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Guideline to establish a collection system for equipment containing ODS

Management and destruction of existing ozone depleting substances banks

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Abbreviations

AC	Air Conditioning
CFC	Chlorofluorocarbon
EEE	Electrical and Electronic Equipment
EPR	Extended Producer Responsibility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HPMP	Hydrochlorofluorocarbon Phase Out Management Plan
IPCC	International Panel on Climate Change
NOO	National Ozone Officer
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
PPM	Planned Preventive Maintenance
RAC	Refrigeration and Air Conditioning
RAC&F	Refrigeration, Air Conditioning and Foam
RMP	Refrigerant Management Plans
TEAP	Technology and Economic Assessment Panel
UNEP	United Nations Environment Programme
WEEE	Waste Electrical and Electronic Equipment

1 Introduction

The global volume of Waste Electrical and Electronic Equipment (WEEE) is growing rapidly and represents a major environmental risk. Besides the typical hazardous components in WEEE (e.g. lead, cadmium and flame retardants), the ozone depleting substances (ODS) contained in refrigeration, air conditioning and foam (RAC&F) appliances have a high global warming potential (GWP) and ozone depleting potential (ODP)¹. The escape of ODS to the atmosphere contributes both to ozone layer depletion and to global warming. Therefore, the establishment of a functioning collection system for equipment containing ODS is key to successful ODS bank management, similar to the collection of recovered ODS from large systems such as refrigeration systems found in supermarkets.

While the technology needed for recycling and destroying ODS is often considered a priority, equally important are an appropriate policy framework, existence of technical standards and a collection system that guarantee a sustainable ODS waste stream management. At the same time, the establishment of a collection system is one of the most costly and complex aspects of ODS bank management (cf. TEAP, 2002, 2009; ICF, 2008).

An ODS collection system needs to address both the collection of the recovered ODS themselves (refrigerants, blowing agents) and the collection of waste equipment containing ODS (WEEE). Many countries around the world have already established a collection scheme² and related infrastructure for refrigerants used under the Montreal Protocol and for the implementation of their national CFC Refrigerant Management Plans (RMP) and HCFCs

Phase-Out Management Plans (HPMP)³. Usually, national ODS recycling and reclaim centres have been established throughout the countries to serve as central collection points for ODS recovered during servicing and waste treatment of refrigeration and air conditioning (RAC) equipment. In countries that lack ODS destruction facilities, these recycling and reclaim centres often serve as storage locations until procedures and technologies for destruction are available or the gases can be exported for destruction. A lack of cylinders, collection points or storage capacity typically lead to the venting of ODS and thus to severe negative environmental impacts.

In addition to collection systems which focus on recovered ODS as pure substances, there is a need for collection systems for ODS containing equipment, such as refrigerators and air conditioners. In many countries, relevant e-waste⁴ provisions exist. However, a general WEEE regulation must be in place before specifying the proper handling of extracted ODS from collected WEEE.

Objective of this guideline

This guideline focuses on the collection of ODS containing equipment⁵. It provides practical guidance for national ozone officers (NOO), policy makers from the waste sector and other stakeholders. As decommissioned ODS containing equipment is classified as WEEE, this guideline's recommendations are valid for the collection of WEEE in general. However, this guideline also includes specific aspects related to ODS.

1 Only CFC and HCFC refrigerants and blowing agents are considered in this guideline, as these are the most important substances that build up ODS banks. For halon see discussion in GIZ (2015a).
2 The term collection system/scheme is used for simplicity reasons in this document but also includes take back schemes. For a detailed elaboration of a collection scheme, a distinction should be made (see Box 2).

3 http://www.undp.org/content/undp/en/home/ourwork/environmentandenergy/focus_areas/ozone_and_climate/hcfc_phase-out_managementplans.htm, last access November 2016.
4 E-waste is used as a synonym for WEEE in the document.
5 For an overview about categories and systems of ODS containing equipment, please see the 'Guideline to conduct an ODS bank inventory' (GIZ, 2017c).

2 Establishing a collection system for ODS containing equipment

The guideline provides a step-by-step process for setting up a collection system.

