



Section Sciences et Ingénierie de l'environnement **Design Project 2024 (semestre de printemps)**

Proposition n°28

Sustainability and electric mobility in logistics - Battery Swap Technology for Electrification of heavy duty transport

Partenaire externe ou laboratoire IIE

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Swiss Post

Taille de l'entreprise (nbre de collaborateurs) : 47'000

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Descriptif du projet

Swiss Post is electrifying its whole fleet at a rapid pace. The fleet includes 10'500 lighter vehicles for parcel and letter delivery, 2'400 passenger busses from PostAuto and 1'700 lorries. Busses and lorries normally drive many hours and many kilometres per day, having enough time to charge the batteries and having access to a high power charging station is a processual challenge. For the heavy vehicles (busses and lorries), battery swapping could be an option.

The batteries of the heavy duty vehicles are often charged with high power superchargers. Electricity prices for industrial customers as the Swiss Post are designed in a way, that the higher the peak power demand, the higher the price of the kWh (load tariff). Swiss Post would therefore benefit in two ways from the battery swapping technology: reduced charging time



increases productivity of the lorries & employees and a reduced electricity price reduces operational cost. On top of that, different studies show, that stationary battery storage is needed for a successful energy transition to renewables. This would mean that the exchanged battery for the battery swap would not necessarily be redundant during the time it's not in the lorry but would actually have a use for the energy system.

Objectif et buts

General objective: Swiss Post would like to gain a better understanding of Battery Swap technology and its development.

Make a recommendation, whether Swiss Post should consider electrification of lorries by means of battery swapping or not.

- Obtain information on the costs of charging electric trucks at public or self-owned superchargers and compare them with the prices of recharging by means of battery swap (Post electricity and charging prices will be provided).
- Carry out three simulations with total costs of operation for the following three usage patterns:
 - Scheme 1: annual distance of 70,000 km, truck replaced after 8 years
 - Scheme 2: annual distance of 100,000 km, truck replaced after 10 years
 - Scheme 3: annual distance of 140,000 km, truck replaced after 8 years.

Descriptif tâches

- Assess the market for battery swap lorries. Are there models available on the European market? How much more expensive are these models in the procurement? Are there countries (e.g. China), where battery swapping is already often used?
- Assess to what extent and under which conditions battery swapping can cover the demand for stationary battery storage in Europe by 2050. Does literature suggest where the stationary batteries are located and who operates them?
- Assess what other benefits and risks battery swapping could have for Swiss Post (e.g. physical space needed for the swapping, technical development of batteries, bidirectional battery usage, longevity of battery increases due to healthier charging of battery etc.)
- Possible experimental part: observe the sorting center in Daillens: How many lorries arrive at what hour, how long do they stay? This could give implications on how and where the lorries need to be recharged.

Divers

Personal skills development

- Accounting skills to compare different scenarios regarding to cost
- Project management
- Systematic risk assessment
- Market research

Work is written preferably in English. French and German are also possible.

References



1. Flexibility Requirements and the Role of Storage in Future European Power Systems, 2023 (<https://publications.jrc.ec.europa.eu/repository/handle/JRC130519>)
2. Battery swapping station for electric vehicles: opportunities and challenges (<https://ietresearch.onlinelibrary.wiley.com/doi/full/10.1049/iet-stg.2019.0059>)
3. Post electricity price assumptions (will be provided bilaterally)