DEVELOPMENT OF A ROBUST INDEX TO QUANTIFY RESOURCE USE IMPROVEMENTS OF ORGANISATIONS

Dr.-Ing. Almut Sanchen, Prof. Dr. Elimar Frank

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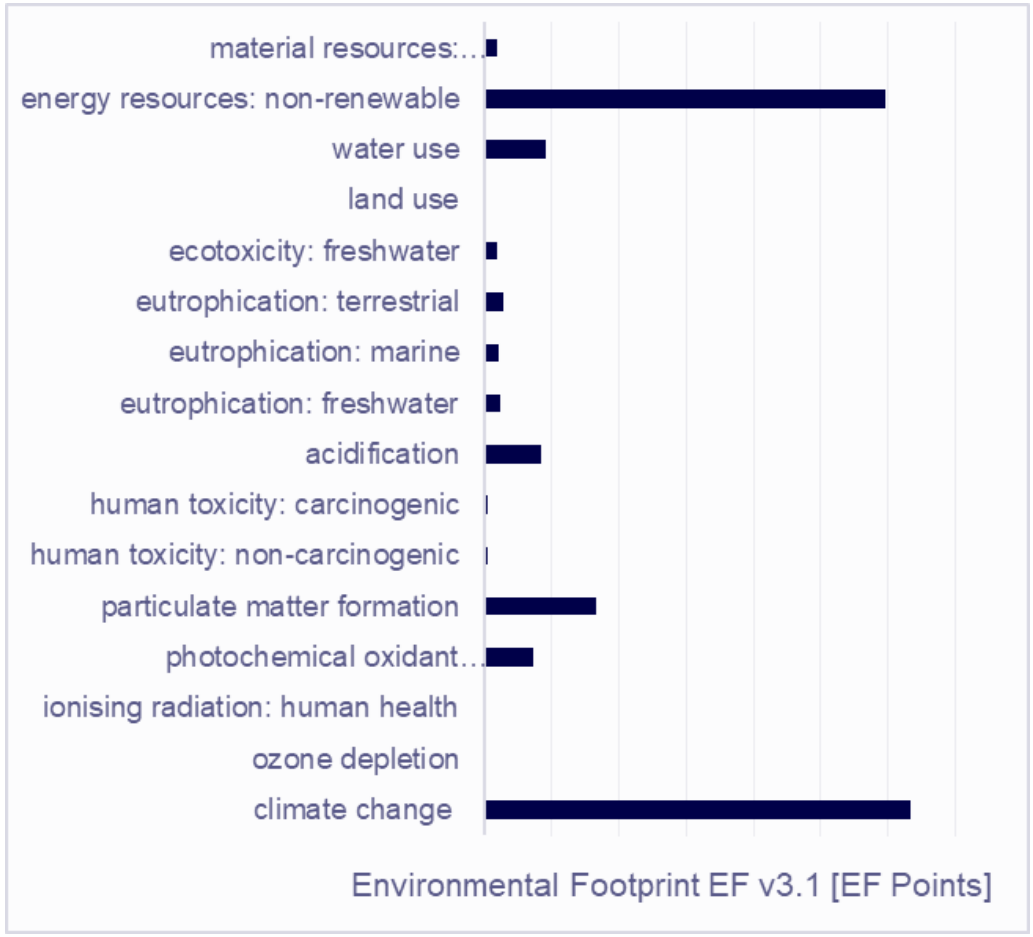
Introduction

- Resource efficiency and resource conservation are becoming increasingly important to organisations (e.g. in terms of cost savings, critical materials/resilient supply chains, environmental issues, reduction of greenhouse gas emissions).

➔ A single, simple key figure for assessing resource use and environmental impact over time would help organisations evaluate their progress in resource efficiency and resource conservation.

- For the purposes of this study, it is assumed that the consumption of natural resources can be determined using environmental life cycle assessments (LCA).



Example of an LCIA method (part of LCA), which also includes categories relating to the use of materials and energy resources. Example of a result for a plastic material.

