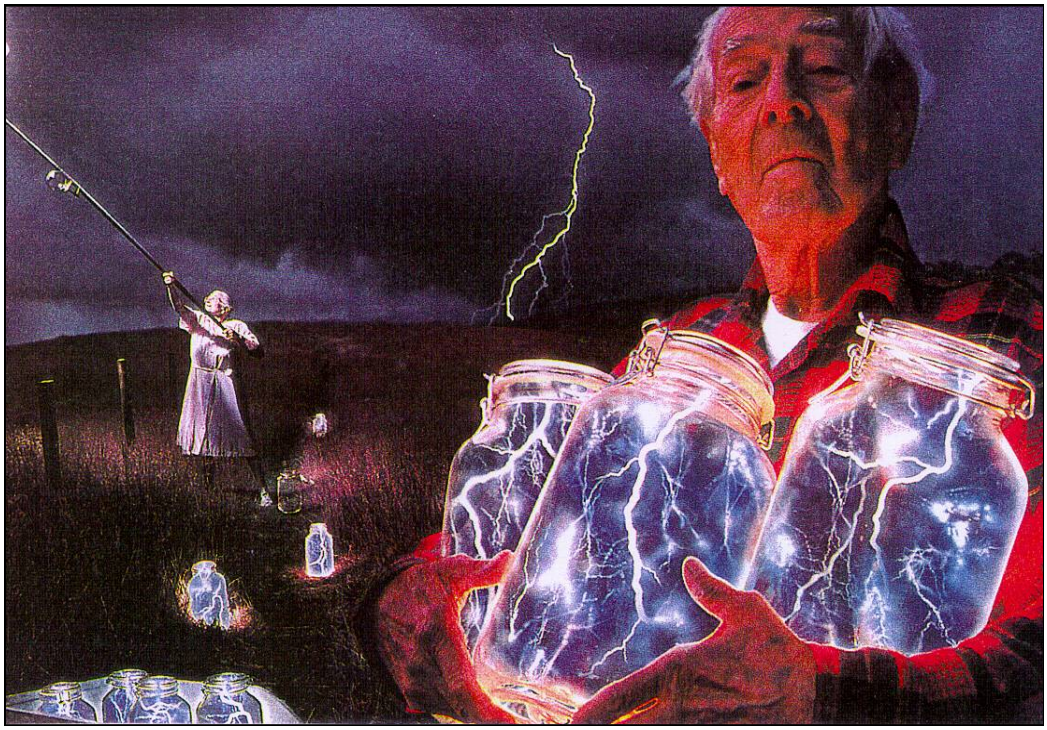
Alternative Approaches for Electricity Storage

Availability, maturity & potential of other storage media

Theo Bosma, 27 January 2011
RGI Storage Workshop Montreux, Switzerland

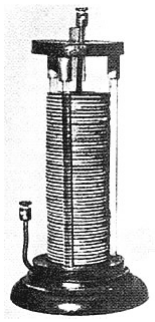
Experience you can trust.



Electric power storage

Bagdad Battery, 227 to 126 v. Chr.

Leidsche fles, 1746



Rittersche Säule, 1802

Varta Battery, 1907

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energy transition will cause major changes in power system …

- Many small scale (renewable) power generators will be added to fewer large scale power plants; note large plants move to the coast and away from load centers → more cross border transmission (European thinking needed)
- With CHP the "must runs" decrease the flexibility→ operating reserve
- Increased local matching of demand and supply → smart distribution grids

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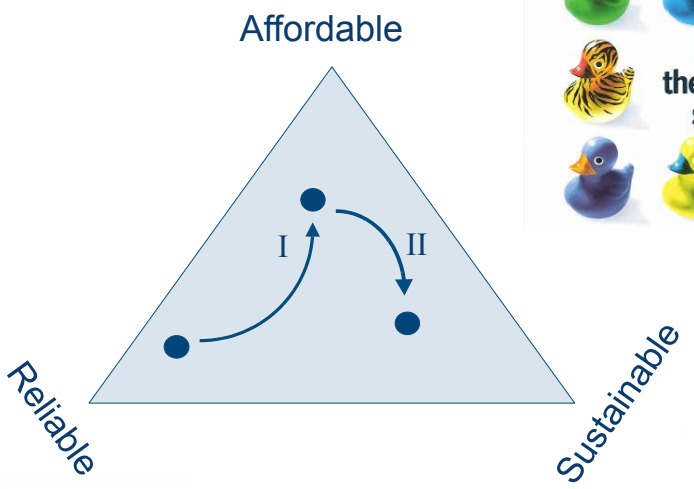
How to keep the balance …



