Measuring the circular economy performance of

ROCKWOOL

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CIRCLE ECONOMY CONSULTING

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EXECUTIVE SUMMARY

The circular economy offers a toolbox of solutions that can tackle today's pressing global challenges. This is why **ROCKWOOL is amplifying its commitment to sustainability by developing its own circular economy dashboard.** While stone wool has many circularity attributes, such a circular economy dashboard will allow ROCKWOOL to take its commitment to increasing resource efficiency to the next level.

Supported by Circle Economy Consulting, ROCKWOOL has developed a set of circularity KPIs to not only support disclose requirements from the CSRD and the EU Taxonomy but also to help drive the transition along every step of the value chain. **By increasing the use of non-virgin materials, using materials for longer, and cutting waste generation, the company is actively minimising the consumption of natural resources.** These actions help ensure a stable supply of materials for years to come—and align with sustainable development goals.

MEASURING CIRCULAR ECONOMY PERFORMANCE

It can be difficult for businesses to increase their circularity efforts without having clear goals, definitions and KPIs. **Circle Economy Consulting developed an indicator dashboard for ROCKWOOL to measure its efforts against.** It leads with a headline indicator, a single metric that captures the benefits of long-lasting products that have been designed for reuse and/or recycling and made partly with non-virgin materials. This offers clarity and will empower the company to easily track progress and communicate its commitment to circular economy principles.

In addition, three circular economy opportunity areas were identified, applying to different steps of the value chain: Circular materials, Circular use and Circular end-of-life. For each of these areas, key performance indicators were defined for ROCKWOOL to track its progress.

Headline Indicator	Consumption of virgin resources for the production of products and packaging (tonnes) / Expected lifetime of products (years)		
Circular Economy Opportunities for ROCKWOOL	**Circular Material** Increasing sourcing of non-virgin material to decrease dependency on virgin resources for products and packaging.	**Circular Use** Rethinking products' design for reuse and recycling from the start, to use materials for longer.	**Circular End-of-Life** Increasing the effectiveness and efficiency of reverse logistics, and increasing waste diverted from landfill.
Performance Indicators	1. Non-virgin resources for products (%) 2. Non-virgin resources for packaging (%)	3. Designed for reuse (%) 4. Designed for recycling (%)	5. Recovered products from market (tonnes) 6. Waste diverted from landfills (tonnes)

Circular Economy Dashboard for Rockwool

1 INTRODUCTION

In today's rapidly evolving business landscape, the adoption of sustainable and circular practices has become imperative. Companies worldwide are recognizing the need to transition towards a circular economy. Circle Economy Consulting collaborated with ROCKWOOL, the global leader of stone wool solutions, to develop an indicator dashboard to measure ROCKWOOL's progress in the transition to a circular economy. This methodology document presents the selected indicators and details on their scope, measurement, and required data.

The indicators selected by ROCKWOOL for guiding their circular economy dashboard are heavily based on the existing measurement frameworks, policies, and regulations on circular economy, especially the Corporate Sustainability Reporting Directive (CSRD) and within that the European Sustainability Reporting Standards (ESRS), the EU Taxonomy and the Circular Transition Indicators (CTI) Framework. To prepare ROCKWOOL for future reporting requirements, most notably under the CSRD and EU Taxonomy, the indicators are aligned with (our interpretation of) these reporting requirements where possible and relevant.

This document details how the developed indicator dashboard measures ROCKWOOL's circular economy performance. It starts with a description of the use of a headline indicator to measure ROCKWOOL's overarching circular economy goal—minimizing virgin resources consumption per year of use of its products. In accordance with the headline indicator, three opportunity areas were defined: Circular Material, Circular Use, and Circular End-of-life. These are shortly described in the infographic on the following page, and in chapters 3 to 5 key performance indicators are defined to monitor progress in these three opportunity areas.

CORPORATE SUSTAINABILITY REPORTING DIRECTIVE (CSRD)

The CSRD, the new EU directive, will come into effect in 2024. The CSRD reporting will be required by companies that meet two of the following three criteria: have a turnover that exceeds €40 million/year, a balance sheet of more than €20 million and/or more than 250 employees. Companies that have to report on CSRD must follow the **disclosure requirements** stated in the **European Sustainability Reporting Standards (ESRS)**. In this document, we focus only on ESRS E5 Resources use and circular economy.

