

**9th World Telecommunication/ICT Indicators
Meeting (WTIM-11)
Mauritius, 7 - 9 December 2011**



Contribution to WTIM-11 session

**Document C/25-E
8 December 2011**

English

SOURCE: CEDARE and STeP

TITLE: Solving the E-Waste Problem (StEP) Initiative – Measurement activities towards sustainable solutions



UNITED NATIONS
UNIVERSITY



Solving the E-Waste Problem (StEP) Initiative –

Measurement activities towards sustainable solutions

Hossam Allam, Ruediger Kuehr, Jaco Huisman, Cédric Gossart

Mauritius, 9 Dec. 2011

“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.”

Solving the E-waste Problem (StEP) Initiative was created to...

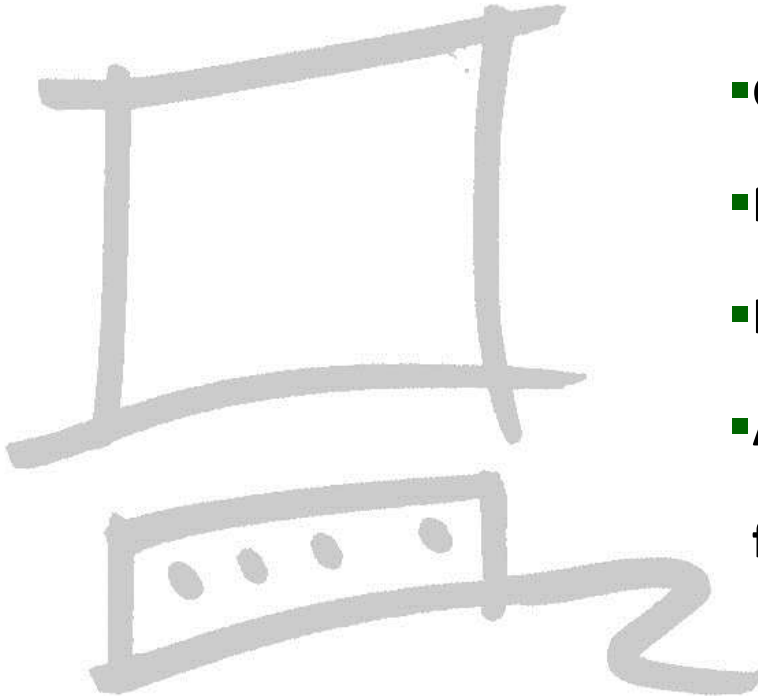
➤ Initiate and facilitate environmentally, economically & socially sound approaches to reduce e-waste flows and handle them in a sustainable way around the globe



- (1) Functions as a **network of actors** who share experiences and best practices
- (2) Carries out **research and development projects**
- (3) **Disseminates** experiences, best practices and recommendations

1. StEP's work is founded on **scientific assessments** including **social, environmental and economic** aspects
2. StEP conducts research on the **entire life-cycle** of electronic and electrical equipment
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
5. StEP seeks to foster **safe and eco/energy-efficient reuse and recycling practices** around the globe in a socially responsible manner

StEP invites pro-active:



- **Companies**
- **Governmental Organizations**
- **Non-governmental Organizations (NGOs)**
- **International Organizations**
- **Academic Institutions**

from around the world to become a member

Members have to agree with the StEP principles through signing a Memorandum of Understanding between all StEP members

International Organizations

- Basel Convention Coordinating Centre for Asia and the Pacific (BCRC China)
- Basel Convention Coordinating Centre for the African Region (BCCC Africa)
- Center for Environment and Development for the Arab Region and Europe (CEDARE)
- Secretariat of the Basel Convention (SBC)
- South Pacific Regional Environment Programme (SPREP)
- United Nations Conference on Trade and Development (UNCTAD)
- United Nations Environment Programme (UNEP)
- United Nations Industrial Development Organization (UNIDO)
- United Nations University (UNU)

Industry

- AER Worldwide
- Cisco Systems Ltd.
- Compliance & Risks
- Dataserv Group
- Datec Technologies Ltd.
- Dell
- Ericsson
- Flection
- GOAB mbH
- Hewlett Packard (HP)
- MicroPro
- National Center for Electronics Recycling (NCER)
- Nokia Corporation
- Philips Consumer Lifestyle
- PT Worldwide
- Sims Recycling Solutions
- Taizhou Chiho Tiande
- Umicore Precious Metal Refining
- Vertmonde cia. Ltda.*

