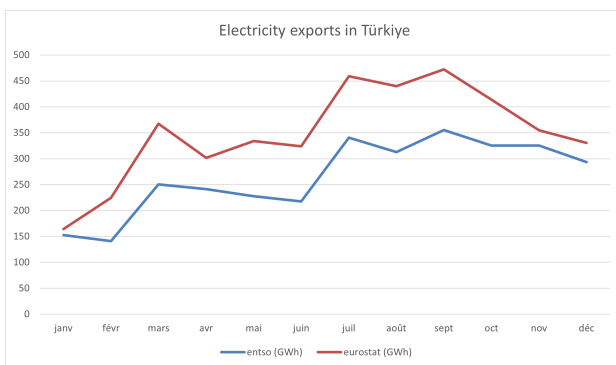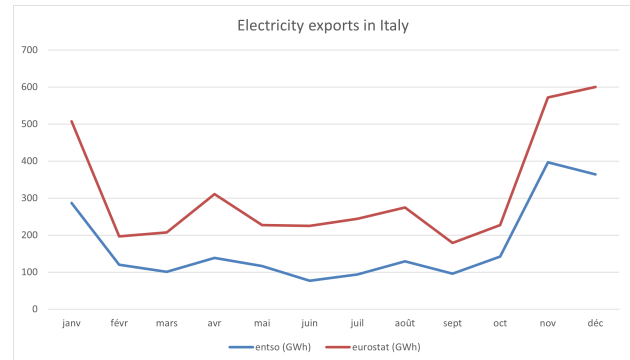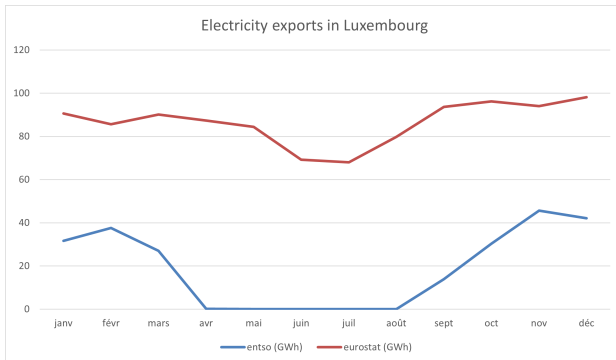
1.2 Exports

Difference	Countries
> 75%	Austria, Hungary, Luxembourg, North Macedonia, Slovenia
> 50%	Croatia, Ireland, Italy
> 25%	Belgium, Estonia, Lithuania, Malta, Norway, Portugal, Romania, Turkey

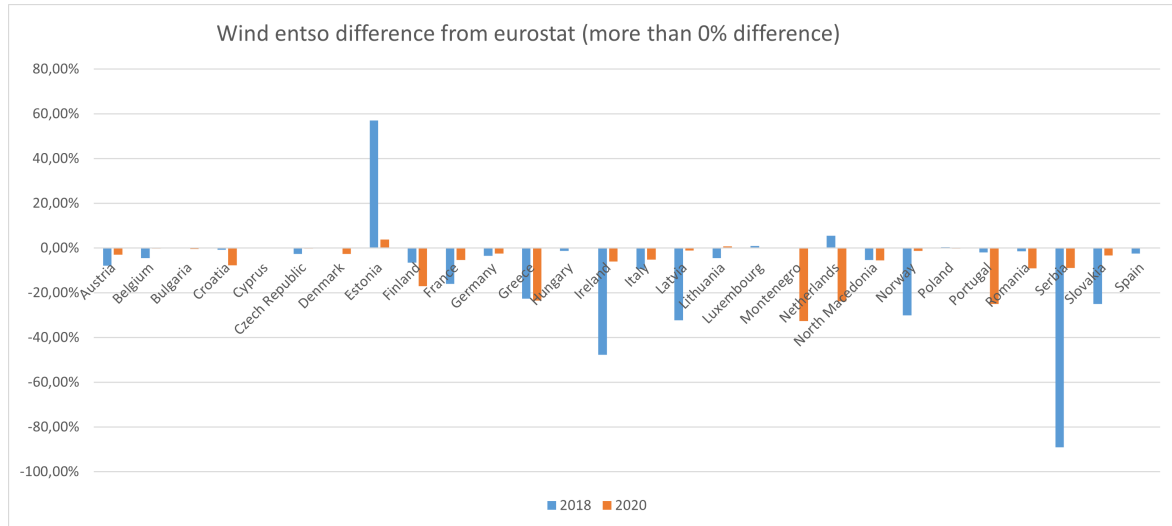Table 2: Biggest differences between ENTSO-E and Eurostat (Exports)

