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Smart power applications and peak load management in distribution networks with energy storage solutions

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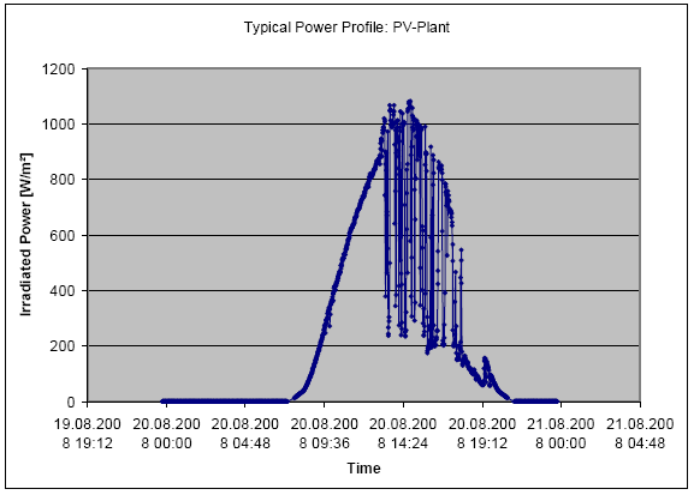
Existing problems and limits

Security of supply and maximum peak loads

→ Networks designed for maximum peak loads
→ **Expensive** distribution network **infrastructures**
→ **Capacity** utilzed during **short peak times only**.
→ peak load management close to the electrical consumers required.

Renewable Power Generation

→ Weather dependend random generation.
→ complicates requirement to **balance power generation** and **consumption**
→ **limited utilization** of renewable energy sources in distribution networks.



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Challenges for future distribution networks

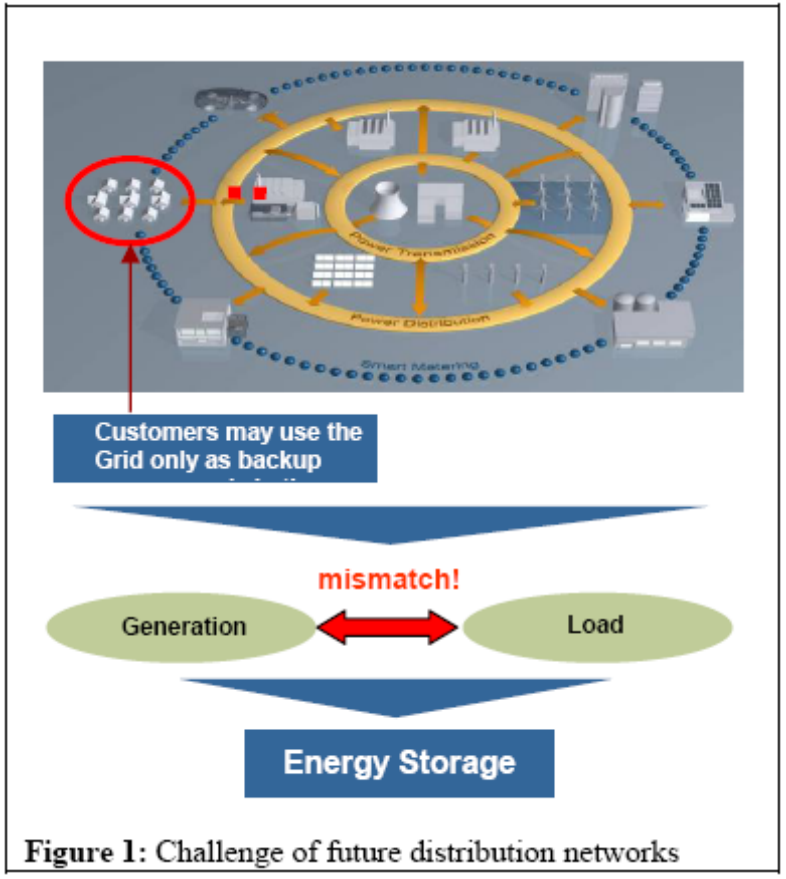


Figure 1: Challenge of future distribution networks

→ Power generation **decentralized**
→ **Load flow** between transmission-, distribution- and consumer level **bi-directional**.
→ Increasing number of **microgrids** with own electricity production (mainly **renewable sources**)
→ grid as back up supply only.

