# THE ROLE OF STORAGE SOLUTIONS IN THE ENERGY TRANSITION

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***FLEXIBILITY, ENERGY STORAGE AND DEMAND SIDE RESPONSE***
*16. 03. 2023*

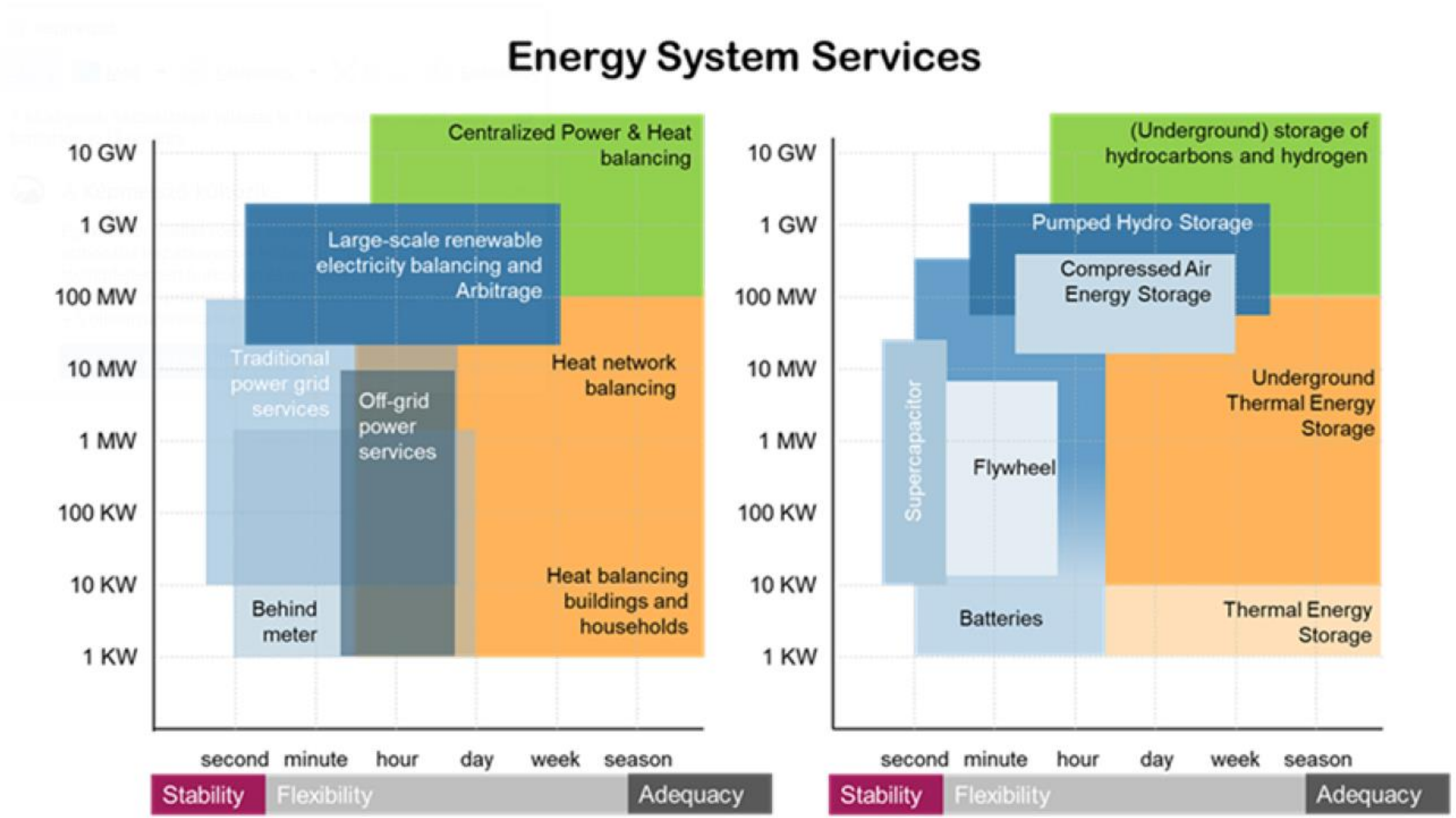
***Knowledge sharing between the United Kingdom and Hungary to enhance energy security***
***Online workshop,***
*Organised by REKK & the British Embassy Budapest*

