

Smart Energy and Smart Grids

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References

- [1] SEPS, a.s., “Schémy siete”. 31. december 2021. [Online]. Available at: <https://www.sepsas.sk/sk/technicke-udaje/schemy-siete/>
- [2] “ÚVOD DO LIBERALIZOVANÉ ENERGETIKY”. Asociace energetických manažerů, 2016. [Online]. Available at: <https://www.mpo-efekt.cz/upload/7799f3fd595eeee1fa66875530f33e8a/kniha-trh-s-elektrinou.pdf>

1 Electrical power grid

Electrical power grid is an interconnected network of power lines and associated equipment used to deliver electricity from producers to consumers.

The most electricity production is typically done in power plants (e.g. coal, nuclear, water based) but are often far away from consumers. The long distance is caused by several factors, such as economy, health, security, environmental. The delivery generally occurs at two levels: **transmission** and **distribution**. **Transmission** carries the power for long distances (e.g. hundreds of kilometers) and uses higher voltages for more effective transmission. Distribution is focused on delivery for individual consumers and uses lower voltages for safer and easier distribution.

Generally, the **energy chain** is generation -> transmission -> distribution -> consumption.

Besides this traditional concept, there exist concept of **distributed energy resources (DER)**. In DER concept, the power is generated close to the consumption point, e.g. in the same building. Typically, DER are small and environment friendly. They typically use solar energy, natural gas, or wind. Placement of both concepts is depicted on the Fig. 1.

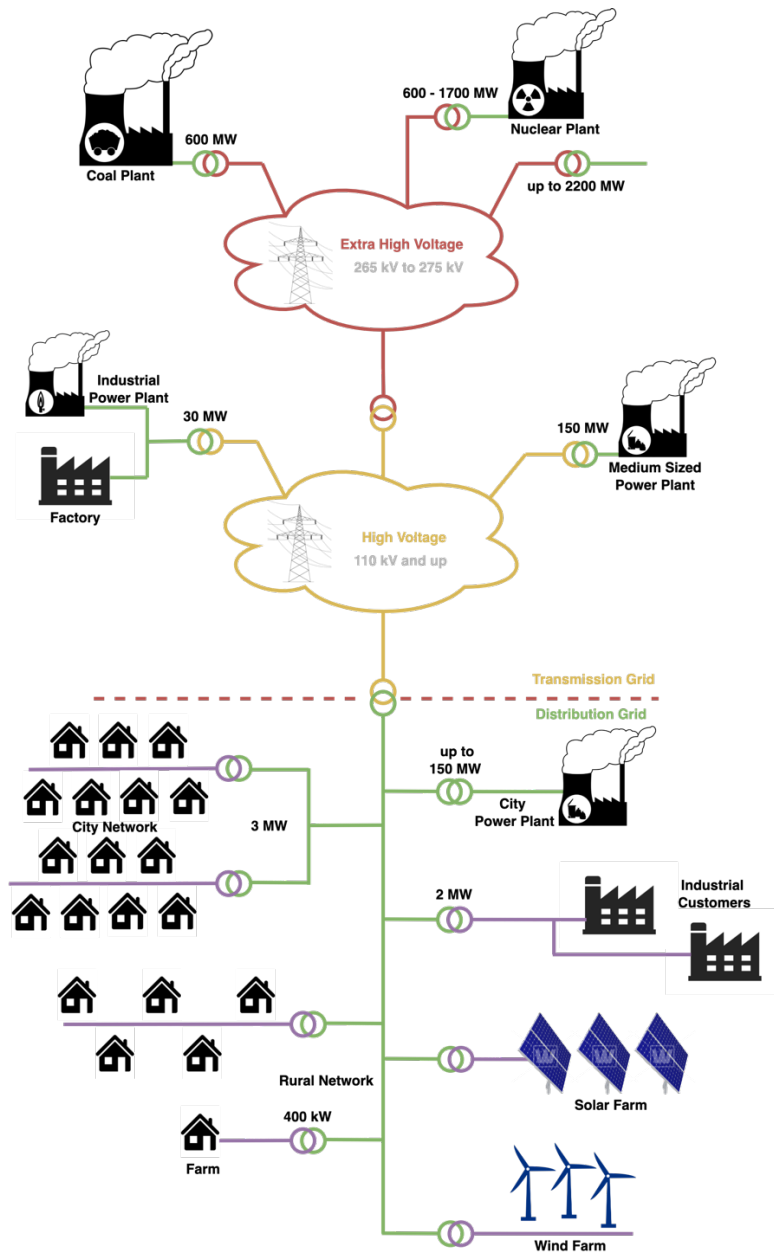


Fig. 1 Basic scheme of electric grid with energy generation, transmission, distribution, consumption