→ **mismatch** between **power generation and consumption** needs to get managed on the lower distribution level → **Energy Storage**

Distributed Power Energy Storage with Li-Ion Batteries

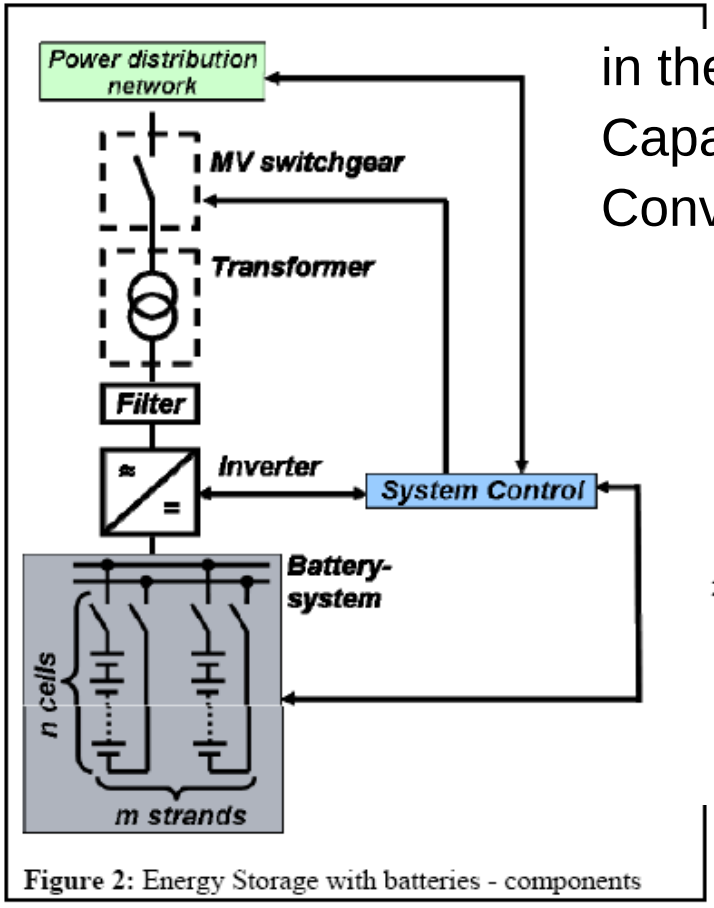
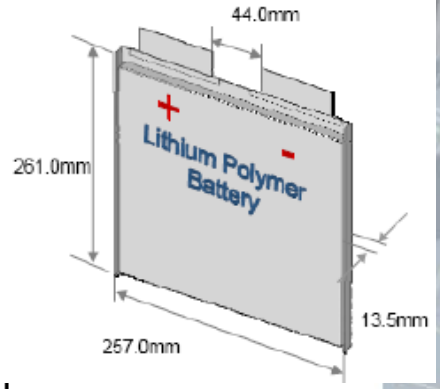
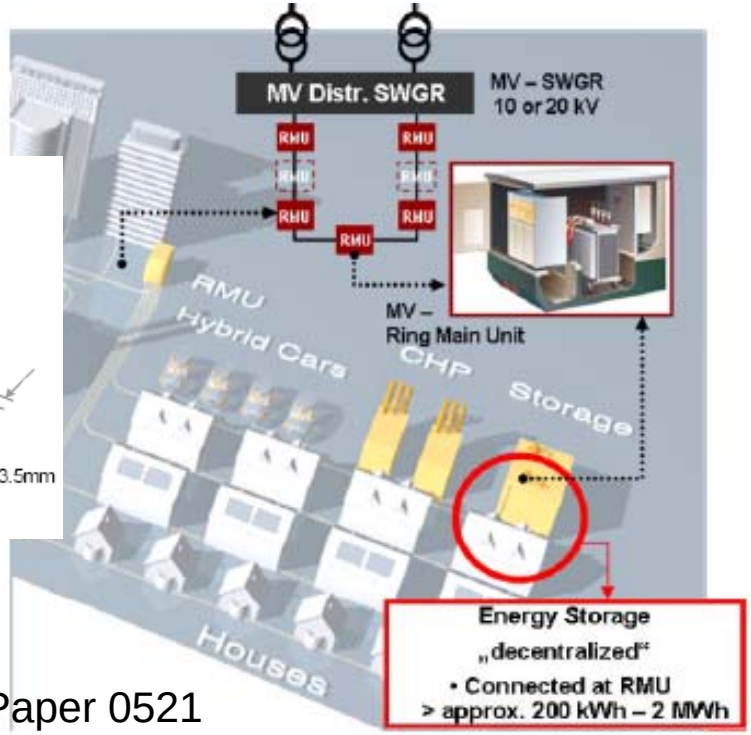


