



This project has received funding from the
European Union's Horizon 2020 Research and Innovation Programme
under Grant Agreement № 773430.

More information available at <https://crossbowproject.eu>

This presentation reflects only the author's views and
neither the Agency nor the Commission are responsible for any use that
may be made of the information contained therein



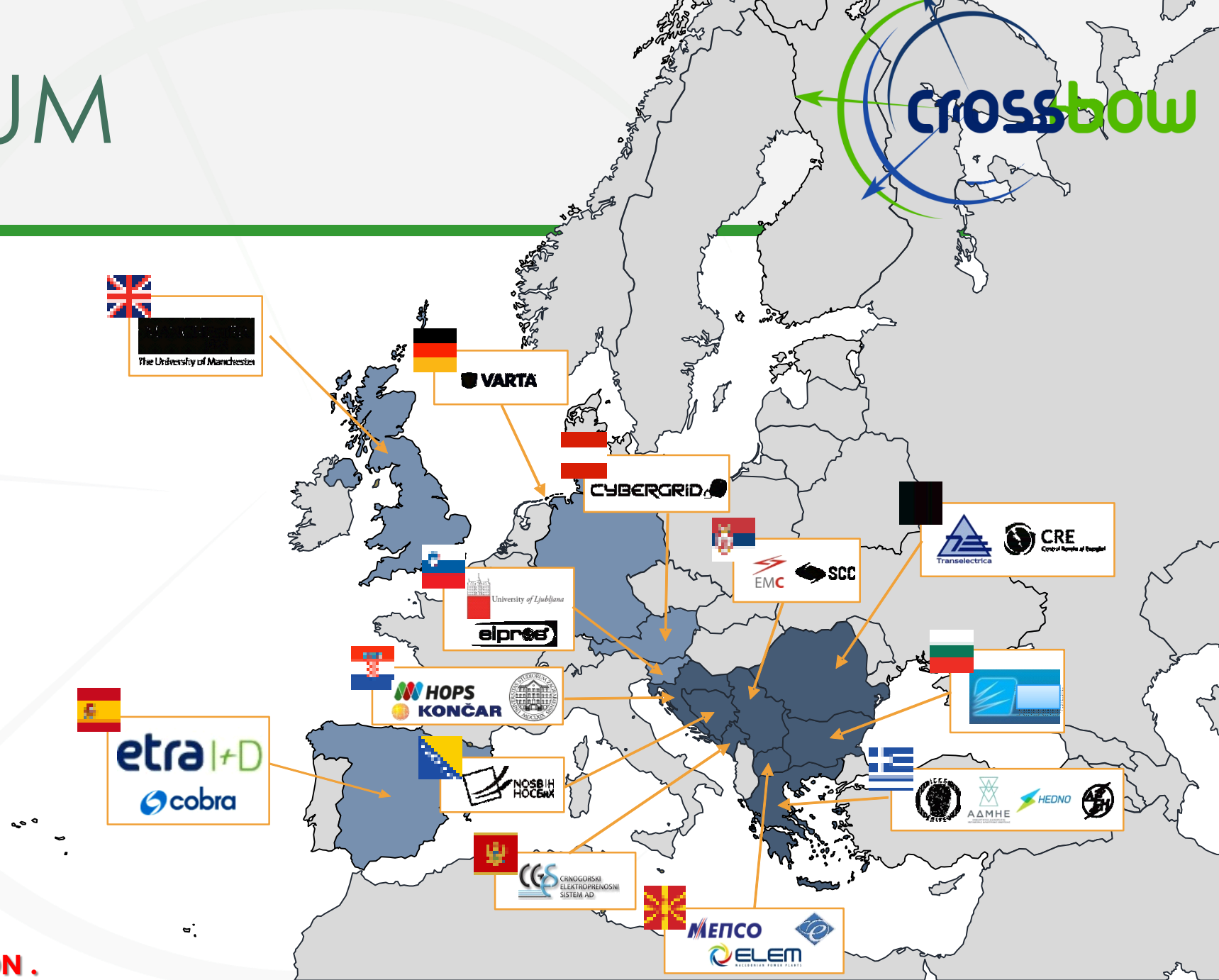
ESO PARTICIPATION IN CROSSBOW PROJECT



STEFAN SULAKOV

CONSORTIUM

- 3 Large producers
- 6 Universities
- 6 Industrial partners
- 1 Industrial Association
- 1 DSO
- 1 RSC
- **8 TSOs:**
 - ✓ DEFINING REQUIREMENTS;
 - ✓ DATA VALIDATION; AND
 - ✓ PARTICIPATION IN DEMONSTRATION .



CROSS-BORDER RES MANAGEMENT:

Bulgaria reaches its RES indicative goal 8 years before deadline (2020). Such forced RES penetration, creates many operational problems concerning the balance between generation and consumption during the spring. During the period 2013-2015, ESO has had to apply as final measure RES curtailment in some days during the spring. **Thus, ESO participates in the demonstration activities at CROSSBOW with an actual and challenging problem that has been affecting the full adoption of RES for the last years.** CROSSBOW analyses the historical RES production, integrate the real-time data and forecast of production of RES and demand to facilitate the use of RES excess by neighbor countries. The challenge is not be so much on the capacity of the interconnection points, but on the coordination with other parties in the region and the availability of an intra-day regional and balancing market.

ESO CHALLENGES AND ACTIVITIES



CROSS-BORDER RES STORAGE:

Bulgaria counts with the largest hydro power plant in the region – PSHPP Chaira, generators (4 x 217 MW) and pumps (4 x 198 MW) – which could be used to facilitate the storage of energy produced in the region – coming from RES. In addition, there are two small PSHPPs: Belmeken - generators (5 x 75 MW) and pumps (2 x 52 MW) and Orpheus - generators (4 x 40 MW) and pump (1 x 45 MW).

CROSSBOW enhances the storage assets installed in Bulgaria, extending the capability of ESO to use other actors not only in Bulgaria, but also in neighbor countries. In a similar way, it will be analyzed how these contracts could be used by other TSOs in the region in the context of a transnational ancillary market.

ESO CHALLENGES AND ACTIVITIES



TRANSNATIONAL DEMAND SIDE MANAGEMENT:

ESO has two demand-side contracts with two companies (large industrial plants) in Bulgaria: Stomana Industries with range 0.457 MW and Radomir Metal Industries with range 1.5475 MW. These contracts are used to modulate the demand depending on the availability of RES in order to maximize the penetration of clean energies. ESO mainly use them at spring, but they could be used during the winter for peak load shaving purposes.

CROSSBOW enhances the demand-side schemas already in place in Bulgaria, extending the capability of ESO to use other actors not only in Bulgaria, but also in neighbor counties. In a similar way, it will be analyzed how these contracts could be used by other TSOs in the region in the context of a transnational ancillary market.

ESO CHALLENGES AND ACTIVITIES



COOPERATIVE OWNERSHIP OF FLEXIBILITY ASSETS – innovative business model based on ICT. **The results will be starting point for the next project, where ESO will extend cooperation with ETRA and UL – XFLEX financed by Horizon 2020.**

WHOLESALE AND ANCILLARY MARKET TOOLSET - The market platform will introduce and demonstrate new innovative concepts, based on blockchain technology, microservices and APIs (automation programming interface) to demonstrate the contractual and payment possibilities with systematic assessment of their efficiency, transparency, scalability, interoperability, security and resilience, and the overall impact on ancillary services and wholesale electricity markets. **The results will be starting point for the next project, where ESO will extend cooperation with ETRA and some WB6 partners – TRINITY financed by Horizon 2020.**

REGIONAL OPERATION CENTRE – increasing functionalities:

An integrated approach in the management and the operation of the transmission network in south eastern Europe. Creation of a regional operation center (ROC) extending the RSC functionalities. Supporting the definition activities of this center and explicitly address the development of balancing capabilities of future ROCs – adaptable to any existing RSC. The ROC balancing cockpit will allow the data and information exchange between TSOs in order to increase reliability and efficiency in the transmission system.

ESO is engaged with additional task: Creation of Regional short-term (week ahead) adequacy methodology and prototype.

