

Module A1: Circular Economy

AAE-E3120 Circular Economy for Energy Storage

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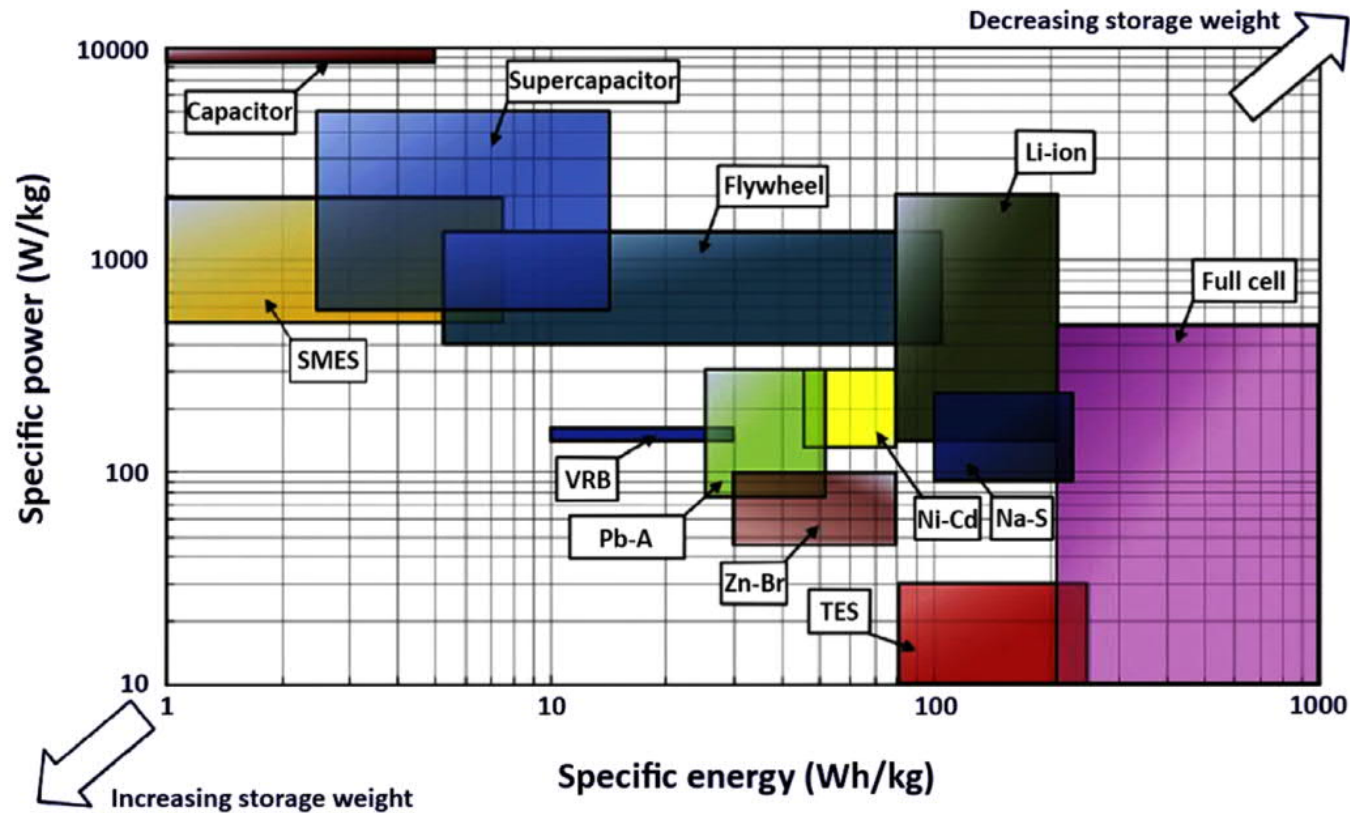
Aalto University
School of Engineering



