

Sustainability Criteria for White Goods

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Abstract

This paper develops a catalogue of criteria for the sustainability assessment of household dishwashers as an example for white goods. Drivers for this are the implementation of the Ecodesign Directive and sustainability strategies that companies define. While the focus of the Ecodesign Directive was previously on energy efficiency, now resource and material efficiency is in the focus.

A multi-stage literature research had been carried out on existing catalogues of criteria for assessing the ecological dimension of sustainability aspects in the different product categories of electrical appliances.

The research results were summarized and introduced into an evaluation system, which served as a basis for the development of the catalogue of significant criteria. Applicable criteria were identified, the criteria were adopted to the product category of household dishwashers in accordance with the method for multi-criteria decision support.

The summary of the results shows a catalogue with 66 individual criteria in nine different categories. Although the responsibility of sustainable product design is primarily with the manufacturer, the system boundaries were chosen to include criteria from the design phase to disposal of the product.

For example, resource productivity and replacement of non-renewable materials with renewable ones contributes largely to sustainable development. The limitations of the catalogue presented are to a large extent in the use phase and in user behaviour because it influences the total energy and water consumption.

The application and suitability of the catalogue of criteria, as well as the contribution to sustainable development and for society were evaluated. A recommendation for further action was concluded. Finally, possible uses and further developments of the catalogue of criteria are described.

1 Introduction

The aim of the present work was the identification of requirements for the sustainable design of white goods with the example of household dishwashers in the context of the expansion of the Ecodesign directive [2] towards material efficiency and sustainability of products in general.

Companies thrive for strategies to make themselves sustainable. One major part besides the operation of the company's facilities and the supply chain is the manufactured product itself with the influence of the product design.

A catalogue of criteria was developed for the assessment of the sustainability of white goods. Motivation for this activity was based on the additional measures on material efficiency that the ecodesign directive requires as a second policy focus in addition to the energy efficiency requirements that are already widely

implemented. As a result, 66 criteria in nine categories were identified.

Literature research was done to identify criteria existing for electronic products in general. An evaluation system was defined and applied based on multi criteria decision support to develop a catalogue specific for white goods.

To look at the influences of Regional specifics and in order to be able to address unique specific resource and consumable requirements dishwashers were selected as an example.

During the development of the criteria it was important to include all phases of the life cycle with focus on the design and manufacturing phase.

2 Baseline of the Criteria Development

Principles of sustainable development were used as a baseline such as Efficiency, Consistency and Sufficiency addressing the increase of productivity, renewability of the resources and the limitation of use.

Also it was important to focus on the applicability of the criteria and the benefits for the single actors.

3 Principles of Sustainability Criteria

Sustainability of electronic products uses certain principles such as expansion of the lifetime, reparability, modularity, expandability, design for End of Life and Information, for example on material types or environmentally preferred use.

According to UBA [1] (German EPA) environmentally preferred product design involves reduced energy and raw material use, the increased use of renewable materials, increased longevity including endurance, reparability, adjustability and functional extension. Additionally, reusability and recyclability are important.

Also emissions shall be reduced, for example Volatile Organic Compounds, noise or radiation.

4 Existing Systems

A number of systems and labels already address the sustainability of electronic products, such as PROSA, EPEAT, Blue Angel, EU Ecolabel, Energy Star, N Cert, or



Figure 1: Examples for Existing Sustainability Eco-labels

Eco Top Ten amongst others. They all have different areas of application, focus of evaluation and

importance. None of them comprehensively approaches the sustainability of white goods.

5 Multi Criteria Decision Analysis

A hierarchy of goals was created. As main goal the sustainability of Dishwashers was defined. Level 1 Criteria were assigned, selected from the Eco Design Directive, the Concept of environmentally preferred product design and existing systems.

Single Level 2 criteria were assigned that had to be measurable (with a unit), had to have an optimization goal (direction) and were finally also assigned a priority.

An comprehensive rating system the attribute of required and optional was found to be useful.

The develop Criteria had to have the following criteria: A good description to be able to identify what needs to be addressed. Verification requirements had to be added to proof validity. Quantitative thresholds or quotes had to be defined and a motivation and benefits assessment had to be done for each criterion.

6 Criteria Groups

In the end the criteria were grouped to reflect the following topics:

- Reduction of Materials of Concern
- Design for End of Life
- Product Lifetime
- Energy use / Emissions
- Recyclability of Product and Packaging
- Company Environmental Performance and Sustainability
- Supply Chain

Additional new fields identified and found to be important with white goods

- Consumables
- Renewable and Biobased Materials
- Innovation
- Indoor Air Quality

7 Reduction of Materials of Concern

Similar to existing sustainability catalogues focus should be in the existing regulations with extend of thresholds or slight extend of some substance ranges.

Regarding RoHS for example the acceptable level of CrVI could be further reduced below the regulatory threshold. Regarding Phthalates the longer chain Phthalates could be included that are banned in toys for example.

8 Recyclability and Reparability of Product and Packaging

Regarding Recycling Recycled and Biobased plastic content shall be declared.

To simplify disassembly the variety of connection technologies shall be reduced. Irreversible connections shall be avoided down to the level of functional units.

Moreover, recycling and recoverability quotes shall be published yearly for the products.

Regarding packaging the packaging materials shall not contain halogens, be easily or manually separable as well as compostable or recyclable at a high rate. The number of different packaging materials shall be reduced. Avoiding plastic packaging or bleaching agents could be considered in the rating as well. Recycled content of the packaging shall be declared. The packaging ratio shall be reduced by a minimum amount.

Accessories shall not be packed separately. A transport packaging takeback system shall be provided also for B2C packaging.

9 Efficiency

Specific to white goods consumables are important. The availability of consumables may also vary.

Intelligent dosing recommendations based on load sensing, temperature actual water hardness or other shall be given to the user. Also the environmentally preferred use / programs in certain applications shall be recommended.

In addition power use in operation as well as water consumption are important

10 Ecodesign Requirements for Dishwashers 2019/2022/EU

The EU has in the meantime released the regulation 2019/2022/EU. This regulation defines the requirements as follows:

- Programme requirements
- Energy efficiency requirements
- Functional requirements
- Low power modes

- Ressource efficiency requirements
- Information requirements

Also Measurement Methods and Calculations were defined.

- Energy Efficiency Index
- Cleaning Performance Index
- Drying Performance Index
- Low Power Modes

In detail with the following parameters to be monitored

- „Eco“ programme energy consumption
- „Eco“ programme water consumption
- Cleaning performance index
- Drying performance index
- Programme duration
- Power consumption in off mode
- Power consumption in standby mode
- Power consumption in delay start



Figure 2: EU Energy Label

11 Summary and Outlook

Potential sustainability criteria for dishwashers have been evaluated. Some criteria are quite similar to existing rating standards for other electronic devices other are new and specific for white goods and dishwashers. The criteria could be used as a starting point for standardization

12 Literature

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