

# A N N U A L R E P O R T 2009





# TABLE OF CONTENTS

Preface Introduction StEP's Prime Objectives 2009 by Numbers Real Impacts of Primary Production	3 4 4 4 4
ABOUT THE STEP INITIATIVE	
Vision & Key Objectives Principles Membership Organization StEP Publications	5 5 6 8 12
STEP TASK FORCES EXPLORE SUSTAINABLE SOLUTIONS	
Task Force 1: Policy and LegislationWhite Paper on the Revision of EU's WEEE Directive-COM(2008)810 finalWhite Paper on Take-Back Systems and Design GuidelinesBest E-waste PoliciesEEE and Climate Change	<b>13</b> 13 14 14 15
Task Force 2: ReDesign	16
Closing the Loop - Electronics Design to Enhance Re-use and Recycling Value lameco II - Low Carbon, Resource Efficiency and Long Life in PC Design Asian Electrical and Electronic Green Society Conference	16 17 17
Task Force 3: ReUse	18
Towards Common Definitions in Re-use	18
Best Practices in Re-use	18
Keyboards for AllAt Any Price? Re-Evaluate Project	19 19
Task Force 4: ReCycle	20
Recycling – From E-waste to Resources	20
Best of 2 Worlds	21
StEP Recycling Guidelines	21
Task Force 5: Capacity Building	22
Annual E-waste Status Report	22
NVMP-StEP E-waste Summer School	22
The StEP Website	23
	24
StEP Events	25
StEP Members	26

## PREFACE

Many people will remember 2009 as the year of a deep economic crisis, where many became unemployed and nation states substantially increased their budget deficits in order to stabilize our sway systems. 2009 was also the year in which the world failed to agree on global harmonized action against climate change despite the substantially increased public awareness. Despite these challenges, 2009 was another good year for StEP since its formal launch in March 2007.

High-points were certainly the publication of a number of StEP White Papers. These White Papers provided guidance on e-waste take-back system design and respective policy approaches, outlined a common terminology in re-use and expressed recommendations on the 2008 Review of Directive 2002/96 on WEEE. These documents are not only illustrating StEP's competencies in addressing specific issues associated with a sustainable solution to the e-waste problem, but set the foundation for further work in research, capacity development, outreach and policy issues.

In May 2009 StEP organized its annual General Assembly, the first time hosted by the United Nations University at the UN Campus in Bonn, Germany, directly on the bank of the famous Rhine river. During this meeting StEP members identified the growing need to reach out with our work to other continents with special attention to developing countries and economies in transition. Ultimately we agreed on approaches to meet these ongoing challenges, e.g. by developing concrete projects with relevant stakeholders in these regions.

Also a highlight in 2009 was the first NVMP-StEP E-waste Summer

School with an interdisciplinary student composition of 17 participants coming from every continent. The summer school started in Eindhoven, Netherlands, and culminated at the R'09 Twin World Congress in Davos, Switzerland, where the students of the summer school conducted a workshop for delegates of the R'09 Congress on "E-waste in Developing Countries".

In 2009 StEP was contracted by UNEP to undertake a research study to identify and assess innovative e-waste recycling technologies with special attention to ferrous, base and precious metals. Moreover, the study analysed the market potential of relevant technologies for the ewaste recycling sector in 11 developing countries and explored innovation hubs and centres of excellence in these emerging economies. The official release of the UNEP/StEP study Recycling - From E-waste to Resources in early 2010 garnered significant media attention worldwide.

StEP has also started research work on the interlinkages of electronics and climate change and the positive contributions electronics recycling and re-use can make in the mitigation of greenhouse gas emissions.

StEP will continue to grow and evolve. It will also continue to look at urgent and pressing issues in ewaste management and challenges resulting from the production, use and disposal of electronics, to offer an impartial platform for developing sustainable solutions and to work to reduce environmental and health risks and increase resource recovery worldwide. We welcome the publication of this Annual Report which sets out the work of StEP and its results during 2009.

Paris/Bonn, April 2010



Guido Sonnemann Chair Steering Committee StEP Initiative



Ruediger Kuehr Executive Secretary StEP Initiative

# INTRODUCTION

#### 2009 by Numbers

#### The Problem

- 9.2 mio. tons of WEEE arising in EU 27
- 8.1 mio. tons of WEEE generated for
- North America
  More than 34 million TVs and displays placed on the market in the US in 2006
- More than 24 million PCs and roughly 139 million portable communication devices such as cell phones, pagers or smart-phones have been manufactured in the US in 2006
- India had an installed base of about 5 million PCs in 2006
- Roughly 14 million PCs were sold in China in 2005
- GSM Association estimates that 896 million mobile phone handsets were sold worldwide in 2006

#### StEP

- 47 StEP members
- 16 ongoing or completed projects
- 3 published StEP White Papers
- 7 events with StEP involvement

#### This is the second Annual Report of the Solving the E-waste Problem (StEP) Initiative.

With prominent members from industry, government, international organizations, NGOs and academia, StEP's overall aim is to develop strategies to solve the e-waste problem - globally. Every day a vast number of electrical and electronic devices end up as waste. Some of them no longer function, others are obsolete. Pressure is mounting to manage our resources more sustainably. StEP was founded to offer an impartial global platform for developing sustainable solutions for e-waste management. We work to reduce environmental and health risks and increase resource recovery worldwide.

#### StEP's prime objectives are:

• To act as a knowledge hub on e-waste for industrialized and industrializing countries

- To increase re-use of electrical and electronic equipment
- To increase materials recovery from e-waste
- To support the safe processing of e-waste
- · To encourage life-cycle thinking
- To develop clear policy recommendations

This Annual Report takes a detailed but brief look at StEP's activities in 2009.

It is targeted at StEP members as well as others concerned with threats and opportunities resulting from the growing e-waste problem, drawing the attention to the key issues faced by StEP in the previous 12 months. It is arranged according to the five key priorities – as reflected in StEP's five Task Forces – Policy, ReDesign, ReUse, ReCycle and Capacity Building – and further displays StEP's networking activities as well as major events in 2009.

