

October 2012  
ISSN 1863-2025

 **Öko-Institut e.V.**  
Institut für angewandte Ökologie  
Institute for Applied Ecology

# **eco@work**

Sustainable reading from the Öko-Institut

## **Urban Mining**

**Is the city a goldmine?**

**Together**  
E-waste recycling in Africa

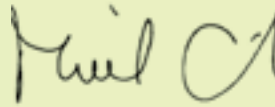
## Everyone is talking about resources

Few research topics have experienced such a resurgence in recent months as resource efficiency and recycling. Last year the European Commission set out its roadmap for a resource-efficient Europe, calling on EU member states to use resources sustainably and to tackle the shortage of strategically important resources by efficient use and better recovery of resources from previously used materials. The German government now has to work on developing its own targets and milestones for conserving resources and submit them to the Europe-wide consultation process in 2013. This process, says the EU Commission, is to culminate in a binding resource strategy for European member states.

The Oeko-Institut has been working on the sustainable use of resources for many years. This current edition of eco@work is devoted to a subject that will need researching in future: urban mining, and the city as a goldmine. We know that empty buildings, obsolete electronic equipment and scrap cars are a huge potential source of resources – and not just in cities, of course. In their latest research, our colleagues have calculated just how great this potential is from some of these sectors and from products such as redundant electronic equipment, identifying as well the untapped reserves for resource recovery. The Knowledge 1 article provides an introduction to the topic and is at the same time a plea for the better use of secondary resources.

Outside Europe the issue is even more highly charged. Last year we reported in detail on the problem of illegal e-waste shipments to African countries. The Oeko-Institut has collaborated with the United Nations Environment Programme (UNEP), the governments of seven African states and other partners to work out what potential exists for resource recovery and what the social and health-related advantages of alternative recycling technologies and structures may be. You can read about this and about the newly launched "Best of two worlds" project in Knowledge 2.

I hope you enjoy this issue and are excited by the insights it offers into our work.



Michael Sailer  
Chairman of the Executive Board of the Oeko-Institut  
m.sailer@oeko.de

## Contents

<b>EDITORIAL</b> .....	2
By Michael Sailer CEO, Oeko-Institut	
<b>VALUES</b> .....	3
"We want to ensure that e-waste is handled correctly" Interview: Christina Meskers of Umicore Precious Metals Refining	
<b>KNOWLEDGE</b>	
<b>Is the city a goldmine?</b> .....	4
The potential of urban mining	
<b>Recycling between two worlds</b> .....	8
E-waste in North and West Africa	
<b>WISHES</b> .....	10
<b>Player profile</b> Andreas Manhart, a researcher at the Oeko-Institut, Vivian Ahiayibor Meinel and Jürgen Meinel of City Waste Group (Ghana) and Dr. Hossam Allam of CEDARE in Cairo	

### Imprint

eco@work – October 2012, Published by: Öko-Institut e.V.  
 Edited by: Mandy Schossig (mas), Christiane Weihe (cw)  
 Responsible editor: Michael Sailer  
 Translated by: Vanessa Cook, Christopher Hay  
 Design/Layout: Tobias Binnig, www.gestalter.de  
 Technical implementation: Markus Werz, Wilhelm Innovative Medien  
 Address of editorial office: P.O. Box 17 71, 79017 Freiburg, Germany  
 Phone: +49 (0) 761/452 95-0, Fax: +49 (0) 761/452 95-288,  
 redaktion@oeko.de, www.oeko.de  
 Account Details for Donations:  
 Sparkasse Freiburg – Nördlicher Breisgau,  
 Bank Code No.: 680 501 01, Account No.: 2 063 447  
 IBAN: DE96 6805 0101 0002 0634 47, BIC: FRSPDE66  
 GLS Bank, Bank Code No.: 430 609 67, Account No.: 792 200 990 0,  
 IBAN: DE50 4306 0967 7922 0099 00, BIC: GENODEM1GLS  
 Donations are tax-deductible for German income tax purposes.

