DATA ANALYSIS OF GERMANY'S ELECTRICITY IMPORTS AND EXPORTS

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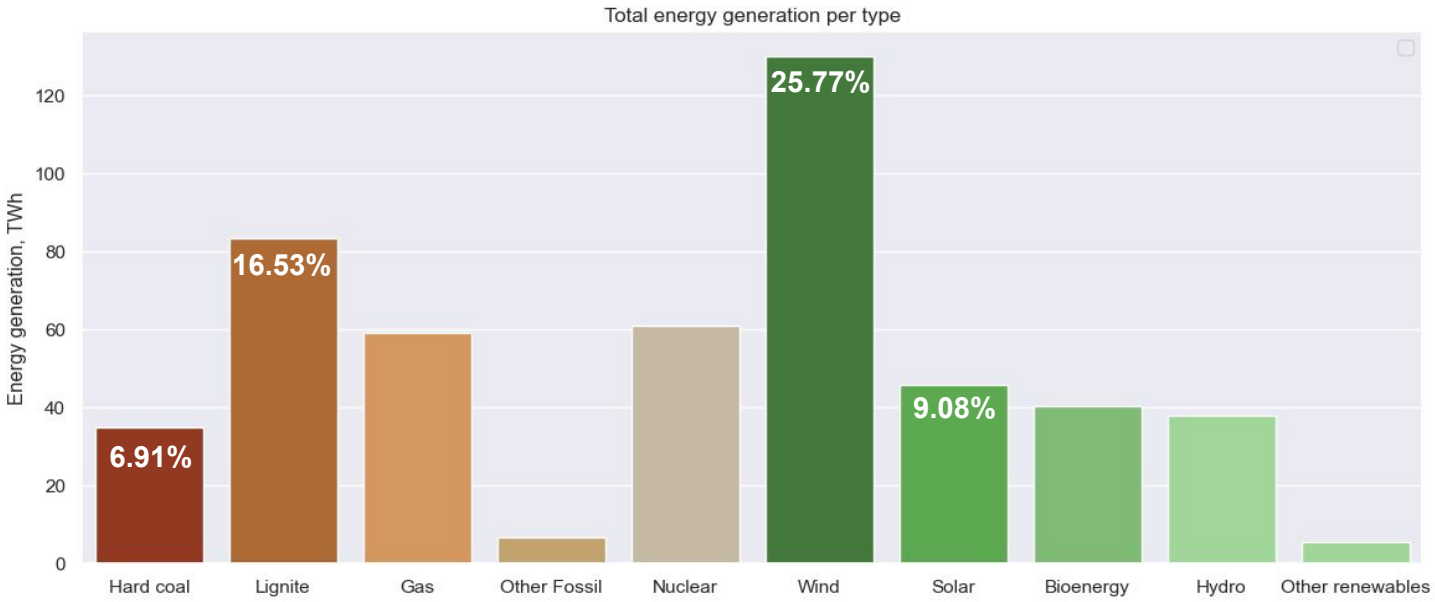
Introduction

What is ENTSO-E?

- ENTSO-E is the association for the cooperation of the European TSOs
- It includes 42 TSOs from 35 countries
- Common voice of the largest interconnected electrical grid in the world
- Ensures
  - security of the interconnected power system
  - developement and integration of REE sources and emerging technologies
- Provides forecasting and reliable statistical data (Statistical Factsheet, Monthly Statistics Report, Transparency Platform etc.)
- Involved in RDI (ENSO-E's R&D Roadmap)

[2]

Total energy generation



Hard coal, TWh	Lignite, TWh	Gas, TWh	Other Fossil, TWh	Nuclear, TWh	Wind, TWh	Solar, TWh	Bioenergy, TWh	Hydro, TWh	Other renewables, TWh
34.87	83.37	59.13	6.51	60.92	129.97	45.82	40.28	37.98	5.43

- 2020 is landmark year, renewables overtook fossil fules for the first time. Renewables share – 51%, fossils share – 36%.

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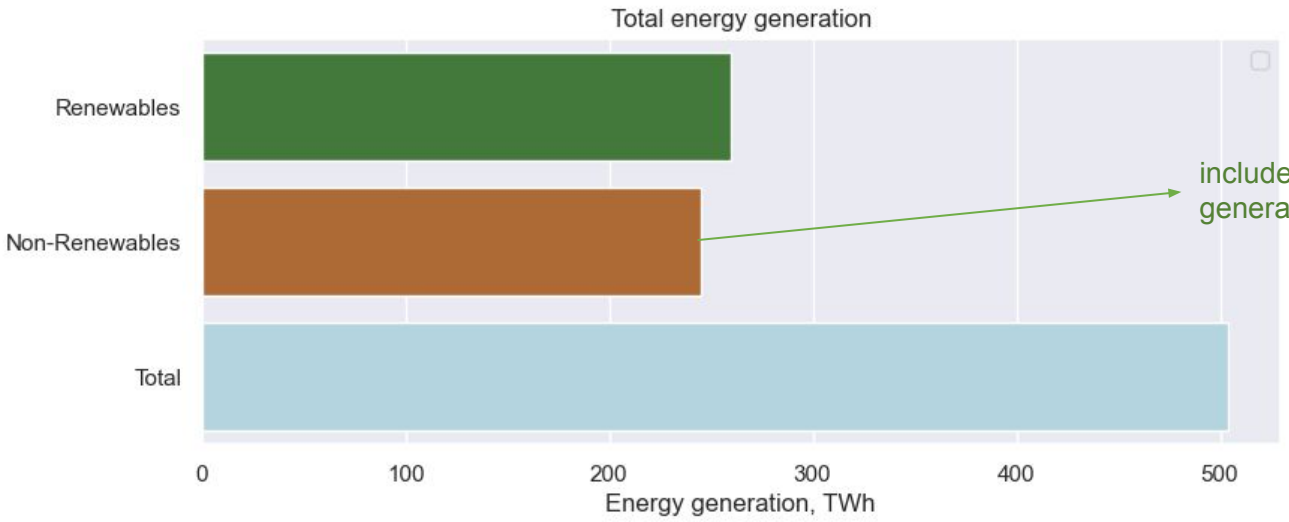
Total energy generation aggregated



includes nuclear generation

monthly peak in february

Renewables, TWh	Non-Renewables, TWh	Total, TWh
259.49	244.81	504.31

- In 2020 share of Wind and Solar together is 34.86%. In 2019 it was 28.45%, so Wind and Solar share in German Electricity mix increased to 22%.