Learning outcomes

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

Energy Storage Applications



Energy Storage Applications

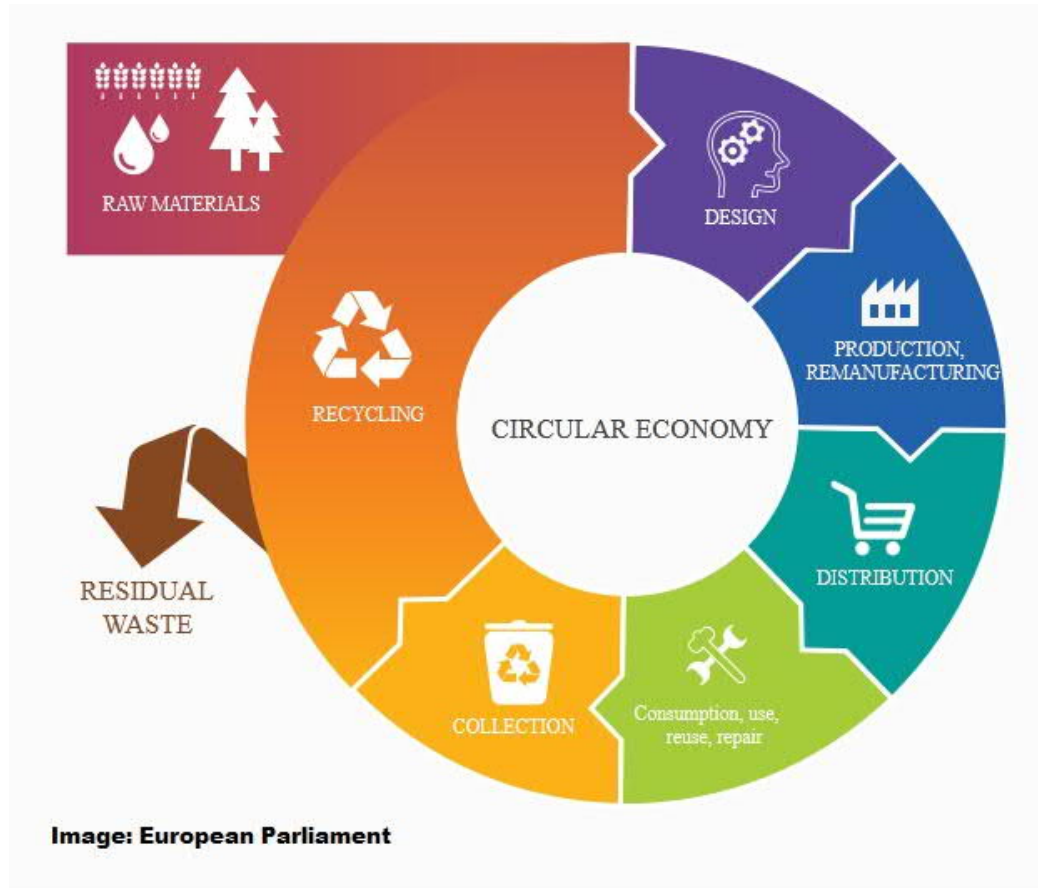
How is Circular Economy related to Energy Storage?

Energy Storages do not have emissions?