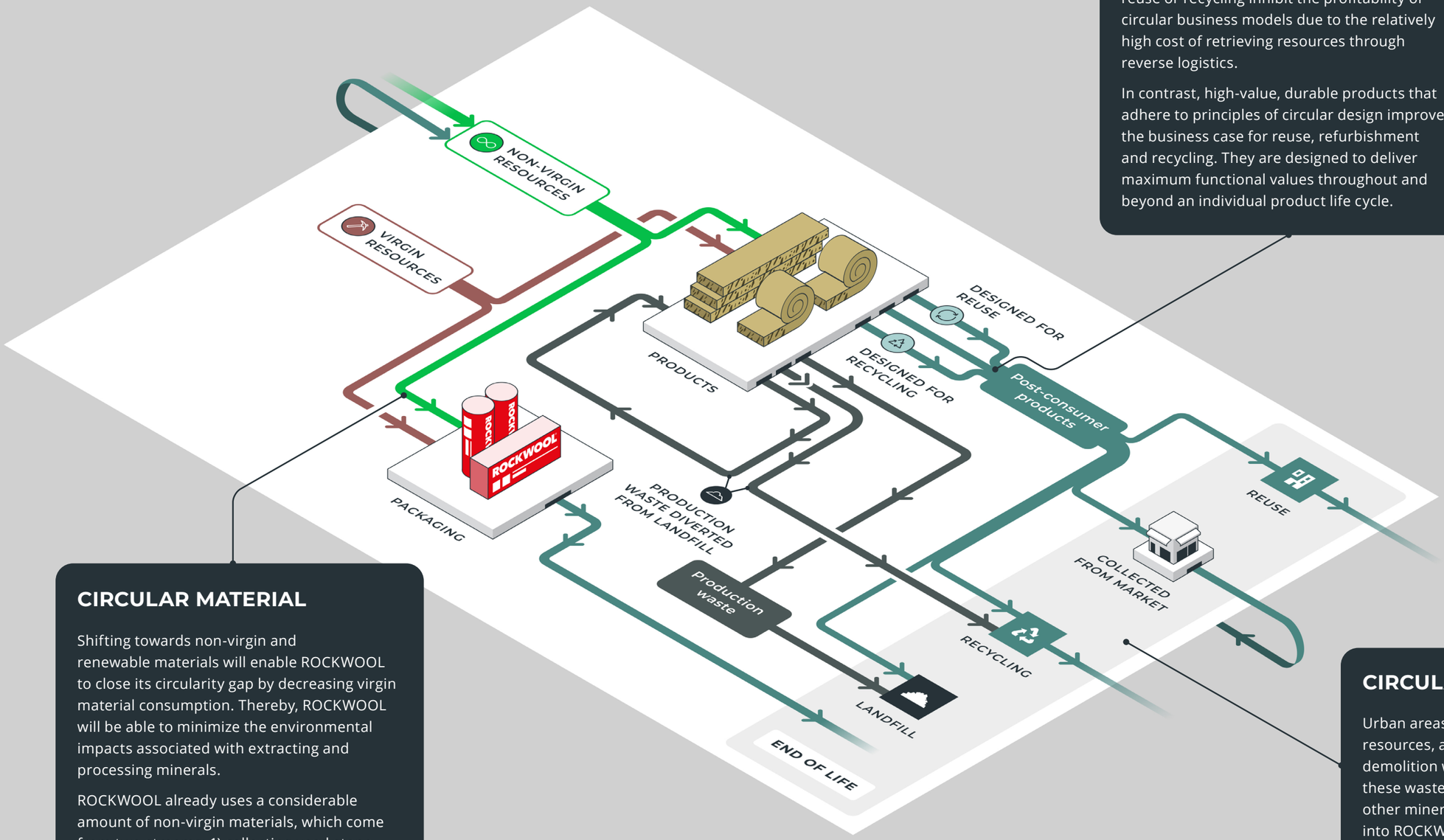
EU TAXONOMY

The EU Taxonomy is a classification system that helps investors make sustainable investment decisions. It defines environmentally sustainable activities as economic activities that make a **substantial contribution** to at least one of the EU's environmental objectives while at the same time, **do no significant harm** (DNSH) to any of these objectives and meet the minimum social safeguards.

CIRCULAR TRANSITION INDICATORS (CTI) FRAMEWORK

CTI is a universal and transparent framework to measure circularity, developed by the **World Business Council for Sustainable Development** (WBCSD). It was chosen for ROCKWOOL for being an objective and quantitative framework that can be applied to businesses of all industries, sizes, value chain positions, and geographies.

CIRCULAR ECONOMY OPPORTUNITIES FOR ROCKWOOL



CIRCULAR USE

By developing high-value circular product applications, ROCKWOOL can reshape its value chain to foster circularity. Low-value, non-durable products that are not designed for reuse or recycling inhibit the profitability of circular business models due to the relatively high cost of retrieving resources through reverse logistics.

In contrast, high-value, durable products that adhere to principles of circular design improve the business case for reuse, refurbishment and recycling. They are designed to deliver maximum functional values throughout and beyond an individual product life cycle.

CIRCULAR MATERIAL

Shifting towards non-virgin and renewable materials will enable ROCKWOOL to close its circularity gap by decreasing virgin material consumption. Thereby, ROCKWOOL will be able to minimize the environmental impacts associated with extracting and processing minerals.

ROCKWOOL already uses a considerable amount of non-virgin materials, which come from two streams: 1) collecting used stone wool from the market, and 2) using secondary materials from other industries, such as slags from the steel and metallurgic industry.

CIRCULAR END-OF-USE

Urban areas act as a massive stock of resources, a part of which becomes demolition waste every year. Part of these waste flows include stone wool and other minerals, which could be recycled into ROCKWOOL production processes. Additionally, ROCKWOOL has a goal to expand its Rockcycle® program, taking back used stone wool from the market to a minimum of 30 countries by 2030.

