

Energy Revolution or Evolution?

Professor Wladyslaw Mielczarski

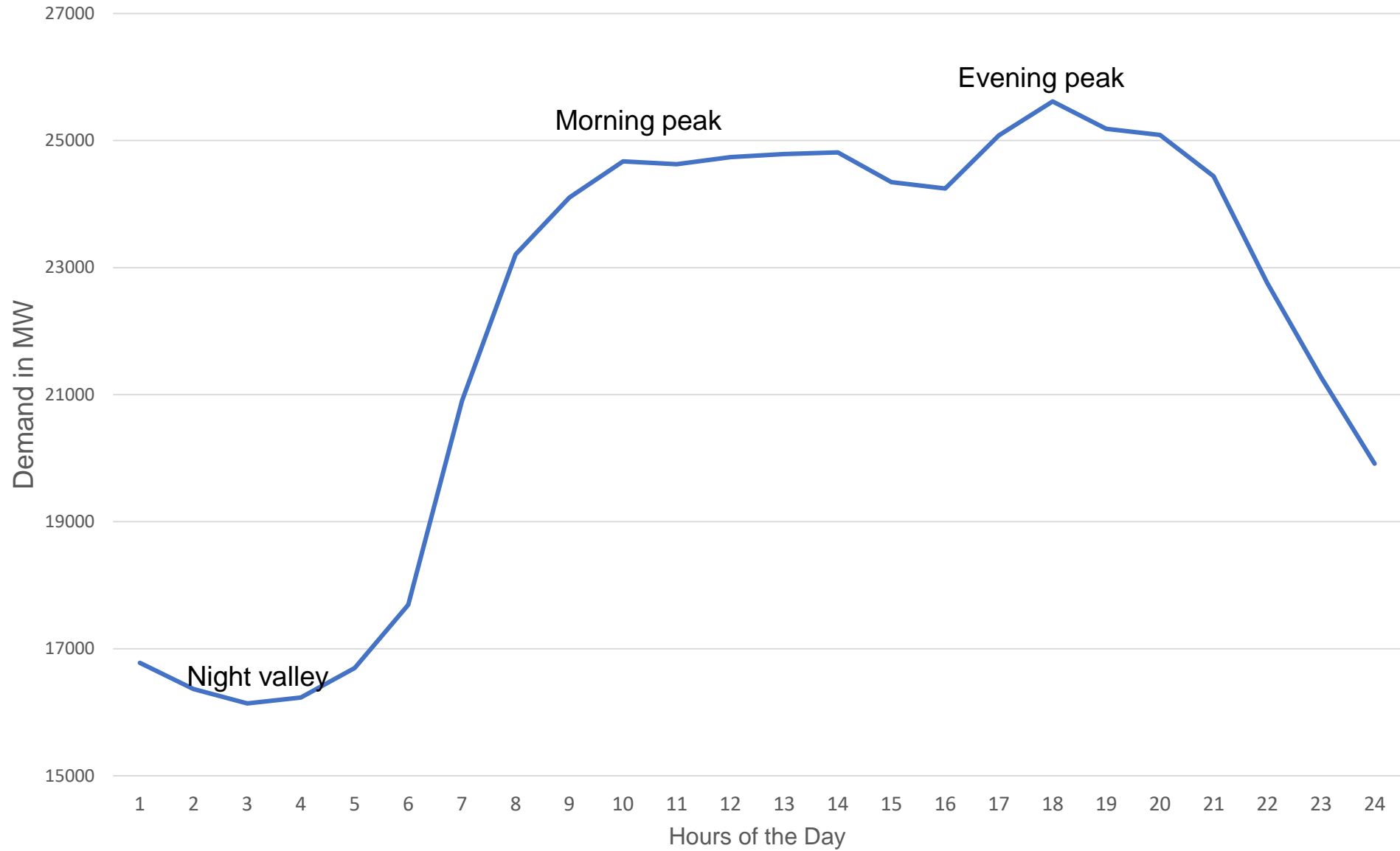
Institute of Electric Power Engineering, Lodz University of Technology, Poland

European Energy Markets – 27-29 June 2018, Łódź, Poland

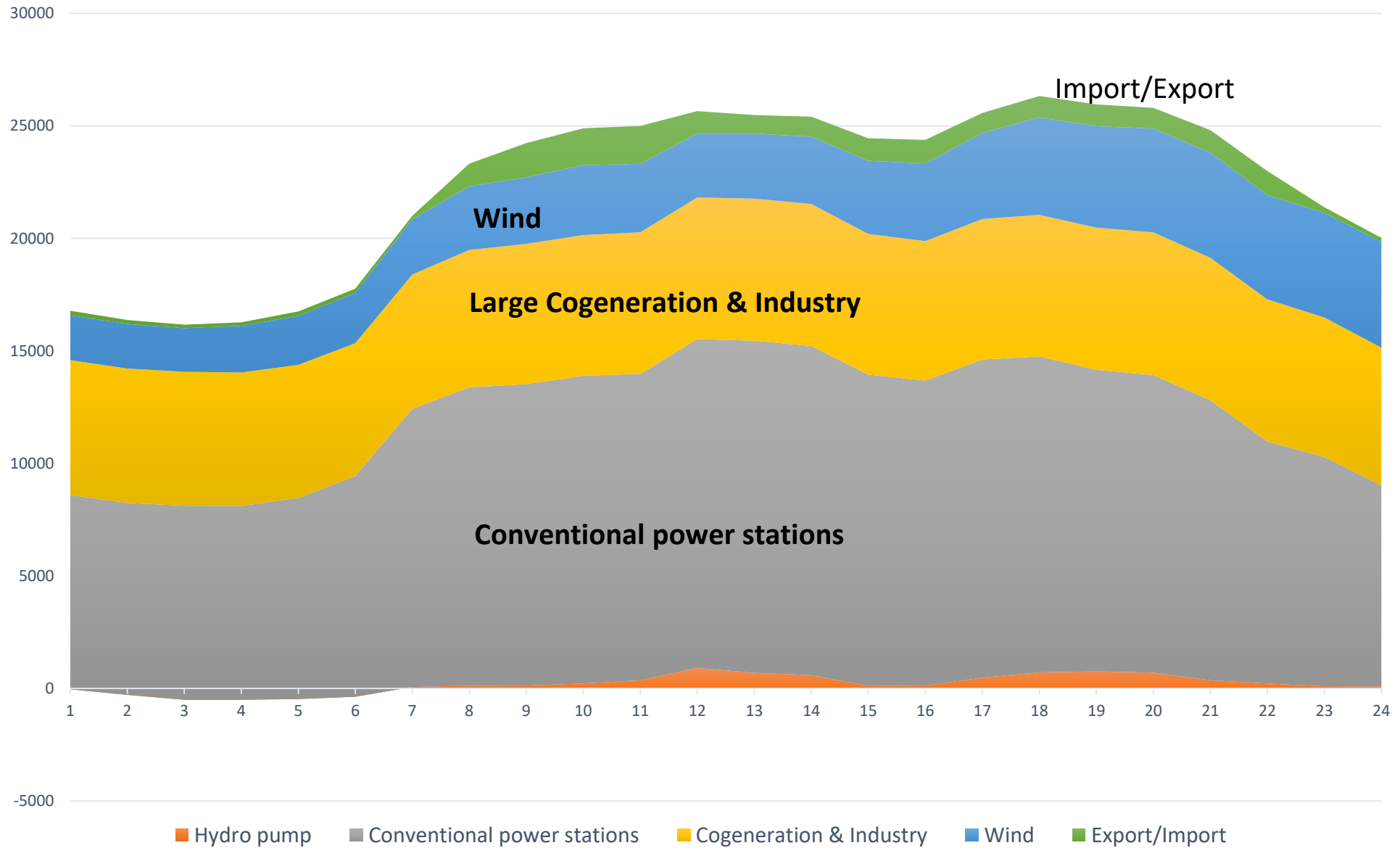
What are (were) energy systems for?

