



UNITED NATIONS  
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ELECTRONIC INDUSTRY & E-WASTE  
RECYCLING:  
AN UNDERESTIMATED CONTRIBUTION TO  
CLIMATE CHANGE MITIGATION STRATEGIES

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## United Nations University Institute for Sustainability and Peace (UNU-ISP)

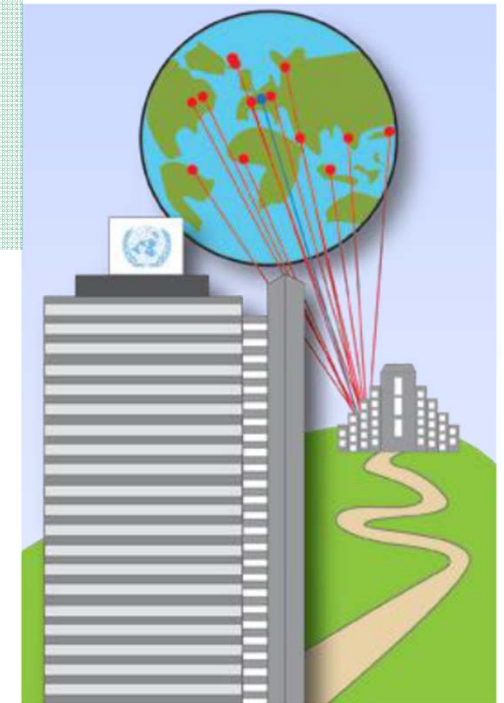
- Established in 2009
- Located in Tokyo
- UNU-ISP SCYCLE: 1st Operating Unit in Germany

### Focus on 3 themes:

- Global Change & Sustainability
- International Cooperation & Development
- Peace-building & security

→ Combining natural sciences, social sciences and the humanities, thus following a transdisciplinary research approach

→ Hosting the Secretariat of the *Solving the E- waste Problem Initiative*



**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.



StEP...

- Functions as a **network of actors** who share experiences and best practices,
- Carries out **research and development** projects,
- **Disseminates** experiences, best practices and recommendations.

- **In EU (in 2005)**
  - >44 million large household appliances
  - 48 million desktops and laptops,
  - app. 32 million TVs,
  - 776 million lamps,
- **In USA (in 2006)**
  - > 34 million TVs
  - > 24 million PCs
  - roughly 139 million portable communication devices (cell phones, pagers or smart-phones manufactured)
- **In India (in 2006)**
  - 5 million PCs
- **In China (in 2005)**
  - roughly 14 million PCs
  - 48 million TVs,
  - app. 20 million refrigerators





## Mobile Phones

1,200 million units  
x 250 mg Ag  $\approx$  300 t Ag  
x 24 mg Au  $\approx$  29 t Au  
x 9 mg Pd  $\approx$  11 t Pd  
x 9 g Cu  $\approx$  11,000 t Cu  
1,200 Mio x 20 g/Battery\*  
x 3.8 g Co  $\approx$  4,500 t Co

\* Li-Ion Typ



## PCs & Notebooks

300 million units  
x 1000 mg Ag  $\approx$  300 t Ag  
x 220 mg Au  $\approx$  66 t Au  
x 80 mg Pd  $\approx$  24 t Pd  
x  $\approx$  500 g Cu  $\approx$  150,000 t Cu  
140 million Laptop/Batteries\*  
x 65 g Co  $\approx$  9100 t Co  
\* Li-Ion Typ

## World Mine Production

Ag: 20,000 t/a  $\blacktriangleright$  3%  
Au: 2,500 t/a  $\blacktriangleright$  3%  
Pd: 230 t/a  $\blacktriangleright$  13%  
Cu: 16 Mt/a  $\blacktriangleright$  1%  
  