# The definition of energy storage

*A technology that is capable to accept electricity generated by the power system, to convert it into a suitable form for storage, to keep it for a certain time and to return energy back in a form that is usable when it is needed (Ter-Gazarian, 2011).*

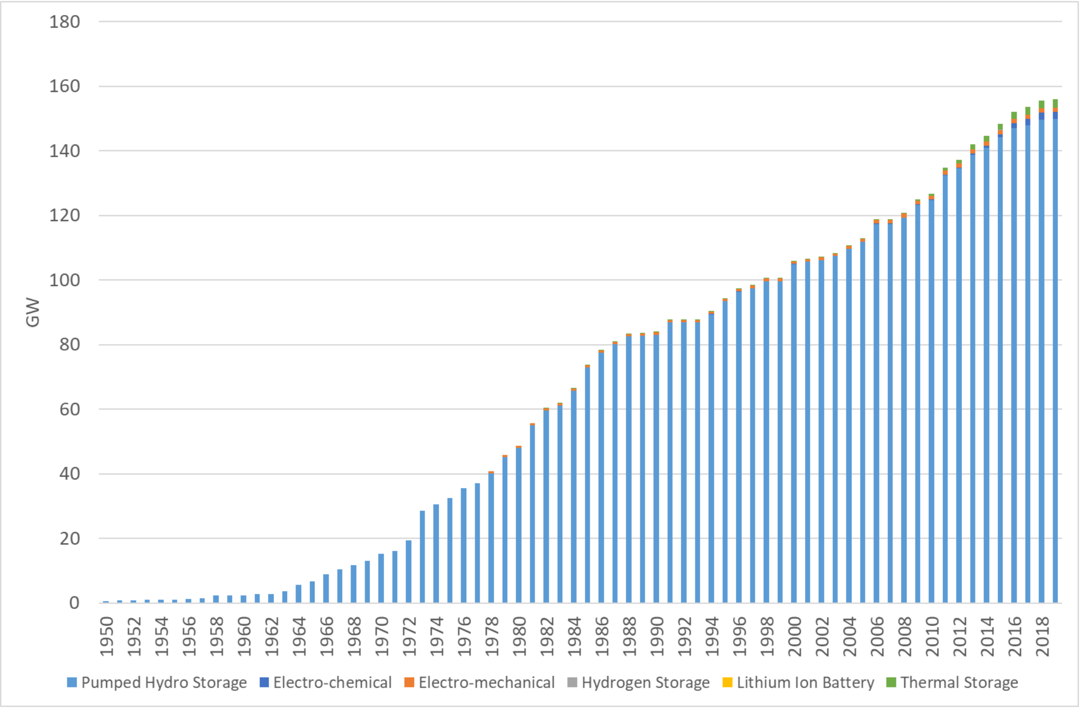
| Based on the form of energy stored | | Based on the form of energy discharged | |
|---|---|---|---|
| Mechanical ES | use the potential or kinetic form of energy (e.g. pumped-hydro, compressed air, flywheel) | Electricity storage (P2P) | electric power is charged and stored in any kind of form of energy, then electric power is discharged when needed |
| Electromagnetic ES | store energy in magnetic and electric fields (e.g. supercapacitor, superconducting magnetic) | Heat storage (P2H) | electric power is charged and stored in the form of heat energy, then heat energy is recovered |
| Electro-chemical ES | conventional and flow batteries | Power-to-X (P2X) | electric power is charged and stored typically in the form of hydrogen, methane, or ammonium, then energy is recovered in the form it is stored |
| Thermal ES | heat stored in insulated solids and fluids, | Power-to-X-to-Power | bi-directional i.e. electricity is given back to the system (V2G) |
| Hydrogen/methane and other ES | energy stored in different form | | |

