



Storage Systems for Large Wind Turbines

Swierczynski, Maciej Jozef; Teodorescu, Remus; Rasmussen, Claus Nygaard; Rodriguez, Pedro

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Storage Systems for Large Wind Turbines

Challenges



2nd Annual Symposium on Grid Integration of Wind Power
Vestas Power Programme
Sept. 7th, 2009 Terrassa/Barcelona, Spain

Objectives

- Make the wind power plant to appear and behave like conventional power plant.
- Move the wind power plant to the sector where it can be considered as more reliable and controllable source of energy.
- Better correlation between actual market energy price and actual wind power generation.
- Offer various services to the power system.

- Energy storage for Wind Power System – state of the art, especially present situation and trends.
- Services that energy storage technologies can provide to the WPP and power system.
- Modeling of wind and the most relevant storage technologies and their services.
- Evaluation of obtained results.
- Laboratory validation of different storage techniques and storage managements.

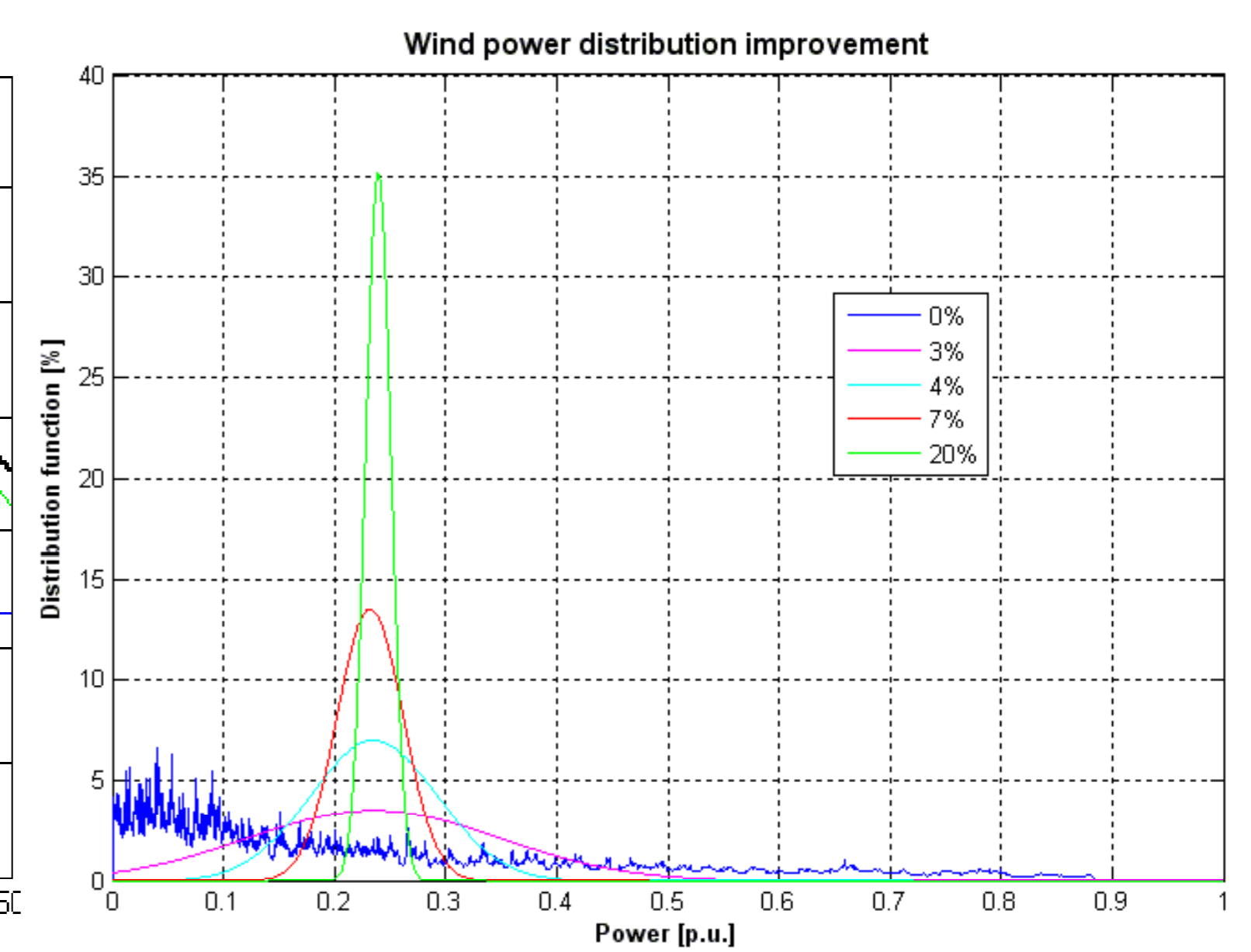
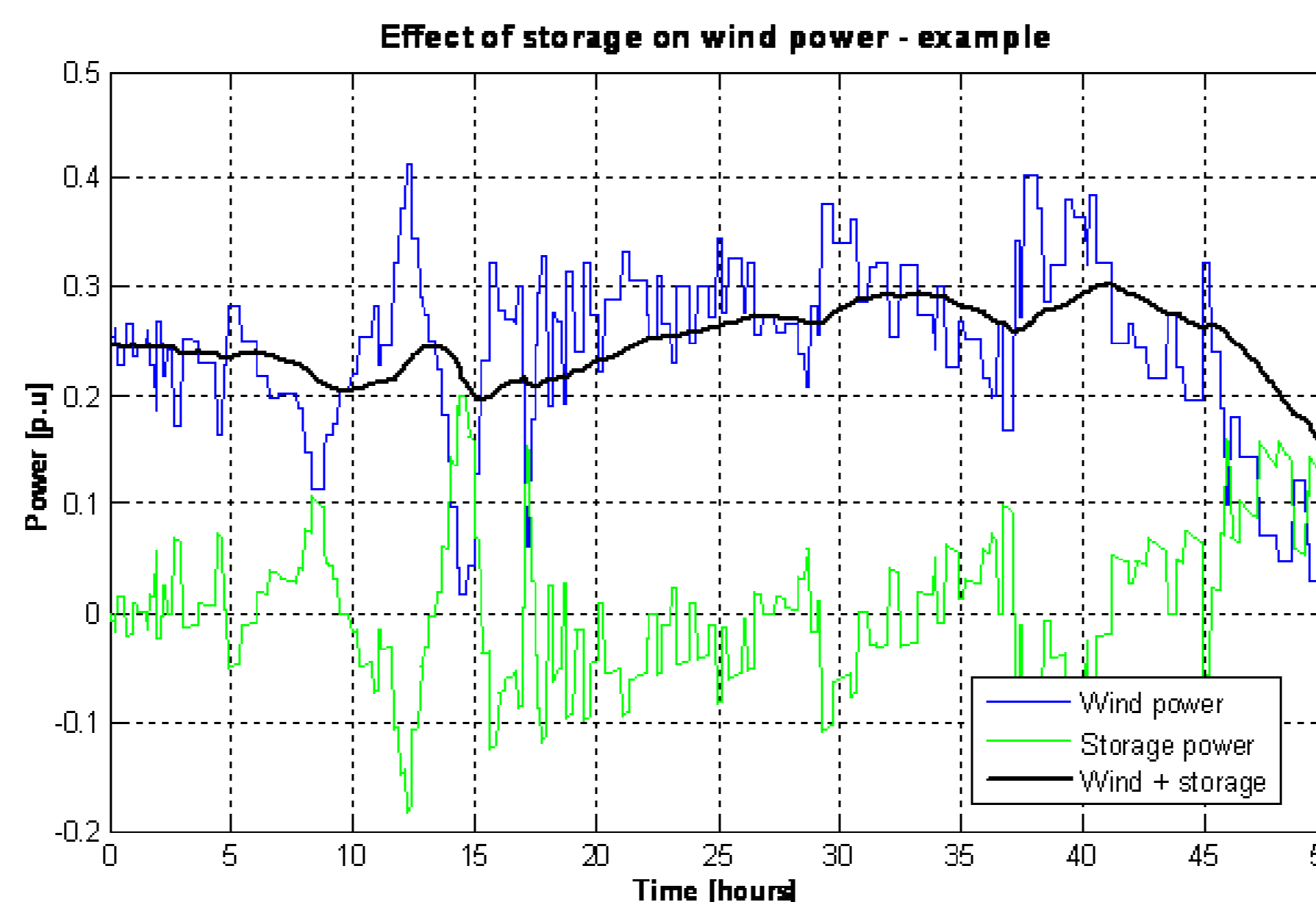
Main Services that can be offered by ES