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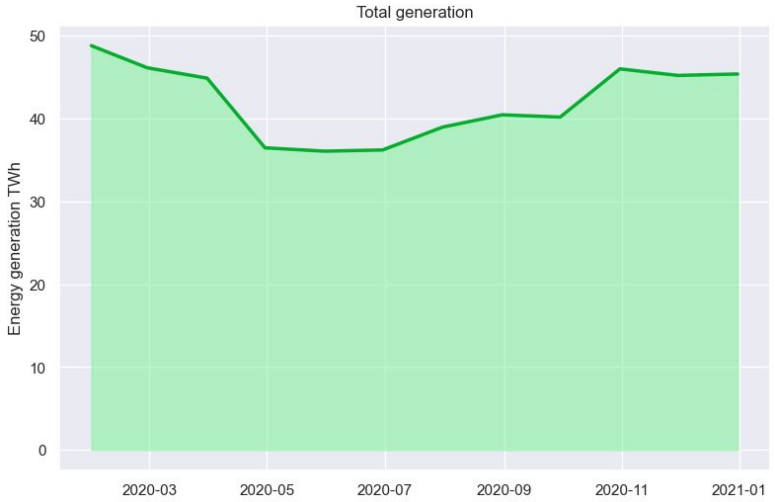
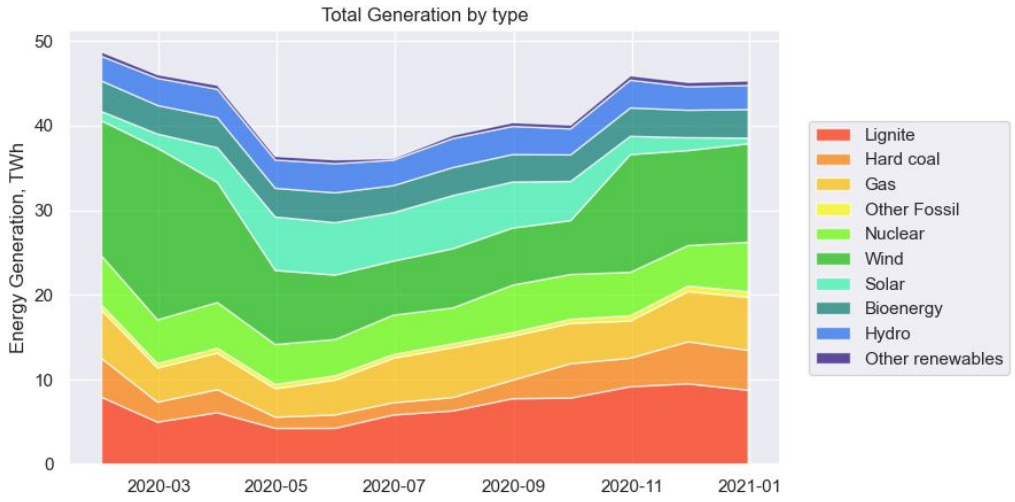
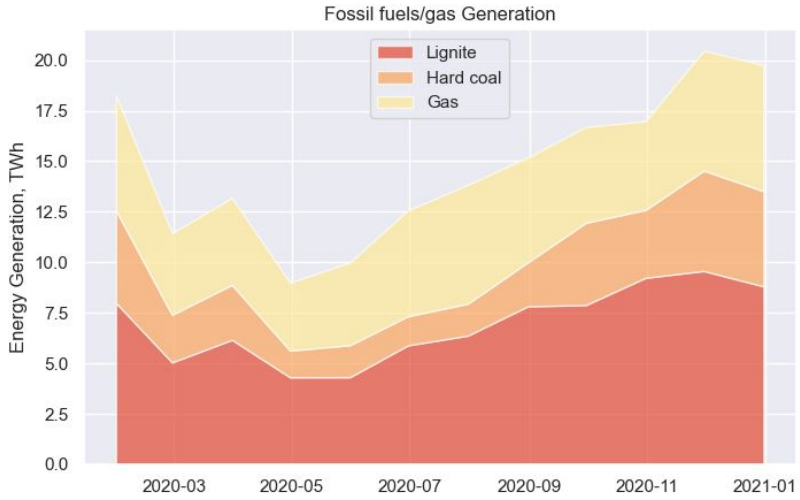
Total energy generation







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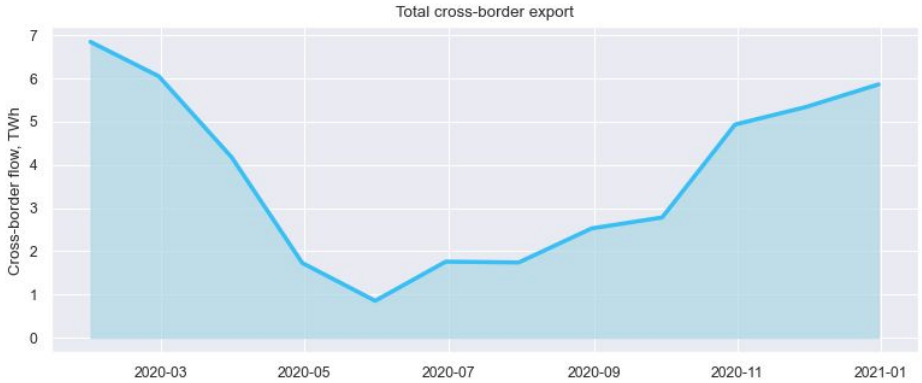
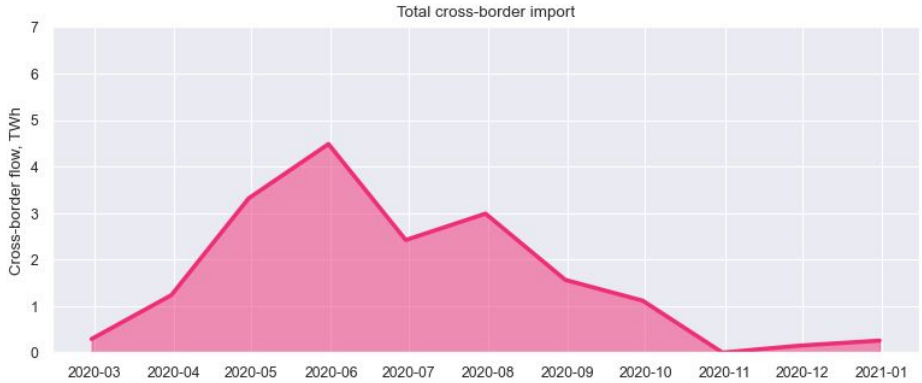
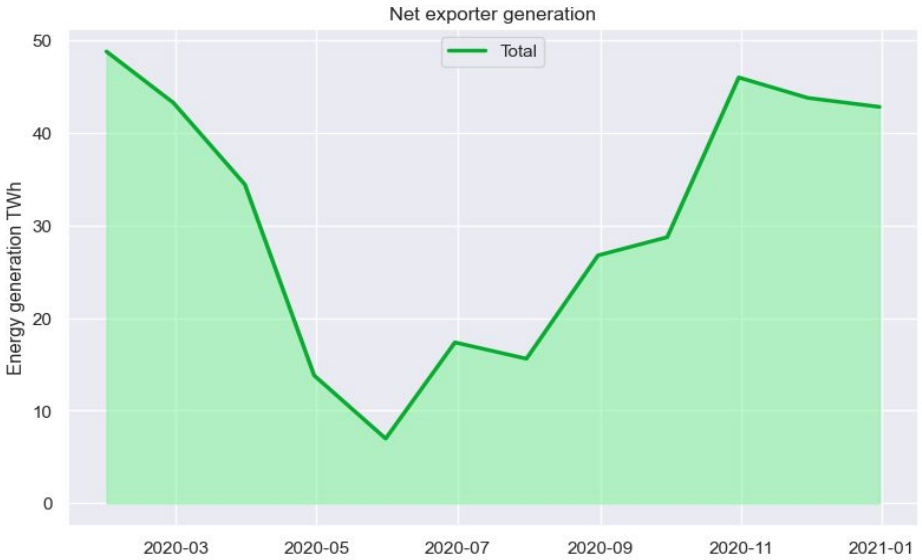
Total cross-border export and import







- Generation when Germany is net exporter reaches its minimum when generation in case of net importer reaches its maximum. Generation when net exporter – 368 TWh, when importer – 136 TWh

