



TECHNISCHE
UNIVERSITÄT
WIEN



17. Symposium Energieinnovation, 16.-.18.2.2022. Graz/ Austria



Modeling energy storage systems in electricity markets
Zejneba Topalović, Reinhard Haas,
Energy Economics Group, TU WIEN

Agenda

1. Motivation
2. Storage development
3. Austria's generation mix
4. Method
5. Results
6. Conclusion and Outlook

- Paris Agreement, 2015.
- Net- zero emission by 2050.
- Emissions increased by 60% (* UN Convention on Climate Change 1992.)
- Climate Change Conference in Glasgow, November 2021.
- Renewables increase from 2010.
- Storage technologies as flexibility measures
- 182 GW installed storage power capacity
- Hydrogen and batteries emerging new technologies

Storage development

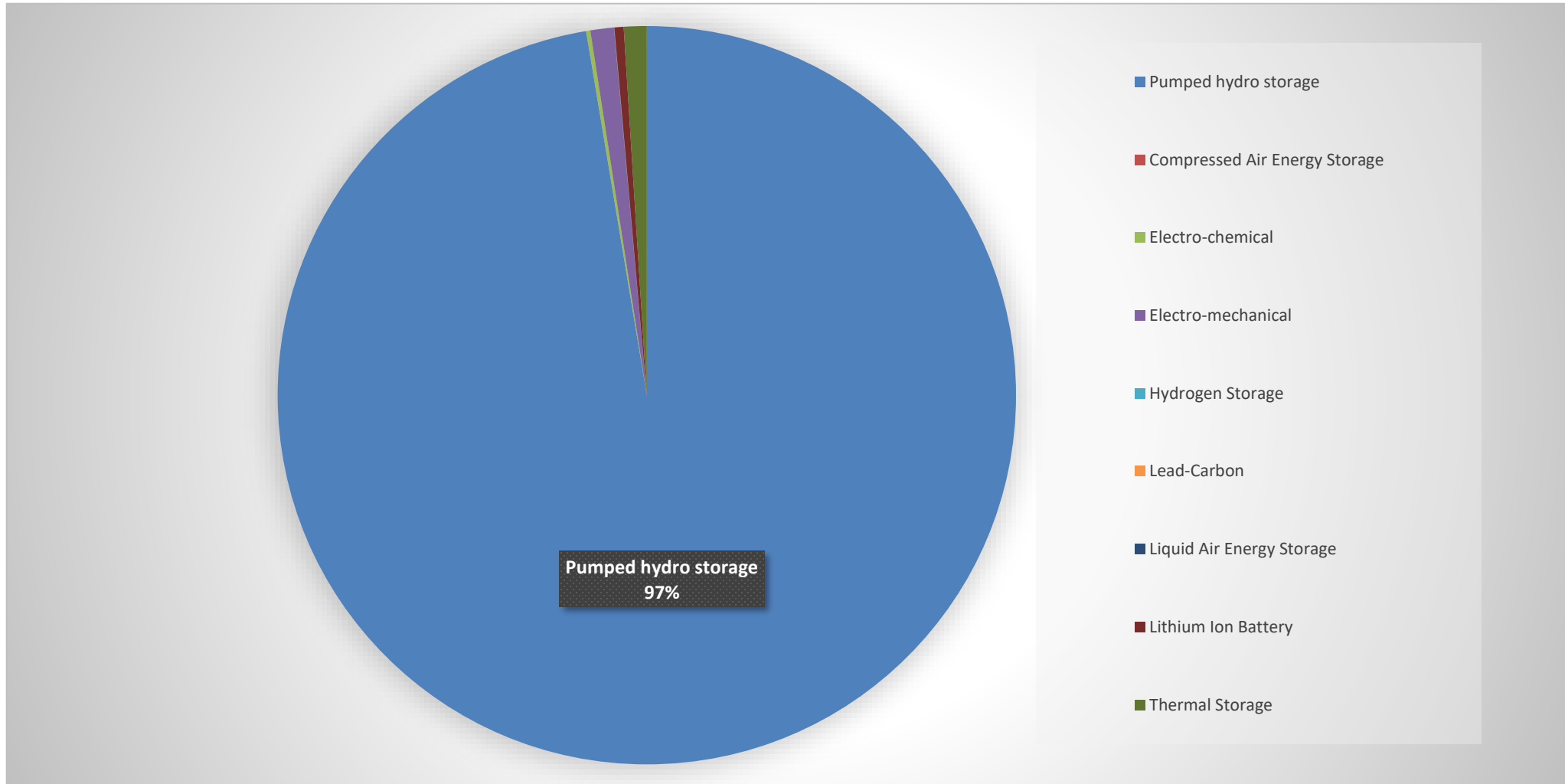


Figure 1 Installed storage power capacities, source: Global Energy Storage Database