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

Circular Economy

Energy intensiveness

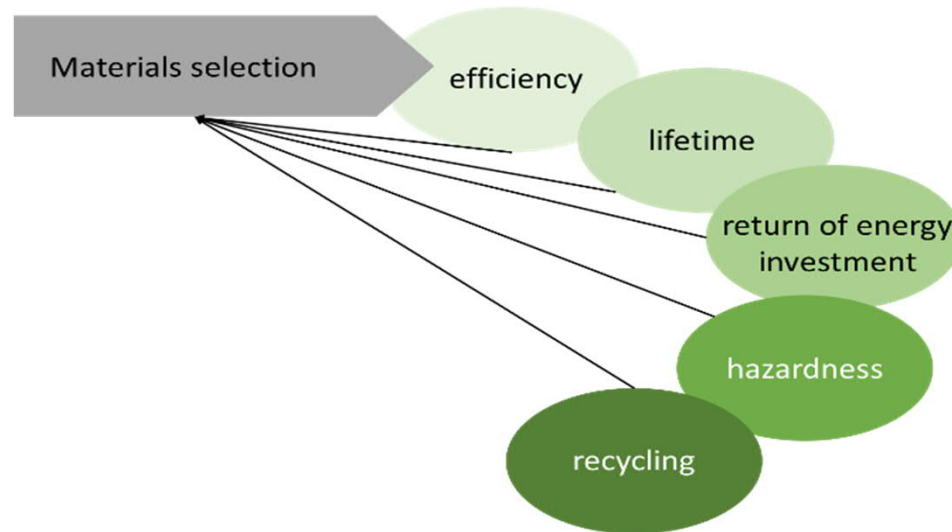


**Reflect to your
lecture journal**

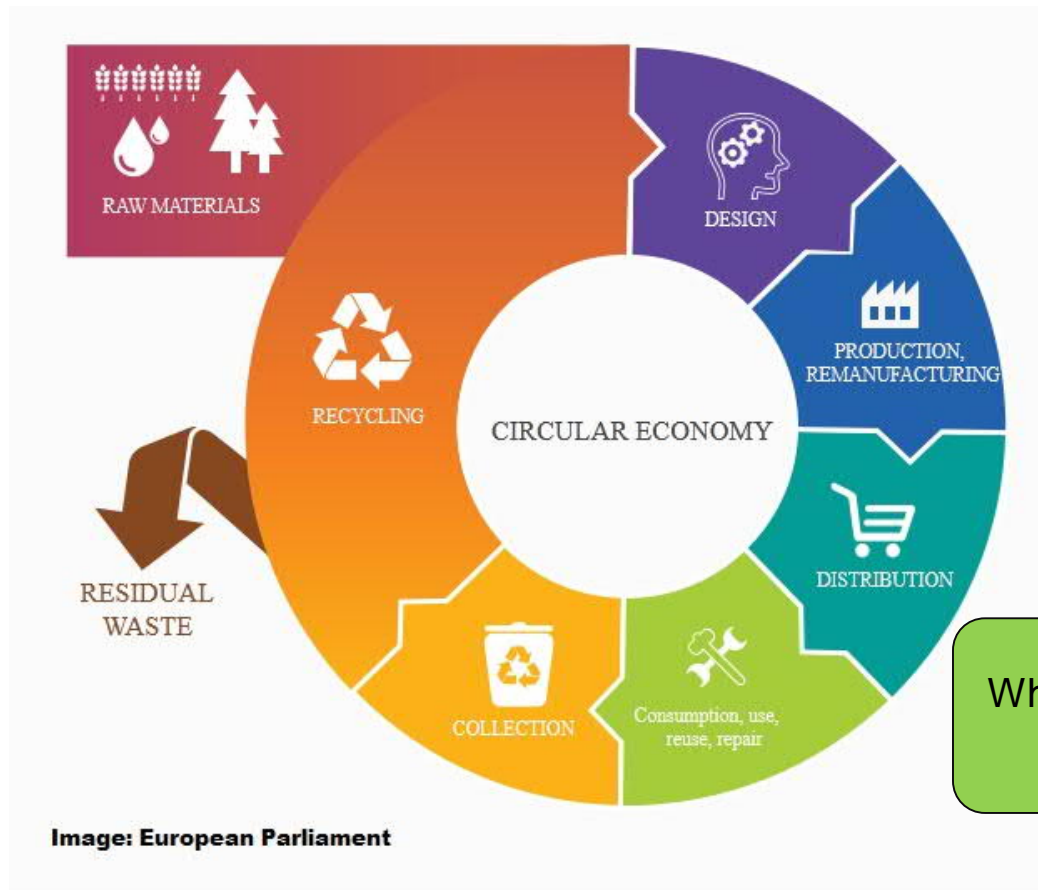
What do you think of the realism of this image?

What do you consider are the most energy intensive process stages?
What things they dependent on?