For the general exports comparison we can see that for 16 countries out of 32, the ENTSO-E import data values are 25% higher or lower in January or in June than the Eurostat import data values. For these countries the values don't seem to improve from January to June, but there is a trend of ENTSO-E values being lower than those provided by Eurostat. We can also say that out of the 15 countries that were in the imports table, 9 of them are also in the exports table.

Again, we can see that the trends exist in both data sources, but that the main difference is in the values. For both imports and exports there is a significant difference between ENTSO-E and Eurostat data, about 50% of the ENTSO-E data has a difference that is higher than 25%.

2 Installed capacity per production type

Installed capacity per production type (ICPPT) data was gathered annually from 2014 to 2020. This is the sum of net installed generation capacity for each type of production (nuclear, hydro, combustible fuels, ...). To simplify the analysis, we will only compare the installed capacity for wind power. Both of the data sources are available in MWh.


Difference	Countries
> 75%	Serbia
> 50%	Estonia
> 25%	Ireland, Latvia, Montenegro, Norway

Table 3: Biggest differences between ENTSO-E and Eurostat (ICPPT)

Out of the 29 countries compared, 6 have a difference that is higher than 25%. For Estonia, Ireland, Latvia, Norway, Serbia (4/6 countries), the difference drastically improves in 2020 compared to 2018. Overall, ENTSO-E data values are inferior to those provided by Eurostat.
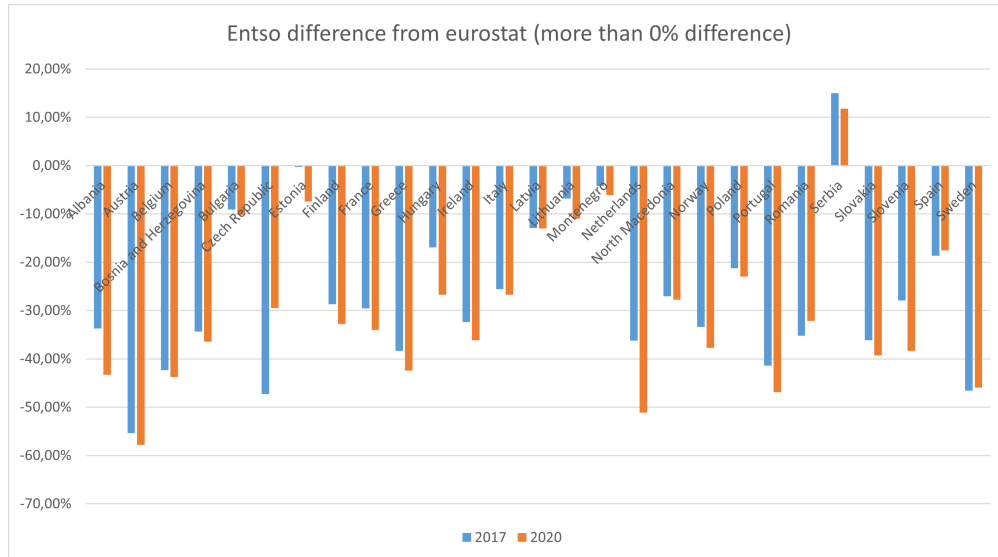