Figure 1: Overview of different steps for establishing a collection system for ODS containing equipment.



STEP 1

Assess existing policy framework

An appropriate legal mandate and policy framework is essential for any ODS management system to be successful. Sustainable, long term collection structures should integrate financial mechanisms such as e.g. extended producer responsibility (EPR) schemes. This instrument requires manufacturers to bear the responsibility for their products at the post-consumer stage.

Policy makers should also establish a system for monitoring ODS use, in particular in the RAC&F

sectors. Here strong enforcement structures are needed to ensure efficient control and compliance. A lack of enforcement will result in an uneven playing field in the marketplace and allow free riders to avoid taking responsibility.

The EU Directive 2012/19/EC⁶ on waste electric and electronic equipment of 4 July 2012 (WEEE Directive) serves as a role model in many countries worldwide to establish a collection system for a sound treatment and recycling of WEEE. Key sections of the EU Directive 2012/19/EC that relate to collection schemes include:

- ‘Consumers [...] should be encouraged to return WEEE. For this purpose, convenient facilities should be set up for the return of WEEE, including public collection points [...]’
- ‘Users of EEE from private households should have the possibility of returning WEEE at least free of charge. Producers should finance at least the collection from collection facilities, and the treatment, recovery and disposal of WEEE. Member States should encourage producers to take full responsibility for the WEEE collection, in particular by financing the collection of WEEE throughout the entire waste chain, including from private household [...]’
- ‘[...] Member States [...] should be required to achieve a high level of collection of WEEE, particularly for cooling and freezing equipment containing ozone-depleting substances and fluorinated greenhouse gases, given their high environmental impact [...]’

➔ A detailed description on how to create a suitable policy framework is found in the ‘Guideline on policy measures for the management and destruction of ozone depleting substances’ (GIZ, 2017a).

⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0038:0071:en:PDF>, last access November 2016.

STEP 2**Establish steering structure and set up stakeholder process**

The implementation of a collection system should be based on a well-defined stakeholder process, allowing for transparent interaction with involved stakeholders throughout the whole development process. Thus, the establishment of an appropriate steering structure and a participatory stakeholder process are key success factors.

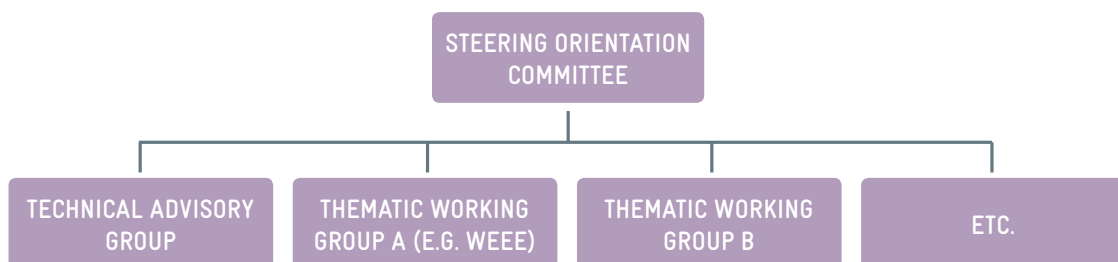
Usually, government entities coordinate the development of collection systems for ODS containing equipment and establish the strategic orientation and the binding timelines for their implementation (Figure 2). As there is a strong linkage between ODS management and waste management, policy makers should aim for an integrated approach and interdepartmental cooperation. The Ministry of Environment is usually the coordinating government entity for the development of an ODS collection system. Two aspects should be taken into consideration here:

1. An advisory group consisting of representatives from various ministries to address specific technical matters and to consider cross-sectoral issues.
2. Thematic working groups (e.g. WEEE working group) to provide support in decision-making through analysis, studies and comprehensive proposals for collection systems and their implementation.

Generally, it is beneficial to obtain additional competence and to promote inter-ministerial dialogue and communication to harmonise policies and to enable synergy effects (e.g. creating job opportunities, especially for the informal sector; improving energy efficiency by exchanging old inefficient cooling devices).