### Picture Credits

Cover © mhp - Fotolia.com  
 P.3 left: © Ilja C. Hendel  
 P.4/5 © Ilja C. Hendel  
 P.6 © Daniel Ernst - Fotolia.com  
 P.7 © Ilja C. Hendel  
 P.8 © Ilja C. Hendel  
 other © private or © Öko-Institut

## "We want to ensure that e-waste is handled correctly"

State-of-the-art procedures, highly efficient recycling: as a specialist for materials technologies the Belgian Umicore Group knows very well the requirements for recycling and the processing of metals from e-waste. In conversation with eco@work Christina Meskers of Umicore Precious Metals Refining tells us what contribution European recycling specialists can make to establishing efficient structures and procedures in African partner countries.

### Ms Meskers: What precisely is the task of Umicore within the scope of international co-operations on e-waste recycling?

Our task is two-fold. First of all there is our usual work: we receive materials from developing countries and recycle them in our recycling plants. The second part of our work lies in the transfer of knowledge as that practised in the „Best of two worlds“ project. This is primarily a case of helping local recyclers take the first steps towards processing e-waste. We explain to them how appliances can be disassembled before they are passed to further recycling. We show what materials are valuable and which are not. In a nutshell: we help in the setting-up of local infrastructure.

### The keyword "Best of two worlds" – What task does Umicore have in this project geared to establishing new recycling structures in Ghana and Egypt in pilot tests?

At the beginning of the project it's first of all a case of collecting knowledge and background information. We evaluate the situation, looking at local conditions, the composition of e-waste and the different materials contained therein. The „Best of two worlds“ project deals only with locally generated e-waste and should not stimulate illegal imports of e-waste from other countries.

### What are the tasks in terms of practical implementation?

Important elements of this project are the practical transfer of knowledge locally, the evaluation of implemented procedures and also the question of what economic rewards there can be for people locally. And also to answer the question of whether the recycling project can be financially sustainable in the long term. Twice a year we will be visiting these sites since we want to work closely together with the project partners and the local NGOs, and authorities, etc..

### What are the greatest challenges for European companies in such international co-operations?

Above all the different size of the companies involved in the co-operations. We collaborate with very small companies – that's a big challenge for us as a large company. Small companies naturally have very different structures, a completely different administration, and often in developing countries people are self-made, possibly with much less formal education. Thus it's important to develop mutual understanding and recognise the respective challenges.

### How does Umicore profit from these projects?

Maybe we will be able to make a financial profit in the long term with these projects. But that's not the main motivation


for us. We regard the project as one of social responsibility – we want to share our expertise. We want to ensure that e-waste is handled correctly. When that happens, then we and the general society have already profited.

### What actors are in your view particularly important when confronted with the problem of e-waste recycling in Africa?

Many different actors can do something about, for example, the e-waste from Europe that is shipped to Africa. It is just as necessary for state authorities like customs authorities to get involved as it is for the manufacturers of appliances or the users themselves. They should critically question what happens with their used appliances. I don't think it's fair to send appliances that no longer function to countries which do not have sufficient structures for recycling and recovery. European waste should be disposed of in Europe in an environmentally sustainable manner. Only those appliances which can still be used should be shipped.

### Thank you.

The interview was conducted by Christiane Weihe.

 [Christina.Meskers@eu.umicore.com](mailto:Christina.Meskers@eu.umicore.com)  
[www.oeko.de/123/values](http://www.oeko.de/123/values)