For more information please also check our website at www.step-initiative.org

#### **Real Impacts of Primary Production**

Modern electronics can contain up to 60 different elements; many are valuable, some are hazardous and some are both. The most complex mix of substances is usually present in the printed wiring boards (PWBs). In its entity electrical and electronic equipment is a major consumer of many precious and special metals and therefore an important contributor to the world's demand for metals. Despite all legislative efforts to establish a circular flow economy in the developed countries, the majority of valuable resources today are lost. Several causes can be identified: firstly, insufficient collection efforts; secondly, partly inappropriate recycling technologies; thirdly, and above all large and often illegal exports streams of e- waste into regions with no or inappropriate recycling infrastructures in place. Large emissions of hazardous substances are associated with this. Unfortunately, these regions with inappropriate recycling infrastructure are often located in developing and transition countries. Developing and transition countries are currently striving to implement technologies to deal with the recycling of e-waste and to establish circular flow economies.

Besides the direct impact of effective recycling on the resource base of the recycled metals, state of the art recycling operations also considerably contribute to reducing greenhouse gas emissions. Primary production, i.e. mining, concentrating, smelting and refining, especially of precious and special metals releases a significant amount of  $CO_2$  into the atmosphere. "Mining" our old computers to recover the contained metals – if done in an environmentally sound or correct manner – needs only a fraction of energy compared to mining ores in nature.

(from the UNEP/StEP study: Recycling – From E-waste to Resources)

## **Vision & Key Objectives**

"StEP envisions a future in which societies have reduced to a sustainable level the e-waste-related burden on the ecosystem that results from the design, production, use and disposal of electrical and electronic equipment. These societies make prudent use of lifetime extension strategies in which products and components – and the resources contained in them – become raw materials for new products."

StEP, acting as a network of actors, sets forth clear and achievable objectives that are broad in scope but aim to solve concrete issues.

1. StEP conducts cutting-edge research and undertakes activities assessing the e-waste problem from a holistic perspective in order to optimize the entire life-cycle of electrical and electronic equipment, from policies to design to refurbishment to capacity building. Such activities are often in the form of pilot-projects, which aim to improve supply chains, close material loops and reduce contamination.

2. Because of the adverse ecological and economical impacts associated with mismanagement of resources and the exponential increases in (waste) electrical and electronic equipment, StEP strives to increase utilization of resources, focusing and steering many activities on safe and proper re-use and recycling of (waste) electrical and electronic equipment.

3. An overarching theme in all of its activities, StEP exercises concern about disparities between industrializing and industrialized countries, such as the stark digital divide hindering persons in the industrializing world from accessing technology and acquiring the resources to effectively use it.

#### **Principles**

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.
- StEP conducts research on the entire life-cycle of electrical and electronic 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 re-use/recycling practices that are harmful to the environment and human health.
- 5. StEP seeks to foster safe and eco/energy-efficient re-use and recycling practices around the globe in a socially responsible manner.

4. StEP also concentrates on increasing public, scientific and business knowledge about current e-waste challenges and developments through its interdisciplinary composition of actors and dissemination and capacity building activities.



## **Membership**

StEP is generally open to all entities committed to proactive and constructive participation and cooperation in addressing the objectives of StEP. All StEP members go through a formal application process whereby they sign StEP's Memorandum of Understanding (MoU) and agree to its provisions. All applicants illustrate how they will uniquely contribute to StEP as well as indicate their expectations from StEP membership. After submission of completed applications, their membership is voted on by all StEP members, entrance being granted by a majority in favour of a new member. Only associations are not entitled to full, but associate membership. More information on eligibility is available via the StEP Secretariat.

Hosted by the United Nations University (UNU), StEP does not receive any funding from the United Nations General Assembly and relies solely on the entrance fees and annual contributions of its members

as well as certain sponsoring activities and successful acquisition of project grants. In turn, as indicated in the StEP MoU, StEP members are expected to contribute monetarily and in-kind to fund the existence and seed the development of the Initiative. Monetary contributions are made via a one-time entrance fee and then an annual membership fee each year thereafter.

The amount each member is expected to contribute is based on the type of organization of each member. New commercial members are charged EUR 10,000 as a single entrance fee; non-commercial members are charged either EUR 2,000 or 1,000, depending on their size, as a single entrance fee. Payment of the entrance fee waives the annual contribution for the first year of membership. In return for their monetary and in-kind contributions, StEP members have access to StEP databases and relevant scientific information, opportunities for





knowledge and information sharing as well as one vote in the decisionmaking processes.

Because many small companies, academic/research institutes, associations and NGOs, especially those from the developing world, have i) difficulty affording the annual membership fee, ii) are interested only in contributing to specific projects and/ or iii) are not eligible (e.g. associations), the StEP General Assembly approved the inclusion of Associate Membership beginning in 2008. Associate members have access to StEP information and scientific databases, may contribute to StEP objectives but are not permitted to vote in StEP's strategic decisionmaking.

In exceptional circumstances and on a case-by-case basis, the StEP Steering Committee may decide to waive an organization's entrance fee and/or annual membership contribution. In such cases it is expected that the corresponding member must clearly commit via certain inkind contributions to the seeding of the Initiative whose value should be equal in value to their financial contribution. The above stated annual membership contributions secure the basic maintenance of the StEP Initiative and its further development.

Annual contributions can be broken down as follows:		
Type of organization	Amou	Int
Large-size companies	EUR <sup>2</sup>	10,000
Medium-size companies	EUR	5,000
Small-size companies (including micro-enterprises)	EUR	1,000
All other full members	EUR	1,000
Associate members	EUR	500

## Organization

**The StEP Initiative** has five principle organs: The General Assembly, the Steering Committee, the Secretariat, the Task Forces and the Regional Focal Points.

#### **1. General Assembly**

The General Assembly functions as the primary body of StEP. The General Assembly meets at least once per year to

- a. Vote on prospective new members
- b. Elect the members of the Steering Committee
- c. Approve annual budgets and other financial matters such as project seed-funding
- d. Approve Steering Committee policy proposals
- e. Set up committees and subgroups

Each full member has one vote in the above fields. The 2009 General Assembly convened at the UN Campus in Bonn, Germany.