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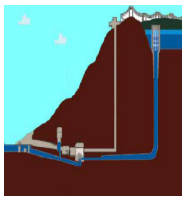
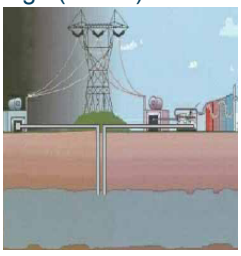
Storage technolgies (1)

1. Pumped hydro storage



2. Compressed Air Energy Storage (CAES)



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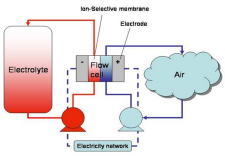
Storage technolgies (2)

3. Batteries
   - Soldium Sulphur (NaS)
   - Lead Acid Batteries
   - Redox Flow Batteries
   - Nickel Batteries
   - Li-ion Batteries
   - Metal-air batteries



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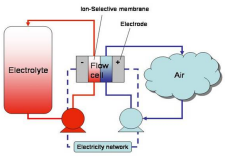

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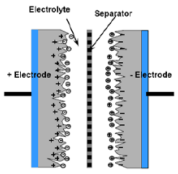
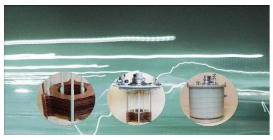
Storage technolgies (3)

4. Mechanical (Flywheels)

5. Ultra or Super Capacitors



6. Super Magnetic Energy Storage Devices (SMES)



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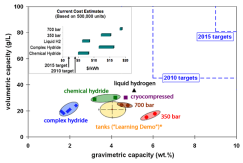
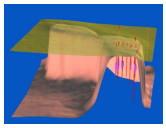
Storage technolgies (4)

7. Hydrogen

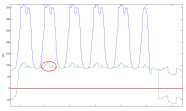


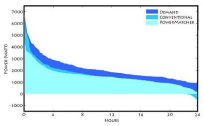
8. Thermal Energy Storage

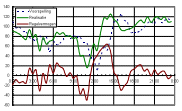
9. Gas storage facilities



10. Virtual Power Plant / Demand Side Mangagement (VPP / DSM)







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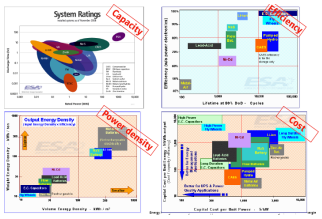
Applications

- Energy storage: no single solution
  - Capacity - Efficiency
  - Power Density - Cost



- Central Storage – generation management
- Decentral Storage – demand side management
- Grid congestion management
- Time & power rating: Power quality – uniterrupted power supply – Frequency controll – Voltage support – Peak Shaving – Energy Trading – (Spinning)Reserve – Black Start - Integration of renewables

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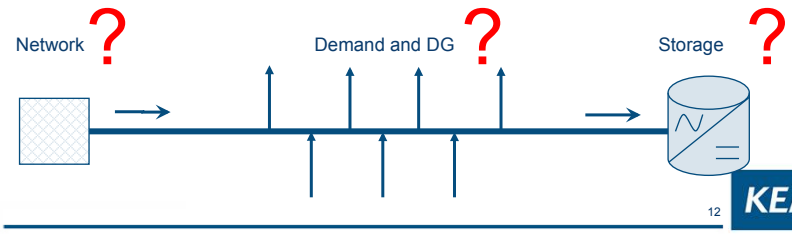
Questions

Questions that need to be answered:

- What type and size of storage is required?
- Where on the network should storage be installed?
- When should the storage system be charged / discharged?
- What are the costs and benefits?