Governmental & Development Cooperation, Non-profit Organizations

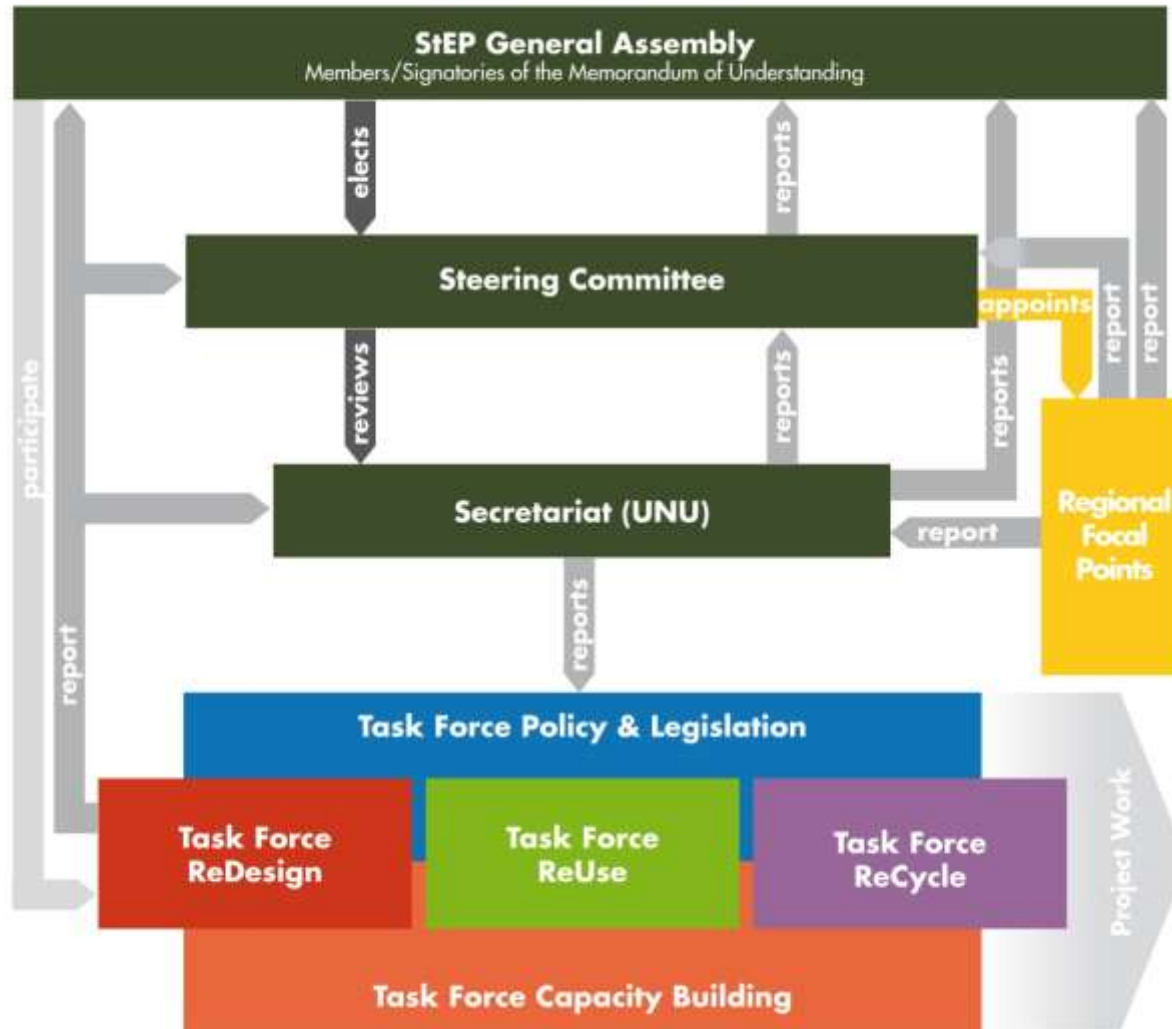
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Enda Europe*
- Morocco Cleaner Production Centre
- Renewable Recyclers
- Swiss State Secretariat of Economics (SECO)
- TechSoup Global
- United States Environmental Protection Agency (US-EPA)

Academia & Research

- Austrian Society for Systems Engineering and Automation (SAT)
- BIO Intelligence Service
- Chinese Academy of Sciences (CAS)
- Delft University of Technology
- GAIKER Foundation
- Griffith University
- Institute for Applied Ecology (Öko-Institut)
- Swiss Federal Laboratories for Materials Testing and Research (EMPA)
- Fraunhofer Institute for Reliability and Microintegration (IZM)
- KERP Research Electronics & Environment
- Korea Institute of Geoscience & Mineral Resources (KIGAM)
- Massachusetts Institute of Technology (MIT)
- Rifer Environmental
- The Sustainability Consortium
- Sustainable Electronics Initiative
- Technical University of Braunschweig
- Telecom Business School
- Thai Electrical and Electronic Institute (EEI)
- University of Limerick
- WEEE Forum*

* Associate Member

StEP Organizational Chart





Analyzes the status of existing policy approaches on e-waste, and elaborates policy recommendations for future developments...

