Second Life EV Batteries

Safe e-waste handling. Collection and disposal of e-waste.

Madeleine Raabe
Junior Researcher
Wuppertal Institute

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 101037141. This material reflect only the views of the Consortium, and the EC cannot be held responsible for any use that may be made of the information in it.

In this video you will learn about:

- Why is safe e-waste handling important?
- The End-of-life of electronic products : Collection, storage, recycling & disposal
- Barriers to safe e-waste handling
- Implementing safe e-waste handling
- Practical examples

SESA

Why is safe e-waste handling important?

Why is safe e-waste handling important?

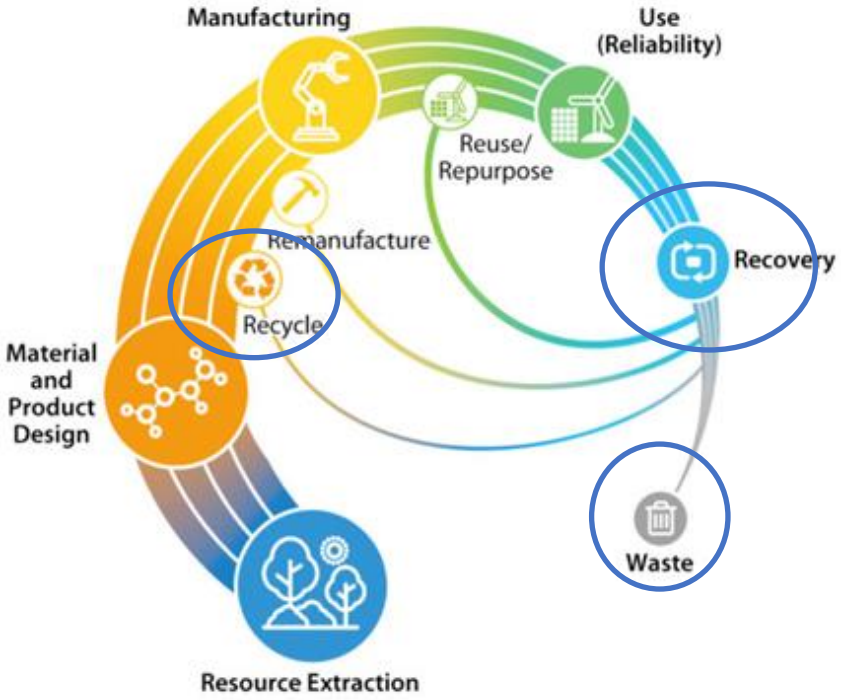
- E-waste is the fastest growing waste stream in the world (Unitar, 2020)
- Only 17.4 % of 2019's e-waste was collected and recycled (Unitar, 2020)
- Unsafe handling of e-waste has detrimental effects on human health & environment
- E-waste is a source of scarce and valuable materials
- Socio-economic potential of safe e-waste handling:
  - Employment creation in recycling & refurbishing sector
  - Health safety for children and pregnant women
  - Economic benefits through recovery of valuable materials
  - Potential for e-waste in a circular economy

E-waste is a sub-indicator for the SDGs

SESA

End-of-life (EoL) electronic products: Collection, storage, recycling & disposal

End-of-life electronic products: Collection,storage, recycling & disposal



Collection & Storage

Recyclin g

Disposal

Fig. 1: *Circularity in sustainable energy solutions* (NREL, 2022)

Zoom in: EoL batteries from EVs

- EV batteries are labeled as hazardous waste because of their toxic contents & flammable properties (Zhu et al., 2021)

