05 March 2009

Solving the E-Waste Problem (StEP) White Paper

# One Global Understanding of Re-Use — Common Definitions


ISSN: 2071-3576 (Online)
ISSN: 1999-7965 (In-Print)

## Members and Associate Members of the StEP Initiative are:

**International Organizations:**
Center for Environment and Development for the Arab Region and Europe (CEDARE), Global Digital Solidarity Fund (DSF), United Nations Conference on Trade and Development (UNCTAD), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), United Nations University (UNU)

**Governmental and Development Cooperation:**
German Technical Cooperation (GTZ), Swiss State Secretariat of Economics (SECO), US Environmental Protection Agency (US-EPA)

**Business & Industry:**
AER Worldwide, Cisco Systems Ltd., Dataserv Ltd., Datec Technologies, Dell, Ericsson, Flection, GOAB mbH, Hewlett Packard, MicroPro, Microsoft, Nokia, Philips CL, promotion team wetzlar, Sims Recycling Solutions, Taizhou Chiho Tiande, UMICORE Precious Metal Refining

**Academia & Research:**
Austrian Society for Systems Engineering and Automation (SAT), Chinese Academy of Sciences – Research Center for Environmental Sciences, Delft University of Technology, ENDA-Europe*, Federal Laboratories for Materials Testing and Research (EMPA), GAIKER Foundation, Griffith University, Institute for Applied Ecology (Öko-Institut), Fraunhofer Institute for Reliability and Microintegration (FHG-IZM), Korean Institute of Geoscience and Mineral Resources (KIGAM), Massachusetts Institute of Technology (MIT) – Materials Systems Laboratory, National Center for Electronics Recycling (NCER), Regional Environmental Center for Central and Eastern Europe (REC), Rifer Environmental, Technische Universität Braunschweig – Institute of Machine Tools and Production, TELECOM & Management Sud Paris, Electrical and Electronic Institute (EEI), University of Limerick, University of Melbourne – Faculty of Engineering, 3P Consortium for Sustainable Management, WASTE advisers on urban environment and development*

* Associate Member

# Acknowledgements

This StEP White Paper has been developed within Task Force “ReUse”. We take pleasure in thanking those who have actively contributed to the development of this paper:

- Borrman, Jeff (Datec Technologies)
- Costa, Ed (Hewlett Packard)
- Cox-Kearns, Jean (Dell)
- Crock, Wesley (United Nations University)
- Dickenson, John (AER Worldwide)
- Fitzpatrick, Colin (University of Limerick)
- Herrmann, Christoph (Technische Universitaet Braunschweig)
- Kramer, Daniel (Datec Technologies)
- Kuehr, Ruediger (United Nations University)
- Li, Juan (SAT – iCREE)
- Luger, Tobias (Technische Universitaet Braunschweig)
- Maurer, Claudia (United Nations University)
- Radulovic, Verena (US Environmental Protection Agency)
- Rifer, Wayne (Rifer Environmental)
- Rodgers, Stephen (Ericsson)
- Saunders, Neal (Dataserv)
- Scheidt, Lutz-Guenther (SAT – iCREE)
- Schischke, Karsten (Fraunhofer IZM)
- Schneider, Axel (promotion team wetzlar)
- Schroeder, Gideon (Cisco)
- Streicher-Porte, Martin (Empa)
- Van Loon, Joep (Flection)
- Widmer, Rolf (Empa)

# One Global Understanding of Re-use - Common Definitions

## 1 Introduction

This paper is intended to provide StEP definitions for terms associated with "re-use" of electrical and electronic equipment (EEE) or its components. It has been developed within StEP's Task Force "ReUse" and discussed with StEP's other Task Forces, thus displaying agreement among the StEP members.