Project overview (samples):

- ✓ White Paper Recast WEEE Directive
- ✓ White Paper 'Take-Back Systems and Design Guidelines'
- ✓ Research Study 'Best e-waste policies'
- @ Project 'EEE and Climate Change'
- @ Green Paper on E-waste Indicators
- @ White Paper on Transboundary Shipments (with Task Force ReUse)

✓ completed, @ working phase, \$ acquisition phase, ? idea phase

Objective: identify best policy practices used by governments when trying to solve the e-waste problem

- to understand how the policies of countries can be improved
- the extent to which they can serve as an example for other countries,
- to understand which instruments work best in a given context,

Approach: comparatively evaluate the performance of e-waste policies in four European countries (Belgium, Netherlands, France and Switzerland)

Results:

- A methodology allowing to construct the e-waste profile of a country capable of reporting all these indicators in a comparable way.
- An alternative to the use of indicators to identify the factors conducive to best policy practices capable of solving the e-waste problem.

http://www.step-initiative.org/pdf/green-papers/StEP_GP_Indicators.pdf



... dedicated to product design aspects to reduce negative impacts of the entire life cycle of electronics...

Project overview:

- ✓ DfR Case Studies Library
- ✓ Research study 'Wearable Computers – End-of-Life Implications'
- ✓ Closing the Loop
- ? Project 'Certification Technology for Recycling Plastic'

✓ completed, @ working phase, \$ acquisition phase, ? idea phase



... defines globally consistent “re-use” practices, principles, and standards to enhance re-use opportunities, change consumer behaviour & reduce „sham re-use“...

Project overview (samples):

- ✓ Conference ‘1st World ReUse Forum’
- ✓ White Paper ‘One Global Understanding of Re-use – Common Definitions’
- ✓ Case studies synthesis ‘Best practices in re-use’
- @ White Paper on Transboundary Shipments (with Task Force Policy)
- ? Recommendations for re-use certification/guidelines

✓ completed, @ working phase, \$ acquisition phase, ? idea phase



... overall aim is to enhance global recycling infrastructures and technologies to realise a sustainable e-waste recycling...

Project overview (samples):

- ✓ Research study 'Recycling – From E-waste to Resources'
- ✓ Review 'Environmental fate and effects of hazardous substances of informal e-waste recycling'
- @ Project 'Best of 2 Worlds'
- @ Green Paper on End-of-Life Standards

✓ completed, @ working phase, \$ acquisition phase, ? idea phase



... aims at increasing public, scientific and business awareness and disseminating the results of TFs 1 - 4...

Project overview (samples):

- @ Annual Reporting on the global E-waste Status (ADDRESS)
- @ 2009 & 2010 NVMP-StEP E-waste Summer School Series
- \$ E-waste Academy for policymakers and small and medium size enterprises
- ? Online Recycling Trainer

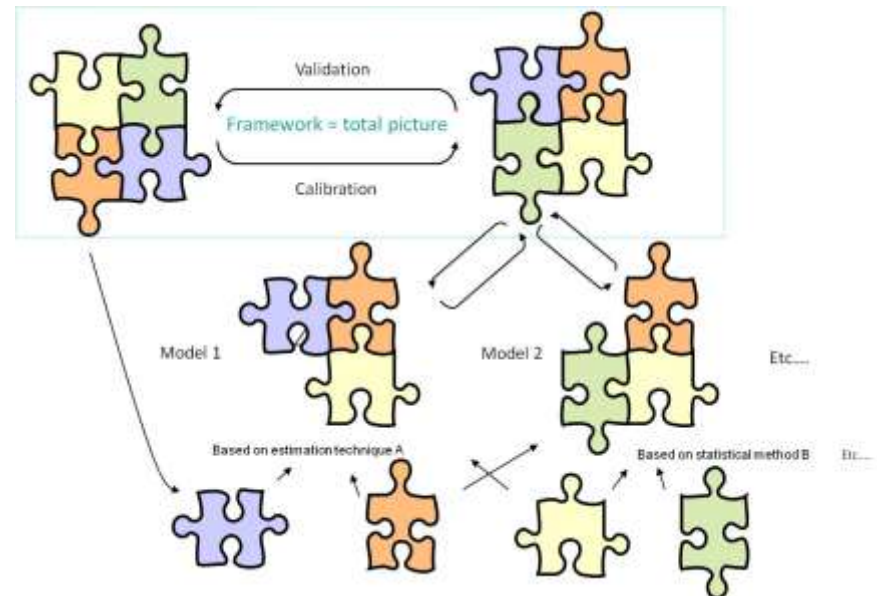
√ completed, @ working phase, \$ acquisition phase, ? idea phase



- Size of the problem remains largely unclear!
- How much e-waste is generated?
- How much thereof gets properly collected and treated?
- How much goes to developing countries?
- What is the scope of 'e-waste'?
- What are the developments over time?
- StEP initiated *Annual Dynamic Digital Reporting on the global E-waSte Status (ADDRESS)*
- To inform e-waste related **researchers** with up-to-date and solid data on e-waste globally
- To enable **policy-makers** to make better informed decisions

