

## ENVIRONMENTAL IMPACTS OF INFORMAL REUSE

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### ABSTRACT

In Europe informal collectors from new EU member states are collecting commodities (WEEE; textiles and bulky waste) in one of the economically well-developed EU 15 member states and bring it to their home countries to sell the items at flea markets. Reuse is seen as a promising waste prevention measure and environmental benefits are expected in most cases compared to the use of new items. But the environmental benefit of these informal transnational activities was doubt especially for WEEE. Thus, the impact of this informal type of reuse was investigated in detail during the Central Europe project TransWaste for 13 different products exemplary presented in this paper for a refrigerator and a plastic garden chair.

### INTRODUCTION

The existence of informal waste collection activities as a remarkable contribution to re-use in Central Europe has more or less been neglected to date. The European informal collectors are collecting commodities in one of the economic well-developed EU 15 member states, bring it to their home countries (in most of the cases they come from CEE countries) and sell it at flea markets. Compared to the traditional industry and services, the informal sector is often called the “black” or “hidden economy”. Informal means “without formal assignment, not official” and refers to all economic activities by workers and economic units that are not or insufficiently covered by formal arrangements. In contrast to the situation in developing countries, where recyclables are collected and recycled, mainly bulky waste, metal, WEEE and textiles are collected and reused.



Figure 1. Example for informal collected and transshipped goods in Austria

Reuse in general is seen as a promising waste prevention measure and environmental benefits are expected in most cases compared to the use of new items. Nevertheless especially this transborder reuse is seen as environmentally questionable by Western Europe waste management authorities as they assume worse waste management conditions in Eastern

European countries. To verify this argument the environmental impacts of the collection of goods in Austria and reuse in Hungary were investigated in detail during the Central Europe project TransWaste ([www.transwaste.eu](http://www.transwaste.eu)) for 13 different indicator products (hazardous and non-hazardous items) and results are presented in this paper exemplarily for a refrigerator and a plastic garden chair.

## **MATERIALS AND METHOD**

The chosen indicator products represent items that are mainly collected by informal collectors cover the whole array of collected goods from WEEE to furniture or bulky sports equipment. Environmental effects for a plastic garden chair and a refrigerator containing CFCs as cooling and foaming agents, as it was considered that the appliance is from 2000, are estimated using the methodology of Life Cycle Assessment (LCA) for formal and informal waste collection and treatment scenarios. Ecoinvent® v2.2 was used as data inventory for material production and assembly. Additionally literature based data was taken for illegal disposal. Data from project specific investigations was considered for informal sector activities. GaBi 5 was used to support the calculations.

The following environmental categories (according to CML 2001) were applied:

- Abiotic Depletion (ADP) [kg Sb-Equiv.]
- Acidification Potential (AP) [kg SO<sub>2</sub>-Equiv.]
- Eutrophication Potential (EP) [kg Phosphate-Equiv.]
- Global Warming Potential (GWP 100 years) [kg CO<sub>2</sub>-Equiv.]
- Ozone Layer Depletion Potential (ODP, steady state) [kg R11-Equiv.]
- Photochem. Ozone Creation Potential (POCP) [kg Ethene-Equiv.]

The scenarios cover both formal and informal activities. The formal scenario is necessary to provide a baseline scenario without informal collections at all. The informal scenario shows the status quo of informal collection, transborder shipment and reuse of collected goods as well as assumed inadequate disposal. The formalised scenario is similar to the informal scenario in the case of reuse but considering proper disposal technologies. It was assumed that 30% of the devices cannot be sold and be therefore dismantled (cables are removed) and dumped in uncontrolled sites. 70% of the devices are sold and reused. At the end of the second lives both products are properly disposed in the receiving country. The ratio between illegal disposal and reuse and the influence of these end-of-life possibilities is considered in the assessment. For the formalisation scenario it was assumed, that the former informal collectors get a training concerning legal and environmental issues (Obersteiner et al., 2012) and act in a legal way. As far as possible only use- and sellable items are taken. Therefore it was estimated that a share of 95% of reused products may be realistic. This implies that only 5% need to be disposed of without reuse. It comes along with a decrease of illegal dumping

## **RESULTS AND DISCUSSION**

The plastic garden chair shows environmental benefits in the formalized scenario for the most categories except for EP and ODP. Landfilling dominates EP in receiving countries, which is still the most common disposal option for garden chairs. In the informal scenario the disposed amount in receiving countries increases as more materials have to be transferred due to lower

product quality which leads to 30% loss of materials. However the total environmental impacts in case of EP are lowest in the formalized scenario, as the reuse benefits occur and the disposal of unsold products is less than in the informal scenario. For ODP benefits of thermal recovery of plastic is decisive. It decreases the total emissions of the formal scenario significantly. These benefits are missing in the informal and formalized scenario as the disposal takes place in receiving countries, where landfilling is dominating. Additionally, the transport by collectors to receiving countries is an important factor.

