Paris Session 2022

Energy storage: quantification of needs and anticipated benefits

NTUA

C1 – Power system development and economics

PS 2 – Energy sector integration and tackling the complexity of multi-faceted network projects

Question 2.3.3: What approaches are used to quantify the system service needs—as well as their benefits—of battery storage, and means of flexibility for the electricity system, and how are those benefits comparable in order to make an optimal portfolio to be used by system operators?

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Approaches to quantify system storage needs

•Two basic approaches to identify storage needs in terms high level energy benefits such as RES curtailments reduction, reserves provisions, reduction of system generation cost etc.

❑ **Capacity expansion modelling**:

- Optimization of system operation over a **long time horizon**, considering the investment in new generation and accounting for the full system cost to **finally derive the optimum generation portfolio, including storage.**
- A **unique solution** for generation system development depending on the predetermined targets.
- **Simplifications in management and operational constraints**, to reduce the number of variables and constraints of the problem trying to maintain a balance between detail and feasibility of solution.

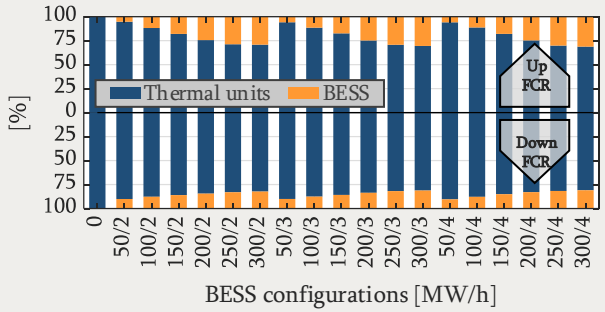
❑ **Day-ahead scheduling simulation method**:

- Optimization of system operation over a **limited look-ahead horizon**.
- The main target is to **capture in detail the impact of storage on system operation**.
- **Realistic representation** of actual unit commitment and economic dispatch (UC-ED) practices.
- For the identification of optimal BESS solution different scenarios regarding energy and power capacity of storage are investigated and the corresponding results are compared.
- **Direct comparison between the benefits attributed to different BESS configurations**.

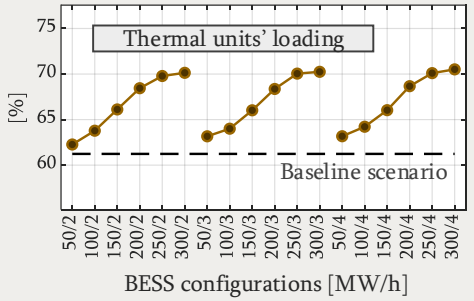
Anticipated benefits from storage integration – Implementation of DAS-based approach in the power system of Cyprus

- System operation is simulated in **absence** (baseline scenario) and in **presence of battery energy storage systems**-BESS.
- Assessment of the **improvement in system performance due to BESS introduction**.
- Various configurations of BESS are tested in order for the optimal solution to be determined.
- **Anticipated benefits from BESS introduction:**

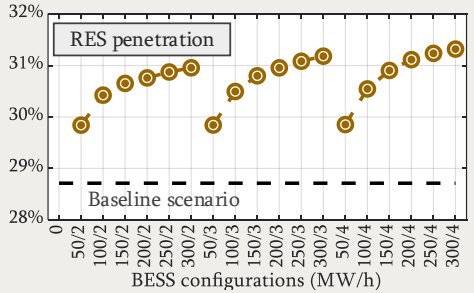
Provision of reserves



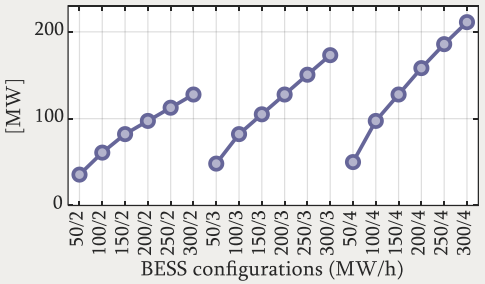
Thermal units' improved operation



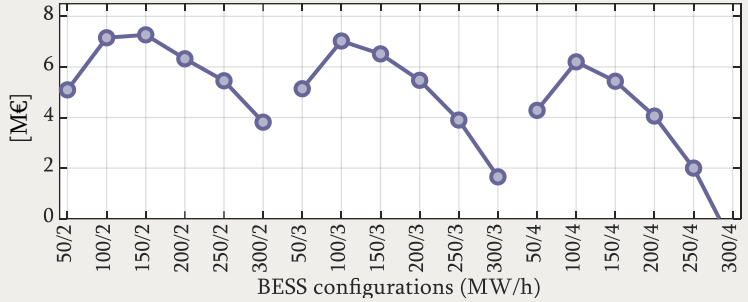
Increase in RES penetration



Enhancement of system adequacy



Net system economic benefit



Optimal BESS configuration for Cyprus: **150MW / 300MWh BESS**
net annual system benefit €7.3 million –
~30.8% RES penetration level - ~72% reduction in RES curtailments

Thank you for your attention !