Part 1: Amounts

- Amounts:
 - (1) EEE POM (put on market)
 - (2) WEEE Generated
 - (3) WEEE C&T (collected & treated)
- Characteristics:
 - Per country
 - For product categories, subgroups and individual appliances
- Approach:
 - Standardized **data input** format
 - Aggregation and validation of results from multiple **modelling** approaches
 - Standardised **reporting of results**



Part 1 b. Iterative Modelling Module

Part 2: Progress Tracking

- Reporting on the e-waste solution per country/state over time
- Characteristics:
 - Additional criteria: status of legislation, presence of consumer education, availability of recycling infrastructure, ...
 - Applicable for developed & developing countries
- Approach:
 - (1) Selection of **criteria**
 - (2) Application of **country benchmark**
 - (3) Reporting into country specific **progress indicators**

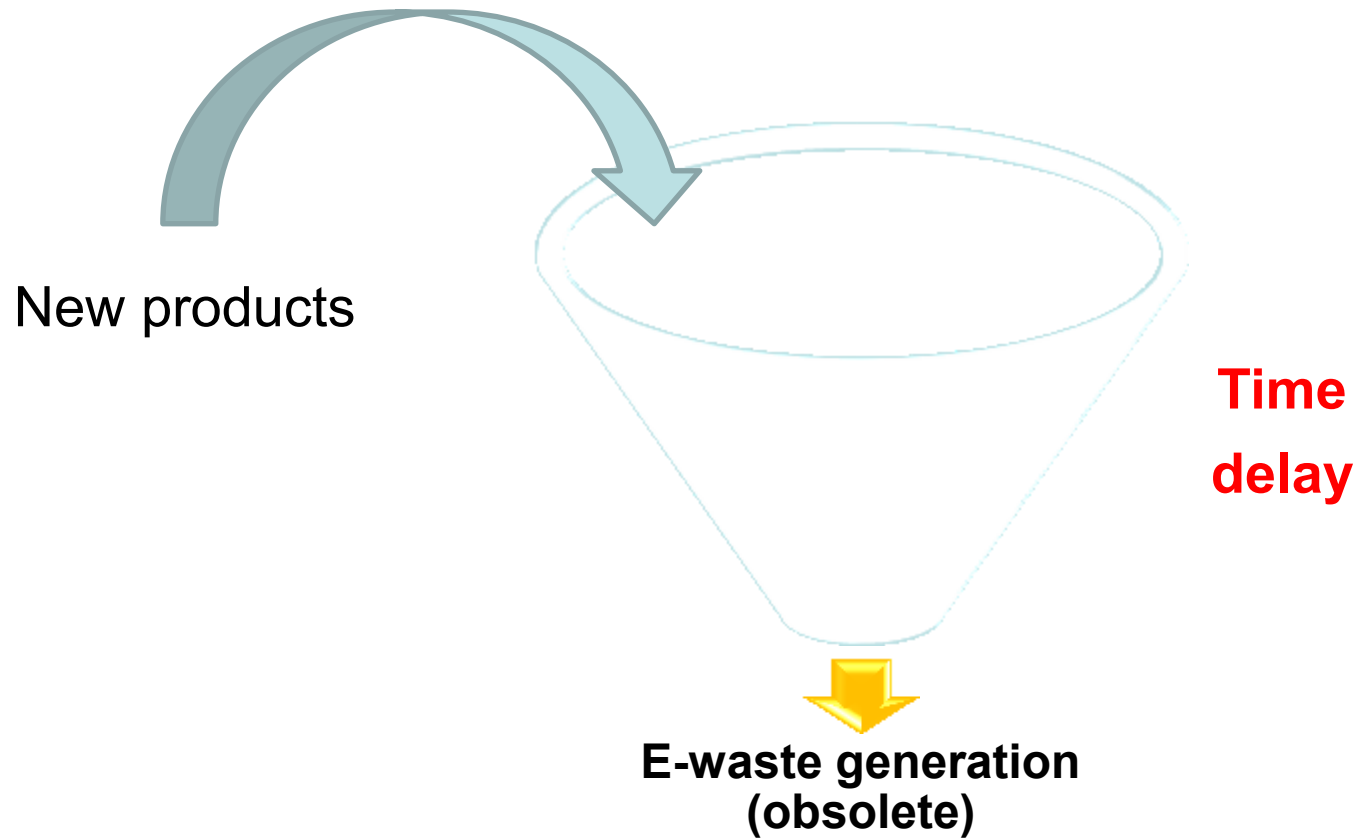


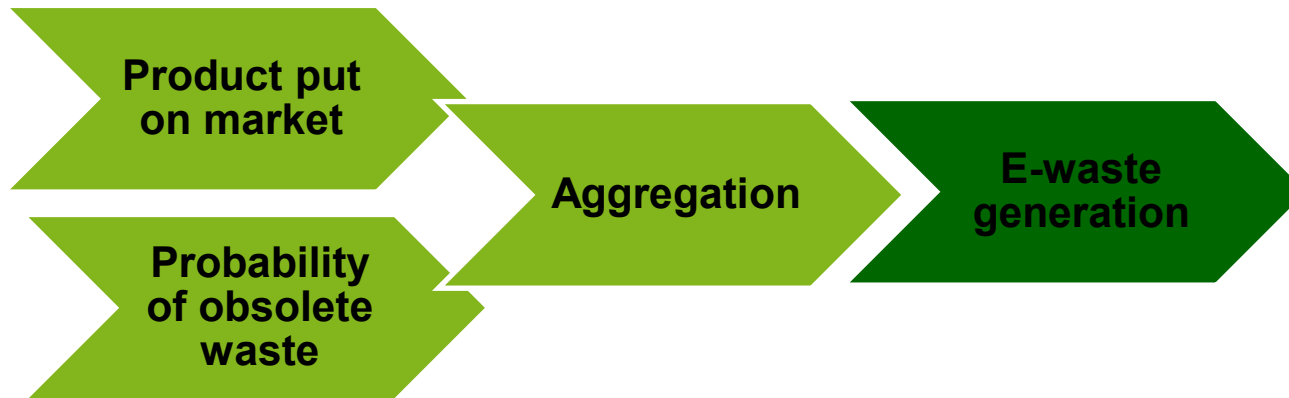
Part 2: Progress tracking

- Provide smart access to e-waste knowledge
- Characteristics:
 - Enhance knowledge exchange between existing platforms
 - Streamline information
 - Identify gaps from a worldwide perspective and try to fill these
- Approach:
 - (1) Gathering **additional information** per country
 - (2) Development of **database** and links with existing tools
 - (3) Continuous online **reporting**



(online, annual reports, journal papers)





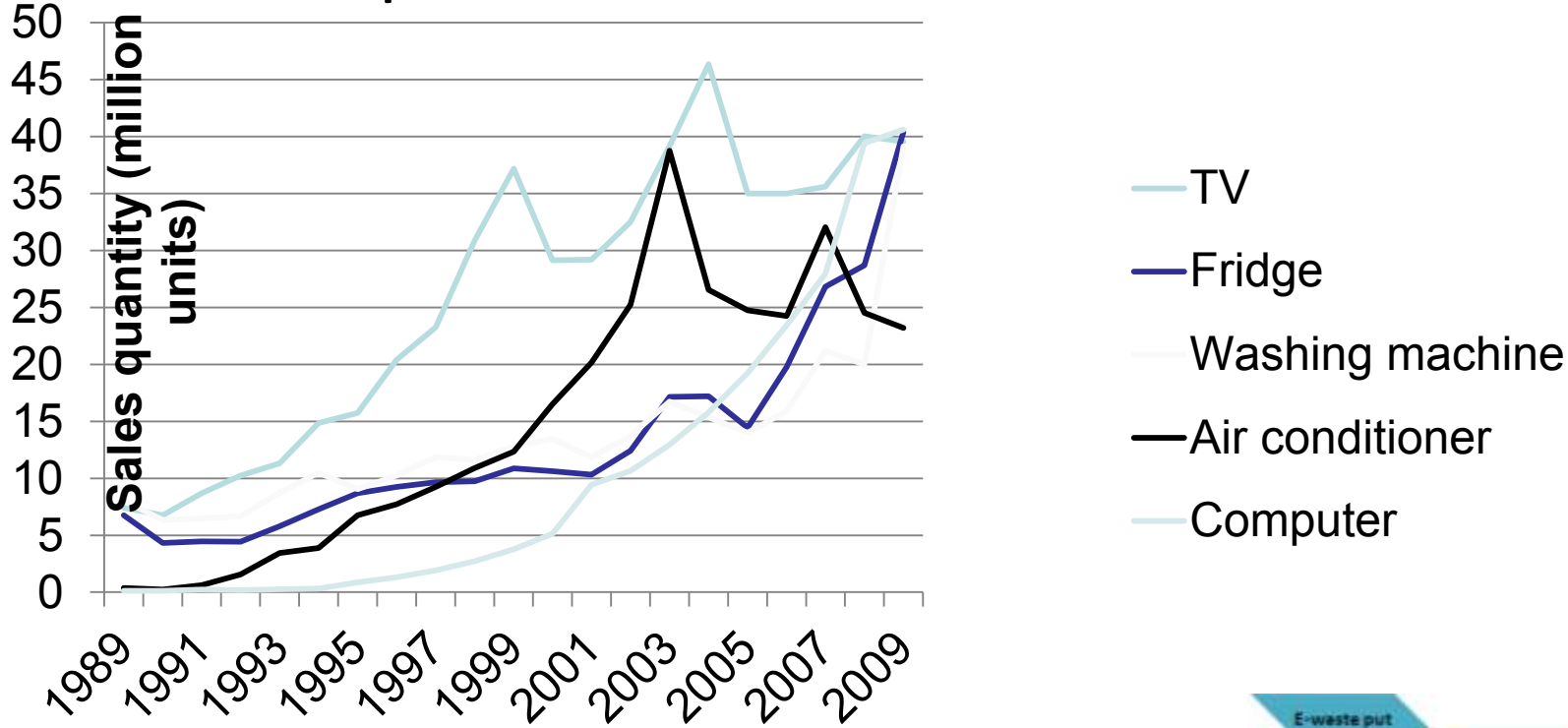
- E-waste POM: historical data on EEE sales (based on products)
- Probabilistic representation of the service life
 - What percentage of the products sold in year a becomes waste in year x ? Weibull distribution
- Aggregation: added up of historical waste generation

