

Module A1: Circular Economy

Circular Economy for Energy Storage

AAE-E3120/AAE-E3121

Prof. Annukka Santasalo-Aarnio



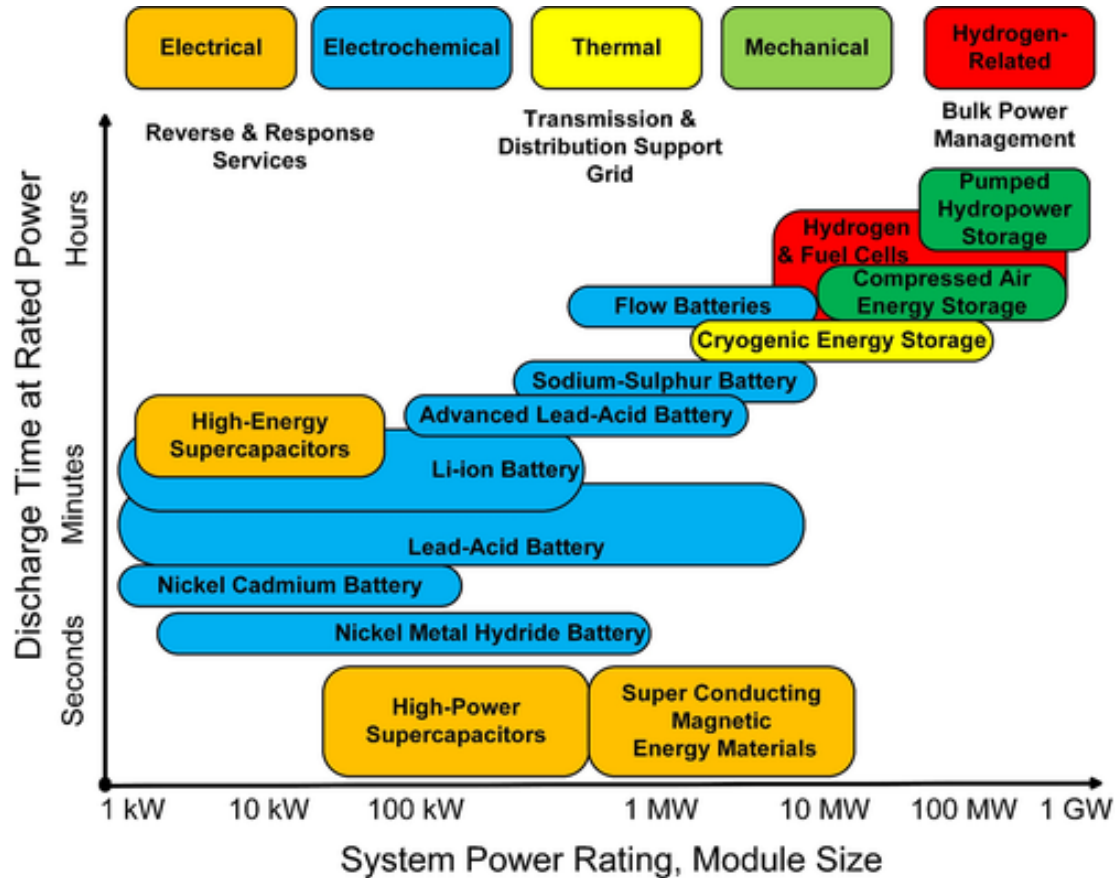
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Learning outcomes

- **Identify circular economy concepts and the role of energy in recycling**
 - Introduction to Circular Economy
 - Introduction to Waste hierarchy
- **Apply the levels of recycling to Energy Storage devices**

