

CIRCLE user guide

The Circular Index for Resource Conservation and Loop-based Economy (CIRCLE) is a 10R-based assessment tool that provides a quantitative score for circularity. It evaluates performance across ten principles (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Recycle, Rot, Repurpose, Resell) using a clear scoring rubric. The final output is a single percentage score (CIRCLE-SCORE) and a visual profile, helping you identify strengths and gaps in your circular strategy.

The Assessment Process: A Step-by-Step Guide

Follow these five steps to complete a CIRCLE assessment.

Step 1: Define the System Boundary

Clearly state what you are assessing. The boundary could be:

- A single **product** (e.g., a smartphone, a plastic plate).
- A specific **process** (e.g., a chemical synthesis, a manufacturing step).
- A **facility or plant** (e.g., a manufacturing site, a waste treatment plant).
- An **organization** or a segment of a **value chain**.

Why this is important: The CIRCLE score is only meaningful within a declared boundary. Principles are scored based on what happens *inside* this boundary.

Step 2: Gather Relevant Information

Collect data and information relevant to the 10R principles within your defined boundary. This may include:

- Material composition and sourcing data.
- Product design and manufacturing specifications.
- Operational data on resource consumption, waste generation, and recycling.
- Information on maintenance, repair, and end-of-life management processes.
- Business models related to reuse, resale, or other schemes.

Step 3: Score Each R-Principle

For each of the 10 principles, assign a raw score of **3, 2, 1, or NA (Not Applicable)** based on the criteria in the table below.

Scoring Rubric for the CIRCLE Metric

Principle	Core Idea	Score 3 (High Performance)	Score 2 (Moderate Performance)	Score 1 (Low Performance)
Refuse	Avoid hazardous	All hazardous	Some hazardous	Used without

	materials.	substances avoided.	substances avoided.	consideration.
Rethink	Innovate to minimize waste.	Novel internal solutions implemented.	Adopted external innovations.	Conventional approaches without innovation.
Reduce	Minimize resource use.	Measurable resource efficiency in core operations.	Partial reduction.	No proactive reduction.
Reuse	Use products/materials repeatedly.	Maximum reuse, no new inputs needed.	Partial reuse.	No reuse (single-use only).
Repair	Restore functionality.	Fully repaired.	Partially repaired.	Not repaired.
Refurbish	Upgrade to like-new condition.	Fully refurbished (like-new).	Partially refurbished.	No refurbishment.
Recycle	Process materials to reduce waste.	Full recycling, high-quality recovery.	Partial recycling.	No recycling.
Rot	Compost biodegradable materials.	All composted.	Partial composting.	No composting.
Repurpose	Use discarded materials for new functions.	Fully repurposed.	Some repurposed.	None repurposed.
Resell	Extend life through resale.	Actively resold and reused.	Viable but unsold.	Not resellable.

Guidelines for Using "NA" (Not Applicable)

A principle should only be marked **NA** if it meets **all three** of the following conditions:

1. **Absence:** No relevant item, material, or process within your declared boundary can be subject to that principle (e.g., 'Rot' for a system with no biodegradable streams).
2. **Irrelevance:** The principle cannot meaningfully influence the circular performance of the system as you have scoped it (e.g., 'Resell' for a consumable reagent that is used up).

3. **No Data:** There is insufficient information within your boundary to assess the principle, even qualitatively.

If any condition is not met, you must assign a score of 1, 2, or 3.

Step 4: Calculate the CIRCLE-SCORE

The final score is calculated in two stages to ensure fairness and clear visualization.

1. **Normalize Individual Scores:** Convert each raw score (1-3) to a normalized score on a 1-10 scale.
 - $\text{Normalized Score} = \text{Raw Score} \times (10 / 3)$
 - **Raw 3** → Normalized **10**
 - **Raw 2** → Normalized **6.7**
 - **Raw 1** → Normalized **3.3**
 - NA is excluded from the calculation.
2. **Calculate the Final Percentage:**
 - **CIRCLE-SCORE (%)** = (Sum of all Normalized Scores) / (10 × Number of Applicable Principles) × 100
 - *Example:* If you have 8 applicable principles and their normalized scores sum to 60, your CIRCLE-SCORE is $(60 / (10 \times 8)) \times 100 = 75\%$.

Step 5: Interpret the Results and Visualize

- **The CIRCLE-SCORE:** Provides a single, comparable percentage for overall circularity performance.
- **The Visual Profile:** Plot the normalized scores (1-10) for each principle on a radar chart. This creates a visual profile that instantly shows which principles are strong (green), moderate (yellow), or weak (red).
- **Use these outputs to:**
 - **Benchmark** against previous assessments or competitors.
 - **Identify** specific areas for improvement (e.g., low scores on 'Repair' and 'Resell').
 - **Track progress** over time as you implement circular strategies.
 - **Communicate** performance clearly to stakeholders.
 - **Scores ≥ 75 are excellent, 50 to 74 are acceptable, less than 50 are not adequately circular**

Frequently Asked Questions (FAQ)

Q1: Can I use CIRCLE for any industry?

Yes. The 10R framework is universally applicable. The scoring criteria are designed to be interpreted within the context of your specific industry, from manufacturing and chemicals to agriculture and consumer goods.

Q2: What if I don't have precise quantitative data for a principle?

CIRCLE is designed to work with both quantitative and qualitative information. Use the best

available evidence—from technical specifications and operational logs to company policies and process descriptions—to make an informed judgment based on the scoring rubric.

Q3: Is a higher score always better?

A higher score indicates better alignment with circular economy principles. However, the diagnostic power of CIRCLE lies in the detailed profile. A medium score with a balanced profile may represent a more robust and resilient system than a high score achieved by excelling in only a few areas.

Q4: Where can I find the tool?

A free, user-friendly version of the CIRCLE tool is available at bit.ly/CIRCLE2026

Glossary of Terms

- **10R Principles:** A hierarchy of strategies for circularity: Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Recycle, Rot, Repurpose, Resell.
- **CIRCLE-SCORE:** The final percentage score (0-100%) representing the overall circularity performance.
- **Normalized Score:** A converted score on a 1-10 scale, used for creating the visual profile.
- **Raw Score:** The initial assessment score for a principle, based on the rubric (1, 2, or 3).
- **System Boundary:** The clearly defined scope of the assessment (e.g., product, process, site).

For further information, please refer to the main manuscript: "**Integration of 10R Principles into CIRCLE as an Innovative Tool for Assessing Circular Economy.**"