



TSOS PERSPECTIVE ON STORAGE

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entsoe
Reliable Sustainable Connected

1. ENERGY POLICIES: IMPLICATIONS FOR TSOS

2. STORAGE: AN OPTION TO IMPROVE SECURITY OF ENERGY SUPPLY

3. MARKET, REGULATORY, PLANNING SERVICES AND INVESTMENT DECISION

4 . STORAGE: TECHNOLOGY NEUTRALITY AND INTEGRATION INTO ENERGY SYSTEM



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Quick facts about ENTSO-E



41 TSOs
from 34 countries

Adequacy forecasts



530 million
citizens served

Ten-Year Network
Development Plans



830 GW
generation

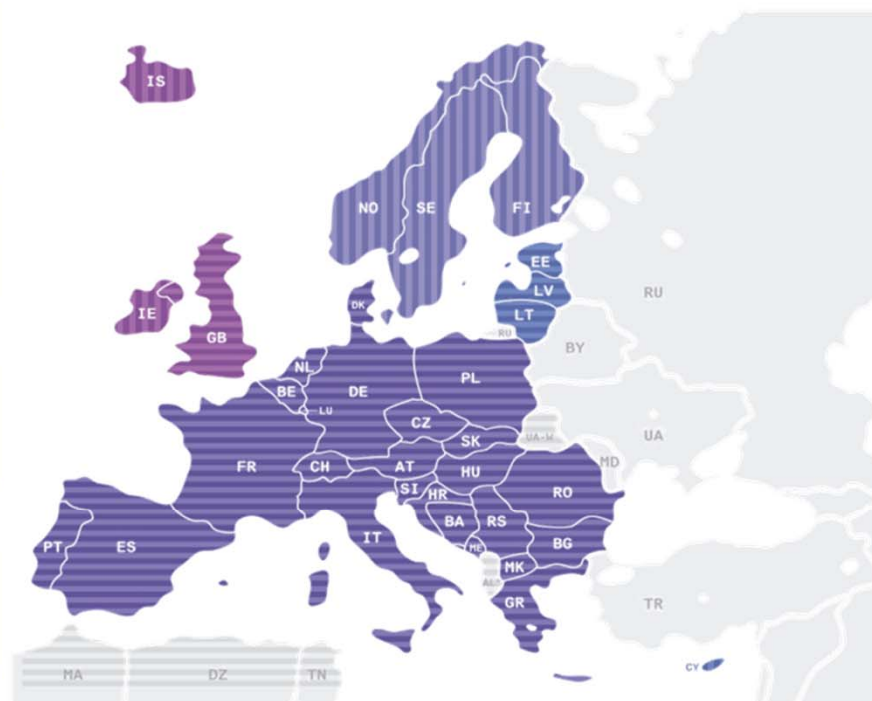
Market Platforms



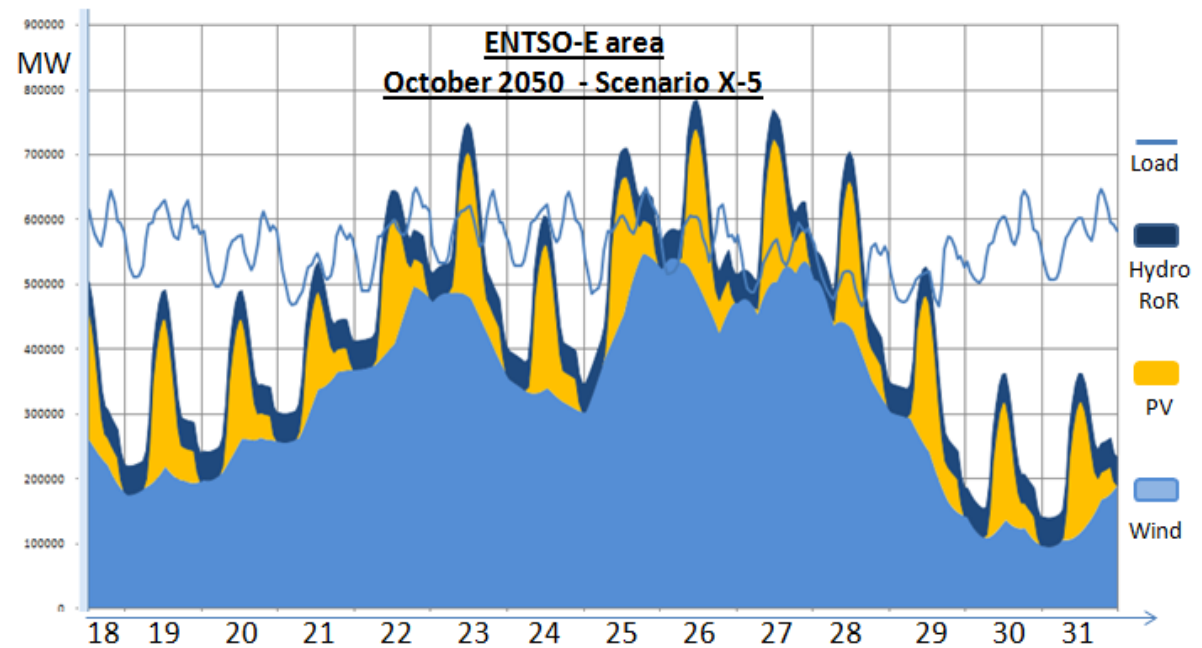
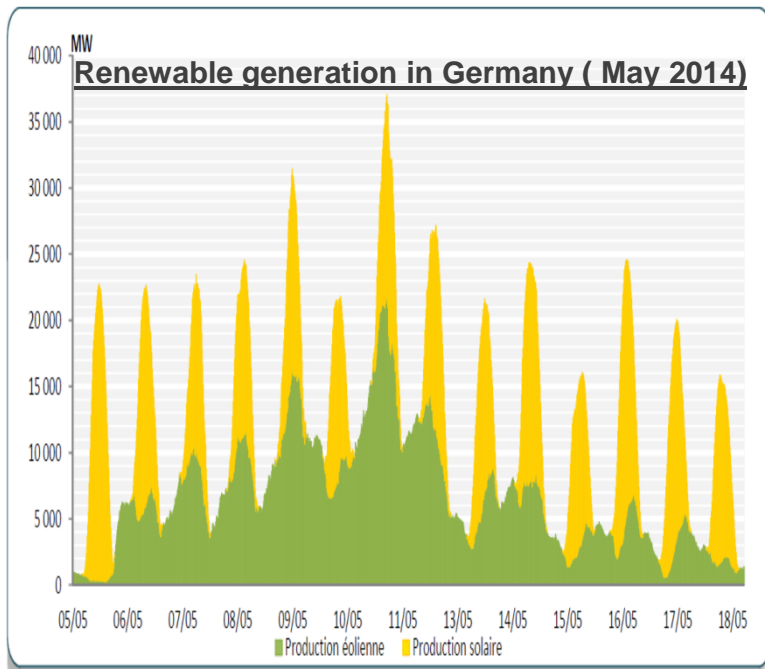
300 Thousand Km
of transmission lines

Network Codes

R&D Plans



Generation and demand: transformative changes



Maintaining power system stable and reliable

Increased system services

- Ancillary services: black start, frequency response, fast reserve
- Provision for reactive power
- Power flows limits
- Inertia
- Dynamic stability
- etc