Definition of the Resource Index

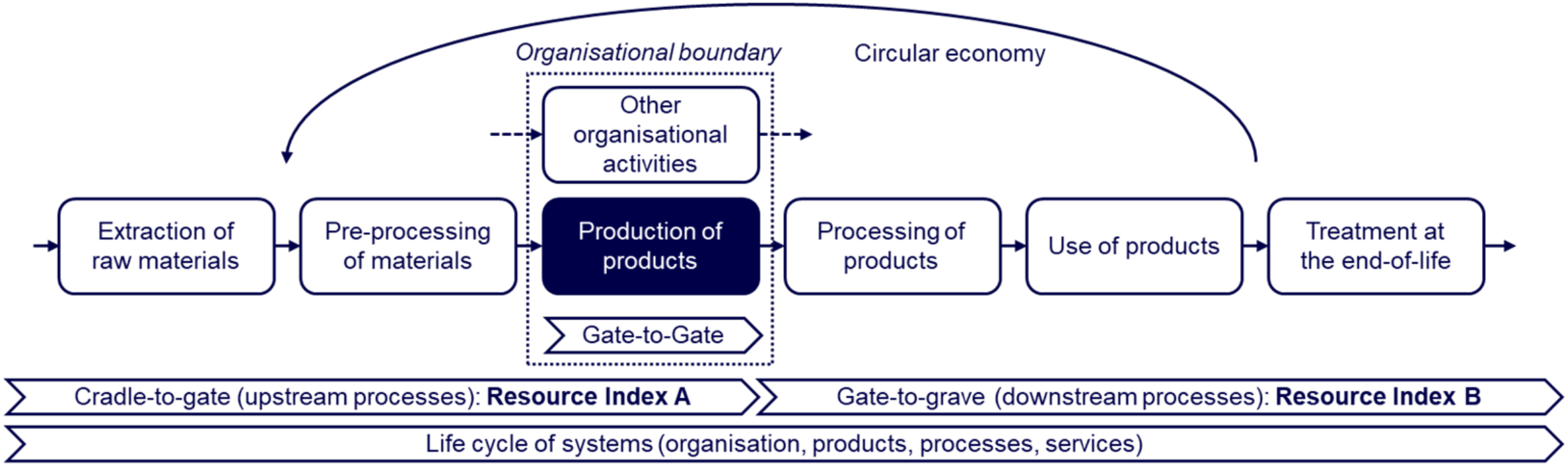
Equation (1)

$$Resource\ Index\ (i)[\%] = 100\ \times \frac{\sum Points\ (i)}{\sum Points\ (i) + \sum_{k=i0}^{i} reduction\ in\ Points\ through\ measures\ (k)}$$

- '*Points*' are the result of a fully aggregating LCIA method, e.g. the Ecological Scarcity method 'ES 2021' (expressed in environmental points with the unit 'UBP') or the European Union's Environmental Footprint method 'EF v3.1' (expressed in 'EF Points')
- '*i*' is the index for the accounting period
- '*k*' is the index for the total assessment period from the start period '*i0*' to the current accounting period '*i*'
- It is assumed that the consumption of natural resources can be determined using environmental life cycle assessments (LCA).

Definition of the Resource Index

- Life cycle and life cycle impact assessments are an integral part of the Resource Index



➔ The Resource Index (RI) is divided into categories “A” and “B”.
➔ This allows the various characteristics of the upstream and downstream processes to be considered.

Investigations of Applicability

- Example Scenario #1a: Increase in production volume, and, consequently, in LCIA results, and a proportional increase in the effectiveness of the measure

