Effects of COVID-19 on the electricity sectors of Ukraine and Hungary: challenges of energy demand and renewables integration

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Aims and Scope

Aim:
to analyze impacts of the COVID-19 and associated lockdowns on the Ukrainian and Hungarian energy sectors.

Focus:
- changes in electricity consumption patterns,
- share of renewables in energy balance,
- readiness of the national power systems in the face of future possible global health crises.

What caused changes in energy demand?

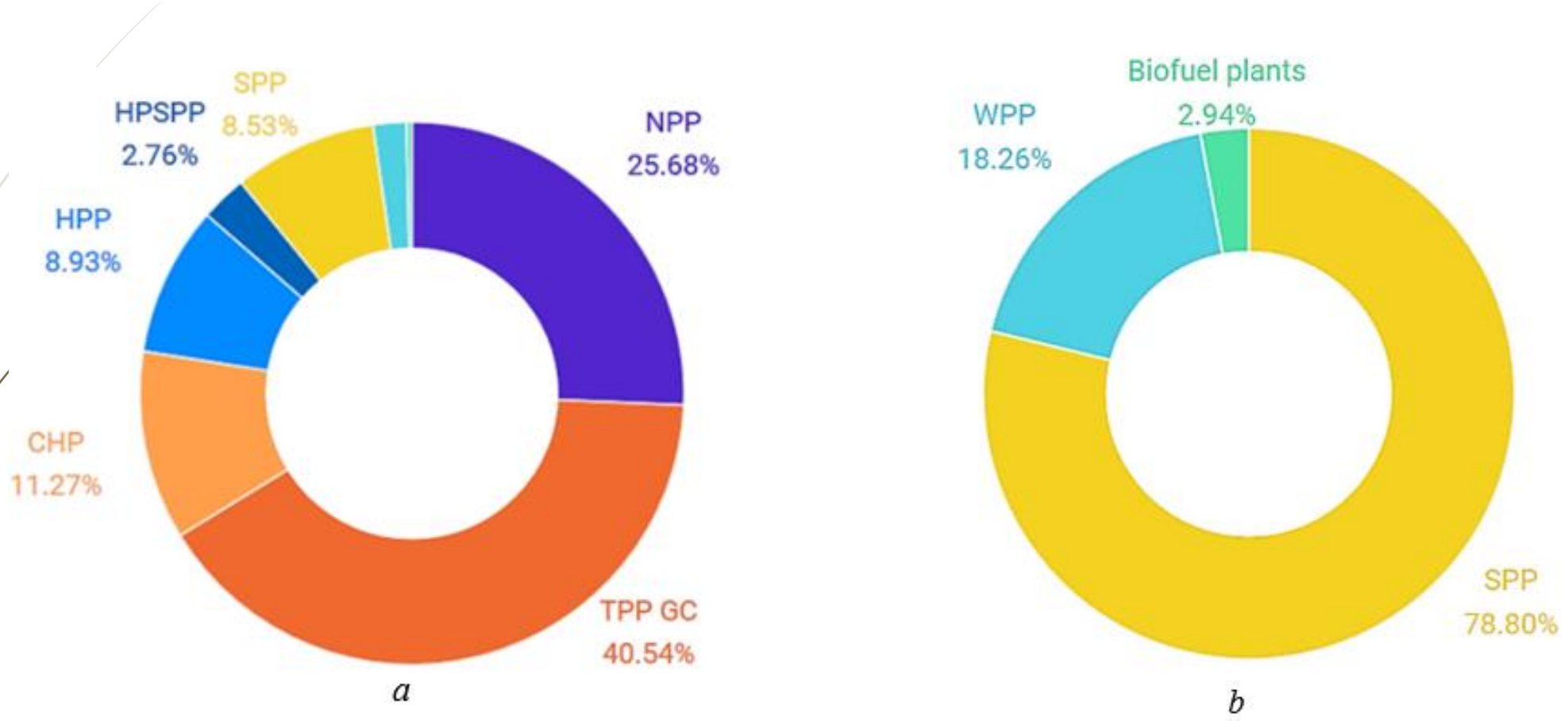
Trace of energy demand is strongly corelated with:

- the rise in the number of COVID-19 cases,
- the size of the stay-at-home population (social distancing),
- population of on-site workers,
- mobility in the retail sector (representative of the share of commercial electricity use).

