



Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

WP4: Promote Efficient Appliances & Develop the Market

Opportunities for investment in e-waste sector

(especially household appliances)

MeetMid Week
28 February 2023



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Background information (Egypt)

Population	104.5 M
Municipal Solid Waste (MSW) Generation:	27 Mt/y
Per Capita MSW Generation:	
- Urban areas	0.25:0.4 kg/day/capita
- Rural areas	0.55:1.2 kg/day/capita
Agricultural waste	32 Mt/y
Construction and Demolition Waste	6 Mt/y
Medical waste generation	0.045 Mt/y
Industrial waste	7 Mt/y
Hazardous waste	0.6 Mt/y
Electronic waste	0.586 Mt/y

Definition and Classification

E-waste (WEEE) is defined as any item of EEE and its parts that have been discarded after the end of its useful life by the owner as waste.

The United States Environmental Protection Agency (EPA) classifies waste into ten categories:

1. Large household appliances, including cooling and freezing appliances
2. Small household appliances
3. IT equipment, including monitors
4. Consumer electronics, including televisions
5. Lamps and luminaires
6. Toys
7. Tools
8. Medical devices
9. Monitoring and control instruments and
10. Automatic dispensers

Definition and Classification

Under Annex I of Directive 2012/19/EU, classifies waste into ten categories:

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment and photovoltaic panels
5. Lighting equipment
6. Electrical and electronic tools (except for large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (except for all implanted and infected products)
9. Monitoring and control instruments
10. Autonomic dispensers



01
LARGE
HOUSEHOLD
APPLIANCES



02
SMALL
HOUSEHOLD
APPLIANCES



03
IT AND
TELECOMMUNICATIONS
EQUIPMENT



04
CONSUMER
EQUIPMENT



05
LIGHTING
EQUIPMENT



WEEE

CATEGORIES



06
ELECTRICAL
AND ELECTRONIC
TOOLS



07
TOYS, LEISURE
AND SPORTS
EQUIPMENT



08
MEDICAL
DEVICES



09
MONITORING
AND CONTROL
INSTRUMENTS



10
AUTOMATIC
DISPENSERS

Quantities - 2022

Globally E-waste is considered the "fastest-growing waste stream in the world" with 59.4 Mt generated, (7.3 kg/capita)

Africa Africa generated 2.9 Mt, (2.5 kg/capita)

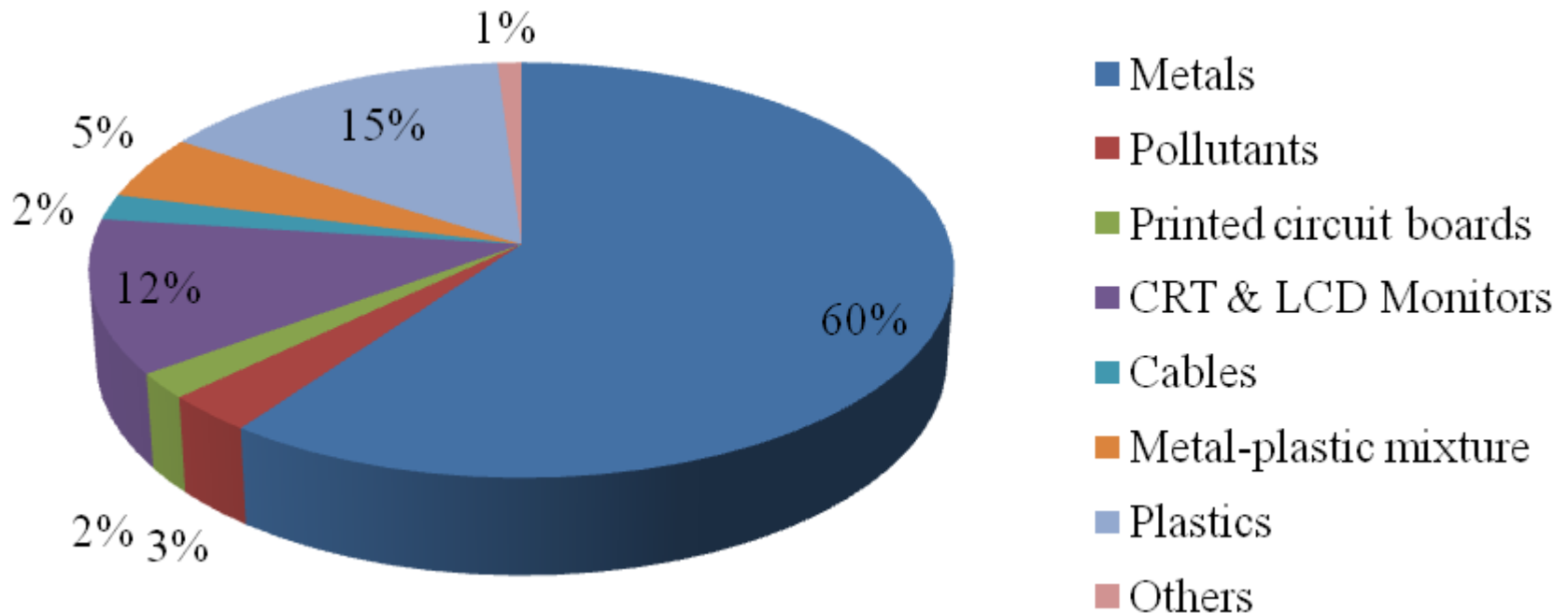
Northern Africa is the highest generation with 1.3 Mt, (5.4 kg/capita)