Services that can be offered to WPP:

- higher availability, predictability and smaller variability
- black start without assistance from a grid
- energy arbitrage
- peak shaving
- production leveling

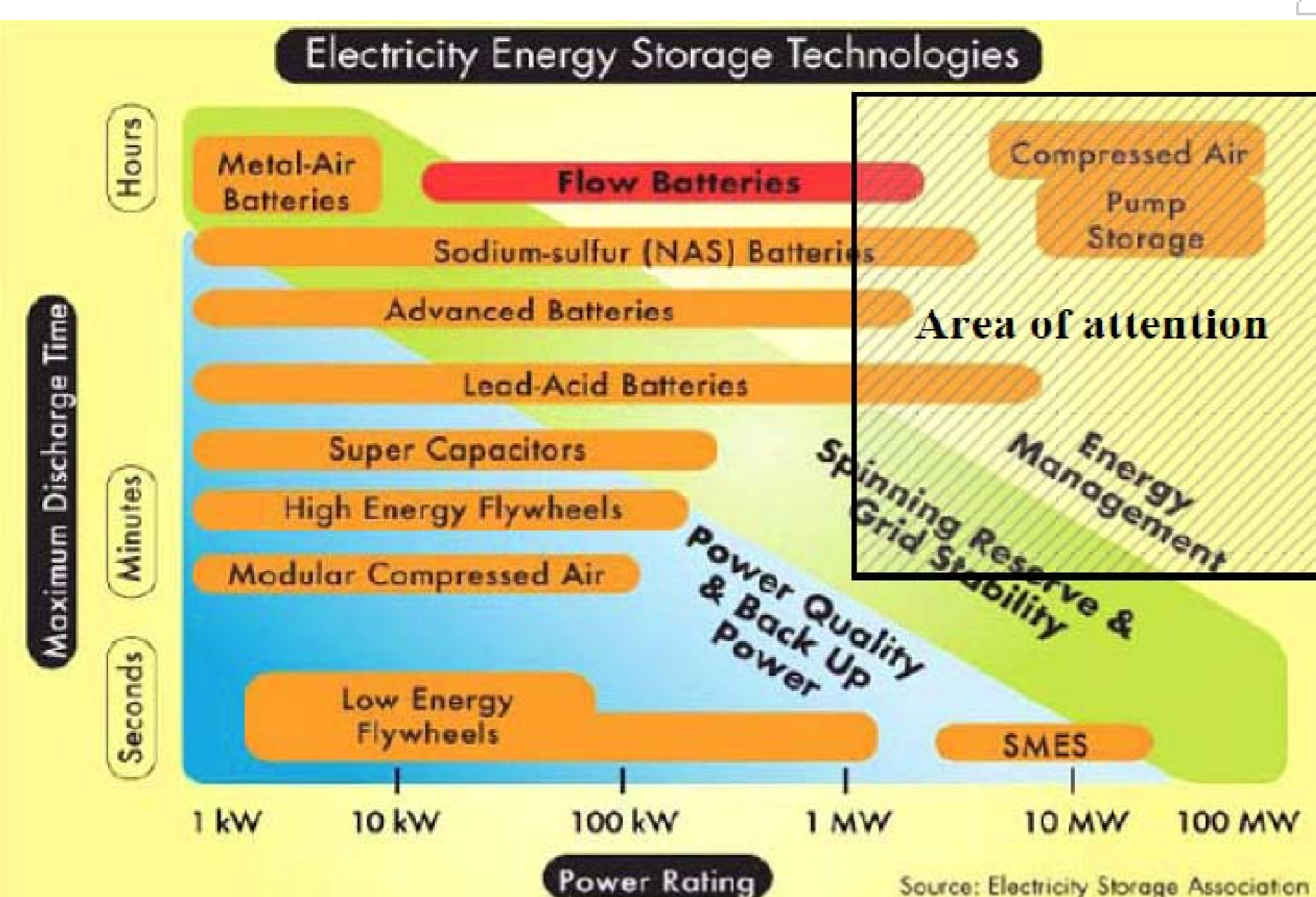