# Energy system services and storage technologies according to their power and timescales for discharging

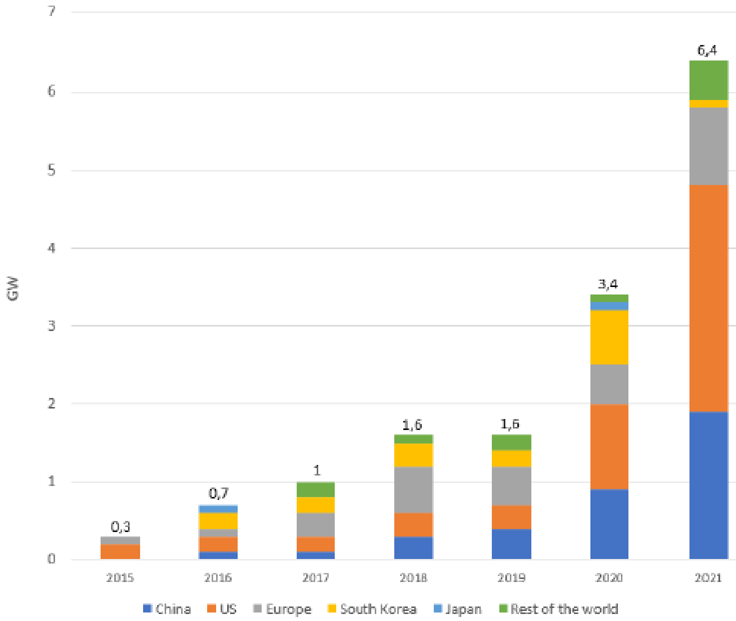


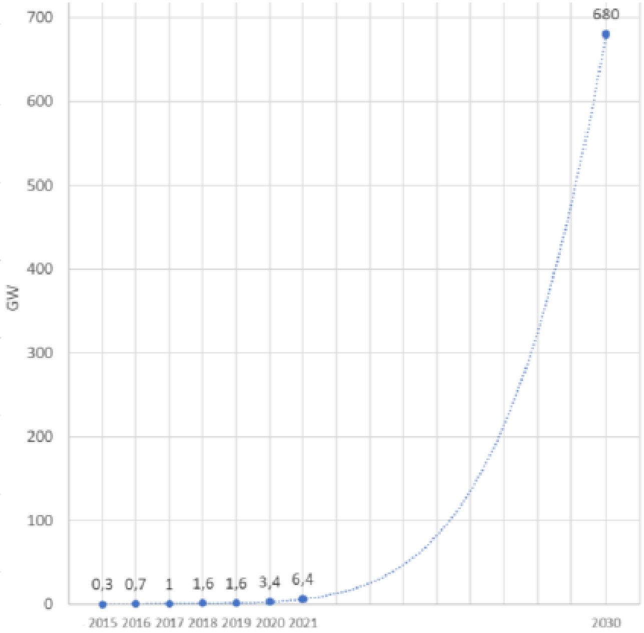

Source: EASE (2022)

# Aggregated global installed capacity and until 2020 and global utility-scale battery-storage additions between 2016-2021 and 2016-2030 (below)




Source: Sandia (2021)




Source: SWD(2023) 57 based on IEA (2021)