Egypt

- Is among top 3-4 African countries (Ghana, Nigeria, Kenya) with highest e-waste generation in absolute quantities (4.3 Kg/capita)
- Is the top of African countries in e-waste generation with an amount of 0.586 Mt, (5.6 kg/capita)
- Currently only around 1,584 tons/year of electronic waste is been collected from the total generated e-waste mass flow, which only represents (2.7%).

Composition of E-Waste

E-waste normally contains valuable, as well as potentially toxic materials. The composition of e-waste depends strongly on factors such as the type of electronic device, the model, manufacturer, date of manufacture, and the age of the scrap.



Main Problems

- Egypt lacks a specific regulatory and policy framework for industrial waste management, (even though some legislative provisions are in place),
- Enforcement is weak, causing industrial waste to end up in open dumpsites mixed with municipal solid waste,
- Absence of companies or entities dedicated to collecting processing,
- More treatment and disposal operations are dependent on the informal sector,
- Failure to properly dispose in designated locations.

Impact

Environmental

- It is common practice within the informal sector to break TV and CRT to retrieve the cooper, then dump the rest. This in turn cause heavy metals such as lead to leach into the ground and release toxic phosphor .where, the lead disrupts the function of water and soil systems.
- Open burning of cables produces a high toxic emission (POPs)
- Land filling of potential hazardous such as CRT monitors with no appropriate treatment causes soil contamination with lead.

Social

- Child labour
- Safe and healthy working conditions

Possible hazardous substances in e-waste components

Component	Possible hazardous content
Plastic	Phthalate plasticize, Brominated flame retardants (BFR)
Insulation	Insulation ODS in foam, asbestos, refractory ceramic fiber
Glass	Glass Lead, Mercury (if coated)
CRT (Cathode Ray Tubes)	Lead, Antimony, Mercury, Phosphors
LCD (Liquid-crystal display)	Mercury
Rubber	Phthalate plasticizer, BFR
Wiring/Electrical	Phthalate plasticizer, Lead, BFR
Circuit board	Lead, Beryllium, Antimony, BFR
Fluorescent lamp	Mercury, Phosphorus, Flame Retardants
Thermostat	Mercury
CFC, HCFC, HFC, HC	Ozone depleting substances, such as chlorofluorocarbons
External electric cables	BFRs, plasticizers

Policy and Legislation (Worldwide)

The European Union (EU) has addressed the issue of electronic Waste by introducing two pieces of legislation.

The first, the Waste Electrical and Electronic Equipment Directive (WEEE Directive) came into force in 2003, (The main aim of this directive was to regulate and motivate electronic waste recycling and re-use in member states at that moment).

The second, EU has also implemented the Directive on the restriction of the use of certain hazardous substances in electrical and electronica equipment from 2003.