Austria's generation mix in winter

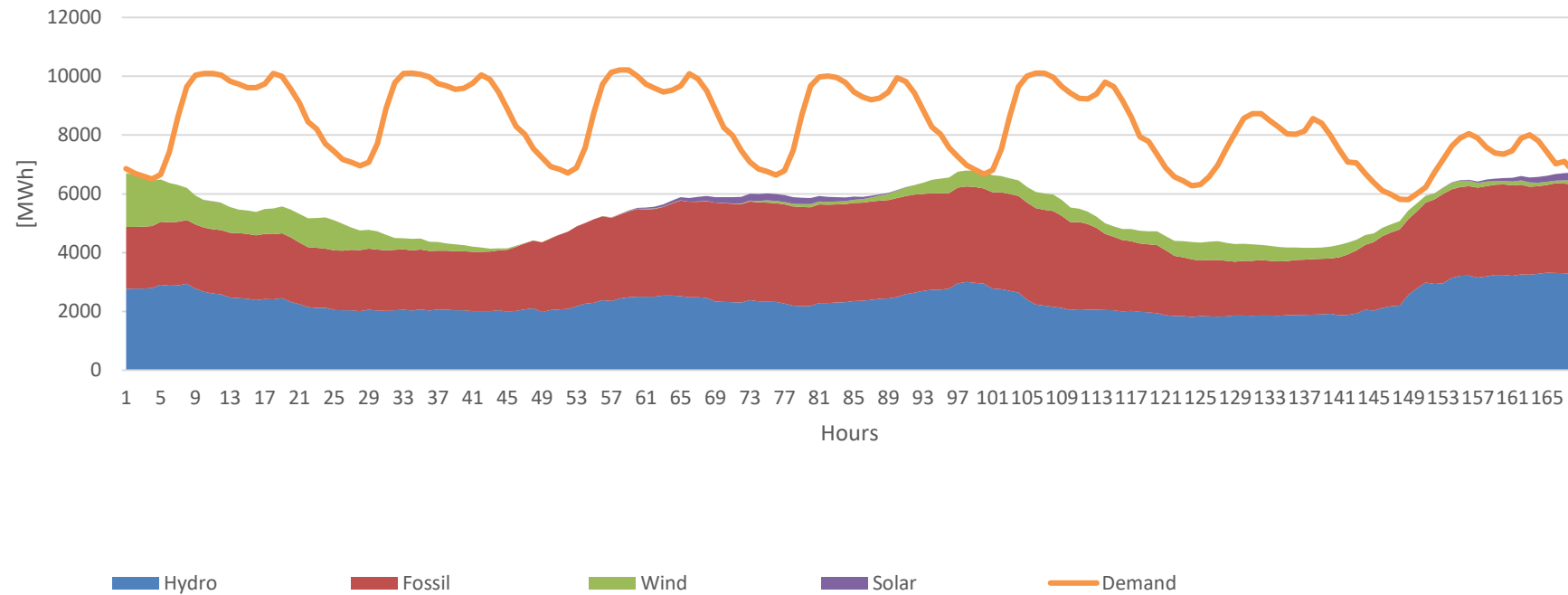


Figure 2 Generation in winter week 20.1.2020.-26.1.2020.