Characteristics of the Ukrainian and Hungarian power systems

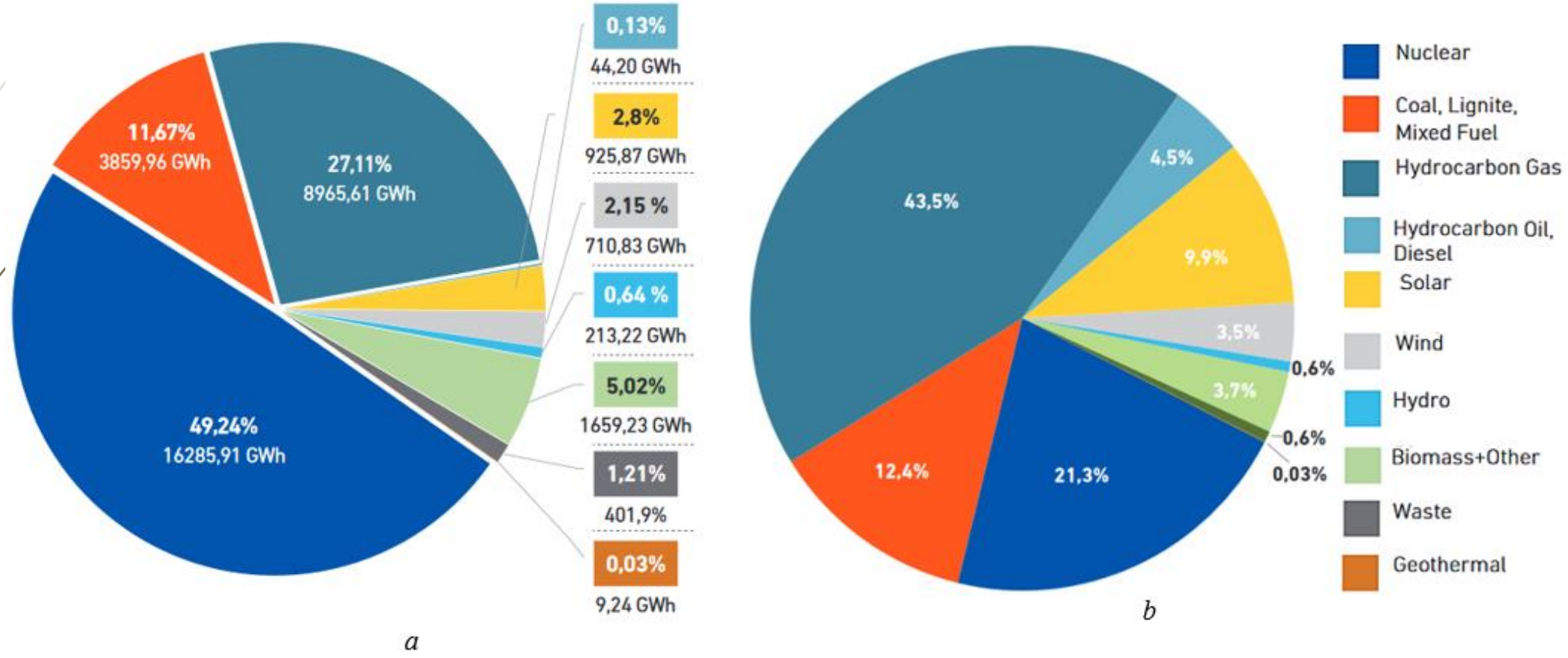
Characteristic	Ukraine	Hungary
Population, mln.	41.786 (as of June 2020) [15]	9.773 (as of 2019) [16]
Total area, km^2	603628	93030
Date of emergency state declaration	12 March 2020	11 March 2020
Details of grid connection	AC connections with Belarus, Moldova, Russia, Romania, Hungary, and Slovakia	Part of ENTSO-E. AC connections with Austria, Slovakia, Ukraine, Romania, Serbia, and Croatia
Total installed generation capacity, MW	53874.62 (as of July 2020)	9441.8 (as of December 2019) [14]
Share of RESs*, MW	12128.2 (as of 2020)	1668.9 (as of December 2019) [14]
Share of RESs excluding hydro, MW	5829.2 (as of 2020)	1611.1 (as of December 2019) [14]

