METHODOLOGY

This document presents the methodology used by the OptimAction platform to calculate environmental benefits. In addition to documenting the qualitative aspects of optimization initiatives, the tool makes it possible to calculate net environmental benefits and provides quantitative indicators and qualitative information.

Summary

1. Which performance indicators does the OptimAction tool calculate?

The OptimAction platform produces a before and after comparison of the net benefits of optimization efforts according to a range of performance indicators. The indicators are calculated based on information provided by the user and generic data obtained from internationally recognized public life cycle inventory databases. Performance indicators are only calculated for projects to optimize packaging that is already in use (before and after comparison).

The performance indicators calculated by the OptimAction tool are:

- Percentage reduction in packaging weight per product (%)
- Percentage increase in recycled content (%)
- Percentage increase in the packaging recovery rate (%)
- Percentage reduction in packaging mass (%)
- Percentage reduction in greenhouse gas (GHG) emissions (%)
- Percentage reduction in the number of freight containers used to transport 1 tonne of product (%)

2. How are the performance indicators calculated?

The performance indicators in the OptimAction tool are based on a comparison of the packaging characteristics before and after the optimization initiative.

The performance indicators only appear in the case study in the ecodesign portal when the optimization generates a benefit. Therefore, only positive indicators (i.e., above 0) are displayed on the ecodesign portal.

2.1 Calculation of the % reduction in packaging weight per product

The percentage (%) reduction in packaging weight per product is equal to the difference between the ratio of packaging mass to product mass before and after optimization. The ratio is calculated according to the following formula:

$$P_{emb/prod} = \frac{\sum_i^n m_i}{m_{prod}}$$

Legend:

$P_{emb/prod}$: ratio of packaging mass per product
n: number of primary, secondary and tertiary packaging components
i: packaging component
m_i: mass of component “i” per product
m_{prod}: mass of the product

2.2 Calculation of the % increase in recycled content

The percentage (%) increase in recycled content is equal to the difference in total recycled content (primary, secondary and tertiary packaging components) before and after optimization. Recycled content takes into account pre-consumer and post-consumer content. The indicator does not take into account the amount of product contained in the packaging.

2.3 Calculation of the % increase in the packaging recovery rate

The percentage (%) increase in the packaging recovery rate is equal to the difference between the packaging recovery rate before and after optimization. The rate of recovery is calculated based on current provincial statistics for each material. When data are unavailable, Canadian averages are used (based on current provincial statistics). To determine the recovery rate, OptimAction considers only the main component of primary packaging and its end-of-life location.

2.4 Calculation of the % reduction in packaging mass

This indicator corresponds to the mass difference in percentage (%) of the packaging (primary, secondary and tertiary components) before and after optimization. It therefore does not consider the amount of product contained in the packaging.

2.5 Calculation of the % reduction in greenhouse gas (GHG) emissions

The GHG emissions reduction indicator is based on simplified life cycle analysis (LCA) and the ISO 14040-44 standard.

Simplified LCA makes it possible to highlight key trends in terms of environmental impact related to the life cycle of a packaging or printed matter. Compared to a detailed LCA, a simplified LCA may be carried out in a shorter time frame and considers the life cycle stages deemed most relevant or for which data are available and/or calculations can be adequately performed. It is mainly based on internationally recognized generic environmental data and may aim to assess a single environmental indicator (e.g., the impact on climate change (GHG balance) or the impact on ecosystem quality).
Because they are not significant contributors to the GHG balance or because they cannot be adequately calculated based on the information in the OptimAction tool, certain life cycle stages are excluded from the calculation, specifically product transportation by the consumer and the use stage of the packaging or printed matter (e.g., refrigeration, washing, etc.) by the consumer. Indeed, although the characteristics of the packaging or printed matter may potentially impact the use stages (e.g., waste rate, reuse, etc.), they are highly dependent on consumer behaviours and are therefore not modelled quantitatively. Even so, the OptimAction platform makes it possible to document certain actions from a qualitative perspective.

2.6 Calculation of the % reduction in the number of freight containers used to transport 1 tonne of product

This indicator corresponds to the difference between the number of freight containers required to transport 1 tonne of product before and after optimization.
The calculation of the number of freight containers required to transport 1 ton of product is only possible when the user specifies the number of products contained on one pallet (tertiary packaging component). The OptimAction tool will estimate that each freight container can hold an average of 30 pallets of product. The calculation formula is as follows:

$$P_{cont} = \frac{1000}{Nb_{prod} \times m_{prod} \times 30}$$

Legend:

P_{cont}: number of freight containers required to transport 1 ton of product
Nb_{prod}: number of products per pallet
m_{prod}: mass of the product (kg)

3. Methodology to calculate the greenhouse gas (GHG) balance

As stated in Section 2.5, the percentage reduction in greenhouse gas (GHG) emissions indicator is based on a simplified LCA that quantifies GHG emissions over the life cycle of the packaging before and after optimization.