The term "re-use" (and its associated terminology) has several definitions in international legislations, norms and re-use practice, all embracing different contexts and not following a global standard for communication. The StEP Initiative discovered early on that mixed definitions of key terms became barriers for solutions as well as creating confusion among academia, government, business and consumers, eventually hindering an efficient re-use market. The purpose of this paper is to present re-use terminology based on a holistic approach and create one "dictionary" of key terms, their definitions and underlying concepts for establishing a global standard for communication. It does not raise the claim to discuss in depth the variety of existing definitions, but it is intended to be a basis for recommendations to foster re-use, and to evaluate policies and standardize concepts against these definitions.

## 2 Re-use Defined

Re-use of EEE or its components is to be seen in the context of the waste hierarchy, wherein the avoidance of waste generation is seen preferential to activities of waste processing, namely recovery of materials and energy and ultimately disposal. By extending the use phase of EEE or its components with a *potential for re-use* and, thus, substitute for the use of newly produced EEE or its components, re-use is seen as a form of avoidance of waste generation.

*(1) Potential for re-use*

*Potential for re-use is defined as the ability and advantageousness of electrical and electronic equipment or its components to be re-used.*

In general, the *potential for re-use* is composed of five dimensions: (i) Technologic, (ii) economic, (iii) ecologic, (iv) social and cultural and v) legal aspects. A detailed product specific analysis considering the involvement of the private sector as well as charity organizations takes into account background and all influencing factors to determine whether re-use is advantageous to recovery alternatives.

Figure 1 shows the interrelations between the main activities in the context of re-use of EEE or its components. For clarification, processes of waste processing are included, however, not discussed in detail in this White Paper.

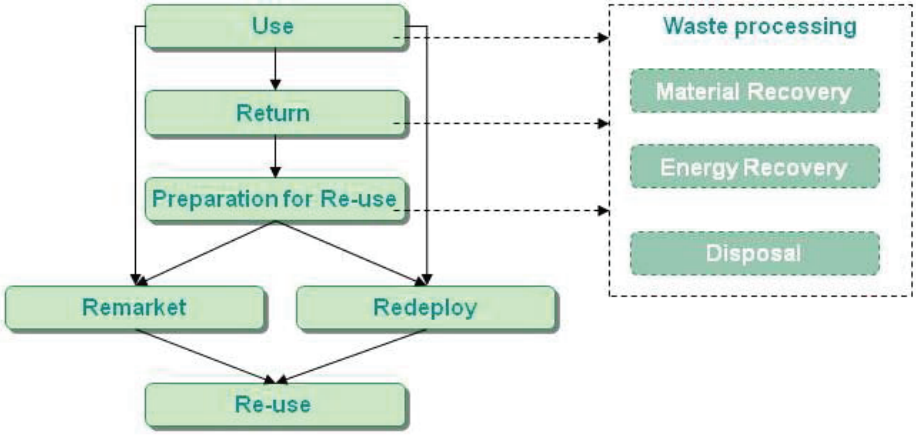


**Figure 1: Activity-oriented view on re-use terminology**

The figure shows an activity-oriented view on the context of re-use of EEE or its components. It does neither include any actors involved nor any transfer processes between actors involved. At the end of a use phase, EEE is returned from the place of use. This logistic process involves collection, identification and sorting of EEE. EEE with a *potential for re-use* is passed on to a *preparation for re-use*. Such qualified EEE or its components is either remarketed or redeployed for a re-use. EEE may be *remarketed* or *redeployed* for a continued use without any further preparation for re-use. EEE or its components without the *potential for re-use* is passed on to waste processing activities.

*(2) Re-use*

*Re-use of electrical and electronic equipment or its components is to continue the use of it (for the same purpose for which it was conceived) beyond the point at which its specifications fail to meet the requirements of the current owner and the owner has ceased use of the product.*

Thereby, it is an activity to prevent EEE from being put into storage and not used anymore or from being deposited into the waste stream. Another owner thus begins use of the EEE or its components and this continued use then substitutes the use of a new product.

Re-use can be applied either on the whole product level or on the component level. While evaluating re-use options, a first consideration should be to determine whether the (whole) product specifications still meet the perceived needs of another potential user.

If the (whole) product specifications do not meet the perceived needs of another user, then it should be determined if any of its components can still be harvested for re-use.