IC mix of the Ukrainian power system



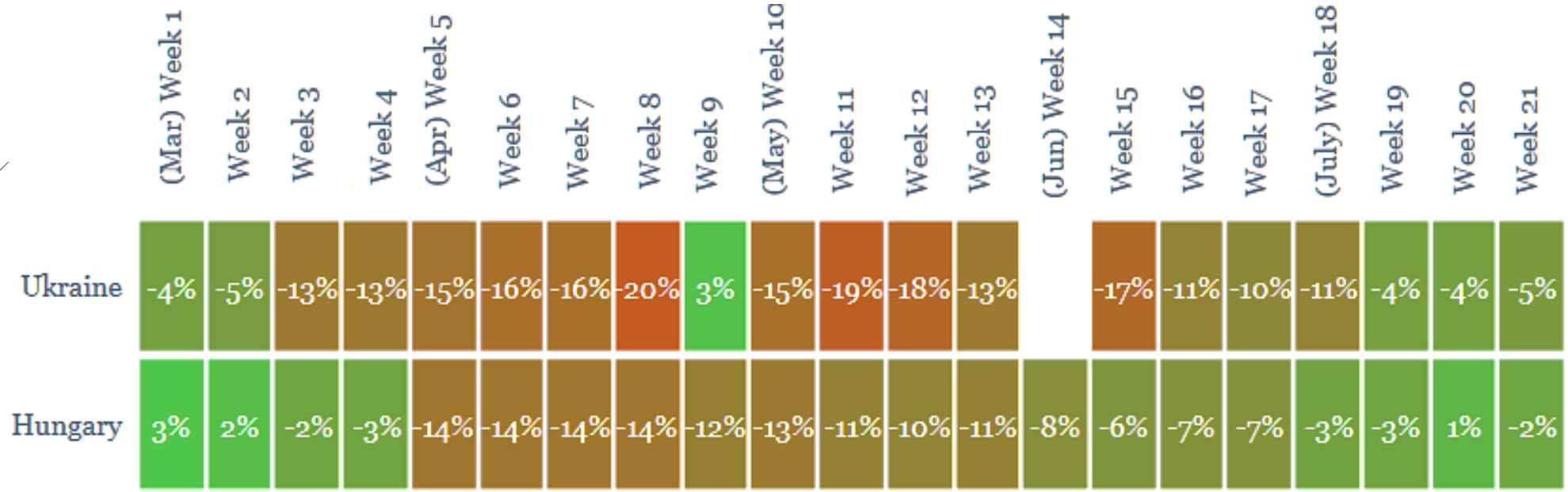
(a) overall IC mix; (b) RES-based IC mix

