

LIVA Project Update

- AMG

ACCELERATING THE ENERGY TRANSITION

LIVA Hybrid Energy Storage Systems

November 28th, 2023

Vanitec ESC Webinar



Part of



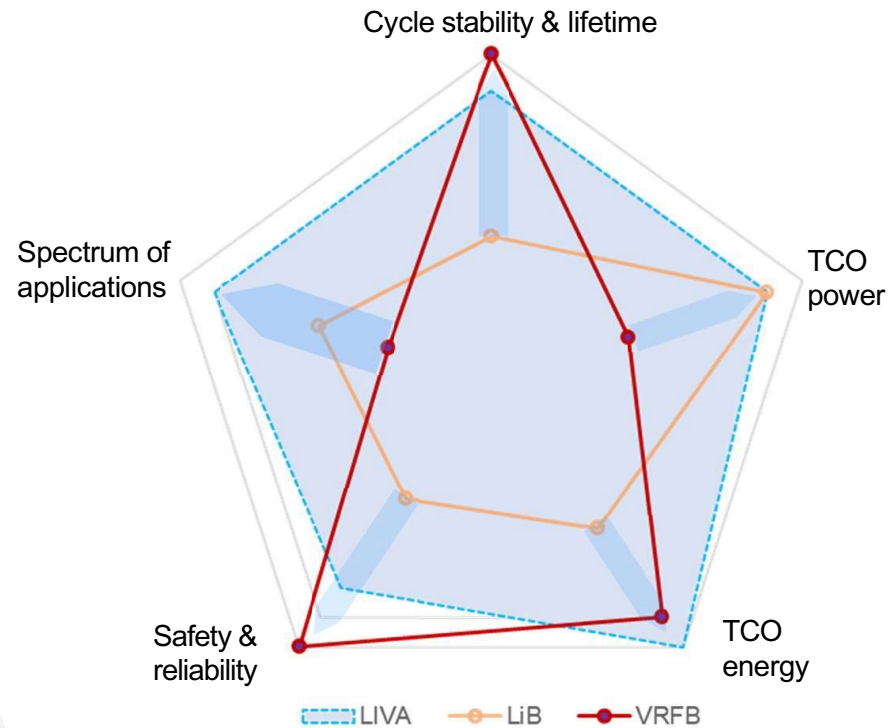
AMG ADVANCED
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TECHNICAL ADVANTAGE & BENEFITS OF A HYBRID ESS

LIVA's battery technology approach: use respective KPI advantages (key performance indicators)

Performance profile virtual Hybrid ESS



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Advantage & Benefits

- ▶ Broad Range of industrial and grid scale applications
- ▶ Optimal use of the KPI's
- ▶ Increased overall system efficiency to power supply and energy storage
- ▶ Improved safety & increased reliability (availability >99,9%)
- ▶ Long lifetime of the batteries: 15-20 years, +20,000 cycles
- ▶ Lowest Total Cost of Ownership/ Levelized Cost of Storage (LCOS)
- ▶ Custom tailored system with flexible up-grade capabilities for power and energy
- ▶ Low CO₂ footprint at life-cycle

LOCATION HAUZENBERG: LIVA 3.45 MWH HYBRID ESS

Hybrid Energy Storage System

- Location: Hauzenberg, Bavaria/Germany
- 2.0-level design, active thermal management
- Energy: up to 3.45 MWh
- Power: up to 1.1MW

Applications

- Power Management / Peak Shaving
- Reduction grid cost by up to 80%
- Emergency Power Supply

Up-grade (2024)

- Energy Shifting with Solar plant
- Increase in energy content VRFB
- Grid Service (FCR)