- The main aim of the energy system operation is (was) to ensure „**Energy Security**”.
- The Energy Security is the reliable supply of fuels and energy to the economy and the public on „*affordable prices*”.
- „**Affordable prices**” allow for the competitive operation of the economy and realization of the basic human needs.
- **Energy paradigm: The lights always must be ON – 24 hours per day and 7 days per week.**

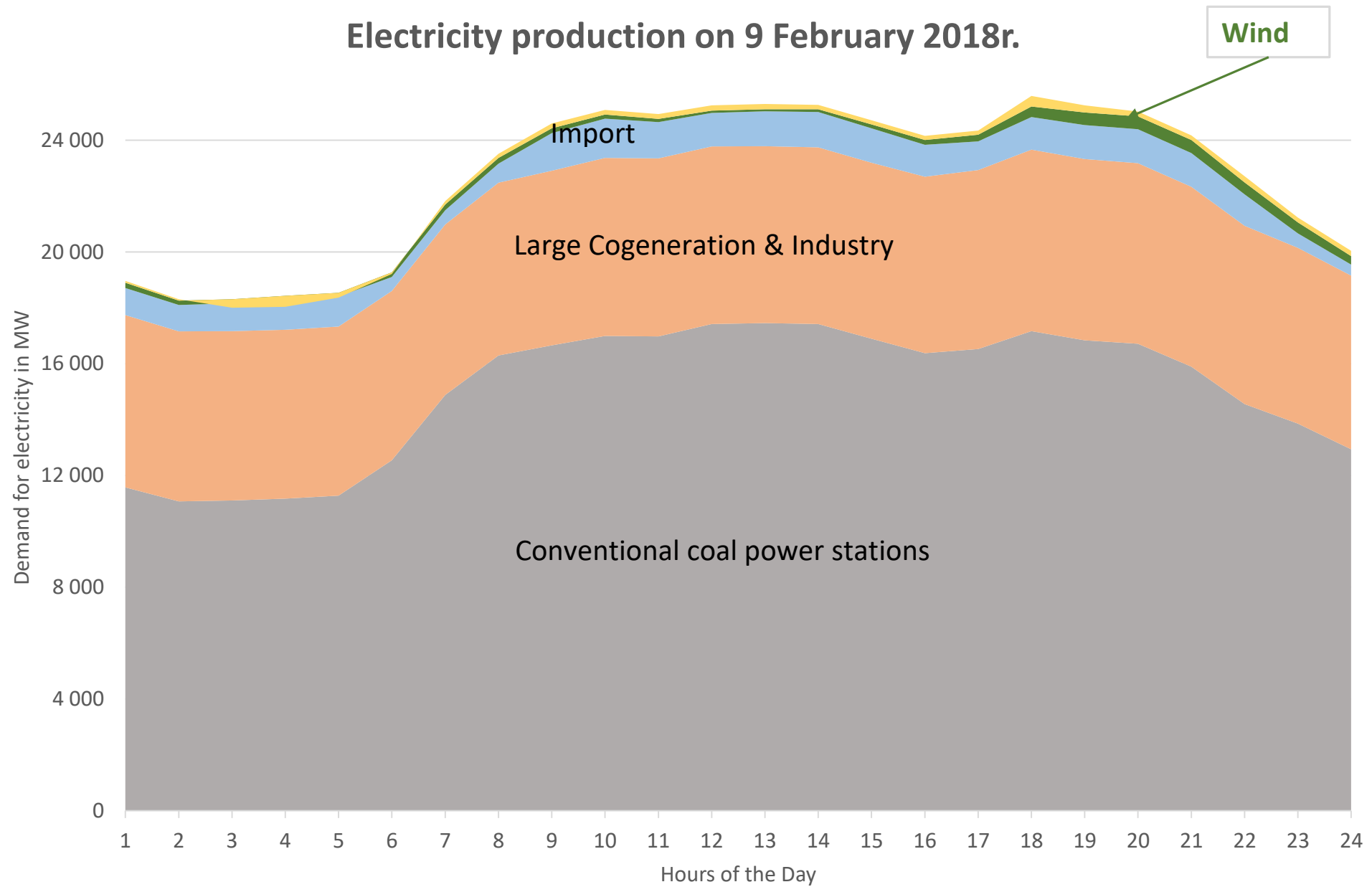
Daily demand for electricity in winter working days



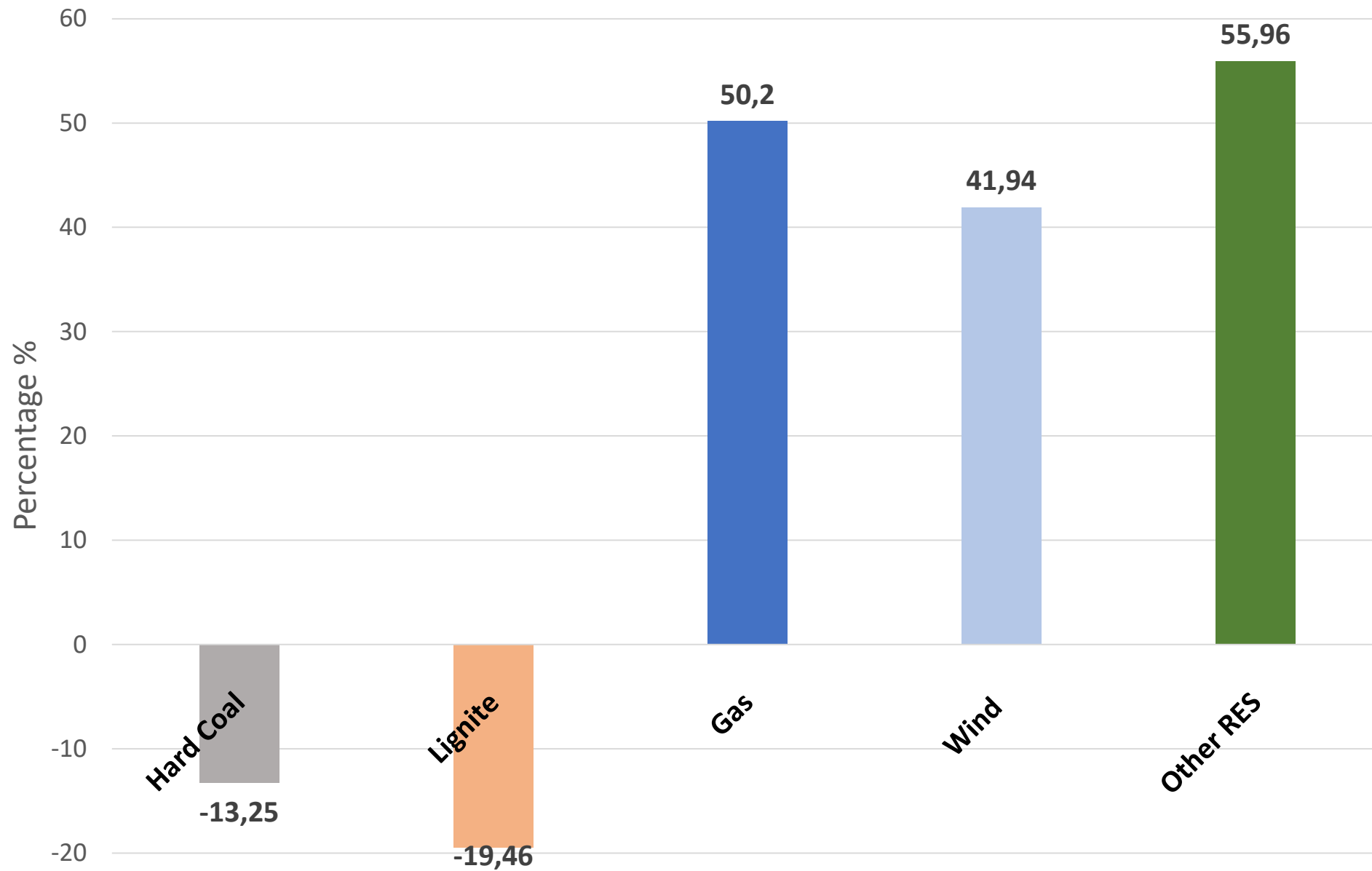
Electricity production on 15 January 2018



Electricity production on 9 February 2018r.