Energy capacities of the Hungarian power system



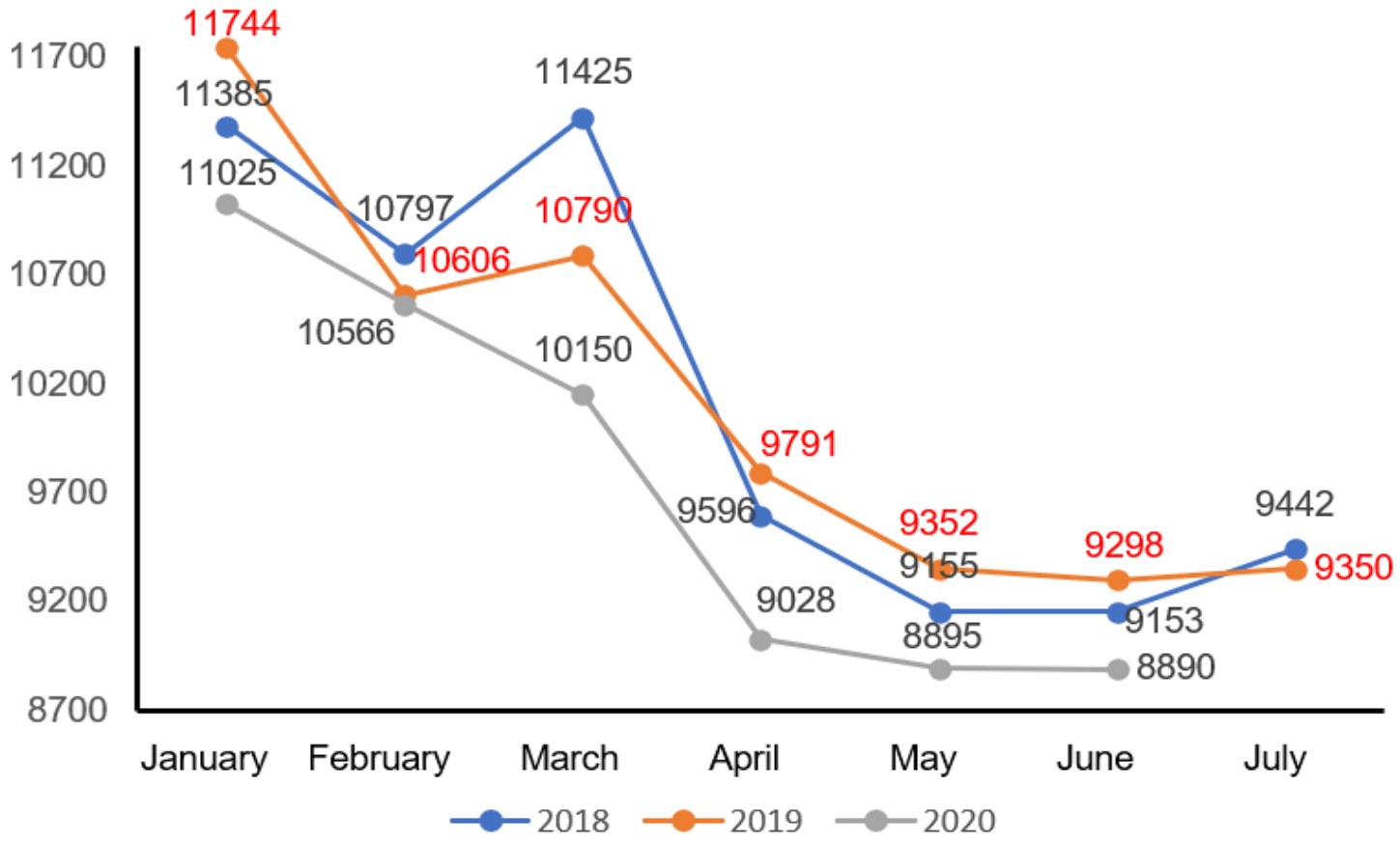
(a) the sources of domestic energy production (b) IC mix