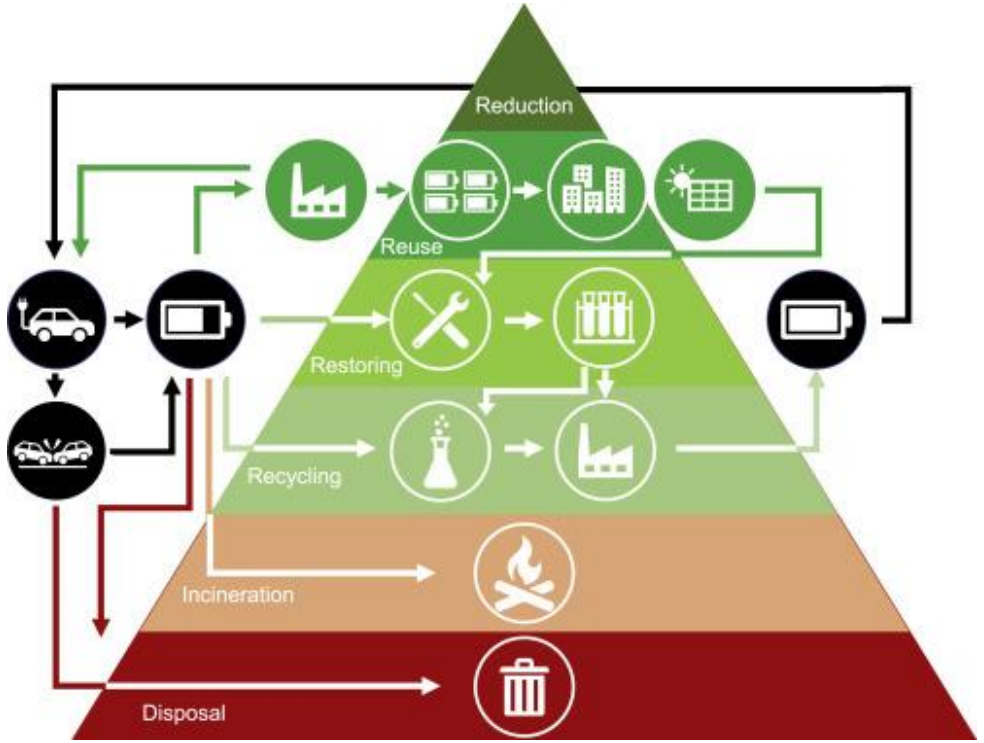


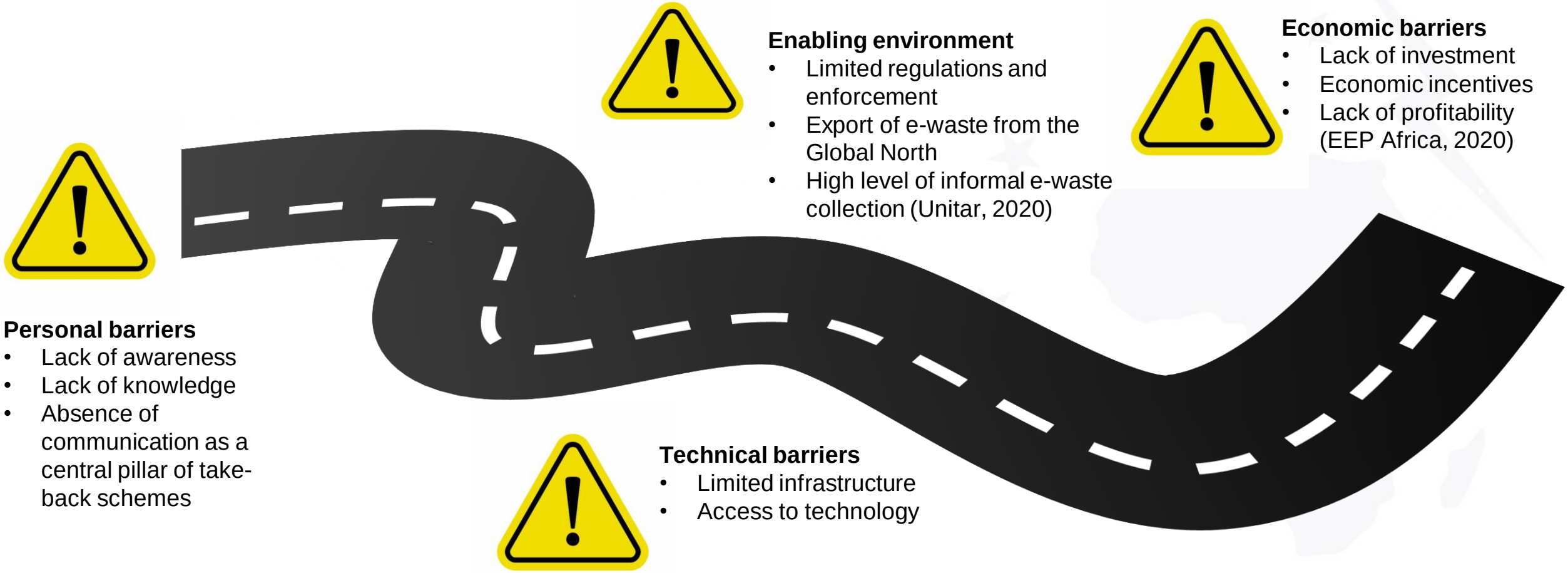
Fig 2.: The life cycle of EV lithium-ion batteries (Zhu et al., 2021)

- If battery from EV is **not** reused (for example for stationary energy storage), EoL of EV battery is reached
- **Restoring:** Option between recycling and reusing, cathode materials restored for battery manufacturing directly without processing (Zhu et al, 2021)
- **Recycling**: Extraction of valuable raw materials, should be the last step after repurpose and restoration

  → Necessity of improvement of recyclability of products (Circular Economy Practicioner Guide, 2022)
- Incineration and disposal **not** desirable due to environmental and health threats

Barriers to safe e-waste handling

Barriers to safe e-waste handling



Enabling environment
- Limited regulations and enforcement
- Export of e-waste from the Global North
- High level of informal e-waste collection (Unitar, 2020)

Economic barriers
- Lack of investment
- Economic incentives
- Lack of profitability (EEP Africa, 2020)

Personal barriers
- Lack of awareness
- Lack of knowledge
- Absence of communication as a central pillar of take-back schemes