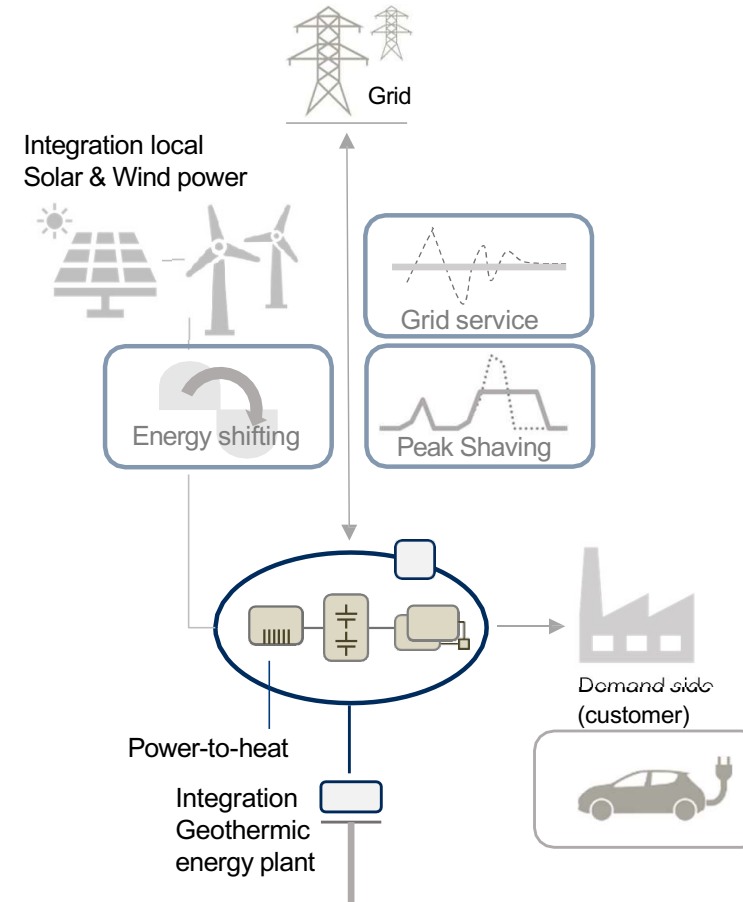
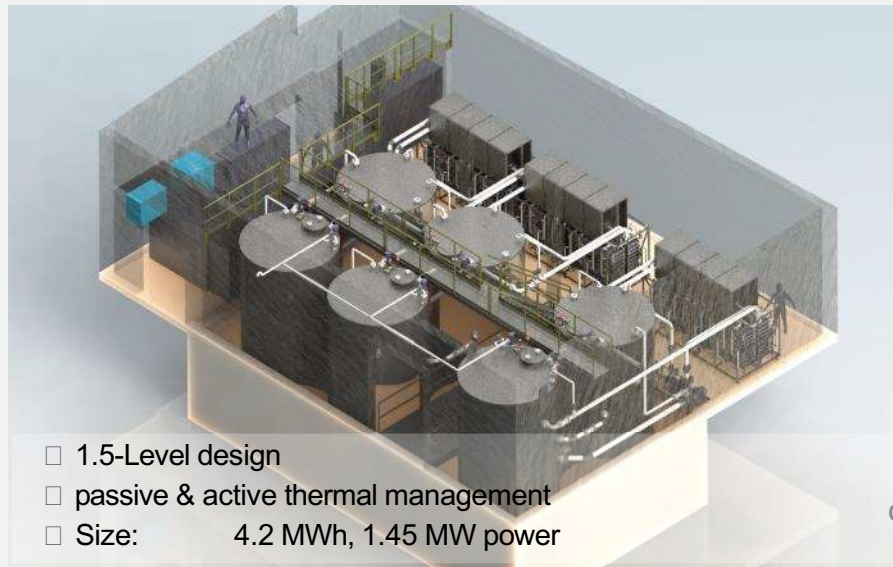
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CASE STUDY: MULTIPLE USE APPROACH MID-SIZED HYBRID ESS FOR COMMERCIAL CUSTOMER (GERMANY)

Multiple use approach – grid side & demand side energy & power management. Integration solar & wind plant and geothermal energy system