Let's see if we can detect these improvements over time :
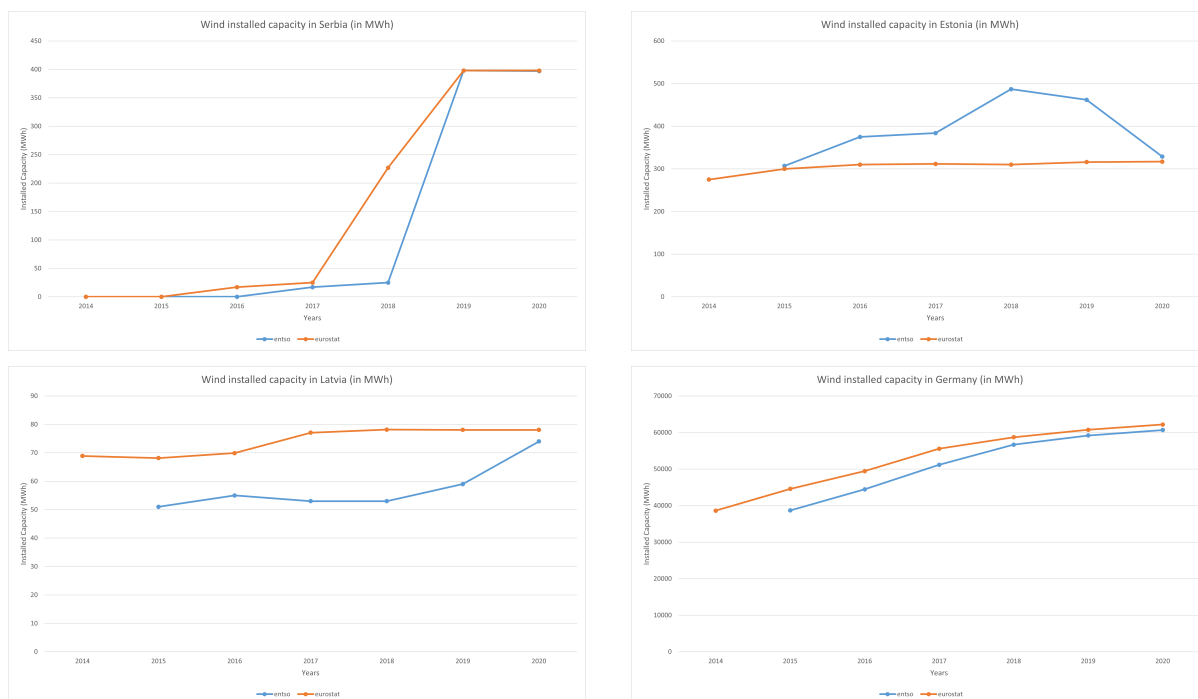
For a lot of these significant differences between ENTSO-E and Eurostat a discrepancy appears in 2018/2019 and disappears again in 2020. In 2020, the data appears to match again. Overall, the data between ENTSO-E and Eurostat is coherent.

3 Installed capacity per production unit

Installed capacity per production unit (ICPPU) data was gathered annually from 2012 to 2020. This is the sum of net installed generation capacity for each power plant that we've aggregated to the country level for the ENTSO-E data. Eurostat data is only available by country. Both of the data sources are available in MWh.

Difference	Countries
> 75%	X
> 50%	Austria, Netherlands
> 25%	Albania, Belgium, Bosnia & Herzegovina, Czech Republic, Finland, France, Greece, Hungary, Ireland, Italy, North Macedonia, Norway, Portugal, Romania, Slovakia, Slovenia, Sweden

Table 4: Biggest differences between ENTSO-E and Eurostat (ICPPU)

Out of the 27 compared countries 19 of them have a difference higher than 25% compared to the Eurostat data. This can be explained by the fact that the definition for ENTSO-E data is different for this indicator. ENTSO-E data only takes into account production units (existing and planned) with an installed generation capacity equalling to or exceeding 100 MW. This can exclude some power plants and therefore lower the installed capacity value at the country level. Because we don't have the detail of the power plants selected for Eurostat data, this is the main hypothesis.

