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OneNet Cypriot Demonstration

Development and Implementation of the Active Balancing and Congestion Management (ABCM) Platform
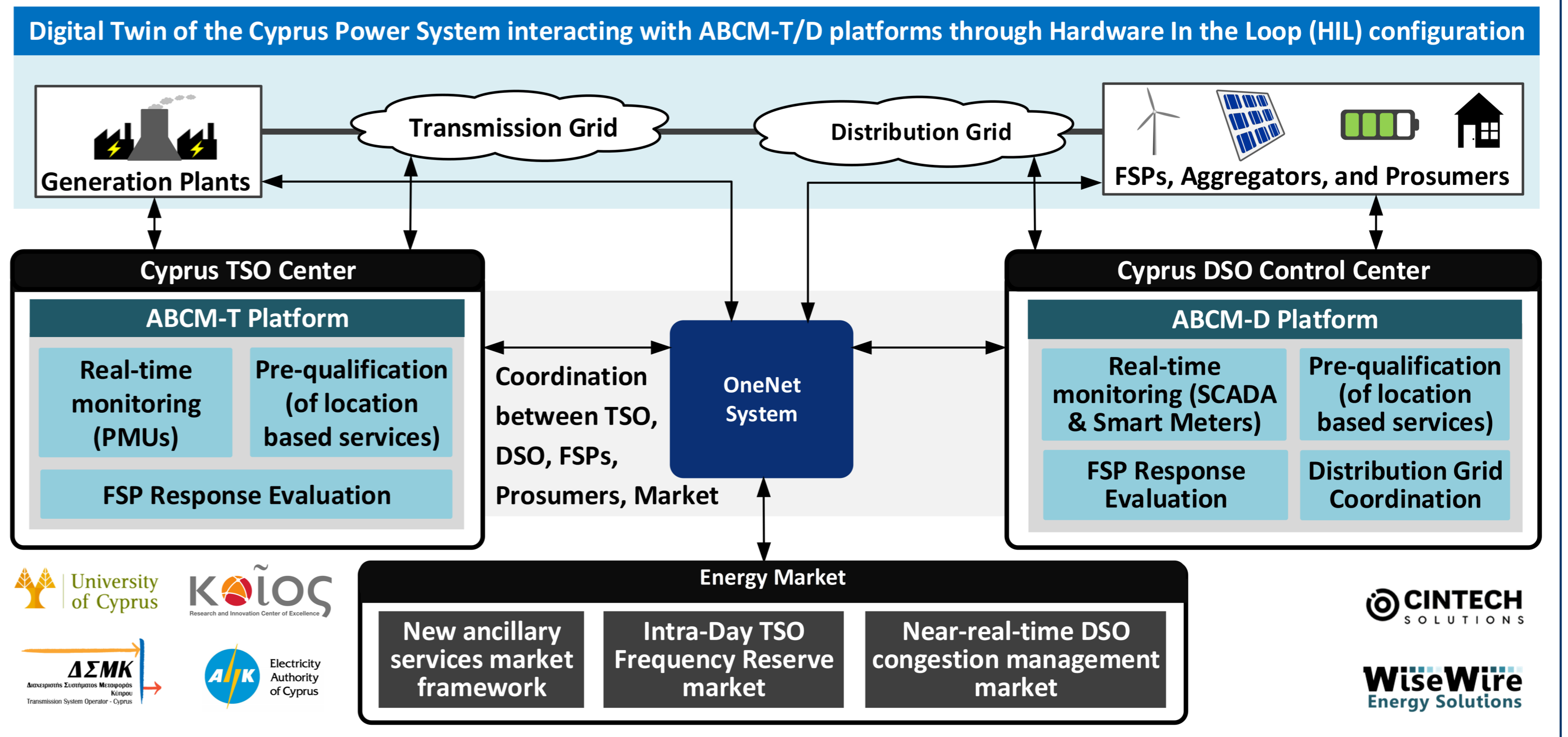
Problem Statement and Challenges