# Installed electricity storage capacities and their main technological characteristics in Hungary (2023 Q1)

| Name of licencee | Sites | Installed capacity | Licence issue date | Storage technology |
|---|---|---|---|---|
| E.ON Energiatároló Kft. | Budapest | 10 MW/ 6.1 MWh | 2018 | Battery |
| ALTEO-Therm Hő- és Villamosenergia-termelő Kft. | Kazincbarcika | 5.7 MW/5.2 MWh | 2021 | Battery |
| Békéscsaba Vagyonkezelő Zrt. | Békéscsaba | 1.19 MW / 2.4 MWh | 2021 | Battery |
| Dunamenti Erőmű Zrt. | Százhalombatta | 3.84 MW / 7.68 MWh | 2021 | Battery |
| MVM Tisza Erőmű Kft. | Tiszaújváros | 0.5 MW / 1.22 MWh | 2022 | Battery |
| E.ON Energiatermelő Kft. | Aszófő | 2 MW / 2.3 MWh | 2022 | Battery |
| PANNON Green Power TSL1. Kft. | Törökszentmiklós | 4.95 MW / 12.15 MWh | 2022 | Battery |

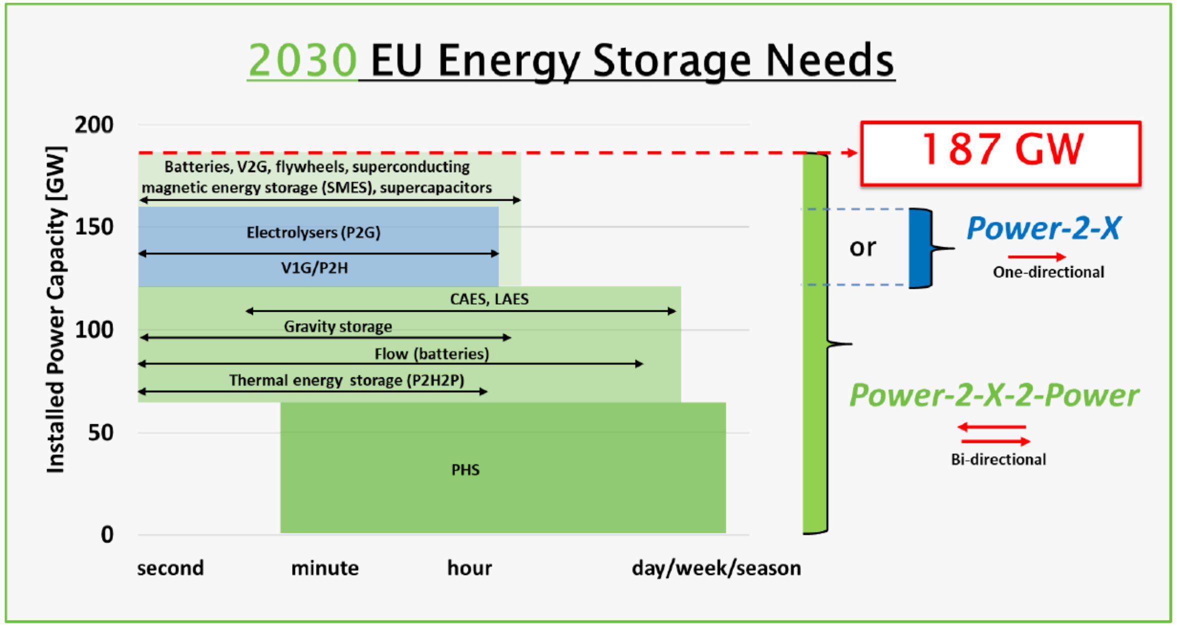
Source: MEKH (2023)

