

Circular economy WUR 2019-2030

**WUR's circular economy policy
Vision & strategy 2019-2030**



WAGENINGEN
UNIVERSITY & RESEARCH

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Summary

This document describes the circular economy vision and strategy of Wageningen University & Research (WUR). In line with the national circular economy policy of the Netherlands, WUR wants to reduce its (abiotic) resource use with 50% by 2030 as compared to 2014 by refraining from using products or their services, by using less products and using them smarter, and by (re-) using products or their components longer within WUR or elsewhere. Using less products and their components, and (re-) using them for a longer time, will reduce WUR's resource use as well as its waste to be recycled or incinerated.

WUR is not yet monitoring its resource use, but does already monitor its waste production and processing (46% incineration, 37% recycling and 17% various other waste processing methods in 2014). The present waste monitoring will be extended with monitoring of resource use. This enables following progress of WUR's circular policy. Meanwhile, WUR has operationalised its circular economy policy by targeting a 50% or more reduction of incineration and recycling in 2030 as compared to 2014. A 50% reduction of incineration and recycling will presumably roughly equal a 50% reduction of (abiotic) resource use. WUR's strategy for achieving the overall 50% or more reduction distinguishes between three categories of product groups (priority groups underlined; packaging is not a separate product group, but part of the product it packages):

- Buildings
- Product groups providing general services, i.e. vehicles/mobility, decoration & furniture, electronic equipment, printed goods, workplace utensils, office supplies, cleaning & sanitary materials, food & drinks, work clothing
- Product groups exclusively related to research and education (core task of WUR), i.e. laboratory utilities, plants & related, animal & feed, chemicals.

For achieving the overall 50% or more reduction, compensation across categories is not supported, but may be accepted as a last resort for the third category (given research and education is the core business for WUR). Note existing buildings have not been designed and build for dismantling them in reusable components. This may hamper reducing incineration (landfill) and recycling of building demolition waste. WUR's circular economy vision and strategy, including the 50% or more reduction target for incineration and recycling for each category as a whole, will be evaluated on its feasibility in 2025.

Reducing resource use for existing and new products involves different strategies. The main strategy for existing products will be to use these products or their components longer, either within or outside WUR (e.g. longer use of furniture, reusing doors and toilet facilities from demolished buildings). These circularity strategies also apply to new products, but to really close the new product's life cycle, those new products should be made from the same quantity and quality of components and materials as will be recovered and reprocessed after they are discarded. For new to procure products also strategies to reduce their use are available, e.g. by shared use of products (like car sharing, or one smartphone with a work and private sim-card), multifunctional products (like the already in use printer-scanner-copy-fax machines), or refraining from using products (like no desktop computers in practical rooms, because login with own laptop is possible).

New supplier contracts will take their basis in before-mentioned circularity strategies, thereby taking into account potential behaviour undermining circular alternatives, 'greenwashing' and unintended trade-offs. Supplier contracts will guarantee, amongst others, how products and their components will be used longer after they are discarded by WUR (e.g. by including a take-back condition for the supplier).

WUR will replace the present waste management contracts by a resource management contract. The contractor will help WUR with looking for new users of discarded products and their components, providing expert input on circular alternatives for products or their services, working on replacing low-grade by high-grade recycling, and by flexibly accommodating changing quantities and composition of waste to be incinerated or recycled.

The success of WUR's circular economy policy depends on acceptance and support by, and behaviour of students and employees whose expertise WUR will furthermore use where possible. WUR will also cooperate where possible with non-WUR organisations and companies on the campus, and Wageningen municipality.

Samenvatting

Dit document beschrijft de circulaire economie visie en strategie van Wageningen University & Research (WUR). In lijn met het circulaire economiebeleid van de Nederlandse overheid wil WUR het gebruik van (abiotische) grondstoffen vóór 2030 halveren ten opzichte van 2014 door af te zien van producten en hun functie, door producten slimmer te gebruiken, en door langer (her-) gebruik van producten en hun componenten binnen de WUR of elders. Het gebruik van minder producten en hun onderdelen, of een langer (her-) gebruik ervan, zal WUR's grondstoffengebruik, alsook het te verbranden of recyclen afval verminderen.

WUR monitort haar grondstoffengebruik nog niet, maar haar afvalproductie en -verwerking al wel (46% verbranding, 37% recycling en 17% andere afvalverwerkingsmethoden in 2014). De huidige afvalmonitoring zal worden uitgebreid met monitoring van het grondstoffengebruik. Dit maakt het mogelijk de voortgang van WUR's circulaire economiebeleid te volgen. WUR heeft haar circulaire economiebeleid geoperationaliseerd met de doelstelling om minimaal 50% minder te verbranden en te recyclen in 2030 ten opzichte van 2014. Halvering van verbranding en recycling zal naar verwachting het (abiotische) grondstoffengebruik ook grofweg halveren. Voor het bereiken van de halveringsdoelstelling onderscheidt WUR drie categorieën productgroepen (prioritaire productgroepen zijn onderstreept; verpakkingen zijn geen aparte productgroep, maar onderdeel van het product dat ze verpakken):

- Gebouwen,
- Productgroepen met algemeen nut, namelijk voertuigen/mobiliteit, decoratie & meubels, elektrische apparaten, drukwerk, werkplaatsbenodigdheden, kantoormaterialen, schoonmaak & sanitair, voedsel & dranken, werkkleding,
- Productgroepen met specifiek belang voor onderwijs en onderzoek (kerntaak van WUR), namelijk laboratorium benodigdheden, planten & toebehoren, dieren & voedsel, chemicaliën.

Behalen van de halveringsdoelstelling door compenseren tussen categorieën wordt niet aangemoedigd, maar kan uiteindelijk nodig zijn voor de derde categorie (gezien onderzoek en onderwijs de kernactiviteit van WUR is). Let op dat bestaande gebouwen niet ontworpen en gebouwd zijn voor ontmanteling in herbruikbare componenten. Dit kan het reduceren van verbranding (storten) en recyclen van sloopafval bemoeilijken. WUR's circulaire economie visie en strategie, inclusief de halveringsdoelstelling voor afvalverbranding en materiaalrecycling voor elke categorie als geheel, zal in 2025 worden geëvalueerd op haalbaarheid.

Verminderen van grondstoffengebruik voor bestaande en nieuwe producten vraagt om verschillende strategieën. Voor bestaande producten is de hoofdstrategie om deze producten of hun onderdelen langer te gebruiken, binnen WUR dan wel elders (bijv. langer gebruik van meubels, hergebruik van deuren en toiletputten uit afgebroken gebouwen). Deze circulariteitsstrategieën gaan ook op voor nieuwe producten, maar om de cirkel voor nieuwe producten echt te sluiten, moeten deze producten uit evenveel gebruikte productonderdelen en gerecyclede materialen met dezelfde kwaliteit worden gemaakt als na afdanking worden teruggewonnen en opnieuw toegepast. Voor nieuw in te kopen producten zijn ook andere circulariteitsstrategieën beschikbaar, bijv. productdelen zoals voor auto's of een smartphone voor werk en privégebruik, multifunctionele producten (zoals de al in gebruik zijnde print-scan-kopieer-fax apparaten), of door af te zien van productgebruik (zoals niet langer meer computers in practica ruimten, maar loginmogelijkheden voor de eigen laptop).