Energy storage applications



Sustainable Energy Storages



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Energy Storage Applications

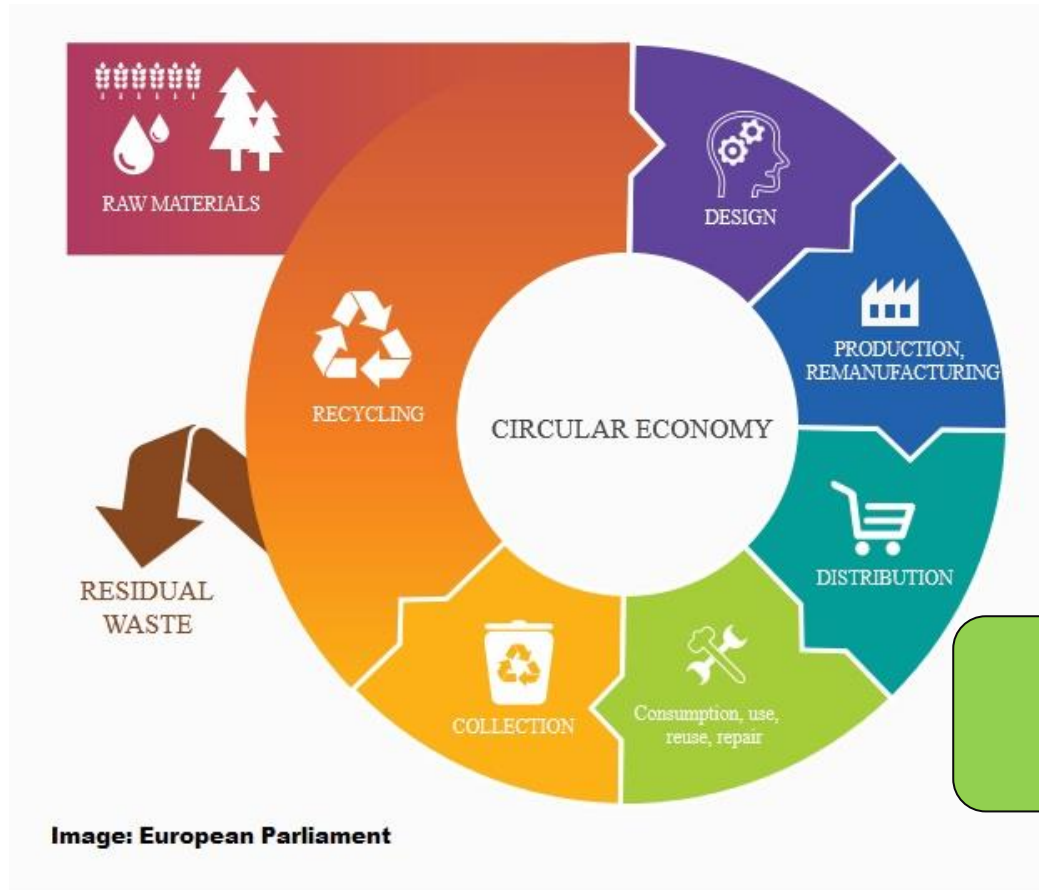
How is Circular Economy related to Energy Storage?

Energy Storages do not have emissions?

Circular Economy has to do with materials – not with Energy!

