## Chemistry as key enabler to meet market needs



#### Market needs

- Defined capacity
- Milliseconds dynamic
- High stability
- Guaranteed safety
- Low losses
- Competitive costs

## Eletrical Storage Solutions

- Different energy output (kWh) and power capabilities (kW)
- Quick respond time
- But limited in duration, energy density, ramp
   rate and costs

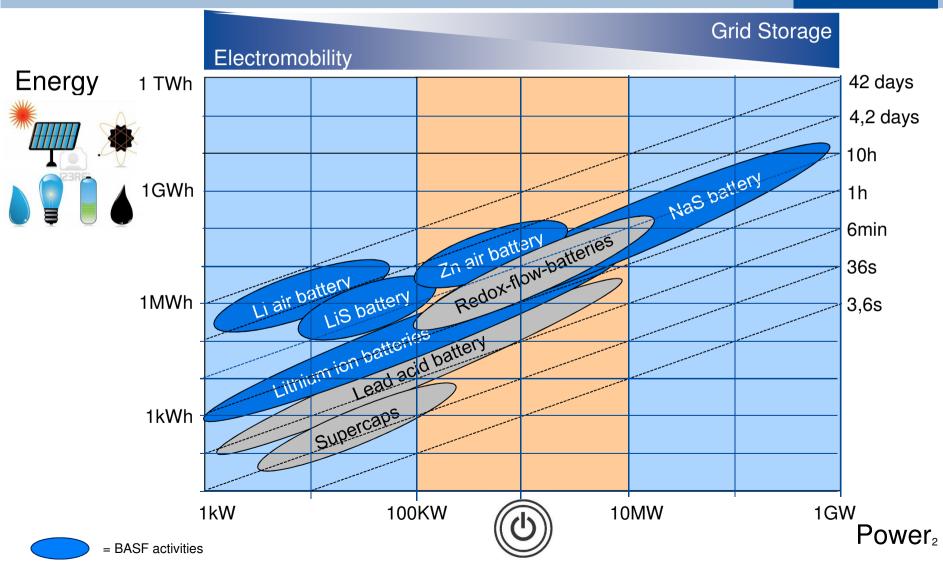
Dr. Thomas Weber Senior Vice President Innovation Management and Science Relation

#### **Material contribution**

- Key battery components like cathodes, anodes, electrolytes, separations
- Determination of key performance parameters
- Significant potential to reduce cost and increase safety
- New chemistries allow breakthrough innovation

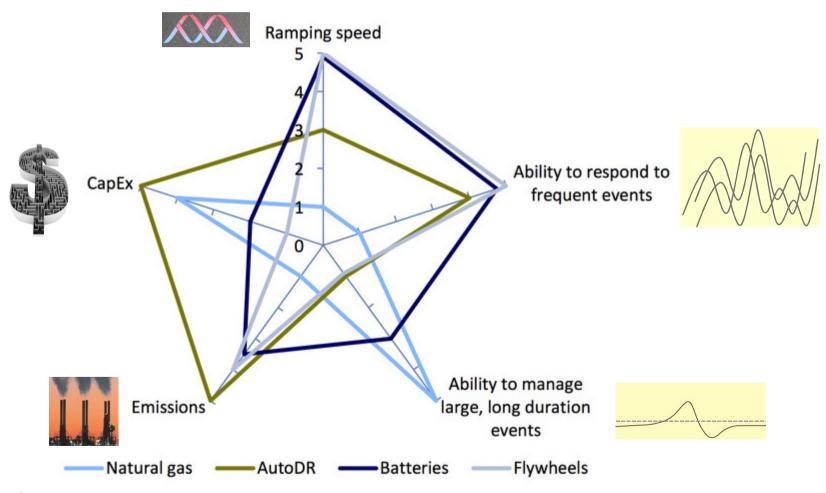
# Electrical storage drives solutions in electro mobility and grid storage