Nieuwe contracten met leveranciers nemen voornoemde circulariteitsstrategieën als uitgangspunt, daarbij rekening houdend met potentieel ondermijnend gedrag, 'groen wassen' en ongewenste terugkoppeling. De nieuwe contracten met leveranciers garanderen onder andere hoe producten en hun onderdelen langer gebruikt zullen worden na hun afdanking door WUR (bijv. voor een terugname-afspraken met leveranciers).

WUR zal de huidige afvalcontracten vervangen door 'grondstoffencontracten'. De opdrachtnemer hiervan zal WUR actief helpen zoeken naar nieuwe gebruikers voor afgedankte producten en hun onderdelen, expertinput geven over circulaire alternatieven voor producten of hun diensten, laag- door hoogwaardige recycling vervangen, en veranderende hoeveelheden en samenstelling van te verbranden of recyclen afval kunnen accommoderen.

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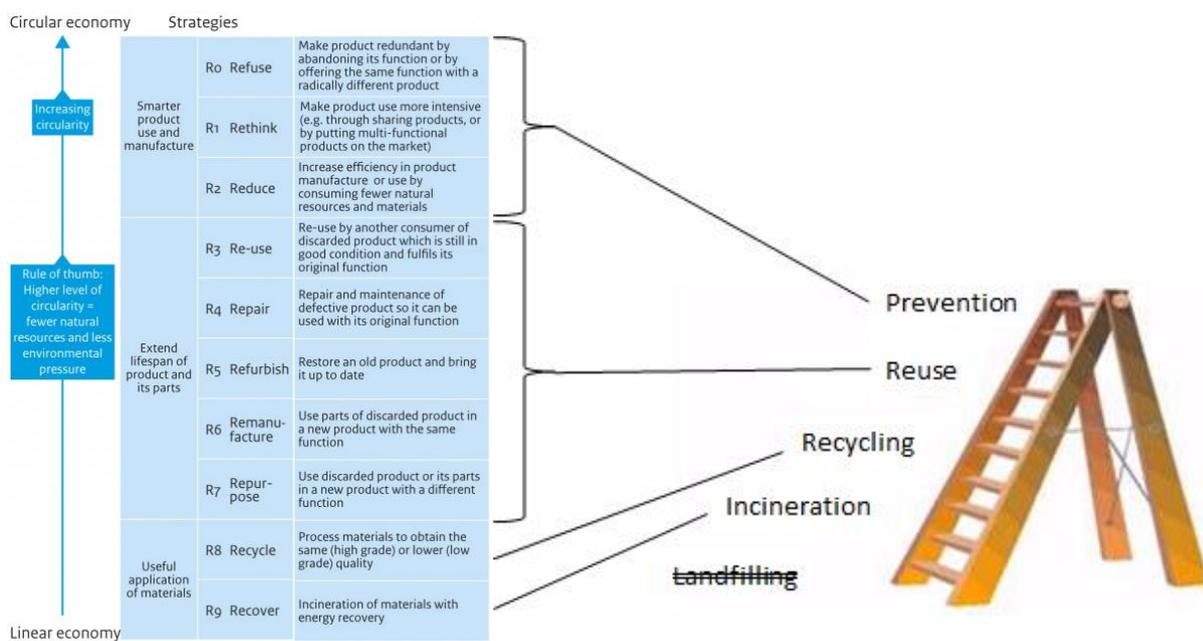
Vision

Dutch circular economy policy program aims at radical reduction of national (abiotic) resource use

In 2016, the Dutch government released its policy programme ‘A circular economy in the Netherlands by 2050’. The policy programme targets to substantially reduce the Dutch use of abiotic resource, i.e. minerals, metals and fossil resources. The interim-target is a 50% or more reduction by 2030 as compared to 2014. The target for 2050 is to reduce abiotic resource use to the minimum achievable. The policy programme wants to realise this via three strategic aims. Abiotic resources should be replaced by sustainably extracted, widely available and renewable resources (e.g. biobased resources; 2nd strategic aim). Both abiotic and biotic resources should be more efficiently used in existing product chains (1st strategic aim) and in new product chains (3rd strategic aim)¹.

Resource efficiency can be increased by implementing, in decreasing order of priority, the circularity strategies in Figure 1. The upper three strategies further specify prevention (R0-R2) and the middle five strategies further specify reuse (R3-R7) in the waste hierarchy. The waste hierarchy is in the Netherlands also known as ‘ladder of Lansink (see Figure 1). Circular economy basically represents a shift from waste management to resource management of which waste management is part^{2,3}.

Implementing the circularity strategies in Figure 1 will lead to less new products, less new product components and less new materials. This consequently results, as a rule of thumb, in fewer resources needed to be extracted for producing new (primary) materials in new (primary) product components and new (primary) products.^{1,3}



Source: RLI 2015; edited by PBL

Figure 1: Priority order of circularity strategies in product chains on the left³, and waste hierarchy or ‘Ladder of Lansink’ at the right⁴, and the relation between both (landfilling is crossed out as to express this is nearly forbidden in the Netherlands nowadays)

¹ IenM & EZ (2016). A circular economy in the Netherlands by 2050. Den Haag: Ministry of Infrastructure and Environment (IenM) & Ministry of Economic Affairs (EZ).

² Blomsma F and Brennan G. (2017). The Emergence of Circular Economy: A New Framing Around Prolonging Resource Productivity. Journal of Industrial Ecology, 21(3): 603–614 (doi:10.1111/jiec.12603).

³ Potting, J. & A. Hanemaaijer (2018). Circular economy: What we want to know and what we can measure. Framework and baseline assessment for monitoring the progress of the circular economy in the Netherlands. Den Haag: PBL Netherlands Environmental Assessment Agency.

⁴ IGEAN (2019). IGEAN-internetsite (https://milieuveiligheid.igean.be/product/512/default.aspx?_vs=0_N.&id=64).

WUR performs well on waste processing, and wants shifting focus to reduction of resource use

WUR monitoring results for waste production and processing in 2014⁵ show 46% incineration of residual and bulky waste, 37% recycling (green, paper, glass, plastic, construction & demolition, others), and 17% various waste processing methods. WUR's 46% incineration of residual and bulky waste complies with the Dutch waste policy target of halving residual waste⁶. WUR now wants to make a next step with a circular economy policy that moreover may be facilitated by the required renewal of its waste contracts in 2021 latest (see page 10 'WUR's waste processing ... resource management contracts'). WUR's circular economy policy, as proposed in this document, complements and encompasses WUR's present waste policy⁷ as well as its present policies on energy⁸ and climate change⁹ (see also page 3 'Circular economy should ... other sustainability issues'), and mobility policy¹⁰ (see also page 4 'WUR will use ... for prioritizing products' and page 7 'Circular procurement ... undermining circular initiatives').