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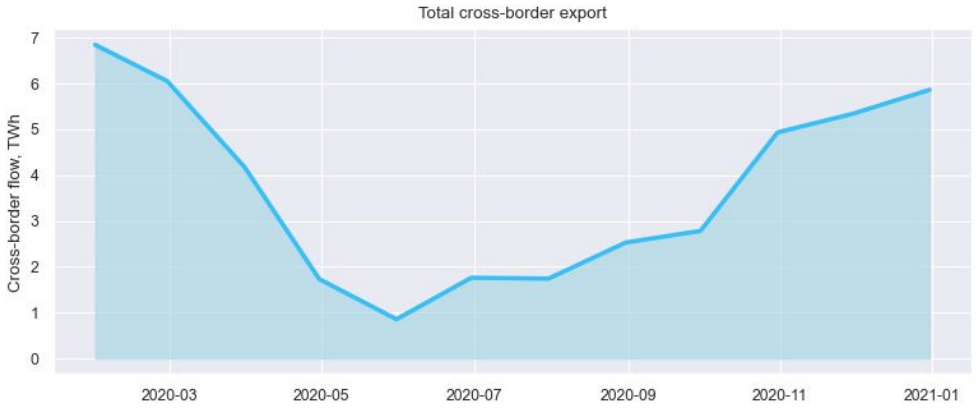
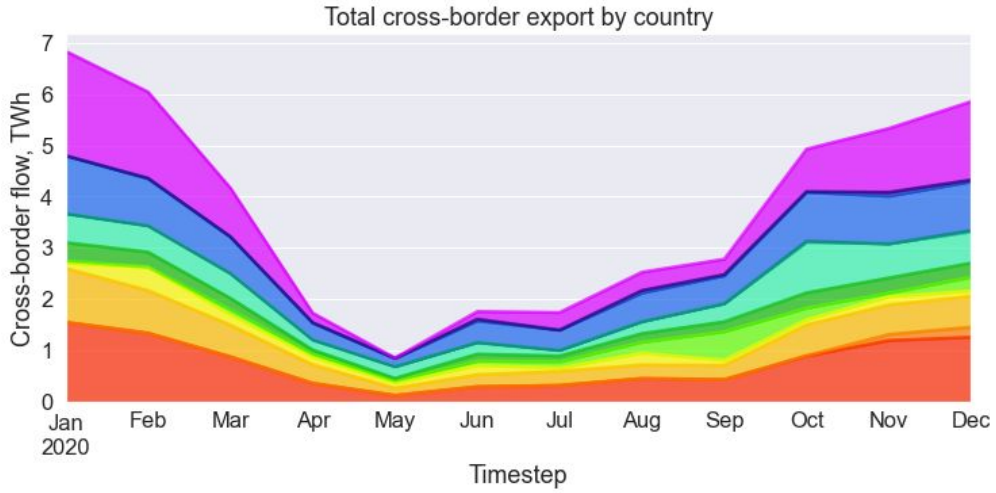
Cross-border export (net exporter), closer look



Germany (DE) > Austria (AT)(TWh)	9.0768
Germany (DE) > Belgium (BE)(TWh)	0.325
Germany (DE) > Czech Republic (CZ)(TWh)	5.8388
Germany (DE) > Denmark (DK)(TWh)	1.9428
Germany (DE) > France (FR)(TWh)	1.799
Germany (DE) > Luxembourg (LU)(TWh)	2.4803
Germany (DE) > Netherlands (NL)(TWh)	5.1608
Germany (DE) > Norway (NO)(TWh)	0.0483
Germany (DE) > Poland (PL)(TWh)	7.9924
Germany (DE) > Sweden (SE)(TWh)	0.2752
Germany (DE) > Switzerland (CH)(TWh)	9.6238



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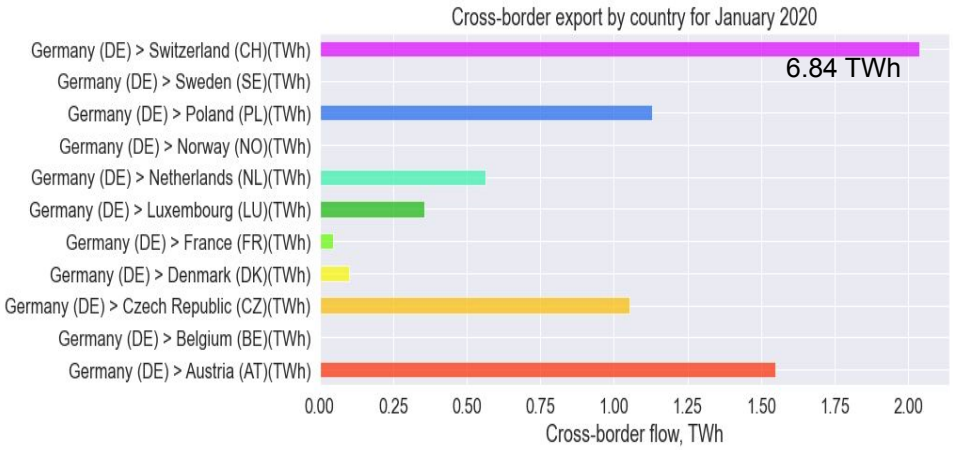
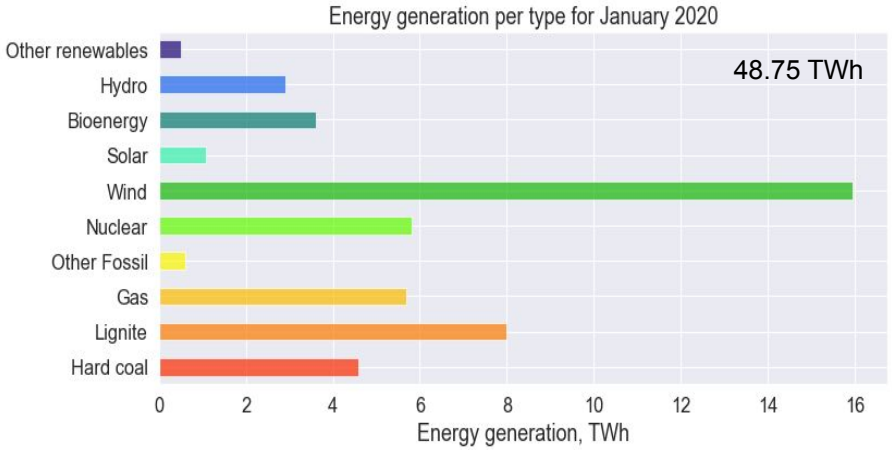
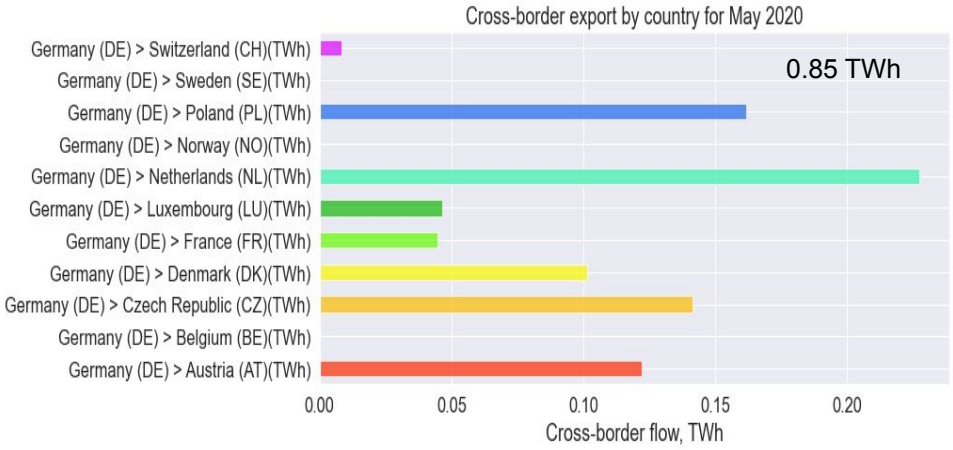
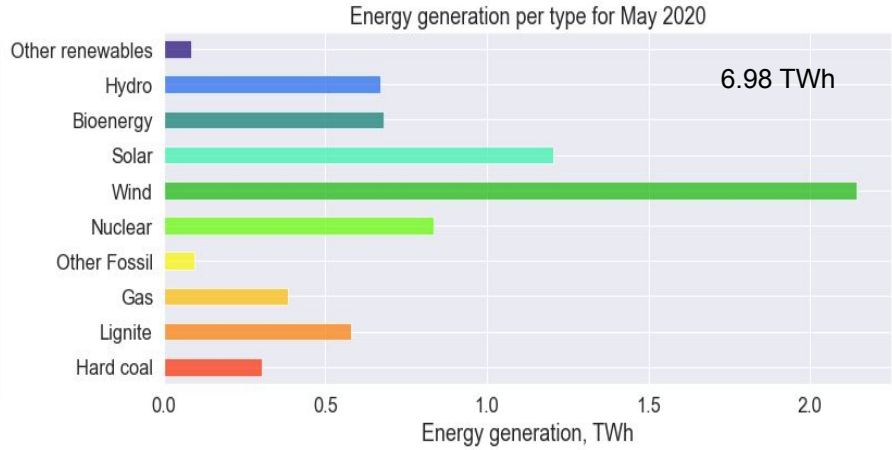
Cross-border export (net exporter), closer look (monthly max, min)