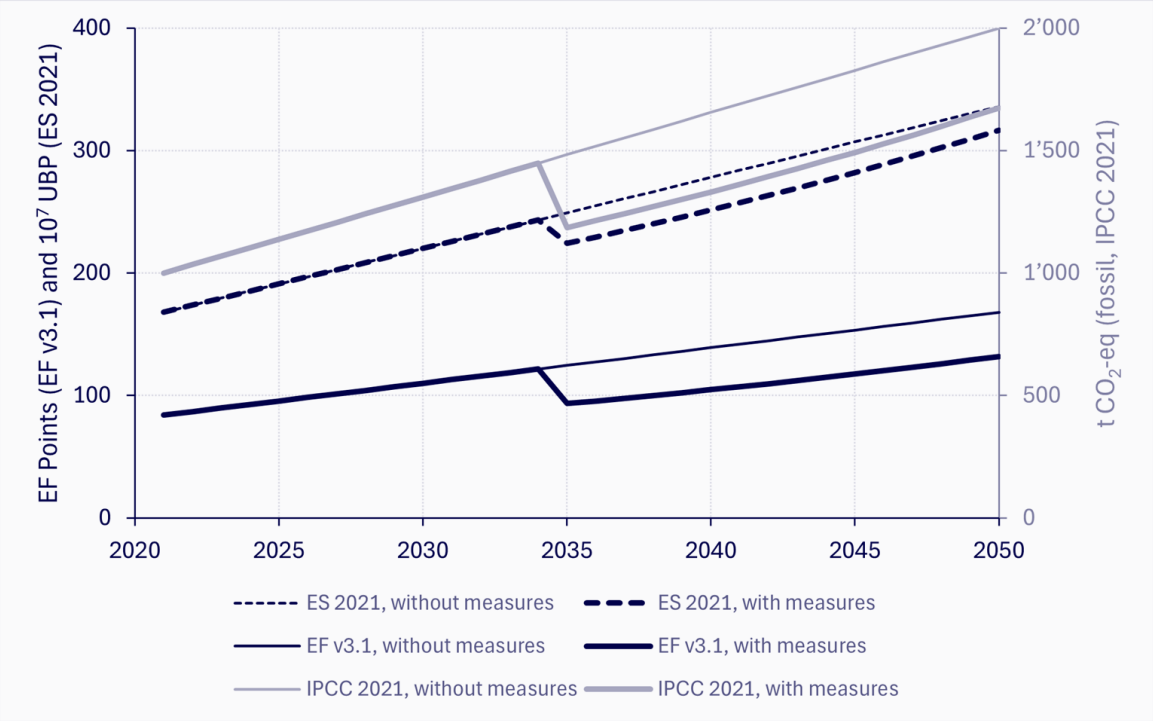


Figure 4. *LCIA results for a linear growth in production volume of 100 % from 2021 to 2050 with a corresponding proportional increase of environmental impact. The figures show results without and with the implementation of a measure in 2035.*