Many stakeholders at the regional and local level play key roles and need to be identified and involved early on in the process. **In order to create ownership among the involved stakeholders, the development and implementation of collection schemes should be the result of a participatory stakeholder consultation process.** Relevant stakeholders should actively participate in the thematic working groups.

Figure 2: Example for basic steering and national management structure for the development of a WEEE collection system.



Key stakeholders include:

- Ministry of the Environment (usually responsible for the formulation of waste management and ODS emission reduction policies);
- ministries involved in cross-sectoral issues (e.g. ministries of health, ministries of development and industry, ministries of finance, ministries of transportation etc.);
- regional and municipal governments (e.g. state department of environment; municipal solid waste management department);
- private sector (e.g. producers, retailers, importers of EEE, servicing and recycling companies, logistics companies);
- private sector associations as important interface between the government and individual companies;
- committed NGOs;
- informal waste sector (waste picker cooperatives or associations, e.g. National Movement of Waste Pickers in Brazil MNCR).

CHECKLIST FOR STEP 2

Establish appropriate steering structure, including the nomination of a leading government entity	✓
Establish a technical advisory group	✓
Establish additional inter-ministerial cooperation structures for consideration of cross-sectoral issues	✓
Conduct a comprehensive stakeholder analysis identifying the roll of all relevant players involved in the product lifetime of ODS equipment	✓
Create thematic technical working groups and establish a transparent stakeholder process with feedback and participation of all identified relevant stakeholders	✓

BOX 1**Visualising stakeholders and their relationships**

When starting with the establishment of a steering structure and setting up a stakeholder process, it can be very helpful to use a 'Map of Actors' (GIZ, 2015b). Such a map visualises relevant stakeholders (Figure 3) and the relationship between them:

- Define the establishment of a collection system for ODS containing equipment as the central objective (red circle, Figure 3).
- Identify state, civil society and private sector actors. Key actors are those who significantly influence the objective; they are therefore placed close to the centre. The influential power and importance of stakeholders decrease with the distance to the centre.
- Draw additional lines and symbols between actors to symbolise the character of their relationship, i.e. whether there are close relationships, mutual trust, information exchange, conflicts etc.

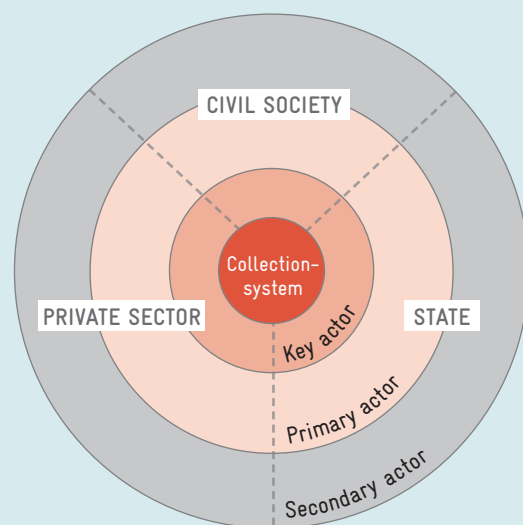


Figure 3: Map of actors to identify relevant actors for establishing a collection system (GIZ, 2015b; modified).

STEP 3**Draft sector plan**

The country's specific situation greatly influences which collection system is selected. Therefore, the sector plan should be based on a **good understanding of the sector, its industries, the availability of adequate technology to handle ODS waste, current emissions and waste streams, and the current and future regulatory framework.**

The first step involves initiating a detailed sector analysis. The resulting sector study should provide recommendations for a sector agreement on implementing a collection scheme based on achievable and technically and financially feasible options.

Please note that sector studies generally include all kinds of WEEE, not only ODS containing WEEE.

Examples of sector studies:

- Status analysis, generation of WEEE and ELVs in Ghana, and analysis of collection, sorting and pre-treatment in Ghana (Manhart, Schleicher et al. 2014);
- Socio-economic assessment and feasibility on sustainable e-waste management in Ghana (Prakash & Manhart, 2010);
- Economic Feasibility of E-Waste Treatment in Tanzania (Blaser & Schluep, 2012);
- Needs Assessment of the E-Waste Sector in Egypt (CEDARE, 2011).

