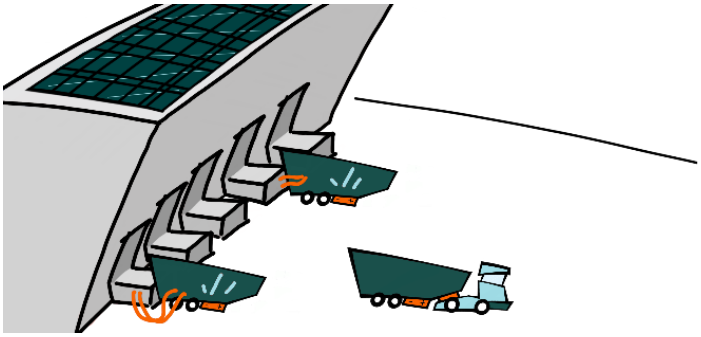
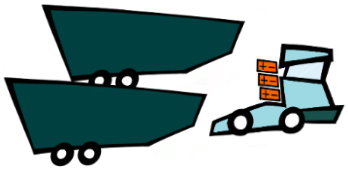
«Powerbank-trailer» economic benefits



With the **Powerbank-trailer**, part of the batteries is transferred to the trailer. These batteries can be charged independently of the tractor. By coupling the trailer, the energy can be transferred from the trailer to the tractor during driving. This increases flexibility in energy management.

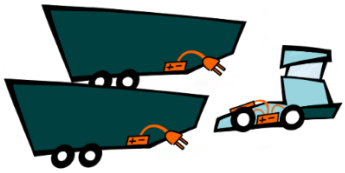
To demonstrate the advantages of this concept, we compare the approach of the "XXL battery tractor," where large batteries are placed on the tractor, with the concept of the "Powerbank-trailer," where the batteries are split between the tractor and two trailers.

Video «Powerbank-trailer»: https://youtu.be/btJxP4sqlh8?feature=shared



XXL- Battery- tractor

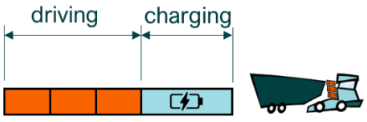
VS.



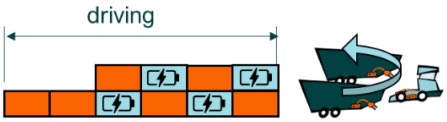
Powerbank-trailer

Range

The possible distance that can be covered with an electric vehicle is limited to the battery capacity and the charging strategy.



The battery capacity limits the maximum range until the next charging stop.



With the Powerbank-trailer, the charging process takes place without any charging interruptions. By swapping trailers, the range can be endlessly extended.

Battery lifespan

Fast charging has a negative impact to the lifespan of a battery [1]. The battery is the most expensive component of an electric vehicle. A long lifespan is both economically and environmentally beneficial.

To achieve optimal vehicle utilization, many electrified logistics processes today use high-power fast charging. However, the higher the charging power, the bigger the strain on the batteries, which accelerates the aging process.

With a decoupled charging process, batteries can be charged gently. In Switzerland, trailers have a 57% longer lifespan than tractors [2]. A Powerbank-trailer provides the optimal conditions for maximizing the battery's lifespan.

Grid load / Charging infrastructure

High-power fast charging is expensive because it places a significant strain to the power grid and requires costly infrastructure, such as fast charging stations and stationary batteries, to smooth out power peaks. If you have twice as much time to charge, half the power is sufficient to deliver the same amount of energy to the vehicle.

High-power fast charging stations are expensive and draw large amounts of energy in a short period. When energy is consumed in this way, an additional power tariff is incurred due to the grid load.

Powerbank-trailers enable decentralized charging with low charging power, as more time is available for the charging process. Due to the more consistent energy consumption, power tariffs decrease or are eliminated entirely.

Use of solar energy

Due to solar power production, energy prices tend to be lower during the day than at night.

Due to the night driving ban (Switzerland), vehicles are mainly charged outside of solar power production and therefore with more expensive energy.

With the Powerbank-trailer, vehicle use and simultaneous daytime charging are enabled. Charging without time pressure and at low power levels allows for optimal and direct use of solar energy.

Energy logistics

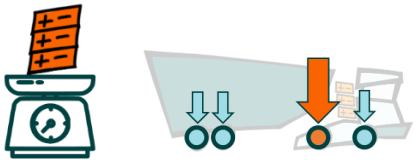
The larger the share of renewable energy, the more volatile the energy production becomes. As a result, flexible consumers receive better rates, and grid-connected storage capacities become more valuable.

The batteries are connected to the power grid at certain times, especially at night. Due to this limited flexibility, you are forced to draw energy at the current market price.

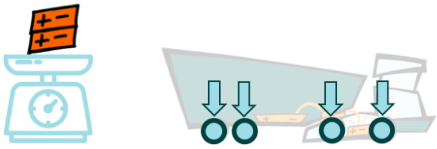
With the Powerbank-trailer, a portion of the batteries is always connected to the power grid, allowing energy to be drawn at an advantageous time. Additionally, a logistics center with Powerbank-trailers becomes a large energy storage system. This enables additional revenue generation through the trade of balancing energy and peak shaving (BESS) outside of operating hours.

Payload / Weight distribution

The battery weight is a significant part of the vehicle's weight and therefore affects the available payload. Additionally, the weight distribution also influences optimal load utilization.



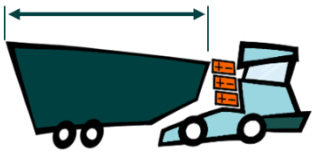
Today, the entire battery capacity is always carried along. This not only requires additional energy and increases wear and tear on the vehicle, tires, and roads, but also reduces the payload capacity. Additionally, the battery weight and the saddle load concentrate a large portion on the drive axle of the tractor, which can negatively impact load distribution.



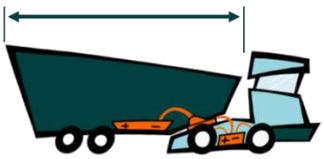
With the Powerbank-trailer concept, not all batteries are on the road with the truck. This allows the battery weight to be used as additional payload. Additionally, the battery weight can be optimally distributed across the axles of the vehicle.

Cargo volume

The available spaces for batteries and components that do not impact the usable volume are limited in a semi-truck.



Larger battery capacities on the tractor can limit the cargo volume.



The alligator high-voltage interface is fully integrated into the trailer floor. Integrating the trailer into the energy network creates new opportunities to install batteries without losing usable volume.

[1] Battery degradation
Erstmalige Messung der Batteriedegradation in Abhängigkeit zum Schnellladeanteil - AVILOO [DE]
[2] Average age of semi-trailers BfS
Bestand der Strassenfahrzeug-Anhänger nach Kanton, Jahr der 1. Inverkehrsetzung, Fahrzeugart, Fahrzeugklasse nach EU, Anzahl Achsen, Zulässiges Gesamtgewicht, Zulässige Nutzlast und Jahr. PxWeb (admin.ch)
Average age of semi-trucks BfS
Bestand der Sachentransportfahrzeuge nach Kanton, Fahrzeugart und Jahr. PxWeb (admin.ch)

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