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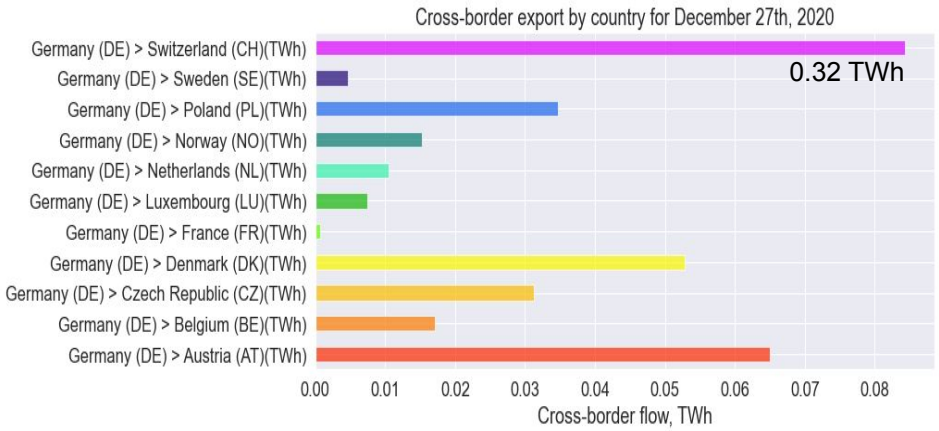
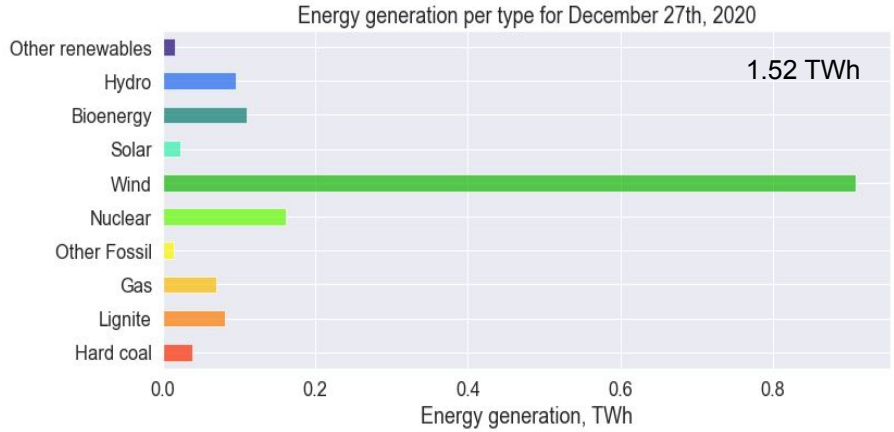
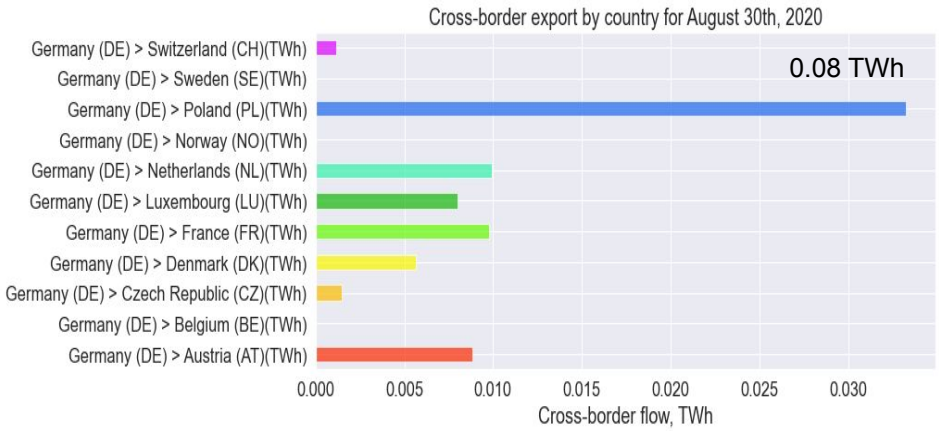
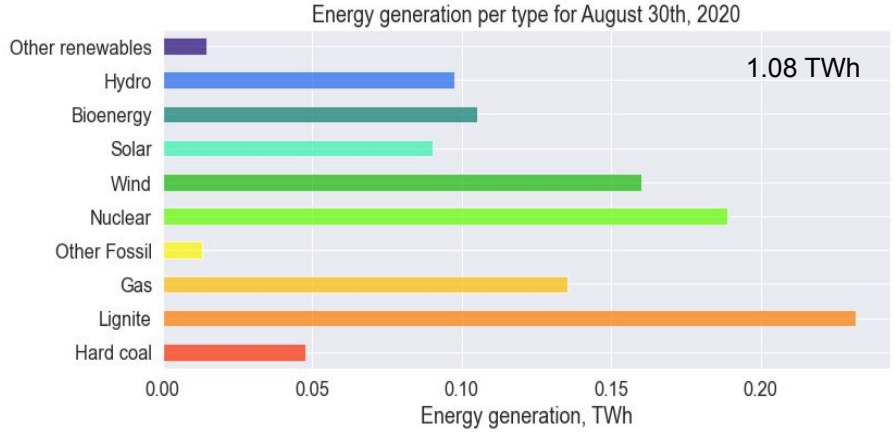
Cross-border export (net exporter), closer look (daily max, min)









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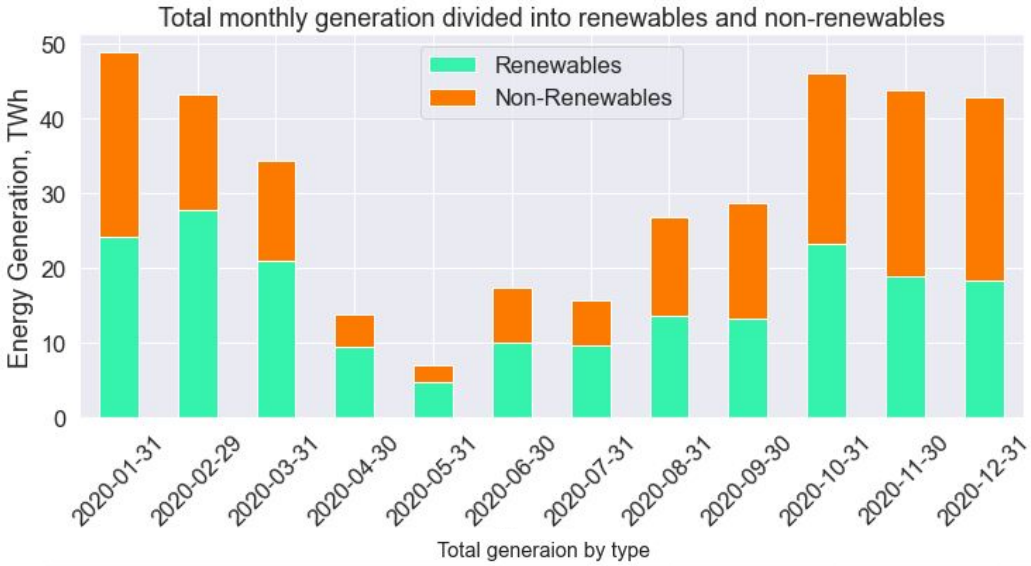
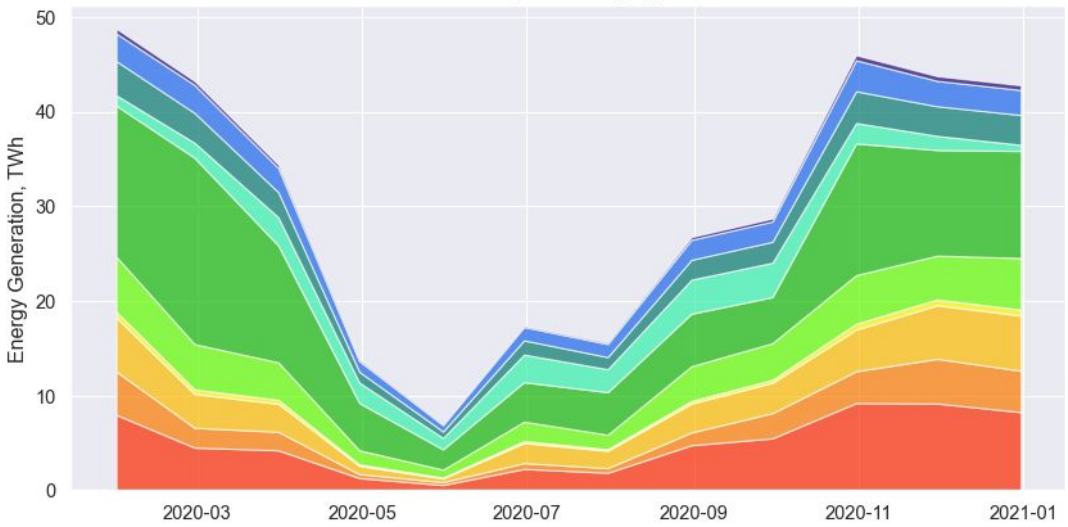
Cross-border export (net exporter), closer look (generation mix)