Figure 2 depicts these interrelations along with the decisions to be made over time. The re-use cascade does not explicitly include any activities to prepare EEE or its components for reuse, any owners/actors in the fields of preparation for reuse and remarketing, any loops of material or energy flows.

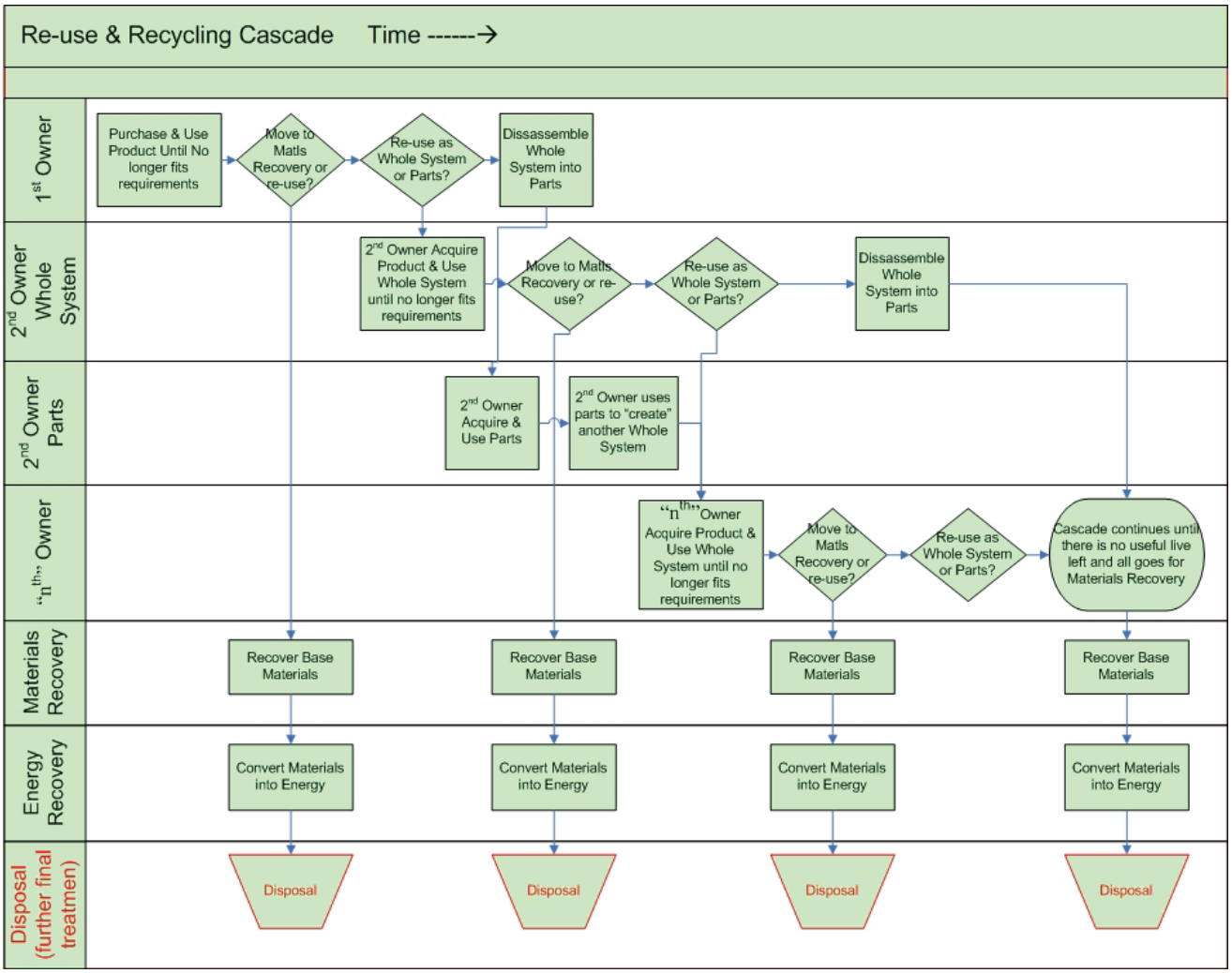


**Figure 2: Re-use cascade**

*(3) Preparation for Re-use*

*Preparation for re-use comprises any operation performed to bring used electrical and electronic equipment or its components into a condition to meet the requirements of a next potential owner.*