#### 2. Steering Committee

The Steering Committee's chief responsibility is to monitor and steer the overall progress and developments of the StEP Initiative. Steering Committee members are elected for two years, after which there is a possibility for them. Of the members on the Steering Committee, one assumes the voluntary role as the permanent Chair, the appointment being rotated among elected members at least every 1 July and 1 January. The Steering Committee's terms of reference are prepared by the Secretariat, reviewed by the Steering Committee as such and then agreed upon by all StEP Members.

# Elected on 13 May 2008, the current Steering Committee members are:



Jean Cox-Kearns, Dell (Chair to 31 December 2008)



Charuek Hengrasmee, Thai Electrical and Electronics Institute



Per Döfnäs, Ericsson (Chair to 31 June 2009)



Guido Sonnemann, United Nations Environment Programme (Chair since 1 January 2010)



Christian Hagelueken, Umicore Precious Metals Refining (Chair to 31 December 2009)



Rolf Widmer, Swiss Federal Laboratories for Materials Testing and Research (EMPA)

Ex officio: Ruediger Kuehr, Executive Secretary of the StEP Initiative, United Nations University



#### 3. Secretariat

The StEP Secretariat is being hosted by United Nations University Institute for Sustainability and Peace -SCYCLE (UNU-ISP SCYCLE) in Bonn, Germany. The Secretariat functions as the internal and external operations hub by coordinating and managing the flow of information and relevant developments among the StEP Task Forces and StEP members. The Secretariat is also responsible for the executive management, administration and daily operational work of the Initiative and serves as the liaison between United Nations Agencies and the individual StEP members.

The Secretariat is headed by the Executive Secretary who serves as the chief academic project and administrative officer and is responsible for the overall management, strategic progress toward overarching objectives and serves as focal point to external actors.

#### 4. Task Forces

There are five StEP Task Forces and each Task Force (TF) directs its strategic aim toward research, analysis, evaluation and effective facilitation of pilot-projects contributing to overarching StEP objectives. Ideally, each Task Force is coordinated by two StEP members who serve the role of Task Force Coordinators. The Task Force Coordinators are responsible for representing each Task Force, manage the overall coordination within the Task Forces, as well as maintain positive momentum and ensure Task Force activities fall in line with StEP's overall objectives. Each StEP member is obliged to actively participate in at least one Task Force.

#### Task Force 1 Policy and Legislation

Chief objective is to report and analyse the status of existing approaches and relevant policies on e-waste and used electronics in order to effectively develop concrete yet malleable recommendations for future progression to solve the e-waste problem.





Cédric Gossart, Telecom Business School



Ruediger Kuehr, United Nations University

#### Task Force 2 ReDesign

Overall aim is to contribute to a sustainable solution to the e-waste problem by focusing on the concept and design of electrical and electronic equipment. This is envisaged to be achieved by optimizing the entire life-cycle of electrical and electronic equipment with special attention to the industrializing world.



Charuek Hengrasmee, Thai Electrical and Electronics Institute (EEI)



Karsten Schischke, Fraunhofer Institute for Reliability and Microintegration (IZM)



#### Task Force 3 ReUse

Primary goal is to define globally consistent re-use standards for electrical and electronic equipment by raising consumer awareness on re-use opportunities and take-back systems, extending the life of electrical and electronic equipment and reducing the flow of irresponsible reuse between developed and developing countries.

#### Task Force 4 ReCycle

Chief objective is to enhance global recycling infrastructure, systems and technologies by realizing sustainable e-waste recycling systems with critical attention on industrializing countries.

#### Task Force 5 Capacity Building

A cross-cutting Task Force, the main aim is to develop infrastructures for a sustainable, efficient, effective and target-group oriented capacity building taking into consideration the entire life-cycle of electrical and electronic equipment, initiating and maintaining a network of practice and organizing interactive learning environments.

#### TF3 Coordinators are:



John Dickenson, AER Worldwide



Colin Fitzpatrick, University of Limerick (since April 2010)

#### TF4 Coordinators are:



Jason Linnell, National Center for Electronics Recycling (NCER) (since April 2010)



Mathias Schluep, Swiss Federal Laboratories for Materials Testing and Research (Empa).

#### TF5 Coordinators are:



Jaco Huisman, United Nations University/TU Delft (since April 2010)



Claudia Luepschen, United Nations University (since April 2010).



#### **5. Regional Focal Points**

The primary purpose of the Regional Focal Points is to serve as a link between the StEP Secretariat and StEP members, activities and issues in their corresponding regions. Additionally, they provide information to the Secretariat and StEP members on activities and relevant e-waste issues in their regions as well as function as primary focal point for StEP members on StEP activities and events.

StEP Regional Focal Point for North America: Jeremy Gregory and Randy Kirchain, Materials Science and Engineering Systems, Massachusetts Institute of Technology (MIT). StEP Regional Focal Point for the Middle East and North Africa: Hossam Allam, Center for Environment and Development for the Arab Region and Europe (CEDARE).





## **STEP PUBLICATIONS**



#### **StEP Publications**

28 January 2009 StEP White Paper "E-waste Take-back System Design and Policy Approaches"

5 March 2009 StEP White Paper "One Global Understanding of Re-use – Common Definitions

10 May 2009 StEP Annual Report 2009

1 October 2009, revised 22 March 2010 StEP White Paper "On the Revision of EU's WEEE Directive - COM(2008)810 final"

22 February 2010

Recycling - from E-waste to Resources, co authored by Mathias Schluep, Christian Hagelueken, Ruediger Kuehr et al.

### **StEP Task Forces Explore Sustainable Solutions**

#### Task Force 1 Policy and Legislation

One of the overarching themes within the StEP Initiative is the role policymakers and legislation play in mitigating adverse impacts from irresponsible and uninformed ewaste management. In 2003 the EU implemented the WEEE and RoHS Directives - a critical first step in addressing the exponential increases in waste electrical and electronic equipment (WEEE) by setting collection, recycling and recovery targets for the EU Member States. However, the WEEE Directive in its current form still contains many shortcomings which StEP has identified and assessed by publishing a White Paper On the Revision of EU's WEEE Directive - COM(2008)810 final to inform policymakers when the Commission re-visits the WEEE Directive in 2010.