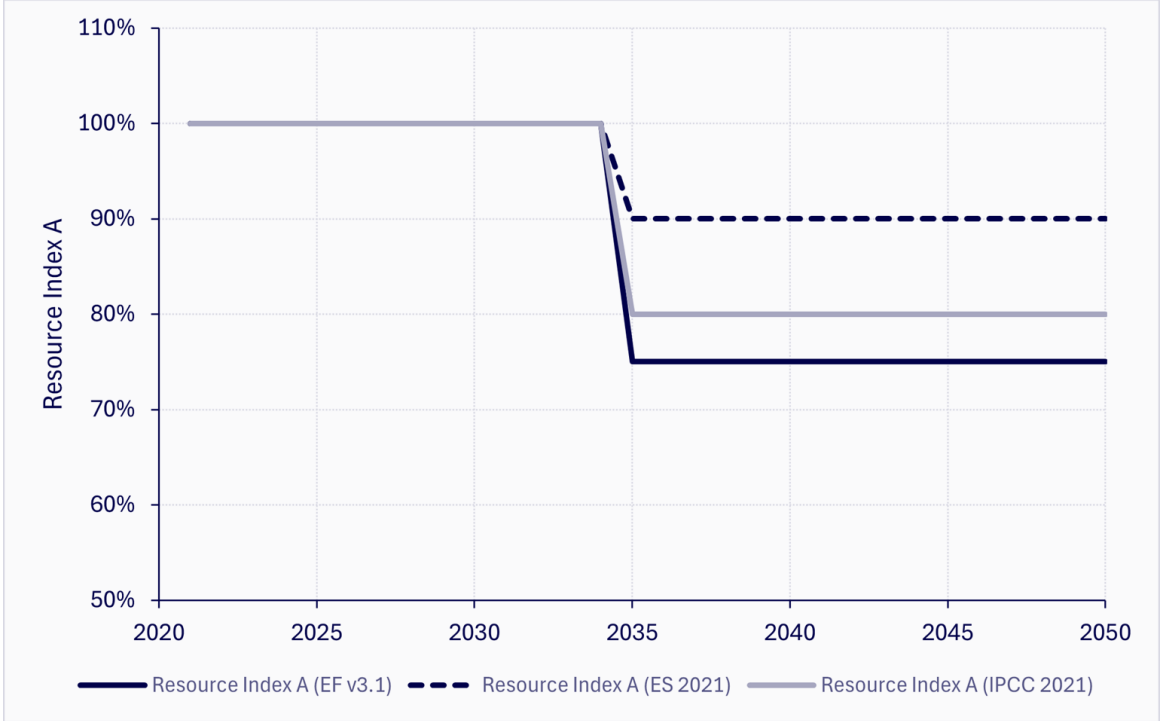


Figure 5. *Derived Resource Index A from the case in Figure 4.*

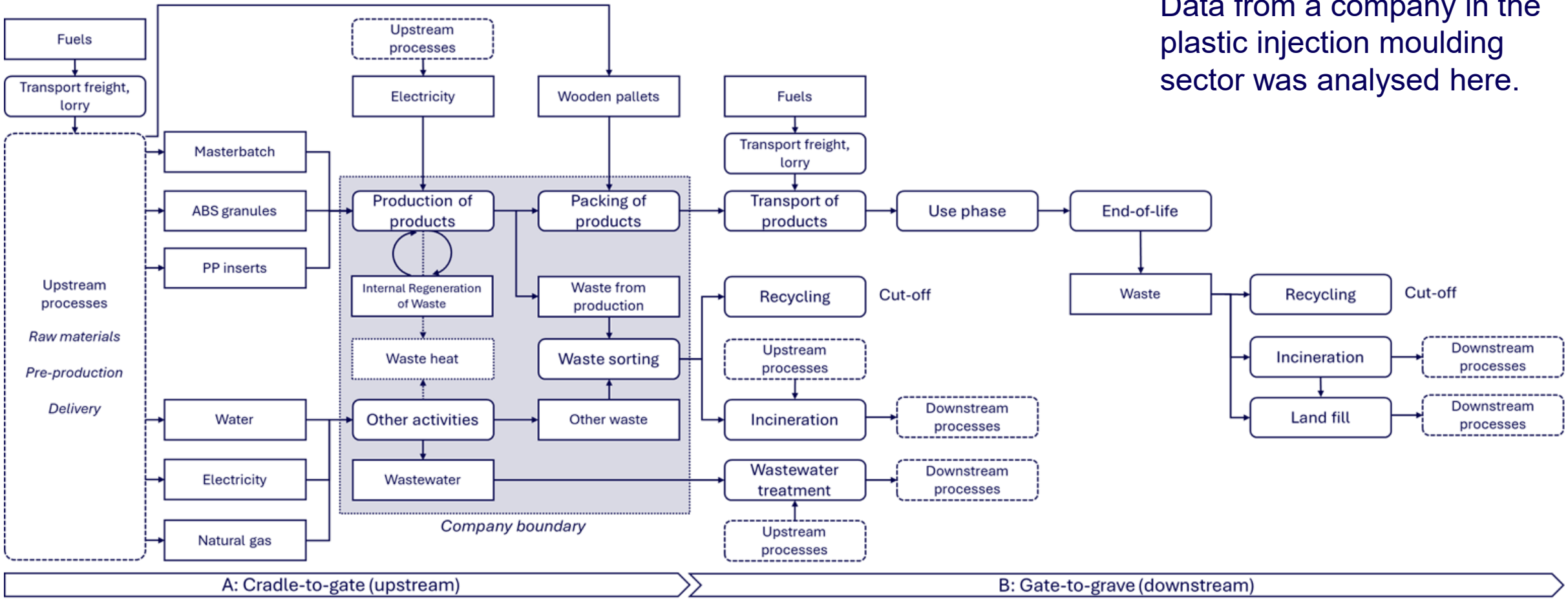
➔ The Resource Index (RI) shows the impact of the measure, regardless of "growth".

➔ Different LCIA methods lead to different RI.

Example Using Real Company Data (Simplified)

- Simplified process diagram: Starting point for the assessment

Data from a company in the plastic injection moulding sector was analysed here.



Example Using Real Company Data (Simplified)

- Results: Effectiveness of measures and annual LCIA results, cradle-to-gate (A)