Cyprus power system faces critical challenges:

- High curtailment of Renewable Energy Source (RES) due to the islanded nature of the Cyprus system
- Increased RES penetration causes critical congestion in the distribution grid, especially in rural substations
- Absence of flexibility coordination and market for ancillary services to enhance operators' capabilities

Demo's Innovation

- Development of an effective coordination framework between TSO, DSO, FSPs, and Prosumers through:

  (a) a suite of digital tools for grid management,

  (b) a new market structure for flexibility

Overall concept of the demonstration

Digital Twin of the Cyprus Power System interacting with ABCM-T/D platforms through Hardware In the Loop (HIL) configuration

Key Outcomes

Cyprus Power System Digital Twin

- **The Cyprus digital twin** has been developed (for demo/evaluation)
  - Considering both transmission and distribution grids
  - Integrating ABCM-T/D platforms in a real-time HIL configuration
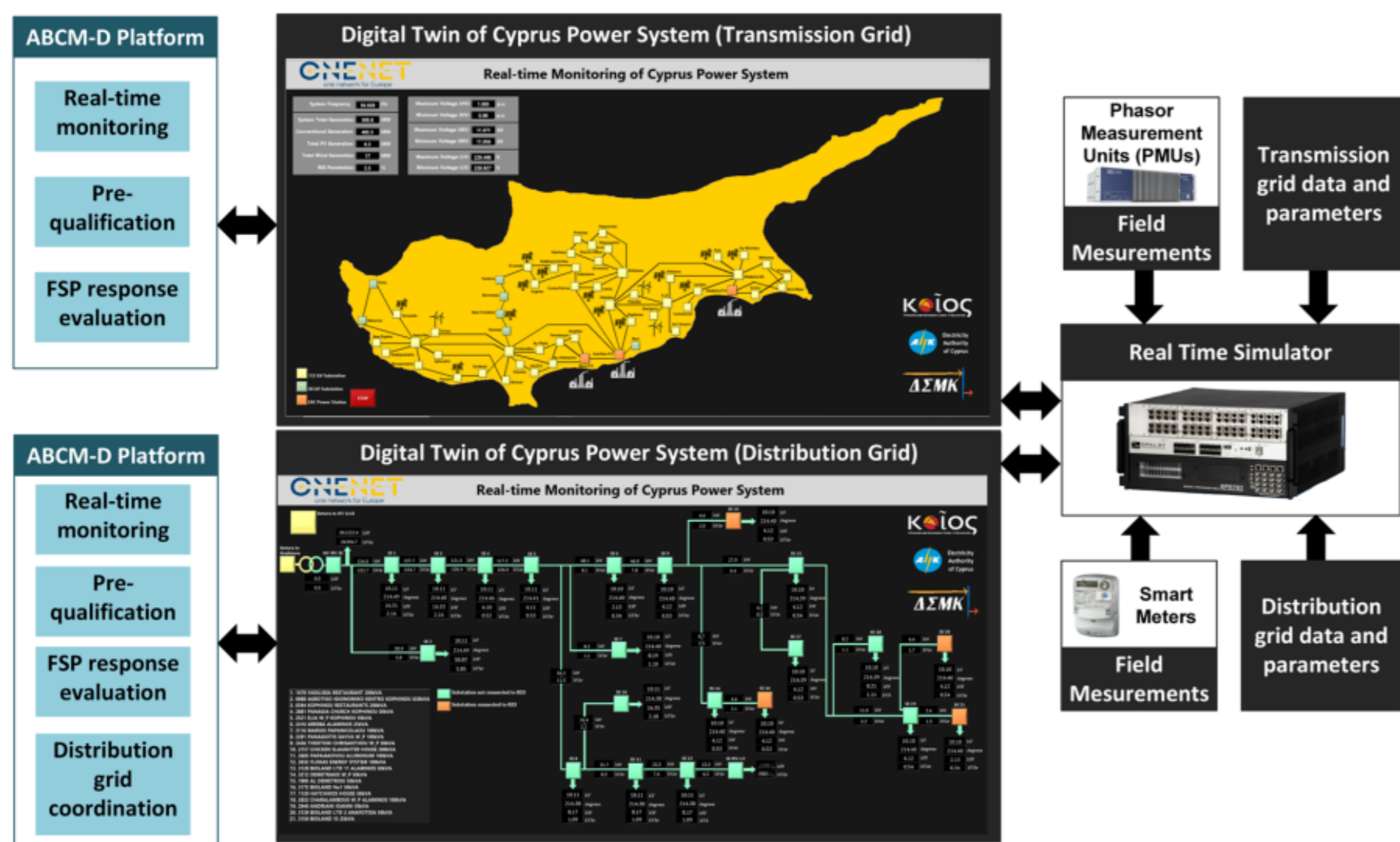
New Ancillary Services Market Framework