2 MEASURING ROCKWOOL'S CIRCULAR ECONOMY PERFORMANCE

The transition to a circular economy is complex and multifaceted. For a production company like ROCKWOOL, this means that a circular economy strategy is not confined to a single location or department but spans various parts of the business, such as procurement departments, production facilities, and waste management. In such a case it is helpful to set a company-wide target using a headline indicator describing the overarching circular economy goal of ROCKWOOL.

THE HEADLINE INDICATOR WE DEVELOPED IS:

$$\frac{\text{Consumption of virgin resources for the production of products and packaging (tonne)}}{\text{Expected lifetime of products (years)}}$$

This indicator (tonnes/year) is developed to highlight two key aspects of ROCKWOOL's transition towards a circular economy—minimise the use of virgin resources and design products to be long-lasting.

"Virgin resources consumption" is defined as the weight of all virgin resources that are used for manufacturing by ROCKWOOL during the period under consideration.

"Expected lifetime of products" is defined as the weighted average of the expected product life of all products produced in the period under consideration. Due to stone wool's durable nature, some of ROCKWOOL's products can last well above 65 years. For this variable, we advise adhering to the existing norms for estimating product lifetime, such as those used in Life Cycle Assessments (LCA). Currently, LCA estimates the product lifetime for construction products to be 50 years.

GUIDANCE FOR MEASUREMENT

To calculate the headline indicator, we suggest following the steps below.

Step 1

Calculate the headline performance of individual product groups with similar designs and performance.

For each product group:

$$\frac{\text{Virgin resource consumption}}{\text{Average expected product life}}$$

A product group should contain products made of a similar composition of virgin and non-virgin materials with a similar expected product life.

Step 2

Take the weighted average, based on all resource consumption (i.e. the sum of virgin and non-virgin resources) of all product groups to arrive at the company-level performance.

At company level:

$$\frac{\sum \frac{\text{Virgin resource consumption}}{\text{Average expected product life}} \times \text{All resource consumption}}{\sum \text{All resource consumption}}$$

A decrease in the headline indicator signals an improvement in ROCKWOOL's circularity performance. The indicator decreases when the share of non-virgin resources increases, the efficiency of resource use improves, the product durability increases, or producing more products with better performance (change in product portfolio). It is independent of the change in sales.

Nevertheless, the formula does not distinguish between modular products (that need other products to function properly) and non-modular products. Modular products should therefore be combined and considered as a single product for this indicator. Also, this indicator cannot be used for products that fulfil an instant and ending need. It uses lifetime as a denominator, which assumes products fulfil an ongoing need (i.e. need to be replaced when reaching end-of-life) and not a one-off function.

REQUIRED DATAPOINTS

To calculate the indicators described in the previous paragraphs, ROCKWOOL will have to collect the following data for each product group under consideration in the reporting period:

- Total weight of virgin resources used in production per product group
- Year of average expected product life of each product group
- Total weight of resources used in production per product group

3 MEASURING CONSUMPTION OF CIRCULAR MATERIALS

ROCKWOOL's core business is the manufacturing of stone wool products. ROCKWOOL could minimise its virgin materials consumption by replacing them with non-virgin materials, from products collected via its recycling service, Rockcycle®., and recycled slag, a by-product from the steel industry.

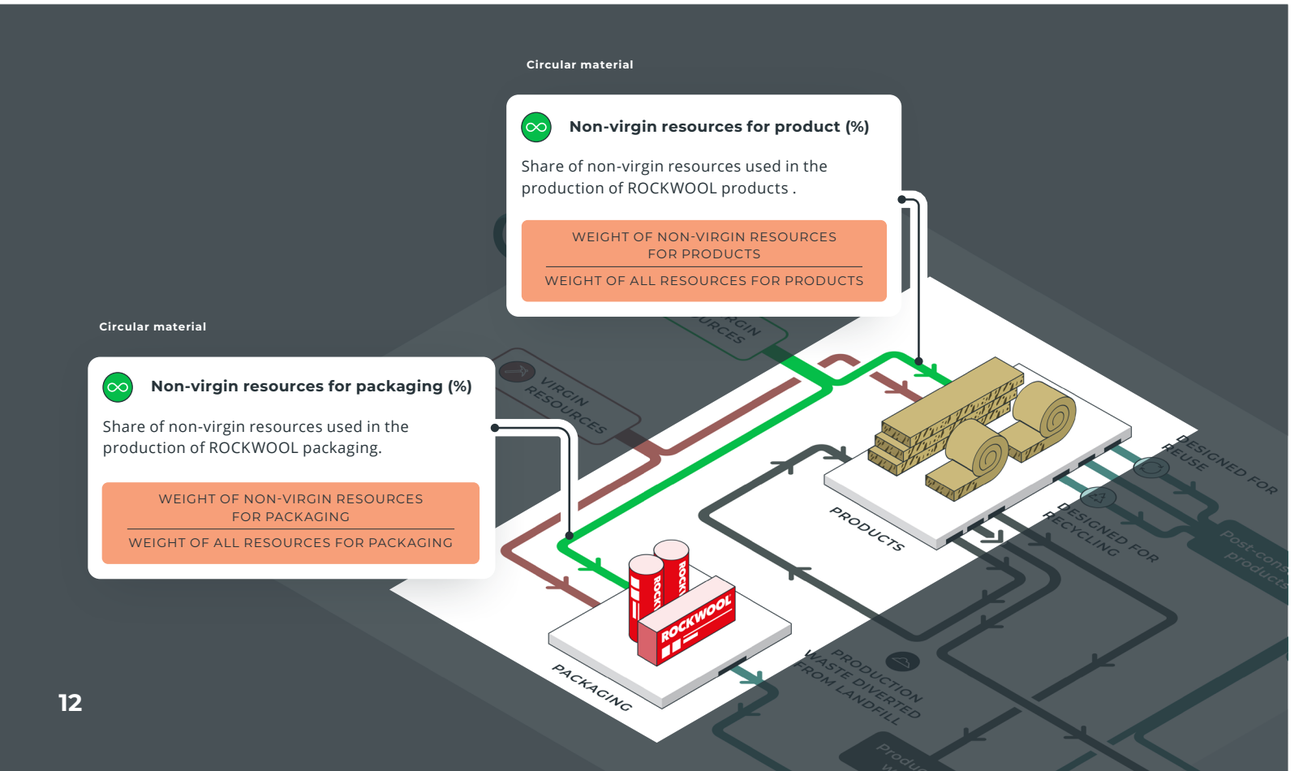
Two performance indicators are developed to measure the use of circular material by ROCKWOOL.