* reference: TemaNord (2009), Müller et al.(2009), Melo (1999)

Task Force Capacity Building – ADDRESS

Example: China – Stock and flow model (domestic e-waste generation)

STEP 1. Products put on market



Sales of EEE in China over time

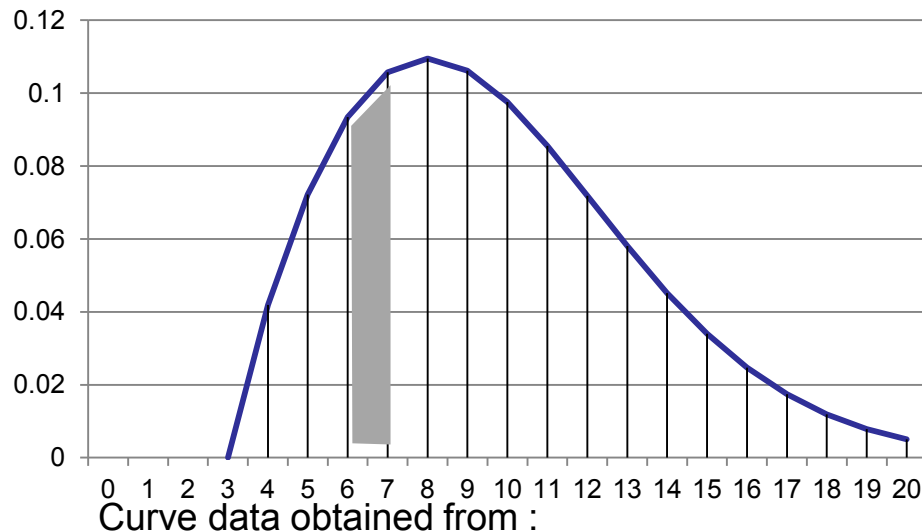
Reference: China National Bureau of Statistics (1989-2010)



Example: China - Prediction model (domestic e-waste generation)

STEP 2. Probability of waste disposal

Life span of TV for household use
(Probability density function)



- Consumer investigation/possession study
- Expert interview
- Waste sampling etc.

Weibull distribution (p.d.f.)

$$f(t; a, \alpha, \beta) = \begin{cases} \alpha\beta^{-\alpha}(t-a)^{\alpha-1} \exp\left\{-\left(\frac{t-a}{\beta}\right)^\alpha\right\}, & \text{if } t > a \\ 0, & \text{others} \end{cases}$$

Weibull distribution (p.d.f.)

α – shape parameter
 β – scale parameter

$$m = a + \beta \left(\frac{\alpha - 1}{\alpha}\right)^{\frac{1}{\alpha}}, \alpha \geq 1$$

Peak value (the most likely time to become obsolete)



* reference: TemaNord (2009), Müller et al.(2009), Melo (1999)

Example : China – Stock and flow model (domestic e-waste generation)

STEP 3. Aggregation

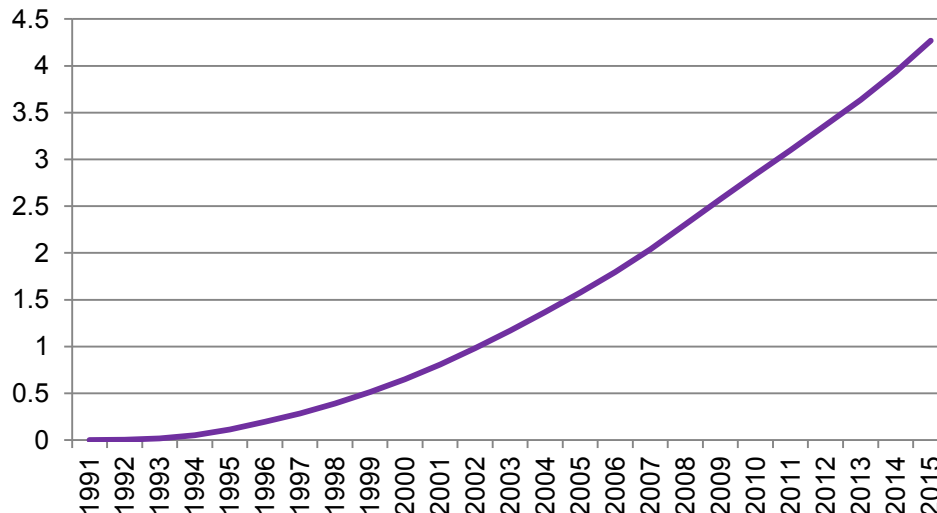
$$\text{Total waste generation}_x = \sum_p^m \sum_i^x \text{POM}_{p,i} * \text{Probability}_{p,x}$$