- **A new ancillary services market** has been developed to allow trading of:
- **Frequency Containment Reserve (FCR)** to TSO Intra-Day market
- **Congestion management services (ΔP, ΔQ, PB)** to DSO Near Real Time market
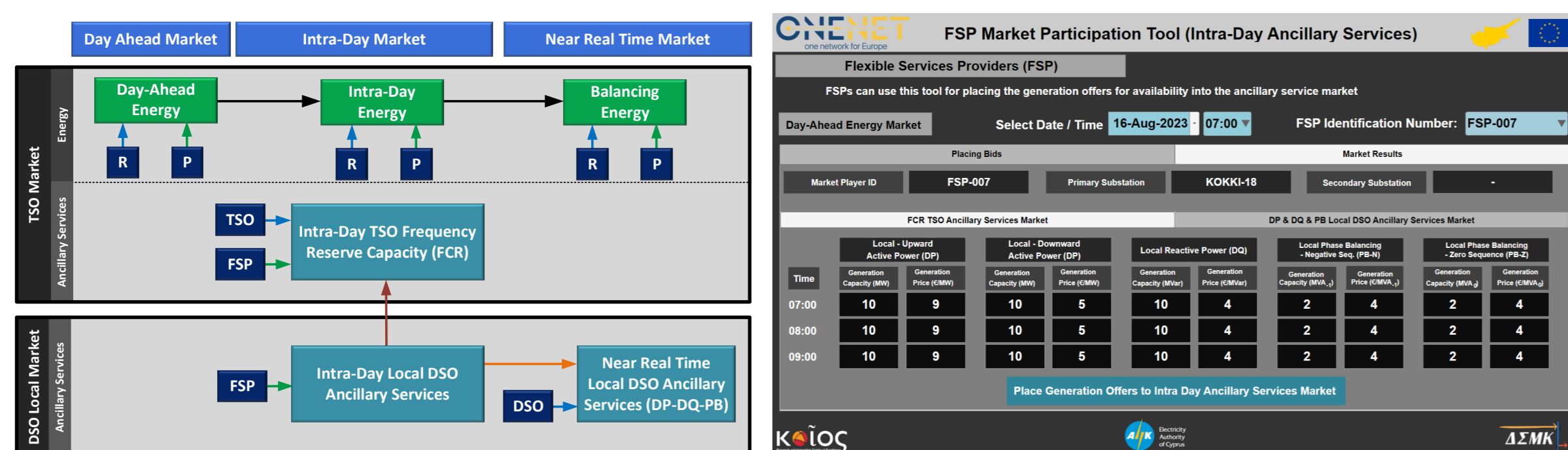
ABCM-T and ABCM-D Platforms for TSOs and DSOs

Real-time monitoring & FSP response evaluation

- Real-time monitoring tools have been developed for:
  - **Transmission grid:** based on PMU measurements to evaluate transient response of FSPs when provisioning FCR
  - **Distribution grid:** based on smart meters/SCADA to enable a timely and precise coordination of FSPs to relieve congestion