The here proposed circular economy policy is a follow-up on WUR's Corporate Social Responsibility (CSR)¹¹ agenda in which waste & circularity is a priority topic, and on WUR's Strategic Plan 2019-2022¹² in which circularity is one of the key words. Circularity should be addressed in research, education and value creation, as well as in operations: "In our procurement policies and practices we push supply chains to be transparent, sustainable, circular and free from modern slavery."¹²

WUR's circular economy policy complies with Dutch circular economy policy programme

National resource use¹³ can be extracted from national statistics¹³, but WUR does not yet monitor its own resource use. Presumably, a further 50% reduction of incineration and recycling will roughly equal 50% reduction of (abiotic) resource use (~ primary material use). This would make WUR complying with the Dutch circular economy programme. Therefore WUR targets to reduce its incineration and recycling with 50% or more by 2030 as compared to 2014, by refraining from using products or their services, by using less products smarter, and by (re-) using products or their components longer within WUR or elsewhere. This means, in other words, moving up in the order of circularity strategies for existing and new products or their services (see figure 1). WUR will replace products made from abiotic resources by biotic ones where relevant. WUR's circular economy target and strategy will in 2025 be evaluated on its feasibility.

Circularity means that the same secondary components & materials are used in, and produced by products

Products are only circular if they consist of the same quantity and quality of before-used (secondary) components and recycled (secondary) materials as will be recovered and reprocessed after the product is finally discarded. Products using but not producing secondary components or materials cause these to be no longer available for other products (e.g. present secondary metal demand exceeds its supply). The other way around, products producing but not using secondary components or materials may lead these to be incinerated after all (e.g. there may be too little demand for, presently often still low-grade secondary plastic). Products using and producing a dissimilar quantity or quality of secondary components and materials do not result in reduction of resource use on the level of economy as a whole. Truly closing the product circle,

⁵ WUR (2015). Wageningen UR 2014 Annual environmental report. Report of the environmental results of Wageningen UR operational management. Wageningen: Wageningen University & Research.

⁶ LAP3 (2017). Derde landelijk afvalbeheersplan (LAP3). Internetpublicatie (<https://lap3.nl/>; last visited May 2019).

⁷ Wageningen UR (s.d.). Wageningen UR Waste policy & implementation. Wageningen: Wageningen University & Research.

⁸ Wageningen UR (2014). Energy Vision for 2030. Wageningen: Wageningen University & Research.

⁹ Klimaatpartners Nederland (2017). Klimaatplan 2017-2021. Wageningen.

¹⁰ Wageningen UR (2019). Mobiliteitsvisie 2030. Duurzame mobiliteit bij Wageningen University & Research. Wageningen: Wageningen University & Research.

¹¹ <https://www.wur.nl/en/Research-Results/Research-Institutes/Environmental-Research/About-us/Corporate-Social-Responsibility.htm>

¹² Wageningen UR (2018). Strategic plan 2019-2022. Finding answers together. Wageningen: Wageningen University & Research.

¹³ CBS (2016). Circulaire economie in Nederland. Den Haag: Centraal Bureau voor de Statistiek.

thereby achieving a reduction of resource use, is an important leading principle in WUR's circular economy policy.

Note that calculation procedures in mainstream life cycle assessment (LCA) do not adequately address that a circular product should use and produce components and secondary materials in the same quantity and quality (see Annex 1 for how to address this properly).

Big steps where possible, small ones where achievable for new circular products and their services

WUR thus targets an overall 50% or more reduction of incineration and recyclings (~ 50% or more reduction of resource use) in 2030 as compared to 2014. Higher circularity strategies and/or large resource use reductions may be possible for some products, but not (yet) achievable for other products due to a combination of reasons. For these latter products, WUR prioritizes small steps forward over delaying progress or no progress at all.

Circular products should also benefit the environment and other sustainability issues

The need for fewer resources, as a rule of thumb, goes hand in hand with less environmental pressure. After all, environmental pressures are typically reduced when resource extraction is avoided and less new materials, components and products need to be produced (see Figure 1). Benefitting the environment is a main underlying aim of the national circular economy policy¹, and is also of core importance to WUR. Additional to reducing resource use, particularly of abiotic resources, circular procurement by WUR should result in less environmental pressure for the product at stake. WUR already has a target of a 2% reduction of its annual direct energy use⁷, whereas its direct energy use should be carbon dioxide neutral⁸. The same reduction target for direct energy, and the requirement of carbon dioxide neutrality, will from now on apply to indirect energy use (i.e. for from-cradle-to-gate material production and waste processing). Indirect energy use and carbon dioxide emissions may slightly increase if this enables a considerable reduction in (abiotic) resource use (see page 2 'Circularity means secondary ... used and produced by products'). Specific product groups may have additional reduction targets for product-specific environmental pressures (see Table 1).

As already mentioned on page 2, citing WUR's Strategic Plan 2019-2022¹², 'in our procurement policies and practices we [also] push supply chains to be [...] free from modern slavery'.

Strategy

Buildings dominate mass, costs and global warming potential of WUR's product inflows

WUR performed a so-called product flow analysis (PFA) for the purpose of this vision and strategy document. This PFA provides quantitative estimates for costs, mass and carbon dioxide emissions of inflows of procured products and outflows of waste based on detailed procurement and waste data for WUR in 2017 (a summary of the PFA is retrievable from Annet.deHaas@wur.nl). Stocks of long-lived products in WUR, i.e. not bought or discarded in 2017, were not covered by the PFA. For product inflows, also their material composition, shares of abiotic and biotic materials, and cradle-to-material carbon dioxide equivalents and energy use were estimated based on product specific data (including weighting them), databases and literature. Product inflows were next ranked according to their mass shares in total mass of product inflows. The results are summarized in Table 1 that also indicates other environmental issues relevant for specific product main categories. Buildings (i.e. a multi-storey parking garage & renovation works) clearly dominate mass, costs and global warming potential of WUR's product inflows in 2017. Note packaging is not a separate product group, but is part of the product it packages (and thus belongs to that product group).