# In grid storage, electrical storage manage intermittency effectively...



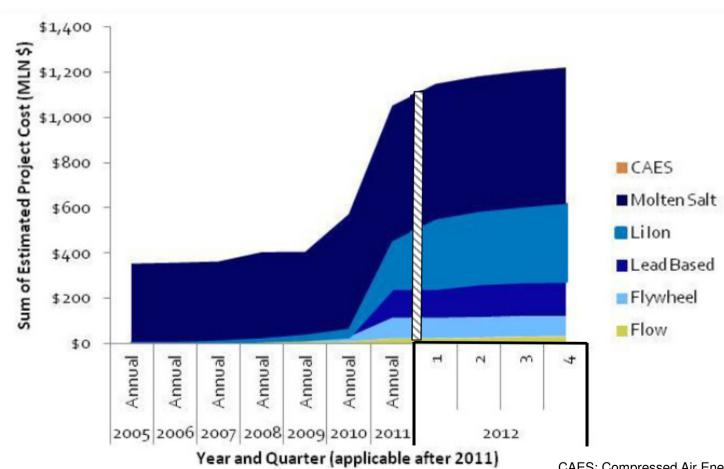


Source: Lux Research

AutoDR: Auto Demand Response

# ... and represent > 80% of global grid storage project cost



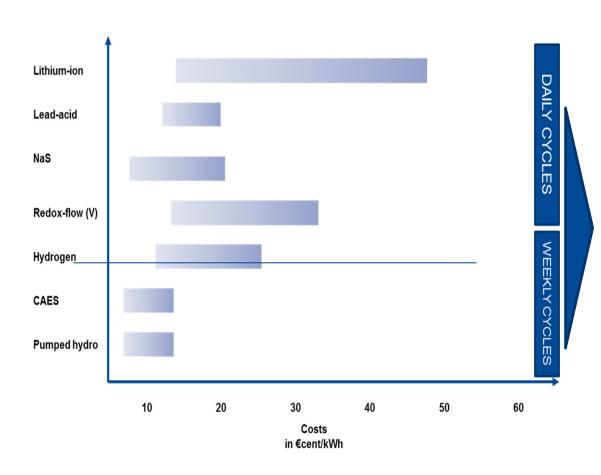


Source: Lux Research

CAES: Compressed Air Energy Storage Molten Salt: NaS, NaNiCl (Zebra)

## Achieving cost benchmark crucial for market success





## Approaches for innovation towards cost reduction

- Mass production / automated manufacturing, e. g. Li-Ion
- Reduced material cost / higher energy density, e. g. High Energy Li-lon
- Scaling system size, e. g. Redox-Flow
- Breakthrough innovation and technical development,
  - e. g. NaS large scale, Zn-Air
- ...

Assumptions: 1 GW, 8 GWh, electricity costs: 4 €cent/kWh, interest rate capital costs: 8% Source: RTWH Aachen, BCG, VDE, Lux Research, internal



## **BASF** committed to battery material solutions for electromobility ...

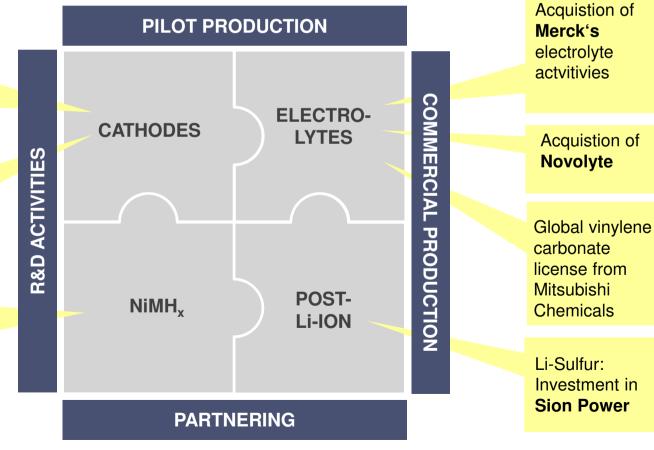


#### Goals: Better performance, improved safety and lower costs

Production plant in Elyria, USA suitable for NCM materials and next generation HE-NCM

Lithium iron phosphate license from LiFePO4+C licensing AG

Acquisition of **Ovonik Battery** Company



## ... and leverage expertise in electrochemistry and large scale operations



#### Goals: Energy storage to ensure stable energy supply

- Advances in electrical storage technologies required to ensure stable energy supply
- Electrochemical storage in large scale batteries based on cost-competitive raw materials like Na and S seen as potential future solutions for large scale electricity storage
- Electrochemical power storage stations are chemical depots
- Electricity storage is industrial electrochemistry





# Already today BASF takes care of tomorrow's battery solutions



- Jointly addressing fundamental questions related to new materials,
  functional components and systems
  for electro mobility and energy storage
- International competence network with outstanding experts from academic research
- Joint lab BELLA together with Karlsruhe Institute of Technology



Foto: KI

Total investment of three-digit million EUR in R&D and production of battery materials from 2011 - 2016

# All in all, joining forces along value chain crucial for success of electrical storage and a prerequisite to speed up



#### **Networking**

- Projects
- Interfaces
- Working groups, Congresses

#### **Application**

- Building of a platform for storage networks
- Infrastructure and operating data available for members

#### **Pooling of Interests**

- Public relations
- Proposals of funding
- Regulatory framework

### Energiespeicher Systeme e. V.

**StoREgio** 

#### **Demonstration**

- Demonstration center for storage in urban areas
- Information, events
- Qualification, acceptance

# Summary: A common success?!



# Contribution of Chemical Industry (BASF)

- Commitment to battery solutions for electromobility
- Expertise in electrochemisty and large scale operations
- Strong R&D activities
- Production capabilities

BASF – The Chemical Company

and

StoREgio Energiespeichersysteme e. V.

## How to achieve a common success

- Networking
- Application
- Pooling of Interests
- Demonstration
- Partnering
- Cost benchmarking



The Chemical Company