While policies and legislation can be vital instruments and although policymakers worldwide are responding ever more to the growing e-waste problem, this is creating a problem in itself. Countries throughout the world are developing and implementing legislation on e-waste creating a potpourri of policies, each indicating different targets, setting different standards and in some cases, working against the objectives of other countries' policies. In response to this increasing patchwork of single-state legislation, StEP has continued its progress with the Best E-waste Policies project, aiming to identify necessary indicators, analyse and compare actors and institutions involved in WEEE legislation.

StEP was officially launched back in 2007 due to the stark inter-relation between e-waste and the environment. In recent years the climate change debate has become more visible and pronounced and direct effects of climate change are becoming increasingly apparent. StEP has continued its progress on the TF1 project EEE and Climate Change which identifies the environmental benefits whereby corresponding environmental impacts are translated into  $CO_2$  equivalent emissions.

In essence TF1 – Policy and Legislation focuses its work on identifying and analysing existing national policies, initiating dialogues with key stakeholders, pointing out existing business models, exploring and assessing feasible alternatives more suitable for the developing world and providing science-based recommendations to relevant policymakers.

#### White Paper on the Revision of EU's WEEE Directive COM(2008)810 final

Back in the summer of 2008 at the General Assembly in Stockholm, TF1 formed a Subgroup to develop and work out the points of agreement/ disagreement in the UNU 2008 Re-





## POLICY AND LEGISLATION

view of Directive 2002/96 on WEEE in order to have internal discourse, subsequent consensus and smooth out any shortcomings that came into light since the publishing of the UNU Review.

Once the Commission circulated its recommendations, the Subgroup responded to the Commission's recommendations by developing and publishing a White Paper.

The scope of the White Paper enveloped such themes as collection rate, treatment, shipments, recovery targets, financing, reporting etc in alignment with the Commission proposal for a Recast on the WEEE Directive and the hands-on experiences StEP members have accumulated with the WEEE Directive. For example, the current collection rate of 4kg per year per inhabitant was easily met and offered Member States no incentive to improve collection rates; the Commission then recommended a 65% collection rate of the average weight of products placed on the market in the past two years. StEP recommends that, e.g. one collection rate for all categories could lead to low collection of smaller WEEE and that it would be more advantageous to develop specific collection targets per category.

This TF1 White Paper was intended to take a holistic view on the proposals made from a science-based, but nevertheless applied perspective. It provided further suggestions to enhance environmental effectiveness, social implication and economic efficiency while illustrating the need for policy coherence.

The White Paper can be downloaded at http://www.step-initiative.org/publications/

#### White Paper on Take-Back Systems and Design Guidelines

In January 2009 StEP published its White Paper on Take Back Systems and Policy Approaches.

The primary objective of this paper is to provide guidance to policymakers and system architects on the policy tools, configuration alternatives, financing schemes and management alternatives that may be used to operate such systems. It provides a description of the generic structure of a take-back system, followed by details on the alternatives available to fulfil each component of the system and strengths and weaknesses of various alternatives. Key considerations in system design and examples of current system models are included at the conclusion of the document.

#### **Best E-waste Policies**

With the initial proposal submitted in June 2008 and verification at the General Assembly in May 2009, the Best E-waste Policies meta-project poses a chief research objective to develop an effective methodology to identify best e-waste policies. The approach to efficiently complete the aforementioned is to build a comparative framework analysis based on comparable indicators in at least four case-study countries with i) an advanced infrastructure allowing these case-study countries to identify e-waste issues and ii) accessibility to data. The countries chosen to undergo this framework analysis are Belgium, France, Netherlands and Switzerland; a US State will be incorporated at a more advanced stage.

The comparative framework developed for this project will take



## **POLICY AND LEGISLATION**

into account four dimensions, i.e. indicators comprising sustainable development – economy, society, environment and government. One measurable outcome will be a table of indicators used to evaluate ewaste policies from a sustainable development perspective. Thereby, it will be possible to assess these indicators via stakeholder consultations in order to identify potential missing indicators and evaluate relative significance.

The further development of this project is foreseen to be a long-term objective. Because e-waste is a politically contentious issue, there is the need for science-based analysis and constructive dialogue from a neutral standpoint. It is therefore envisaged that this meta-project provide a comparative framework that is applicable in identifying policies and analysing their implementation effectiveness in various scenarios.

#### **EEE and Climate Change**

With the Kyoto Protocol expiring at the end of 2011, this year was an active year for stakeholders involved in the climate debate. There were high hopes for a replacement international agreement at the COP13 in Bali and the COP15 in Copenhagen but unfortunately to no avail; climate actors are working effortlessly to ensure an international agreement will be agreed upon later in 2010 in Cancún, Mexico.

Due to the excelerating discussions surrounding climate change, United Nations University, concentrated in a small consortium under StEP, is continuing with its developments on outlining the positive contributions electronics recycling and re-use can make in the mitigation of greenhouse gas emissions. The EEE and Climate Change debate is quite dynamic in that  $CO_2$  can be prevented among various parts of the supply chain – at the primary production stage as well as the use phase and the take-back and recycling stages.

Primary production, i.e. extraction of virgin metals, plays a pivotal role in supplying precious metals to producers and the carbon footprint left behind from primary production is significant, primarily due to the large amounts of energy required to extract precious metals from their ore compositions. In particular the increasing demand for these precious metals is linked to the specific metals required to increase functionality of these electronics. For example, electronics make up for almost 80% of the world's demand for indium (transparent conductive layers in LCD glass) and over 80% of ruthenium (magnetic properties in hard disks). In order to substantially curb the carbon-concentrated primary production phase of the supply chain, efficient recycling systems need to be in place where precious metals can be extracted in a controlled environment via processes substantially less carbon intensive. For example, the current collection rate of e-waste in Europe is 2.2 Mt out of 10.3 Mt arising. If Member States were to collect an ideal 5.3 Mt, CO<sub>2</sub> emissions would be reduced by nearly 38 Mt CO2 equivalent per year.