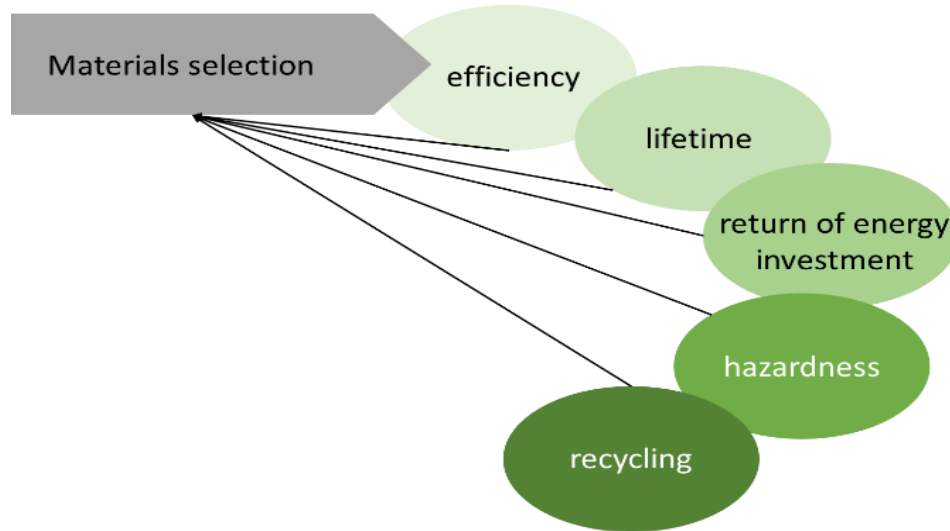
Circular Economy

Energy intensiveness

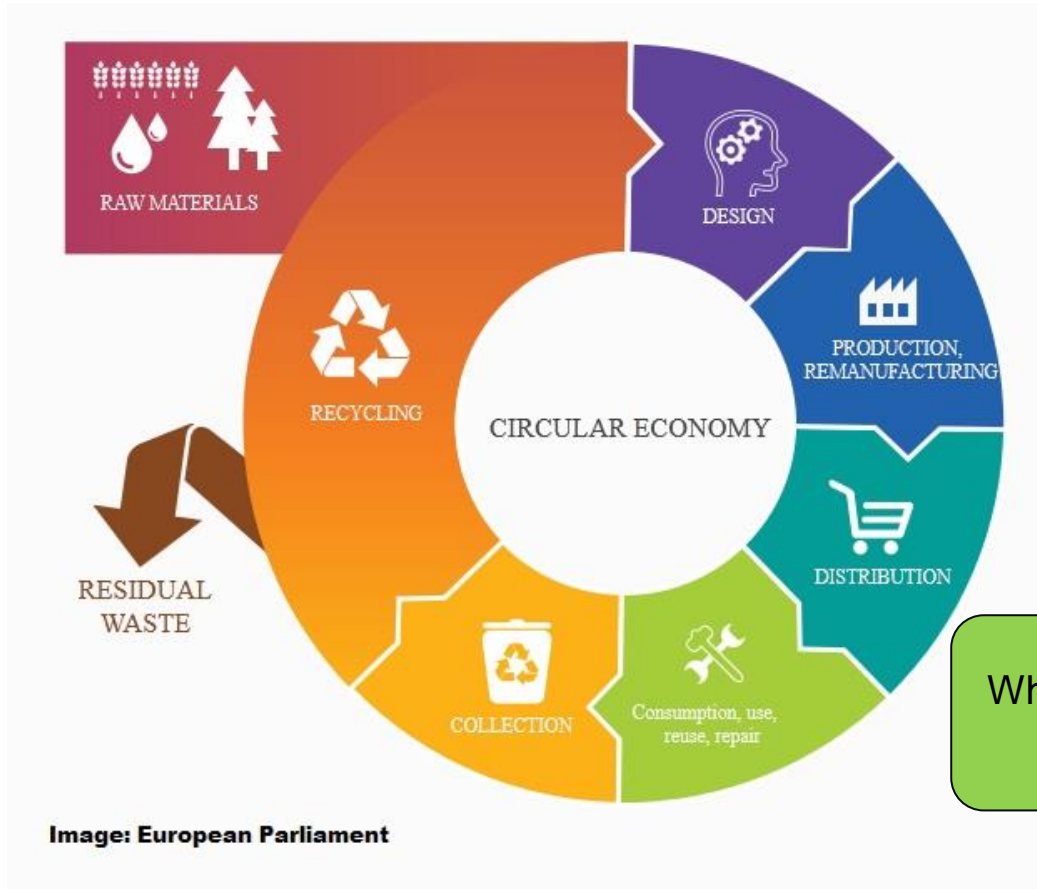


Which part is the most energy intensive?

Material selection for Energy Systems

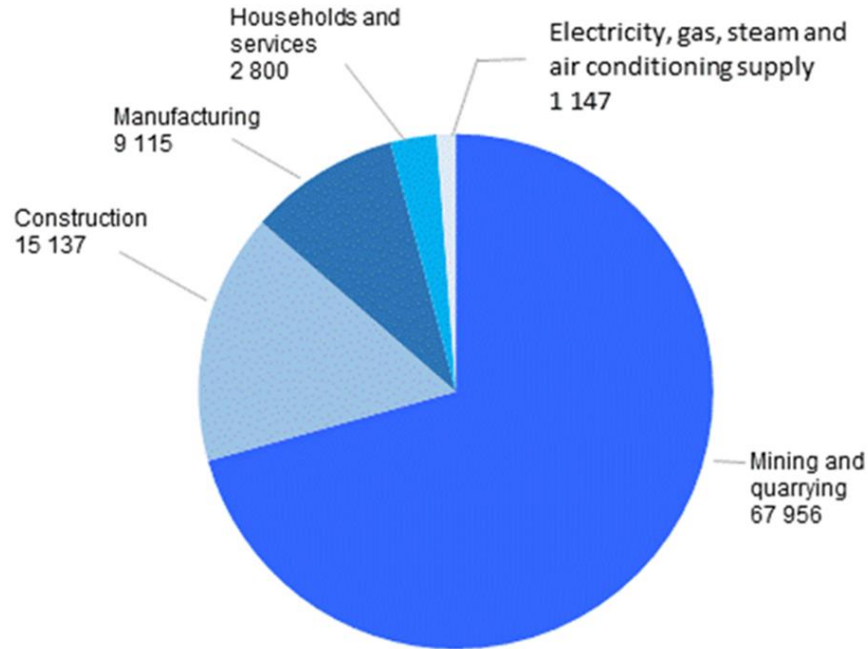


Waste production



Which part creates the most waste?