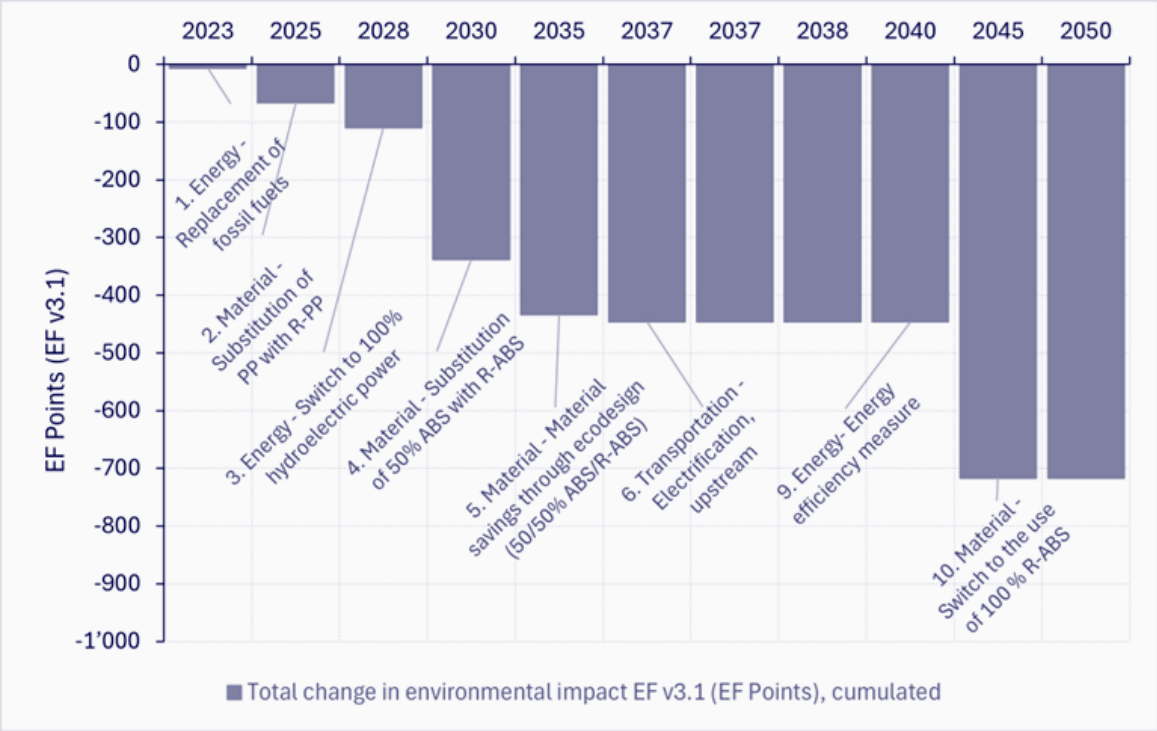


Figure 7. *Measured (2023, 2025) and predicted (from 2028) cumulated effects of improvement measures on EF Points, estimated according to Environmental Footprint method EF v3.1, on a cradle-to-gate perspective (upstream processes).*

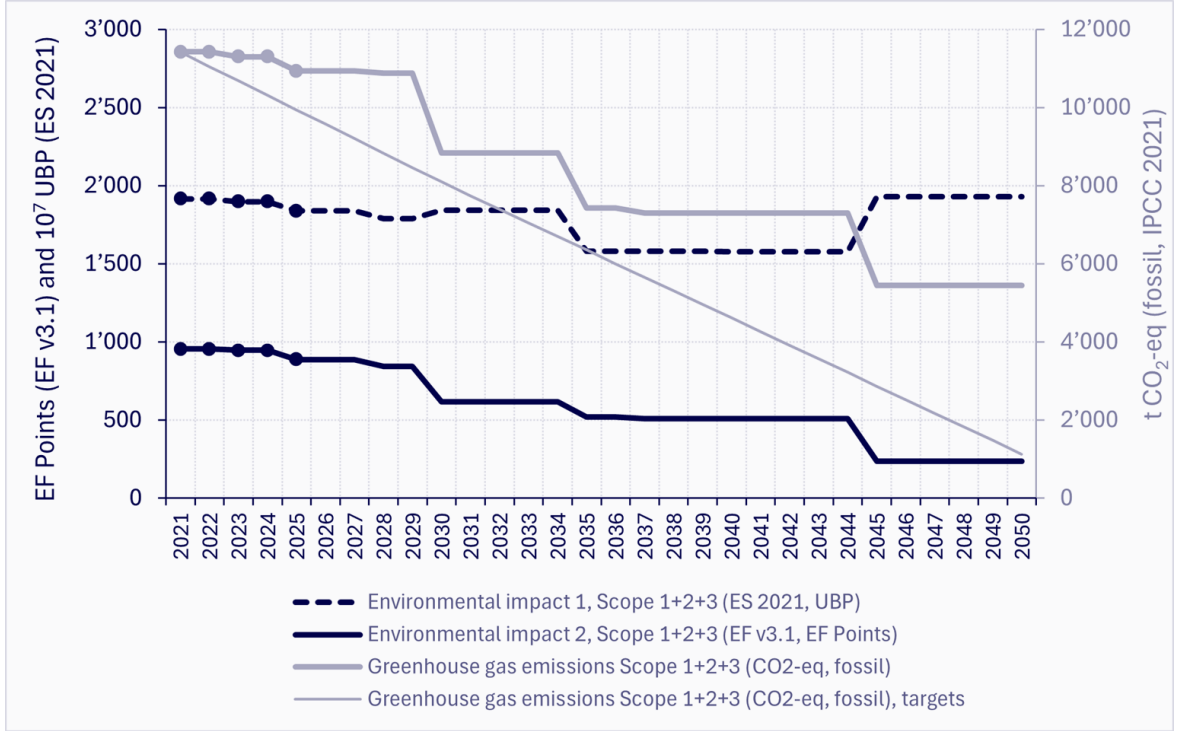


Figure 9. *Measured (from 2021 to 2025, lines with dots) and predicted (from 2026) environmental impacts, cradle-to-gate (upstream, scope A), resulting from the implementation of improvement measures by the company (Figure 7). Greenhouse gas emission targets aim for a reduction target of -90 % from 2021.*

Example Using Simplified Real Company Data

- Results: Resource Index A (upstream) and B (downstream)