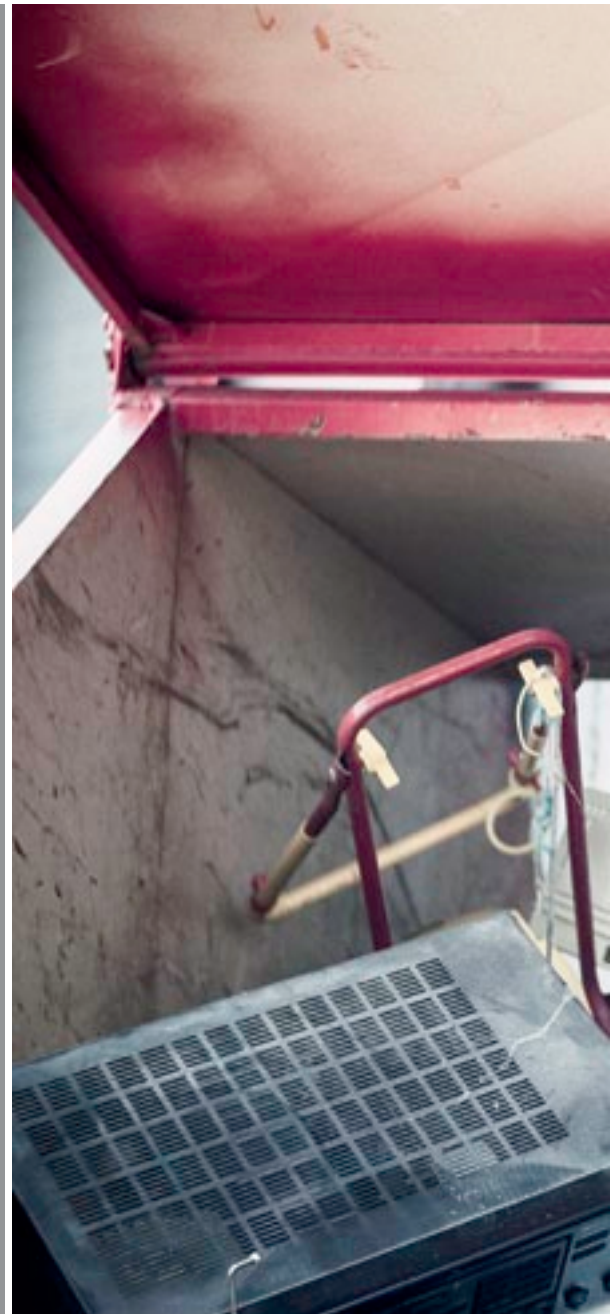


*In conversation with eco@work:  
Christina Meskers, Business Development  
Manager at Umicore Precious Metals Refining  
in Hoboken, Belgium.*

# Is the city a goldmine?

## The potential of urban mining

They are in the magazine we hold in our hands, the traffic signs at the roadside and the packaging on supermarket shelves: resources such as paper, aluminium and crude oil. In what are known as their anthropogenic repositories or, more simply, the places where they are temporarily used, they may lie dormant for only a short while, like the iron in drinks cans, or else they may be there for many years, like the iron in bridge railings. And some are left there for too long, such as the copper in derelict buildings or the gold in redundant smartphones. Urban mining seeks to recover these valuable secondary resources and reuse them – analyses done by the Oeko-Institut show just how great their potential is.



Every year large quantities of resources go to waste worldwide. This is the case with copper, for example. It is present in many parts of our lives: in heating pipes and guttering as well as in cars and mobile phones. "Copper is a universal resource," explains Dr. Matthias Buchert from the Oeko-Institut. "It can be used in many applications and can be successfully recycled." The good conductivity of this raw material is what makes it especially popular. Owing to its versatility the amount of copper used in our homes, products and infrastructure is constantly increasing. Thus a report by the United Nations Environment Programme (UNEP) on the amount of metal in anthro-



pogenic repositories gives a figure of up to 55 kilos of copper per person globally.

Moreover, in more developed countries the figure is significantly higher (140-300 kilos per capita) than in less developed countries (30 to 40 kilos). However, copper's good recyclability is not always exploited. "The major resource losses for copper occur particularly in mobile electronic items such as mobile phones and notebook PCs," says Matthias Buchert. "This potential ought to be exploited more – not least because of the rising price of raw materials." At present the end-of-life recycling rate for copper stands at a little over 50 percent – the re-

mainder ends up somewhere other than the recycling industry.