October 2019, 78 countries globally have established either a policy, legislation or specific regulation to govern e-waste, However, there is no clear indication that countries are following the regulations.

Regions such as Asia and Africa are having policies that are not legally binding and rather only programmatic ones. Hence, this poses as a challenge that e-waste management policies are yet not fully developed by globally by countries.

Policy and Legislation (Egypt)

Laws Influencing WEEE

- **Age of Imports:** restricting the Import of old EEE equipment with exception of some EEE goods conditional it is not longer than 5 years from day of production.
- **Secondhand Telecommunication Equipment Import:** Article 46 prohibits the import of used telecommunication equipment for purpose of trading.
- **WEEE Import:** Decree 165 of year 2002 of ministry of industry prohibits the importing of WEEE

Policy and Legislation (Egypt)

Laws Influencing WEEE

- **Waste Management Regulatory Law No. (202) for year 2020**

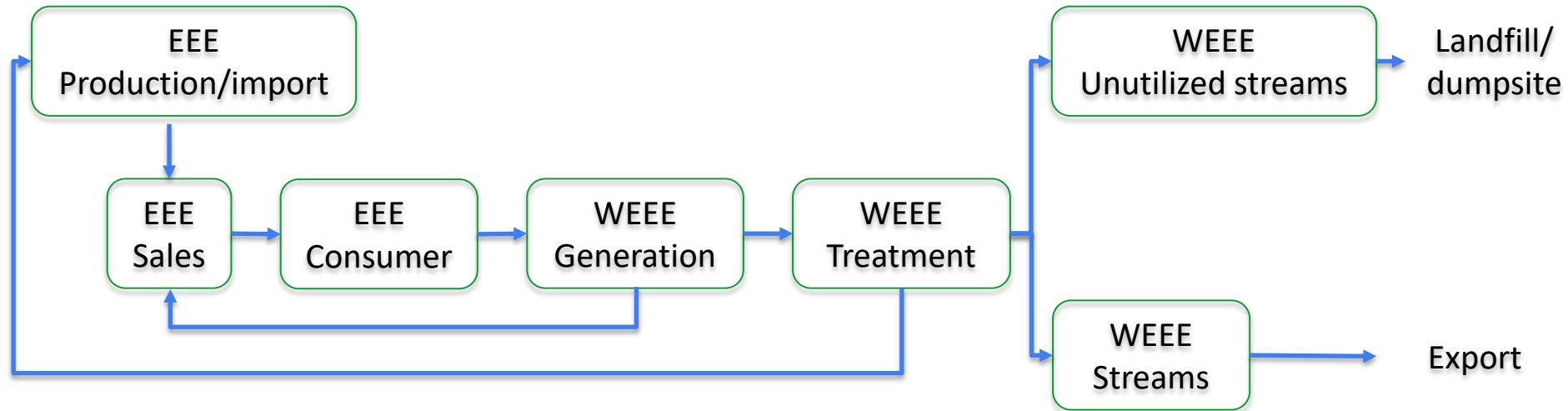
Article (53) “A technical committee is formed from the competent administrative authorities for hazardous materials and waste to develop, issue and review unified lists of hazardous materials and waste, set controls and requirements for handling and integrated management of hazardous materials and waste, and determine the method for limiting their generation”.

Executive regulations No. (722) for year 2022

Article (46) specified the formation of the committee and its 24 members,

Article (47) defines the duties of the committee.

Stakeholder



1. **Production/import:** Electrical and electronic equipment imported into the country or manufactured within the country.
2. **Sales:** Electrical and Electronic equipment in the market, ready for sales to end user.
3. **Consumption:** Consumption by households, private and public entities.
4. **WEEE generation:** The end of useful use of EEE and disposing to collectors/merchants.
5. **Re-use /down cycle:** Disposed EEE, which can be fixed or refurbished for secondhand consumer.
6. **WEEE treatment/ Re-cycle:** Applied process to EEE (e.g., dismantling) to extract useful fractions.
7. **Secondary raw material:** Specific fractions, which are reused as a feedstock for other industries (e.g., copper, plastics, iron and etc..)
8. **Secondary raw material:** Fractions such as electric boards, which are exported to other countries.