Table 1: Costs, mass and environmental pressure estimates of product groups for WUR in 2017 (ranked by share of product inflows in total mass inflow to WUR; 3rd column)

| Product groups | Costs ^a | Mass ^b | Biotic ↔ abiotic ^c materials | Carbon dioxide equivalents ^d | Energy use ^d | Other environmental issues typically associated |
|--------------------------------|--------------------|-------------------|---|---|-------------------------|---|
| Buildings | 40.2% | 81.0% | 99% | 47.1% | 14.9% | |
| Laboratory utilities | 19.5% | 3.0% | | 15.2% | 28.6% | |
| Plants & related | 0.8% | 2.9% | 85% | 2.3% | 2.8% | Land use, eutrophication, acidification |
| Animal & feed | 2.4% | 2.8% | | 1.4% | 1.2% | Same as for plant & related, animal welfare |
| Vehicles | 0.5% | 2.3% | | 8.8% | 13.5% | |
| Chemicals | 7.6% | 1.2% | | 3.7% | 3.2% | Human and ecotoxicity |
| Decoration & furniture | 2.2% | 1.1% | 93% | 3.6% | 6.3% | |
| Electronic equipment | 16.0% | 1.1% | | 5.1% | 5.4% | Scarce precious metals |
| Printed goods | 2.6% | 1.1% | | 1.9% | 4.0% | |
| Workplace utensils | 4.0% | 1.0% | | 4.0% | 7.6% | |
| Office supplies | 1.0% | 1.0% | 65% | 3.4% | 6.8% | |
| Cleaning & sanitary material | 0.4% | 0.7% | 89% | 1.3% | 2.2% | Water pollution from detergents |
| Food & drinks | 2.2% | 0.6% | 67% | 0.9% | 0.7% | Land use, eutrophication, acidification |
| Work clothing | 0.8% | 0.2% | 84% | 1.1% | 2.3% | Water scarcity for cotton |
| Fuels | 0.0% | 0.2% | | 0.3% | 0.6% | Acidification, eutrophication, particulate matter |
| Total of product groups | 100% | 100% | 82% | 100% | 100% | |
| Packaging ^{e,f} | | 2% | 79% | 4% | 7% | |

^a Procurement costs in % (i.e. product inflows), waste processing costs from high to low in dark to light colours (i.e. product outflows)

^b Product groups are ranked according to their mass shares in total mass of procured products (i.e. product inflows)

^c Abiotic materials includes unknown materials

^d Carbon dioxide equivalents and energy use are based on cradle-to-material calculations

^e Packaging for buildings and vehicles (and fuels) are not included in the total (total expressed relative to total product groups)

^f Packaging is quantified separately from the products they package, although it does not represent a separate product group, but is part of the product it packages (and thus belongs to that product group)

WUR will use mass and environmental pressures as main criteria for prioritizing products

Circular economy is about reducing resource use, in particular abiotic resource use. Mass and abiotic materials share in Table 1 thus give a first indication of product groups to be prioritized in WUR's circular policy. The other columns in Table 1 give additional information. There are also other considerations for prioritizing product groups. These considerations were partly put forward in two stakeholder workshops during preparations for the circular economy policy proposed here. WUR used the following criteria for prioritization of product groups:

1. Mass share of product group in total mass of product inflows (3rd column in Table 1)
2. Mass share of abiotic resources in total mass of product groups (4th column in Table 1)
3. Environmental pressure of product groups, including resource scarcity (5th, 6th and 7th column in Table 1)
4. Costs of product groups (2nd column, i.e. columns 2a & b, in Table 1)

5. Availability of circular alternatives for product groups, or products belonging to them
6. Existing or upcoming product-related regulations at the national or local level
7. Influence of product groups, or products belonging to them, on WUR's image
8. Product groups being core subjects of research and education of WUR
9. Fit of circular alternatives with Facility and Services processes
10. Influence of circular products on their services
11. Possibility for involving non-WUR organisations & companies on the campus, or Wageningen municipality

For its circular economy, based on above criteria, WUR prioritizes buildings, laboratory utilities, chemicals, decoration & furniture, electronic equipment, food & drinks (see Annex 2 for specific products in product groups). Added to this list of priority product groups are vehicles, actually mobility in general (e.g. traveling by plane), given their fuel uses involved (only partly covered in the PFA and Table 1). Fuel use for transportation is a major contributor to climate change. Packaging is also added as a priority, but as mentioned in previous section, packaging is not a separate product group but part of the product it packages (and thus belongs to that product group).

Even when product groups are not prioritized, circular alternatives will at minimum be explored when the present supplier contract expires and a new one has to be set for those product groups. Prioritizing product groups means, however, that improving their circularity will be addressed regardless of their procurement, e.g. through prolonged use of products (R3-R5) by extending their depreciation period. Note that exploration of circular alternatives should cover (from-cradle-to) procurement, use and end-of-life processing of products (see page 6 'Circular procurement should ... end-of-life processing of products').

Overall target of 50% or more reduction of incineration and recycling varies across product groups

Building of a multi-storey parking garage construction & renovation works clearly dominate product inflows in 2017. Building-related inflows and outflows may highly vary from year to year, depending on new building construction or old building demolition. The other product groups partly provide general services and partly are exclusively related to research and educations (i.e. the core-business of WUR). WUR's strategy therefore distinguishes for its circular economy policy target between the following three categories of product groups (note packaging is prioritized, though not a separate product group, but is part of the product it packages and thus belonging to that product group):

1. Buildings.
2. Product groups providing general services: i.e. vehicles/mobility, decoration & furniture, electronic equipment, printed goods, workplace utensils, office supplies, cleaning & sanitary materials, food & drinks, work clothing.
3. Product groups exclusively related to research and education (i.e. laboratory utilities, plants & related, animal & feed, chemicals).

WUR's overall target of 50% or more reduction of incineration and recycling compared to 2014 applies to each category as a whole, but not to its product groups separately. When the reduction for product groups within a category lags behind, this will need additional compensating reduction for other product groups within that category. Compensation across categories is not supported, but may be accepted as a last resort for the third category (given research and education is the core business for WUR). It should be noted, that existing buildings have not been designed and build for dismantling them in reusable components (e.g. doors and window frames). This may hamper reducing incineration (landfill) and recycling of building demolition waste in particular. WUR's circular economy vision and strategy, including the 50% or more reduction target for incineration and recycling for each category as a whole, will be evaluated on its feasibility in 2025.

Buildings, decoration & furniture, electronic equipment, and food & drinks represent priority product groups and chemicals represent priority groups. This leaves above specified reduction targets across product groups unchanged, but means reducing incinerations and recycling for these product groups remains a continuous point of attention. Non-priority product groups are in principle only addressed when there is a reason for that, e.g. when its new supplier contract needs to be renewed.

The 50% or more reduction of incineration and recycling should be achieved by moving up in the order of circularity strategies for existing and new products. WUR's will replace products made from abiotic resources by biotic ones where relevant (see page 2 'WUR's circular economy ...policy program').

In addition, WUR targets a 2% reduction of indirect energy use and carbon dioxide neutrality (i.e. for from cradle-to-gate material production and waste processing). Indirect energy use and carbon dioxide emissions may slightly increase if this enables a considerable reduction in (abiotic) resource use (see page 3 'Circular products ...sustainability issues'). Specific product groups may have additional reduction targets for product-specific environmental pressures (see Table 1).

Main circularity strategies for WUR's existing product stocks involve longer using them

Stocks of long-lived products in WUR, i.e. not bought or discarded in 2017, were not covered by the PFA described on page 2 'Buildings dominate ... product inflows' and summarized in Table 1. However, these stocks represent an enormous quantity (i.e. WUR's inflows multiplied by average lifespan of long-lived products). Main strategies for improving the circularity of long-lived products and their components involve extending their lifespan (R3-R7). Product lifespan extension within WUR may be achieved through stimulating their prolonged use of products by extended depreciation periods and better maintenance (& repair) and refurbishment schemes (R3-R5). Lifespan extension of products and their components outside WUR may be achieved through selling or donating discarded products to secondary users (R3-R7).