Material selection for Energy Systems

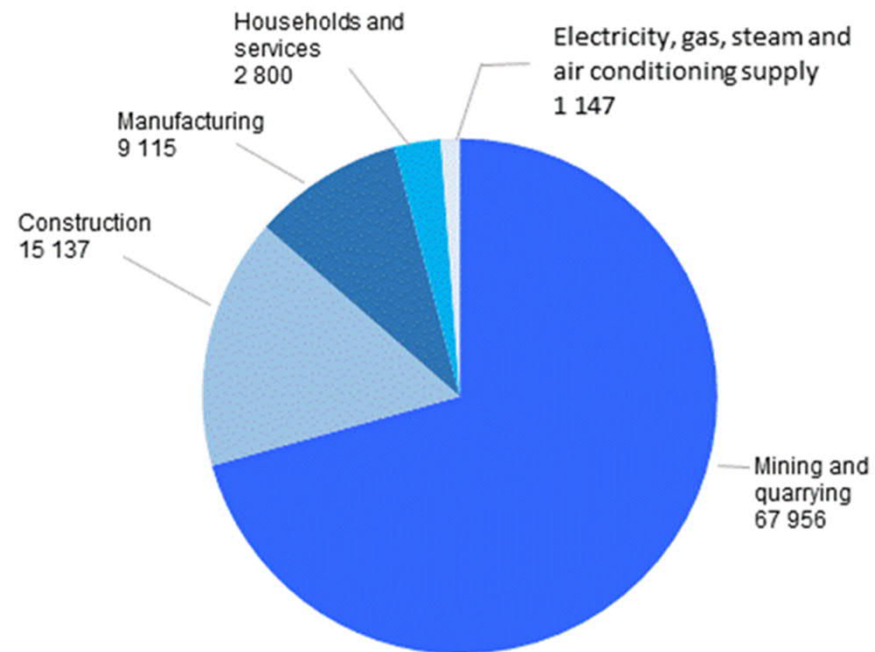


Waste production



Which part creates the most waste?

Sources of Waste



Country dependent...

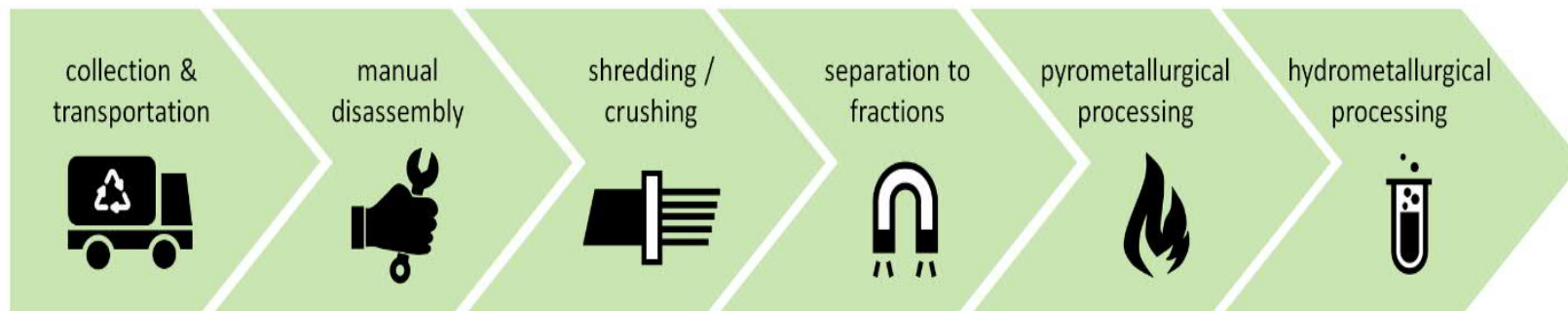
Mining waste -> IS considered as a waste