BOX 2**Two different collection concepts****BRING SYSTEMS**

End user delivers ODS containing equipment to collection points or recycling centres free of charge. The collection points are generally operated by public waste management authorities. This is very cost-effective but often not well accepted by end users, in particular in developing countries.

PICK-UP SYSTEMS

ODS containing equipment is directly picked up from the private households. When public waste management authorities offer this service, there are either pre-defined routes and time schedules of the trucks which collect the equipment, or the equipment is collected upon request by the end user (service hotline). Often distributors also offer this service when end users purchase new equipment. Then the distributor can

- 1) pass the equipment to official collection points,
- 2) pass the equipment to the manufacturers or
- 3) take over responsibility for recycling and final disposal (see also UNEP, 2012).

The term 'take back scheme' should be used if producers, their authorised representatives and distributors are involved, as they originally were in possession of the EEE. In contrast, the term 'collection scheme' refers to public waste management authorities or the informal waste sector.

The scope of the study may vary from country to country, e.g. some countries may not have original equipment manufacturers (OEM) but only import EEE. The following questions provide guidance to cover some **key aspects of a sector study**.

1. How much ODS and ODS containing equipment is generated annually?

→ see also 'Guideline to conduct an ODS bank inventory' (GIZ, 2017c)

2. **What is the waste flow of ODS containing equipment and which actors are relevant at each stage?**
 3. **How do existing and future policies and regulations address the different actors?**
 4. **Are there any take back and ODS handling structures already in place?**
 5. **Is technology for environmentally sound ODS handling and processing available on the market?**
 6. **What are the cost implications of the collection system for the different actors?**
 7. **How can these cost implications be allocated to different stakeholders?**
 8. **What is the share of orphan and illegally imported products in the market?**
 9. **What are the main barriers and benefits of implementing a collection system?**
- How can discrimination of market participants be avoided? How can the informal sector be included into formal structures and cooperation be enabled?
 - Who is allowed to collect WEEE (qualification, certification)?
 - How can existing municipal infrastructure and solid waste management be incorporated?
 - What kind of end user involvement and incentives are feasible?
2. **How can new collection schemes be divulged and environmental education and awareness raised?**
 - What training capacities are available?
 - Is there a need for additional training programs?
 3. **What quantitative and qualitative criteria can be achieved in an initial phase of the collection scheme?**
 - What minimum coverage range of collection points is adequate?
 - What annual minimum collection rate is appropriate?

The data collection and findings from the study should enable a comprehensive sector plan to be compiled that serves as an agreement for the implementation of the collection systems. Stakeholders' responsibilities should be proportionate to their ability to implement and affect the system. In line with this, inputs and proposals from the stakeholder process (Step 2) must be considered in order to present a comprehensive strategy.

The following **guiding questions** should be answered for the **sector plan**:

1. **Which stakeholders will be involved at which stage of the collection system?**
 - What will be the role, assignments and individual responsibilities of the different stakeholders?

4. **How can compliance be demonstrated?**
 - What penalties may be applicable in case of non-compliance?
 - How can orphan and illegally imported products be handled?
5. **What structural characteristics are necessary for the financial sustainability of collection scheme and sector plan?**
6. **How can a sustainable monitoring and reporting mechanism be implemented?**

The final version of the sector plan should be discussed and agreed with all relevant stakeholders and published for public consultation.

BOX 3**Defining responsibilities for the collection and treatment of ODS containing equipment**

Within EPR schemes, producers are responsible for the further treatment and processing of the equipment after decommissioning. However, different players are involved when equipment is decommissioned: distributors/retailers, municipalities and producers. Also, a distinction must be made between financial and physical responsibility. European countries have developed a variety of different concepts (see also Institute for Structural Policy and Economic Development, 2014) and part of the sector plan's aim is to identify the optimal solution for each country.

Producers commonly commission waste management operators, or producer responsibility organisations (PROs⁷), with logistics and treatment of WEEE. More PROs enable vital competition and decrease the costs for waste management. However, there is a risk that this occurs at the expense of the recycling and disposal quality. Generally, those players who put more EEE on the market should have greater responsibility for the proper management of WEEE, i.e. they should process more WEEE. For more information, see UNEP (2012).