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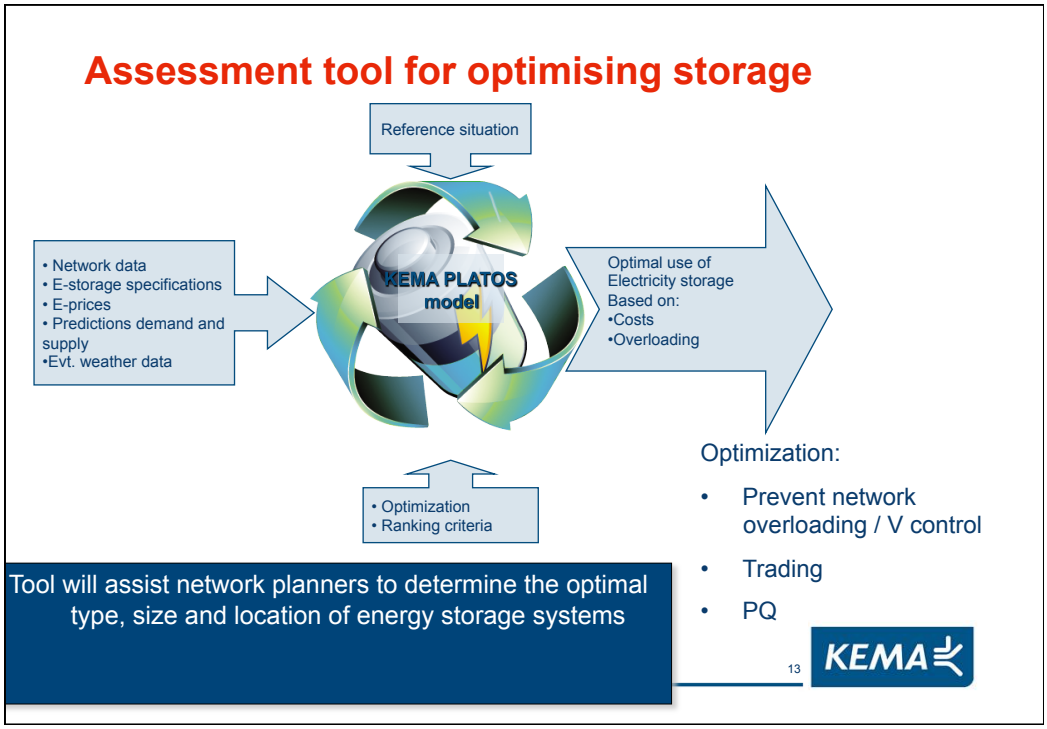
Assessment tool for optimising storage
Reference situation
• Network data
• E-storage specifications
• E-prices
• Predictions demand and supply
•Evt. weather data
KEMA PLATOS model
Optimal use of Electricity storage Based on:
•Costs
•Overloading
• Optimization
• Ranking criteria
Optimization:
• Prevent network overloading / V control
• Trading
• PQ
Tool will assist network planners to determine the optimal type, size and location of energy storage systems
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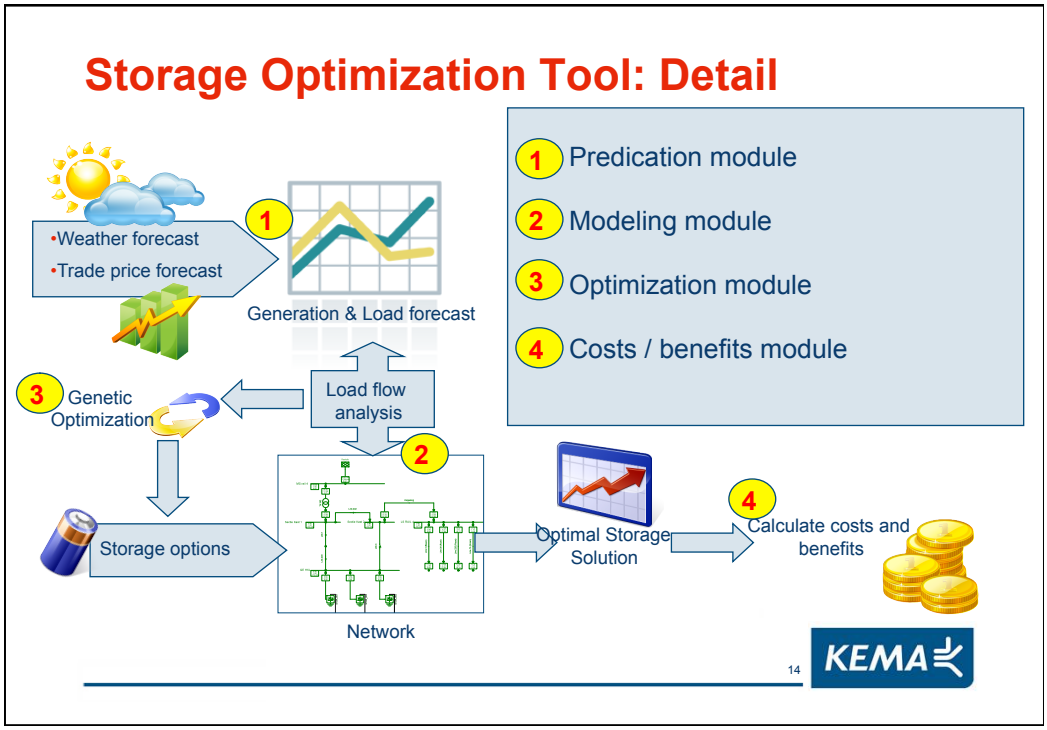
Storage Optimization Tool: Detail
1 Predication module
2 Modeling module
3 Optimization module
4 Costs / benefits module
•Weather forecast
•Trade price forecast
1
Generation & Load forecast
3 Genetic Optimization
Load flow analysis
2
Storage options
Network
Optimal Storage Solution
4
Calculate costs and benefits
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Some Remarks