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

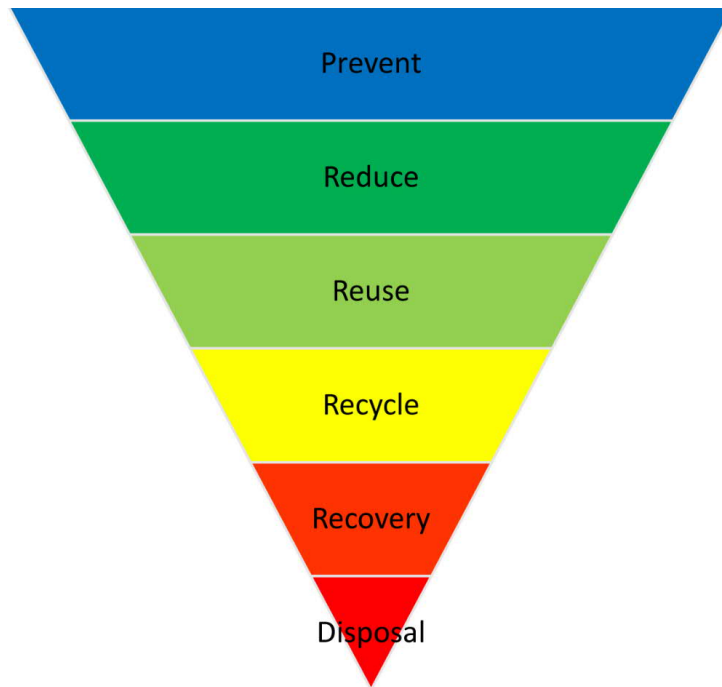
Recycling of Energy Storage Systems



The route of Recycling of Metals



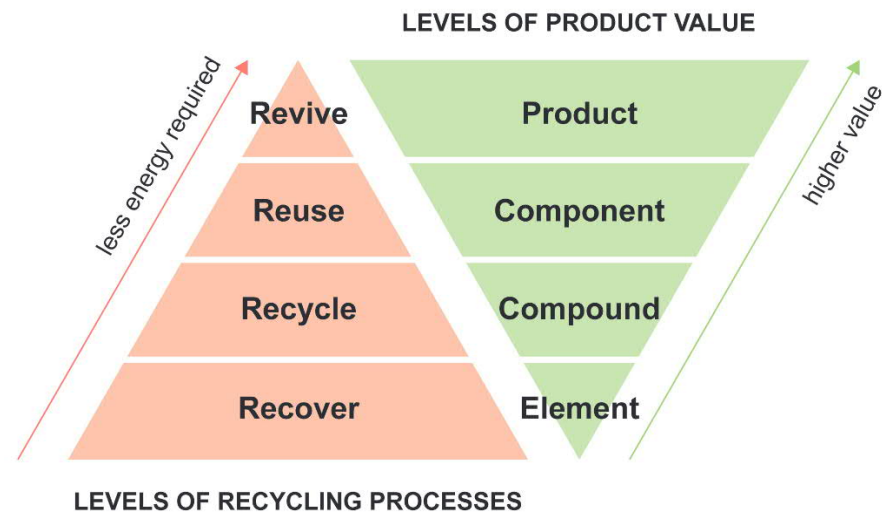
Waste Pyramid



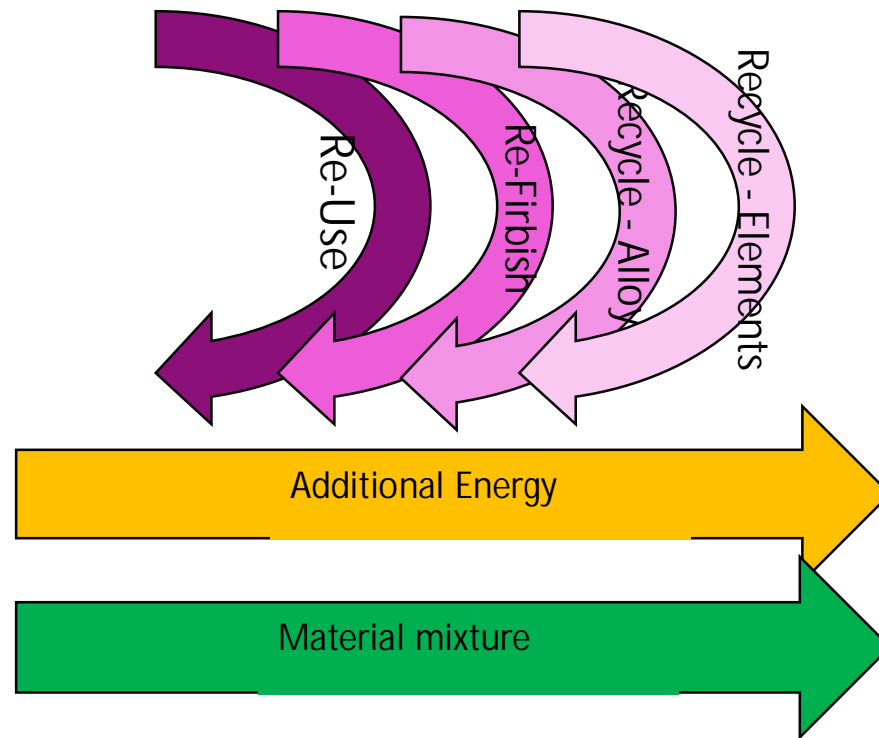
The higher the better

What comes
BEFORE Recycling?