Dynamic of electricity production (Y-to-Y) in Poland in January 2018 in %

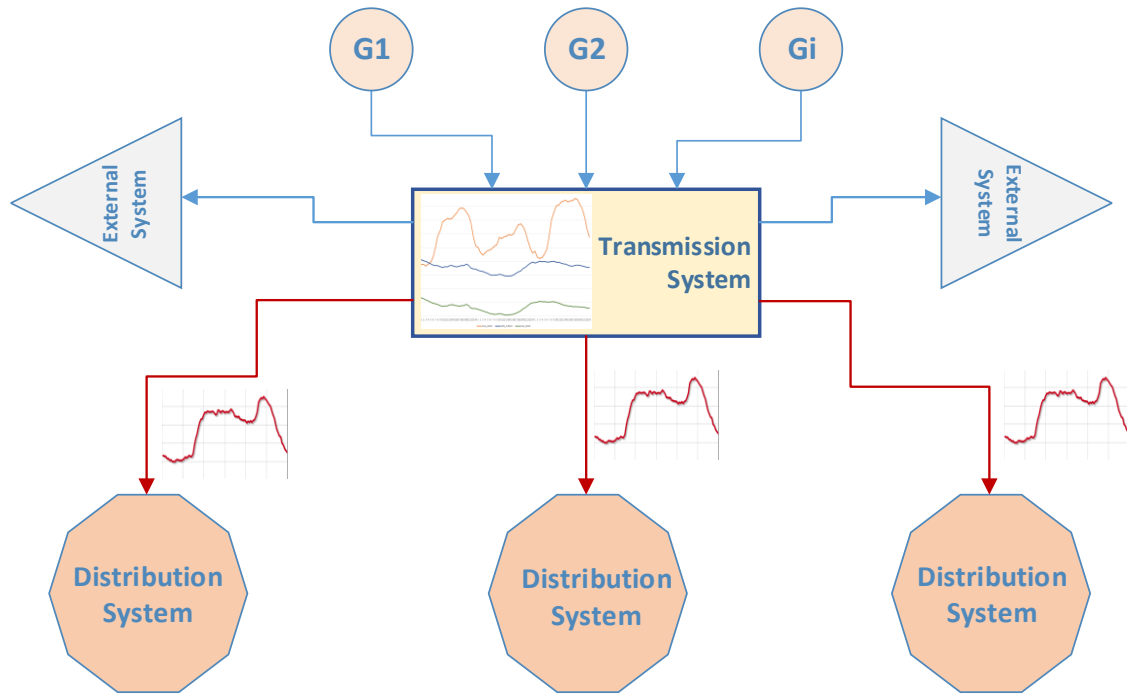


New targets for the power supply industry

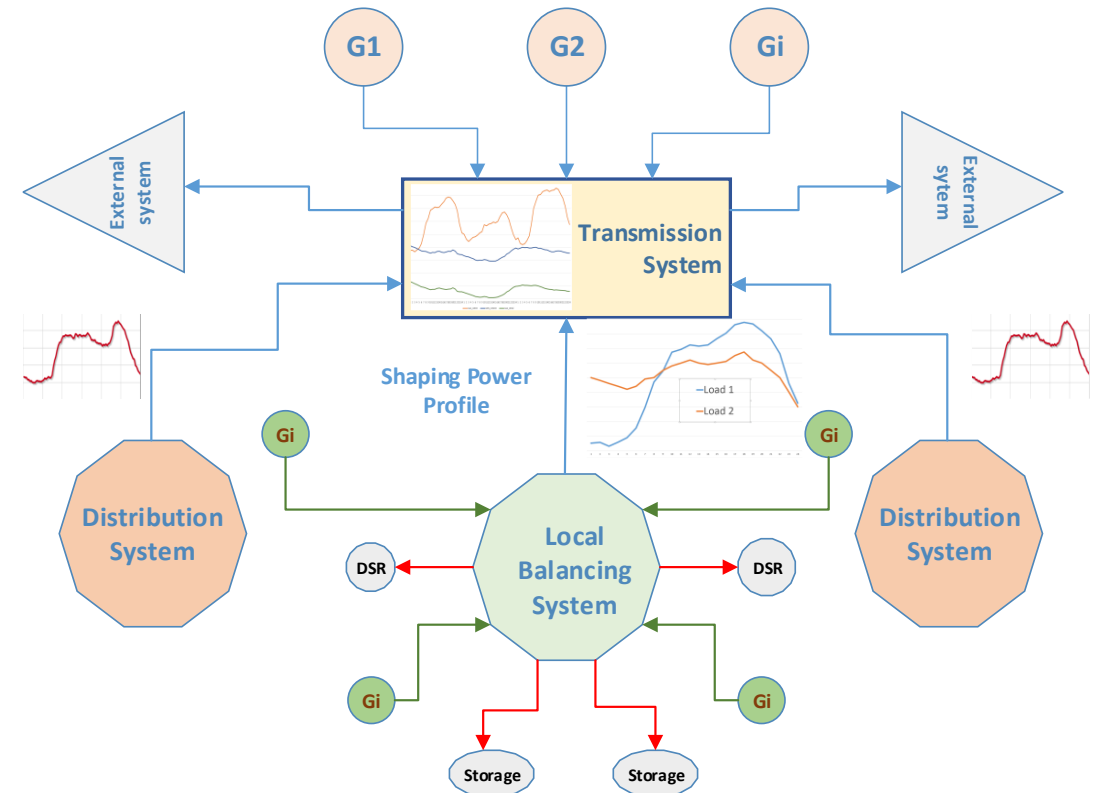
- **Energy and climate package 2020 – „3 *20”**
 - RES production share - 20%
 - CO2 emission decrease – 20%
 - Energy efficiency improvement – 20%
- **Energy and Climate Package 2030**
 - RES production share – (27%) – 32%
 - CO2 emission reduction – 40% (?)
 - Primary Energy consumption reduction – 27% or more
- **How to find the adequate measures to achieve the Energy and Climate Policy targets and ensure the Security of Supply?**