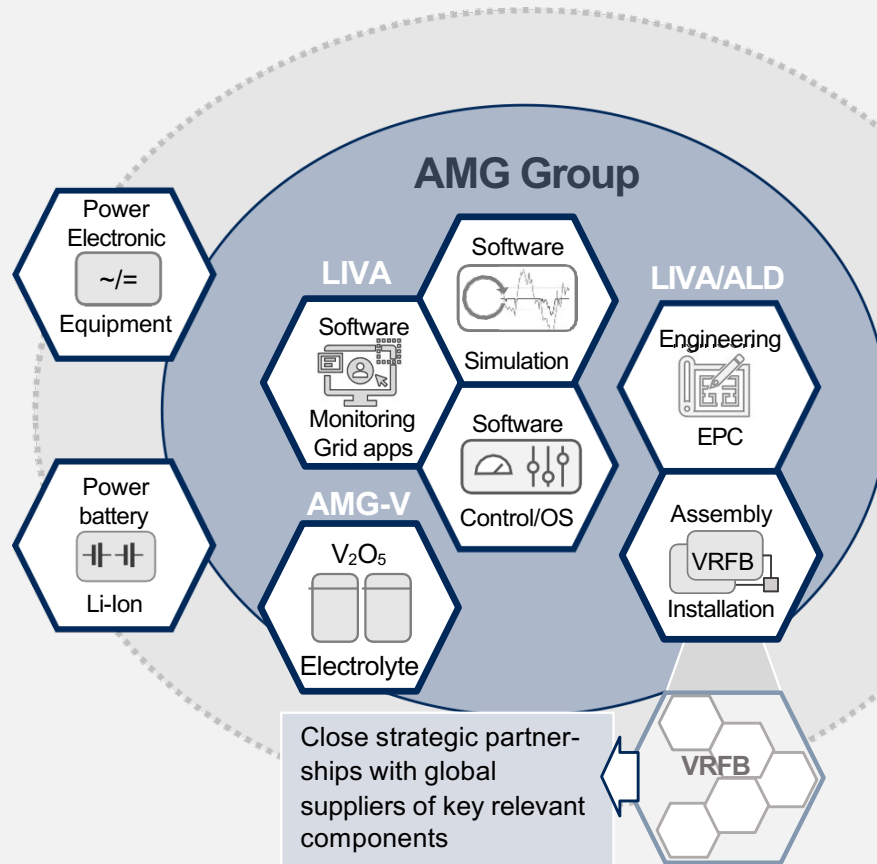
Application & benefit

- RE shifting & peak shaving strategies (power & energy)
- Reduction energy & grid cost
- Optimizing energy self-sufficiency (70%)
- Income with Grid Service (frequency containment reserve)
- Realization Sector Coupling Strategy with
- P2H/C to produce process heat and cooling



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LIVA VALUE CHAIN



LIVA approach: turnkey facility

- ▶ Simulation and analyzing energy storage facility with further energy assets
- ▶ Concept study and predesign of all energy storage assets: capacity, performance and characteristics
- ▶ Basic engineering & detailed engineering
- ▶ Full-service EPC of the Hybrid Energy Storage System (Hybrid ESS)
- ▶ Integration of further energy supplying and energy demanding assets
- ▶ Coordination of on-site engineering and construction with local partners
- ▶ Automated operating, energy balancing & optimizing with self learning algorithms
- ▶ Operating routines for grid service
- ▶ Remote monitoring with AI based analytics & monthly reporting
- ▶ Maintenance & replacement service

Power Management as a Service



Frankfurt/Germany



Hanau/Germany



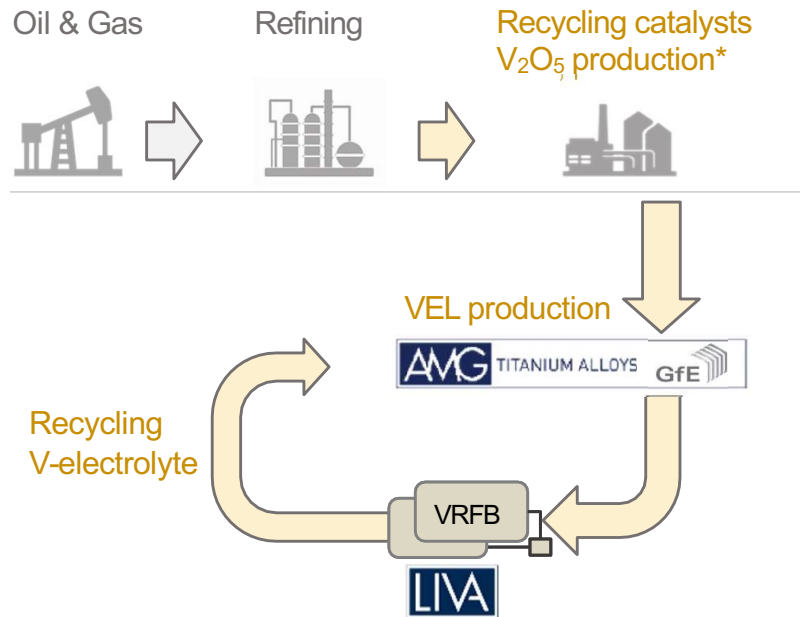
Nürnberg/Germany



Cambridge-Ohio/USA

AMG GREEN MINING STRATEGY

AMG **green mining** strategy of Vanadium and Vanadium Pentoxide (V_2O_5) as active material for LIVA's Redox Flow batteries



AMG Vanadium, Shell & AMG Recycling: recycling of spend catalyst and gasification ash as waste material from the oil & gas industry: Production of Vanadium & high-grade Vanadium salt V_2O_5 as active material for Redox-Flow batteries. Compared to classical mining process 85% less CO_2 emissions.

AMG GfE: (Nürnberg): production of Vanadium-electrolytes for VRFB's as part of LIVA's Hybrid ESS.

LIVA: Global vanadium value asset of endless usable, 100% recyclable & convertible V-Electrolyte for worldwide large energy storage systems at lowest carbon footprint.

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