Installed capacity in Austria

Installed capacity in France

Installed capacity in Serbia


Installed capacity in Sweden
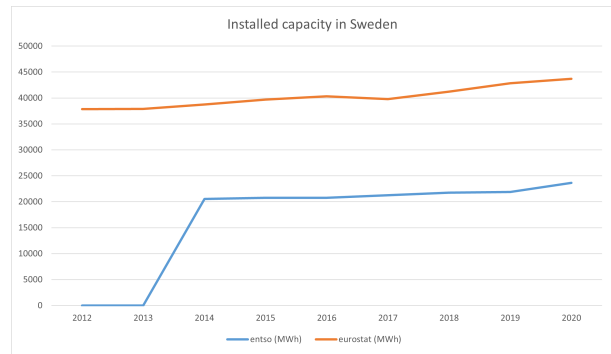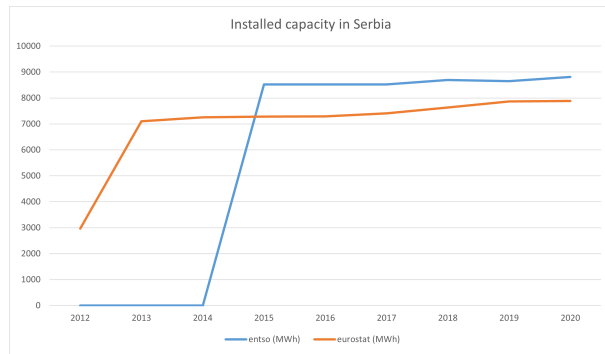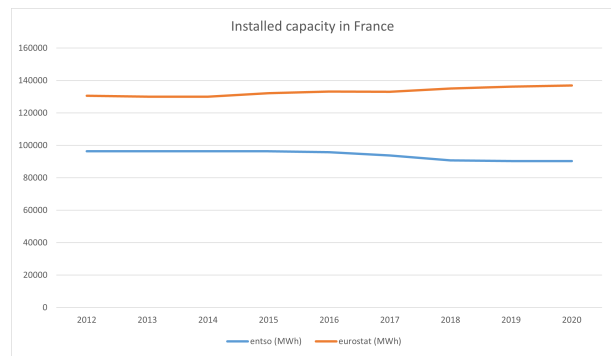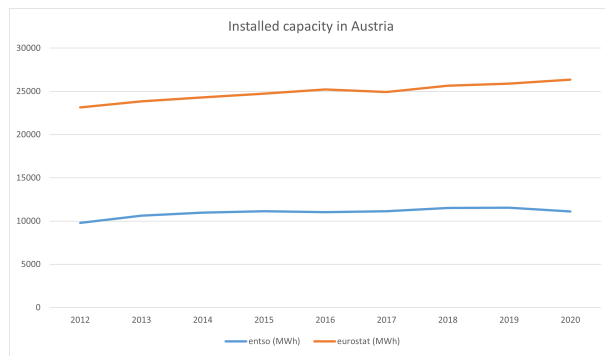
For these individual observations the trend is stable overall. This is due to the fact that power plants usually take a long time to be built or decommissioned. Since the trend is the same, the problem is possibly due to the fact that the definitions are different.

4 Actual Generation per production type

Actual generation per production type is the net electric generation output by type of production (nuclear, hydro, combustible fuels, ...). For ENTSO-E there are some problems that we came across in the extraction of the data. First of all, there are different time ranges where the data is uploaded depending on the country. Some countries have an hourly update, some every 15 minutes. This means that we have to take the mean by hour.