Stocks of existing products can also be used as 'spare change' in new supplier contracts. A sufficient number of old chairs, for example, could be taken back by a supplier of newly procured refurbished or remanufactured chairs (R5 & R6), so the supplier can refurbish or remanufacture the old WUR-chairs for a next sale. Lifespan extension is not necessarily preferred for products needing resource for operating them. Replacing electronic equipment might be more circular, for example, if the existing product is using considerably less electricity compared to its new alternative.

Circularity strategies Refuse (R0), Rethink (R1) and Reduce (R2) are mainly of interest for products or their services for which supplier contracts need to be renewed. For some products, however, Facility and Services may stimulate intensified use (e.g. like they do for vehicle use by means of organising a sharing platform; R2).

New circular procurement provides key leverage for WUR's circular economy policy

WUR is committed to Corporate Social Responsibility (CSR) in all its activities. "Waste and circularity" is one of the priority topics on WUR's CRS Agenda. Central to the approach is that procurement trajectories provide the opportunity to scan the market for innovative CSR-proof solutions, thus providing momentum for change. Procurement of products, or of services provided by products, indeed gives the perfect opportunity for moving up in the order of circularity strategies (see Figure 1). WUR has multi-year contracts with suppliers for specific products needed on a regular basis. Circular procurement becomes at stake when a new contract is needed for a specific product or its service, usually because the current contract expires. This will to some extent set the pace for the implementation of WUR's circular economy policy.

Circular procurement should address the use and end-of-life processing of products

Procurement is only circular if a net reduction of resource use (and environmental pressures) is obtained from cradle-to-procurement, use and end-of-life processing of product (see also page 2 'Circularity means secondary used and produced by products'). Evaluating such net reduction basically requires a similar kind of thinking as needed for calculating financial operating costs for products, i.e. costs related to (from-cradle-to) procurement, use (e.g. for operating resources or work-time), and end-of-life processing of products.

The lifespan of new products, similar as for existing products (see page 5 'overall target ... across product groups'), may be prolonged through better maintenance (& repair) and refurbishment schemes (R3-R5). Modular design of products may moreover enable upgrading products (R5) to best available technology (e.g. replacing a telephone's processor) or current fashion (e.g. re-shuffling and partial replacing carpet tiles). New

products needing resource for operating them, e.g. water & soap for dishwashing, often will be more efficient compared to its old version (R2; thanks to autonomous resource efficiency improvements in technologies). Products can also be designed for using less operating resources (R2), e.g. washing machines automatically tuning their water & soap use to textile loads. Claimed operating resource efficiency of products may on the other hand sometimes lead to more operating resource used, e.g. new electronic equipment using more energy due to more powerful electronic components with higher performance than old electronic equipment.

Products may also be procured with the intention of a prolonged use outside WUR (R3-R5), reprocessing of its components in new products (R6-R7), or recycling of its materials (R8). Particularly circularity strategies R6-R8 need products to be of modular design (i.e. designed for disassembling), enabling disassembling of discarded products, reprocessing of their components and recycling of their materials. This reprocessing and recycling does not happen by itself, but needs anticipative thinking and possibly already action in the procurement stage about how to facilitate this (possibly as part of the supplier contract). WUR procurement processes start with a product manager outlining the expectations for the new to procure product or its service. A multidisciplinary team next translates this in a call for tenders complying with legal and other requirement. Once the new supplier contract is signed, a contract manager takes care the contract is executed as agreed. In practice the procurement process is an iterative one, and the contract manager is often part of the multidisciplinary team together with a procurement officer.

WUR's procurement and contract officers are used to think through the need for operational resources and services in using products (i.e., as to calculate related operational costs). They are less used though to also consider waste processing as this will take place in the far future for long-lived products particularly. WUR's present waste officers, which will be replaced by resource officers (who will also cover waste management) as well as the new resource management contractors (see page 10 'WUR's waste processing ... resource management contracts') will therefore from now onwards be involved in the procurement process from its start. This will be included in the procurement protocol of WUR (see page 11 'WUR's procurement protocol ... circular considerations'). Furthermore, procurement and contract officers, and resource officers will in 2020 get training in circular thinking (see page 10 'Acceptance and support ... by WUR-community').

Some WUR-suppliers, e.g. of office furniture or hot beverage vending machines, already offer their products combined with a guaranteed take back and reprocessing of components and recycling of materials in these products. These and other WUR-suppliers, e.g. of multi-functionals, also offer a service contract for maintenance and repair of their products (R4). This keeps their products in good shape, which may extend their lifetime with a first or second customer (reuse; R3), possibly after refurbishing the product (R5), or else facilitate reprocessing of its components and materials (R6-R8). Circular offers like these should be checked as to whether they really lead to reduction of resource use and environmental pressures (i.e. no undermining behaviour, greenwashing or unintended trade-offs; see next two sections).

Circular procurement should anticipate behaviour undermining circular initiatives

Circular alternatives for an existing product (or its service) sometimes require substantial behavioural changes in using or providing that product (or its services). Users and providers of that product (or its service) may nevertheless show resistance to change to such behaviour. It appears to be difficult, for example, to make some employees printing less (despite existing measures of Facility and Services intended to achieve so). Similarly, some caterers incidentally serve disposable (plastic) tableware or cutlery during peak hours (despite agreements with Facility & Services about avoiding this). Available circular products may not be procured because employees authorized to procure are too accustomed procuring (still available) non-circular alternative.

Circular alternatives may also lead to unintended increased use of product (services), for instance because they become easier to use. Car sharing initiatives, for example, may make it easier for users to take a car instead of a bike or public transport. Disposable cups may not be better or worse than reusable cups if they are used equally often before being thrown away or washed, but some users take two cups if they consider a beverage too hot in the hand with one cup only.

There are numerous examples and reasons for (unintended) behaviour, either by users or providers of a product (or its service), that undermine circular alternatives becoming successful in realising the intended resource use reduction. Procurement officers carefully need considering potential undermining behaviour when exploring circular alternatives for existing products or their services.

Circular procurement will be stimulated by making the procurement-software offering circular products as the first choice. WUR is presently implementing such circular alternative as a first choice for mobility procurement. Traveling by train sometimes involves less energy use (and related carbon dioxide emissions) than traveling by plane (while also being faster). Car traveling may be more efficient for other destinations, and will then be offered via a car sharing platform. Other ways for changing the behaviour of users or providers of products or their services will be a continuing point of attention for Facility and Services. Sometimes a change in behaviour is prevented by regulations, or regulations in another way prevent introduction of circular alternatives. In such case, procurement officers may explore exemption by the Dutch government (<https://www.ruimteinregels.nl/>).

Circular products should not lead to ‘greenwashing’ or unintended trade-offs

Products using and producing a dissimilar quantity or quality of secondary components and materials do not result in resource gain on the level of economy as a whole (see page 2 ‘Circularity means secondary ... used and produced by products’). Behaviour may undermine circular alternatives to achieve the intended resource use reduction (see page 2 ‘Circularity means secondary ... used and produced by products’).

