Assessment of resource efficiency in a life cycle perspective: the case of reuse

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22nd June 2017
Structure of the presentation

- **Aims of the study:** Assessment of resource efficiency in support of policy decision making

- **Method development:** Assessment of ‘preparation for reuse’ of energy using products

- **Case-study:** Washing machine

- **Discussion:** LCA and resource efficiency assessment

- **Conclusions**
Aims

- Assessment of the potential benefits / impacts of ‘preparing for reuse’ (i.e. once WEEE) of energy using products (EuPs)

- Main focus were the potential trade-offs between resource savings due to reuse and potential higher impacts due lower energy efficiency of used appliances

Approach

“REAPro” (Resource Efficiency Assessment of PROducts*), method developed by the European Commission to support policy makers to identify workable entry market criteria to improve resource efficiency performance of products

REAPro tackled so far other resource efficiency strategies (e.g. recyclability, recycled content, durability, etc.)

* Ardente et Mathieux, Journal of Cleaner Production 83 (2014)
Method to assess re-use of EuP

The method is based on the comparison, in a life cycle perspective, of two scenarios:

• a ‘base-case’ scenario, where a product (A), after its first use, is discarded and substituted by a new product (B).

• a ‘reuse’ scenario, where the product (A), after its first use, undergoes a series of treatments for the reuse.

Details of the method, equations and complete case-studies, available in:
Method

Indicators to assess the benefit of reuse have been developed, with the following concept:

\[
\Delta_{\text{reuse}} = \frac{[\text{Impacts Sc.1}] - [\text{Impacts Sc.2}]}{[\text{Impacts Sc.1}]} \times 100\%
\]

Benefits / impacts of reusing a WEEE

Reference scenario

For example, a value of \(\Delta_{\text{reuse}} = 5\%\) for a certain impact (e.g. GWP), implies that the reuse of the waste has the overall effect of reducing the impact by 5% on the life cycle, compared to purchasing a new one.
Case-study:

The method has been applied to a case-study washing machine (WM) that is reused after being WEEE.

• Survey of experienced reuse operators in the EU (in France and Belgium) for assumptions on waste washing machine and ‘preparing for reuse’ process

• Life Cycle Assessment (LCA) of the system

• LCIA results as input of REAPro method to evaluate the potential benefits for reuse

• Indicators calculation and interpretation for policy use
Case-study: example of two impact categories

Some benefits occur if the replacing product has an energy consumption 85% higher of the consumption of the reused product.

Always largely beneficial
Discussion:

Looking at previous results,

• Environmental benefits of reuse (in a life cycle perspective) depend on the selected impact categories.
• Among the considered impacts, only ADP clearly showed a marked advantage of the reuse.

According to our experience:

I) decision makers generally base their decisions on a limited set of life cycle indicators, *mainly GWP and energy consumption indicators*

II) robustness of ADP (indicator that relates to the consumption of non-energy resources) is *largely questioned* by the scientific community, and its understanding is very limited to the wider public of stakeholders, including policy makers.
Discussion:
... and this is bringing therefore to a fundamental question...

*Is LCA an effective method to assess material efficiency of products?*

Based on the analysis of our researches:

- LCA seems **not fully able to capture resource efficiency aspects and impacts** of a product life cycle, such as the changes in the quantity and quality of resources used (including potential downgrading of material occurring other EoL treatments as recycling)

- LCA, as currently, has difficulties in **assessing the benefits of certain strategies** (e.g. reuse) from the resource efficiency point of view (non-energy issues)
Discussion:

LCA is in a crucial step of its development to prove its robustness and applicability for a larger public (including policy makers), beyond a simple exercise of ‘academics for academics’.

‘over-complication’ of LCA as risky as ‘over-simplification’

Strengthen a ‘new course’ of development of the LCA by interconnection with other methodologies

The warnings raised from our researches in the last 6 years about bringing LCA into some policy decision processes are still an isolated case, but can already represent an ‘alert alarm’ for bigger challenges to be tackled by the scientific community.
Discussion:

JRC introduced specific indicators (e.g. re-use indicators) to model and assess the resource efficiency of EuPs along their overall life cycle, in different scenarios.

Moreover, the integration / coupling of LCA with other tools dedicated to material accounting (e.g. MFA; CRMs flows) in the product systems is relevant and necessary.

... providing disaggregated figures of the flows of certain materials within the life cycle of the product (i.e. life cycle inventory flows) resulted sometimes more effective than LCIA to demonstrate or communicate that certain practices can provide resource efficiency benefits.
Conclusions:

- ‘Preparation for reuse’ already revealed its potential for resource efficiency improvement, but this requires further studies and, moreover, policy support. Progress of reuse of WEE in Italy are poor compared to other countries.

- It is necessary to invest more research in the development of new impact categories and indicators related to resource consumption. Current available ones appear inadequate.

- It is necessary to invest in making more intelligible LCA impact indicators, to allow their efficient use in practical contexts (e.g. policy making).

- LCA could be integrated with other methods to better capture the time dimension of flows of materials within the product life cycle. This implies more attention to life cycle inventory flows.
Thank you for your attention

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List of JRC reports tackling the theme of resource efficiency of products

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