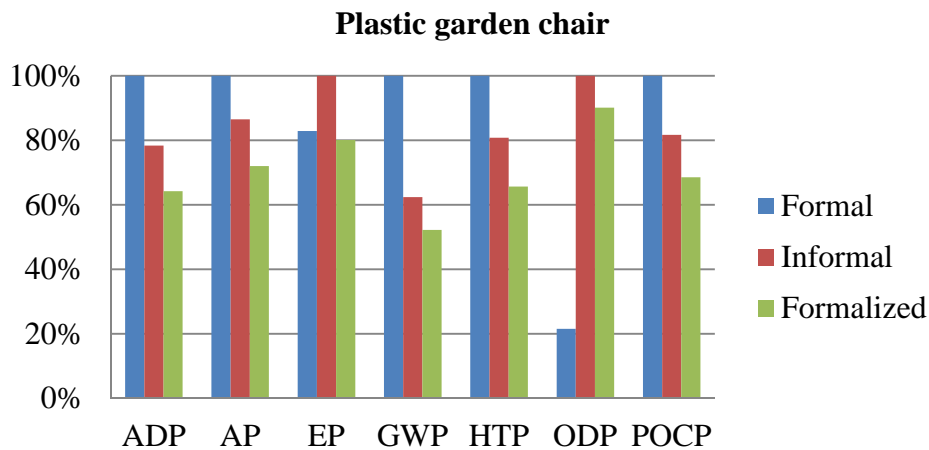


Figure 2. Relative results of one piece of plastic garden chair over all environmental categories

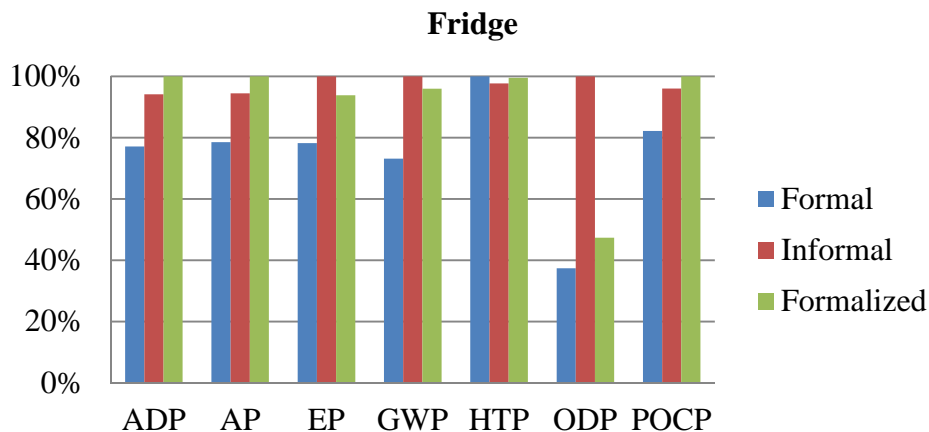


Figure 3: Relative environmental impact of one refrigerator over all environmental categories

Electronic equipment studies state that the environmental advantage of reuse is depending on various critical parameters in this area (Ökopol, 2008; Sahni et al., 2010). Environmental benefits of reuse are largely depending on the use phase and energy efficiency of the product e.g. refrigerators show decreasing energy consumption in recent years.

Figure 3 shows that contrary to the plastic garden chair for the refrigerator the formal scenario shows the fewest emissions. The refrigerator shows significant environmental burdens in case of reuse. The formalized scenario shows 20% (EP) to 31% (GWP) more emissions compared

to the formal waste management scenario. The emissions of the total life cycle are determined by the use phase (Pertl et al., 2010). The use phase of an old fridge has much higher emissions than from a new fridge. This concerns the informal as well as the formalized scenario. The more refrigerators are reused the worse the environmental effects. The formalized scenario shows therefore in most of the categories more emissions compared to the other scenarios except for EP, GWP and ODP. Those categories are affected by the illegal disposal in the informal scenario. In these cases the informal sector shows the worst results in view of the environment.

## CONCLUSIONS

As a conclusion for the environmental assessment it can be stated for non electronic products that the status quo of the informal sector produces less emissions for the environment than the theoretical solely formal scenario. This is due to the effect that reuse of goods avoids the production of new goods and therefore emissions which would occur in the production process. Compared to the formalisation scenario the status quo produces slightly more emissions as more goods are collected which can't be resold and therefore not reused anymore. All formalisation scenarios have the advantage that fewer goods are disposed off without reuse. For electronic devices the environmental impact of reuse depends on the use phase and on the energy efficiency of new devices compared to reused items. Additionally the use phase as well as the EoL phase is determined by the different electricity mix in each country. Production phase was modelled in terms of global or European conditions depending on the data set, as the least products are produced in the considered countries. Different results are therefore based on the different electricity mix in the use phase and the different recycling and disposal habits for each country.

As overall conclusion it can be stated that the most relevant parameters influencing the results are the energy efficiency from the reused item compared to a new product and the illegal disposal activities. If the energy efficiency compared to a new product is not much different and illegal disposal activities can be banned in the formalisation ideas, then the reuse is advantageous.

## REFERENCES

- Ökopol (2008): ReUse und Ressourcen- und Klimaschutz (ReUse and resource and climate protection), Brief report provided for bag Arbeit e,V,
- Sahni, S.; Boustani, A.; Gutowski, T,G., Graves, S,C, (2010): Reusing personal computer devices – good or bad for the environment?, Proceedings of the 2010 IEEE International Symposium on Sustainable Systems and Technology, ISSST 2010
- Obersteiner, G; Linzner, R; Pertl, A; Scherhauser, S; Schmied, E (2012): The informal sector in waste management and it's contribution to Re-Use in Central Europe .[6th annual international experts conference Enviro-Management 2012, New Forest, UNITED KINGDOM, OCT 9-11, 2012
- Pertl A., Obersteiner G. Scherhauser S., Den Boer, J. (2010): Ecological and economic informal waste management strategies - A case study. [Crete 2010 - 2nd International Conference on Hazardous and Industrial Waste Management, Chania, Crete, Greece, October 5-8, 2010] In: Gidakos E., Cossu R., Stegmann R. (Eds.), Crete 2010 - 2nd International Conference on Hazardous and Industrial Waste Management. Executive Summaries., Abstract p.65-67; full paper on CD