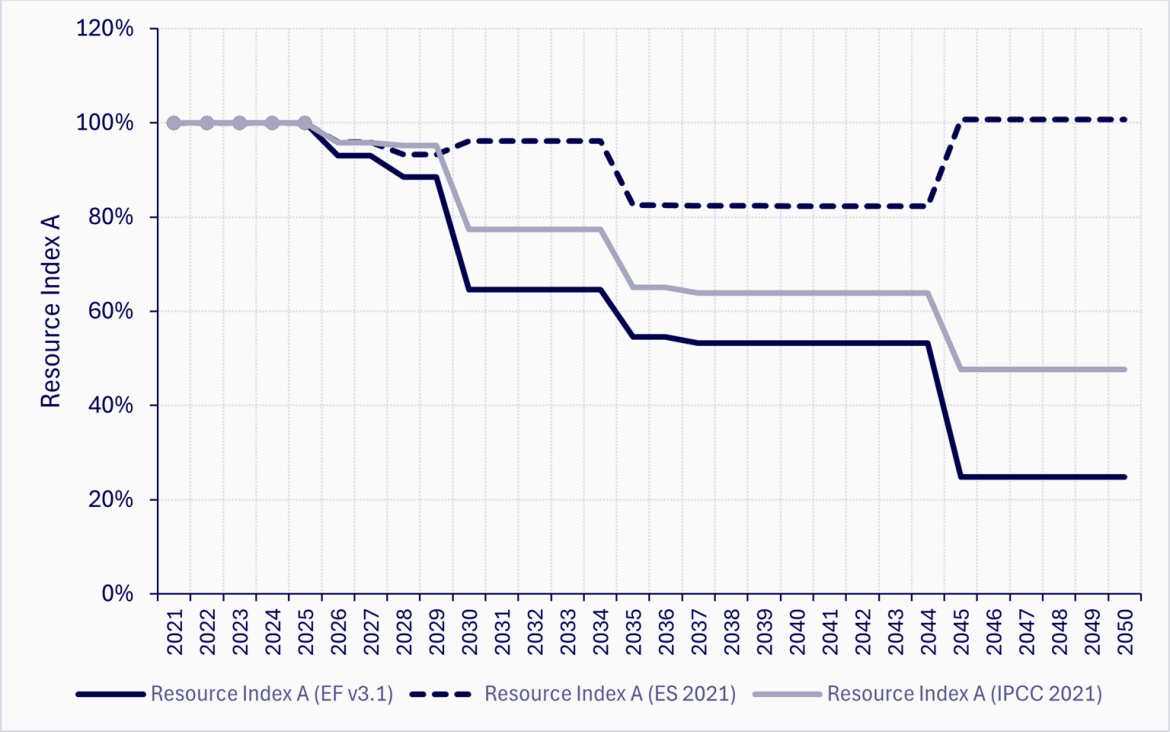


Figure 11. *Resource Indices A show the relative improvement of resource efficiency and resource conservation from a cradle-to-gate perspective. The data trends correspond to the trends in absolute values shown in Figure 9.*