Pre-qualification

- Estimate location-based limits based on historical-forecasting data
- Pre-qualify services and avoid conflicting decision-making
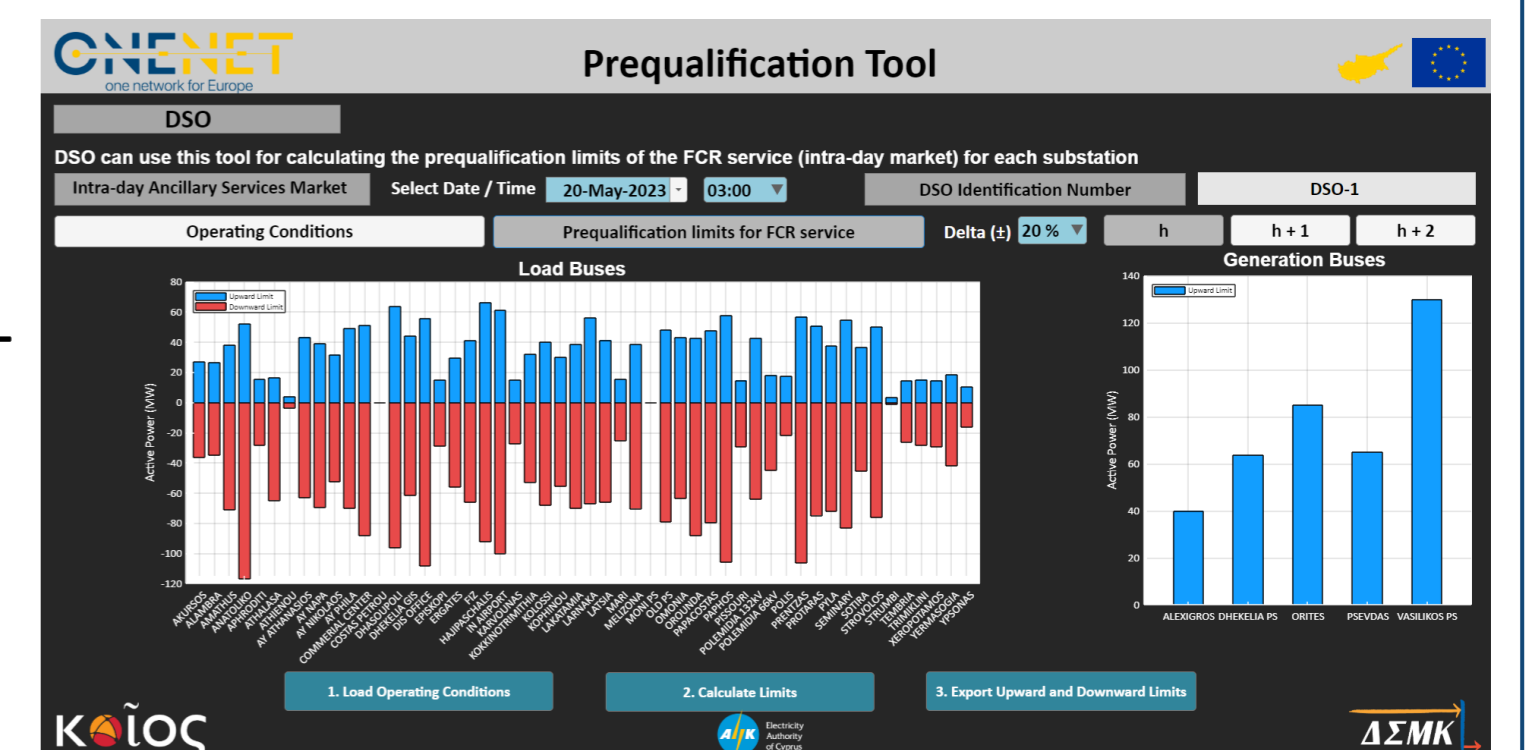
Distribution grid coordination