## Recycling electronic waste

The researchers at the Oeko-Institut can also see considerable potential for improving long-term resource use in terms of electronic waste. In the "Recycling of critical raw materials from waste electronic equipment" project conducted for the North Rhine-Westphalia State Agency for Nature, Environment and Consumer Protection (LANUV) they analysed the critical resources used in four different electronic products and developed recycling options. An analysis of potential for cobalt, gallium, germanium, indium, tantalum, metals in the platinum group and rare earths was drawn up for four groups of devices, namely, flat screens, LED lights, notebook

PCs and smartphones. The project also aimed to identify deficiencies in recycling structures and technologies and to develop recommendations for action to optimise recycling in North Rhine-Westphalia.

The analysis of resource potential produced astonishing figures for notebooks. "The seven million or so notebooks sold in the German private sector in 2010 contain a total of at least 460 tonnes of cobalt," says Matthias Buchert, "and even the rare earth metal neodymium reaches the impressive figure of over 15 tonnes." Figures for the precious metals silver and gold amount to 3.1 tonnes and 740 kilos respectively. Yet a large proportion of many resources is never reused. Oeko-Institut researchers identified major weaknesses relating to the availability of data about the equipment and its treatment prior to recycling. 50 percent of notebooks remain unaccounted for in the pre-recycling data – although this figure can be put down to the largely illegal exports destined, say, for Africa or Asia. In addition, many critical raw materials do not make it through the preliminary and final treatment of devices here in Germany. Thus in the case of the platinum, tantalum and

the rare earth elements neodymium, praseodymium and dysprosium contained in notebooks, 100 percent losses have been recorded during preliminary treatment, while a substantial 70 percent of silver and gold is lost.

The proposals put forward by the Oeko-Institut researchers in their recommendations for action include raising the recovery rate through such things as information and trade-in campaigns and an improved collection infrastructure, stemming the flow of illegal exports of waste equipment and improving recycling right at the pre-treat-

## Derelict buildings: a source of resources

ment stage by ensuring that the devices are manually disassembled more thoroughly beforehand. "The statutory framework must be improved as well," says Matthias Buchert. "For instance, purely mass-based quotas don't support the recovery of critical raw materials. They can even be counterproductive, if critical metals are wasted in large mass streams such as steel recycling."

It is not only in electronic waste recycling that resource losses are high. A proportion of the resources present in empty buildings and disused infrastructure that are not even sent for recycling in the first place also go (initially) to waste. Vacancy rates, particularly for property such as office blocks, are fairly high here in Germany: according to figures published by Deutsche Genossenschafts-Hypothekenbank they are currently running at around 8.4 percent in Berlin (projected for 2012) and at 10.6 percent in Düsseldorf. In Frankfurt am Main as much as 14.5 percent of office accommodation is standing empty – this is equivalent to an area of over 1.7 million square metres. "A substantial percentage of these properties is actually nothing less than an untapped source of resources," says Matthias Buchert.



## Landfill Mining

In the context of urban mining researchers are now also looking at how to exploit the resource potential – including secondary raw materials such as metals – contained in old landfill sites and rubbish dumps. This practice, known as landfill mining, does not occur as yet. However, if the demand for and price of raw materials continues to rise it could be economically viable in future – in the case of non-ferrous metals and phosphorus, for example – to realise this potential.

With regard to future landfill sites, for example, experts favour setting up interim repositories where different types of waste can be stored in separate segments. This is one of the outcomes from an Oeko-Institut workshop on the role of urban mining held in February 2012. This would make it easier to recover raw materials at a later point in time. One of the other issues noted by the experts is that existing environmental and protection standards must not be compromised in the course of landfill mining.