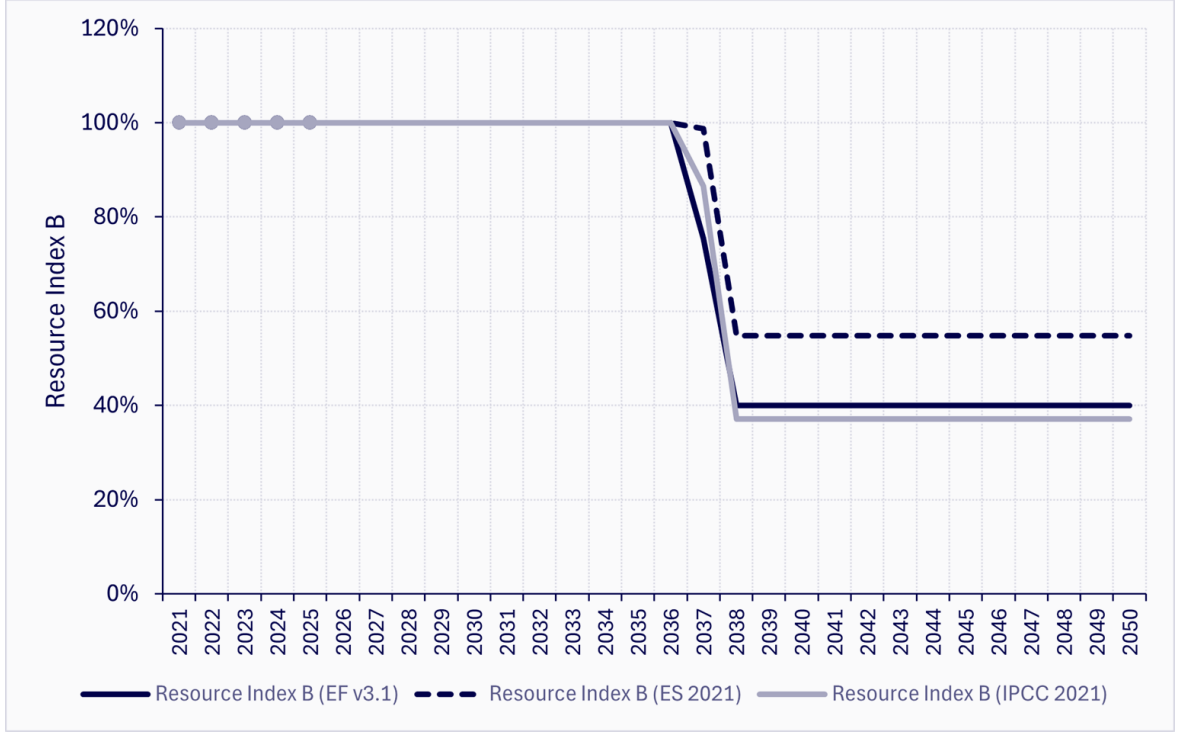


Figure 12. *Resource Indices B show the relative improvement of resource efficiency and resource conservation from a gate-to-grave perspective.*

➔ The Resource Index (RI) shows the actual values and forecasts the future impact of the measures, including the interdependencies between them. The companies analysed to date, and particularly their management teams, found the presentation of progress using the RI to be clear and insightful.

Conclusions

- The Resource Index (RI) enables organisations to demonstrate progress in terms of resource efficiency and resource conservation over time. The use of the RI instead of a set of different key figures simplifies to track the effectiveness of the measures implemented and to forecast progress.

- The RI can reliably indicate the impact of an organisation’s improvement measures over time, even when changes occur, such as in production volumes or changes in the chosen life cycle impact assessment (LCIA) methods. It provides organisations with valuable insights for planning and assessing improvement measures.

- Various LCIA methods can be used to derive the Resource Index, preferably those that cover a broad spectrum of impact categories and result in “aggregated points”.

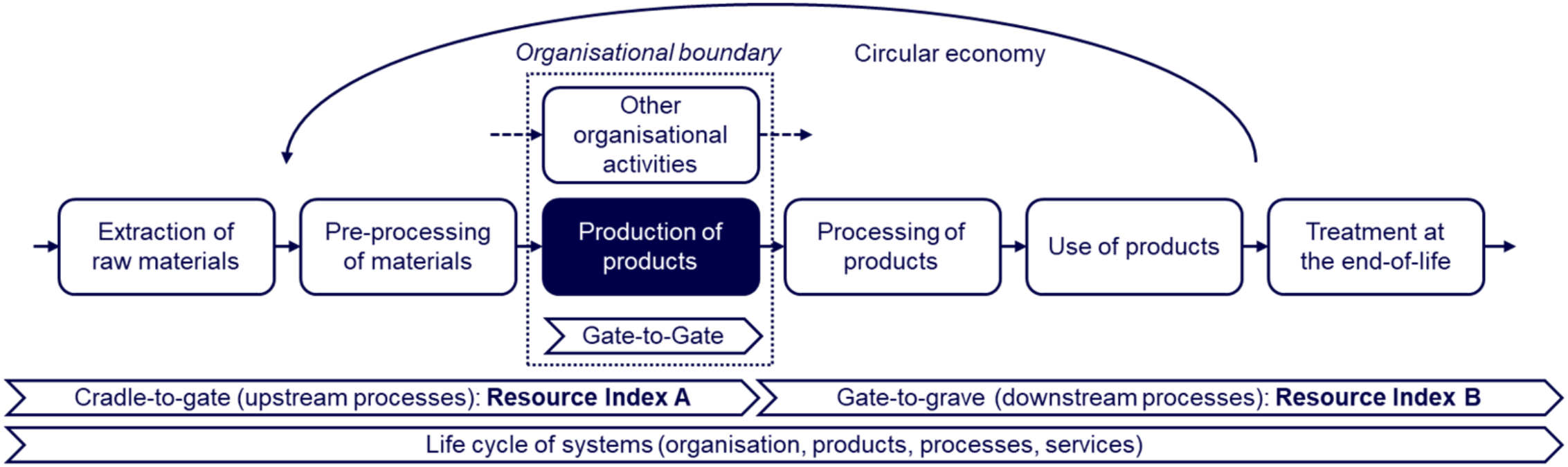
Outlook

- To complete an assessment of an organisation, both financial and social aspects should also be considered. Potential users of the Resource Index include for example the organisations themselves, as well as funding bodies, regulatory authorities and other stakeholders.