Timestep	Renewables	Non-Renewables
January	49.38%	50.62%
February	64.25%	35.75%
March	60.67%	39.33%
April	69.23%	30.77%
May	68.55%	31.45%
June	58.13%	41.87%
July	62.28%	37.72%
August	50.96%	49.04%
September	45.85%	54.15%
October	50.52%	49.48%
November	43.32%	56.68%
December	42.62%	57.38%



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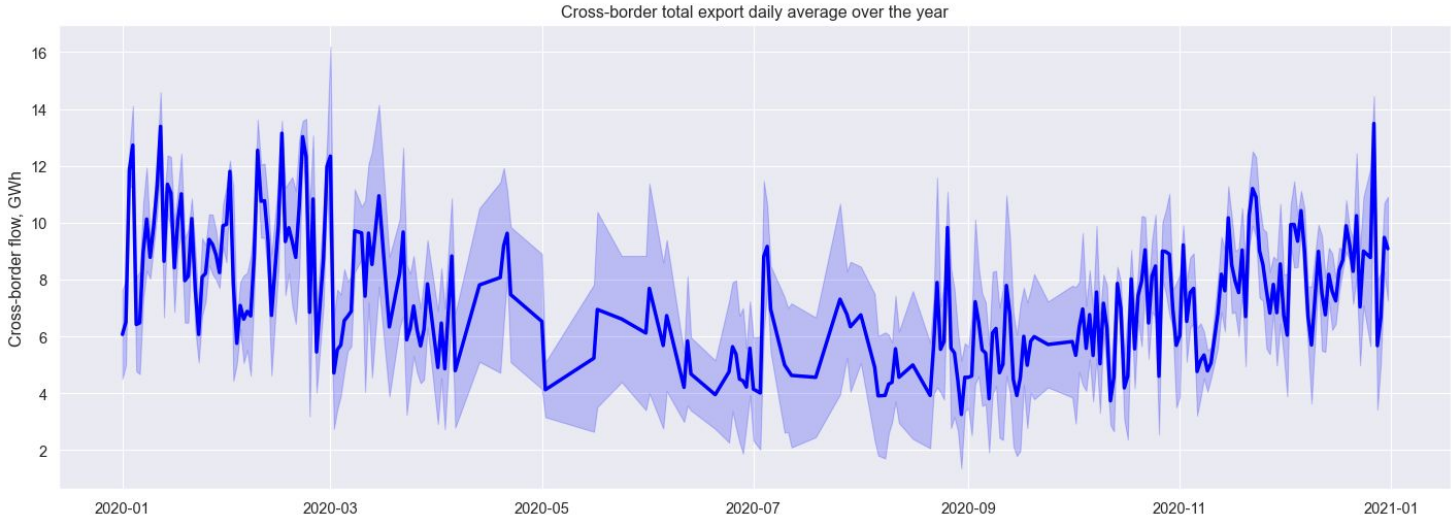
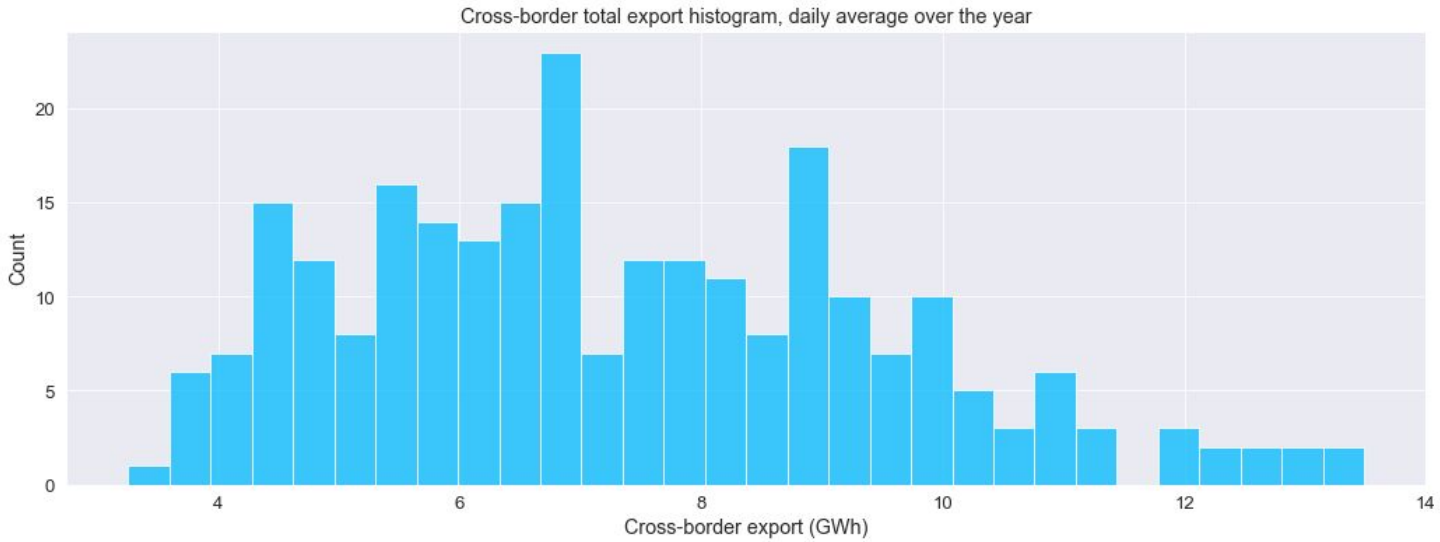
Cross-border export, closer look (by countries)