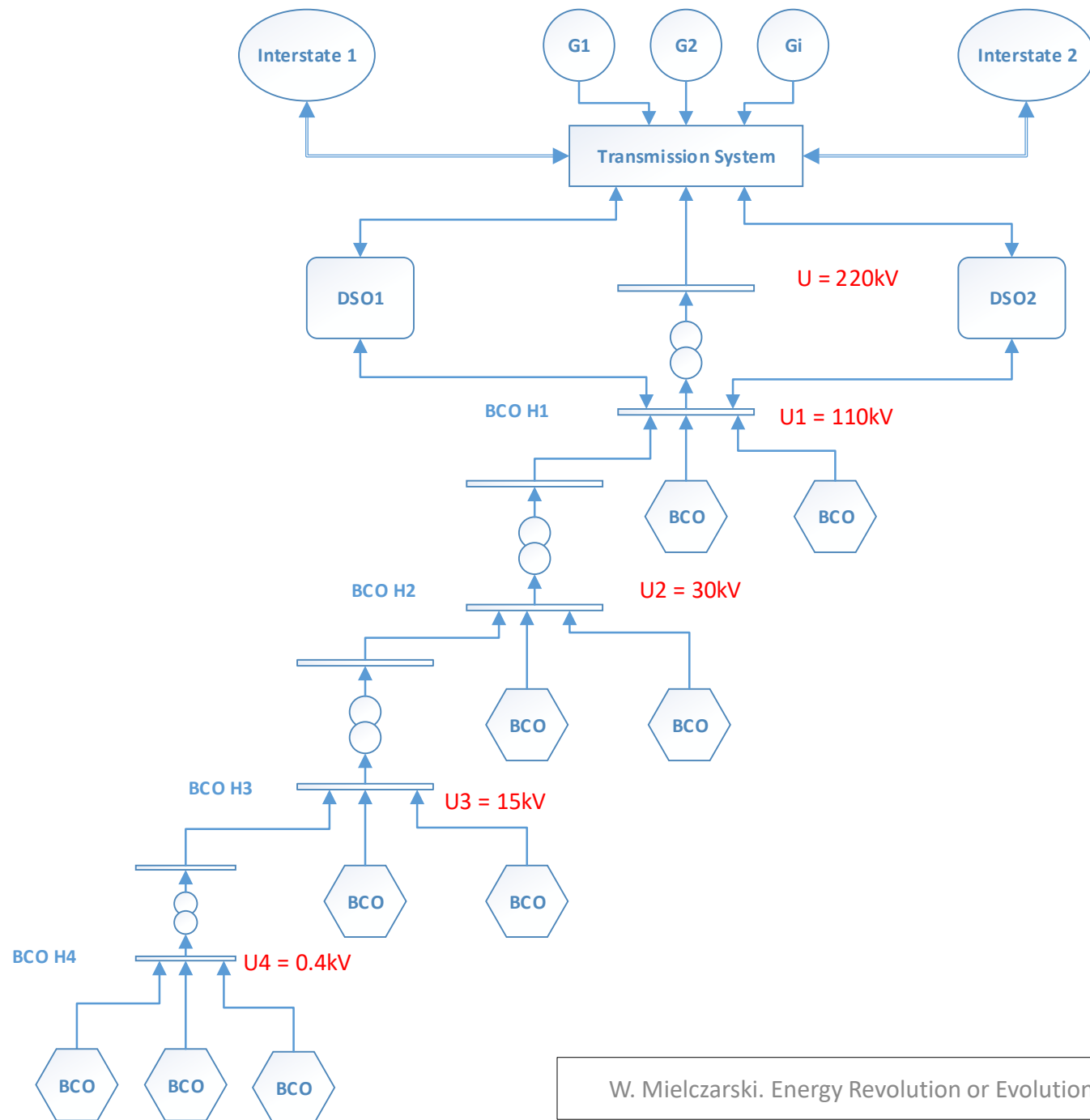
New ways of power systems' operation

• Traditional



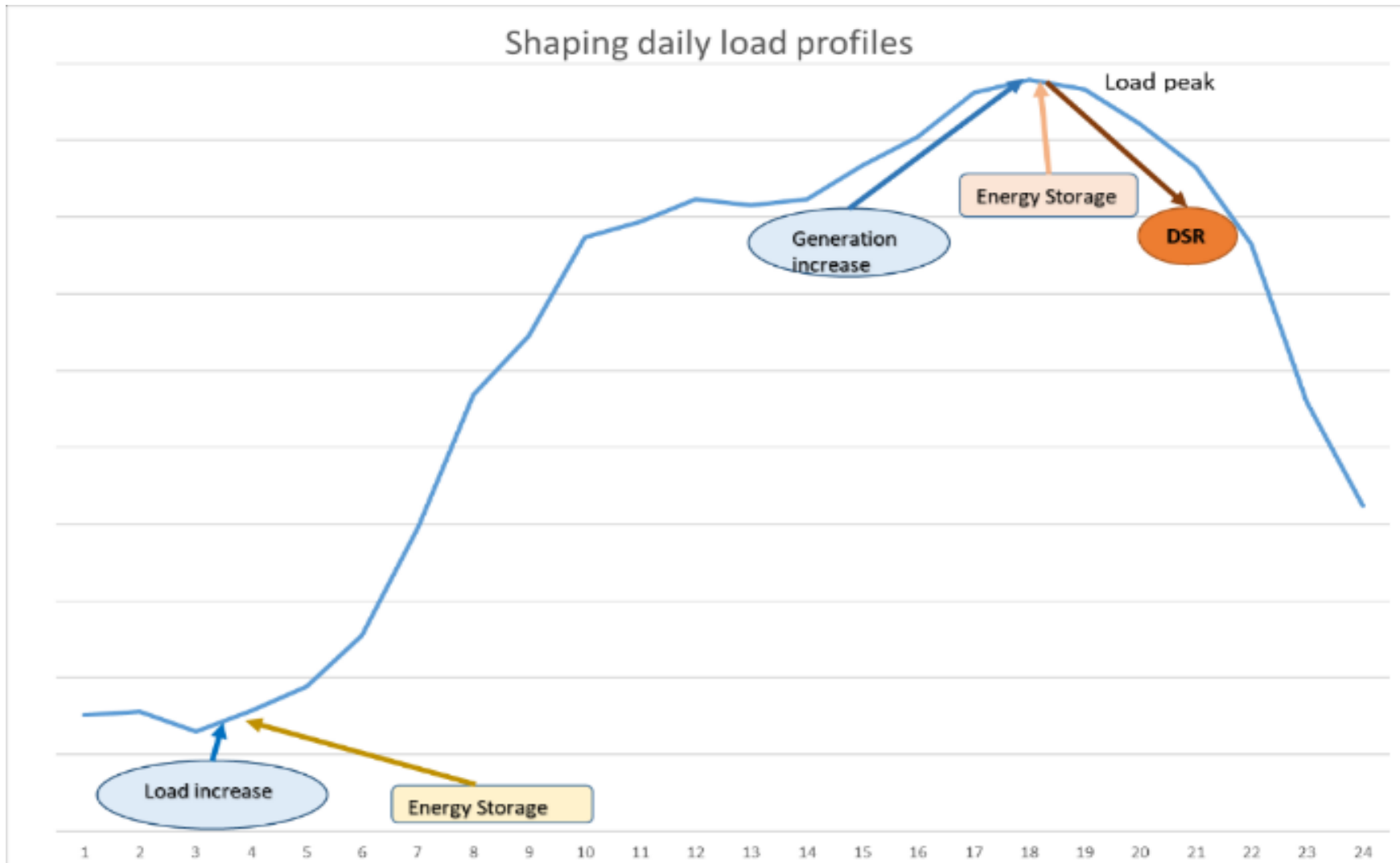
• Distributed generation



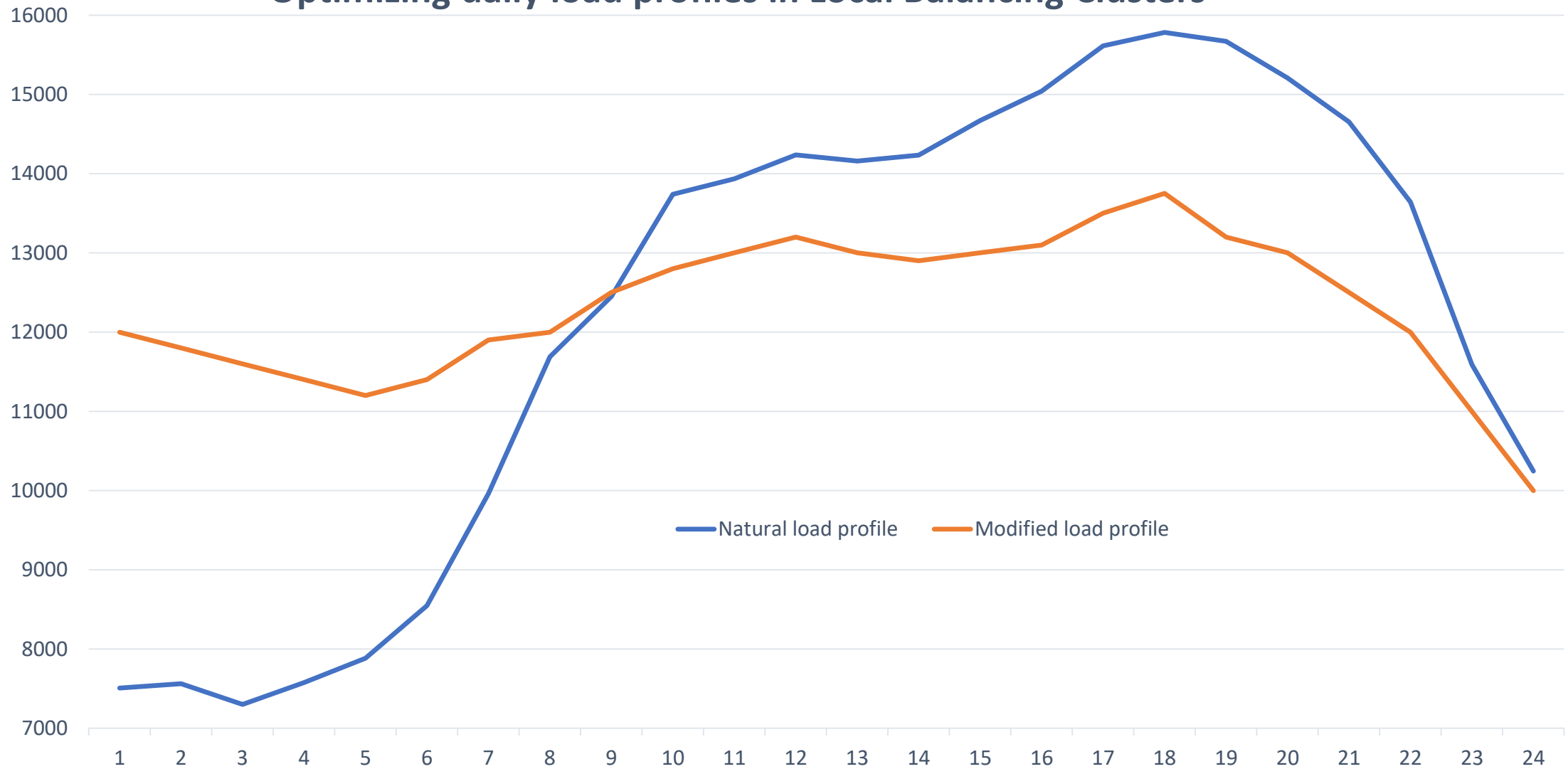


Cluster structure of distributed generation

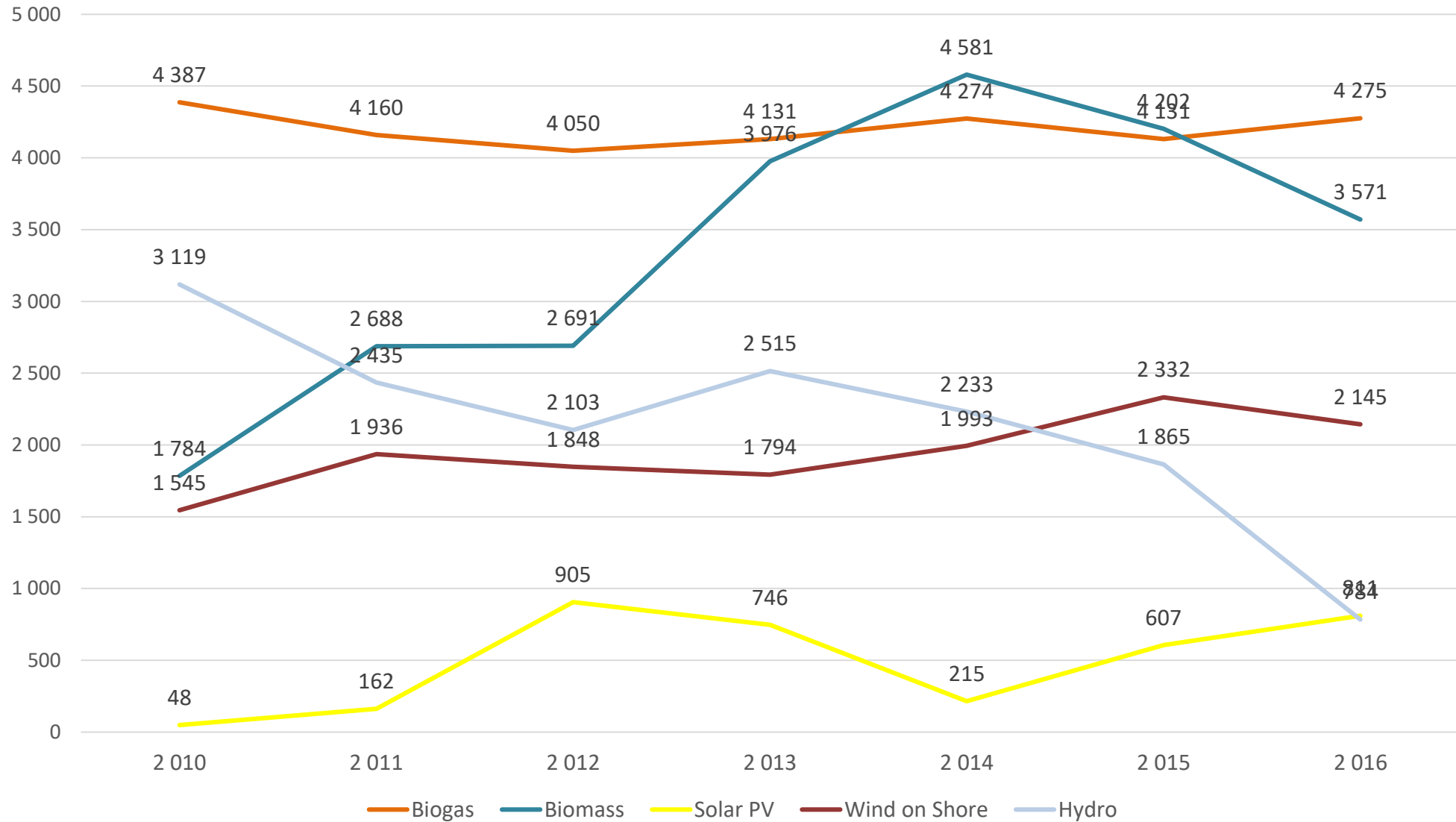