Then, the values for the hydro pumped production type for ENTSO-E can be negative. Hydro pumped storage stores energy in the form of gravitational potential energy of water, pumped from a lower elevation reservoir to a higher elevation. To get the water to the higher elevation there has to be an electric consumption.
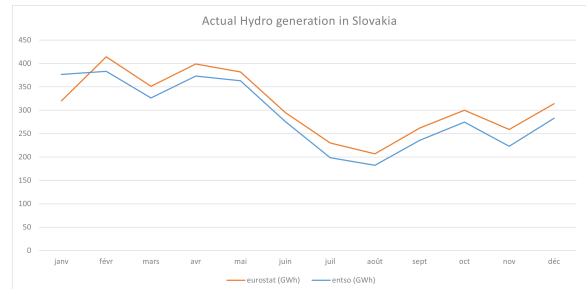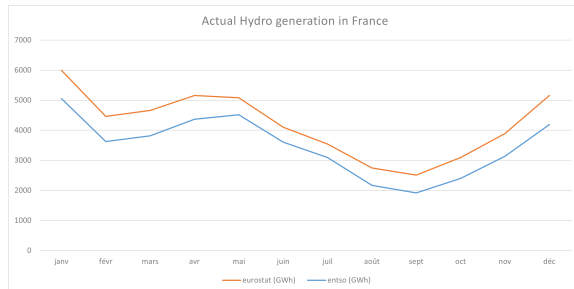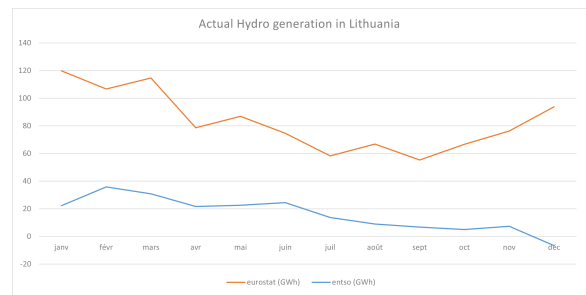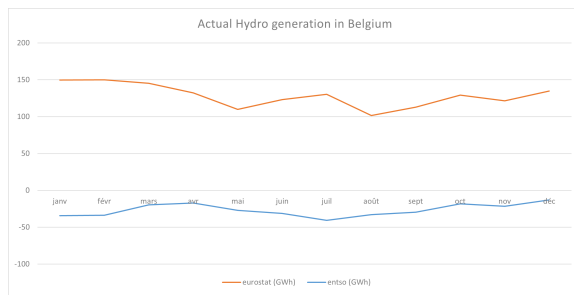
Also the python client for the "actual generation" indicators extracted data in a way that was difficult to aggregate at the country level because of the amount of data that needed to be extracted even for one month. For all of these reasons the results that follow for the ENTSO-E can be false and might not reflect reality 100%. To simplify the analysis, we will only compare the installed capacity for hydro power. ENTSO-E data was only available in MWh and was converted to GWh to match Eurostat data. The data is extracted monthly in 2022.
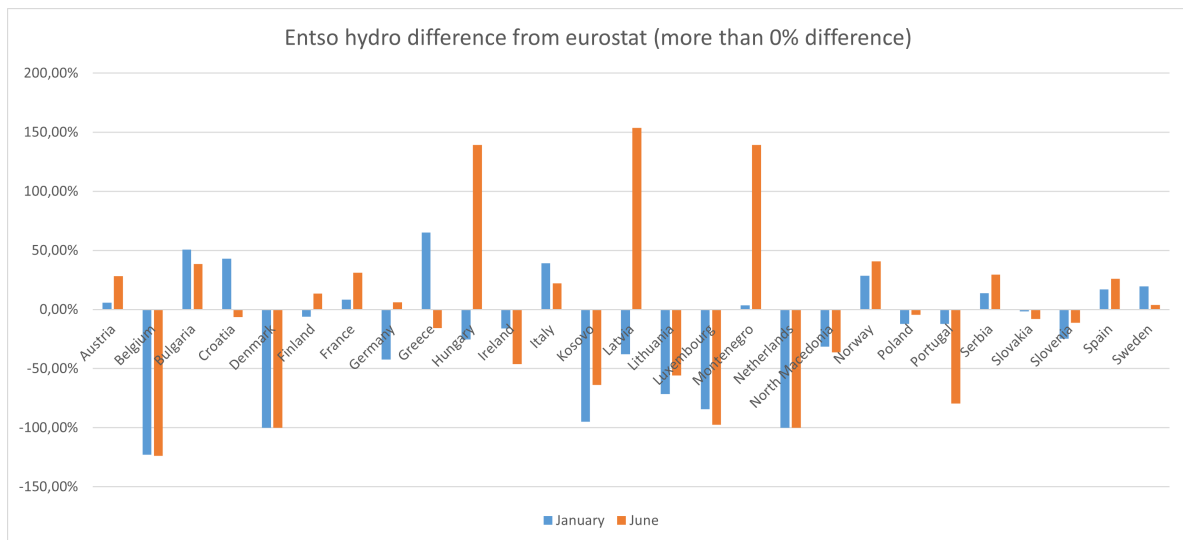
Difference	Countries
> 75%	Belgium, Denmark, Hungary, Kosovo, Latvia, Luxembourg, Montenegro, Netherlands, Portugal
> 50%	Bulgaria, Greece, Lithuania
> 25%	Austria, Croatia, France, Germany, Ireland, Italy, North Macedonia, Norway, Serbia, Spain