"This is a potential we need to exploit." At the same time, says the scientist, derelict buildings are preventing genuinely valuable use of large areas of land. "It would make sense to establish a formal register of all disused buildings, from barns to tower blocks," he suggests. "If this were done, demolition programmes would be of value not only for resource recovery but also for urban development and possible new uses as well." Experts think that new instruments such as a differentiated land transfer tax should also be introduced to make land with disused buildings on it more attractive to buyers. "The idea is to reduce the tax on derelict land in town centres while taxing greenfield land more heavily," explains Matthias Buchert.


These are the instruments scientists like Matthias Buchert are exploring to make it possible to increase the potential of ur-

## The future: closed loop recycling?

ban mining. "Our goal must be to raise recycling rates significantly and, in doing so, to make better use of secondary raw materials," he says. He sees improvements in existing data records as the first step: "In many areas, such as redundant infrastructure or long-term disused buildings, we really still have no idea how great the

resource potential is." Although he thinks that completely closed loop recycling – in which every resource is consistently reused and nothing is wasted – is not realistic, he believes that a significant increase in recycling rates is entirely achievable given that, especially in the case of special metals, a high proportion of resources is not reclaimed at present. For example, the global end-of-life recycling rate for metals such as lithium and gallium is less than one percent, as it is too for the rare earth metals. "I believe that it is only a matter of time before more efficient recycling processes are developed", says Buchert. "Urban mining will experience an upsurge because of the growing global demand for resources and their correspondingly high prices".

*Christiane Weihe*

 [m.buchert@oeko.de](mailto:m.buchert@oeko.de)  
[www.oeko.de/123/knowledge1](http://www.oeko.de/123/knowledge1)



## The smartphone – a resource audit

Smartphones are full of important raw materials and critical metals. In addition to the precious metals silver, gold and palladium they contain copper, nickel, lead, bismuth and lithium. Furthermore, seven metals or groups of metals listed as critical by the European Commission are used in making smartphones; these include niobium, wolfram and metals from the platinum group. In addition, cobalt is used in the batteries, tantalum and gallium in the circuit boards and indium in the LCD display. There are also rare earth metals in the permanent magnets. In terms of the

amount of metals used, estimates by the Oeko-Institut as part of the "Recycling of critical raw materials from waste electronic equipment" project assume that 6.3 grams of cobalt, 305 milligrams of silver, 30 milligrams of gold, 11 milligrams of palladium, 50 milligrams of neodymium and 10 milligrams of praseodymium are used in the manufacture of a smartphone. For the well over seven million smartphones sold in Germany in 2010, this translates into a potential metal resource of 48.5 tonnes of cobalt, 2.35 tonnes of silver, 230 kilograms of gold, 85 kilograms

of palladium, 385 kilograms of neodymium and 77 kilograms of praseodymium.

However, a large proportion of old smartphones are not sent for efficient recycling. According to the figures for 2007, 2273 tonnes of mobile phones were taken out of use while only 110 tonnes were recorded for the recycling data. This represents a data coverage rate of only about five percent: Oeko-Institut researchers believe that the same figure can be assumed for smartphones.

# Recycling between two worlds

## E-waste in North and West Africa



It was a clear "Call for Action!" In March 2012 the Pan-African Forum on E-waste put the spotlight back on the problem of e-waste recycling in Africa and its serious impacts on human health and the environment. At the same time its "Call for Action" is an important point of reference for the range of steps that need to be taken and for the players whose active commitment is required. Researchers at the Oeko-Institut are also conducting various projects investigating how the problems in the African recycling sector can be minimised without simultaneously compromising its importance to the economy. Strategies for preventing resource losses from inefficient recycling are vital.