Backup

Determination of the Resource Index

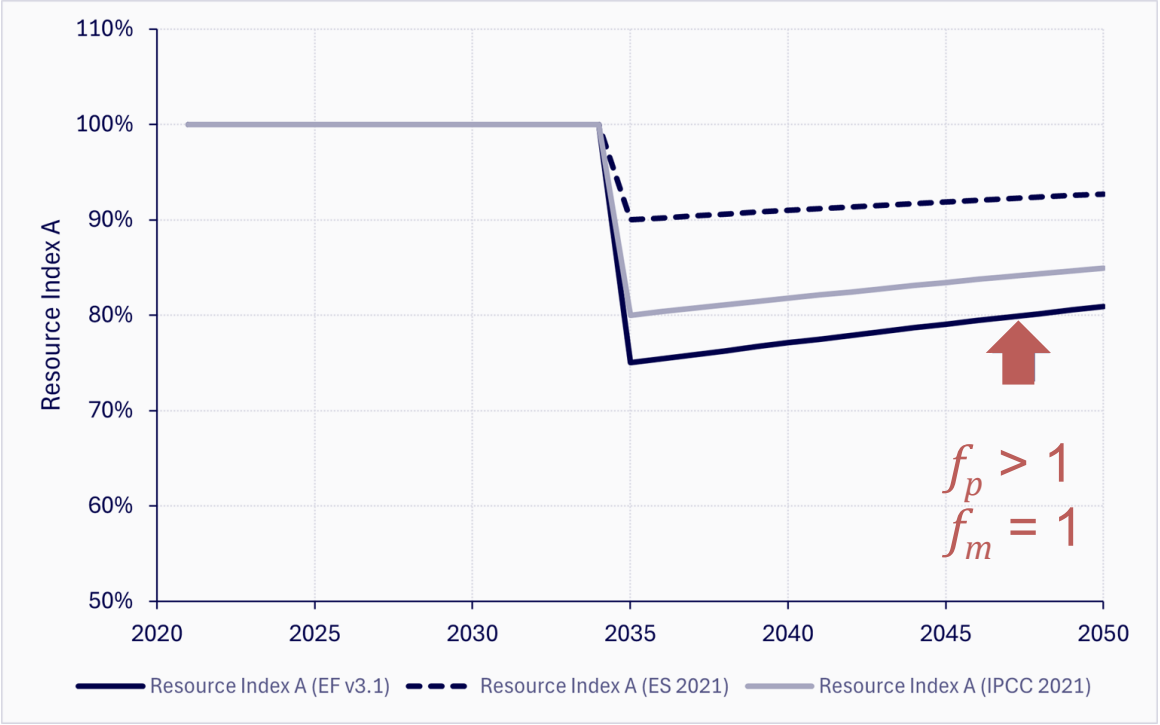
- Phase 1: Organisational life cycle assessment (O-LCA), draft of a list of improvement measures
- Phase 2: Evaluation of the effectiveness of measures (changes to activity data, LCIA)
- Phase 3: Estimation of the future development with measures
- Phase 4-5: Implementation of measures, data monitoring, continuous improvement process



Investigations of Applicability

- Example Scenario #1b: Increase in production volume and, consequently, in LCIA results, without changes in the effectiveness of the measure

Figure 6. *Resource Index A for a linear growth in production volume of 100 % from 2021 to 2050 with a corresponding proportional increase of environmental impact.* ***Without a proportional increase in the effectiveness of the improvement measure****, the Resource Index A will gradually rise after 2035.*



➔ Over time, an increase in the Resource Index can be observed. The extent depends on the LCIA method chosen.

➔ In other words, “resource conservation” declines.

Definition of the Resource Index

Equation (2) extends Equation (1) by two scaling factors, f_p and f_m:

$$RI\ (i)[\%] = 100\ \times \frac{f_p \times \sum Points\ (i)}{f_p \times \sum Points\ (i) + f_m \times \sum_{k=i0}^{i} reduction\ in\ Points\ through\ measures\ (k)}$$

- 'f_p' is the scaling factor or the organisation's LCIA result
- 'f_m' scaling factor for the impact of measures on the organisation's life cycle
- If the factors f_p and f_m are equal, they can be factored out of the equation; the Resource Index (RI) is in this case independent of the scaling and thus independent of proportional changes in production volumes and LCIA results.
- If the factor f_m is equal to 1 (static measure) an increase in the factor f_p leads to a decrease in the denominator and thus to an increase in the RI.