EXAMPLES FROM EUROPE:

In **Norway**, there are only five approved industry-financed take back companies that collect and recycle WEEE. Producers and importers of EEE are obliged to be a member of one take back company. Besides, retailers commonly accept returned WEEE.

This concept involving few players seems promising, as Norway has one of the highest collection rates for WEEE with 90%⁸

Germany adopted a 'Shared product responsibility' approach with municipalities being responsible for collection of WEEE and the manufacturers for further transportation, recycling and final disposal. However, public waste management authorities can take over responsibility from producers ('direct marketing'). For more information, see the stiftung ear webpage⁹.

Two major systems exist in **Switzerland**: The Swiss Association for Information, Communication and Organisation Technology (SWICO) and the Swiss Foundation for Waste Management (S.EN.S). SWICO was founded by the association of manufacturers and importers of office electronics and IT equipment, which initially collected only this type of equipment but was later expanded. S.EN.S was established as a non-profit organisation to collect WEEE on behalf of manufacturers, importers and retailers. Both systems are well-established and the costs for the systems are covered by an advanced recycling fee (ADF) paid by the consumer with the purchase of EEE (Ongondo et al., 2011).

An overview of the schemes that have been established in developing countries can be found in Rachna (2008).

7 See also WEEE Forum
<http://www.weee-forum.org>, last access November 2016.

8 Application of EU-WEEE Directive in German Law & Best Practice of Recycling and Refund Systems. Speaker: Moritz Grunow. Roundtable GIZ Eschborn, October 2015.

9 <http://www.stiftung-ear.de>, last access February 2017.

GENERAL RECOMMENDATIONS:

- ▶ Collection systems from developed countries cannot be easily transferred to developing countries because of the fundamental role of the informal waste sector in these countries (see step 7).
- ▶ Include the informal sector to as great an extent as possible to establish competing formal parallel systems (SBC E-waste Africa Programme, 2011).
- ▶ Incorporate country specific considerations, such as geographical size and available infrastructure, into all steps when developing and implementing collection schemes (see Box 4).
- ▶ For both developed or developing countries, pick-up services from private households enjoy greater acceptance when compared to bring services which require end users to deliver their equipment. This holds particularly true for larger systems such as domestic refrigerators.

BOX 4

Taking geographical size and infrastructure into consideration when establishing a collection scheme

Infrastructure and country size are key aspects to consider in developing ODS collection systems. For example, the Brazilian Solid Waste Policy requires the implementation of permanent collection points in all municipalities with a population over 80,000 with a ratio of at least 1:25,000 people. In European countries varying ratios from 1:10,000 to 1:30,000 are found, i.e. one collection point per 10,000 to 30,000 inhabitants. For further information on how to calculate the number of collection points, see UNEP (2012).

Transport of recovered ODS and ODS containing equipment over long distances needs to be avoided for cost reasons but also because:

- transport of decommissioned equipment (e.g. refrigerators) over long distances increases the probability of refrigerant circuit damage and ODS emission during transport, especially if national roadways are poor (potholes, unpaved);
- service technicians and end users are more likely to return ODS and ODS containing equipment to collection points that are located at a reasonable distance. If environmentally sound disposal is associated with significant additional costs, there is a high probability that ODS is vented from the equipment or cylinders.

Availability of adequate technology may also influence how and where recovered ODS and ODS equipment can be processed. For example, refrigerator dismantling plants usually are large-scale systems with an annual recycling capacity of between 100,000 and 500,000 devices that can reliably recover ODS from the refrigerant circuit, but also from the insulation foam. Considering that approximately 70% of ODS of a refrigerator are contained in the insulation foam, the establishment of technical recycling capacities or partnerships (e.g. cooperation with neighbouring countries) is a crucial element in sustainable ODS management.

Certainly, the number of installed dismantling facilities is limited in each country, therefore decentralised collection points involving pre-treatment steps are advisable, e.g. ODS recovery from refrigerant circuit with mobile recovery units and pre-separation of loose components (e.g. plastic shelves, etc.) are reasonable approaches (see also 'Guideline on the manual dismantling of refrigerators and air conditioners' (GIZ, 2017b)).

