



CROSS BOrder management of variable renewable energies and storage units  
enabling a transnational Wholesale market

# GENERAL OVERVIEW OF INSTALLED STORAGE IN SEE AND RELATED REGULATORY ISSUES

IENE Webinar “The Role of Energy Storage in Advancing  
Large Scale RES Penetration”, Online, 27 April 2021

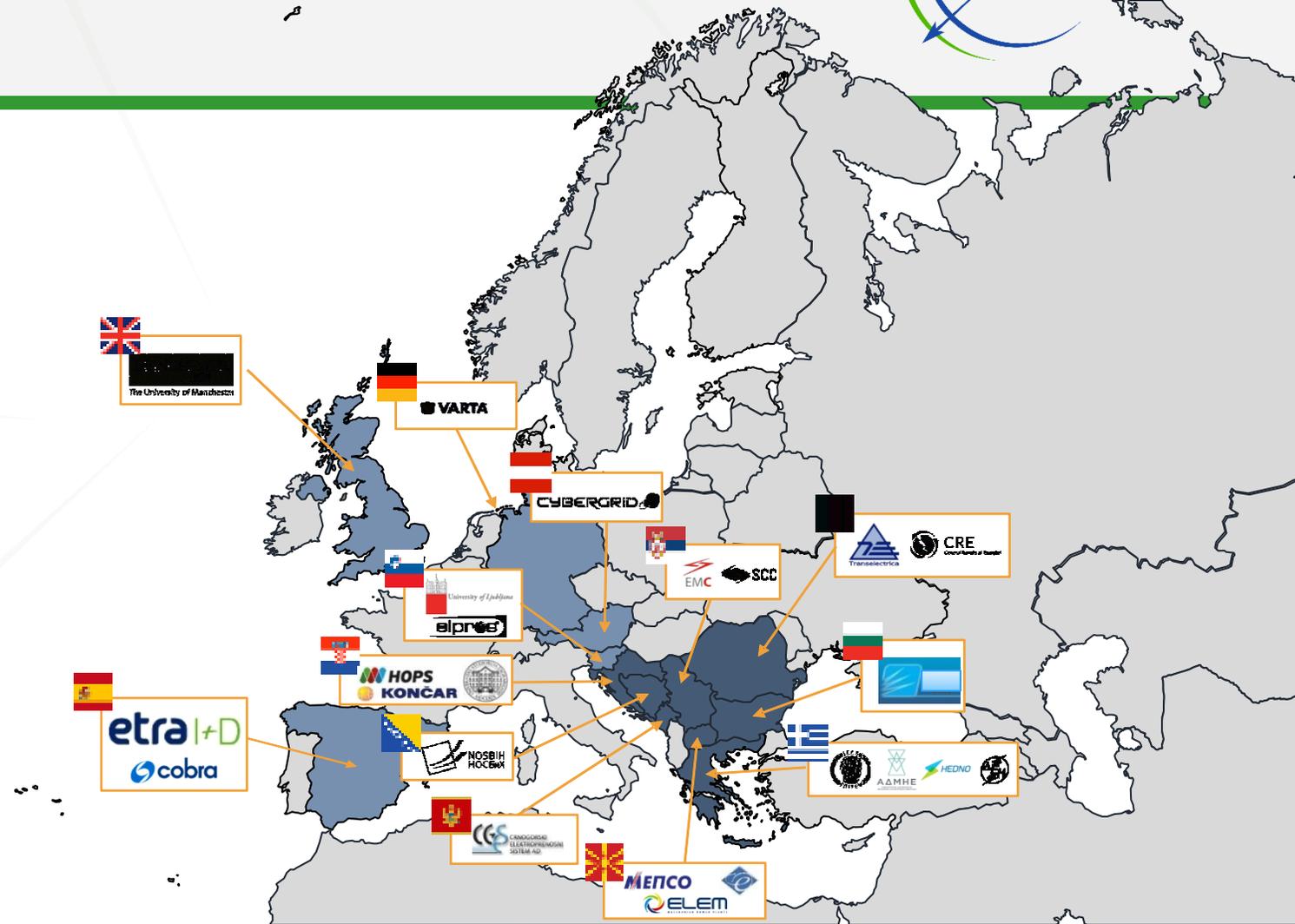


PROF. VESNA BOROZAN, UKIM

# CROSSBOW CONSORTIUM



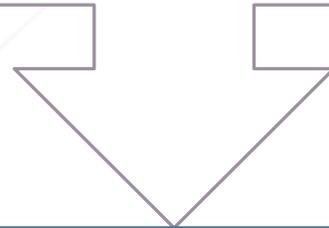
- 8 TSO
- 1 DSO
- 1 RSC
- 2 (+1) Large producers
- 5 (+1) Universities
- 6 Industrial partners
- 1 Industrial Association