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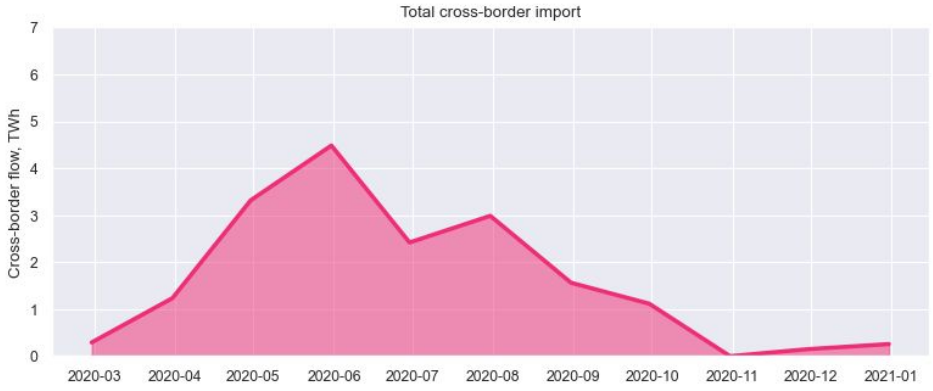
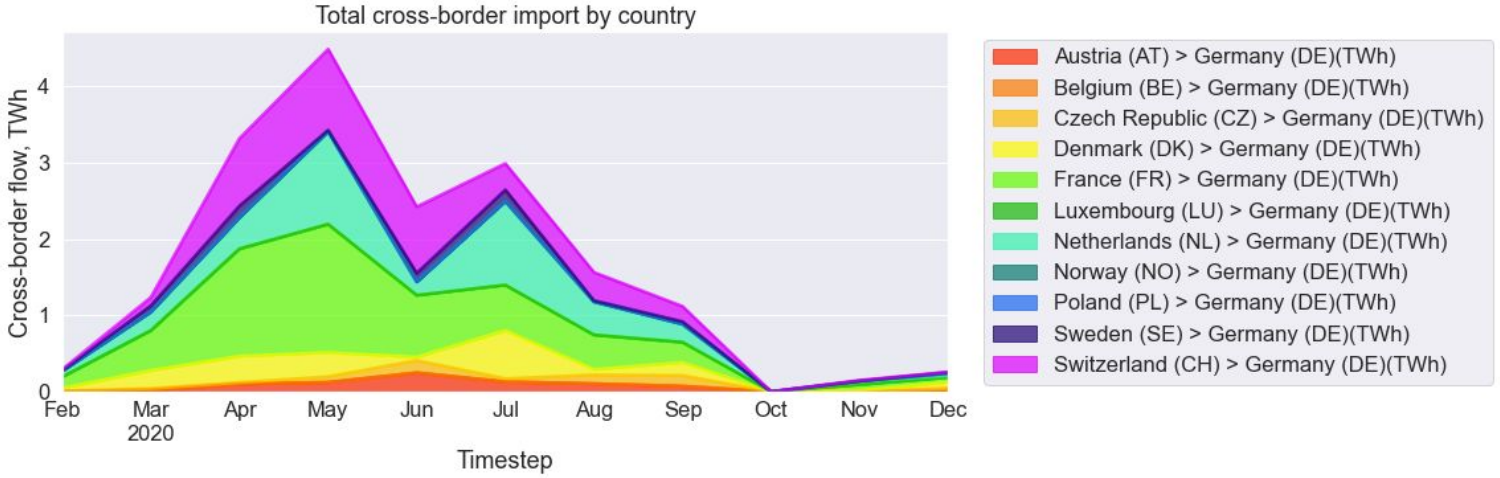
Cross-border import (net importer), closer look



Austria (AT) > Germany (DE)(TWh)	0.80234
Belgium (BE) > Germany (DE)(TWh)	0.02049
Czech Republic (CZ) > Germany (DE)(TWh)	0.60073
Denmark (DK) > Germany (DE)(TWh)	1.9452
France (FR) > Germany (DE)(TWh)	6.02001
Luxembourg (LU) > Germany (DE)(TWh)	2.8E-05
Netherlands (NL) > Germany (DE)(TWh)	3.9497
Norway (NO) > Germany (DE)(TWh)	0.03187
Poland (PL) > Germany (DE)(TWh)	0.00394
Sweden (SE) > Germany (DE)(TWh)	0.58342
Switzerland (CH) > Germany (DE)(TWh)	3.87101



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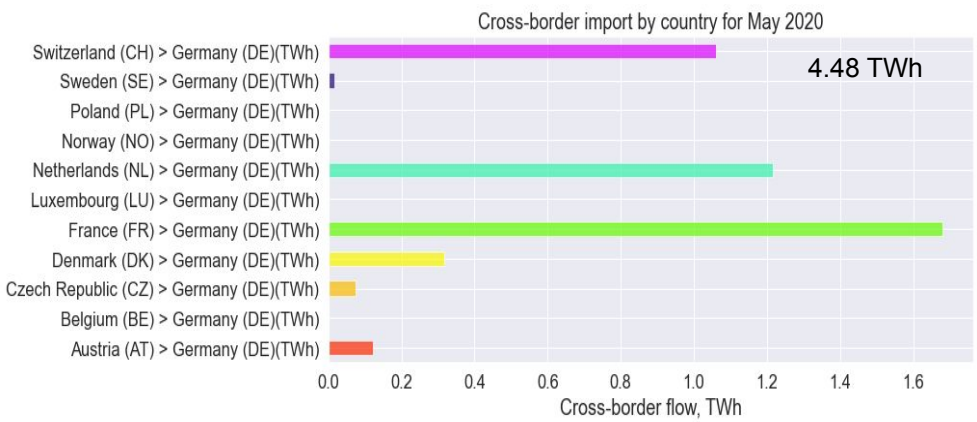
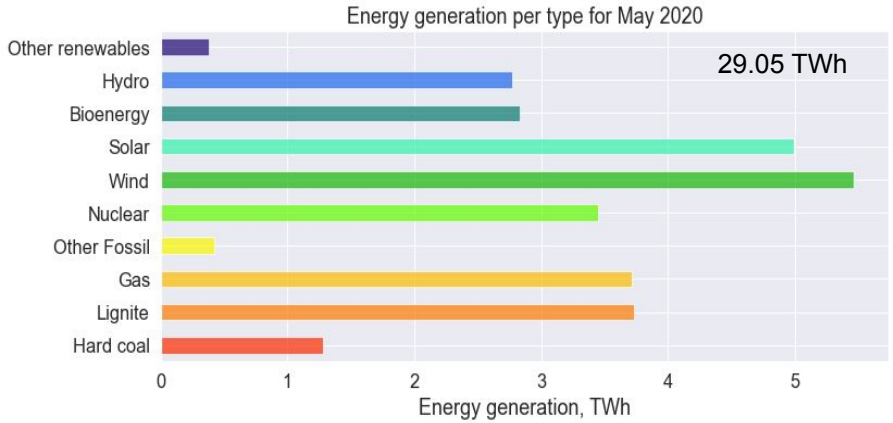
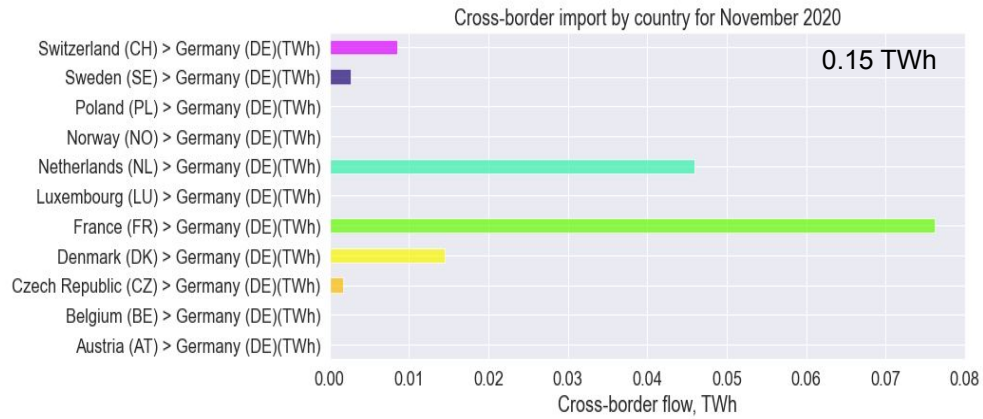
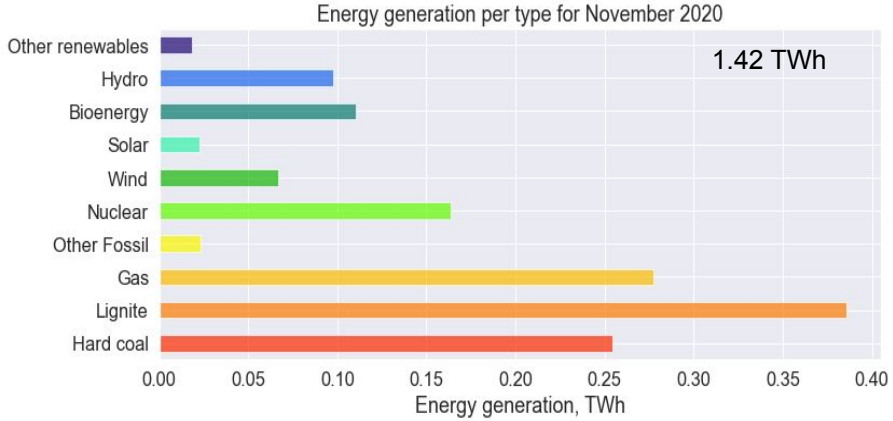
Cross-border import (net importer), closer look (monthly max, min)