Increased Flexibility

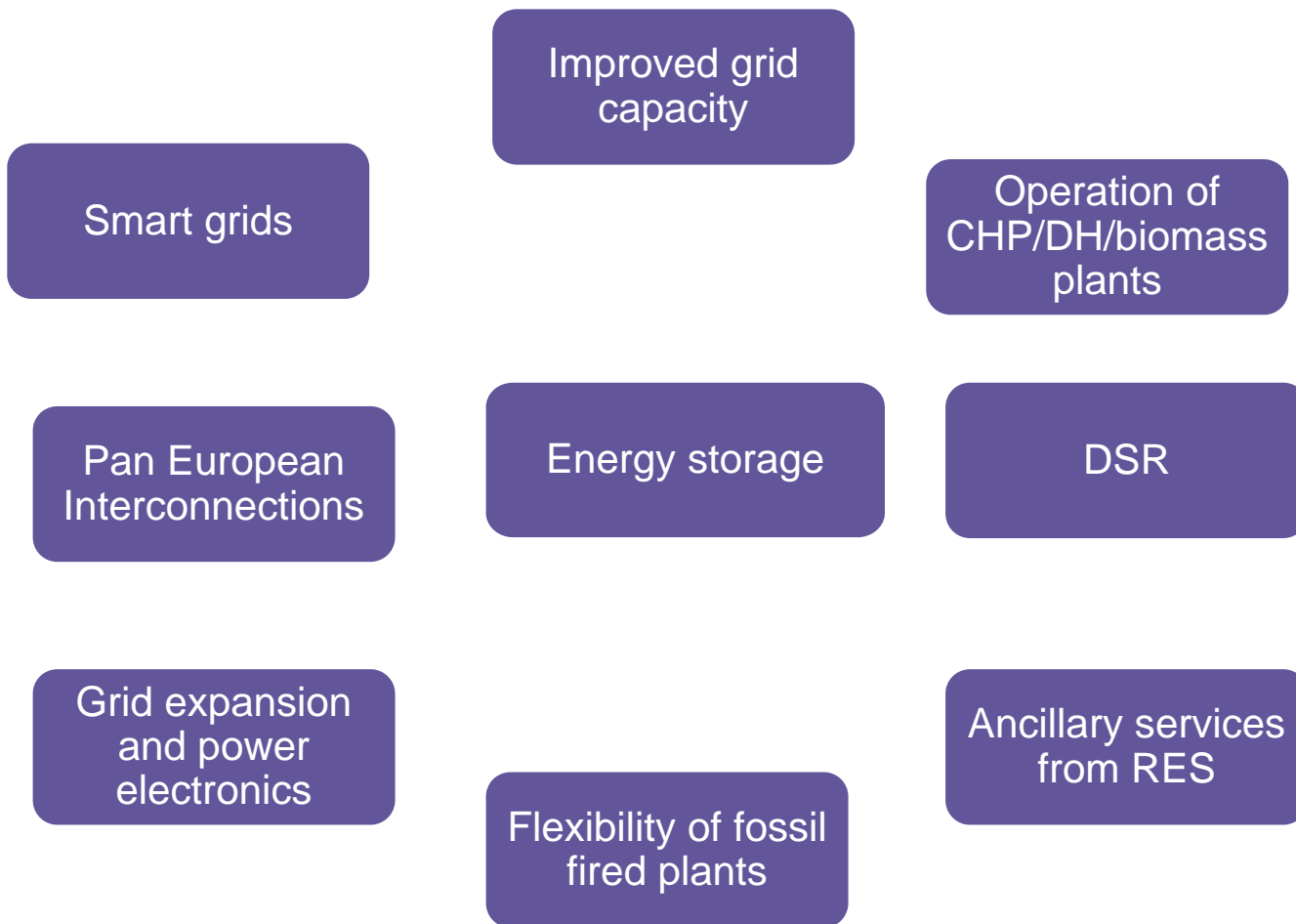
- Multifaceted market that satisfies the system needs



