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Kyburz as Flagship Case (Good practice example)

How to implement a circular economy for batteries

Case Introduction: Develop an effective system to collect, reuse, repurpose and recycle of its own batteries

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement № 869276

KYBURZ

Case Study Learning Objectives

1. **Learning how** to implement a circular business model for its own batteries.
2. **Understand the benefits** of taking responsibility for its own batteries from a manufacturer's perspective.
3. **Get insights into** the entire take-back scheme, reuse/repurpose and recycling process, strategic choices, challenges and success factors.

Case Context

- Kyburz Switzerland AG is using standardized lithium-ion batteries (LFP) for their vehicles (produced in China)
- They sell their vehicles to companies and private persons in Switzerland and around the world.
- After about seven years, the vehicles are bought back, the batteries are tested
  - Batteries over 85% State of Health (SoH) → Reuse in another vehicle
  - Batteries over 65% State of Health (SoH) → Repurposing in a stationary storage
  - Batteries below 65% SoH → Recycling in their own recycling facility
- Recycling is conducted by dismantling of the battery
  - All data about the battery and the vehicle is available
  - Design for recycling can be implemented
  - High recovery rate of materials possible
  - Direct recycling of active materials could be possible and is investigated
- Very high collection rate

Good Practice Aspects

1. There is a close connection between company and customers, leading to several possibilities.
2. The company is taking responsibility and is buying the vehicles back, including the batteries.
3. High reuse rate, only 1 % of batteries had to be recycled after their first life in a vehicle (7 years).
4. With available technologies, a minimum of 91% by weight of batteries can be recycled.
5. With the aim of achieving industrial symbiose

Challenges Addressed

- Keeping the LIBs in use as long as possible.
- Collection and treatment of EoL LIBs.
- Constant improvements of recycling system to make recycling low energy and waste intensive and economically attractive.
- Creating a possibility for a closed loop recycling process.
- EHS aspects of recycling process.

The Characteristics of Kyburz's recycling system

- Approximately 91% of materials (current collectors, active material, housing, separator) used in a LIB can be recovered.
- The cells are discharged, mechanically opened, separator, anode and cathode sheets are separated.
- Aqueous binders are dissolved, and the active material separated from the current collectors.
- Solar power incl. stationary battery is used as energy source.
- The repurchase of the batteries is part of system.
- Financial incentive is given by the Swiss recycling system for batteries, INOBAT.
- Cooperation with other sectors, such as cathode and anode industry to ensure optimized reuse of materials.

The Benefits of Kyburz's recycling system

- Decreasing primary raw material intensity of batteries by creating secondary materials.
- No heat treatment is necessary, low energy use, no exposure to dangerous materials.
- Only water is used as processing solvent, no organic solvents necessary.
- Close connection to customers enables high collection rate.
- Recycling of own cells enables deconstruction und direct recycling due to perfectly adapted process.
- Compliance with recycling regulations of both manufacturer and customer.

Content based on information provided on "Kyburz" website

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How Does the Recycling System Work?

1

Selling/Repurchasing electric vehicles

- Close connection between customer and “Kyburz”.
- At this moment funds are already set aside to cover the repurchasing and recycling costs.

2

Time until end of first life (7 years)

- Kyburz repurchases product and tests battery:
  - > 85% State of Health (SoH)
    → Reuse in another vehicle
  - > 65% State of Health (SoH)
    → Repurposing in a stationary storage
  - < 65% State of Health (SoH)
    → Recycling

3

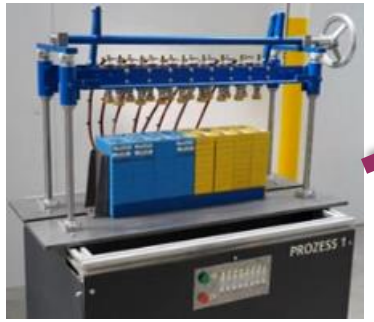
After the second life

- The process is repeated until the batteries have to be recycled
- The price for the stationary accumulator includes a deposit of 5 Swiss francs, which is refunded on return

Content based on information provided on “Kyburz” website

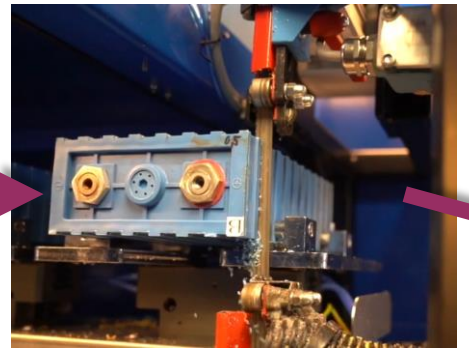
How Does the Recycling System Work?

Recycling Process

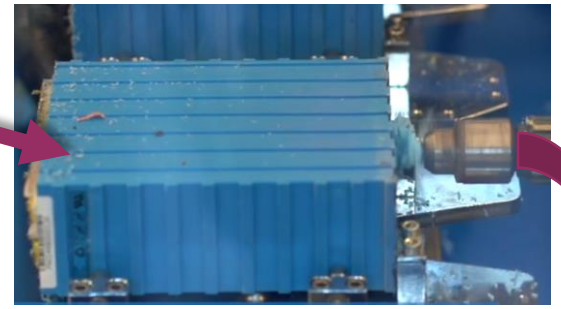


Discharge

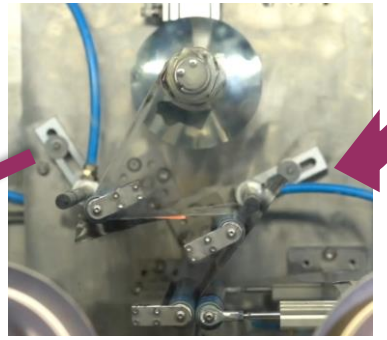
Transport to recycling facility



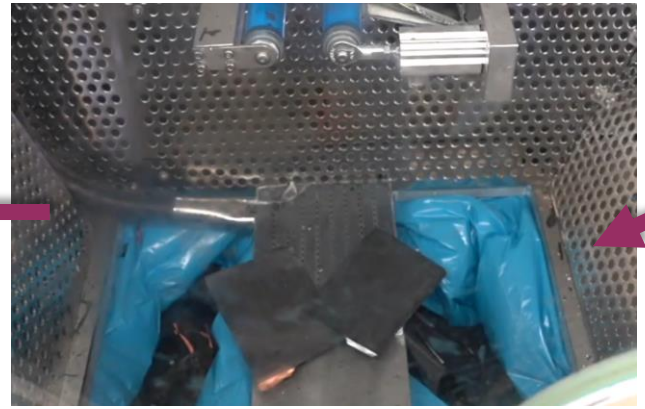
Cut open



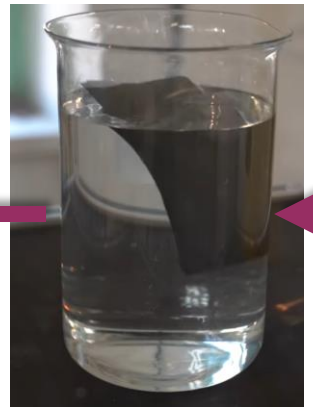
Drill and ejection of stack



Separation



Anode, cathode and separator



Dispersion in water

Binder dissolution

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How Does the Recycling System Work?

Output of the Recycling Process

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