x , the year for e-waste estimation

POM p,i , product type p put on market in year i

Prbability p,i , the probability product p becomes waste in year x

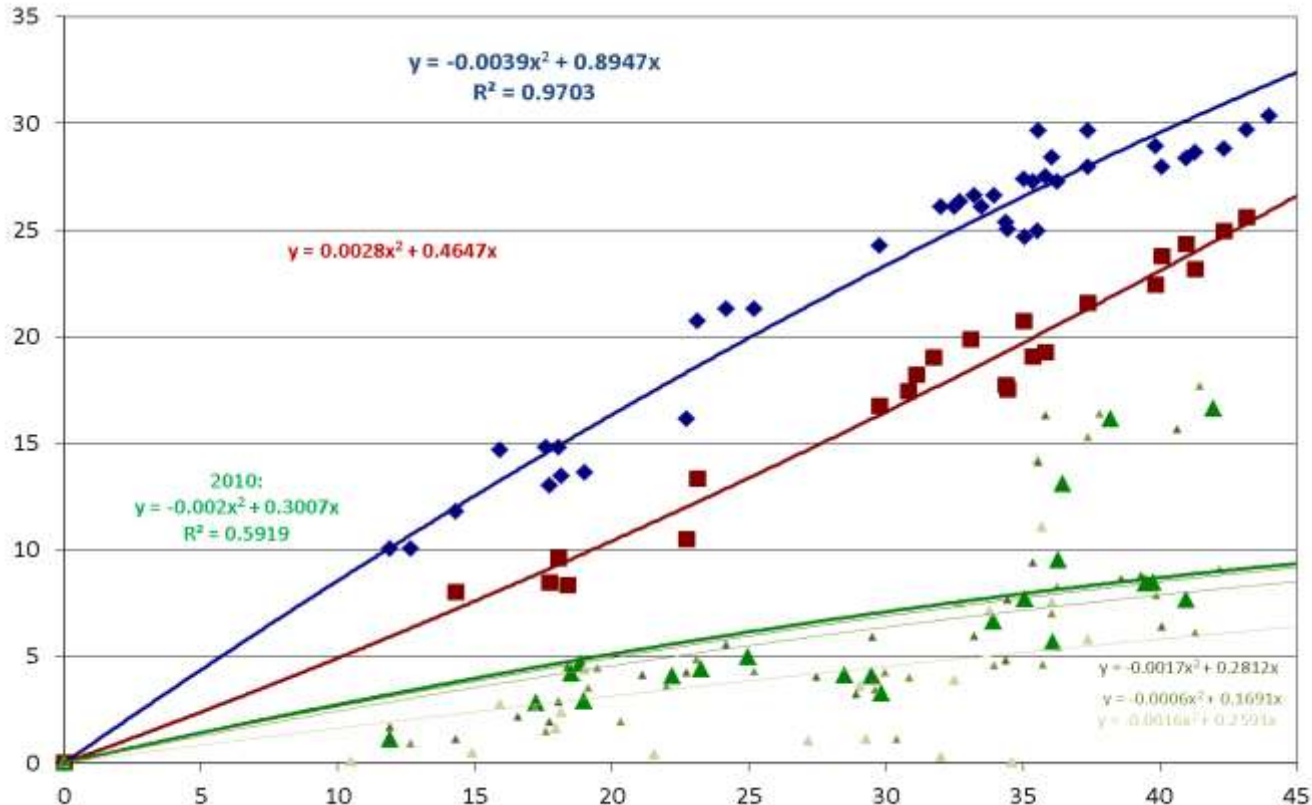
Domestic e-waste generation in China (million tons)



Further modeling:

- Reuse
- B2B products
- Technology change (CRT -> LCD)
- International trading of e-waste
- Other countries of data scarcity
- ...