Co: 60,000 t/a  $\blacktriangleright$  15%

Source: Hagelüken/Umicore 2008

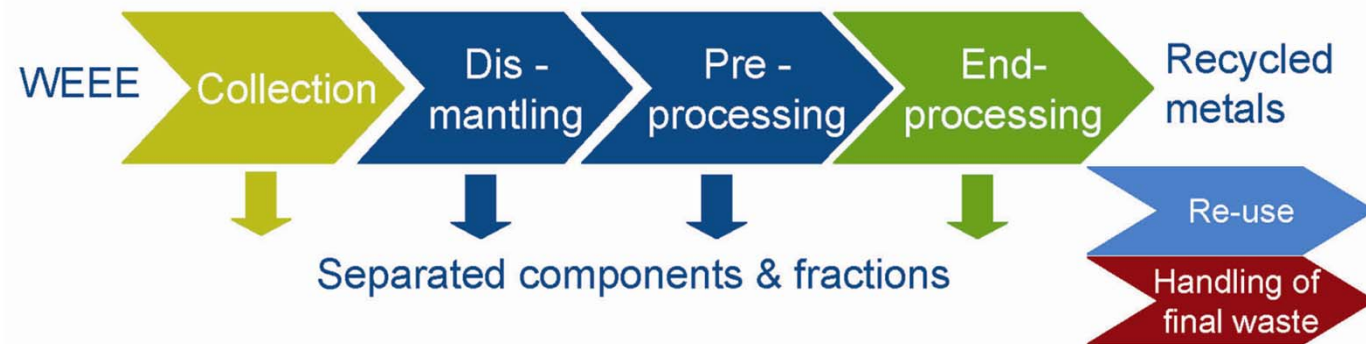
# Emissions and Opportunities

Metal	Demand for EEE [t/a 2006]	% on global Prod.	CO2 for Primary Prod. [t CO2/t Metal]	CO2 Emissions [Mt]
Copper	4.500.000	30%	3,4	15,3
Cobalt	11.000	19%	7,6	0,08
Tin	90.000	33%	16,1	1,45
Indium	380	79%	142	0,05
Silver	6.000	30%	144	0,86
Gold	300	12%	16.991	5,10
Palladium	32	14%	9.380	0,30
Platinum	13	6%	13.954	0,18
Ruthenium	6	84%	13.954	0,08
<b>Total</b>				<b>23,4</b>

Source: Ecoinvent 2.0 - EMPA/ETH Zürich 2007



- Increasing sales of EEE
- Increased resource consumption
- Increased energy consumption of powerful EEE
- Decreasing lifetimes
- Increasing mountains of E-waste
- Need for a proper «Recycling Chain»





# Impacts of (W)EEE on Climate Change



## Production (EEE)

- Use of Natural resources (particularly precious & special metals)



## Use (EEE)

- Energy consumption
- Re-USE impacts linked to production prevention
- **Role of ICT in mitigating Climate Change > GHG gases**



## End-of-Life (WEEE)

- **Primary emissions (CFC containing) > GHG gases**
- Secondary emissions
- Tertiary emissions
- Mitigate resource use (recycling society)