Changes in 2020 consumption relative to 2019 in Ukraine and Hungary

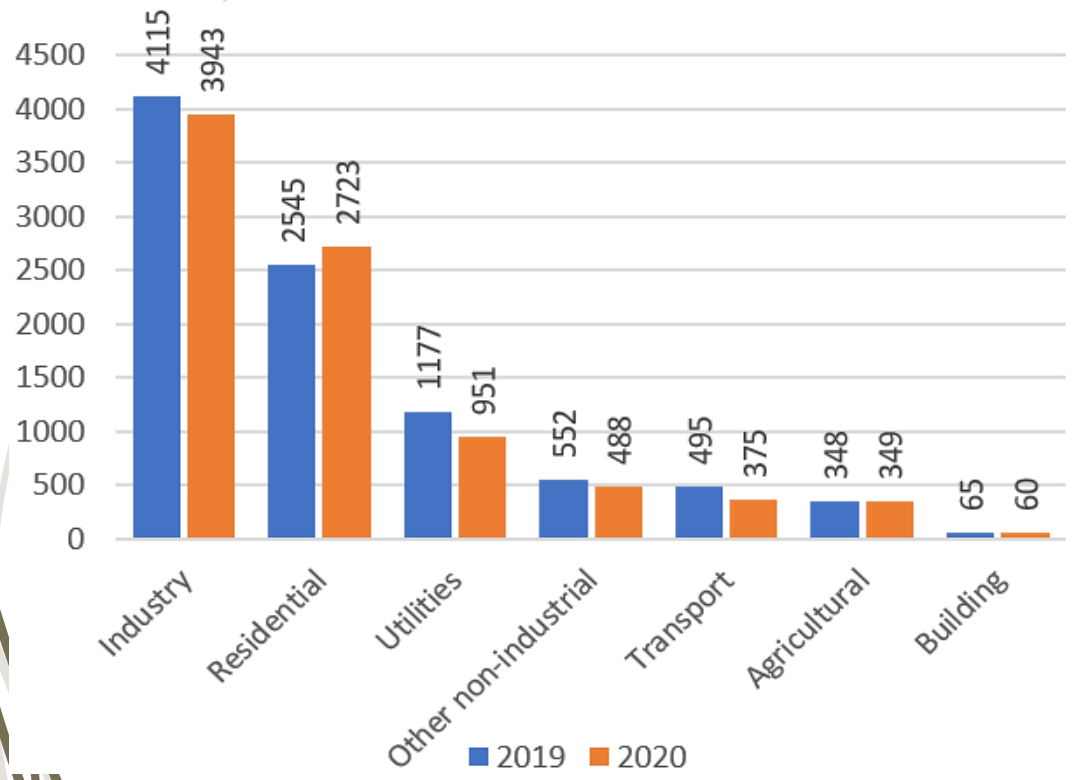


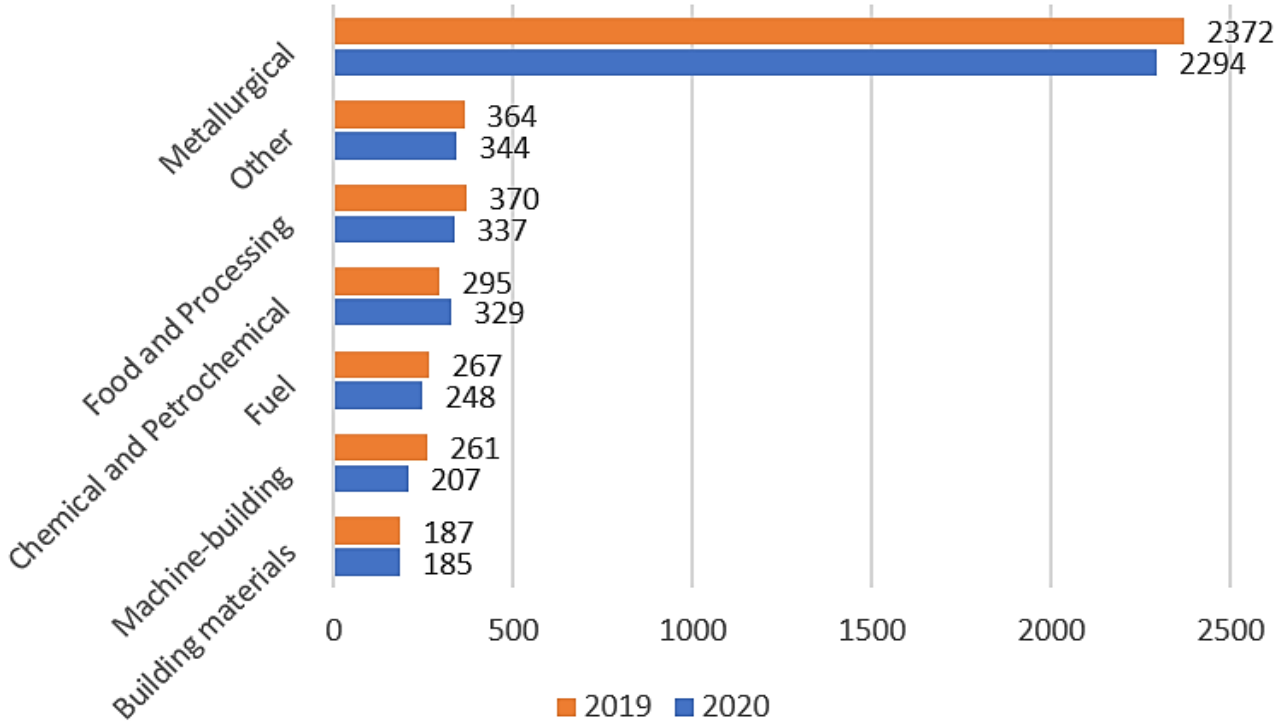
"Bruegel electricity tracker of COVID-19 lockdown effects," *Bruegel datasets*, 5 Aug. 2020. [Online]. Available: https://www.bruegel.org/publications/datasets/bruegel-electricity-tracker-of-covid-19-lockdown-effects/.