Technical barriers
- Limited infrastructure
- Access to technology

Implementing safe e-waste handling

Implementing safe e-waste handling

Implementing safe e-waste handling

Policy and Regulation

- Safe e-waste handling requires an effective enabling environment and policy framework → Policy is the foundation of e-waste market
- Enforcement needs to be strengthened significantly (Maes & Preston-Whyte, 2022)

Business & financing models

- Business models of companies are influenced by enabling environment
- Two policy approaches: Consumer-financing & Producer- financing
- Public-private partnerships
- Take-back models (accompanied by customer education)

Capacity building

- Awareness campaigns need to accompany business models, policies, etc.
- Communication and awareness raising is a central pillar of take-back schemes (EEP Africa, 2020)

Control of illegal e-waste exports to Africa

- Domestic generation of e-waste in Africa only amounts to 50%-85%, of the whole volume → rest originates from imports from Europe, the Americas, and China (Maes & Preston-Whyte, 2022)

→ rest originates from imports from Europe, the Americas, and China (Maes & Preston-Whyte, 2022)

→ Most of the imports are illegal, despite existence of treaties that forbid import of hazardous waste

Practical examples of safe e-waste handling

WEEE Centre, Nairobi, Kenya

The idea: WEEE Centre is an e-waste recycling company based in Nairobi, that provides e-waste collection, dismantling and automated processing services in Nairobi and several other major cities in Kenya. It sources e-waste from the public and private sector and raises awareness through collection campaigns aimed at individual households.
Areas of expertise and innovation: WEEE Centre works in the areas awareness creation, e-waste disposal, e-waste processing, secure data destruction and training
The business model: Hybrid PPP partnering with SME´s across Kenya, international NGOs and the Kenyan government. Company uses a dispersed incentive and collection model. WEEE Centre extracts valuable materials from collected e-waste to be sold and reused in the production of other electronics

Through the safe disposal of e-waste, a safe and green environment is being ensured. Moreover, the company provides training and awareness creation for the safe handling and disposal of e-waste.WEEE Centre creates jobs in the formal sector.
https://www.weeecentre.com/

SESA

Practical examples of safe e-waste handling

Hinckley Associates, Lagos, Nigeria

The idea: The company is the first registered e-waste recycler in Nigeria, providing end-of-life solutions for electronic equipment, preventing environmental pollution and human harm caused by hazardous e-waste.

- **Areas of expertise and innovation:** Hinckley Recycling is forging the way for the formal e-waste sector in the country, balancing bureaucratic challenges with competition from a massive, well-organized informal collector coalition, with an emphasis on batteries used in off-grid solar
- Collection and recycling of e-waste
- Re-use and redeployment
- Value return services

The business model: Hybrid PPP, working together with Hewlett Packard (HP) and other manufacturers across Africa as well as the informal sector

Hinckley Associates has positive environmental impact through the recycling of e-waste. They work on strengthening the formal e-waste sector by conforming to strict environmental recycling and working closely with the government.

https://hinckley.com.ng/

SESA

References

- **Circular Economy Practicioner Guide, 2022.** Design for recoverability/recyclability. (Accessed Sep 8, 2023).
- **EEP Africa**, 2020. Solar E-waste Management Innovations in Sub-Saharan Africa. (Accessed Sep 8, 2023). https://eepafrica.org/webinar-solar-e-waste-innovations-in-Africa/
- **Efficiency for Access**, 2021. Business Model Innovations project. (Accessed Sep 8, 2023). https://efficiencyforaccess.org/publications/business-model-innovations-project
- **E-waste Africa**, 2021. E-waste Africa. (Accessed Sep 19, 2023). https://ewasteafrica.net/contact-us/
- **GOGLA**, 2019a. Introduction to Recycling. GOGLA. (Accessed Sep 8, 2023). https://www.gogla.org/what-we-do/circularity/introduction-to-recycling/
- **NREL,** 2022. Circular Economy for Energy Materials. https://www.nrel.gov/about/circular- economy.html
- **Maes, T., & Preston-Whyte, F.** 2022. E-waste it wisely: Lessons from Africa. SN Applied Sciences, 4(3) 72. https://doi.org/10.1007/s42452-022-04962-9
- **Unitar**, 2020. The Global e-waste monitor 2020 (Accessed Sep 6, 2023) https://ewastemonitor.info/gem-2020/
- **Zhu, J**., Mathews, I., Ren, D., Li, W., Cogswell, D., Xing, B., Sedlatschek, T., Kantareddy, S., Yi, M., Gao, T., Xia, Y., Zhou, Q., Wierzbicki, T. Bazant, M., 2021. End-of-life or second-life options for retired electric vehicle batteries. Cell Reports Physical Science, Vol.2, Issue 8. https://doi.org/10.1016/j.xcrp.2021.100537

SESA

THANK YOU

sesa-euafrica.eu/
toolbox.sesa-euafrica.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No. 101037141. This material reflect only the views of the Consortium, and the EC cannot be held responsible for any use that may be made of the information in it.