Technology neutrality : storage benefits

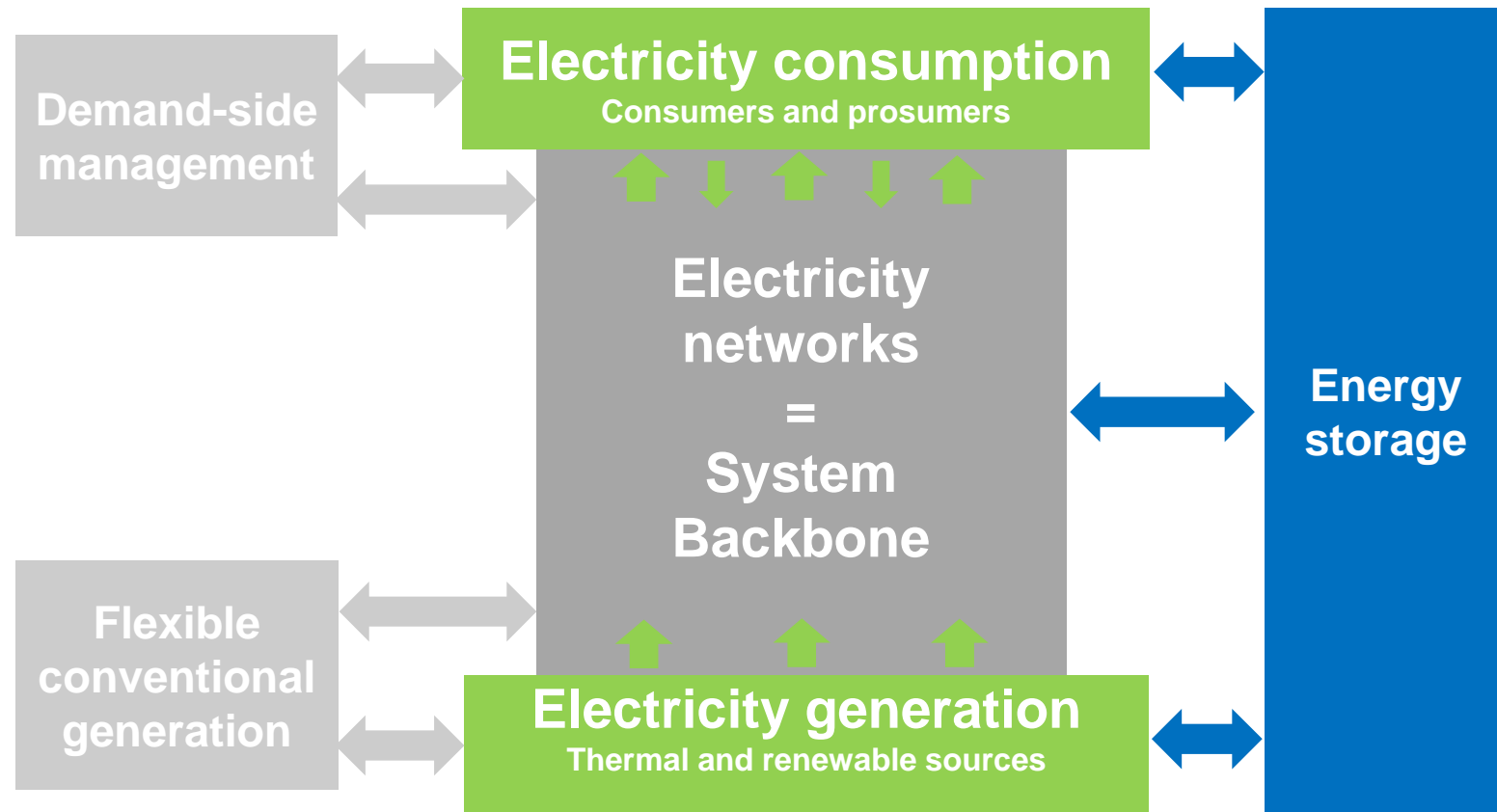
Optimal system

- **Flexibility**
- **Capacity**



Storage : market, operational, planning services

- **Market perspective**
- **Operational security**
- **Planning and Network investments**



Source: Grid +Storage project

Market and regulatory options for TSOs on storage

Market based option

- through appropriate market design and competition
(operational flexibility, ancillary services and capacity markets)