Health and the environment, industry and technology, law and politics: six fields affected by waste recycling. And they show that there are no simple solutions. "The "Call for Action" has focused on important areas of activity, for example, knowledge transfer about hazardous constituents and extending manufacturers' responsibility to include collection and recycling," explains the Oeko-Institut's Andreas Manhart, "but the need for appropriate statutory frameworks and the prevention of illegal e-waste shipments to Africa are also key features." Just stopping the shipments would not solve the problem, however, since in any case around 70 percent of the electrical and electronic waste (e-waste) arising in



West Africa results from its own consumption. "Given the economic growth in countries such as Ghana and Nigeria, and rising usage figures in Africa for items like mobile phones and electronic notebooks, the amount of e-waste there is more likely to increase rather than decrease in future," says Andreas Manhart. In his view the key to properly recycling the waste generated is to understand the local situation and adapt to the conditions: "One important statement in the "Call for Action" is that the most appropriate technologies should be used in recycling. Those are not necessarily the newest on the market."

The fact that the most appropriate technology can also boost rates of reclaimed resources substantially in comparison with those used at present is shown by a calculation for the use of alternative recycling technologies and organisational modes in Ghana and Nigeria as part of the E-waste Africa project. "According to our estimates, if the most suitable technology were used instead of the one being used at present, the recovery rate for gold from desktop computers could be increased from 30 to 93 percent," says Andreas Manhart. As part of the United Nations Environment Programme (UNEP) E-waste Africa project, the Oeko-Institut has worked with the governments of seven African states, the Swiss Federal Laboratories for Materials Science and Technology (Empa) and the European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL) to conduct a detailed study of the situation in West Africa. The project, coordinated by the Secretariat of the Basel Convention, analysed the e-waste situation in Benin, Côte d'Ivoire, Ghana, Liberia and Nigeria. The UN report 'Where are WEee in Africa?' provides a summary of the results. "The results from these analyses are still very alarming," says Andreas Manhart. "There is an urgent need for action here regarding the toxic substances being released and their impacts on people and the environment." As part of the project the research team is also looking at the shipment of waste from Europe to West Africa, which is making the problem there even worse. According to the researchers' findings, Nigeria has the most imports of e-waste, followed by Ghana. However, 30 percent of Ghanaian imports of electrical and electronic equipment declared to be "used goods" are not functional and only some of them can be repaired, according to the UN report. This generates

an additional 20,000 or so tonnes of waste per year. Most of these shipments come from Great Britain, with France and Germany following quite far behind.


## Best of two worlds

The transport routes between Africa and Europe – albeit in the opposite direction – are a key issue in a new Oeko-Institut project as well. Through the "Best of two worlds" project the research scientists now want to lay the foundations for the sustainable development of the recycling sectors in Ghana and Egypt by setting up pilot projects there. "This project won't just be about e-waste," explains Andreas Manhart. "The controlled reclamation of resources from scrap vehicles will be addressed as well." Furthermore, with funding from the German Federal Ministry of Education and Research, the Oeko-Institut is working with partners such as Umicore and Vacuum-schmelze to achieve better links to recycling structures in industrialised countries. "The basic thinking behind it is that, as far as possible, local infrastructures should be used," explains Andreas Manhart. "But when it comes to the components required by modern processes, European recycling specialists will get involved." The aim is to establish a connection with specialist recyclers in Europe (see also the interview with Christina Meskers, page 3). The project will be supported locally by the African partners in the project, City Waste Management in the Ghanaian city of Accra, and the Center for Environment and Development for the Arab Region and Europe (CEDARE) in Cairo (see profiles on page 10). A strong project group – but one which will encounter major challenges, too. "We are aware that a great deal of know-how will be required, not least with regard to the bureaucratic processes," says Andreas Manhart. "It is quite a challenge for a small recycling

firm to send processed waste to Europe – if only because of the customs forms."

For Andreas Manhart the "Best of two worlds" project is setting an example both in terms of the actors involved and the know-how they bring to it, and in terms of taking into account the socio-economic importance of the African recycling industry. "In view of the serious impacts of current recycling methods on health and the environment, the need for them to be re-structured is beyond question," says the Oeko-Institut researcher, "but we must not forget that this sector is an important branch of business in these countries and that many jobs are dependent on it." 5500 small businesses and 15,000 people are employed in the repair and sale of used electronic goods in the two largest Nigerian markets alone. It is important, Manhart says, to improve existing jobs as well as creating new green ones – a need also highlighted by the Pan-African Forum on E-waste's "Call for Action".