A "case-study approach" has been identified as a next step to begin to assessing impacts of greenhouse gas emissions and resources in the production and re-use activities as well as end-of-life and benefits of proper recycling.





#### Task Force 2 – ReDesign

Environmental concerns are becoming more and more important in the development of electronic products. This does not only include the environmental impacts resulting from the production or use of a product - like material compositions and energy use – and "designingin" environmental benefits but also the final End-of-Life management of electronic products and how the product design can support and enhance their re-use and recycling.

StEP's Task Force ReDesign is dedicated to product design aspects. Its members contribute to the StEP aim – solving the e-waste problem – by fostering the re-design of electrical and electronic equipment in order to reduce negative impacts of their entire life-cycle. The status in industrializing countries is taken into particular account.

Task Force members collect and compare present industry approaches in electronics design, study End-of-Life implications of electronics with regard to product design issues, investigate current techno-



logy trends affecting backyard recycling processes and analyse and formulate possible design changes from perspectives of

- removing toxics and substances that become toxic in backyard recycling
- enhancing re-use through e.g. labeling systems on parts
- enhancing the recyclability of materials in End-of-Life electronics

#### Closing the Loop – Electronics Design to Enhance Re-use and Recycling Value

The Closing the Product Design -End-of-Life Loop project ("Closing the Loop") intends to generate recommendations to promote design for End-of-Life (EOL) management of electronics which enhances their re-use and recycling value. This has traditionally been an externality for those who design and sell electronic products. The study has been conducted by StEP member Wayne Rifer as a member of the Green Electronics Council (GEC) and the National Center for Electronics Recycling (NCER). This study explores the following questions:

- 1. What are the greatest challenges and obstacles for electronics refurbishers and recyclers that are caused by the design of consumer electronic products?
- 2. How could the design of these products be changed to enhance the EOL value proposition?
- 3. What kind of information from manufacturers, and in what form, would expedite the most efficient management of electronics at EOL?

The draft report has been reviewed by StEP members, the final report was then published in January 2009.

#### lameco II - Low Carbon, Resource Efficiency and Long Life in PC Design

The iameco II project builds on the pioneering iameco PC developed by StEP Partner MicroPro (Multimedia Computer Systems) in Dublin, as one of the principal outcomes of Project HEATSUN (LIFE00/ENV/ IRL/000764). This Project was a partnership of three Dublin local authorities, two private companies and two social economy organizations. The main objective of the project was to demonstrate better recycling and reprocessing of waste, by piloting re-use and eco-design of IT equipment.

The first iameco prototype was a pioneering design, aimed at securing the European Eco-Label. Iameco prototype had a life expectancy of around 6 years, used mostly renewable or re-usable materials and components, was designed for upgrading and re-use, and could be dismantled in 11 minutes. It was highly energy-efficient and minimized hazardous materials such as lead or mercury.

The iameco II project is a follow-up from Project HEATSUN, funded under the Irish Environmental Protection Agency (EPA)'s Cleaner Greener Production Programme (CGPP), and aims to develop an iameco II prototype, that will improve on the previous prototype by 50 % in almost every way, and finalize the securing of the Eco-Label. The iameco II will be rolled out for manufacture and marketing in 2011.

Energy efficiency is being improved in line with the quirements of the EuP Directive, and the carbon footprint of the equipment is being reduced by around 50% on the already efficient first prototype. Analysis of the new model and recommendations on eco-design have been made by the University of Limerick's Department of Electronic and Computer Engineering, and a Life Cycle Assessment in respect of the carbon footprint of the product (and resulting recommendations) has been carried out by Fraunhofer IZM.

ReUse Computer and Tricom in Berlin have also analysed the new prototype and made recommendations on design improvement to optimize re-use. Through eco-design iameco II aims to reduce the need for proliferation and obsolescence of IT equipment and to extend the use and life of the prototype by increasing functions and design for re-use and upgradability. It will increase resource efficiency by substituting materials that are not recyclable or re-useable and those with high embedded energy. It will reduce hazardous and polluting materials and minimize heat waste, and promote user-awareness of the ecological issues involved.

Manufacture of the iameco 1st prototype was completed in 2009. This prototype is currently being evaluated, and reports are now available. The re-design and manufacture of the iameco II prototype is underway and will be completed by around August 2010, with the Eco-Label expected by the end of 2010.

# Asian Electrical and Electronic Green Society Conference

StEP's Task Force ReDesign hosted a StEP session at the Asian Electrical and Electronic Green Society (AGEES) Conference, which was organized on the occasion of the 10 year anniversary of StEP member EEI from 7 - 9 October in Bangkok, Thailand.

Among the objectives of the conference was to facilitate the dialogue on e-waste related issues between the EU, Asia and Thailand. Product design, life-cycle assessment, corporate social responsibility, and global sustainability at both public and private levels, were among priority issues to be discussed. The conference concluded with a panel discussion on how to develop a global "green society network", an initiative seen vital for the Asian-Pacific region. This will also be reflected in the further programme development of the 1st Asia-Pacific and StEP Workshop on E-waste, to take place in 2011 in Brisbane, Australia.



## REUSE



#### Task Force 3 – ReUse

There are numerous environmental and societal benefits to re-using or recycling used electronics. Proper End-of-Life management diverts materials from disposal, creates social benefits through making equipment available at affordable prices for low-income society groups and conserves natural resources and reduces pollution. Current waste legislation supports the prevention approach by laying down a clear order of preference for waste operations within the five-step hierarchy of waste management options: 1. waste prevention; 2. re-use; 3. recycling; 4. recovery (including energy recovery) and 5. safe disposal.

StEP's Task Force ReUse wants to strengthen and enhance re-use practices around the globe by defining globally consistent re-use principles and standards, by changing consumer behaviour garnering more acceptance for re-use and early product take-back (avoiding long storage at consumer sites) while at the same time reducing the flow of irresponsible re-use between donor and developing countries. Task Force members focus on the development of replicable and sustainable re-use / refurbishment models, which minimize overall environmental impacts as well as health and safety implications – especially in industrializing countries.