It is measured in grams of CO_2 eq (carbon dioxide equivalent): the reference unit to which other GHG emissions are converted. The indicator is calculated based on the global warming potential (GWP) of greenhouse gases over 100 years, as established by the Intergovernmental Panel on Climate Change (IPCC, 2007). Substances known to contribute to global warming are adjusted according to their GWP expressed in kilograms of carbon dioxide (CO_2) equivalent.

Because CO_2 emission and uptake by plants can lead to the misinterpretation of results, biogenic CO_2 is often excluded when assessing GWP. In accordance with the recommendations of the Publicly Available Standard (PAS) 2050 for carbon footprint calculation (BSI, 2011), biogenic CO_2 uptake and emission are not accounted for in the GHG emission assessment methodology on 100-year (IPCC, 2007) because the captured and emitted flows are considered zero. By default, CO_2 of unspecified origin is associated with fossil-based CO_2. The GWP of fossil-based methane (CH_4) is 27.75 kg CO_2 eq/kg CH_4 to consider the effect of its degradation into CO_2. Methane of biogenic or unspecified origin is 25 kg of CO_2 eq/kg CH_4. Although carbon monoxide (CO) is not a greenhouse gas, a characterization factor of 1.9 kg CO_2 eq/kg CO is determined to account for its partial transformation to CO_2.

4. Data source

The data used to calculate the greenhouse gas (GHG) emissions generated during the life cycle of packaging and printed matter were obtained from ecoinvent 3.5 (ecoinvent, 2018), an internationally recognized database with over 4,000 life cycle inventories of agricultural, energy, transportation and materials processes. Most of the data were generated in Europe, and they were adapted as much as possible to reflect the North American context.

5. End-of-life modelling

The modelling of end-of-life scenarios for packaging components was carried out using provincial statistics for each material. The OptimAction tool automatically considers the statistical distribution of end-of-life streams (i.e., between incineration, landfilling and recycling) for each province and for each category of material when data are available. Otherwise, Canadian averages are used (based on the provincial data). The tool only considers the main component of the primary packaging and its end-of-life location to determine the most likely end-of-life scenarios.

6. Modelling of the environmental benefits of recycling

In LCA, a number of methodological questions arise when modelling the environmental benefits of materials recycling, which is a process to manage materials at the end of their service life and produce recycled content to manufacture new products.

Packaging or printed matter may contain recycled materials or be recycled at the end of its life, and it is generally accepted that both processes generate an environmental benefit compared to a similar product that is made from only virgin materials or not recycled, since both actions help reduce the demand for virgin materials, which are replaced by recycled content.

But before the benefit is calculated, a number of methodological questions must be addressed. For example, to whom should the benefits of recycling be attributed? To the company that recycles or the company that uses recycled content? Should the user of recycled content bear some responsibility for the impacts of the production of virgin materials? The questions highlight the challenge of allocating end-of-life impacts. Indeed, there is no universal answer. Choosing one method over another creates different incentives depending on whether the product is recycled or used to produce recycled content.

One way to tackle the issue is to consider the realities of the market and context in which the product is used. That is the principle on which the decisions for the OptimAction tool were based. There are countless methods in the literature, but only a few may be realistically applied in OptimAction’s context: system expansion, 50/50 and cut-off.

The system expansion approach (impact avoidance) attributes a benefit in the form of impact credits to products with components that will be recycled, since the recycled material thus produced will replace virgin material. The approach is commonly used for metals such as aluminium and steel. The approach may be modelled by assuming that aluminium and steel packaging options are produced from 100% virgin material to avoid applying a double credit to the same product for its recycled content and then again for its end-of-life recycling. The approach tends to favour steel and aluminium packaging recycling over the use of recycled materials. It allocates a positive incentive when the recycled materials market is very mature and manufacturers do not control the recycled content of their products. In other words, when all the materials sent to be recycled are indeed recycled. In current streams, that is the case for steel and aluminium. The methodology does not differentiate between a product made only from virgin materials and one made entirely or partially from recycled materials.