# CROSSBOW PROJECT STRATEGIC GOAL



CROSSBOW will propose the **shared use of resources at regional/transnational level** to foster cross-border management of variable **renewable** energies and **storage units**, enabling a higher penetration of clean energies whilst reducing network operational costs and improving economic benefits of RES and storage units



Implement CROSSBOW products that would provide **business opportunities to RES, storage units and DSM resources** to compete in **providing sophisticated close to real-time market services**, instead of playing passive roles and waiting for subsidies in the form of FIT or FIP schemes

# CROSSBOW PRODUCTS



**CROSSBOW Regional  
Operation Centre  
Balancing Cockpit**



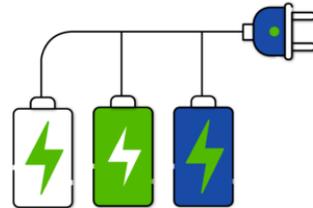
**CROSSBOW Regional  
Storage Coordination  
Centre**



**CROSSBOW Regional  
DSM Integration  
Platform**



**CROSSBOW RES  
Regional Coordination  
Centre**



**CROSSBOW Virtual  
Storage Plants**



**CROSSBOW Wholesale  
and Ancillary Market  
toolset**



**CROSSBOW Hybrid  
RES Dispatchable Unit**

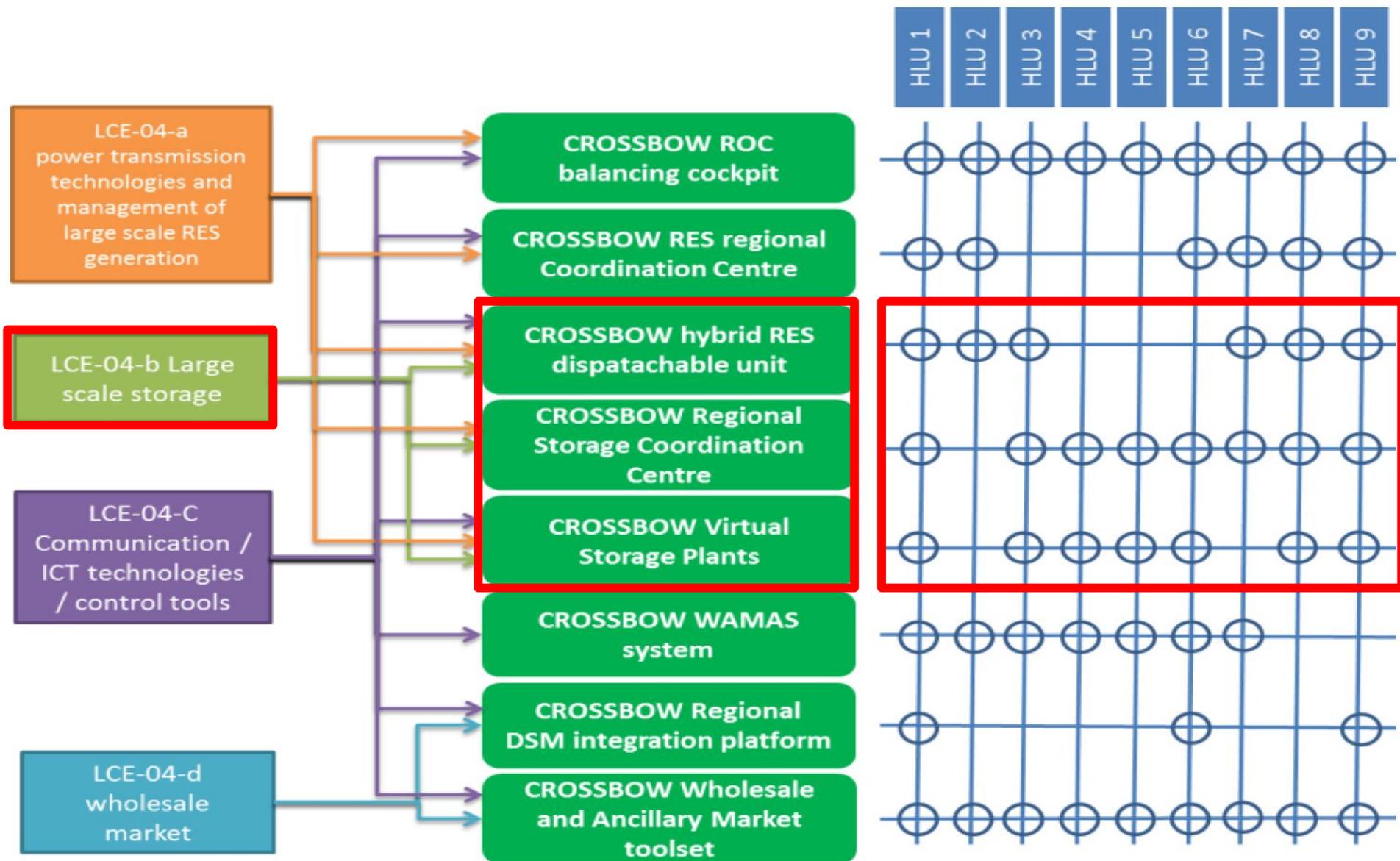


**CROSSBOW WAMAS**



**CROSSBOW  
Cooperative Ownership  
of Flexibility Assets  
Platform**

# CROSSBOW HIGH LEVEL USE CASES (HLUS)



# ENERGY STORAGE ASSETS IN SEE



## ○ Availability of storage assets

- **BiH:** 1 Pumped hydro storage (2x220 MW)
- **RS:** 1 Pumped hydro storage (600 MW)
- **BG:** 3 Pumped hydro storage plants (1,399 MW in total)
- **HR:** 1 Pumped hydro storage plant (276 MW), no other storage facilities
- **RO:** 5 Pumped hydro storage plants (265 MW total), 2 wind power plants with storage of 500 kW for 30 min, 1 wind plant with storage of 1.26 MW for 1h