NON-VIRGIN RESOURCES FOR PRODUCT (%)

NON-VIRGIN RESOURCES FOR PACKAGING (%)

The system boundaries for these indicators include all materials used in production, such as materials that are wasted or reused during production and do not end up as part of the resulting products and packaging.

These indicators measure the share of non-virgin materials in the total weight of materials used to produce all products and packaging within the period under consideration. Packaging hereby refers to all primary packaging of ROCKWOOL products.



In addition to these two indicators, we also suggest the use of two sub-indicators, one for each of the performance indicators.

NON-VIRGIN CONTENT IN PRODUCT (%)

NON-VIRGIN CONTENT IN PACKAGING (%)

The sub-indicators measure the share of non-virgin materials in the total weight of materials in all products and packaging in the reporting period. This would be a subset of the materials described in the previous two indicators, as it excludes materials that are wasted during production and don't end up in the resulting products. These two sub-indicators are especially relevant for ROCKWOOL's customers as they show how ROCKWOOL's products could help them become more circular and comply with the guidelines on the use of virgin materials stated in the EU Taxonomy

We understand the importance of aligning the terminology of indicators with the existing frameworks and standards, and here we follow the same definitions of non-virgin used by the Ellen MacArthur Foundation and CTI framework. For ROCKWOOL, we suggest defining non-virgin resources as materials, products and components that have been previously used and enter ROCKWOOL's company boundary through material recovery. For this document, we consider the use of by-products for manufacturing a valid method for material recovery and therefore by-products as non-virgin resources. Here "non-virgin" is used interchangeably with "secondary".

GUIDANCE FOR MEASUREMENT

The two performance indicators are aligned with the definition of "% circular inflow" indicator in the CTI framework.

Figure 1: Material flows to and from the company boundary in CTI framework.

As shown in the figure above, the inflow of a company refers to all materials flowing into the organisation. Hence, the assessment of inflow materials does not only include the materials that will be part of the resulting product but also other resources necessary to produce the product (e.g. energy carriers, catalysts, material lost during manufacturing, etc.). To consider inflow materials circular, they should have been (partially) used in a previous cycle (for example reuse, remanufacturing, recycling). The exact nature, duration or quality of the previous level is not relevant for determining circular inflows: virgin resources are deemed 0% circular and secondary resources are considered 100% circular.

The circular inflow can be calculated on a product (or product group) and company level, as shown in the diagrams below. Taking the weighted average of the circular inflows for all product or product groups should result in the same value as the circular inflow for the whole organisation.

% circular inflow (calculated per product)

(% circular inflow A * mass A)
+ (% circular inflow B * mass B)
+ (% circular inflow C * mass C)

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total mass of all inflow (A+B+C)

% circular inflow calculated on company level

(mass of renewable inflow + mass of non-virgin inflow)

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total mass of all inflow **X 100%**

Figure 2: Calculation of % circular inflow in CTI framework.

Translating the definitions and guidance from the CTI framework described above, we suggest the following two formulas to measure the non-virgin resources in products and packaging:

Weight of non-virgin resources for products

Weight of all resources for products

Weight of non-virgin resources for packaging

Weight of all resources for packaging

In this formula, we define the weight of non-virgin resources in products to be all circular inflows used or consumed in the production of (a) product(s) by ROCKWOOL, either calculated as a weighted average of the product(s) under consideration or as the total circular inflow on the company level. For practical reasons, we will assume this indicator will be first applied at the level of individual product groups and then combined to assess the use of non-virgin resources at the company level.