## Towards Common Definitions in Re-use

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 can become barriers for solutions and create confusion among academia, government, industry and of course, consumers, thus hindering an efficient re-use market.

In this White Paper One Global Understanding of Re-Use – Common Definitions, Task Force ReUse lays down a common understanding of key terms related to re-use, their definitions and concepts. It does not discuss existing definitions in depth, but creates one "dictionary" of key definitions in order to establish a global standard for communication. Major work on this paper was done in 2008 resulting in a StEP White Paper publication in March 2009.

#### **Best Practices in Re-use**

Many different business models in terms of products, target markets and involved actors have been successfully established allowing economically feasible and environmentally sound re-use of EEE. The operations are either working as profit driven businesses or as nonprofit operations. Each business case is enabled by specific success factors and, at the same time, is facing specific barriers. StEP members themselves have either carried out or have access to scientific and practical case studies analysing such successful business cases or are themselves involved in carrying out re-use business operations.

The goal of this project is to analyse the case studies in order to identify common success factors and best practices for re-use operations as well as identify barriers actors are facing. Thus, this analysis will provide the basis for the derivation of guidance documents or certifications for re-use business models.

As a first step each case study will be described and outlines in great detail offering a solid framework for comparison. A generic description model containing the characteristics to be assessed for each case will provide a common frame for this description. The analysis will include specific framework conditions, such as product, target market and involved supply chain as well as the current practices in the business case. Based on this analysis, generic success factors and barriers can be derived. A comparative evaluation of the importance and impact of the success factors and barriers will then identify recommendations for guidance documents and certification standards.

This study is planned as a thesis work under the StEP umbrella and supervised by StEP members Technische Universitaet Braunschweig and Empa. The start of the research work is envisaged for mid-2010.

#### Keyboards For All...At Any Price? Towards Responsible Digital Solidarity

In partnership with the international development NGO Enda Tiers Mondein Senegal, StEP members WASTE and Enda Europe launched the project "Keyboards for all...at any price? Towards responsible digital solidarity" in March 2008. The project aims at raising awareness on two issues, and identifying the links that exist between these issues. The first issue is what is generally known as the 'digital divide', or the gap in access to Information and Communication Technology (ICT) between developed countries and developing countries, but also the gap within developing countries. The second issue is the growing amount of ewaste, and the general unavailability of safe e-waste treatment facilities in low-and middle-income countries.

The project team carried out a study on donations of ICT equipment in France, the Netherlands and Senegal. Moreover, a web search and literature review have been conducted to establish an overview of organizations involved in second hand computer donations ("digital solidarity initiatives"). The project team also contacted public and civil society organizations as well as relevant companies and municipalities in France, the Netherlands and Senegal for interviews. The project team is carrying out a sensitizing campaign targeting these organizations but also the general public (the European local governments, firms, NGOs facilitating 2nd hand ICT export to developing countries, the European ICT firms and the European consumers of ICT material) based on several sensitization tools like round tables between firms, local governments and NGOs on the digital gap/digital dump, a guidance manual on facilitating the process of sending and maintaining high quality equipment and take-back and management of WEEE in developing countries, a travelling exhibition, a press kit to send to journalists, a comic book, radio sessions, a leaflet on how to use note of EEE and quarterly e-newsletters.

For more information see http:// www.step-initiative.org/projects/

#### **RE-Evaluate Project**

Although European legislation has discouraged disposal and encouraged recycling, some think it has discouraged re-use. Re-use of EEE has remained a marginal activity, applicable in Ireland to only a tiny proportion of e-waste. The experience of successful re-use projects outside Ireland indicates that a much higher proportion (possibly up to 60%) of e-waste could be diverted from reprocessing by successful refurbishment and re-use, providing environmental, social and economic benefits. The RE-Evaluate Project has been awarded funding over the next three years by the Irish Government's Science, Technology, Research and Innovation Programme (STRIVE) co-ordinated by the Environmental Protection Agency. This Programme with involvement of StEP member University of Limerick and supported by the social economy enterprises Rehab and Clondalkin Community Recycling Initiative, aims to evaluate in what circumstances should products be re-used and what WEEE management conditions should exist in order to facilitate re-use. This includes evaluating existing initiatives for e-waste re-use in Dublin, identifying best practice in re-use from Europe and elsewhere, and conducting re-use trials in order to make and pilot recommendations for the increase of re-use in Ireland. The RE-Evaluate Partnership has proposed a comprehensive R&D Programme which will be developed over a 36 month period beginning in November 2008.



## RECYCLE







#### Task Force 4 – ReCycle

The official release of the UNEP/ StEP study, Recycling – From Ewaste to Resources in early 2010 highlighted the exponentially increasing amounts of WEEE in the developed world and garnered significant media attention worldwide. The study, drafted by StEP members, emphasized the need for sustainable innovation requiring a sound market concept and one common global agenda. The role of industrializing countries is especially underscored, a concrete thematic area on which TF4 devotes much attention.

Proper recycling activities, including pre- and end-processing techniques, in developing countries can substantially mitigate the adverse ecological and biological impacts of e-waste mismanagement. The TF4 project, the Best of 2 Worlds, assesses the capacity in China for eco-efficiency by means of safe and appropriate manual dismantling. Not only does this create new markets. introduction of safe manual dismantling practices in China directly impacts resource efficiency and contributes to the reduction of greenhouse gas emissions.

In addition to evaluating the importance of manual dismantling in the developed world, the Task Force is also concentrating capacity to develop recommendations for globally accepted recycling auditing standards. Creation and acceptance of such guidelines would allow for ewaste flows to be accounted for in an internationally standard manner.

Through the above activities TF4 is holistically aiming to enhance infrastructures, systems and technologies to realize sustainable e-waste recycling. In turn, TF4 provides an international, multi-stakeholder forum for collaboration and scientific discussions critical for the sustainable development of economically, environmentally and socially sound solutions.