- **GR:** 2 Pumped hydro storage plants (699 MW total), but the regulatory framework does not provide sufficient motivation for their appropriate exploitation

## ○ Planned new investment projects

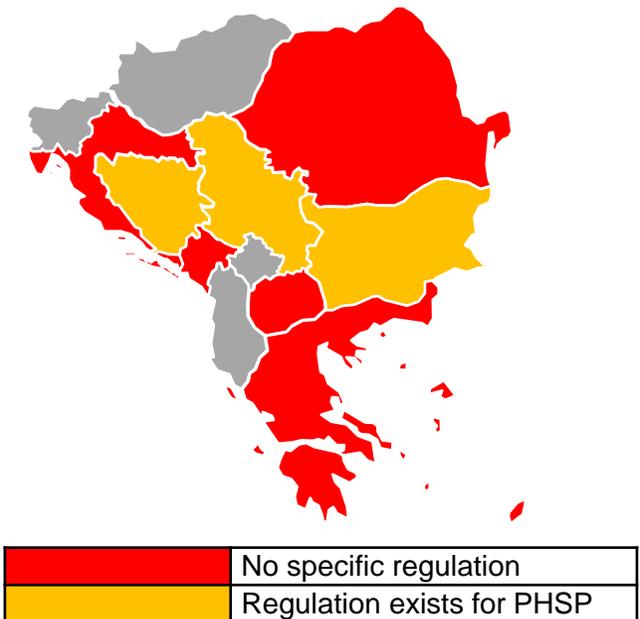
- **NMK:** Pumped storage hydro (3x111 MW)
- **RO:** Pumped hydro storage plant Tarnita-Lapustesti (1,000 MW)

# REGULATION ON ENERGY STORAGE SYSTEMS (ESS) IN SEE



- The current regulatory framework classifies ESS as generation assets
- The region lacks regulation related to ESS connection, ownership and operation
  - **BIH, BG, RS:** connection rules for PHSPs exist
  - **HR, RS:** storage units can participate in the wholesale market to provide mFRR in both directions
  - **BG:** TSO/DSOs are not allowed to own storage
- Recent developments
  - **RO:** plans for regulation on storage to be adopted, along with energy storage support measures
  - **BG:** adoption of regulation on energy storage connection

Energy storage connection



CROSSBOW, TSO's questionnaire, 2018

# VALUE OF ENERGY STORAGE SYSTEMS (ESS)



- Value of ESS from a system perspective
  - Generation operation and investment costs reduction,
  - **Network investment costs reduction – cross-border exchange of resources for congestion management**
- Value of ESS from a market perspective
  - Ability to **help other technologies meet contractual agreements**,
  - **Price arbitrage** - buy electricity during periods of low demand and low prices, and sell it during demand peaks at a higher price
  - Providing **balancing and ancillary services**
  - **Capacity market** - could be an **important revenue source for ESS** due to the significant potential for ESS of different sizes **to contribute to system adequacy**