*Christiane Weihe*

 a.manhart@oeko.de  
www.oeko.de/123/knowledge2




## Taking a look



**Andreas Manhart**  
gets out his toolkit now and then, too

Taking a smartphone apart is something Andreas Manhart has never tried to do. "It's a well-known fact that the batteries are really hard to get out," he says, "and besides that, smartphones are far too expensive for anyone to let me near one with a screwdriver." However, other devices are by no means as safe from this Oeko-Institut researcher's tools, once he starts looking for the raw materials inside them. "My research involves the recycling of notebook PCs and televisions, so I want to know exactly what I'm dealing with," he says.

Only occasionally does the geography graduate spend his working days dismantling electronic equipment, however. More often – about four times a year – he takes a week-long trip to West Africa, where he is overseeing projects on e-waste recycling. "I wasn't really shocked by the vast rubbish heaps there," he says, "as I was prepared for them. It was more the chance encounters – seeing even children working on the waste with the most basic of tools." Nevertheless, Andreas Manhart remains a realist when expressing his hopes for the African recycling sector: he does not think that European standards can be expected across the board here at the moment. However, the abolition of the worst abuses, such as processes that damage the environment and endanger health, and child labour, will certainly remain high on his agenda. *cw*

 a.manhart@oeko.de  
[www.oeko.de/123/wishes](http://www.oeko.de/123/wishes)

## Tackling




**Vivian Ahiayibor Meinel and Juergen Meinel**  
are breaking new ground

It all began in the year 2000 with three workers and the recycling of plastic. Today the City Waste Group employs over 500 people in the formal and informal sector: Vivian and Juergen Meinel have already achieved a lot in the area of recycling. But although they have many years of experience, they are now facing a new task in the Ghanaian capital of Accra. With the recently founded company City Waste Recycling they are now also tackling e-waste recycling. Collection points are currently being set up all over Ghana.

Vivian Ahiayibor Meinel initiated their efforts in e-waste recycling when she saw the cataclysmic environmental effects of the rubbish dumps in Agbogboshie, a suburb of Accra. "At that time I convinced my husband to find a solution for e-waste recycling," she says. An engagement that is worthwhile not only from an environmental perspective, she adds. "I also see it as a business opportunity," says Vivian Ahiayibor Meinel, "not only for us, but also for others since we create cleaner workplaces."

The married couple are highly dedicated to environmental protection. "Every contribution to saving the environment counts," says Juergen Meinel. "The greatest challenge for us is to make people aware of the consequences of environmental pollution." *cw*

 cwmcl@gmx.net  
[www.oeko.de/123/wishes](http://www.oeko.de/123/wishes)

## Starting



**Dr. Hossam Allam**  
puts the focus on green jobs

The awareness campaign lasted for two years and encompassed policy advocacy, workshops and international forums. It ended with an important success: the launch of the first private company for e-waste recycling in Egypt in 2010. For Dr. Hossam Allam of the Centre for Environment and Development for the Arab Region and Europe (CEDARE), this was a defining moment in his work in this area. As the Regional Programme Manager for the Strategic Concerns Programme at CEDARE, he has one goal firmly in view: green jobs in e-waste recycling. "In cooperation with the international community I want to help in establishing an industry in the region which manages the environmentally friendly recycling of e-waste," he says.

To improve the current situation in Africa regarding e-waste recycling, it is necessary to improve the existing legislations for the development of this industry and to enhance institutional and human resources capacity, adds Dr. Allam. In terms of e-waste imports, he takes a clear stance. "In my view such imports must be stopped until the respective countries have set up recycling capacities – this will accelerate the establishment of a recycling industry." *cw*

 hallam@cedare.int  
[www.oeko.de/123/wishes](http://www.oeko.de/123/wishes)