Figure 2: Energy Storage with batteries - components

in the range of 200 kWh to 2 MWh with power
Capabilities up to 8 MW by combining modern
Converter technology with new high power
Li-Ion battery
technology





Applications in distribution networks …

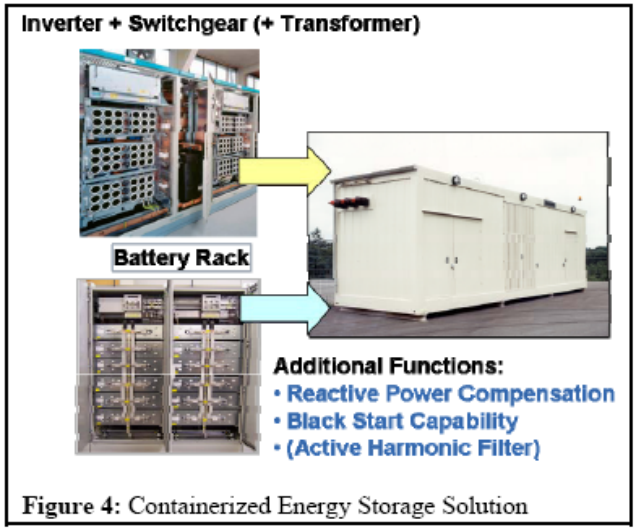


Figure 4: Containerized Energy Storage Solution

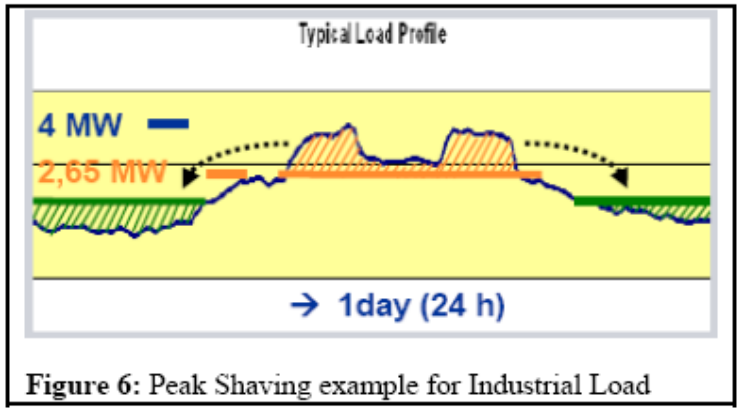


Figure 6: Peak Shaving example for Industrial Load

… acting as **primary reserve** for **frequency regulation**,

… performing **peak shaving**

… improving **power quality** by injecting active and reactive power.

… **renewable energy firming** by compensating stochastic power fluctuations of renewable power generation sources (wind + solar)

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Conclusion

Study shows that among all electrical energy storage options for **distribution networks** an **energy storage portfolio** based on **Li-Ion batteries** and **2-level or multi-level converter technology** is **environmental friendly** and has a **broad scope of applications** and **advantages.**

However there is no universal solution in energy storage.
→ Specific use case determines the most suitable solution.