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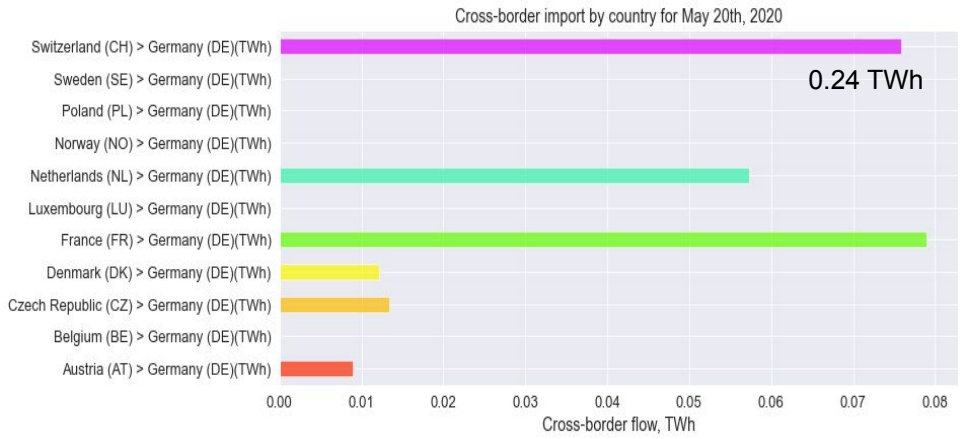
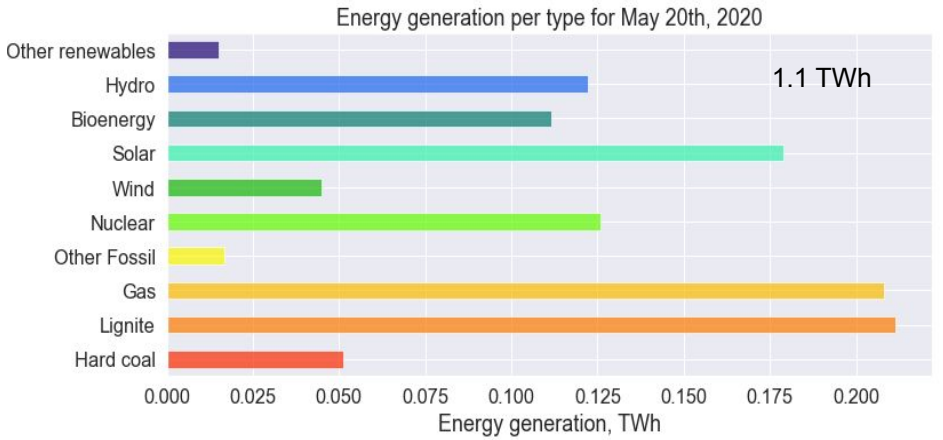
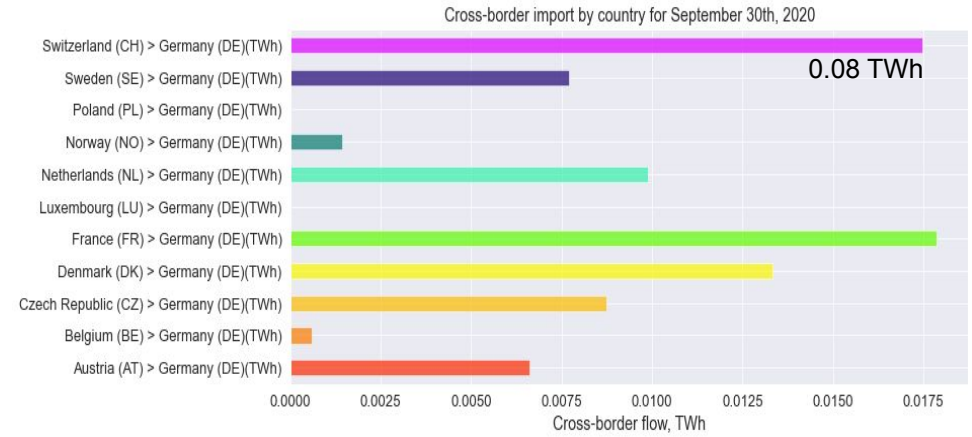
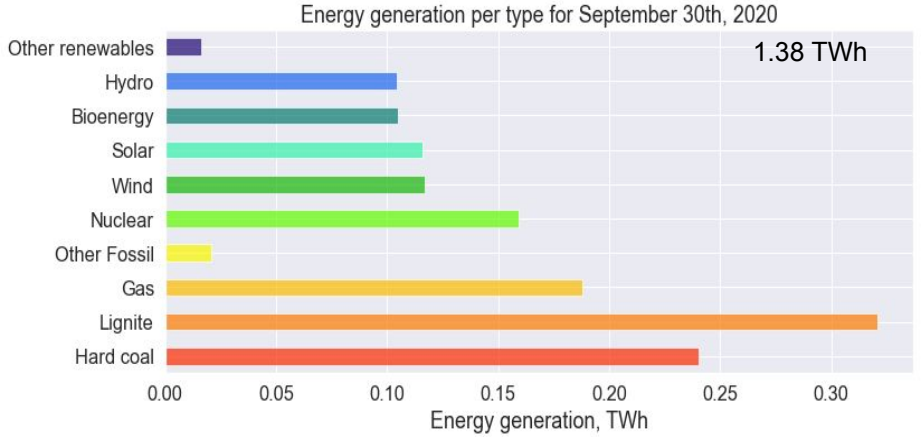
Cross-border import (net importer), closer look (daily max, min)









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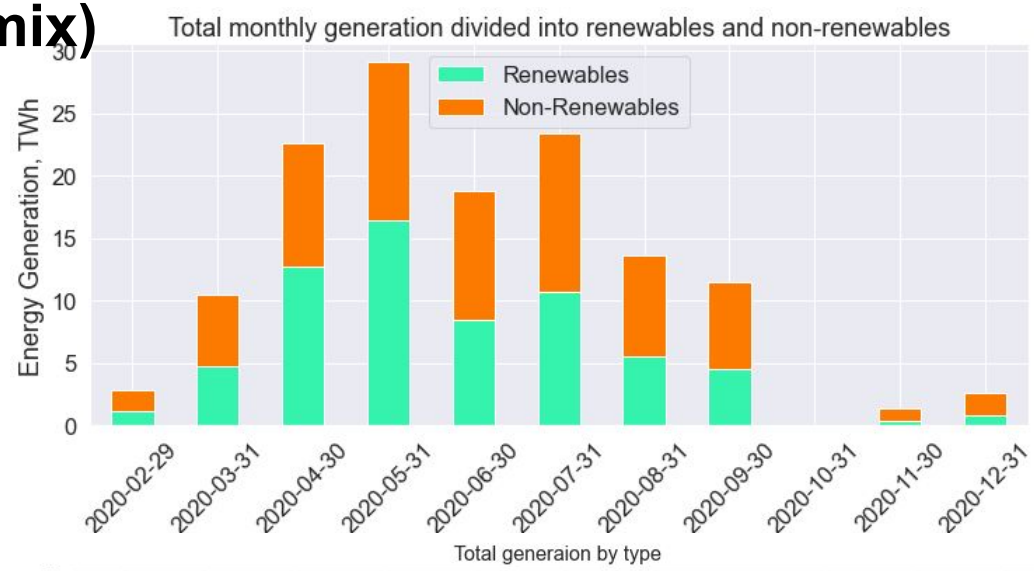
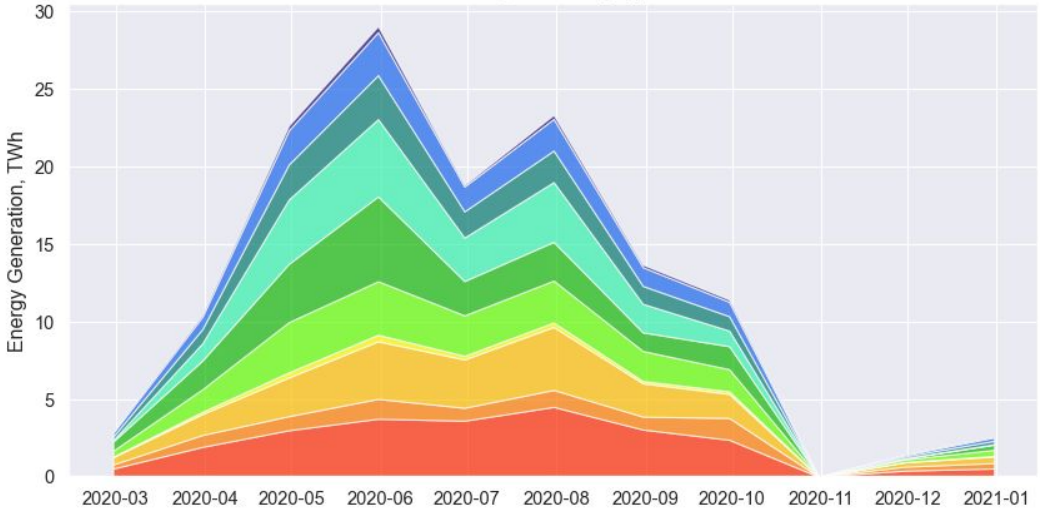
Cross-border import (net importer), closer look (generation mix)