As the selection and production of packaging for ROCKWOOL products is a very different process from the manufacturing of its own products, we suggest splitting the measurement of the use of non-virgin resources over two indicators: one measuring the resource consumption for the manufacturing of products and one for measuring the resource consumption for the use of packaging. The methodology for measuring the use of non-virgin materials in packaging is identical to that of products.

As for the two sub-indicators, they focus on the products and packaging, which are part of the outflow exiting the company boundary (see Figure 1).

The non-virgin content of a single product/packaging could be calculated using the following formula:

Weight of non-virgin resources in product/packaging - weight of manufacturing loss of non-virgin resources

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Weight of final product/packaging

Weight of manufacturing loss is defined as the weight of all resources consumed during production that do not become part of the resulting product/packaging. Similar to the performance indicators, the sub-indicators could be translated to a company-level sub-indicator calculating as a weighted average of all product(s)/packaging(s).

REQUIRED DATAPOINTS

To calculate the indicators described in the previous paragraphs, ROCKWOOL will have to collect the following data for each product group under consideration in the reporting period:

- Percentage of recycled resources used in production per product group
- Total weight of resources used in production per product group
- Percentage of recycled resources used in production of packaging per product group
- Total weight of resources used in the production of packaging per product group

To calculate the sub-indicators, the following data points are needed:

- Total weight of non-virgin resources lost during manufacturing
- Total weight of final products
- Total weight of final packaging

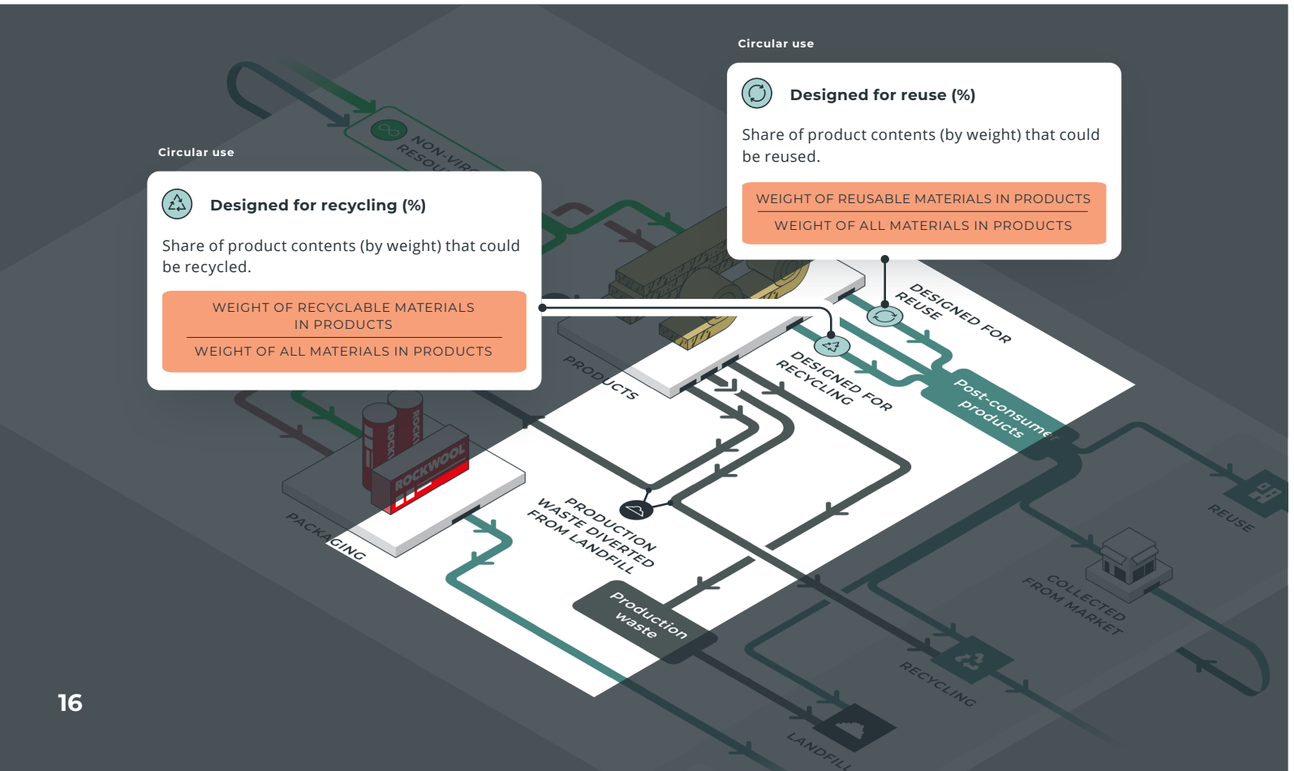
4 MEASURING CIRCULAR USE OF PRODUCTS

ROCKWOOL's products are very durable, lasting on average over 65 years without losing performance. In the cases of building demolition or renovation, the insulation material could be recovered and reused if product design and construction practices allow.

On the other hand, stone wool can be endlessly recycled without losing its properties. It is important to preserve this advantage during product design, which allows material recovery at the end-of-life and substitution of virgin materials with non-virgin.