- Storage has the ability to be able to provide more than one service and can therefore benefit from more than one revenue stream
- The main competitor for energy storage is not a gas turgine or another storage system but the realisation of demand side management (DSM) possibilities
- Markets & Regulations don't lead but follow, timing important – Markets are not the same (eg. US, Europe, Japan)
- The early bird catches the worm!

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Thank you for your attention

Looking forward to work together

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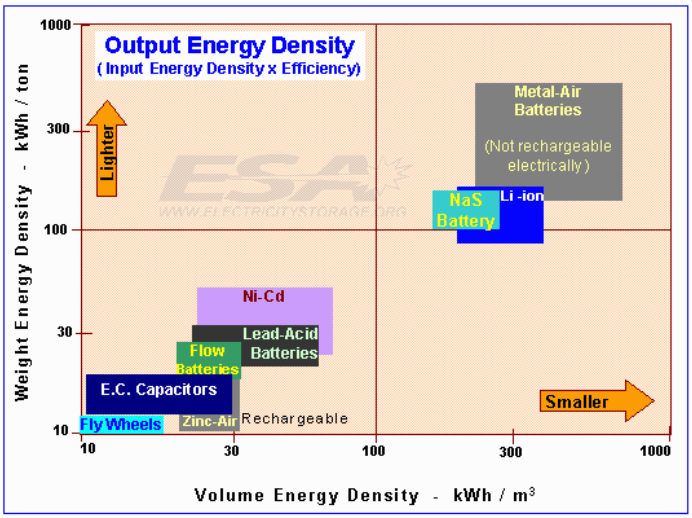
Experience you can trust.

Extra data



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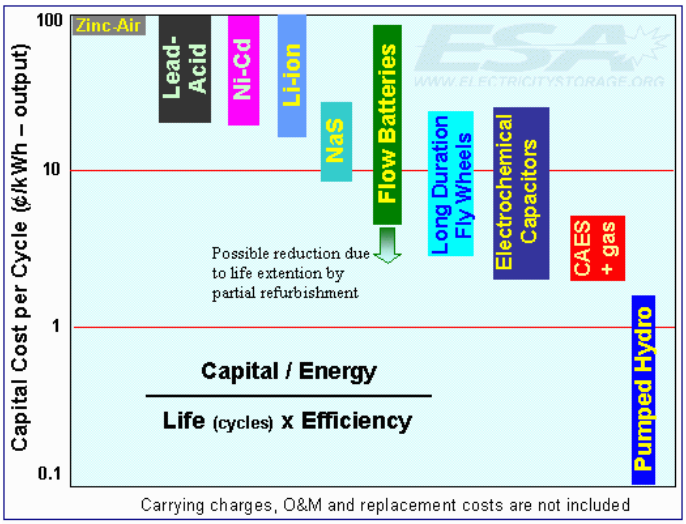