**Direct Impacts – GHG emissions**  
In-Direct Impacts



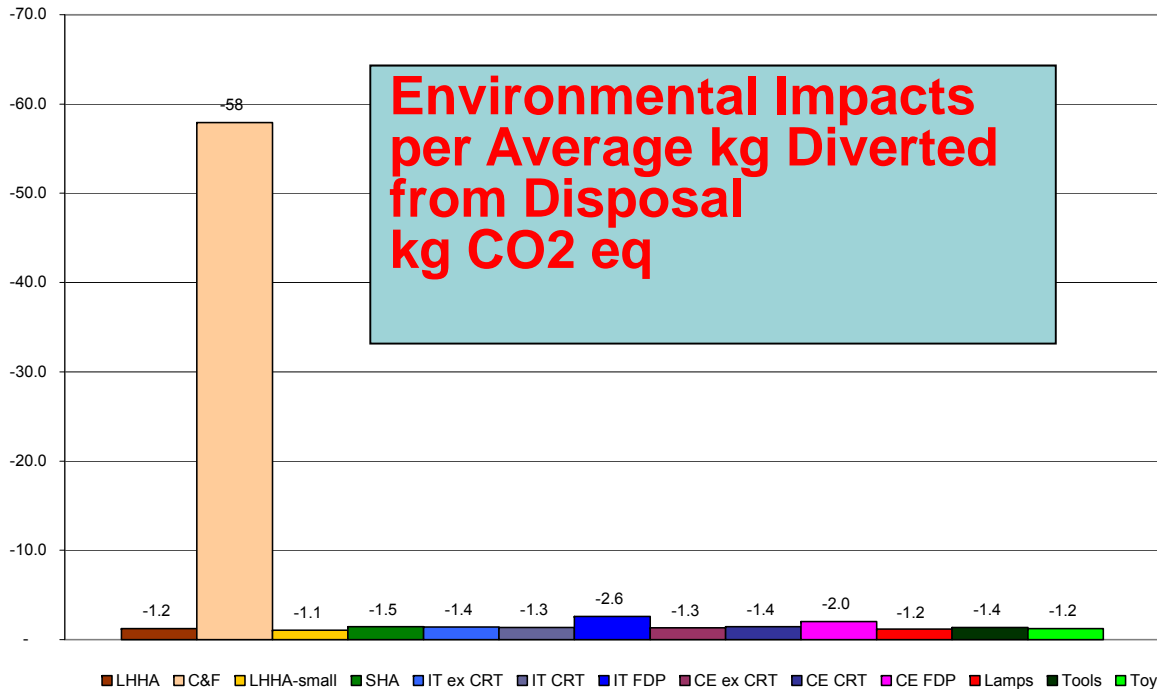
# The EU Scenario – UNU WEEE Review Study



2005 data – Current WEEE Directive:

- Put on Market 10,3 Mt/y (19 kg/person)
- WEEE Arising 8,3 – 9,1 Mt/y (24 kg/person by 2020)
- Collected (2005) 2,2 Mt (5 kg/person)
- Full implementation\* 5,3 Mt (2011)
- Current Target 4 kg/person, no specific targets on EEE categories

↑ (in kg CO<sub>2</sub> eq.) CML2 Global Warming Potential, per kg



**Environmental Impacts per Average kg Diverted from Disposal kg CO<sub>2</sub> eq**

ENVIRONMENTAL BENEFITS EXIST:

From 2,2 to 5,3 Mt Collected and treated under “default scenario”

**36 Mt CO<sub>2</sub> eq**



# The role of e-waste worldwide



- Global Estimates for 2014: 42 Mt/y
  - More than **400 Mt CO<sub>2</sub> eq** potential (under EU scenario) ●
- Growing number of countries being covered by e-waste bills ●
  - Limited EEE covered (hardly C&F appliances) ●
  - No specific targets on EEE categories (collection & treatment) ●
  - No specific requirements on:
    - Pre-processing (e.g. ensuring efficient GHG gas removal) ●
    - End-processing (e.g. ensuring proper recovery of precious & special metals) ●
- Countries without any e-waste bill ●

- Regulated Carbon Markets: **5000 Mt** in 2008, 92 B\$

- Voluntary Carbon Markets: **100 Mt** in 2008

— *Enhancing practices for environmentally sound **management of hazardous and other wastes** offers an **opportunity** to support the achievement of national objectives relating to climate change and energy production and use [Basel Convention 2007]*



- Recycling Industry to trade in Regulated (ETS)

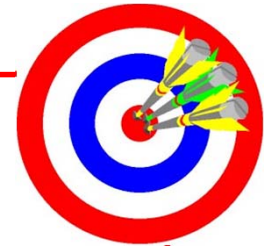
e.g. recovery of GHG gases from C&F appliances

e.g. promote proper recovery for metals

Set threshold limit for trading (push efficiency GHG removal, recovery metals)

- Enable project-based offsets

e.g. setting up a take back scheme in country without legislative obligations (CDM)



## StEP Secretariat

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