Sources of waste

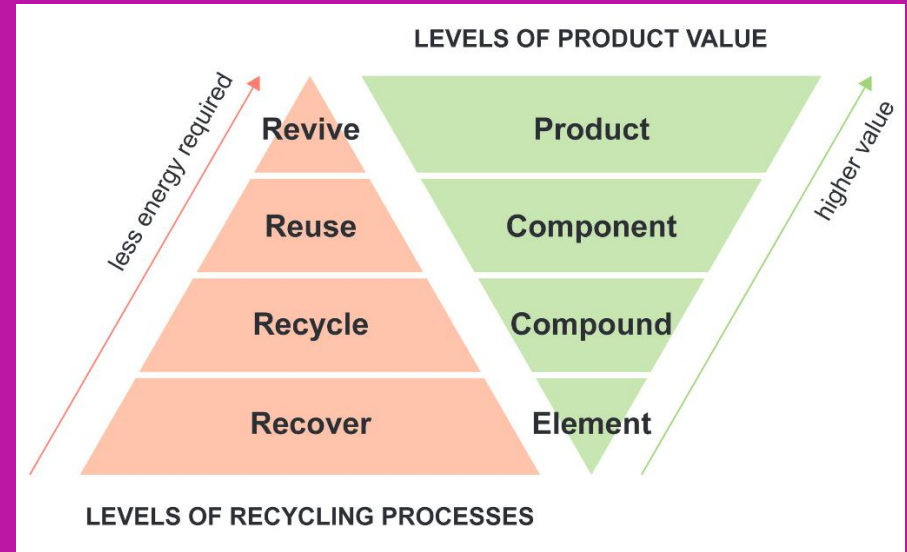


Country dependent...

Mining waste -> Is considered as a waste

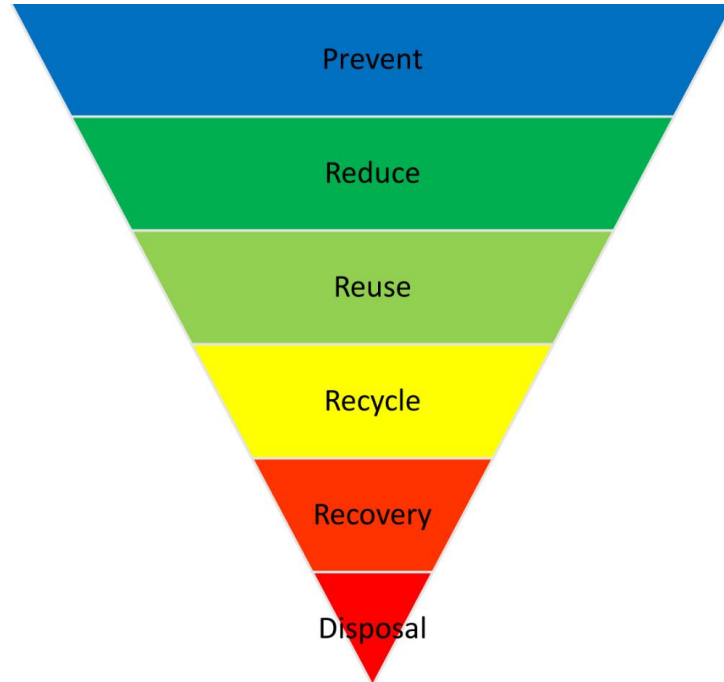
Distribution of waste amounts per sector in 2013, 1000 tons.
(Statistics of Finland 2013)