The 50/50 approach applies in cases where market maturity is debatable or variable, since 50% of the benefits are attributed to the product that uses recycled materials and the other 50% are attributed to recycling at the end of the product's service life. The total impact of the packaging or printed matter thus depends on its recycled content and recycling rate. This approach creates an equally positive incentive for organizations that rely on recycled content and those that recycle products. In the OptimAction tool, the approach was applied to paper, cardboard, glass and plastics.

Finally, the **cut-off approach** is applied when the demand for recycled content is lower than supply. In such cases, it is preferable to encourage the use of recycled content over product recycling, as incentives for recycling would further increase supply, which is already greater than demand, and the materials would likely not be used. In this approach, benefits are attributed to recycled content users, and recycling only avoids end-of-life streams such as landfilling or incineration without replacing the production of virgin materials. The OptimAction tool does not apply this approach.

Following a comparative study of different end-of-life allocation approaches (K Allacaker, 2017), the Product Environmental Footprint (PEF) of the European Commission chose to rely on this strategy.

7. Limitations of the GHG balance methodology and results dissemination

7.1 Limitations of the GHG balance

The methodology used to develop the tool is based on the ISO 14040 standard and considers current best practices and the knowledge of several recognized experts. For the purpose of simplification (because they do not significantly contribute to the GHG balance or because they cannot be adequately calculated with the data in the OptimAction tool), some stages of the life cycle of packaging were not taken into account when developing the tool, namely product transportation by the consumer, the use of the packaging or printed material (e.g. refrigeration, washing, etc.) by the consumer, packaging transportation to the sorting centre at the end of its service life and any losses or food waste associated with the packaging life cycle. To facilitate the tool's development, a simplified approach was used. It does not affect the quality of the study but rather the use that may be made of it.

The following limitations must therefore be considered when interpreting the GHG emissions reductions results generated by the OptimAction tool:

- The inventory data used to model potential GHG emissions reductions are based on generic data that may not be fully representative of the studied packaging (e.g., production technologies, end-of-life management practices, etc.).
- End-of-life packaging transportation to the sorting facility and the rate of loss or food waste associated with the packaging are not taken into account.
- Some modeling assumptions for the end-of-life stage may not be fully representative of specific management practices (e.g., data are based on curbside recycling recovery rates and not actual recycling rates, material-based choices of end-of-life allocation rules).

In the context of a more detailed LCA, more environmental indicators, such as the impact on ecosystem quality or the consumption of non-renewable resources, may be selected. In a broader decision-making context, a more detailed LCA is recommended.

Despite the limitations described above, the OptimAction tool highlights trends and documents potentially promising packaging solutions to reduce GHG emissions.

7.2 Results dissemination

It is possible to disseminate the results of the case studies conducted on the OptimAction platform by taking into account best practices and the following recommendations.

- The results in the ecodesign portal **cannot be modified or altered and must be disseminated in their entirety**. Therefore:

- the context and objectives of the ecodesign approach, challenges encountered and benefits generated should be presented; and
- in the interest of transparency, if a performance indicator is neutral or not supportive of the optimized packaging, making a partial selection of indicators that are favourable is not recommended. Instead, provide explanations and share the organization's next steps to improve the packaging.

- For the percentage reduction in GHG emissions indicator:
  - If there is a change in materials in the optimized packaging, the ISO standards pertaining to the conduct of environmental assessments stipulate that a critical review is required to disseminate comparative claims that negatively affect another product, process or service (potential harm). For example, the environmental comparison of packaging with a different material could be detrimental to other types of packaging on the market and pose reputational risks to competitive solutions. It is therefore recommended that a more comprehensive LCA be conducted before publicly communicating GHG reductions results outside the ecodesign portal.
  - For all communications, it is recommended to specify the limitations of the results in a textual way or by including a link to ÉEQ's ecodesign portal (i.e., by adding a cautionary note).

For example: The estimated percentage **reduction in GHG emissions** is based on a **simplified life cycle analysis** (more specifically, a GHG balance sheet). The analysis considers the life cycle stages deemed most relevant and for which data are available.

This estimate emphasizes **potential** GHG reductions, thus highlighting initiatives.

A detailed life cycle analysis and critical review would increase the robustness of the results.

- In addition, when determining key messages, the conditional tense and terms such as potential and approximately are recommended (e.g., our approach could potentially reduce the GHG emissions by 10% as compared to the previous packaging and increase the recovery rate by 15%.)

- It is strongly recommended that organizations validate their key messages with ÉEQ before any information is shared with the public. ÉEQ can provide support to turn a spotlight on your efforts in a rigorous and transparent manner and avoid the pitfalls of greenwashing.

8. References

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