DESIGNED FOR REUSE (%)

DESIGNED FOR RECYCLING (%)



Two performance indicators are selected to highlight the potential of extending product lifetime through reuse and the recyclability of stone wool.

These indicators measure the share of product contents (by weight) that could be reused or recycled. This should be measured at product or product group level and can be aggregated to company level by taking the weighted average of all products or product groups.

In the context of ROCKWOOL products, reuse is defined as the repeated use of a product, typically by removal from original installations and then reinstalling, for the same intended purpose without significant modification. This may involve preparation steps, such as small adjustments of product dimension and cleaning. This typically requires modular designs that allow for easy installation, removal and reuse.

Recycling is defined as the operation that reprocesses stone wool materials from construction, renovation, and demolition sites and reintroduces the material into the production process of new products.

Here again, we follow the same definitions used by ESRS, EU Taxonomy and CTI.

GUIDANCE FOR MEASUREMENT

The CTI framework provides guidance on how to determine the "% recovery potential" of outflow, which closely relates to the "designed for reuse/recycling" indicators we selected for ROCKWOOL.

% recovery potential is an indicator that measures the share of a company's outflow that is recoverable. If an outflow is fully recoverable, for example, by reusing, remanufacturing, refurbishing or/and recycling, the % recovery potential is 100%. If only 90% by weight of a product is recoverable, the % recovery potential is 90% (see the figure below).

% recovery potential

YES - full potential = 100%

NO - no potential = 0%

some potential = X%

Figure 3: Calculation of % recovery potential in CTI framework.

To determine what recovery processes are circular, the CTI framework provides the following guiding principle: "If a technical material on any level (potentially molecular) can remain a functional equivalent material in a second life in a technically feasible and economically viable manner, it is circular. If the company downcycles inorganic or fossil material or turns it into a fuel or burns it in any shape or form, it is linear." Note that this principle applies at the level of individual materials. The recovery potential of products can be calculated by taking the weighted average of all materials that are included in the product. To assess the recovery potential of all the products at a company, one should take the weighted average of the recovery potential of all materials or the weighted average of the recovery potential of all products.

Adopting the guidance from CTI, we consider "designed for reuse/recycling" to be equivalent to "reuse/recycling potential", and the two terms are used interchangeably below. We suggest the following formulas for the two indicators to measure the reuse/recycling potential of ROCKWOOL's products.

DESIGNED FOR REUSE
(REUSE POTENTIAL)

$$\frac{\text{Weight of reusable materials in products}}{\text{Weight of all materials in products}}$$

DESIGNED FOR RECYCLING
(RECYCLING POTENTIAL)

$$\frac{\text{Weight of recyclable materials in products}}{\text{Weight of all materials in products}}$$

In the formulas, we define the weight of reusable/recyclable materials in products to be the total amount of reusable/recyclable materials in all products produced by ROCKWOOL in the reporting period. Note that reusable and recyclable materials are not mutually exclusive.

To calculate the two indicators on a company level, first calculate the share of materials that can be reused/recycled for each product (group). Then, take the weighted average of the reuse/recycling potentials for each product (group). Alternatively, it could be calculated by aggregating the share of reusable/recyclable materials in each unit of all products produced in the reporting period. For practical reasons, we assume the first option is preferred.

REQUIRED DATAPOINTS

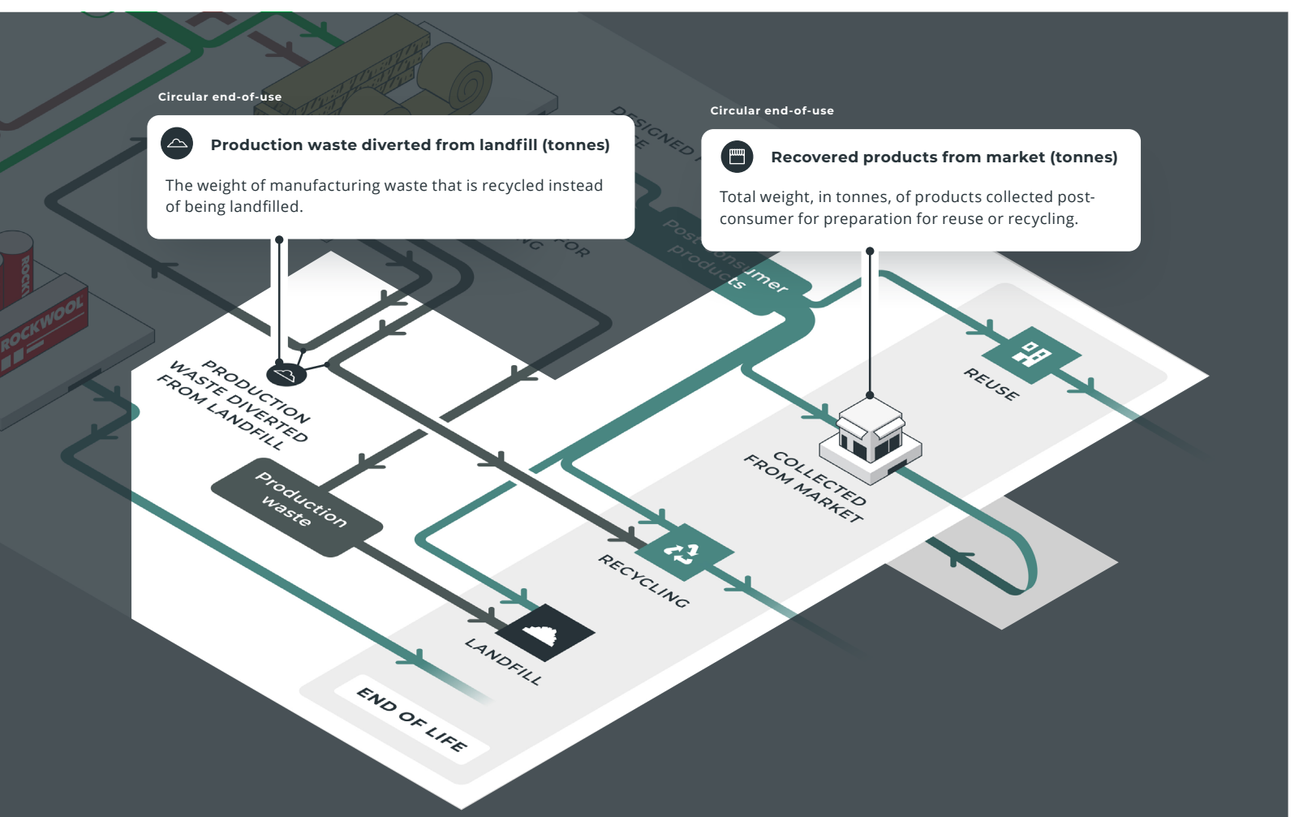
- Percentage by weight of reusable materials per product (group)
- Percentage by weight of recyclable materials per product (group)
- Total weight of each product group produced in the reporting period