# The European Comission’s Recommendation on Energy Storage – Underpinning a decarbonised and secure EU energy system / C(2023) 1729/

| No. | Recommendations |
|---|---|
| 1) | Member States take into account the double role (generator-consumer) of energy storage when defining the applicable regulatory framework and procedures (…) This includes ***preventing double taxation*** and ***facilitating permit-granting procedures***.” |
| 2) | „Member States identify the ***flexibility needs of their energy systems*** in the short, medium and long term” ***in their updates of the NECPs*** to „promote the deployment of energy storage, both utility-scale and behind-the-meter storage, demand response and flexibility”. |
| 3) | „Member States, in particular their national regulatory authorities, ensure that energy system operators further ***assess the flexibility needs of their energy systems when planning transmission and distribution networks***, including the potential of energy storage (short- and long-term duration) and whether energy storage can be a more cost effective alternative to grid investments.” |
| 4) | „Member States identify ***potential financing gaps*** for (…) energy storage, (…) and ***consider the potential need for financing instruments*** that provide visibility and predictability of revenues.” |
| 5) | „Member States explore ***whether energy storage services*** - in particular the use of flexibility in distribution networks and the provision of non-frequency ancillary services - ***are sufficiently remunerated***, and whether operators can add up the remuneration of several services.” |
| 6) | „Member States to consider ***competitive bidding processes*** if necessary to reach a sufficient level of deployment of flexibility sources to achieve transparent security of supply and environmental objectives (…) ***Potential improvements*** should be explored i***n the design of capacity mechanisms*** to facilitate the participation of flexibility sources including energy storage (…),”. |
| 7) | „Member States identify any specific actions (…) ***to remove barriers to the deployment*** of demand response and behind-the-meter storage (…)” |
| 8) | „Member States accelerate the ***deployment of storage facilities*** and other flexibility tools ***in islands, remote areas*** (…)” |
| 9) | „Member States and national regulatory authorities ***publish detailed data*** on network congestion, renewable energy curtailment, market prices, (…) ***to facilitate investment decisions*** on new energy storage facilities.” |
| 10) | „Member States continue to ***support research and innovation in energy storage***, in particular long-term energy storage and storage solutions coupling electricity with other energy carriers, (…). |

Source: C(2023) 1729, PP. 3-5

# The European Association for Storage of Energy's (EASE) estimation about energy storage targets for 2030 and 2050 (EASE)

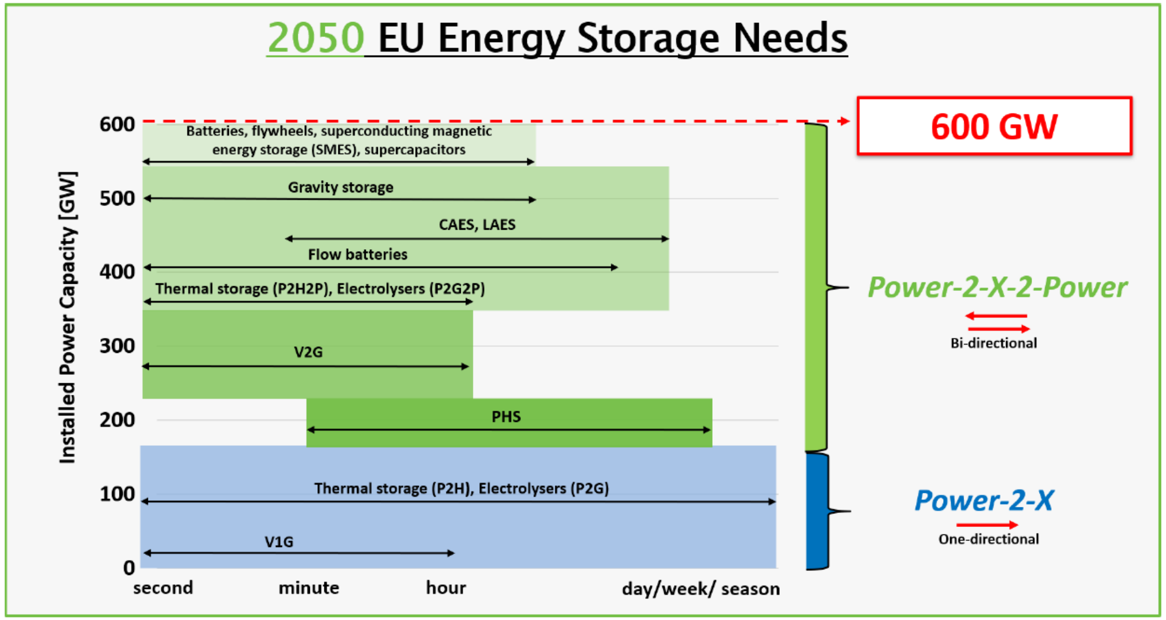



Assumptions for 2030 targets:

- 67 GW batteries and other short duration solutions
- 65 GW PHS (new and existing)
- 55 GW energy storage (Power-to-X-to-Power) to replace a portion of gas turbine flexibility in 2030 (short and long duration ES)
- (40 GW electrolyser target as stated in the European Hydrogen Strategy is taken into account)
- (V1G and P2H is included qualitatively)

Assumptions for 2050 targets:

- 65 GW PHS (new and existing)
- Long duration energy storage technologies are expected to reach between 128 GW and 264 GW. An average of 200 GW LDES is considered.
- 120 GW of V2G based on scenario of European EV deployment
- An additional 50 GW of stationary batteries are assumed.
- To meet the total energy storage flexibility needs in 2050 as much as 165GW could be filled by P2X solutions




Source: EASE (2022)

# References


- Ter-Gazarian, A. (2011). *Energy storage for power systems*. The Institution of Engineering and Technology. ISBN: 978-1-84919-219-4.
- International Hydropower Association (2018). *The World’s Water Battery: Pumped Hydropower Storage and the Clean Energy Transition*. IHA Working Paper, link: https://www.hydropower.org/sites/default/files/publications-docs/the_worlds_water_battery_-_pumped_storage_and_the_clean_energy_transition_2.pdf
- Zhao, H. et al. (2015). *Review of energy storage system for wind power integration support*. Applied Energy 137, pp. 545-553. doi: 10.1016/j.apenergy.2014.04.103.
- Luo, X. et al. (2015). *Overview of current development in electrical energy storage technologies and the application potential in power system operation*. Applied Energy 137, pp. 511-536. doi: 10.1016/j.apenergy.2014.09.081.
- Sandia (2021) *DOE Global Energy Storage Database – The official Hub for Global Energy Storage Data*, US Depertment of Energy & Sandia National Laboratories, accessed: 2022.04.01. link: https://sandia.gov/ess-ssl/gesdb/public/index.html
- IEA (2021) *Renewables 2021 Analysis and forecast to 2026*, *Chapter 4: Renewable energy trends to watch, How rapidly will the global electricity storage market grow by 2026?,* International Energy Agency, PP 154-157. link: https://iea.blob.core.windows.net/assets/5ae32253-7409-4f9a-a91d-1493ffb9777a/Renewables2021-Analysisandforecastto2026.pdf
- Directorate-General for Energy (2023) *Recommendation for energy storage - underpinning a decarbonised and secure EU energy system*, C(2023) 1729, European Commission Link: https://energy.ec.europa.eu/recommendation-energy-storage-underpinning-decarbonised-and-secure-eu-energy-system_en
- Directorate-General for Energy (2023) *Staff working document on the energy storage - underpinning a decarbonised and secure EU energy system*, SWD(2023) 57,European Commission Link: https://energy.ec.europa.eu/recommendation-energy-storage-underpinning-decarbonised-and-secure-eu-energy-system_en
- EASE (2022) *Energy Storage Targets 2030 and 2050 - Ensuring Europe’s Energy Security in a Renewable Energy System*, European Association for Storage of Energy, link: https://ease-storage.eu/publication/energy-storage-targets-2030-and-2050/
- MEKH (2023) *Villamosenergia-ipari engedélyesek és nyilvántartott társaságok listája 2023. február*, Magyar Energetikai és Közmű-szabályozási Hivatal (MEKH), link: http://www.mekh.hu/villamosenergia-ipari-engedelyesek-listaja

# Thank you for your attention!

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