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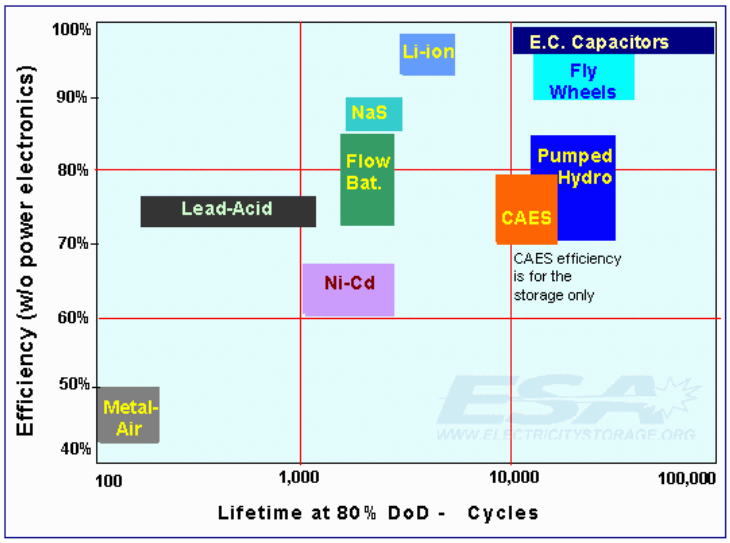

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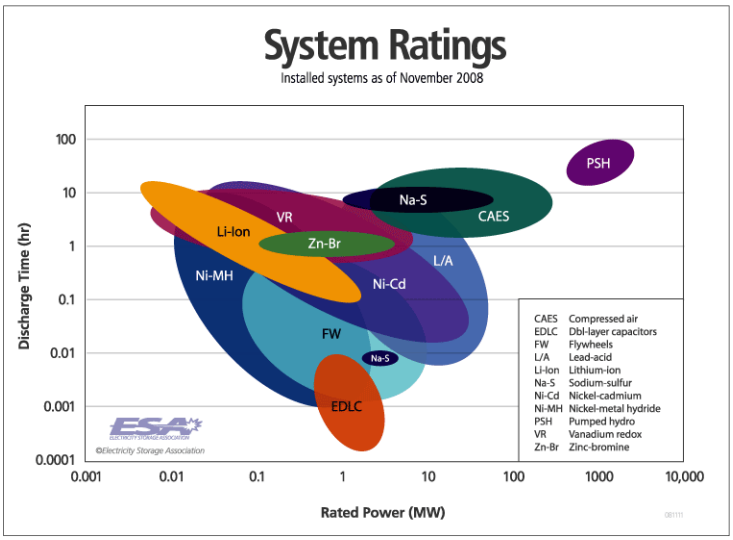

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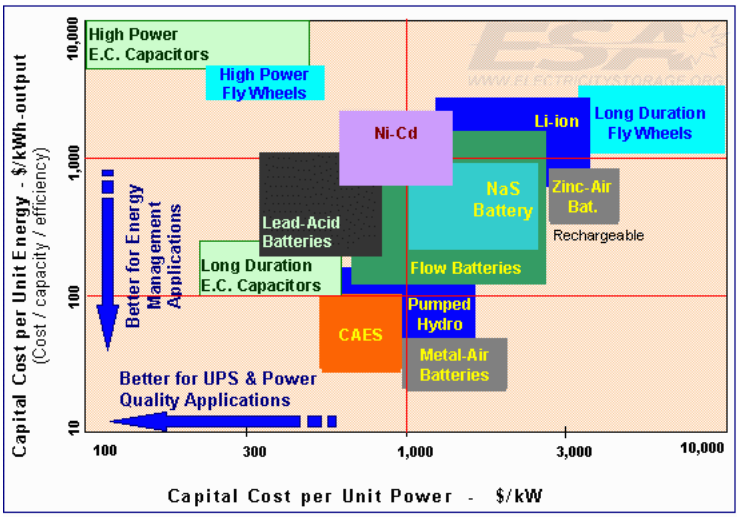

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