Timestep	Renewables	Non-Renewables
January	41.59%	58.41%
February	45.96%	54.04%
March	55.99%	44.01%
April	56.62%	43.38%
May	44.73%	55.27%
June	45.80%	54.20%
July	40.72%	59.28%
August	39.35%	60.65%
November	22.27%	77.73%
December	32.45%	67.55%



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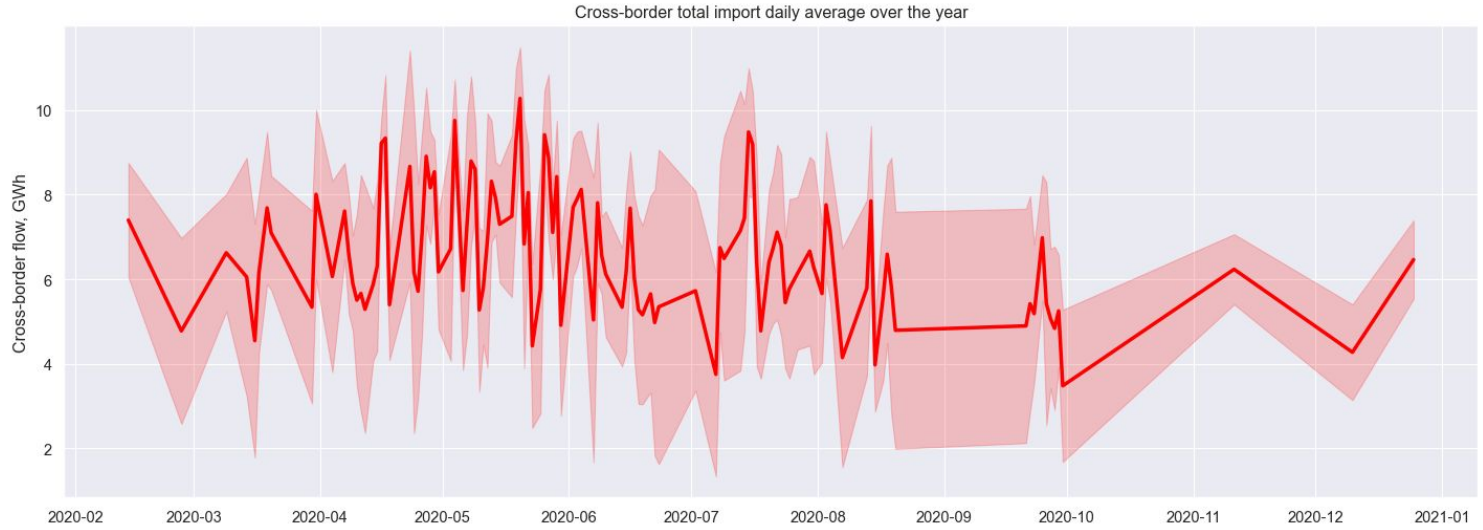
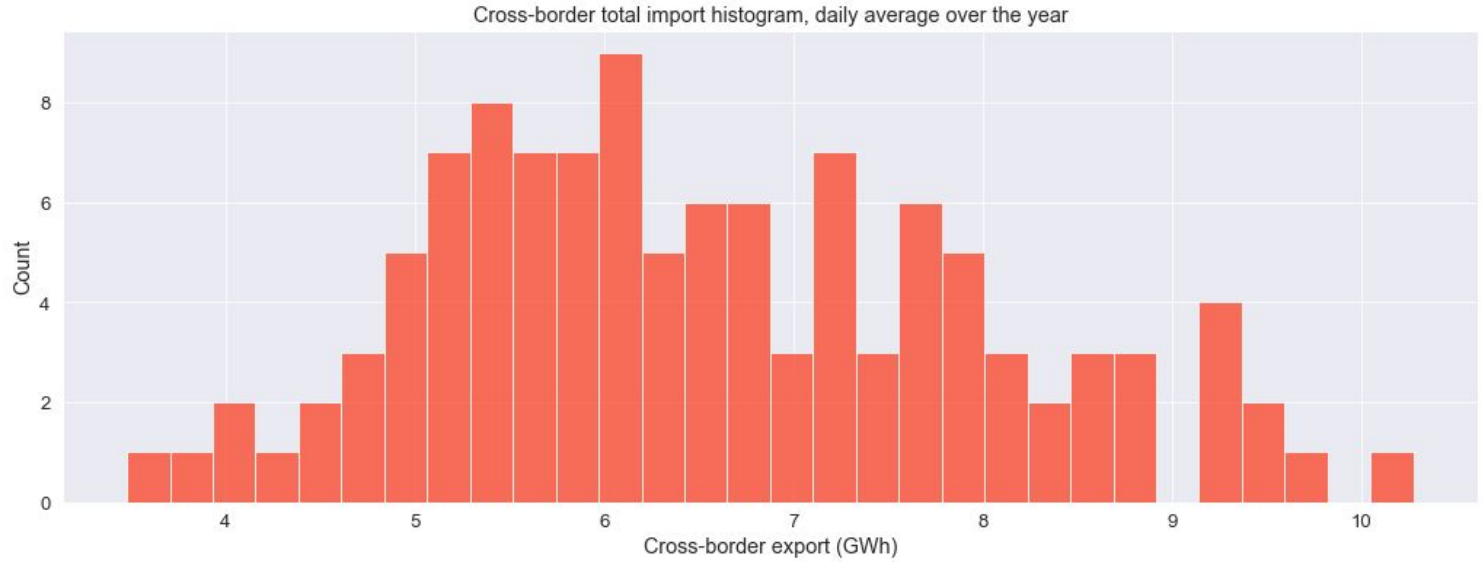
Cross-border import, closer look





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Conclusions

- 2020 is important year, renewables overtook fossil fules for the first time
- Total generation reached 504 TWh, with 34.86% share of Wind and Solar together
- Germany's cross-border imports concentrated in late spring-early summer season. Exports tend to grow in the year's beginning and end.
- Highest cross-border export flow for month was in January, lowest in May. For import flow it was in May and September correspondingly.
- Highest cross-border export flow for one day took place in December 27th, lowest in August 30th. For import flow it was in May 20th and September 30th correspondingly.
- Top 3 largest exporting borders are with Switzerland, Austria and Poland
- Top 3 largest importing borders are with France, Netherlands and Switzerland
- When Germany is net importer, in 10 out of 12 months non-renewables share was higher in electricity mix
- When Germany is net exporter, in 8 out of 12 moths renewables share was higher
- Total cross-border export flow – 44.56 TWh
- Total cross-border import flow – 17.82 TWh

References

1) Image source: https://www.tscnet.eu/tso-proposals-for-balancing-market-integration/
2) https://www.entsoe.eu/about/inside-entsoe/objectives/
3) https://ember-climate.org/global-electricity-review-2021/g20-profiles/germany/
4) https://ember-climate.org/global-electricity-review-2021/data-explorer/
5) https://transparency.entsoe.eu/generation/r2/actualGenerationPerProductionType/show
6) https://transparency.entsoe.eu/transmission-domain/physicalFlow/show

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Thank´s a lot for your attention

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