Levels of recycling



K. Miettunen, et al. J. Cleaner Production, 320 (2021) 128743. <https://doi.org/10.1016/j.jclepro.2021.128743>

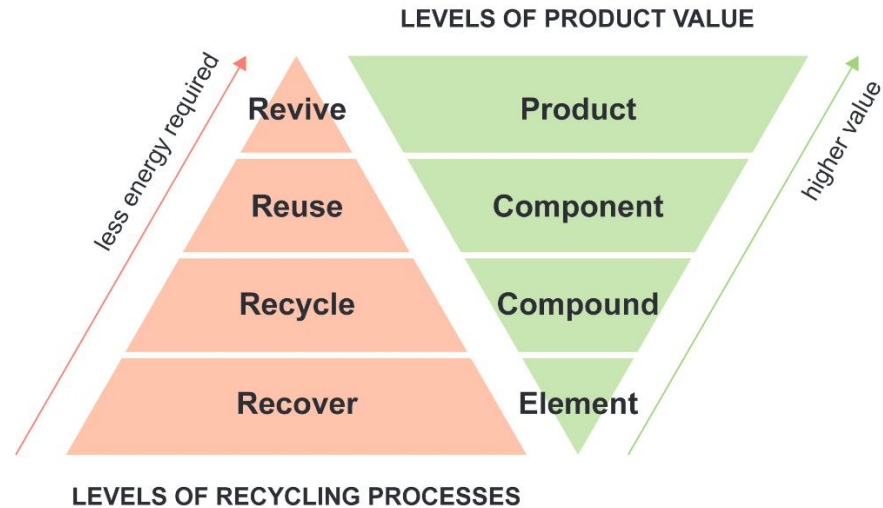
Waste pyramid



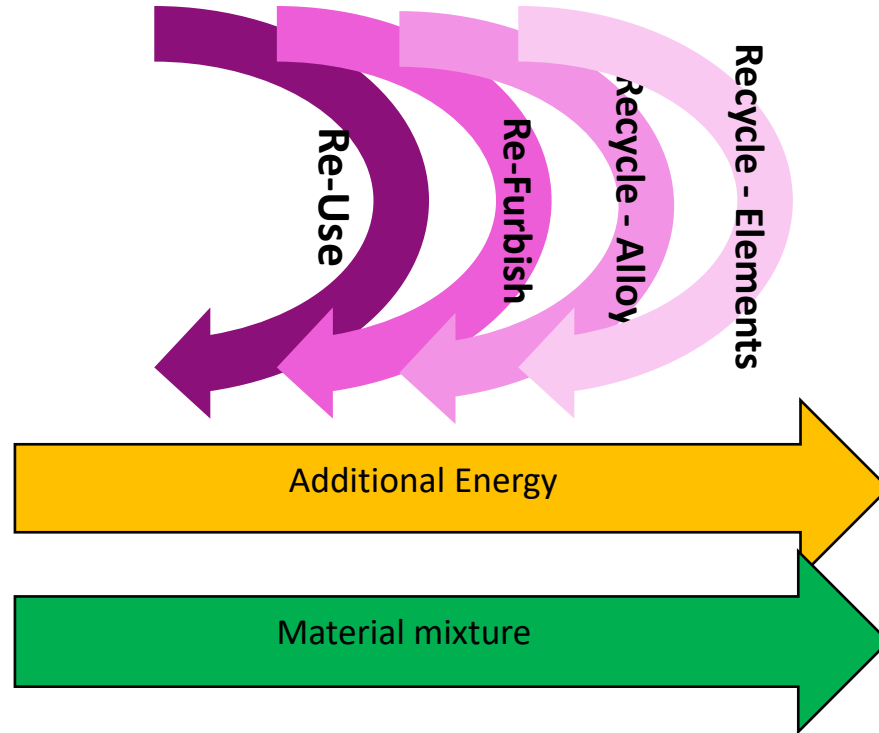
The higher the level
the better

Several stages come
BEFORE Recycling!

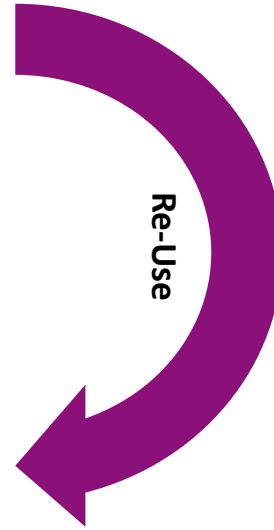
Levels of recycling



Levels of recycling: Chair

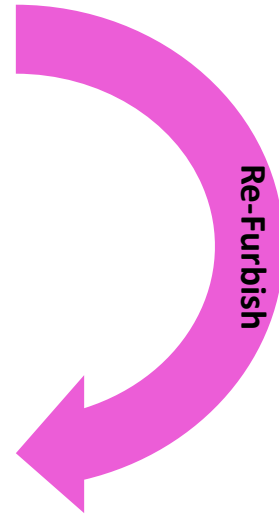


Levels of recycling: Chair



With **no modifications** – you provide the chair to other use yourself (or to someone else)