PPP versus new EEE, WEEE and Collected & Treated



PPP: Purchasing Power Parity

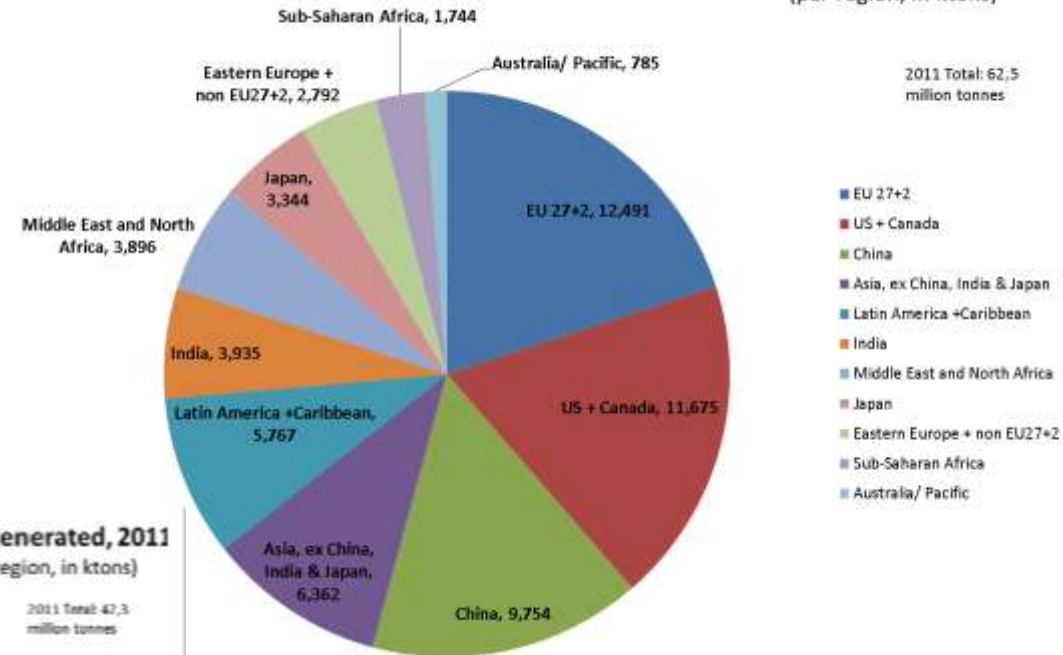
Task Force Capacity Building – ADDRESS



SOLVING THE E-WASTE PROBLEM

EEE placed on market, 2011

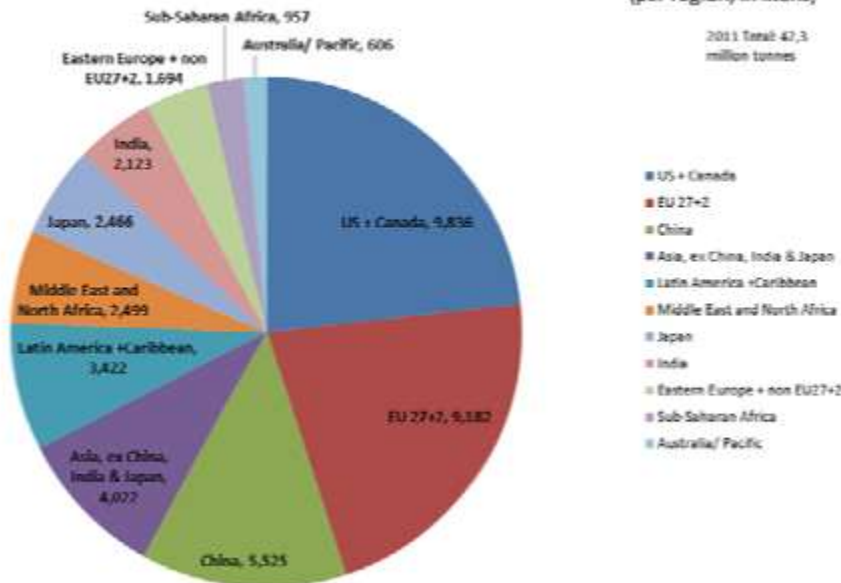
(per region, in ktons)



WEEE generated, 2011

(per region, in ktons)

2011 Total: 47,3 million tonnes



StEP Members: EMPA and CEDARE

Annual increase in EEE stocks

=

Local Production + Imports – Exports

=

Future annual E-waste generation after X years (the lifetime of the product)

Sources of information:

- Central Agency for Public Mobilization & Statistics (CAPMAS): Local Production data.
- Egyptian Customs Authority (ECA): Imports & Exports data.
- Interviews and reference studies/sources elsewhere: Lifetime of the product.

Other sources (less accurate than national data, but as a second check):

UN Comtrade data (www.comtrade.un.org)



<http://www.surveymonkey.com/s/ewastesurvey2011>

- The aim of this survey is to collect necessary data to inform about the e-waste issue, the respective policies and standards
 - Quantities
 - Activities
 - Policies

StEP Secretariat

UNITED NATIONS UNIVERSITY

Institute for Sustainability and Peace (UNU-ISP)

Operating Unit SCYCLE

53113 Bonn / Germany



+49-228-815-0213/-0214



+49-228-815-0299



www.step-initiative.org



info@step-initiative.org