Targets for distributed generations

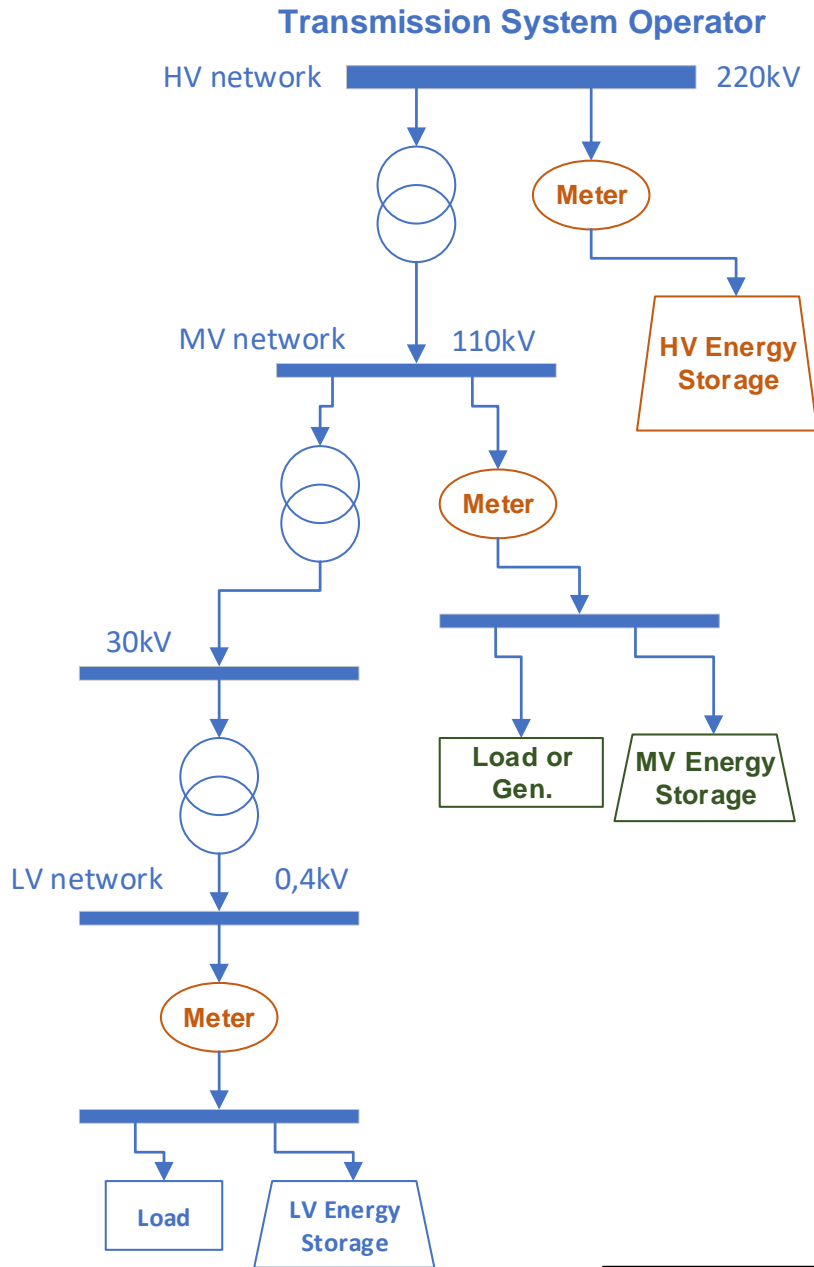


Optimizing daily load profiles in Local Balancing Clusters



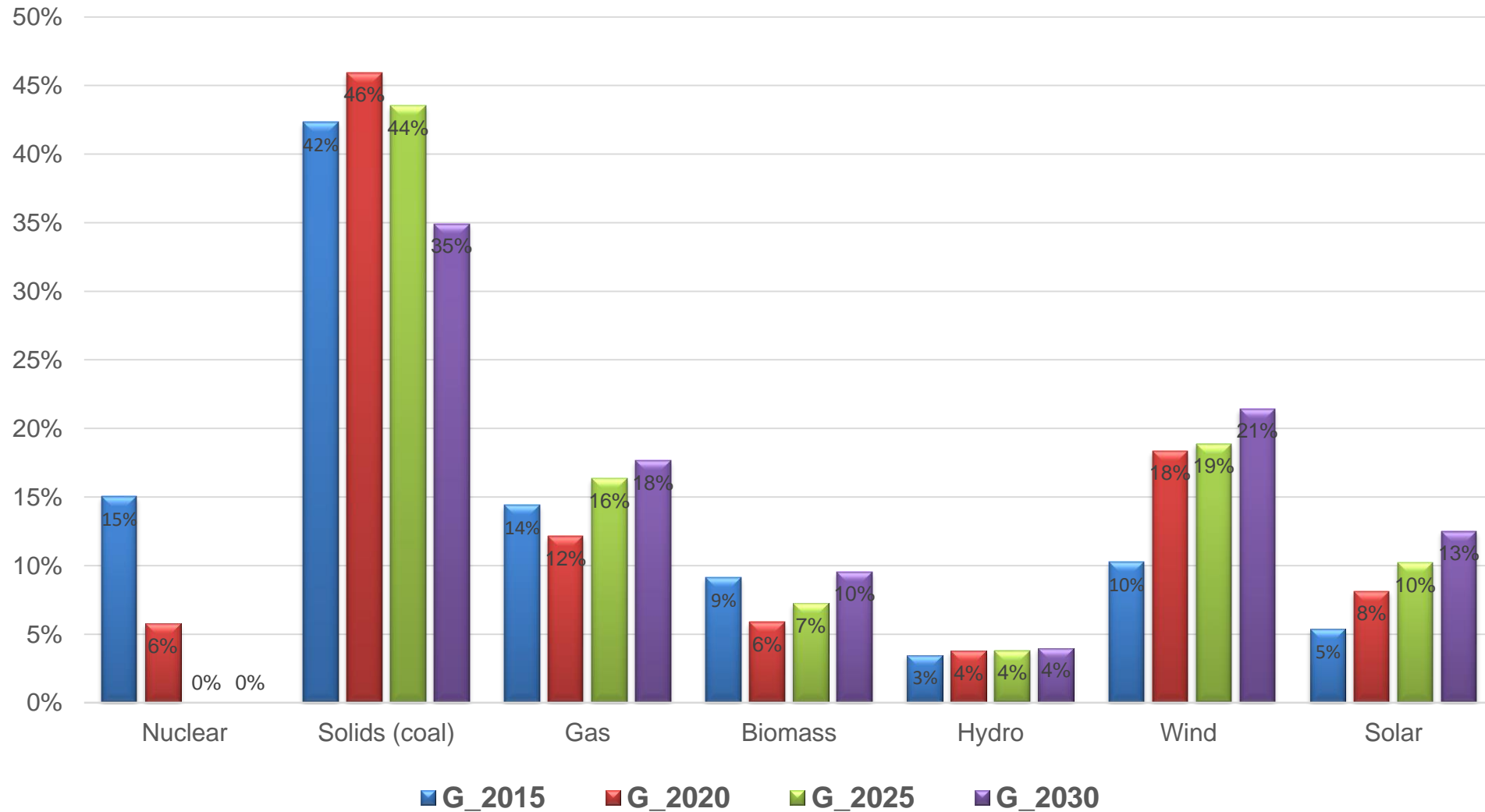
Annual RES operation hours in years 2010 – 2016 in the Central Europe. Year = 8760h.