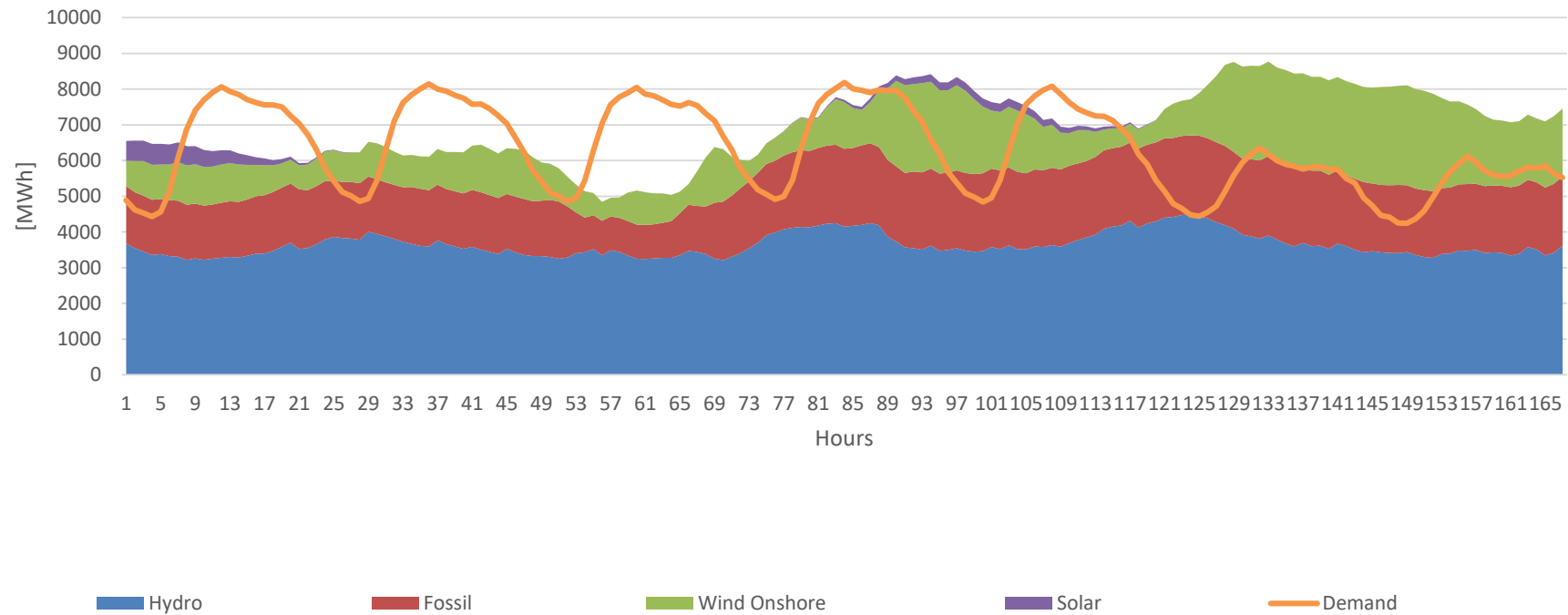


Figure 3 Generation in summer week 10.8.2020.-16.8.2020.

- Daily economic dispatch of thermal and wind generation portfolio
- Mixed-integer quadratic programming, developed in software GAMS
- Study case
- Maximize the profitability of dispatching analyzed system
- $Profit = \sum_{t=1}^{24} C_{i,t} * P_{i,t} - \sum_{t=1}^{24} C_{pw,t} - \sum_{t=1}^{24} C_{pes,t}$
- $C_{i,t}$ is the price in energy market offered at hour t ,
- $P_{i,t}$ is offered power from the generation unit i at hour t ,
- $C_{pw,t}$ and $C_{pes,t}$ are the operating costs of wind facility and energy storage system.

Results

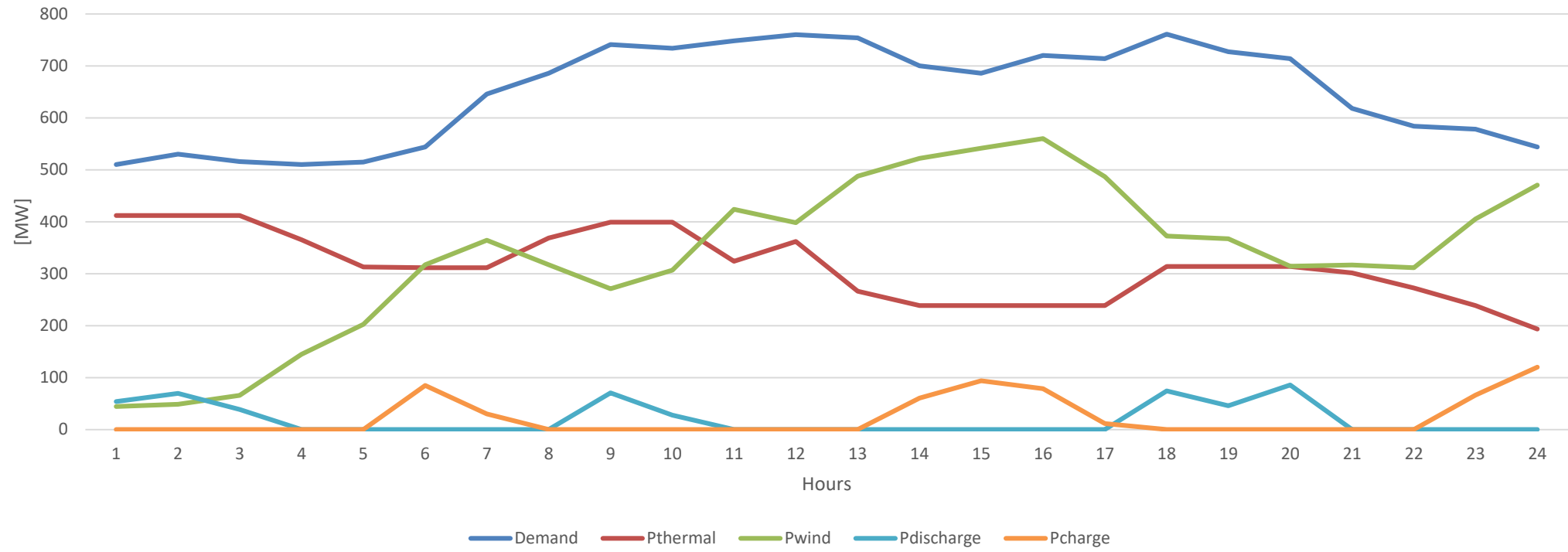


Figure 4 Economic daily dispatch with battery energy storage

- Energy storage is an inevitable tool for further renewable implementation in power systems.
- With adequate economic dispatching, energy storage can be a feasible solution for overcoming challenges with wind and solar generation's intermittent nature.
- With higher electricity market prices, energy storage systems installations are more justified and hence optimal dispatching of these technologies should be considered.



TECHNISCHE
UNIVERSITÄT
WIEN



Thank you!