



### 03. Definition

#### The R Strategies

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The 2017 PBL Netherlands Environmental Agency Report identifies a series of ten strategies, called the R strategies, which can lead to the reduction of raw material resources consumption and the production of waste. These strategies focus mostly on the product scale; however, their implications extend to all six scales identified in the Scales to Aspects diagram.

There is an implicit hierarchy between ten Rs as these originate from three completely different circular approaches: some relate to the end-of-life of materials and products, some focus on prolonging the materials' and products' life-span, and some aspire to fostering smart manufacturing.

#### *End-of Life strategies: Recover and Recycle*

The two strategies that refer to the end-of-life scenarios are recover and recycle.

They both relate to solid materials or products that would either be burned without heat recovery or end up in landfills. *Recover is the strategy of incinerating materials to retrieve their energy.* The downside of incineration is that it destroys materials forever. It also requires abundant waste and therefore it may compete the application of other R strategies. That is why it is considered the least circular strategy of all, if at all.

*Recycle on the other hand, is the strategy of*

*processing materials from discarded products.* These secondary materials can be either upcycled and thus through processing become high-quality materials or downcycled, and thus be turned to low-quality ones. Think for example of concrete recycled to be used again in new concrete aggregates compared to concrete being used as rubble. Despite its apparent popularity, recycling is not always feasible, especially for composite material products. In many cases, it is also energy intensive and requires transportation and chemical or mechanical treatments. And just like with recover, recycle may impede the application of higher order R strategies.

#### *Prolonging materials' service-life: Repurpose, Remanufacture, Refurbish, Repair, Reuse*

One level up, the second group of R strategies contains those related to prolonging the life-span of materials.

*Repurpose refers to using discarded products in new functions.* Think of timber pallets being used for making benches for example.

*Remanufacturing is defined as using parts of discarded products to new products of the same function whereas Refurbish is the strategy of modernizing old products.* The two might sound overlapping, but remanufacturing usually implies a



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product's dismantling, whereas refurbish is mostly about replacement of parts.

*Repair* on the other hand, is best described as maintaining broken or malfunctioning products.

Finally, *Reuse* refers to the practice of employing discarded yet usable products for the same purpose, but by a different user.

Although most of these strategies are increasingly gaining traction, it is still difficult to implement them: main reason behind this is *lack of information or the high cost of spare parts*. What is more, *products are not necessarily designed to be demounted* and therefore different protocols are needed to be installed. Lastly, and perhaps most importantly, *some cultural limitations also exist*: society continues to encourage the making of complex products with short life-spans and with planned obsolescence, thus products with an artificially limited useful life.

*Smart manufacturing: Reduce, Rethink, Refuse.*

The last group of strategies refers to smarter product manufacturing. Three strategies form part of this higher level of circularity and apply to the first stages of a product's conceptualization.

*Reduce* refers to using and/or manufacturing products with fewer resources. *Rethink* alludes to intensifying product use and finally, *Refuse*, turning a product redundant by either cancelling its function or by substituting it with a radically different product.

The R strategies do not only require technological innovations but also major socio-institutional changes. Any of the Rs entails a series of

implications that need to be agreed upon a high number of stakeholders and supported by an equally high number of institutions and practices. Think for example of remanufacturing: companies need to establish take-back systems, storage facilities, skilled personnel and perhaps even machinery. Whereas regulations need to specify in which cases remanufactured products are allowed to re-enter the market, what kind of certifications are required and so no.

Before closing, there is one important argument that needs to be made; for any of these changes implied by the Rs to be successful, a shift of mentality is also required. The values discussion is inherent in all of the R strategies. Let's go back to the example of remanufacturing: breaking down a product to retrieve the functional parts and re-insert them in new ones requires caring for the materials and also for the product. Repair also requires caring.

The highest levels of circularity also require the biggest shifts in mentality. Let's consider Rethink. Intensifying a product's use means that many individuals or groups will benefit of the use of the same product by sharing it. Think of car-pooling where one car serves multiple individuals. This may require a technology that will allow individuals to exchange information; however, it also requires that individuals concede to sharing the same means of transportation. The nature and functionality of the R strategies constitute the reason we consider circularity to be both an operational scheme as well as a value system.