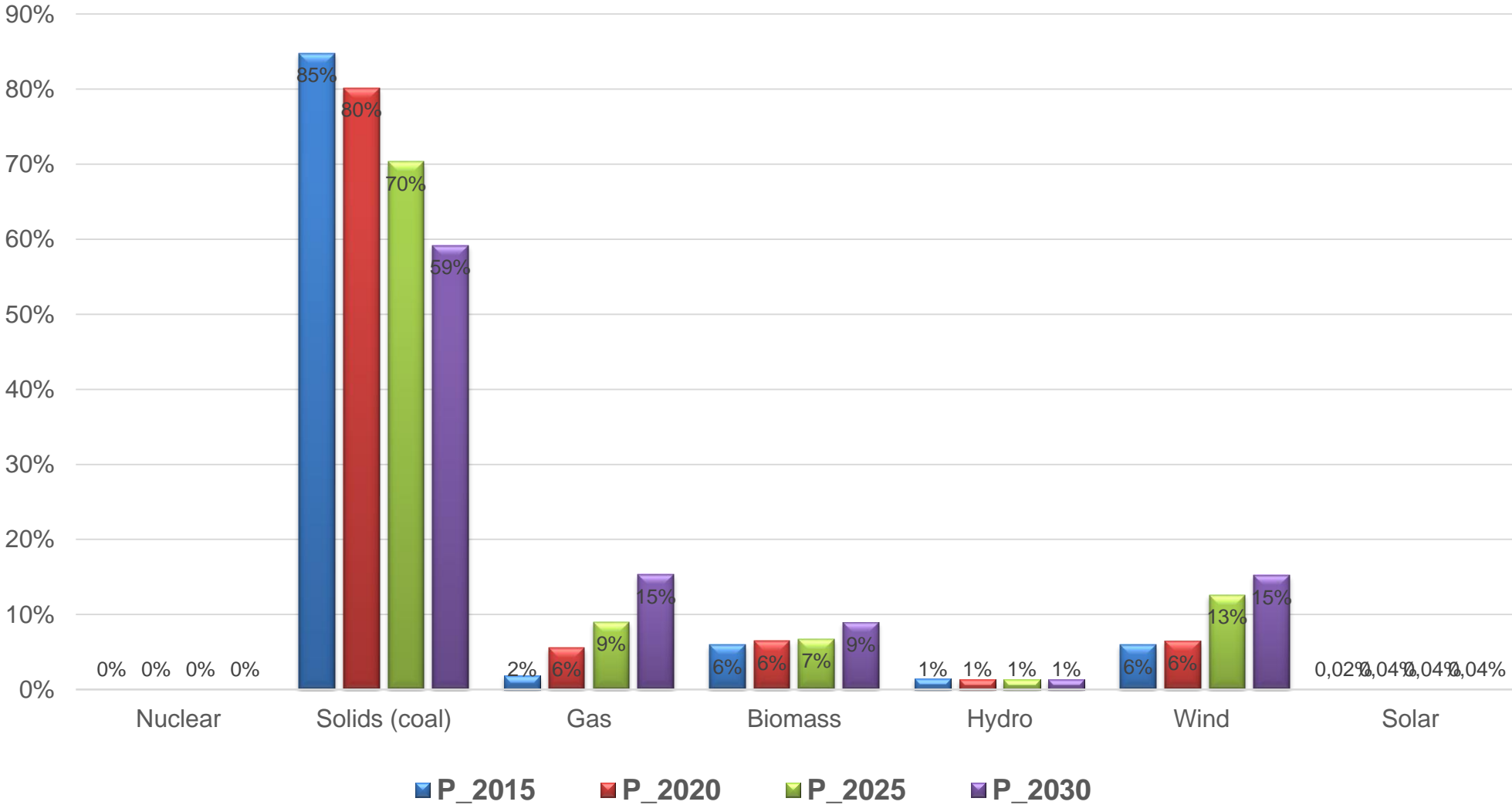


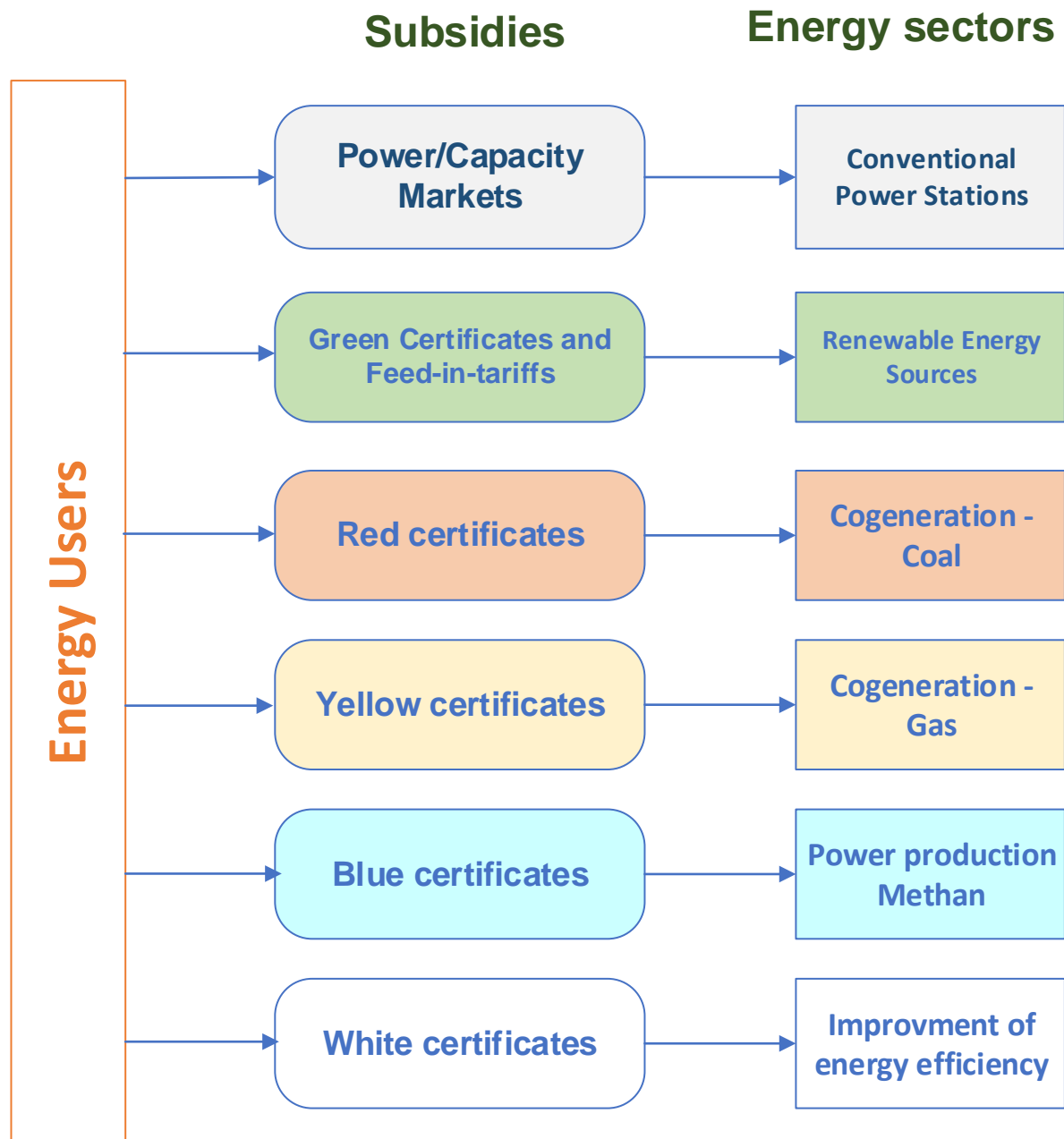
Possible applications of Energy Storage

Share in % of various fuels in German electricity production between 2015-2030 - EUCO27 scenario by E3MLab&IIASA



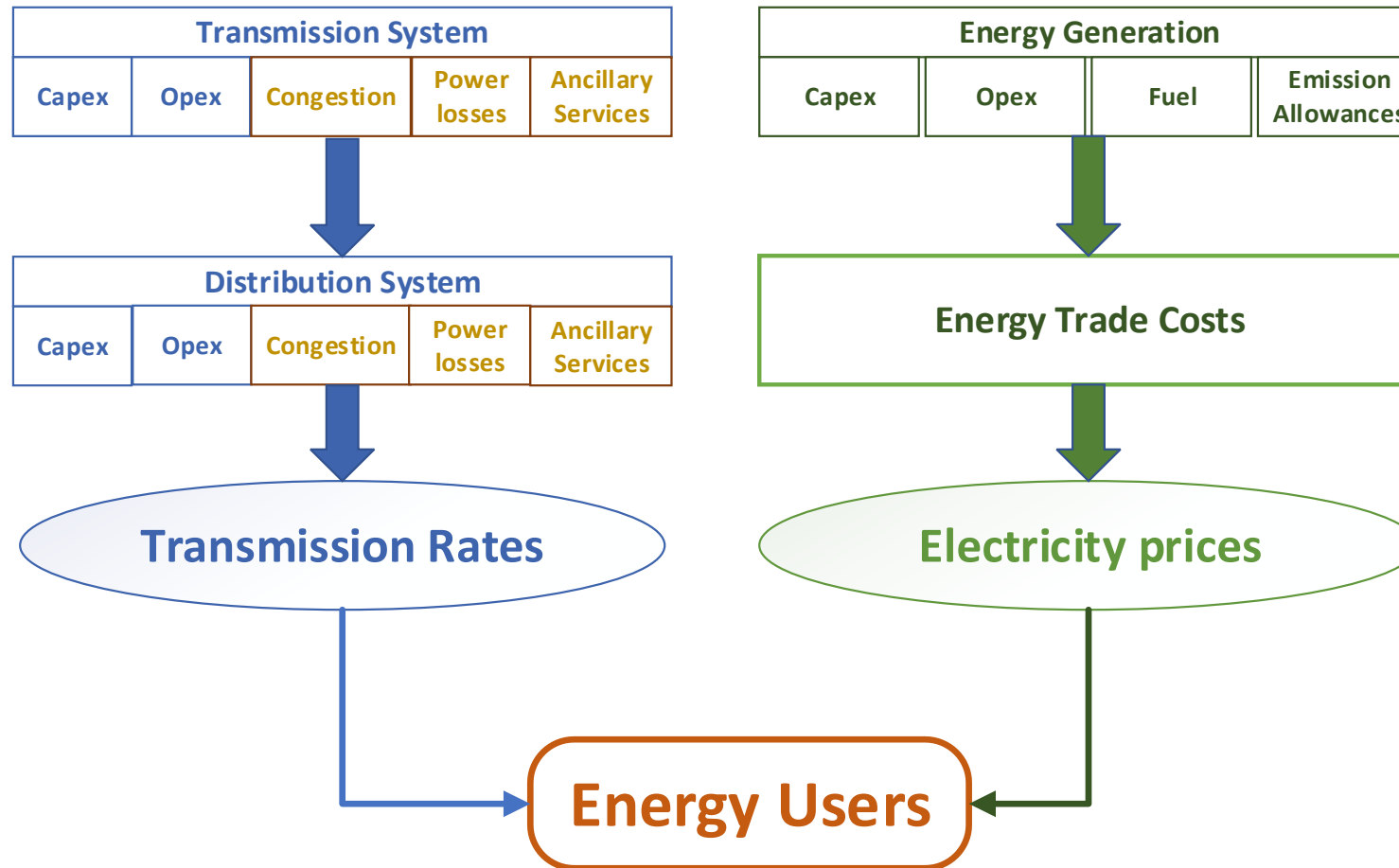
Share in % of various fuels in the Polish electricity production - EUCO27 policy scenario by E3MLab&IIASA