STEP 4**Establish time frame**

The sector plan must contain a realistic and binding timeframe. Note that it may take several years from the moment a WEEE regulation has entered into force until the implementation of the collection systems (Figure 4). Although the actual timeline may strongly vary, at least three years should be allowed for. A continuous stakeholder process should take place and a public consultation process is advisable. The implementation depends on strict government supervision during the whole process.

Figure 4: Expected timeline from launching a WEEE regulation to implementation of a WEEE collection scheme.

**STEP 5****Start capacity building and outreach activities**

The successful implementation of a collection scheme is also closely related to nationwide environmental awareness campaigns and training programmes. These ensure that environmental harm from ODS contained in products and WEEE as well as requirements and best practices are widely known and applied.

Consider training and awareness-raising activities early enough in the process, as changes in awareness and behaviour may take several years to achieve.

Outreach activities are specifically important for

- 1) servicing technicians;
- 2) personnel dealing with ODS containing equipment when becoming waste;
- 3) ministerial departments or third parties who are responsible for monitoring the flow of e-waste including ODS containing equipment.

ODS emissions are largely caused during installation, servicing, maintenance, repair and decommissioning of equipment. This is mainly due to lack of knowledge and experience concerning proper refrigerant handling, recovery, storage and transport.

To ensure broader application of best practices and to improve the qualifications of relevant personnel, special training courses for refrigeration technicians and companies' staff should be developed. Capacity building programs should reflect the needs and specific requirements of the various target groups. A participatory approach in developing curricula is a crucial element in building the national knowledge and support for an educational programme.

RECOMMENDATIONS:

- ▶ Consider the **highly informal structure of the servicing sector** when designing and implementing training courses (illiteracy). Hands on training courses are necessary and require more time than just theoretical lecturing.
- ▶ Training programmes for **RAC servicing technicians** should address the following minimum aspects considering all stages of the equipment lifetime (e.g. production, operation, waste):
 - environment impact of ODS emissions;
 - safe working conditions;
 - leak containment;
 - recovery, recycling, reclaim and reuse;
 - leak detection methods;
 - Planned Preventive Maintenance (PPM) activities;
 - flushing of refrigeration systems;
 - sealed system design;
 - handling, transport and storage of ODS equipment and cylinders.
- ▶ If similar training courses have already taken place in the context of the ODS phase-out under the Montreal Protocol, these should be consulted.

- ▶ For actors only involved in the collection, transport and storage of ODS equipment, the course may focus on the **environmental impact of ODS emissions, safe working conditions and the handling, transport and storage** of ODS equipment.
- ▶ Public awareness raising and information for consumers should focus on
 - environmental damage that, for example, refrigerators and other appliances may cause when not properly treated;
 - collection systems and how they work (bring systems, possibilities on pick up services) and related costs.
- ▶ End users should also be informed about services provided by companies when new products are purchased, e.g. often old ODS containing appliances are accepted free of charge for proper waste treatment. Additional information and awareness raising activities include helpdesks providing information about collection points via internet and telephone as well as seminars and information material/video clips etc.

STEP 6

Create additional incentives¹⁰

One of the decisive factors for the success of ODS bank management in developing and emerging countries is the creation of financial incentives for returning ODS and ODS containing equipment. There must be a motivation for end users, the waste management sector, the service sector and the informal sector to return ODS and ODS-containing equipment. Once returned, incentives for waste managers help to promote state-of-the-art recycling and destruction technology.

The most promising approach is to provide financial incentives, either direct or indirect, for end users, the waste management sector, the service sector and the informal sector. An overview about possible incentives is given in Table 1.

While the net material value of WEEE can cover some of the costs of the treatment after the equipment is decommissioned, additional financing mechanisms are generally necessary (Öko-Institut, 2010). This is the reason EPR schemes became one

Table 1: Examples of direct and indirect incentive in ODS bank management.