- **Real-time power (ΔP & ΔQ) and phase balancing (PB) coordination:**
  - of FSPs and prosumers (including an actual prosumer as well)
  - for enabling congestion management with minimum activation cost
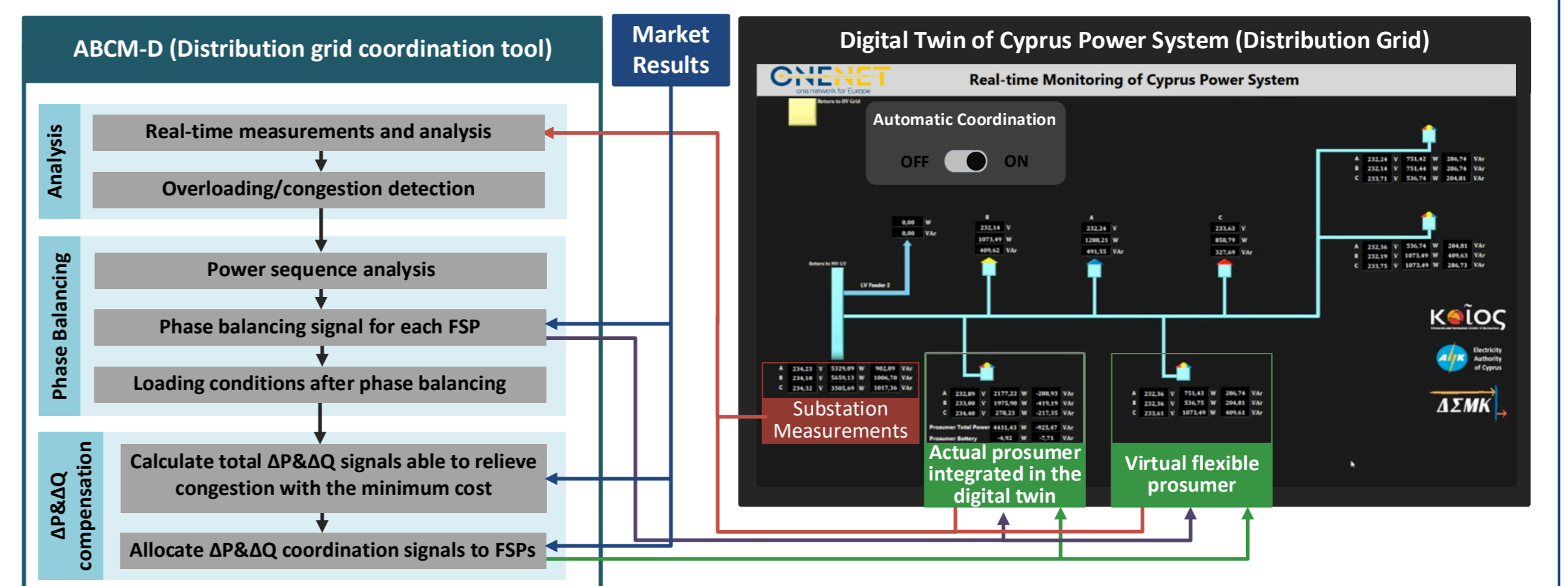
Achieved results by the Cypriot demonstration

- Enhance the system stability by improving the system rate of change of frequency (ROCOF) by 24%
- Decrease the thermal loading of the medium and low voltage distribution feeders by 34% and 54%, respectively
- Improve the loading asymmetries in the distribution grid by 50%
- Reduction of grid losses by 3.5%
- Achieve a maximum available flexibility of 70% in distribution grid

Conclusions, Recommendations, and Lessons Learned

- Global and local ancillary services market are important for the cost-effective, flexible and stable operation of modern power systems
- Stakeholders' collaboration (operators, market, FSPs, prosumers) is crucial Bidirectional and secure communication with the grid edge and fast real-time monitoring capabilities are required to timely activate flexibilities
- Prequalification is needed to avoid conflicting decision making
- Proper baselining schemes are needed for monetizing flexibilities