The circularity strategies in Figure 1, as a rule of thumb, lead to less resource use and environmental pressures with higher strategies (lower R’s). Note less resource use and environmental pressures should be related to the amount of function or service delivered by a product. By making packaging more robust, i.e. typically more heavy, it may become reusable multiple times (meaning less resource use and environmental pressures per unit of service or function). The rule of thumb does on the other hand not apply, however, when large amounts of resources are needed for implementing a given circularity strategy. This can be the case with energy use for recycling processes (i.e. washing and drying or chemical processing).

Circular alternatives may also have unintended trade-offs. Disposable cups may not be better or worse than reusable cups if they are used equally often before being thrown away or washed, but some users take two cup if they consider a beverage too hot in the hand with one cup only. Separating coffee grounds waste will involve extra effort (i.e. costs) and environmental pressures for collection and transport that may exceed the circular gain from reprocessing the coffee grounds (i.e. for growing mushrooms).

Procurement officers should also be aware for suggested circular improvements not feasible in practice. This may be the case for bio-based plastics marketed as biodegradable. Even when such plastics are offered separately, industrial composters typically dispatch them anyway to the incinerator as potential pollution with non-degradable fossil plastics may cause disruption of the composting process. Similarly, procurement officers should be alert on suggested circular alternatives not really representing improvements in practice. This may be the case for offers to an organisation for recycling (high-grade) paper waste from that organisation into (low-grade) toilet paper for that organisation. This would skip interim-grade paper qualities yet typical in paper recycling cascades.

Proposed circular alternatives thus need a good underpinning of the reduction in resource use and environmental pressures they intend (or claim) to achieve.

WUR may stimulate circular economy by paying for using products instead of owning them

Moving up on the hierarchy of circularity strategies may be enabled by procuring the service of products rather than the products themselves. Airport Schiphol, for example, presently procures light from Philips who still owns the lamps and luminaires providing this service according to the agreed performance criteria, including required maintenance and repairs. This stimulates Philips to keep lamps as energy efficient as

possible, because that reduces their costs of supplying light, whereas it facilitates reprocessing before-used components and recycled materials. Some main procurement models:

- Conventional buy in which WUR pays at once for a product that therewith immediately becomes property of WUR
- Conventional buy of a product, but with a take back guarantee fee from the supplier to WUR upon return of the product, after which the property goes back from WUR to the supplier
- Financial lease of a product (e.g. a car for a specific user) that WUR pays off to the supplier who keeps juridical property until pay offs are completed, but leaves WUR to take care and additionally pay for operating the product (e.g. for its maintenance, repair and operating resources as gasoline)
- Renting or operational lease of a product (e.g. a car for different consecutive users), for which WUR pays a fixed price to the supplier who keeps property and also maintains & repairs the product, only needing WUR to take care and additionally pay a price that varies according to operating resources used
- Full service lease of a product (e.g. a hot beverage vending machine), which remains property of the supplier who also takes care for operating the product, and for which WUR periodically pays to the supplier a price that varies according to operating resources used (e.g. coffee and disposable cups)
- Pay per use of a product, where WUR pays a fixed price per unit of product service, independent of the actual costs the supplier need to make for providing this product service

Paying-for-use procurement models are already commonly used for some products, also by WUR, as they provide several advantages above conventional buy. When a new supplier contract is due to be set, WUR will explicitly evaluate whether the circularity of given product or its service alternatives may be enhanced by above procurement models (or combinations or in-between versions of them).

Circular products and their services should still be outstanding, but may cost a little more

Circular products of course need to provide optimal services to their users, unless it is strategy to discourage their use. This can be the case in a 'bring your own ICT-device' approach facilitated by easy internet access, while workplaces are no longer equipped with desktop-devices and borrowing WUR-devices requires some effort from users. Circular products also need to have a good fit with other facility and services arrangements of WUR, and should not ask (substantially) more time or efforts for facilities or services needed to enable their use (i.e. involving operational costs). Circular products may sometimes be more expensive than conventional products, e.g. because of their modular design, equipped with a track and trace system, or will be collected separately for reprocessing of their components or materials. To the extent possible, records will be kept whether circular products and/or their services cost more (or less) than their non-circular alternatives (see also page 11 'WUR will start monitoring progress of WUR's circular economy policy in 2020').

WUR relies on expertise and creativity of its students & employees, and product (service) suppliers

WUR will leave it to the expertise and creativity of suppliers to come with feasible circular product (service) tenders by setting clear circular targets, conditions or requirements to be met. WUR may evaluate tenders, besides looking to financial cost, by also accounting for circularity values by expressing them as gains in financial terms. WUR already has a history in following these principles for procuring products (e.g. sanitary paper) and outsourcing services with products needed for that (e.g. catering, hot beverage vending machines, multi-functionals for printing etc., cleaning and sanitary service).

WUR may use inspiration sessions before starting product (service) tenders to unlock, and stimulate cross-fertilization, of expertise and creativity from students & employees of WUR and product (service) suppliers. This will help WUR to fine tune tender conditions and requirements, and stimulate a broader range of circular offers to WUR.

Students asked to explore circularity of products (and their services) as part of their study

Input from research and education is valuable in shaping and implementing WUR policies in internal business operations, providing opportunities for research pilots and student assignments in a Living Lab type of integral approach. In the period 2019-2022 WUR will aim to take full advantage of knowledge and experience of WUR staff and students in promoting priority topics of the CSR agenda. Where possible, WUR will recruit students to evaluate circular alternatives for existing products as part of their study (e.g. as thesis-work or internship). Such evaluation preferably compares a couple of circular alternatives to the existing product on costs, mass and material composition, and environmental pressures (see Annex 3 for a generic outline for such evaluative student projects).

WUR's waste processing contracts will be replaced by resource management contracts

The new circular policy of WUR should lead to considerably less waste to be processed in the conventional way, i.e. incineration (R9) and recycling (R8). The present waste processing contracts, due to end in 2021 latest, will be replaced with resource management contracts (rather than with new waste management contracts). Note those resource management contracts do also cover waste management, i.e. incineration and recycling, but with a main focus on reducing both while stimulating a shift from low to high grade recycling where necessary. The resource management contractor is expected to be pro-active and flexible in effectively dealing with:

- Looking for new users of products and their components discarded by WUR (R3-R7) as far as not covered by circular product supplier contracts
- Providing expert input on circular alternatives for products or their services to WUR's circular product procurement process
- Working on replacing low-grade by high-grade recycling by implementing effective pre or post separation of relevant waste streams in combination with sub-contracting high-grade recyclers
- Accommodating changing quantities and composition of waste to be incinerated or recycled.

This gives the new resource manager contractors a central role in circular management of WUR's waste. It will be necessary to set clear targets for the resource management contract in consultation with the market.

Central distribution hub and uniform WUR-waste collection as enablers of circular policy

WUR considers a central hub in the periphery of the campus for incoming procured products and outgoing collected waste. Such hub will take heavy transport from the campus, thereby improving its road safety and air quality, but also enable bulk procurement of products. Procuring products in bulk is expected to bring down packaging material as more packaging is used for smaller quantities of products. Receiving products centrally also enables easy packaging separation for reuse or recycling. Such central hub may also be used, the other way around, to temporarily house discarded long-lived products for which a second-user is sought.

