

Management of second-life batteries in the INOBAT system

Summary

Zurich, 28 May 2026

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1 Background

The battery market has developed significantly in recent years. Lithium-ion batteries are increasingly being used in a growing range of applications (for example in electronic devices, wireless tools, e-cigarettes, electric vehicles and stationary battery storage systems). As a result, the volume of waste batteries is also continuously increasing. This development poses new challenges for waste management systems, while also creating new opportunities for resource-efficient recovery processes.

One such opportunity is the reuse of battery packs, modules or cells¹ from waste batteries. In this process, waste batteries or their components are refurbished through “preparation for reuse” to be used again as a “second-life battery”.

Through this extended use phase, battery materials remain in circulation for longer, thereby reducing the demand for new raw materials. Under Swiss waste legislation, preparation for reuse, like recycling, is considered a recovery process.

This new process changes the status quo regarding the financing of battery waste management. For INOBAT², this raises questions regarding the appropriate compensation of preparation for reuse, the handling of the prepaid disposal fee (PDF) for second-life batteries, as well as the mechanisms required to ensure that compensation is granted only for the treatment of batteries for which a PDF has been paid³.

The study shows that manufacturers of second-life batteries are closely embedded into the Swiss battery waste management sector through a variety of business models. These findings provide key insights into the management of second-life batteries within the INOBAT system and help identify potential strategic directions for its future development.

2 Second-life batteries in the current system

The Swiss battery waste management sector comprises a wide range of actors carrying out different activities across the waste battery value chain. They are closely interconnected through financial and material flows. System allocation refers to the financing system to which a given waste battery is assigned. This determines which system is responsible for financing the associated waste management services.

Manufacturers of second-life batteries carry out preparation for reuse and thereby provide a valorisation service within the battery waste management system. In practice, waste batteries are tested to identify functional battery components (cells, modules or complete packs). These components lose their waste status, and are assembled into second-life batteries that are placed back on the market. Non-functional battery

¹ A battery is generally modular in design. It typically takes the form of a so-called battery pack, which consists of several modules that are themselves composed of individual cells.

² Organisation responsible, on behalf of the Federal Office for the Environment (FOEN), for collecting, managing and allocating the prepaid disposal fee (PDF) levied on batteries.

³ Certain battery types may be exempted from the prepaid disposal fee (PDF). Such an exemption requires the sector to establish a so-called sectoral solution, which includes a well-functioning collection system and a secure financing system ensuring a high collection rate and valorisation in accordance with the state of the art.

components are sent for recycling.

The study identified several manufacturers of second-life batteries in Switzerland and focused on four companies presented in the table below. A key aspect of the analysis was the system allocation of both valorised waste batteries and second-life batteries subsequently placed on the market.

Company	Waste batteries	Second-life batteries
Evolium Technologies SA	E-bikes, e-scooters and power tools from Switzerland, dismantled battery cells from the EU System allocation: INOBAT / undefined	Small to medium-sized modular stationary battery storage systems System allocation: INOBAT
Libattion AG	B-grade batteries (not considered waste ⁴), traction batteries from Switzerland and the EU System allocation: sectoral solutions / undefined	Large stationary battery storage systems for industrial applications. System allocation: INOBAT
Modual AG	Traction batteries and industrial truck batteries from Switzerland and the EU System allocation: INOBAT / sectoral solutions / undefined	Modular stationary battery storage systems System allocation: INOBAT
Kyburz Switzerland AG	Traction batteries recovered from customers System allocation: INOBAT	Traction batteries for small vehicles and stationary battery storage systems System allocation: INOBAT

Overall, the analysis shows that none of the companies examined currently receives compensation for preparation for reuse, whether from INOBAT or from sectoral solutions. At the same time, business models vary significantly, particularly in terms of the types of valorised waste batteries used and their system allocation. In all cases, however, the second-life batteries placed on the market are allocated to the INOBAT system.

Many manufacturers source waste batteries from several sectors simultaneously. As a result, battery components with different system allocations may, in practice, be combined within a single second-life battery. This can lead to a change in system allocation between the first-life and second-life of a battery. The implications of this situation for the rules governing the payment of the PDF for second-life batteries have not yet been fully clarified.

⁴ B-grade batteries are factory-new batteries with minor defects and are therefore, strictly speaking, not considered waste. As a result, Libattion is not, *stricto sensu*, a manufacturer of second-life batteries, but nevertheless represents an important actor within the sector.

3 Challenges and possible strategic directions

The study identified three main challenges related to the management of second-life batteries within the INOBAT system:

- 1. Compensation for preparation for reuse:** Preparation for reuse is still a relatively new valorisation process, and the current financing system does not yet include specific mechanisms to compensate these activities.
- 2. Transition from waste to product status:** Preparation for reuse and the manufacturing of second-life batteries raise questions about when battery components produced from waste batteries cease to be considered waste and regain product status. This involves questions relating to functionality criteria, the applicability of the PDF to second-life batteries, and their system allocation.
- 3. Complexity of material flows and system allocation:** During preparation for reuse, waste batteries from different sources and with different system allocations are processed together. This makes it more difficult to track the system allocation of waste batteries and to determine for which batteries compensation is justified.

To address these challenges and support the development of an appropriate framework for second-life batteries, five possible strategic directions are proposed:

- A. Establish a compensation mechanism for preparation for reuse:** Recognise and integrate preparation for reuse as a valorisation process within the INOBAT system, and introduce mechanisms and tariffs to compensate these activities.
- B. Define clear conditions for end-of-waste:** Clarify the transition from waste to product status, in particular by defining functionality criteria and developing standards for preparation for reuse.
- C. Introduce a PDF requirement for second-life batteries within the INOBAT system:** Introduce a PDF requirement for all second-life batteries in order to finance waste management services at the end of their additional service life.
- D. Allow sectoral solutions that include preparation for reuse as a valorisation process:** Fee exemptions should only be granted to batteries covered by sectoral solutions that consider all valorisation processes defined under Swiss legislation - in particular both material recovery and preparation for reuse - and provide appropriate compensation for these activities.
- E. Establish a monitoring system for the battery waste management sector:** Establish a monitoring system to track the material flows and system allocations of waste batteries in order to determine for which batteries compensation for preparation for reuse should be granted.