5 MEASURING CIRCULAR TREATMENT AT END-OF-LIFE

Measuring and reporting upon the collection and recovery of products that have a relatively long lifespan, such as the majority of ROCKWOOL's products, has proven challenging for businesses. Not only is it difficult to track products over such a long period of time to evaluate their end-of-life treatment but it is also difficult to select meaningful indicators to evaluate end-of-life recovery of long-lasting products. This is mostly due to the fact that in many cases, it is hard to define how many products could potentially be recovered in a certain period and, hence, to evaluate how much of this potential has been realised by the company.

ROCKWOOL has been expanding its recycling service offering, Rockcycle®, in recent years with a target of making their service available in a minimum of 30 countries by 2030. Post-consumer collection and treatment of products is important to the stone wool value chain and so it should be included in a measurement dashboard used by ROCKWOOL.

In addition, ROCKWOOL aims to reduce landfilling of manufacturing waste by 85% by 2030, compared to 2015. The reduction is achieved by internally and externally recycling materials from waste, which is another important opportunity for ROCKWOOL to reduce virgin resource consumption.



The following performance indicators are developed to highlight the opportunity for material recovery at end-of-life:

RECOVERED PRODUCTS FROM MARKET (TONNES)

This indicator is defined as the total weight, in tonnes, of products collected post-consumer for preparation for reuse or recycling in the reporting period. Similar to the indicators on circular use, it is important for this indicator on end-of-life recovery to quantify opportunities for reuse and recycling as they are vital to accelerating ROCKWOOL's circular transition.

WASTE DIVERTED FROM LANDFILL (TONNES)

Here waste refers to manufacturing waste of ROCKWOOL's products. Diversion from landfill is defined as the reduction of waste landfilling by recovering materials in waste streams through internal and external recycling. We assume there is no diversion to incineration, with or without energy recovery.

GUIDANCE FOR MEASUREMENT

For long-lasting products such as the majority of ROCKWOOL's products, existing standards and metric frameworks advise measuring company outflows with potential recovery indicators, as there is limited influence on the actual recovery of products. However, considering the current challenges in stone wool value chains, it makes sense to measure the actual recovery in addition to the potential recovery indicators, "Designed for reuse/ recycling", described in Circular Use.

We suggest reporting the actual recovered product in an absolute number instead of a number relative to the current production volume. The products recovered today were potentially produced many decades ago. The large time gap indicates that it is not suitable to compare the products recovered to the products produced in the reporting period as it does not represent the current circularity performance.

For this reason, we suggest simply reporting on the size (weight) of the flow of materials that have been recovered to at least enable the monitoring of collection programs at ROCKWOOL. As a result, this indicator is relatively easy to measure, as ROCKWOOL has data from their Rockcycle® program.

An important distinction that should be made is between the volume of products or materials collected, the volume of products and materials recycled, and the volume of materials that are eventually recovered. First of all, the collection of products does not guarantee that all their contents are recovered as they could also be collected for landfilling or other low-value treatments such as backfilling. Secondly, during the handling and processing of products and materials for reuse or recycling, losses and inefficiencies might occur, making the volume of recovered materials lower than the volume of products that were processed. The "Waste diverted from landfill" indicator focuses specifically on the end result of the recovery process: the volume of materials recovered.