The central hub may or may also be used for receiving separately collected waste streams (as to take heavy transport from the waste collector and processor from the campus). Improving quantity and quality of recycling will be enhanced by replacing presently divergent waste collection systems employed across WUR-buildings by a system for collecting separated waste uniform for all WUR-buildings. To that purpose Facility and Services will explore whether existing contracts for separate waste collection can be reopened to move to such uniform separate waste collection system. WUR will in 2020 latest decide about the central distribution hub as part of the call for tenders for the new resource management contract.

Acceptance and support of circular policy by WUR-community

As mentioned on page 2, circularity is an important issue in WUR's Strategic Plan 2019-2022¹². WUR aims to be a forerunner in CSR and sustainability in its operations. To retain credibility, particularly in an academic community, it is crucial to 'practice what you preach'. WUR's circular policy should thus be known to the WUR community and it needs to be clear how the WUR community can contribute to the circular policy, both

through actions (buying products) and providing knowledge and ideas. It is therefore of key importance for WUR that the WUR-community accepts and supports the circular economy. Facility and Services will actively encourage this by involving the WUR-community in its circular economy policy where possible. This works two ways, it is equally important to integrate WUR knowledge on circularity in WUR's circularity policy. Already mentioned is involving the WUR-community in inspiration sessions for exploring circularity alternatives for new to procure products or their services (page 8 'WUR may stimulate ... instead of owning them'), and evaluation of circularity alternatives by students as part of their study (page 9 'circular products ... may cost a little more'). WUR will also start to involve the already existing student-based Green office and the employee-based sustainability panel for circularity questions.

WUR will actively involve non-WUR organisations & companies on the campus and Wageningen municipality

WUR also intends involving non-WUR organisations and companies on the campus and Wageningen municipality in its circular economy policy, and hopes to thereby stimulate them to follow the example of WUR. Cooperation with other non-WUR organisations and companies of the campus and Wageningen municipality may also enhance implementation of some circularity initiatives by increasing the scale of participation in them, like involving non-WUR organisations and companies in the central distribution hub (see page 10 'WUR's waste processing ... resource management contracts').

WUR will furthermore stimulate start-ups to come with interesting circularity offers to them.

WUR will start monitoring progress of WUR's circular economy policy in 2020

WUR already monitors its waste, and gets its data from the three contracted waste processing companies. This waste monitoring will show whether WUR is on track to the targeted 50% or more reduction of incineration and recycling compared to 2014, but not if this roughly translates to the intended 50% or more reduction of resource use (~ primary material use; see 1.2). WUR will therefore refine its waste monitoring to also cover product and material composition of waste streams, and extend it with similar monitoring of product procurement and use. This enables following whether reduction of incineration and recycling indeed accordingly leads to reduction of resource use (~ primary materials use).

Circular monitoring should cover procurement, use and waste processing of products in terms of their costs, mass, component and material composition and environmental pressures. Cost monitoring should to the extent possible result in total costs of ownership, which amongst others will reveal whether circular products and/or their services cost more (or less) than their non-circular alternatives. It seems more sensible to monitor larger independent subunits than screws as components, but primary and secondary material content for sub-type of e.g. plastics are useful details, and environmental pressures other than cumulative (fossil) energy use and carbon dioxide equivalents may need to be established (e.g. land use as proxy for biodiversity). Format and detail level circular monitoring still need to be set, but these need to the extent possible be default across all product groups, and suppliers will be required to provide data according to this default as part of the procurement process. Translating the default in an easy to use dashboard will facilitate monitoring per product group, as well as for all product groups together.

Similar as for waste monitoring now, WUR may outsource circular monitoring. Such outsourcing can take place on two levels. First, monitoring for given products can be made part of the contract with their suppliers, obliging them to provide WUR with data according to the agreed format and detail level. Secondly, putting together the monitoring data from all product suppliers to arrive at WUR-totals can be outsourced to an external party. WUR will before 2020 decide about its circular monitoring strategy (including monitoring format, detail level, and frequency), and in 2020 start factual circular monitoring.

WUR's procurement protocol will be extended with circular considerations

WUR procurement processes starts with a product manager outlining the expectations for the new to procure product or its service. A procurement officer next translates this in a call for tenders complying with legal and other requirement. Once the new supplier contract is signed, a contract manager takes care the contract is executed as agreed. In practice the procurement process is an iterative one, and the contract manager is often involved in the call for tenders as well. WUR has a protocol for sustainable procurement (the UPI-MVI protocol). WUR will extend this protocol with circularity considerations that follow from above paragraph and are summarized here:

- Set-up a procurement team that also involves WUR's contract and resource managers (see page 6 'Circular procurement should ... end-of-life processing of products') and the resource management contractors (see page 6 'Circular procurement should ... end-of-life processing of products' & see page 10 'WUR's waste processing ... resource management contracts')
- Consider to organise an inspiration session with WUR students and employees, and product (service) suppliers in the beginning of the procurement process to generated input for circular product alternatives
- Check whether the reduction of incineration and recycling applicable for the new to procure product or its service helps or at least does not prevent a minimal 50% reduction in the category to which it belongs:
 - o Buildings
 - o Products providing general services (vehicles/mobility, decoration & furniture, electronic equipment, printed goods, workplace utensils, office supplies, cleaning & sanitary materials, food & drinks, work clothing, packaging)
 - o Products exclusively related to research and education (i.e. laboratory utilities, plants & related, animal & feed, chemicals)

Note reduction of incineration and recycling should lead to a similar reduction in resource use by moving up in the order of circularity strategies for existing and new products or their services

- Include in the appropriate way in the call for tenders:
 - o The relevant reduction target for incineration and recycling (~ reduction of resource use)
 - o The 2% reduction target for direct and indirect energy use and carbon neutrality
 - o A specified reduction target for involved packaging material
 - o That same quantity and quality of secondary components and recycle is used and produced in the product and its service

Note that the reductions should be achieved per unit of function or service (which may require products to be more robust -heavy).

- Consider whether existing products of WUR may be used as part of new supplier contracts (then include this in the appropriate way in the call for tenders)
- Evaluate submitted tenders on whether:
 - o They comply with before-mentioned targets
 - o They involve required behavioural changes that may undermine the success of circular products and their services (and thereby influence obtained reduction of resource use and environmental pressures)
 - o Intended end-of-life processing of discarded circular products are ensured to really take place
 - o They contain (false) greenwashing suggestions and claims

Annex 1: Credits for reuse, recycling and incineration in LCA

Circular economy aims at reducing resource use and environmental by the production and consumption of products. Life cycle assessment (LCA) is typically used for evaluating resource use and environmental pressures of products and their alternatives. Mainstream LCA credits a product when its material is recycled after the product is discarded, but does not credit a product for using recycled material. This way of crediting products for producing recyclate, and 'punishing' them using recyclate is called the substitution-approach.