In general, this activity may contain the steps of

- Disassembly
- Cleaning (including data erasure)
- Inspection
- Component exchange
- Component retrieval
- Component reprocessing
  - — Mechanical, e.g. by manufacturing operations
  - — Electronic, e.g. SMD mounting
  - — With IT processes, e.g. bios flashing
- Reassembly, including recombination of parts from different cores
- Testing

Preparation for re-use can be distinguished in the four different activities depicted in Figure 3. The actual process is constituted of the process steps listed above. The output of the four alternative activities is accordingly a *remanufactured, refurbished*, *repaired* and *upgraded* product, respectively.


**Figure 3: Alternative activities in preparation for re-use**

*(4) Remanufacture*

*Remanufacturing comprises any action necessary to build up as-new products using components taken from previously used electrical and electronic equipment as well as new components, if applicable. The output product meets the original OEM functionality and reliability specifications. To remanufacture a product requires the complete disassembly of the unit, thorough testing and replacement or reprocessing of all components not meeting these specifications. Depending on the applied components this process may significantly change the unit's composition and design.*

*(5) Refurbish (=Recondition)*

*Refurbishment comprises any action necessary to restore a unit up to a defined condition in function and form that may be inferior to a new unit. The output product meets the original functionality specifications. To refurbish a product requires disassembling the unit only to the extent that is required to ensure the testing and reprocessing of all components not meeting these specifications. The unit's composition and design is not changed significantly.*

The term *recondition* is understood synonymously for *refurbish*.

*(6) Repair*

*Repair comprises any action necessary to correct any faults in a unit preventing its specified operation. The output product is in functioning condition. To repair a unit requires only process steps necessary to restore the specified operation. The unit's composition and design is not changed significantly.*

*(7) Upgrade*

*Upgrade describes any action with hardware or software on electrical and electronic equipment to improve and/or increase its performance and/or functionality. The unit's composition and design is changed significantly by this process.*

The following table summarizes the differences of the four alternative activities of *preparation for re-use*.

| | **Disassembly depth** | **Output specification** | **Degree of change in unit's composition and design** |
|---|---|---|---|
| **Remanufacture** | Complete disassembly | Original functionality and reliability | May be changed significantly |
| **Refurbish** | Not complete, only to ensure required specification | Original functionality | Not changed significantly |
| **Repair** | Only to exchange or reprocess defective component | Functioning condition | Not changed significantly |
| **Upgrade** | Dependent on upgrade operation | Upgraded performance and /or functionality | Significantly changed |

**Table 1: Differentiation of alternative activities in preparation for re-use**

Warranty and liability issues of EEE or their components for re-use are influenced by the degree of change in a unit's composition and design.

Furthermore, these aspects are affected by the brand under which an actor is *remarketing* or *donating* EEE or their components for re-use.

Thus, the following definitions apply:

*(8) Remarket*

*Remarketing comprises any action, including marketing activities, necessary to sell previously used electrical and electronic equipment or its components directly to customers or indirectly via channels.*

*(9) Redeploy*

*Redeployment comprises any action of renewed deployment of previously used electrical and electronic equipment or its components within the organization of the owner.*

A particular form of either returning EEE or its components at the end of a use phase or remarketing/redeploying it is to *donate* EEE or its components.

*(10) Donate*

*Donation comprises any action to transfer electrical and electronic equipment or its components for charity to another owner without any reward in return.*

# 3 Alpha Order Full Glossary

*Donate*

Donation comprises any action to transfer electrical and electronic equipment or its components for charity to another owner without any reward in return.

*Potential for re-use*

Potential for re-use is defined as the ability and advantageousness of electrical and electronic equipment or its components to be re-used.