The comparison of energy demand in Ukraine in 2018-2020, TWh

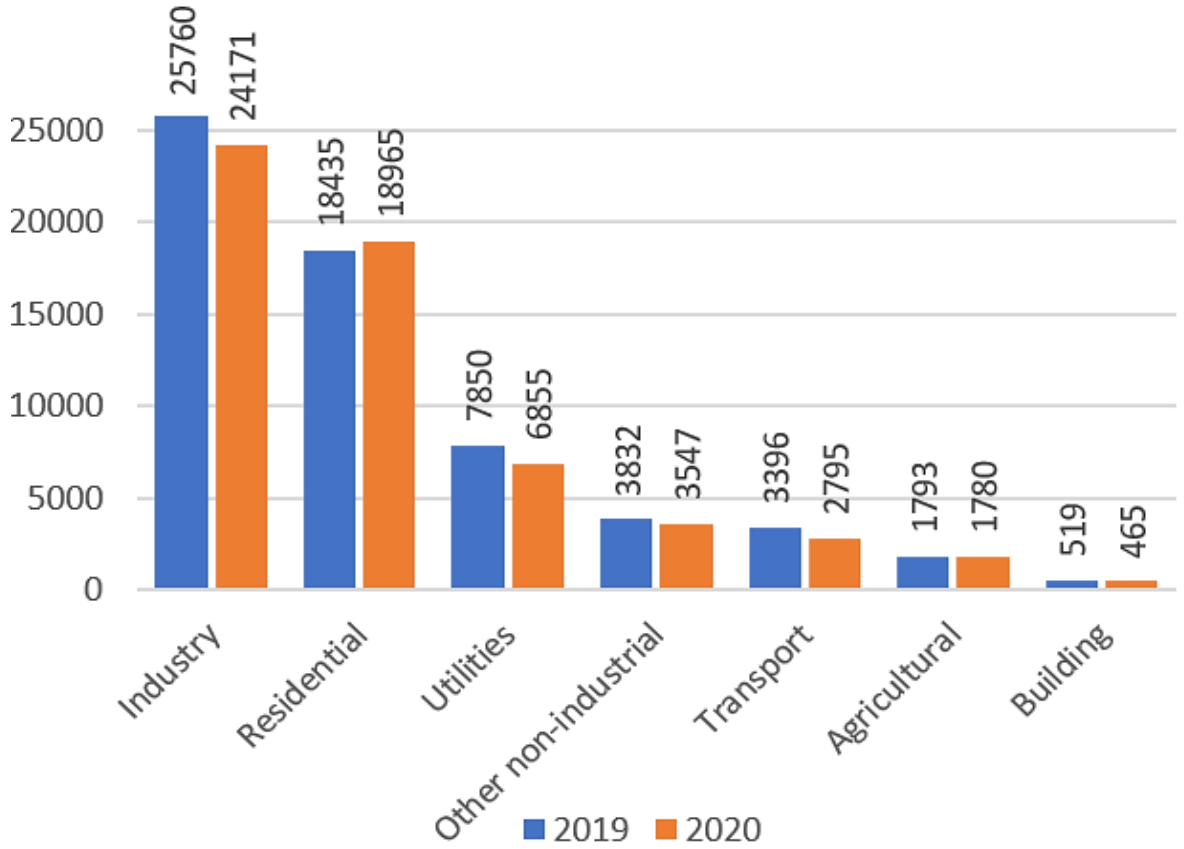


The structure of electric energy consumption in Ukraine in June 2019 and 2020, TWh