#### UNEP/StEP Study: Recycling – From E-waste to Resources

Contracted by UNEP, the StEP Initiative undertook a research study to identify and assess e-waste recycling technologies along the different steps of the recycling chain with special attention to ferrous, base and precious metals. Moreover, the study analyses the market potential of relevant technologies for the e-waste recycling sector in 11 developing countries and focuses on potential application of a Technology Transfer Framework for innovative technologies in the e-waste sector(s). To enable and support e-waste recycling technologies, the study also explores innovation hubs and centres of excellence in these emerging economies.

The research study reports that ewaste levels from computers in select developing countries will skyrocket 400-500 per cent compared to 2007 levels; the e-waste levels from mobile phones, will also substantially increase – in China they will be seven times higher, in India 18 times higher than 2007 levels.

E-waste activities in China were especially emphasized due to the large illegal exports of e-waste to the region. The report elaborates on the detrimental activities carried out in the informal sector in China – mainly through improper manual dismantling of e-waste as well as incineration of computer wire boards to retrieve the precious metals contained in them. This is of particular relevance to StEP due to the Initiative's efforts to set-up manual dismantling practices via another project, Best of 2 Worlds.

According to the study, increasing recycling rates in the developed world also have beneficial economical impacts – it would offer sound employment opportunities for their citizenry.

Because the implementation of complex national recycling policies requires sufficient capacity and existing comprehensive collection networks, such elaborate systems would unlikely work in most developing countries. The experts of the study propose instead that developing countries build e-waste management "centres of excellence" building on existing bodies' contributions to e-waste management.

The full study can be downloaded at http://www.step-initiative.org

#### Best of 2 Worlds

The exponentially increasing amounts of WEEE in China was explicitly highlighted in the UNEP/ StEP study, Recycling – From Ewaste to Resources. Researchers at UNU have concluded that China offers prospective opportunities for efficient manual pre-processing of certain WEEE but primitive and hazardous manual pre-processing activities are in place and are ubiquitous throughout the informal sector in China.

Launched officially back in 2004, the Best of 2 Worlds is a TF4 research project investigating the eco-efficiency of manual dismantling of imported and domestic e-waste in China. Currently in the working phase, the overarching objective of this project is to introduce transparent EHS (Environment, Health and Safety) compliant operations in the combining of manual dismantling while simultaneously providing the best available technology for further processing of complex materials (e.g. to successful recovery of precious metals).

In essence TF4 has identified the inefficiency (e.g. low recovery yields) of "backyard" recycling practices in China as well as its adverse ecological impacts on the local environment (e.g. burning of printed wire boards in failed attempts to obtain precious metals). In turn the Best of 2 Worlds project will engage this informal sector and provide them with capacity and safe working environments in the pre-processing stage. By reinforcing such operations, it becomes feasible to optimize the resource chain and meet the demand for raw materials in an eco-efficient manner while positively impacting local economies by growing employment rates and overall improvements in working conditions.

#### **StEP Recycling Guidelines**

In recent years StEP has aspired to become more active in the discussion on recycling guidelines and standards and has developed this comprehensive StEP project to initiate and further the discussion on recommendations for international standards, which could ultimately be proposed to international standardization bodies (e.g. IEC, ISO, CENELEC).

In order to pave the way for accounting for electrical and electronic equipment flows throughout the entire WEEE chain, StEP, collaborating with other e-waste stakeholders, is focusing research on the development of high level, high quality recycling guidelines to prevent pollution and efficiently recover valuable resources. StEP is also looking to incorporate high quality levels of re-use of electrical and electronic equipment in its scope.

Optimal recycling standards would prevent inadequate disposal of WEEE, its components, fractions and materials while simultaneously addressing the illegal exports of WEEE to non-OECD (developing) countries.

Current activities include compilation, collation and analysis of existing recycling guidelines, standards and relevant legislation as well as initiation of dialogues with strategic stakeholders, including active involvement in the WEEELABEX project and participation in the PACE Initiative of the Secretariat of the Basel Convention.

STINCTOR SEINCELER SEINCELER SEINCELER

#### Task Force 5 Capacity Building

Capacity Building implies imparting knowledge and reinforcing informed decision-making. StEP's Task Force Capacity Building wants to increase public, scientific and business awareness regarding the ever growing e-waste problem as well as to strengthen capacities for its sustainable management around the globe, covering relevant aspects of the entire life-cycle of (W)EEE.

Task Force members want to achieve this by offering open access to the knowledge and experiences gained in the activities of the Task Forces 1 - 4 as well as of other related initiatives. The Task Force initiates and maintains a dialogue with relevant networks to identify and develop sustainable approaches for capacity building in global e-waste management, adapted to different target countries and target groups and tested in pilot-projects. The Task Force strives to elaborate concerted recommendations and guidelines, initiate and attend public events to generate awareness and publish regularly in the mass media and scientific journals.



#### **Annual E-waste Status Report**

StEP has identified a strong need for global e-waste data supporting scientific research in the field. Thus, Task Force Capacity members have started work on an "Annual Dynamic Digital Reporting on the global Ewaste StatuS" (ADDRESS).

ADDRESS should provide data for science-/data-based research work on e-waste in-and outside of StEP, inform StEP's work with up-to-date and solid data on the global e-waste status and global quantities of it and estimate future developments as well as trends and improvements made over time.

The short-term objective is to create much more accurate worldwide assessments of e-waste volumes, i.e. EEE put on the market. WEEE generated, WEEE collected and treated as well as amounts flowing to non-desired destinations like illegal exports, disposal without recycling, etc. The work will cover various regions in the world and will follow the development of e-waste collection and non-collection over time. Long-term objectives are to regularly update this report and enlarge the database (also covering aspects like status of legislation, consumer education and awareness, financing systems etc.).

A project group has started work and first results are expected for mid-2010.

#### NVMP-StEP E-waste Summer School

The first NVMP – StEP E-waste Summer School took place from 7 - 16 September 2009. Among the main objectives of the summer

## **CAPACITY BUILDING**

school were to link young researchers to experts from industry, academia and policymakers and also to develop a sustainable, multi-disciplinary network of young scholars who will function as multipliers in their respective academic and geographic areas.