*Re-use*

Re-use of electrical and electronic equipment or its components is to continue the use of it (for the same purpose for which it was conceived) beyond the point at which its specifications fail to meet the requirements of the current owner and the owner has ceased use of the product.

*Redeploy*

Redeployment comprises any action of renewed deployment of previously used electrical and electronic equipment or its components within the organization of the owner.

*Refurbish (=Recondition)*

Refurbishment comprises any action necessary to restore a unit up to a defined condition in function and form that may be inferior to a new unit. The output product meets the original functionality specifications. To refurbish a product requires disassembling the unit only to the extent that is required to ensure the testing and reprocessing of all components not meeting these specifications. The unit's composition and design is not changed significantly.

The term *recondition* is understood synonymously for *refurbish*.

*Remanufacture*

Remanufacturing comprises any action necessary to build up as-new products using components taken from previously used electrical and electronic equipment as well as new components, if applicable. The output product meets the original OEM functionality and reliability specifications.

To remanufacture a product requires the complete disassembly of the unit, thorough testing and replacement or reprocessing of all components not meeting these specifications. Depending on the applied components this process may significantly change the unit's composition and design.

*Remarket*

Remarketing comprises any action, including marketing activities, necessary to sell previously used electrical and electronic equipment or its components directly to customers or indirectly via channels.

*Repair*

Repair comprises any action necessary to correct any faults in a unit preventing its specified operation. The output product is in functioning condition. To repair a unit requires only process steps necessary to restore the specified operation. The unit's composition and design is not changed significantly.

*Upgrade*

Upgrade describes any action with hardware or software on electrical and electronic equipment to improve and/or increase its performance and/or functionality. The unit's composition and design is changed significantly by this process.

# StEP White Papers

| Number | StEP Task Force | Title | Date |
|---|---|---|---|
| #1 | TF 1 "Policy" | E-waste Take-back System Design and Policy Approaches | 28 Jan. 2009 |
| #2 | TF 3 "ReUse" | One Global Understanding of Re-use – Common Definitions | 5 March 2009 |

All StEP White Papers are online available at http://www.step-initiative.org/publications/

## About the StEP Initiative:

Our name is our programme: solving the e-waste problem is the focus of our attention. Our declared aim is to plan, initiate and facilitate the sustainable reduction and handling of e-waste at political, social, economic and ecological levels.

**Our prime objectives are:**

- Optimizing the life cycle of electric and electronic equipment by
  - improving supply chains
  - closing material loops
  - reducing contamination
- Increasing utilization of resources and reuse of equipment
- Exercising concern about disparities such as the digital divide between industrializing and industrialized countries
- Increasing public, scientific and business knowledge
- Developing clear policy recommendations

As a science-based initiative founded by various UN organizations we create and foster partnerships between companies, governmental and non-governmental organizations and academic institutions.

**StEP is open to companies, governmental organizations, academic institutions, NGOs and NPOs and international organizations which commit to proactive and constructive participation in the work of StEP by signing StEP's Memorandum of Understanding (MoU). StEP members are expected to contribute monetarily and in kind to the existence and development of the initiative.**

## StEP's core principles:

1. StEP's work is founded on scientific assessments and incorporates a comprehensive view of the social, environmental and economic aspects of e-waste.
2. StEP conducts research on the entire life-cycle of electronic and electrical equipment and their corresponding global supply, process and material flows.
3. StEP's research and pilot projects are meant to contribute to the solution of e-waste problems.
4. StEP condemns all illegal activities related to e-waste including illegal shipments and reuse/ recycling practices that are harmful to the environment and human health.
5. StEP seeks to foster safe and eco/energy-efficient reuse and recycling practices around the globe in a socially responsible manner.

## Contact:

StEP Initiative
United Nations University
Zero Emissions Forum, European Focal Point
UN Campus
Herrmann-Ehlers-Str. 10
53113 Bonn, Germany
Tel. : +49-228-815-0213/4
Fax: +49-228-815-0299
info@step-initiative.org
www.step-initiative.org

UNITED NATIONS UNIVERSITY