Regulated option

- Strategic operational asset

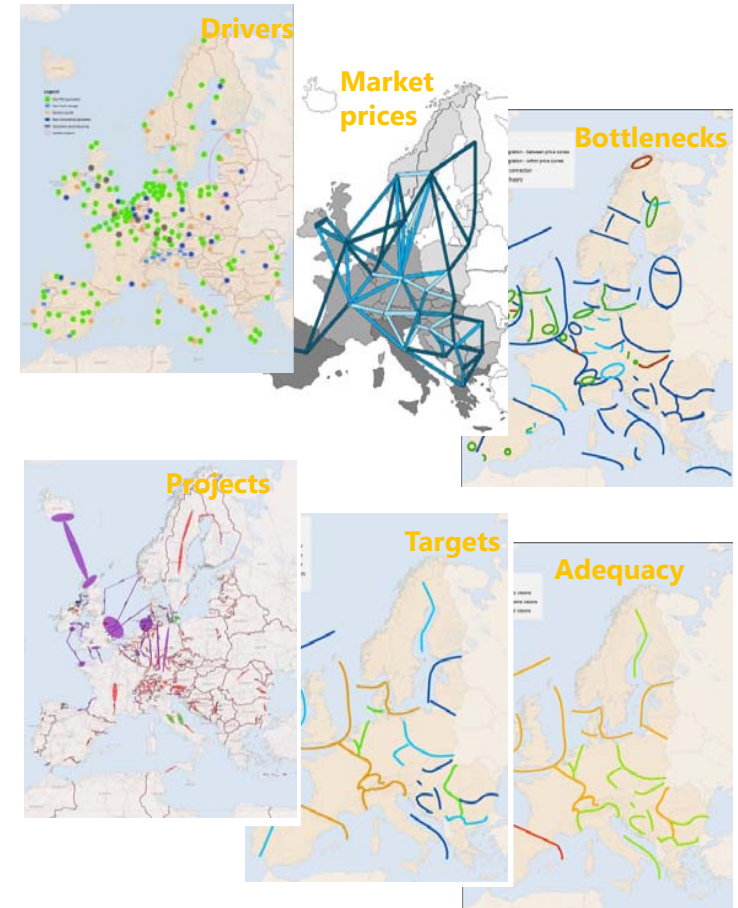
Investment decision on energy storage

Stable market:

- consistent market model
- European perspective
- Reliable and adequate grid connection
- Network codes
- Common agreed CBA