CTI framework suggests to breakdown material recovery types as shown in Figure 4. Note that landfill and incineration are linear treatments as materials are not recovered in the processes.

For ROCKWOOL's manufacturing waste, the most relevant recovery type is recycling. As stated in the Sustainability Report 2022, ROCKWOOL aims to reduce landfilling of manufacturing waste by recycling optimisation and technology innovation, for example, by implementing advanced melting technologies to increase recycling efficiency. As ROCKWOOL increases internal recycling and partners with external recyclers to recover materials, waste is diverted from landfills.

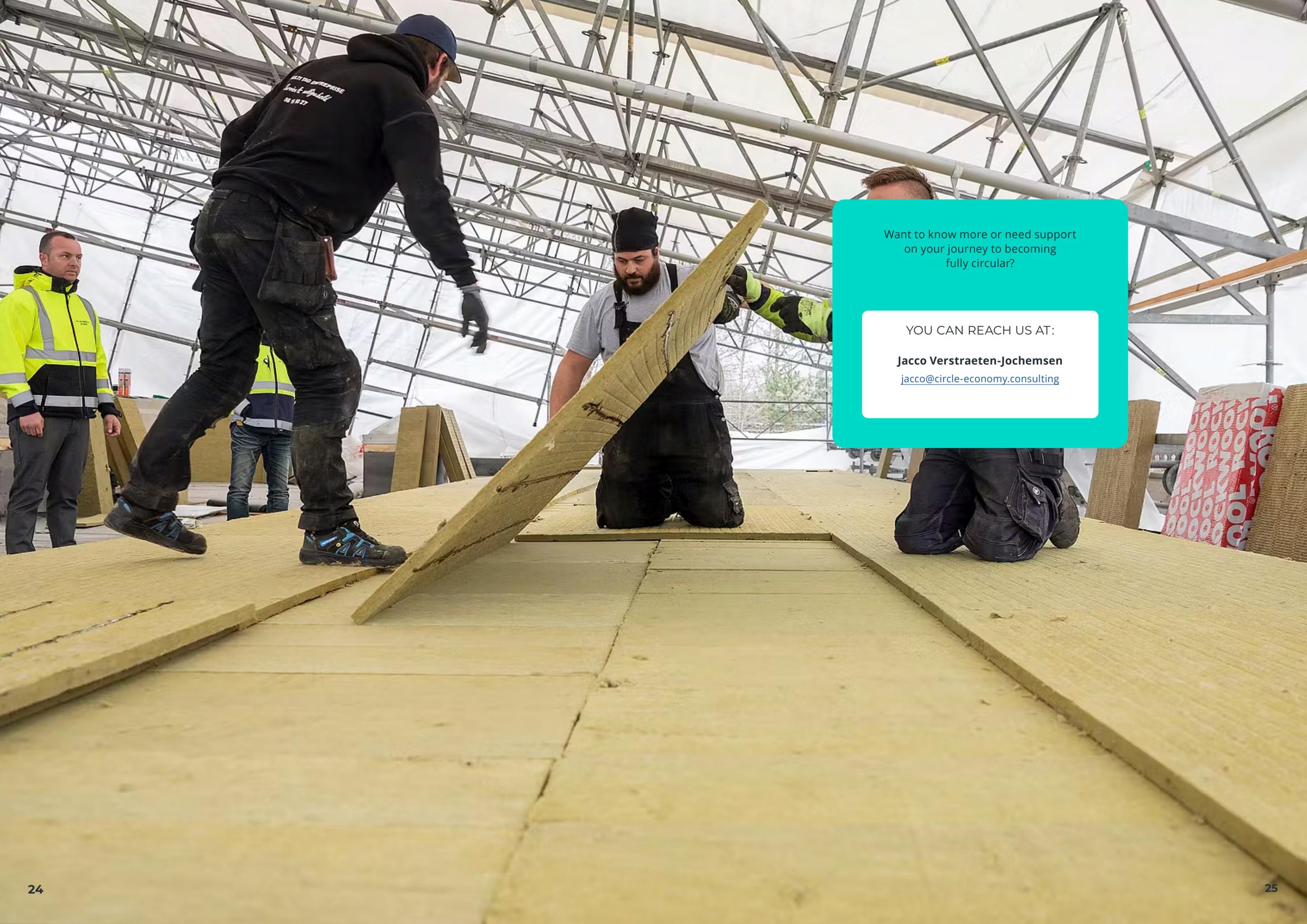
In practice, measuring internal and external recycling volumes remains a challenge in the complex manufacturing processes. Therefore, we suggest measuring the "Waste diverted from landfill" indicator by monitoring the reduction of materials sent to landfills compared to the base year 2015."

RECOVERY TYPE-BREAKDOWN	
Circular	Re-use
	Refurbish
	Remanufacture
	Recycle
Linear	Landfill / mixed waste incineration
	Unknown / other

Figure 4: Material flow breakdown by treatment type at end-of-life.

REQUIRED DATAPOINTS

- Total weight of recovered materials in the reporting period
- Total weight of manufacturing waste sent to landfills.



Want to know more or need support on your journey to becoming fully circular?

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