The 17 participants were a highly motivated, diverse and truly international group, between them representing 17 countries of origin, study or research. The summer school started in Eindhoven, Netherlands and culminated at R'09 Twin World Congress in Davos, Switzerland where the students of the summer school conducted a workshop for delegates of the R'09 Congress on "E-waste in Developing Countries".

Organized by United Nations University, Empa and Technische Universitaet Braunschweig, the outstanding success of the summer school was in large part thanks to the support provided by the main sponsors, The Dutch Foundation for the Disposal of Metal and Electrical Products (NVMP), Philips Consumer Lifestyle as well as the StEP members who supported the summer school as faculty, through study tour visits (namely, Sims Recycling Solutions, Philips Healthcare Refurbishment and Umicore Precious Metals Refining), as well as many others who reviewed applications.

In order to continue and further the network of young e-waste researchers, one of the outcomes of the summer school, developed by the students, is a blog (http://sites.google.com/site/weeespace/), an online meeting point connecting the participants from around the world. Also, one of the project proposals taking shape is the future establishment of half or one-day E-waste Symposia to discuss the e-waste topic in an interdisciplinary context, and provide more opportunities for interaction and collaboration between e-waste researchers.

Preparations are ongoing for the next NVMP-StEP E-waste Summer School which will take place from 29 August to 7 September 2010 in Eindhoven, Netherlands and Hoboken, Belgium.





#### The StEP website

StEP's website has been designed to generate interest in the Initiative's work on the e-waste problem and act as a tool for external communication. Its basic sections are:

- Initiative gives an overview of the main objectives and a brief look back at the history of StEP also linking to its organizational structure and relevant actors
- Task Forces presents the work of the five Task Forces, their objectives and current activities
- Actors gives an overview over StEP's organizational structure with the key elements being the Steering Committee, Secretariat and five Task Forces involving its

## **CAPACITY BUILDING**

coordinators, members and observers. It also states relevant actors and introduces all companies and institutions actively involved in StEP activities

- News
- Events
- Publications
- Projects as one module of making StEP the e-waste knowledge platform, a first version of a project database on e-waste-related projects has been set up. This database comprises information on projects within and outside of StEP, project information can be entered through an easy-to-use form.

For more information see http://www.step-initiative.org

#### The StEP File Gallery

Acknowledging the rising need for an up-to-date and easy to use document management system, StEP has established an online file management system, the so-called File Gallery. Its objectives are to:

- Provide an online-database of StEP documents
- Guarantee internal knowledge dissemination
- · Limit unnecessary email flows
- Provide a tool for external communication allowing 'Anonymous Users' to access some elements of the File Gallery. Hence, non-StEP members interested in the work of the Initiative can get an insight, without having access to sensitive data though.

The file gallery can be found at http://files.step-initiative.org/

In addition, a **StEP Member Newsletter** is published on a regular basis via email.



## **StEP Events**

The following overview summarizes various international conferences and events which have been organized by the StEP Secretariat or where StEP has been present to raise visibility and present outcomes of its work.

StEP Events	
20 January 2009 StEP Open Meeting in Salzburg, Austria	
9 – 10 February 2009 E-waste 2009 – E-waste Management Forum: Circulating Success in Cai- ro, Egypt, organized by StEP member CEDARE and supported by StEP	
12 – 14 May 2009 StEP General Assembly 2009, hosted by United Nations University, Bonn, Germany	
13 September 2009 StEP Open Meeting at R'09 Twin World Congress in Davos, Switzer- land	
7 – 16 September 2009 NVMP-StEP E-waste Summer School in Eindhoven, Netherlands and Davos, Switzerland	
16 – 18 November 2009 Sixth International Workshop on Regional Integration for E-waste Ma- nagement in Latin America in Panama City, Panama	
7 – 9 October 2009 StEP Session at Asian Electrical and Electronic Green Society Confe- rence in Bangkok, Thailand	Please also see http://www.step-initiative.org/ events.php



## **StEP Members**



CAROLO-WILHELMINA

umicore

TELECON

anagem

客席

Taizhou Chiho Tiande Technische Universitaet Braunschweig Techsoup Telecom Business School Thai Electrical and Electronic Institute (EEI)

Umicore Precious Metal Refining United Nations Conference on Trade and Development (UNCTAD) United Nations Environment Programme (UNEP) United Nations Industrial Development Organization (UNIDO) United Nations University (UNU) United States Environmental Protection Agency (US-EPA) University of Limerick

Waste\* WEEE Forum\*









OLISCOL LUMINIGH





\* Associate Member



#### The StEP Initiative

Initiated by various UN organizations, the the Solving the E-wasteProblem Initiative (StEP) works with representatives from industry, governments, international organizations, NGOs and the academia to initiate and facilitate approaches that promote the sustainable handling of e-waste. Organized in fiveTask Forces, feasible, just and environmentally safe solutions for the e-waste problem are developed through analysis, planning and pilot projects. For more information please visit www.step-initiative.org.

#### StEP Secretariat c/o United Nations University Institute for Sustainability & Peace

(UNU-ISP) Operating Unit SCYCLE UN-Campus Hermann-Ehlers-Straße 10 53113 Bonn, Germany Tel: +49-228-815-0213/0214 Fax: +49-228-815-0299 info@step-initiative.org www.step-initiative.org

#### The United Nations University

The United Nations University is an organ of the United Nations established by the General Assembly in 1972 to be an international community of scholars engaged in research, advanced training, and the dissemination of knowledge related to the pressing problems of human survival, development and welfare. The University operates through a worldwide network of research andpostgraduate training centres.

www.unu.edu

#### Photos

© by Ruediger Kuehr, Karsten Schischke, Empa, Gaiker, Nokia, NVMP, Umicore, Sims Recycling Solutions.

#### Disclaimer

United Nations University / StEP Initiative 2010

This work is licensed under the Creative Commons by-nc-ndLicense. To view a copy of this license, please visit http://creative-commons.org.

This publication may thus be reproduced in whole or in part and in any form for educational or nonprofit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the StEP Initiative/ United Nations University.

The StEP Initiative/United Nations University would appreciate receiving a copy of any publication that uses this publication as a source.