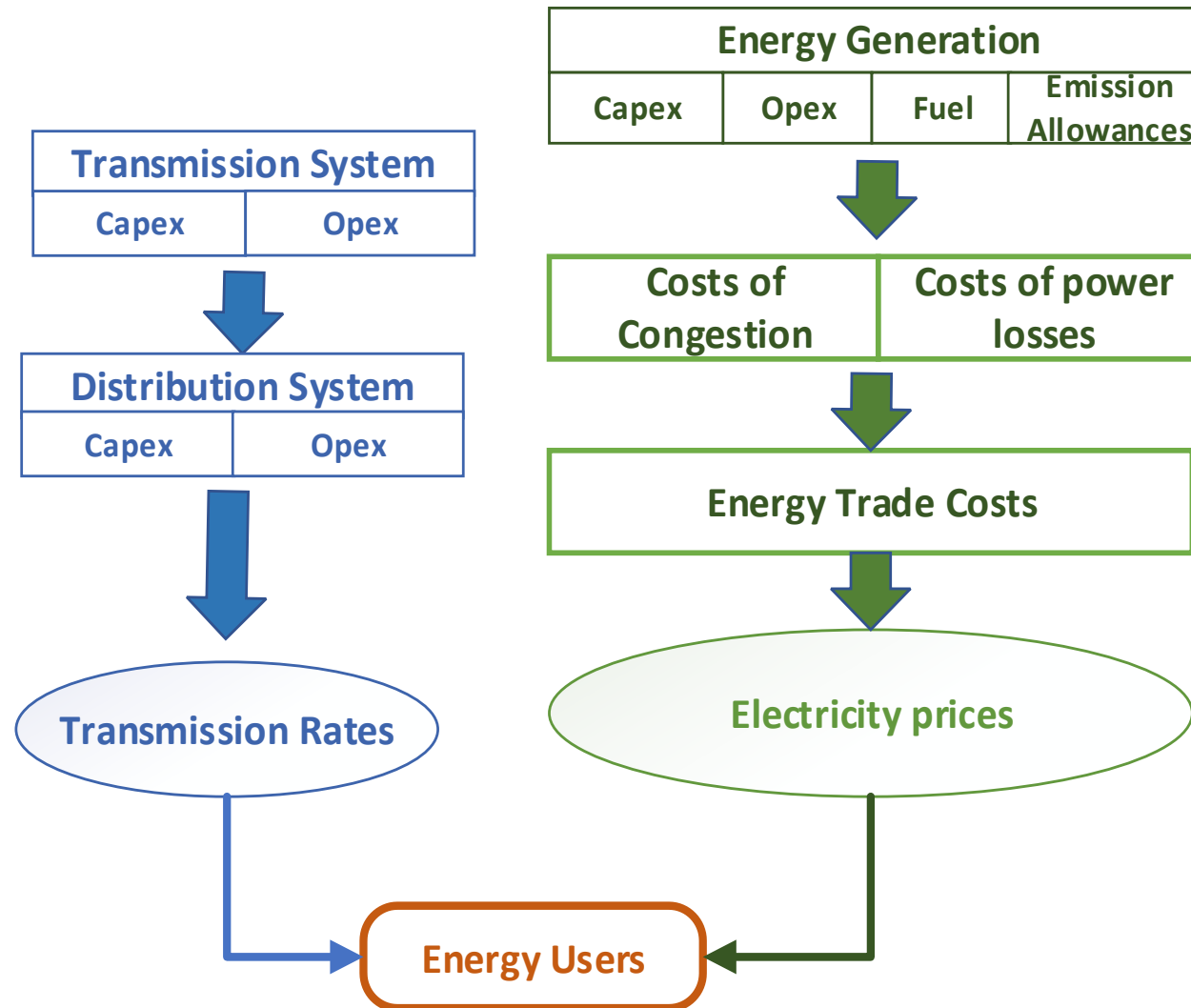


Energy transformation by market forces or subsidies?

Copper plate systems – all other costs are transferred to customers by transmission tariffs

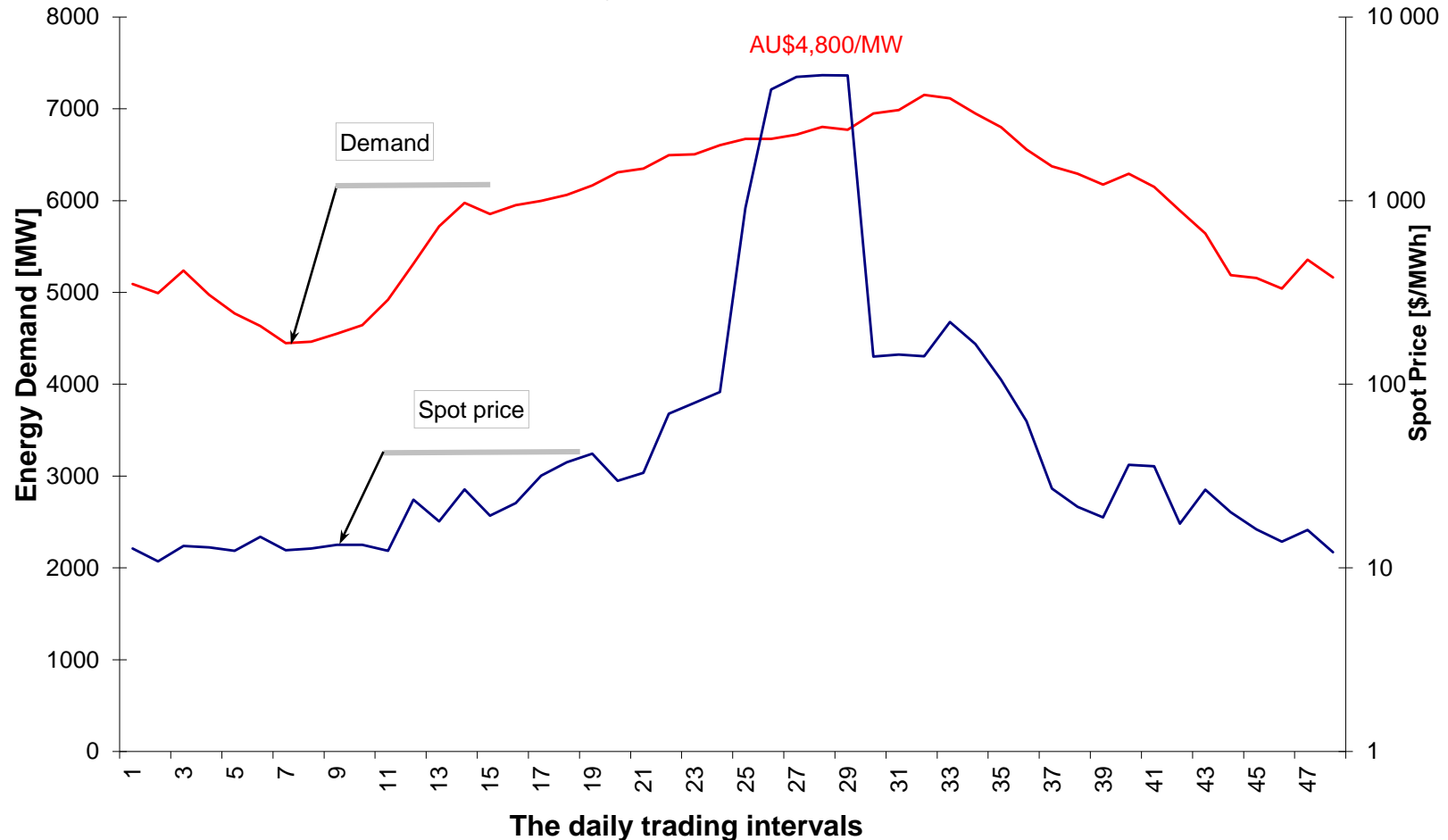


Energy prices reflect localization



Can scarcity pricing send economic signals?