# PARTICIPATION OF ESS IN DIFFERENT MARKETS

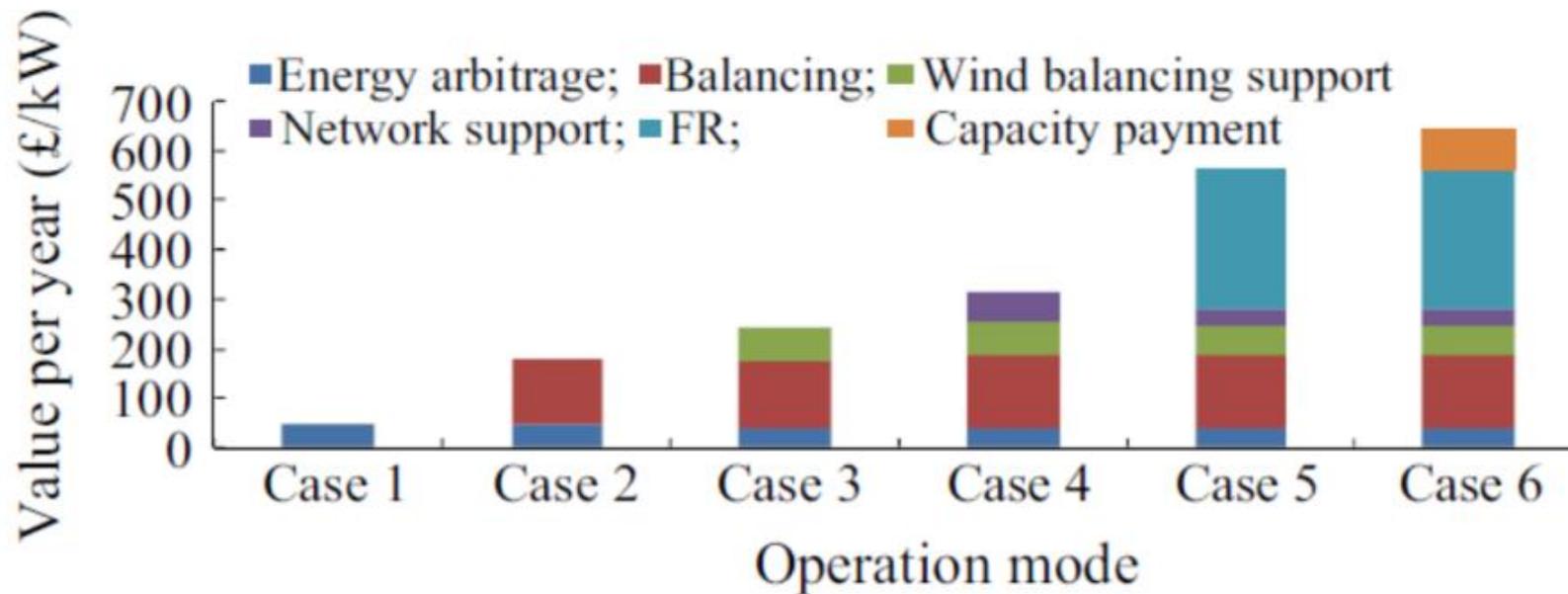


- Facilitating multi-service provision
  - **Wholesale market** - price arbitrage
    - high risk due to the variability of demand and therefore price instability
    - to be profitable, ESS must have a sufficiently large capacity, such as pumped hydro storage plants (PHSP)
  - **Balancing market** (capacity and energy provision) – may represent a significant revenue stream for ESS
  - **Capacity market** - capacity mechanisms, such as a capacity market, could be used to **encourage investment in ESS and ensure system security of supply**
- ESS cannot be economically viable through participation in only one market, and are rarely profitable through participation in two
  - **Multi-service provision** - taking advantage of as many revenue streams **is currently the only profitable business case for storage units**

# PARTICIPATION OF ESS IN DIFFERENT MARKETS (2)



- Aggregated ESS value from the participation in different markets in Great Britain



# CONCLUSIONS - REGULATORY BARRIERS TO MARKET PARTICIPATION OF ESS



- Regulatory and market barriers
  - **Lack of rules on ESS in the entire region**, including ownership, procurement of services by TSOs or DNOs, and support measures
  - **Currently the only viable business case for ESS operators is accessing multiple revenue streams through multi-service provision**, including energy and non-energy services.
  - **The current regulatory framework was not developed to facilitate multi-service provision**; therefore, it could be argued that the current market structure is inadequate for ESS precisely because of their advantage to offer multiple services over all time horizons
  - **The regulatory frameworks must undergo reforms** such that they are aligned with the technical constraints and business models of new technologies
  - **Only after a profound regulatory reform ESS can be profitable and its wide-scale investment will be incentivised**

# THANK YOU



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