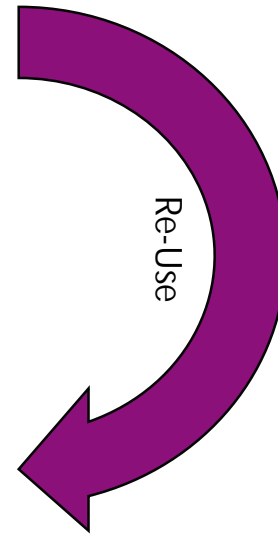
Different recycling levels



Different recycling levels: Chair

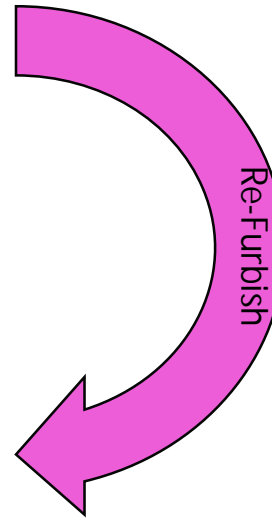


Different recycling levels: Chair



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

Different recycling levels: Chair

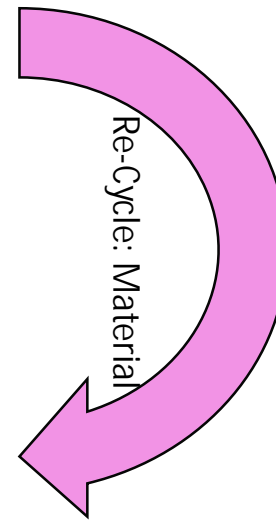


You **invest some energy** into the object, for instance, you change the fabric or paint the chair.

Different recycling levels: Chair



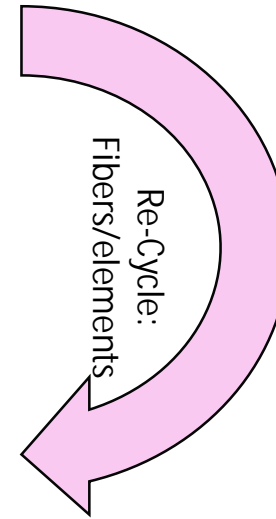
You recycle some parts with not large amount of additional energy, material structures



Different recycling levels: Chair



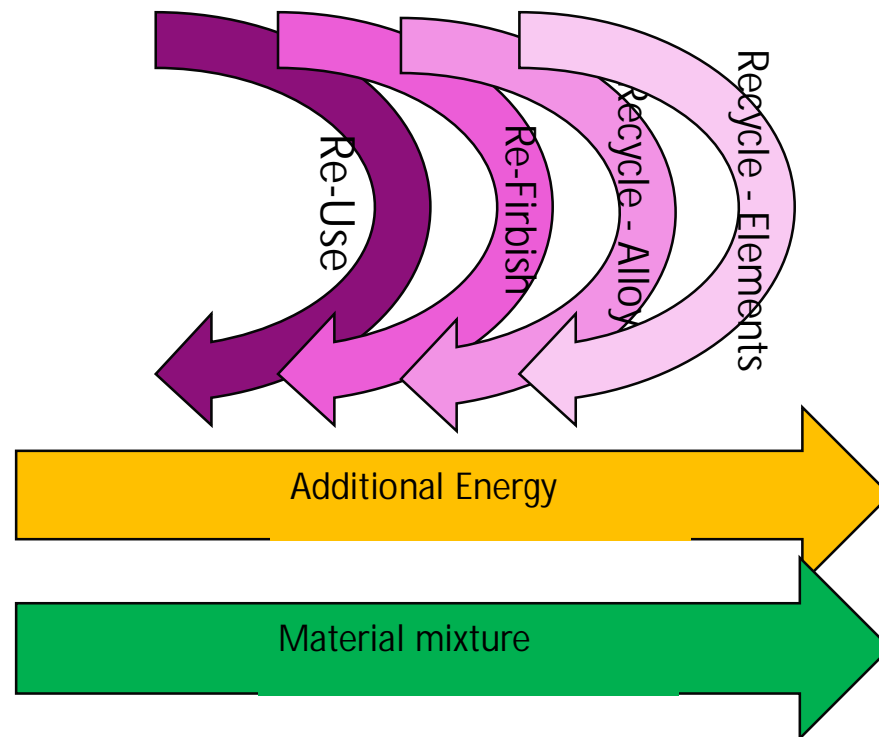
The chair can also be recycled back to fibers (wood/textile) and used in other products. This step requires the most energy input.



Different recycling levels: Chair

Reflect to your lecture journal

Select an energy storage system and discuss these different levels of recycling in the case of 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 to these questions now to your journal.

Take a home message

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