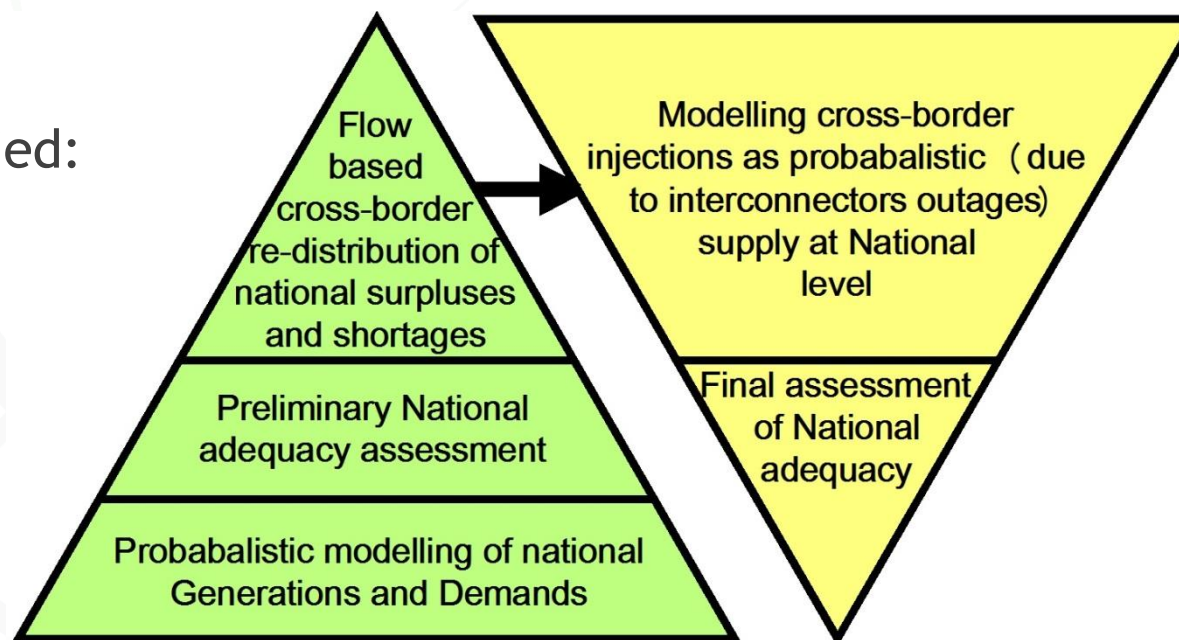
ESO ADDITIONAL TASK



Beyond contracted tasks and together with SCC-Belgrade, ESO takes additional obligation to develop Regional short-term (week ahead) adequacy assessment. This includes methodology and two prototypes:

- Short-term adequacy assessment for individual country and region - defining needed import and possible export in order to keep targeted reliability standard (ESO task).
- Flow-based cross-border re-distribution of needed import and possible export (SCC task).

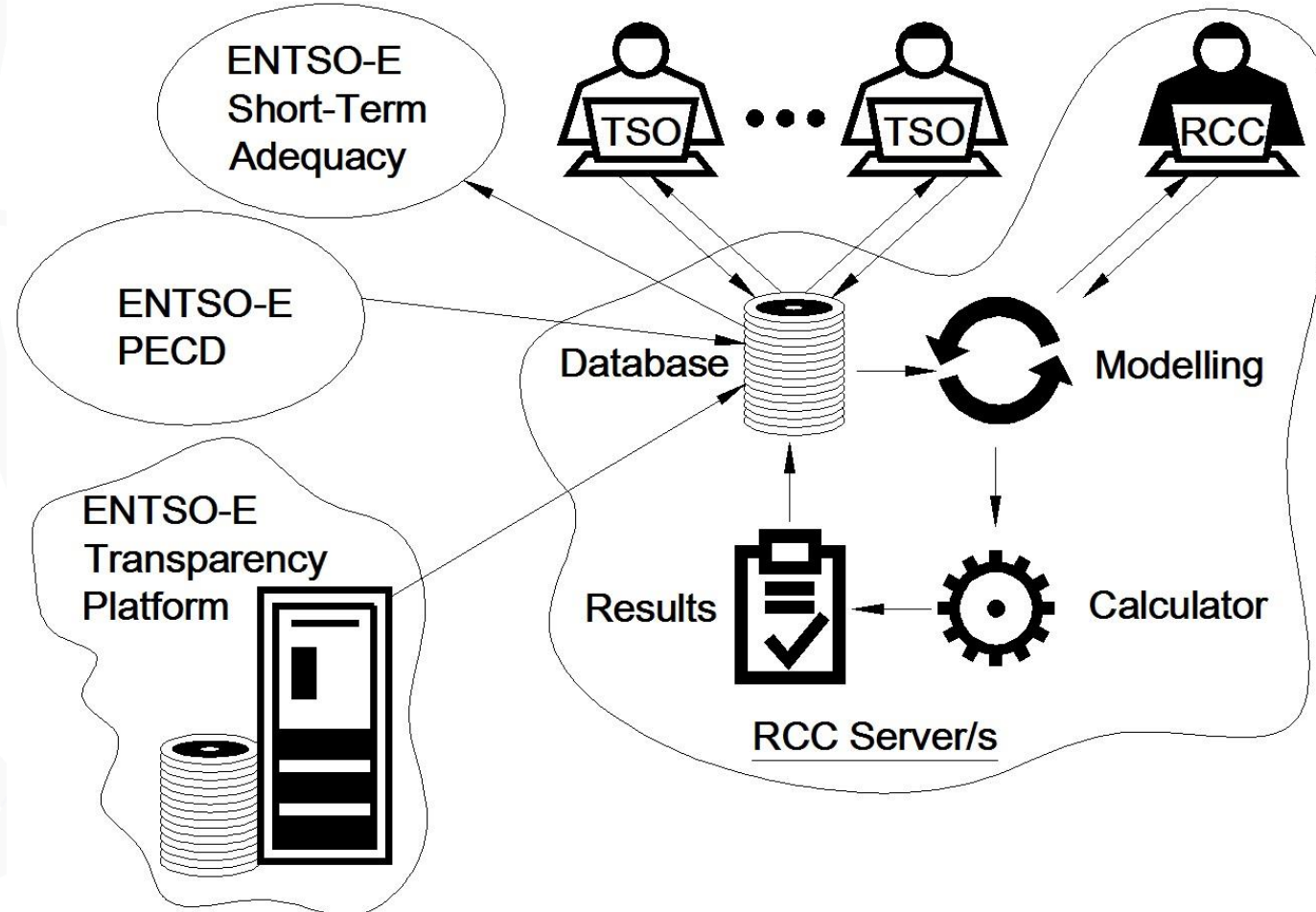
Integrated bottom-up and top-down approach is applied:



ESO ADDITIONAL TASK



Basic conception of regional short-term adequacy assessment:



ESO ADDITIONAL TASK DISSEMINATION



The developed methodology and the prototype results were presented to ENTSO-E STA (Short Term Adequacy) in Paris, Aarau and Bled. Its main advantages are:

- ❑ it takes into account all sources of stochasticity on the generation (supply) side;
- ❑ the probability of tripping of each one of the conventional units is estimated;
- ❑ instantaneous values of outage rate and repair rate of each unit to evaluate the short-term system adequacy (168 hours ahead) are used;
- ❑ concerning wind generation Weibull probability distribution is modeled;
- ❑ for each sub-category of non-dispatchable (renewables, and co-generations) generation probabilistic hourly models are being used;
- ❑ confidence intervals of $\pm 3\sigma$ are used which allows to cover both “tail” areas of the referent probability distribution. Inside these areas are the extreme events with very low probabilities, but with a very high and serious impact on the system adequacy (the “Black Swan” effect).

ESO ADDITIONAL TASK DISSEMINATION



Two conference publications were on place (BulEF-2018; Sozopol, Bulgaria) :

- ✓ Probabilistic modeling of available capacity in the power system;
- ✓ Probabilistic modeling and evaluation of system adequacy.

Another two publications will be presented next days at EEM-2019:

- ❖ Modeling of hourly wind generation using pan-European climatic data base and Weibull probability distribution;
- ❖ Regional short-term system adequacy forecasting using analytical probabilistic approach.

Two more publications are planned, presenting further development of the methodology:

- Integrating probabilities of start-up failures of conventional thermal units in short-term system adequacy assessment;
- Integrating demand side response in system adequacy assessment.

ESO EXPECTATIONS FROM CROSSBOW



- ☐ **Benefits of different solutions for further integration of renewable sources in order to fulfill new European Union Package “Clean energy”.**
- ☐ **Choosing the optimal combination between the solutions that will increase social welfare, including reduction of power system operational cost and increasing the security and reliability of supply.**
- ☐ **Marks roadmap and further steps that power systems in Balkan peninsula have to get over in order to develop and improve operation of RSC.**
- ☐ **Defining framework of regional market integration.**
- ☐ **Knowledge and experience for ESO staff to overcome the future challenges in power system operation.**
- ☐ **CROSSBOW results will be starting point for the next projects XFLEX and TRINITY.**



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

THANKS FOR YOUR INTEREST!

For more information visit: crossbowproject.eu