Tool: CBA

Advanced CBA taking into account technological developments in storage



Energy storage: link between electricity , gas and heat networks

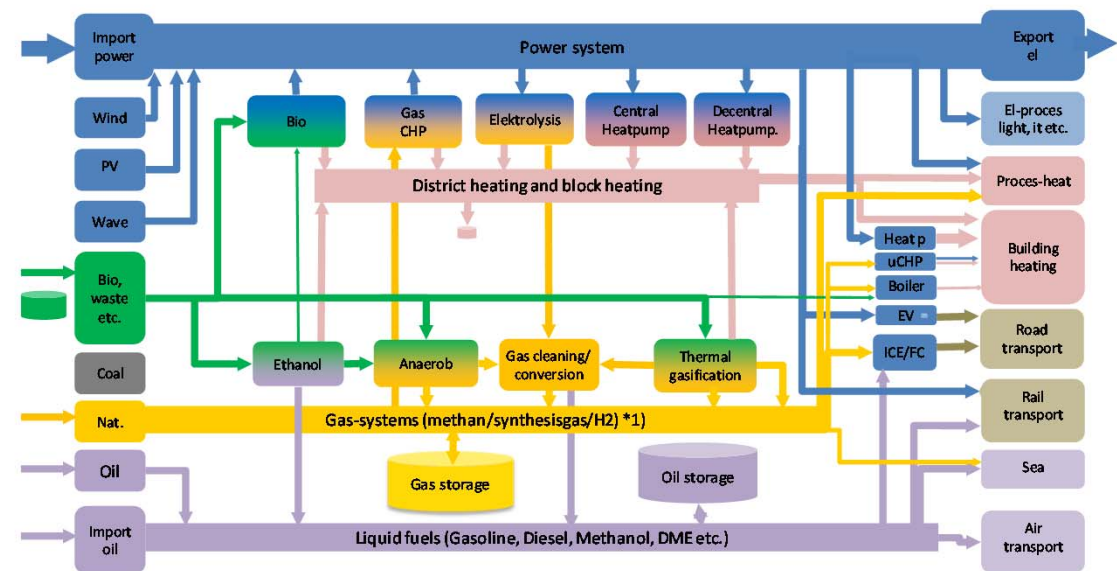
Power to gas/to x

- to optimise energy mix

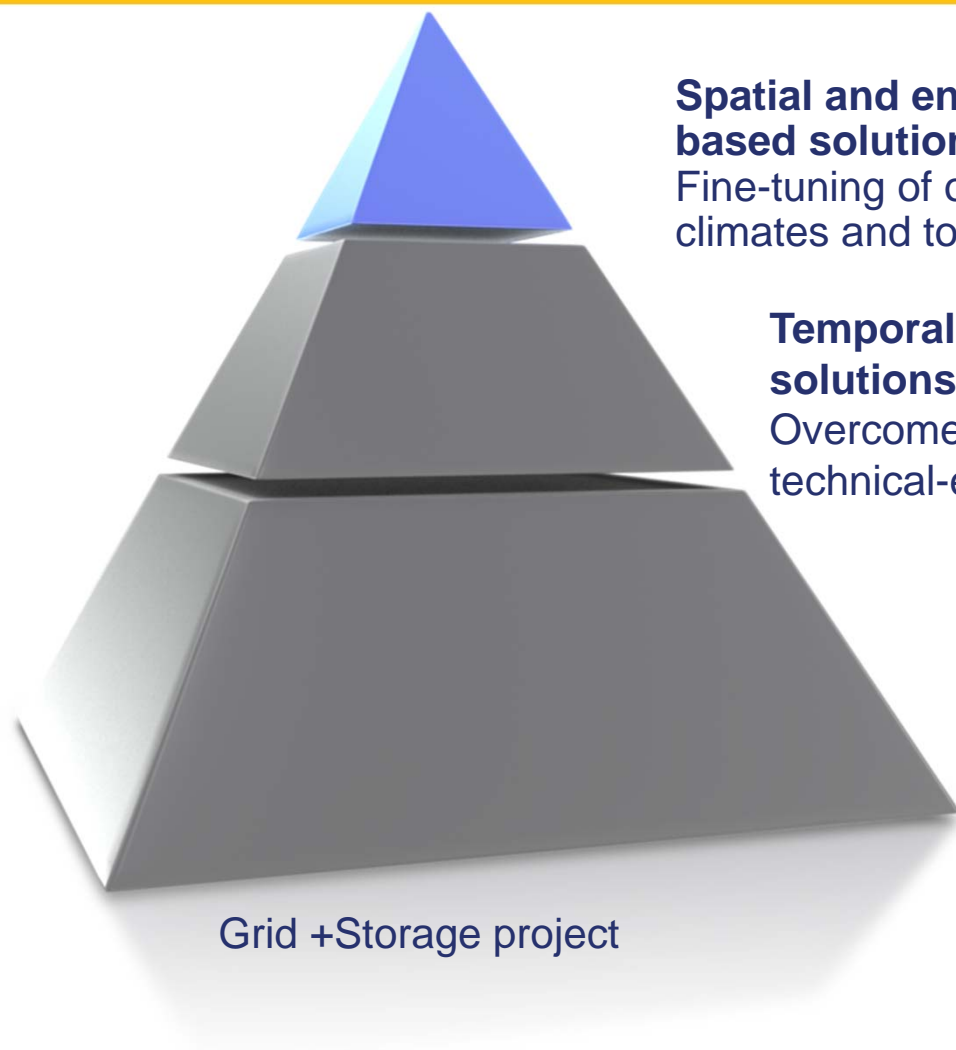
Large scale heat/cold networks

- for seasonal storage

Interacting and harmonised markets for electricity, heat and gas



Integrating storage into energy system



Spatial and environmental integration of storage-based solutions

Fine-tuning of optimal scale, adjustment to local climates and to specific areas.

Temporal integration of storage-based solutions

Overcome R&D issues to address reliability, technical-economical performances.

Functional integration of storage-based solutions into the system

Optimal mix, interfaces, experimental data and simulations to validate end-to-end functionalities

**Thank you for your
attention**



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