Table 5: Biggest differences between ENTSO-E and Eurostat (AGPPT)

Most of the data from ENTSO-E is significantly different to that provided by Eurostat. There is no trend in ENTSO-E values being higher or lower than Eurostat.

Actual Hydro generation in Belgium

Actual Hydro generation in Lithuania

Actual Hydro generation in France

Actual Hydro generation in Slovakia

As we've mentioned in the introduction there are some values that are negative because of the hydro pumped production type which is included in hydro.

5 Actual generation per production unit

For Actual generation per production unit we faced the same issues as before. For ENTSO-E, we had to aggregate the power plant data to country level. We compared data for january and june in 2022.

Entso difference from eurostat (more than 0% difference)
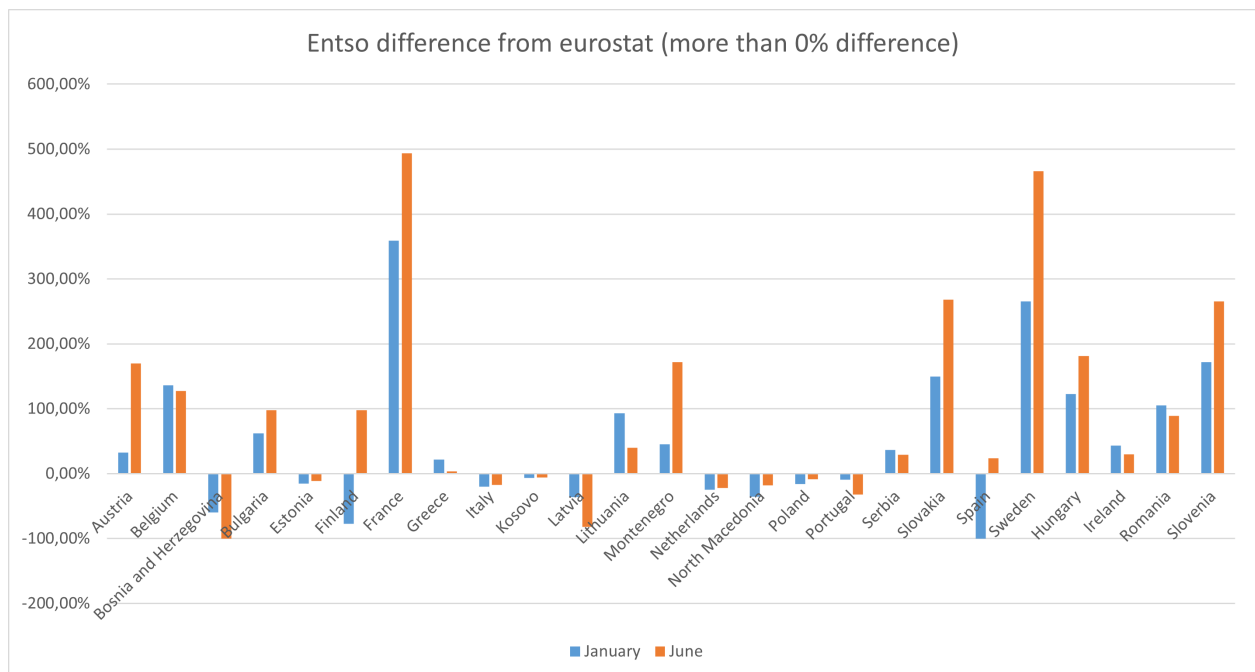
Difference	Countries
> 75%	Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Finland, France, Latvia, Lithuania, Montenegro, Slovakia, Spain, Sweden, Hungary, Romania, Slovenia
> 50%	
> 25%	North Macedonia, Portugal, Serbia, Ireland