There is visible also clear separation of the transmission and distribution levels. This separation is also present in the operation of the power grid. The transmission part is operated by **transmission system operators (TSO)** and distribution by **distribution system operators (DSO)**. The distribution operators can be regional or local.

In Europe, there are above 3500 DSO companies. In some countries (e.g. as Czechia, Slovakia, Hungary) three largest DSO deliver more than 60% of power.

Maps and schemes of transmission parts published by TSOs are publicly available, e.g. in [1] is available scheme for whole Central Europe. We provide here a partial view on Fig. 2.

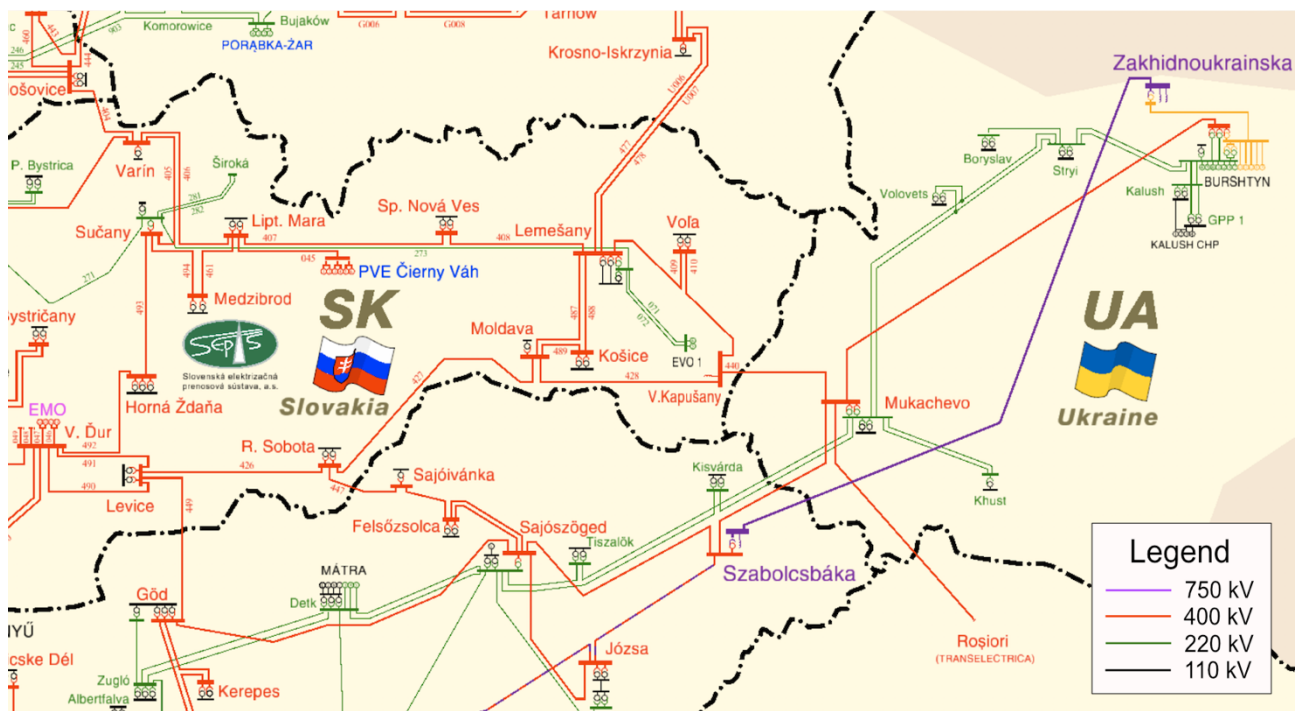


Fig. 2 Power systems of central east Europe [1], zoomed to Slovak-Ukraine border, provided with permission SEPS a.s.