DIRECT INCENTIVES	INDIRECT INCENTIVES
<ul style="list-style-type: none"> • replacement programme 'new for old' with incentive for end users • discount on the purchase of recycled/reclaimed ODS, when recovered ODS is delivered • discount for recovery equipment of technicians • tax-rebate system (e.g. Norway¹¹) • incentives for informal sector • reduced energy costs (e.g. utilities) • tax credits to help companies and organisations offset the purchase price of new equipment 	<ul style="list-style-type: none"> • tax abatement when recycling, reclaim or destruction technology is imported • end user tax abatement or incentive programmes for the purchase of ODS free equipment (e.g. air conditioning chiller based on natural refrigerants) • tax abatement when natural refrigerants are imported • first year amnesty after new law has been introduced to include as many companies as possible • allow arrangements for initial cost to be written off as tax returns

¹⁰ Incentives for returning ODS and ODS containing equipment are covered here.

¹¹ http://www.atmo.org/presentations/files/shecco_Marc_E.pdf, last access November 2016.

of the most promising policy approaches to finance proper waste management (see also OECD, 2001; GIZ, 2015a; European Commission, 2014). In import countries, EPR schemes could be implemented by raising a tax for every EEE entering the country's market. Such an eco-tax can finance the collection scheme of WEEE. The funds from the eco-tax should ideally be administered by an independent third party.

Incentives for the service sector

For technicians, the high cost of recovery equipment can pose a significant barrier. Therefore, they may be encouraged to return ODS through an output-related remuneration and cost payback mechanism. Technicians might receive a discount on the purchase of recycled or reclaimed refrigerants when they return recovered ODS. In addition, technical assistance programs can be established to subsidise the purchase of recovery equipment.

The education of technicians and the provision of recovery equipment is a key aspect of the HPMPs. The implementation of these measures is very important and additional incentives should be complementary to the existing measures.

Incentives for end users

Incentives for end users may include consumer discounts (e.g. tax reduction) for purchasing new ODS free equipment while returning the old appliance¹². For example, the governments of Mexico and Brazil have created refrigerator take-back programmes, typically known as 'new for old' programmes. The idea of these replacement programmes is to promote energy efficient and environmental friendly technology to reduce energy demand, easing the strain on electric grids and helping to achieve defined climate goals. The programmes' approaches may vary from refrigerator donation for low-income households

to providing subsidies of up to 50% of the original price for purchase of new equipment.

RECOMMENDATIONS:

- ▶ Replacement programmes should be realistic. Overambitious programs, that for example only allow the purchase of the highest efficiency class (e.g. A+++ refrigerators¹³) might not have the desired effects of increasing the use of highly efficiency products because of the high investment costs of these products.
- ▶ In countries with a strong public awareness, the incentive for a green image may encourage manufacturers, importers, distributors and other organisations along the product chain to take responsibility for WEEE containing ODS by implementing stewardship programmes on a voluntary basis.
- ▶ Consider demonstration projects to catalyse the process, e.g. projects showing the cost-effectiveness of new recycling business models or encouraging private sector involvement with financial incentives for companies willing to invest in and demonstrate new technologies for ODS and WEEE handling.

¹² See also 'Guideline on policy measures for the management and destruction of ozone depleting substances', GIZ 2017a.

¹³ The EU Directive 2010/30 establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy during use, thereby allowing end-users to choose more efficient products. Thus, refrigerators, among other products, must have an EU Energy Label clearly displayed on the appliance. The energy efficiency is rated in terms of a set of energy efficiency classes from A+++ to G on the label, A+++ being the most energy efficient.

STEP 7**Involve the informal sector**

Informal waste collection and recycling is commonly found in developing countries. Around 90 % of ODS containing waste in developing and emerging countries is processed by the informal sector.

However, the informal sector does not adhere to environmental and social standards, which would be particularly important when dealing with WEEE (including ODS containing equipment) that contain hazardous substances.

Informal waste collectors commonly dismantle domestic refrigeration devices manually in order to sell the valuable components on the recycling market for rapid cash income. As a result, refrigerants and foam blowing agents are released into the atmosphere and harm the ozone layer and the climate.