Energy demand and spot price
on Tuesday, 25 November 1997



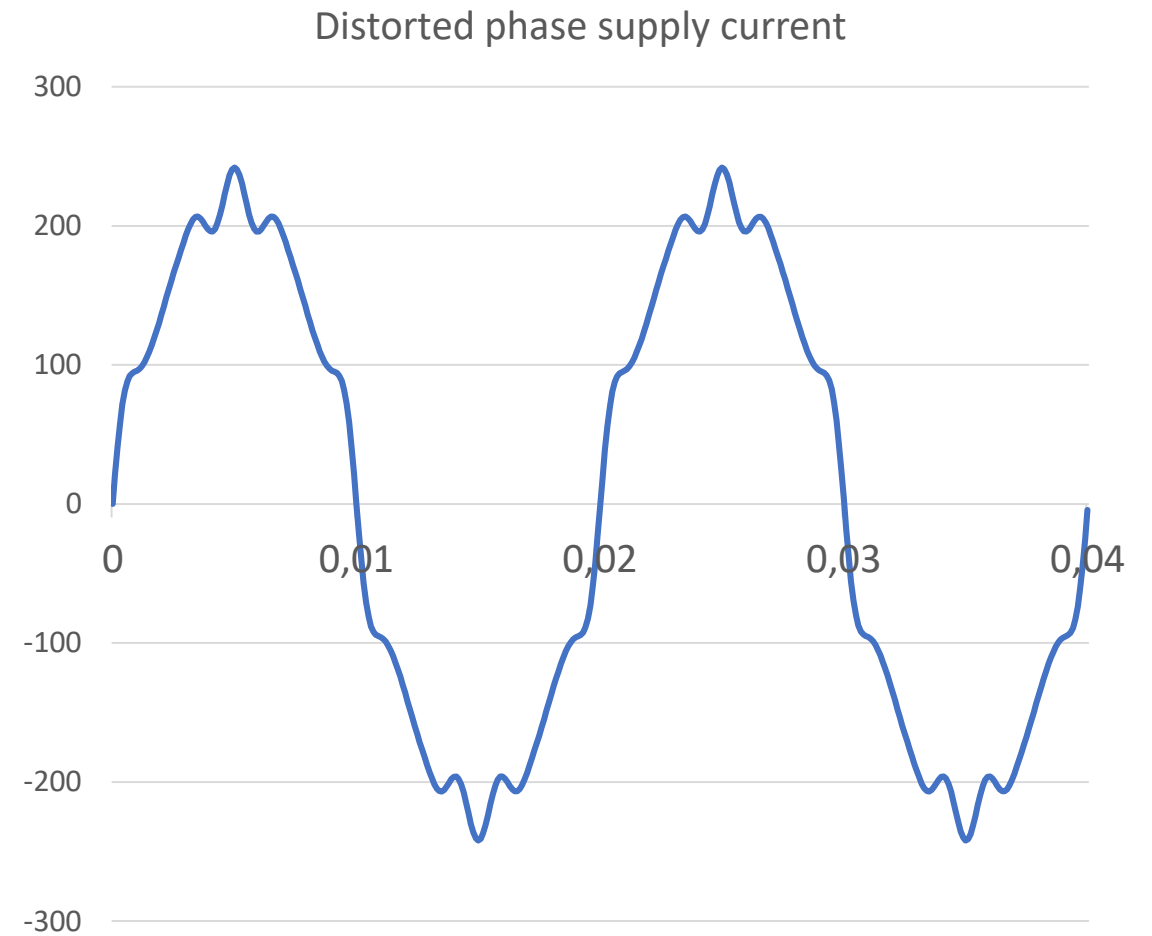
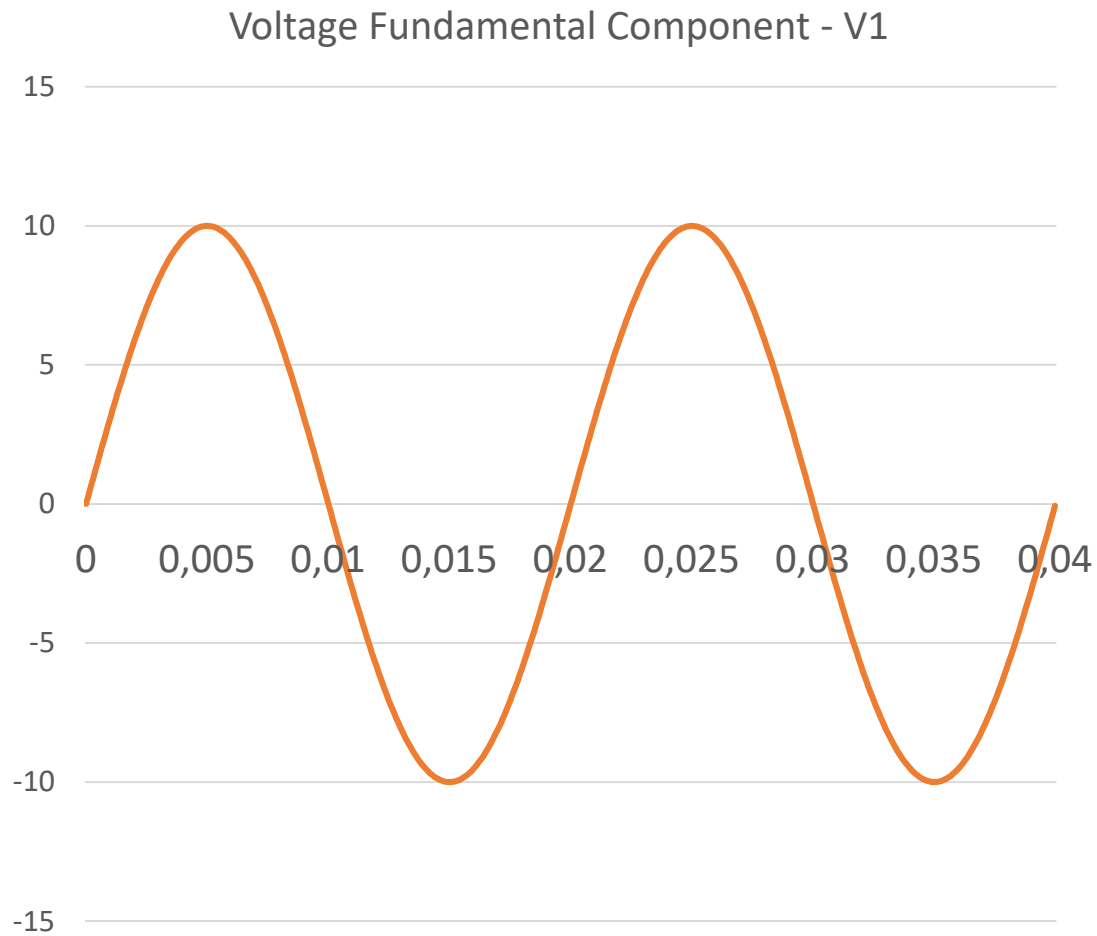
Technical aspects of electricity delivery

New electronic equipment installed in electric networks causes numerous **technical**, **economic** and **regulatory** problems with reliability and quality of electricity supply:

- Compensation of reactive power
- Reduction of harmonics
- Phase asymmetry
- Capacitive power factors
- Security of maintenance in distributed generation.

The main problem is who should be responsible for the reliability and quality of supply, who will be charged for their improvement in distributed power systems?

Distortion of supply voltage by harmonics



HANDBOOK:

Energy Systems & Markets

Part 1. Structure and operation

Part 2. Technical aspects

by

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Generation, Transmission & Distribution. Photo: Author

Edition I - June 2018

Advanced Education in Power System Operation and Energy Markets

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by

Prof. dr hab. inż. Władysław Mielczarski

The HANDBOOK is dedicated to engineers, economists and legal people dealing with the development of energy systems operating in competitive environments.

The book gathers the experience of many years from energy sector reforms in various countries and it indicates the main challenges facing energy supply industry in the future.

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- Power units commitment and dispatch
- Modern power systems

Part 2. Technical aspects:

- Reliability or quality of supply
- Power flow and network loss management
- Harmonics
- Asymmetry
- Power measurement

Energy Revolution or Evolution?

- Transformation of energy systems are possible and necessary.
- The process will be long and expensive.
- Crucial role of **Energy** for the public and the economy requires the adequate level of Supply Security during the entire transformation.
- The successful transformation can be performed by the sustainable implementation of the synergy resulting from the coordination actions of new technical solutions, competitive market environment and prudent legal regulations.