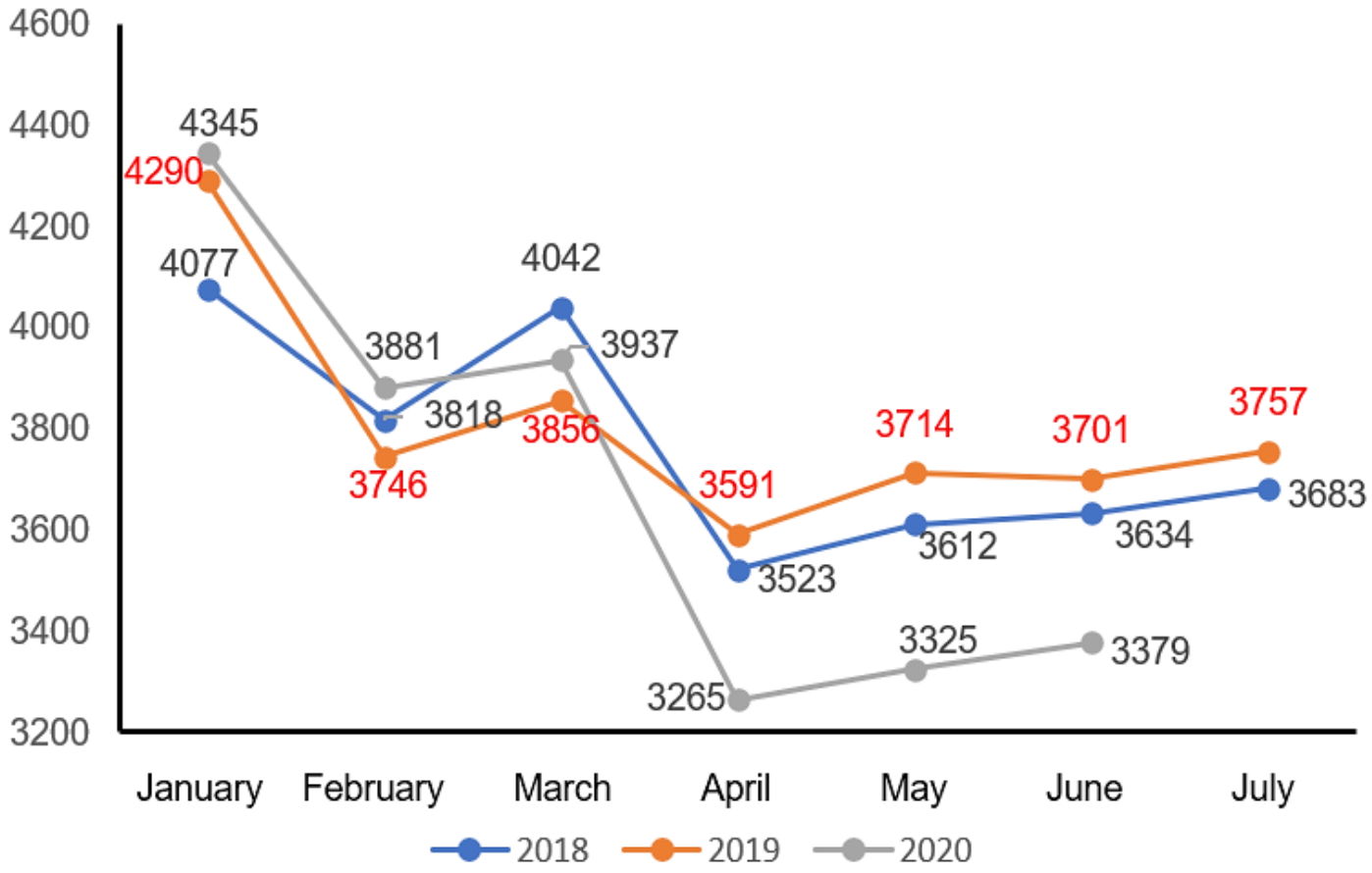




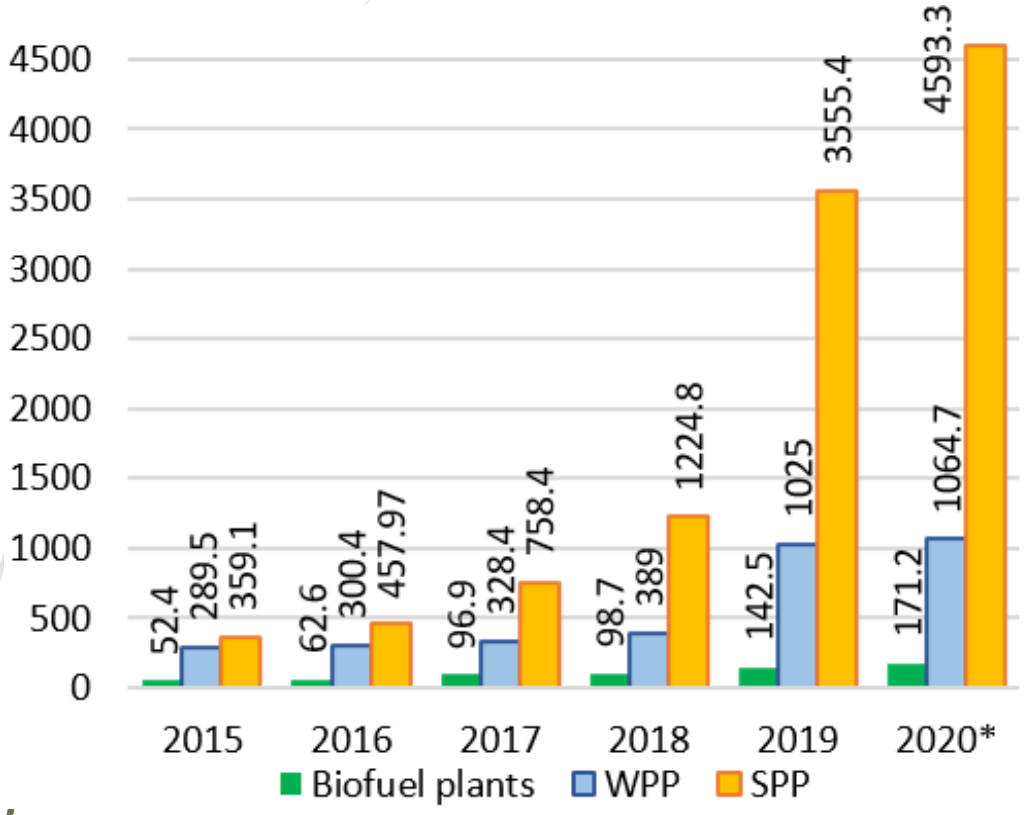
The structure of electric energy consumption in Ukraine in January-June 2019 and 2020, TWh



The comparison of energy demand in Hungary in 2018-2020, TWh



Effects of renewable energy sources



Installed capacity of renewables in Ukraine in 2015-2020, MW
(* values as of 31 June 2020)

For effective integration of solar and wind power technologies without the system's imbalance risks it is necessary to:

a) introduce RES responsibility for imbalances;

b) construct new maneuvering capacity with a short startup time;

c) deploy energy storages of large capacity to provide frequency maintenance reserves;

d) restrain volumes of annual support quotas for business entities, which produce energy from alternative energy sources so, that they do not exceed the capacity of the IPS of Ukraine to fully integrate them without limitations of power output.

Patterns:

- The largest portion of the drop in electricity consumption is caused by lessening of people's daily visits to retail establishments. The mobility in the retail sector is referred as the most significant and robust factor influencing energy demand.
- The number of newly confirmed COVID-19 cases does not have a strong direct influence on changes in energy demand. However, this indicator can influence the electricity consumption rates indirectly, through such factors as commercial activity and social distancing.
- High sensitivities to some of the aforementioned influencing factors may be observed in cities with a mild overall reduction in electricity consumption.

Conclusions

- In both Ukraine in Hungary energy demands started to drop almost immediately after the national emergency announcements.
- In contrast with downturns in energy consumption by industry and business, a significant increase in residential electricity consumption has been detected.
- The mobility in the retail sector, the size of stay-at-home population (social distancing code), and slower commercial activity seem to be the key indicators effecting the trace of the electricity consumption.
- The number of newly confirmed COVID-19 cases does not have a strong direct influence on changes in energy demand.
- For effective integration of RESs without the risk of imbalance it is necessary to construct new maneuvering capacities with a short startup time and reinforce the grid with energy storage.

Thank you for attention!