Underlying thought of the substitution approach is that produced recyclate avoids production of a material it replaces. The product producing recyclate is credited by subtracting resource use and environmental pressures for cradle-to-production of the avoided material. When the avoided material is the same as used in the product, the credit cancels out resource use and environment pressures for cradle-to-production of the material used in the product. The credit is smaller when cradle-to-gate production of the avoided material is lower (e.g. wood replaced by recycled iron), but higher when cradle-to-gate production of the avoided material is higher (e.g. aluminium replaced by recycled plastic) than for the material used in the product. As mentioned, a product does not get credits for using recyclate in the substitution approach. This makes the substitution approach less relevant for evaluating the circularity of products.

Circular products consist of before-used (secondary) components and recycled (secondary) materials that in the same quantity and quality will be reprocessed after the product is finally discarded. Products using but not producing secondary components or materials cause these to be no longer available for other products (e.g. present demand exceeds supply for secondary metals). The other way around, products producing but not using secondary components or materials may lead these to be incinerated after all (e.g. demand for, presently often still low-grade, secondary plastic may dry up). Products using and producing a dissimilar quantity or quality of secondary components and materials do not result in resource gain on the level of economy as a whole.

LCA's evaluating use and produce of recyclate by circular product alternatives considered by WUR should address this by applying the so-called 50-50 approach instead of the substitution approach. The 50-50 approach credits a product producing recyclate at maximum with 50% of the resource use and environmental pressures for cradle-to-production of the material used in the product. Similarly, it credits a product using recyclate at maximum with 50% of the resource use and environmental pressures for cradle-to-production of the primary or virgin version of that material. A product thus gets at maximum credits cancelling out resource use and environmental pressures for cradle-to-production of the primary or virgin version of the material used in the products if it uses and produces the same quantity and quality of the same material. Usually a material degrades with every recycle step. This can be expressed by multiplying the maximum credit, either for the used or produced recyclate, with the ratio of the recyclate's economic values versus the one of the virgin or primary materials. The same approach can be used for reprocessing of used components in products, as well as for incineration of products (allocated credits are 50% of avoided resource use and environmental pressures by conventional incinerations, but never higher than 50% of resource use and environmental pressures for cradle-to-production of the material in the product).

Annex 2: Specific products in product groups

| Product main categories | Product subcategories | |
|---------------------------------|-----------------------|--|
| | No. | Names |
| Animals & feed | 10 | Breeding eggs, chickens, concentrates, cows, mice, pigs, roughage, sheep & others |
| Buildings | 3 | Office buildings, parking garage & others |
| Building decoration & furniture | 7 | Bureau chairs, chairs, office cupboards, lab-chairs, tables, white boards & others |
| Catering | 13 | Breakfast, coffee & tea, cookies, drinks, lunches, mineral water, pizza's, salads, snacks, soup, warm meals, wine & others |
| Chemicals | 5 | Gasses, liquids, primers, solid substances & others |
| Cleaning & sanitary | 10 | Air freshener, cleaning fluid, dishwashing brushes, hand soap & shower gel, tissues, toilet paper, towel role, waste bags, wipes & others |
| Energy | 1 | Gasoline/diesel |
| Electronic equipment | 19 | Armatures, batteries, cables, chargers, computer mice, copy machines, desktops, headsets, key boards, laboratory equipment, laptops, laptop batteries, lights, smartphones, SSD's, tablets, USB-sticks, webcams & others |
| Laboratory utilities | 7 | Columns, filters, glass pieces, magnets, needles, pipets, plastics & others |
| Office items | 18 | Badges, calculators, erasers, folders, glue, liners, note blocks, magnets, paper clips/staples, pens & pencils, scissors, staplers, tableware, tape, toners & others |
| Plants & related | 9 | Agricultural materials, bouquets, compost, pesticides, plants, potting soil, sawdust, seeds & others |
| Printed matter | 9 | Books, envelopes, magazines, posters, printing paper, reports, stickers, visit cards & others |
| Transport vehicles | 3 | Cars/busses, tires & others |
| White & brown equipment | 8 | Dish washers, freezers, micro waves, refrigerators, stoves, televisions/monitors, vacuum cleaners & others |
| Work clothing | 17 | Boots, coats, glasses, gloves, lab-gloves, lab-coats, laptop bags, masks, mouse mats, overalls, shirts, shoes, t-shirts, trousers, underwear & others |
| Work place materials | 12 | Clips, electronic materials, fluorescent tubes, glue/kits/tapes, hand tools, iron products, metal tubes, plastic tubes, sanitary, tie-wraps, tubes & others |
| Others | 1 | Others |

Annex 3: Outline student projects evaluating circular product alternatives

Similar as the Dutch government for Netherlands as a whole, WUR wants using 50% less abiotic resources in 2030 compared to 2014. Abiotic resources refer to metals, minerals and fossil resources. Part of the circular economy is to replace materials from abiotic by materials from biotic resources in products (abiotic resources are metals, minerals and fossils). However, abiotic as well as biotic resource use needs to be reduced in a circular economy. Reducing resource use basically translates to using less products altogether, using these products and their components as long as possible if needing them anyways, and recycle their materials when products or their components finally end up as waste (see Figure 1 in main document). Using less new products made from new components and new materials will typically also benefit the environment as extraction of resources and their processing into new materials is avoided.

Procurement of new circular products provides key leverage for WUR to achieve its 2030-target of using 50% less (a) biotic resources. Facilities and Services, who is responsible for WUR's procurement, likes to get help from students to evaluate the circularity of considered alternatives as part of their education (e.g MSc-thesis or internships). Circularity means product alternatives lead to less resource use and less environmental pressure from cradle to their grave compared to the present alternative used by WUR. Such evaluation thus should also look into the use and what should happen at the end of the life of products procured by WUR.

One should thus look to the whole product's life cycle when evaluating product alternatives on their circularity. The service to be delivered by a product, i.e. its product function, is another important starting point. A more robust (= heavy) product will typically involve more resource use and environmental pressure than a same lighter products. The robust product may serve considerably longer than the lighter one (i.e. a reusable versus a disposable plastic cup), however, thereby possibly reducing resources use and environmental pressure per functional unit. The robust product may on the other hand, however, need maintenance to realise it longer use (e.g. washing of a used cup). This will to some extent cancel out resource and environmental gain from longer use. The function of a product should also not be taken too one-dimensional. For example, hot beverage vending machines with automatic cup supply show more malfunction with paper than with plastic cups (increasing resource use and environmental pressure per cups of hot beverage delivered). Products thus typically need to comply with other performance characteristics besides providing their main function.

Life cycle assessment (LCA) is typically used for evaluating resource use and environmental pressures of products and their alternatives. Besides resource use and environmental pressures also costs will be relevant for Facility and Services in the decision which product alternative to procure. Summarizing, evaluations of product alternatives should thus:

- Compare alternatives with the presently used products by looking
 - o From cradle to grave of those product alternatives (including the presently used one) and
 - o To the main and co-functions (performance characteristics) needed
- On their circularity performance (resource use & environmental pressure) and costs per functional unit