sccer mobility
Swiss Competence Center for Energy Research
Efficient Technologies and Systems for Mobility

In cooperation with the CTI
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Swiss Competence Centers for Energy Research
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E-Dumper: The world's largest electric vehicle

Currently a diesel-powered dumper is used to transport lime- and marlstone from a higher-lying mining area down to the cement factory at Ciments Vigier SA in Péry. The dumper is being fully electrified by Lithium Storage GmbH and Kuhn Group S.A. by replacing the diesel engine with an electric motor and a 700 kWh battery system. The so called E-Dumper acts as a semi-autarkic vehicle by storing braking energy in the batteries while hauling limestone downhill. The recuperated energy is subsequently used to displace the vehicle from the valley to the hill. The E-Dumper will be the world's largest battery electric vehicle (BEV).

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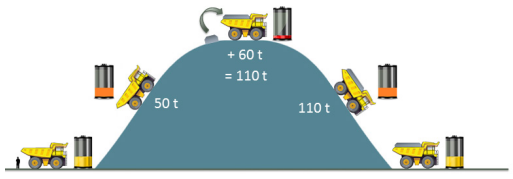
E-Dumper:
- Weight: 46 t empty, 4.5 t battery, 60 t max. load capacity
- Savings per vehicle and year: 50'000 L Diesel or the consequent 135 t CO_2 and additional air pollution through particles and NO_X emissions
- 16 times a day, 350 trips a year, 10 years

Principle:
- Thanks to the difference in potential energy, the energy recuperated through regenerative braking going downhill (with 60 t of limestone) is utilized to displace the dumper from the valley to the hill.



Challenges

Goals:
- Efficient recuperation process
- Long-lasting battery system (Cooling system and intelligent Battery Management System)
- Mechanically crash-safe battery system

Tasks:
- Electrical and thermal characterization of the battery
- Safety and risk analysis of cells and battery management system
- Mechanical integration assessment
- Vehicle homologation

Expected impact

Relevance nowadays:
- Technological impact: Switzerland as Leader for innovation
- Economical impact: Despite the twice higher acquisition costs the operational costs are only half, foreign inquiries for larger E-Dumper already exist
- Ecological impact: Reduction of CO_2 eq emissions
- Scientific contribution: Gaining new insights in energy storage in battery electric vehicles in the MWh range and thus promoting the development of the electrification of mobility

Future possibilities:
- The battery of the vehicle can be used for energy storage in decentralized power plants
- Advanced vehicle monitoring will allow an enhanced battery design and sizing for future E-vehicles

Empa

As an interdisciplinary research institute of the ETH Domain, Empa, the Swiss Federal Laboratories for Materials Science and Technology, conducts cutting-edge materials and technology research. Empa's R&D activities focus on meeting the requirements of industry and the needs of society, and thus link applications-oriented research to the practical implementation of new ideas. As a result, Empa is capable of providing its partners with customized solutions that not only enhance their innovative edge and competitiveness, but also help to improve the quality of life for the public at large. Through an efficient technology transfer Empa is turning research results into marketable innovations: Empa – The Place where Innovation Starts.

NTB

NTB is an interstate university of applied sciences of technology of the FHO Domain. The interdisciplinary cooperation between NTB's institutes creates broad and multifaceted areas of competence. The technology and knowledge transfer is firmly anchored in NTB's philosophy. Since its foundation, the university of applied sciences has developed a corresponding reputation and extensive experience. In the field of battery research NTB focuses on thermal management and crashworthiness of battery designs. NTB's unique test facilities allow to characterise the thermal behaviour of battery cells experimentally and offers the opportunity for verification of cooling/heating strategies on cell as well as on module level. In addition, NTB is building up the know-ledge for simulation of complete battery systems for thermal analyses and optimisation.

BFH

The BFH-CSEM Energy Storage Research Centre from Bern University of Applied Sciences (BFH) carries out research and development together with the "Centre Suisse d'Electronique et de Microtechnique SA" (CSEM, Neuenburg), and other strategic partners, for electrochemical storage solutions for electricity supply and decarbonization in the transport sector. Both energy sectors can be linked thanks to new storage options.
The BFH-CSEM Energy Storage Research Centre is working on questions and practical solutions related to different applications of electrochemical energy storage systems. Our Centre provides one of the largest testing facilities for the electrical and thermal characterization of electrochemical energy storage devices (Li-ion batteries) at cell, module and system level as well as for the characterization and validation of battery management systems.

References

[1] Scheme: BFH-CSEM Energy Storage Research Centre, Alejandro Santis
[2] Photo: KOMATSU HD605-7, Andreas Sutter

Partners

Schweizerische Eidgenossenschaft
Confédération suisse
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Swiss Federal Office of Energy SFOE

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