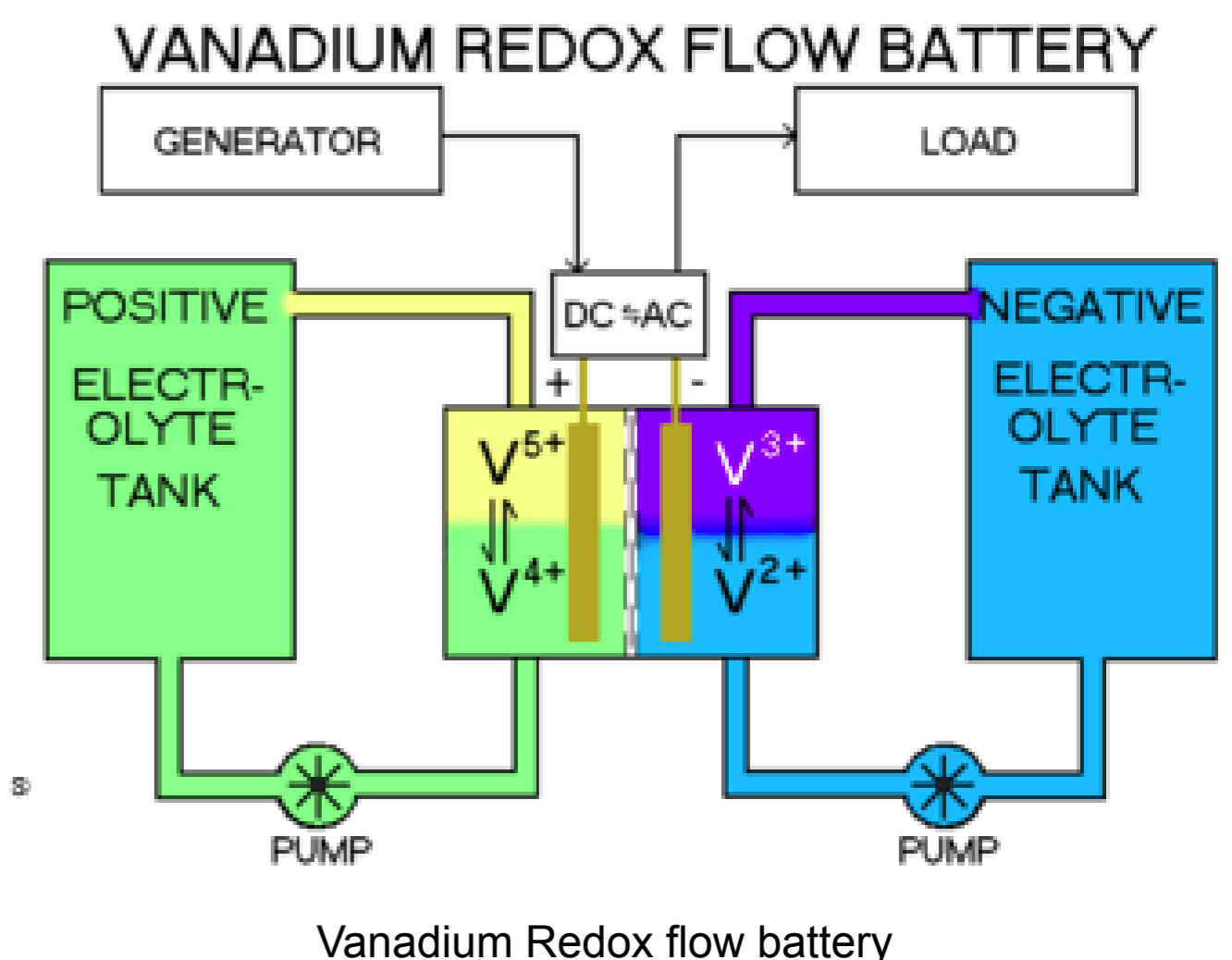
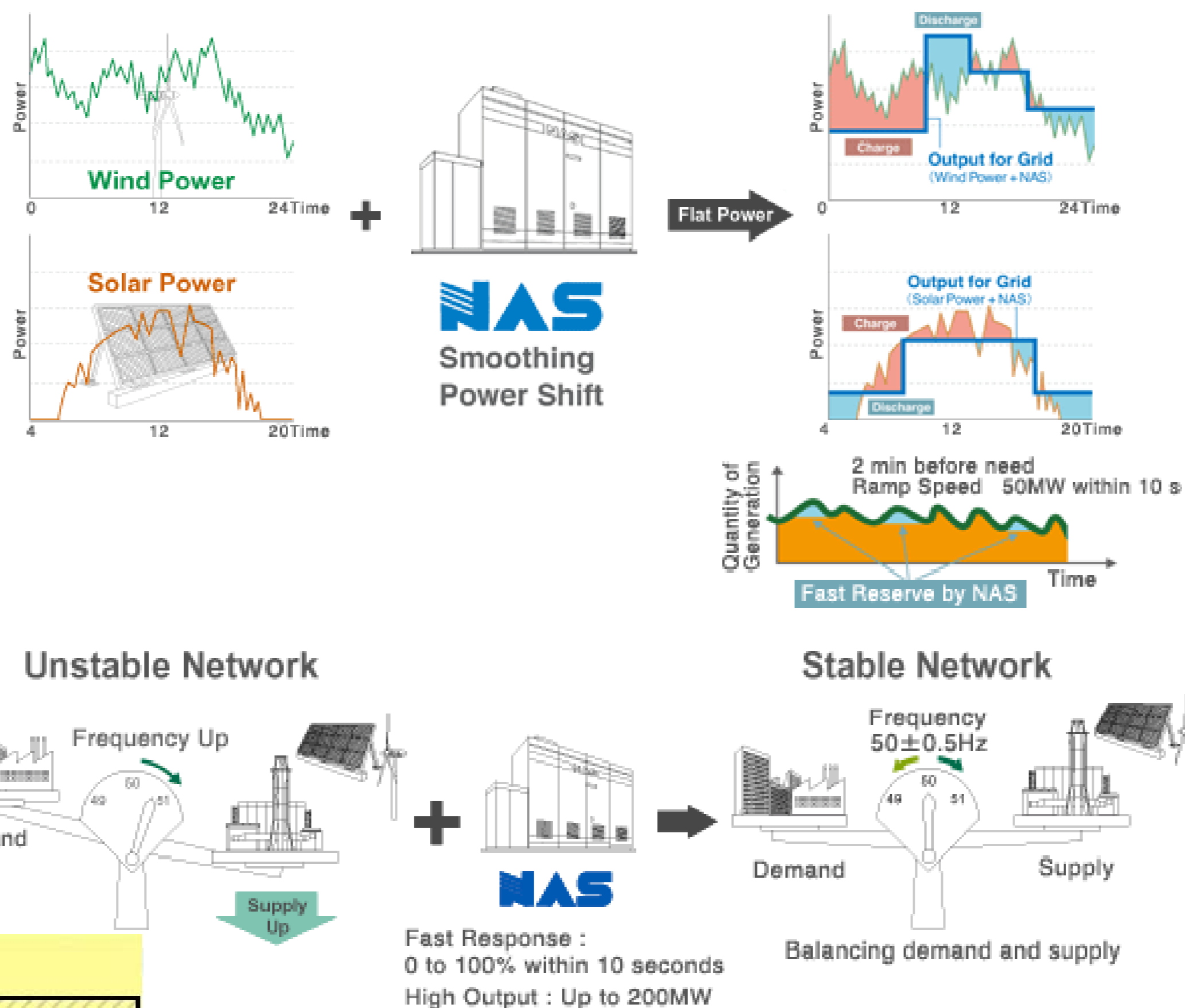
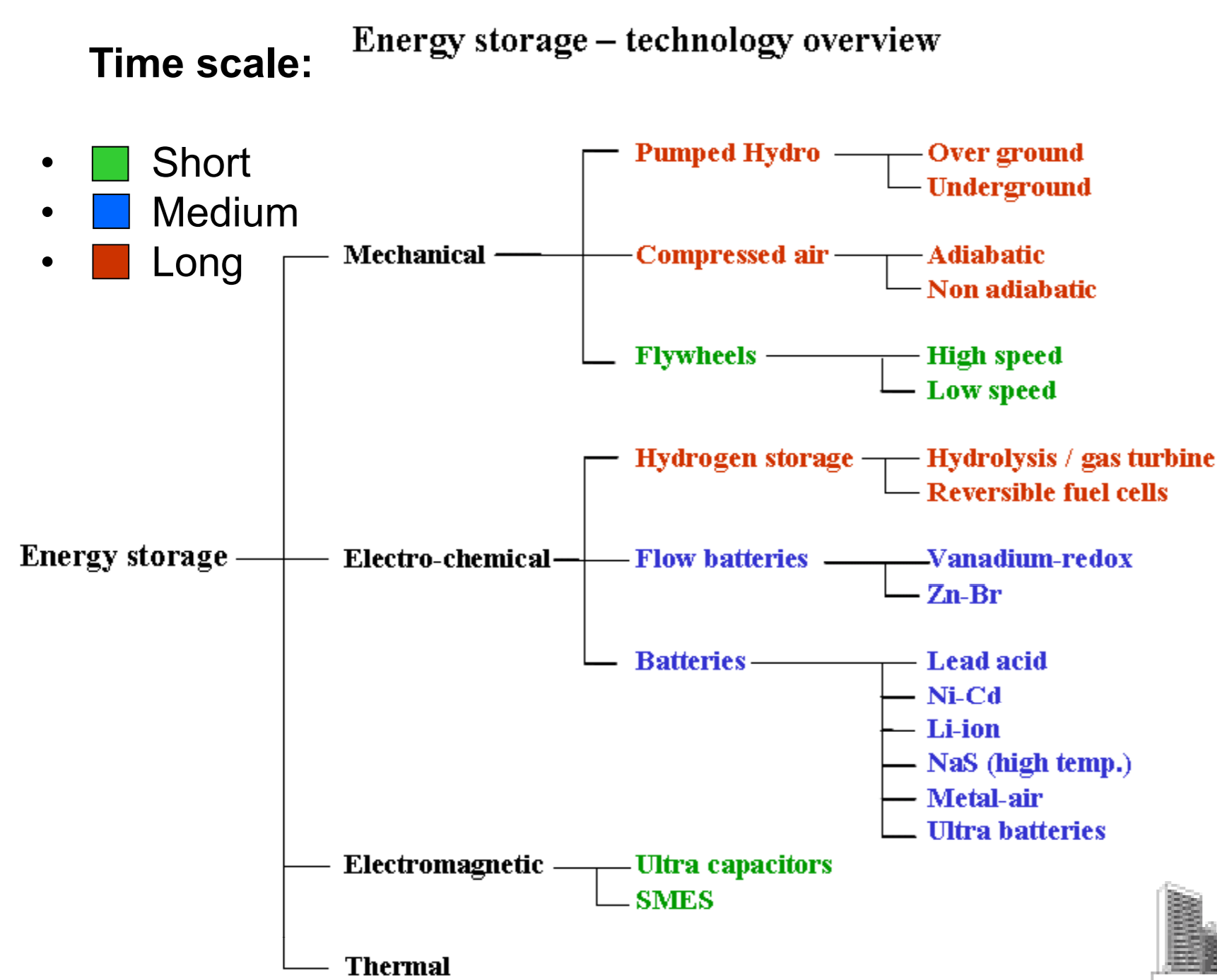
Services that can be offered to the grid:

- frequency control
- regulating reserves
- spinning reserve
- voltage control
- soft stop



Source: Improving wind power quality with energy storage, C. Rasmussen

Some significant technologies



4 MW (6 MW pulse) x 1.5 hour VRB-ESS Grid-Coupled, Sapporo, Japan



34MW NAS storage, Japan

PhD Preliminary Goals:

- State of the art and provisional study plan
- Modeling of relevant storage technologies and services
- Test case studies of services offered by Energy Storage
- Laboratory validation of energy management strategies

Future work:

