

Circular economy applied to flow batteries in current commercial products and future developments

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Introduction

Following the Communication about the Circular Economy Goal from the European Commission on 2015 [1], there has been a great movement for recovering compounds (materials and chemicals) from spent batteries. Basically, the attention is focused over Li-ion batteries because of the well-known cobalt issue.

Nevertheless, the Circular Economy relates to all products POM (put on market) and, logically, this includes new upcoming products like flow batteries (FB).

This presentation is intended to show the problems and solutions working towards the Circular Economy. Thus, an extensive study of how to recover products from the very beginning battery eco-design to those products that are already commercialized.

Current legislation for batteries: Battery Directive

The presentation shows how the Battery Directive 2006/66 [2] relates to the FB market; Compliance Schemes act currently for collecting batteries; the eco-design is important for recycling; all of them under a perspective for FB. In addition, some theoretical pathways are shown to create a discussion based on the present and future needs for the industry.

Therefore, for all batteries, whether in new or early stages or those that are in commercial use, recycling and reusing is now an important issue for many advantages, both environmental, economic and so on.

Today, under the Directive, FB could be classified as Portable, Industrial or Automotive but they are not specifically mentioned, except that they could be allocated as Industrial because of the FB's main components. Commercial FB are supposed to be set as Industrial which means that at least the 50% of their average weight must be recycled.

Recycling

Recycling is defined in Battery Directive [2] as "...the reprocessing in a production process of

waste materials for their original purpose or for other purposes, but excluding energy recovery". In terms of industrial processes, the recycling is the industry in charge of putting as many as possible "raw materials" known as secondary raw materials in the market.

This step in the End of Life of any product is one of the most important from an environmental point of view but at the same time, it is one of the most neglected. A general view of the recycling process under the framework of the Directive will be presented with the aim of leveraging in the new FB design.

Batteries Recycling Map

Across Europe, the Directive [2] has to be fulfilled and today is well implemented but with different results. However, general conclusions could not be presented because official data of Industrial type are not published.

On the other hand, taking Portable collection data which are published every year, one could conclude that there are differences in results and difficulties in collection. Thus, there are countries that pass through the minimum objective of collection (set as 50% in weight of batteries of put on the market from 2021) like France, The Netherlands, Germany but others do not: such as Italy, Finland, Spain etc...

Future Directive

The current Directive has now moved into the review process stage. This normal procedure has been shaken with the rise of lithium-based batteries and their ever increasing importance. Particularly, much attention has been placed on the cobalt element recovery. This important point will be well covered but, in contrast, incoming and incipient batteries are not be addressed and their needs placed into non-specific box which could lead losing the opportunity of a good system for a "total recovery" of products and components from FB.

Ecodesign

This is a goal that is quite linked to Circular Economy as one of its bases to achieve this goal. However, except from some particular manufacturing processes which Ecodesign is a

set procedure to follow, for the rest of the sectors and products it is just a “empty word” but although full of good intentions.

Therefore, even if not following any previous determined protocol, just implanting the basis of a Ecodesign for a better recyclability would increase both the recycling efficiency and decrease the cost of the recovery process.

Conclusion

Recycling is a manufacturer’s obligation executed mainly by specialists known as Recyclers. This process fulfills the EPR obligations. In the light of the current directive FB are almost neglected, they are likely to be treated as Industrial (common classified) or portable

batteries (in new incoming applications) but not well covered with the needs and specifications of FB.

The revision process of the Battery Directive brings a bright ray of hope for covering all gaps that have risen during previous discussions and it should try to set the basis for a new market in Energy Storage taking into account not only well known batteries but also all types that are really close to market.

Ecodesign is a powerful tool to improve recycling but it is not yet developed in batteries. For FB this means there is an excellent opportunity to build up a methodology for applying well known general concepts to FB.

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References

- [1] Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions: Closing the loop - An EU action plan for the Circular Economy. COM/2015/0614 final (available in: EUR-Lex - 52015DC0614 - EN - EUR-Lex (europa.eu))
- [2] Directive 2006/66