Table 6: Biggest differences between ENTSO-E and Eurostat (AGPPU)

Again, most of the countries have a significant value difference compared to Eurostat.
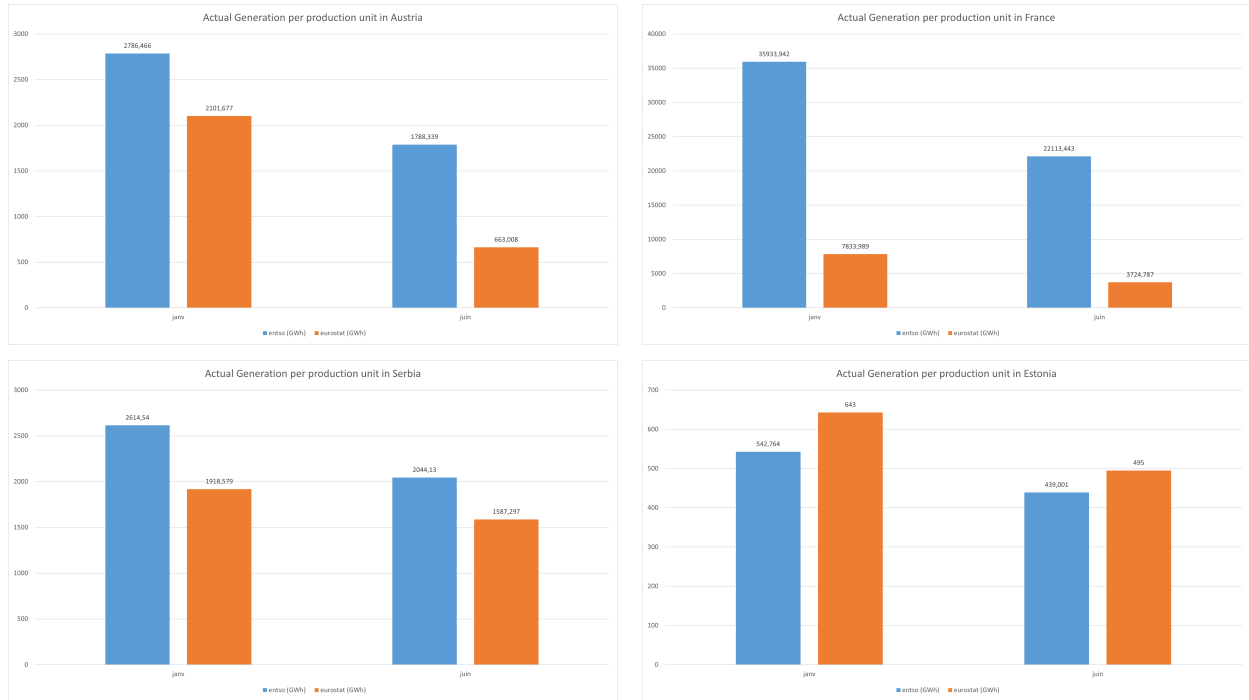
Because we only compare two months it's difficult to see what happens over a bigger timeline. For this indicator, extracting and aggregating the data using the python client was tricky because the output was really disorganised. The differences in values are probably caused by that.

6 Conclusion

Most of the data from ENTSO-E is significantly different from what is extracted from Eurostat. It is important to note that for the "Actual generation" the extraction and aggregation process was very complex and adds uncertainty to our results.Whether it is because of the python client or the differences in definitions, the trends still appear in both data sources.

All of the data sources are linked in the following table :

Indicator	ENTSO-E	EUROSTAT
Imports & Exports	Cross-border physical flows	nrg_cb_e
ICPPT	ICPPT	nrg_inf_epc
ICPPU	ICPPU	nrg_inf_epc
AGPPT	AGPPT	nrg_cb_pem
AGPPU	AGPPT	nrg_cb_pem