sccer mobility
www.sccer-mobility.ch
SBB CFF FFS
In cooperation with the CTI
Energy
Swiss Competence Centers for Energy Research
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Commission for Technology and Innovation CTI

Increasing the energy efficiency of the rolling stock of SBB: goals, challenges and opportunities

Bern University of Applied Sciences
ESReC Energy Storage Research Center

Msc. Ueli Kramer, Prof. Dr. Andrea Vezzini
BFH-CSEM Energy Storage Research Center ESReC, Institute for Energy and Mobility Research
Bern University of Applied Sciences, Quellgasse 21, CH-2501 Biel, Switzerland
ueli.kramer@sbb.ch; andrea.vezzini@bfh.ch

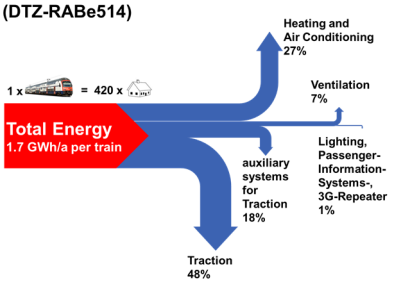
Objective

The Swiss Federal Railways SBB have the ambitious target to save 600 GWh/a by 2025. The objective of the project was to analyse the energy consumption of the rolling stock of SBB. The output of this work is a catalogue of potential projects and a systematic analysis procedure to develop and evaluate new energy saving project ideas.

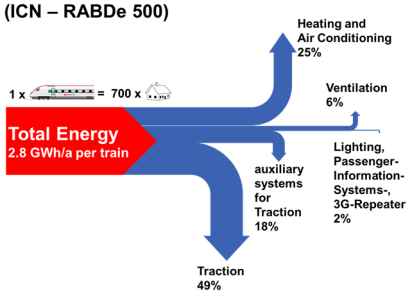
First: Energy Flow Identification

Energy-flow diagrams help identify energy saving potentials in any given system by giving a quantitative overview of the different energy consumers in the system.

Energyflow of a multi-unit-train-coach (DTZ-RABe514)



Energyflow of a multi-unit-train-coach (ICN – RABDe 500)

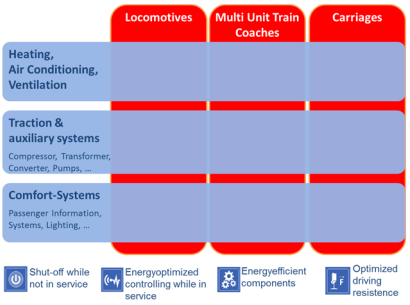


Branches reflecting high energy consumption do not necessarily indicate high energy reduction potential, as there are many other factors that need to be considered.

Second: Classification of Consumers

Understanding the energy flow is crucial for prioritization of different optimization approaches.
The result is a detailed analysis summarized in a structured matrix sorted by the type of rolling stock (locomotives, coaches, multi-unit train coaches) and systems like HVAC (heating, ventilation and air conditioning), traction and auxiliary systems as well as comfort systems.
A detailed classification was developed by dividing it into four main subject groups:

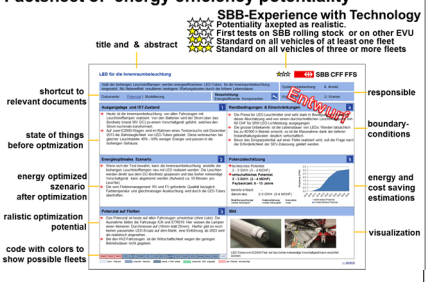
- Consequent shut-off of devices while rolling stock is not in service
- Energy optimized controlling while rolling stock is in service
- Energy efficient components
- Optimized driving resistance



Third: Gathering and Summarizing Information

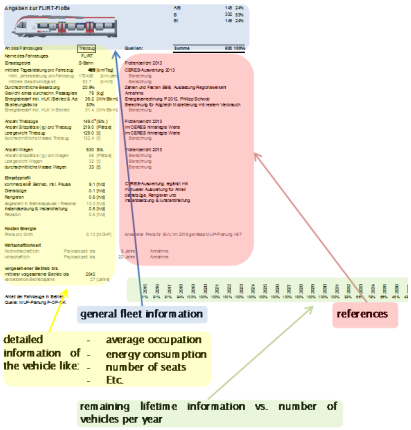
Each project idea contains information such as economic calculations, energy saving potential calculations and a general overview (factsheet) where all details of the project are summarized.

Factsheet of energy efficiency potentiality



Fourth: Modeling and Projection on Fleet

A bottom-up approach from the system view to the different type of rolling stock lead to a model for each coach and locomotive in which all the projects have been consolidated. The methodology of the energy saving potential has been done in a model for each vehicle separately.



Projects and Outlook

Numerous project ideas showing a positive economic impact have already been started, such as:

- New battery pack development (BFH)
- Traction optimization of the Re460
- General optimization of the FLIRT
- Optimized lightning system
- Traction optimization for the ICN
- Remote controlling of HVAC

System optimization through energy usage optimization is a highly important task which should be part the main activities of each company. Integrating this into the SBB will be a further long-term task. The gathered experience from this work should be taken into account for the procurement of new rolling stock.