Levels of recycling: Chair

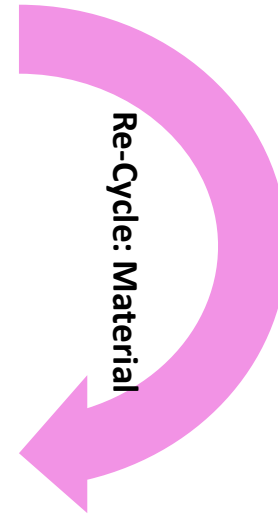


You **invest some energy** into the object, for instance, you change the fabric or paint the chair.

Levels of recycling: Chair



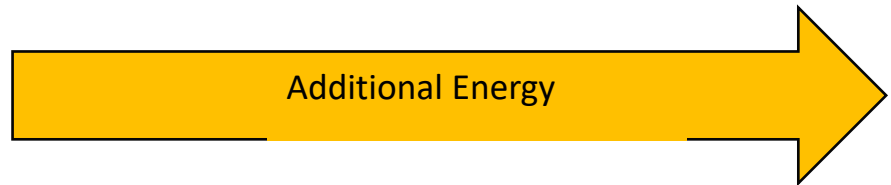
You recycle **some parts** with not large amount of additional energy, material structures



Levels of recycling: Chair



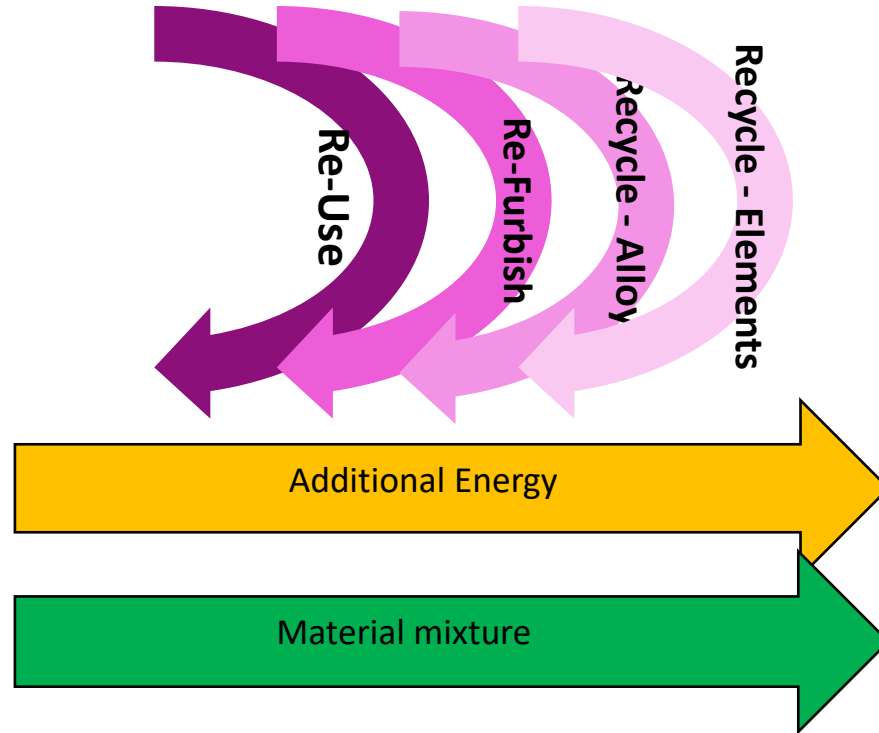
The chair can also be recycled back to **fibers** (wood/textile) and used in other products. This step requires the most energy input.



Levels of recycling - Apply

Reflect to your lecture journal

Select an energy storage system and apply the different levels of recycling to this system.



Energy Storage Applications

How is Circular Economy related to Energy Storage?

Energy Storages do not have emissions?

Circular Economy has to do with materials – not with Energy!

Reflect to your lecture journal

Please reflect these questions to your journal.

Take-home message

“We need to ensure that the renewable energy solutions that we are proposing are more sustainable than the systems we are replacing.”