Electrochemical Energy Storage – A System’s Perspective

“The Role of Electrochemical Energy Storage in the Energy Transition”

Kickoff POF IV

Karl-Kiên Cao, Hans Christian Gils, Manuel Wetzel
German Aerospace Center
Institute of Networked Energy Systems

2. July 2021
Which systems?
Energy Systems Analysis at DLR

Energy Meteorology

Energy Systems Modelling

Energy Scenarios and Technology Assessment

Energy Economics
Energy Systems Analysis at DLR: An example

- Coal phase-out in Germany?
- Security of supply?
- Markets?

- Achieving Paris?
- Scenarios
- Energy Scenarios and Technology Assessment
- Infrastructure
- Energy Systems Modelling
- Data
- Energy Meteorology
- Incentives
- Energy Economics

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Scopes in Energy Systems Analysis

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Modeling scenarios of future energy systems

Spatial scale
- Local: Continents, Countries, Districts, Households
- Global: World economy

Temporal scale
- Seconds: Fluctuation of renewables, Secure system operation
- Decades: Investment planning, Seasonal weather
- Broad: Energy-water-land, Sector coupling, Power generation mix, Process simulation

Technological scale
- Microeconomic: Energy system optimization models
- Macroeconomic: World economy, Markets, Companies, Individuals

Economic perspective
- Accurate: Fluctuation of renewables, Secure system operation
- Broad: Investment planning, Seasonal weather
- Decades: Energy-water-land, Sector coupling, Power generation mix, Process simulation

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Key findings

Electrochemical storage…
1. … is for short-term load-balancing
2. … is particularly important in PV dominated systems
3. … is one option among many for load-balancing
4. … poses challenges due to life-cycle based GHG emissions of PV-battery systems
Short-term load-balancing

Hourly power generation by technology in Iberia

![Diagram showing hourly power generation by technology in Iberia]
Short-term load-balancing

Battery storage operation in Iberia

Charging
Iberia, PV share: 34%, wind share: 46%

Discharging

Installed storage @80% RE power supply

Short-term (battery) storage: important in PV-dominated systems

Installed capacity of Li-batteries

Installed capacity of photovoltaics

Installed battery storage in >30 energy scenarios of Europe

A matter of costs

Load-balancing by mobile and stationary battery applications

Temporally resolved availability of e-vehicles

Results from German energy scenarios


GHG reduction from a life-cycle perspective

From minimal GHG to minimal cost (a) and the differences between these minima (b)

Key findings

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2. … is particularly important in PV dominated systems
3. … is one option among many for load-balancing
4. … poses challenges due to life-cycle based GHG emissions of PV-battery systems
Thank you!

Dr. Karl-Kiên Cao
Deutsches Zentrum für Luft- und Raumfahrt
Institut für Vernetzte Energiesysteme
Energiesystemanalyse
Karl-Kien.Cao@dlr.de