Formal recyclers which guarantee proper waste management are at a disadvantage, because the informal waste sector operates at lower costs: this sector benefits by recycling only the most valuable raw materials such as copper from cables and compressors, steel from the compressor and ABS plastic from refrigerators (cherry-picking process).

As the informal sector plays a dominant role, particularly in developing countries, and waste picking is sometimes the only income source for the poorest, marginalised population groups, one of the policy maker's task is to create alternative employment opportunities and to empower those whose subsistence is based on that sector to explore new livelihood options.

RECOMMENDATIONS AND EXAMPLES:

- ▶ One promising approach is to support the organisation of the informal sector into formal structures, e.g. micro-enterprises, cooperatives or associations, by empowering formally

organised waste pickers through government regulations and policies. The workers integrated into formal structures gain access to better prices and facilities to improve working conditions. They often earn 50–100% more than before because they can process larger quantities and sell the collected materials directly to industries. For example, in 2010, the Brazilian Government launched Decree No. 7,405, which instituted the Pro-Catador Programme ('Programa Pró-Catador') and aims to assist in the development of waste picker cooperatives. The decree assigns the cooperatives a special status in the management and recycling of wastes and requires the inclusion of waste picker cooperatives in waste management plans.

- ▶ For short-term actions, include the informal waste sector to as great extent as possible, in particular for activities that are not critical and not directly associated with hazardous waste, e.g. collection of domestic refrigerators from households or the removal of cables (Öko-Institut, 2013).
- ▶ One exemplary ambitious incentive scheme exists in Ghana, where the formal sector (City Waste Recycling Ltd) signed a Memorandum of Understanding (MoU) with the Accra Scrap Dealers Association, the representation of the informal waste sector. According to the MoU, the informal sector can sell (W)EEE, collected in the city Accra, to the formal sector that are then further processed according to environmental standards. In return, the formal sector commits to educating the informal sector in the area around the well-known waste dump Agbogbloshie and to contract scrap collectors as required¹⁴.

¹⁴ <http://de.slideshare.net/Oeko-Institut/status-of-the-project-best-of-two-worlds-activities-and-results-in-ghana>, last access November 2016.

- ▶ Other possible incentive schemes have been discussed in Ghana, for example where scrap collectors that have collected old refrigerators from households are granted a coupon (at defined collection points) which can be redeemed for cash in a participating bank. Scrap dealers would not have to be registered with a residential address to participate. To function as an incentive, the monetary value of the coupon must be higher than the refrigerator's net material value.

STEP 8

Endorse sector plan and monitor results

Requiring involved actors to report the use of ODS is key to monitoring ODS streams in the country. A monitoring scheme for ODS will also enable evaluation of the effectiveness of the collection system, the regulatory framework and enforcement once the system has been introduced. If the monitoring reveals unexpected issues, these should be discussed in the established steering structure. This process is the basis for reviewing the policy framework until the envisaged targets of the collection systems (e.g. recycling target) are achieved.

All methods for record keeping must be consistent and transparent. In the EU, for example, Regulation (EC) 1005/2009 defines record keeping and reporting requirements in Article 23, 26, and 27. According to Article 23 undertakings operating RAC equipment (among others)

‘[...] shall maintain records on the quantity and type of controlled substances added and the quantity recovered during maintenance, servicing and final disposal of the equipment or system [...]’.

Commonly, logbooks are used to keep these records (Öko-Recherche, 2015) and this information must be made available upon request. In Brazil, for example, an online-logbook¹⁵ assists users in administering, documenting and maintaining stationary refrigeration systems.

EU Member States are required to report information to the European Commission (Article 26), similar to undertakings that produce, import, export or destroy ODS (Article 27). Appropriate electronic templates are provided by the Commission for this purpose.

With regard to EEE containing ODS, other systems have been established during the development of EPR schemes. In Germany, for example, manufacturers that put EEE on the market must register at *stiftung ear*¹⁶ and must provide tonnage details. EU Member States are also required to report these data to Eurostat, the statistical office of the European Union.

15 <http://www.ozoniohcf.com.br>, last access December 2016.

16 <http://www.stiftung-ear.de>, last access November 2016.

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