Stakeholder

Formal Sector – ITG, ERC, Spear ink



ITG



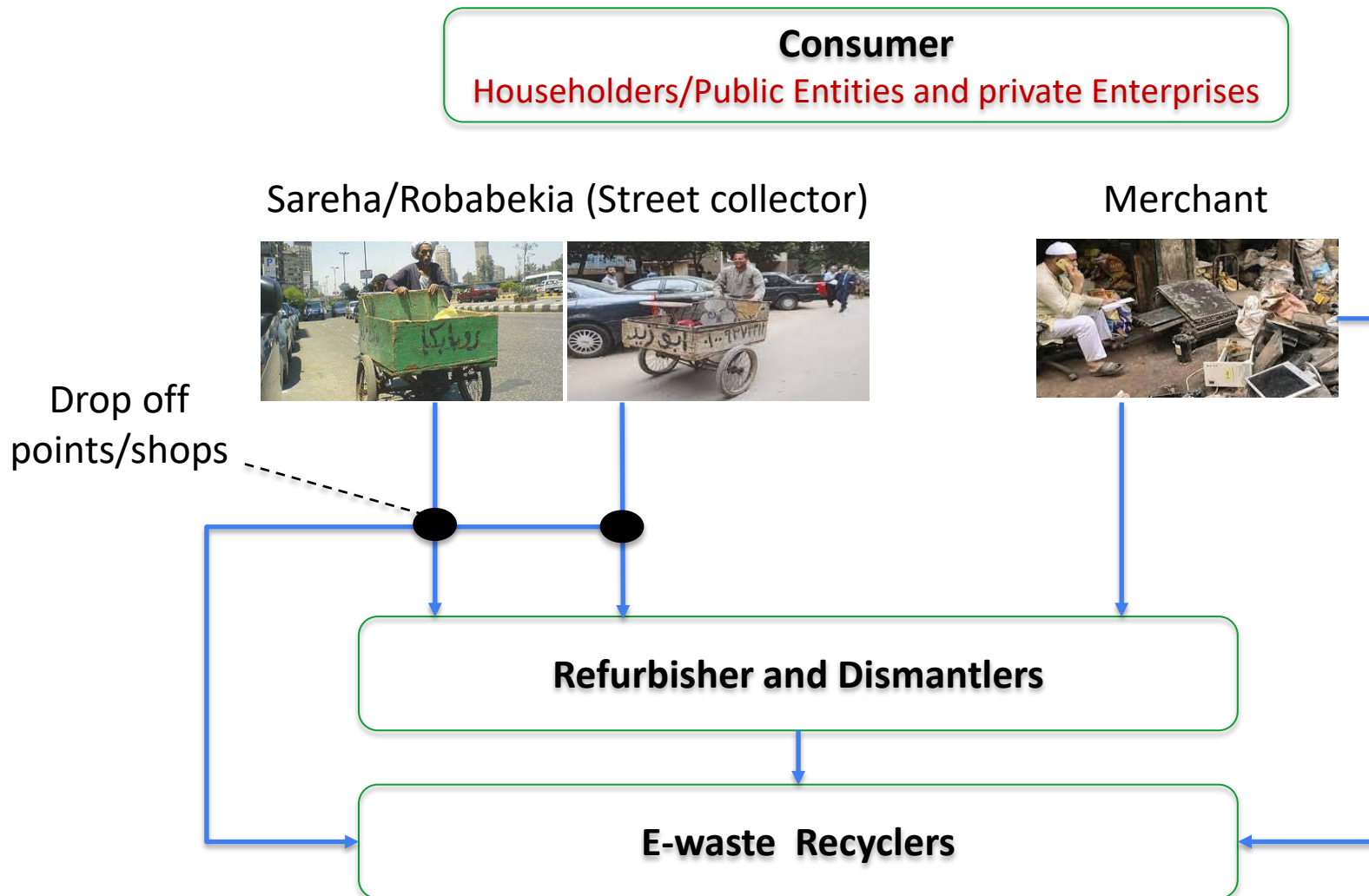
Spear ink



ERC

Stakeholder

Informal Sector



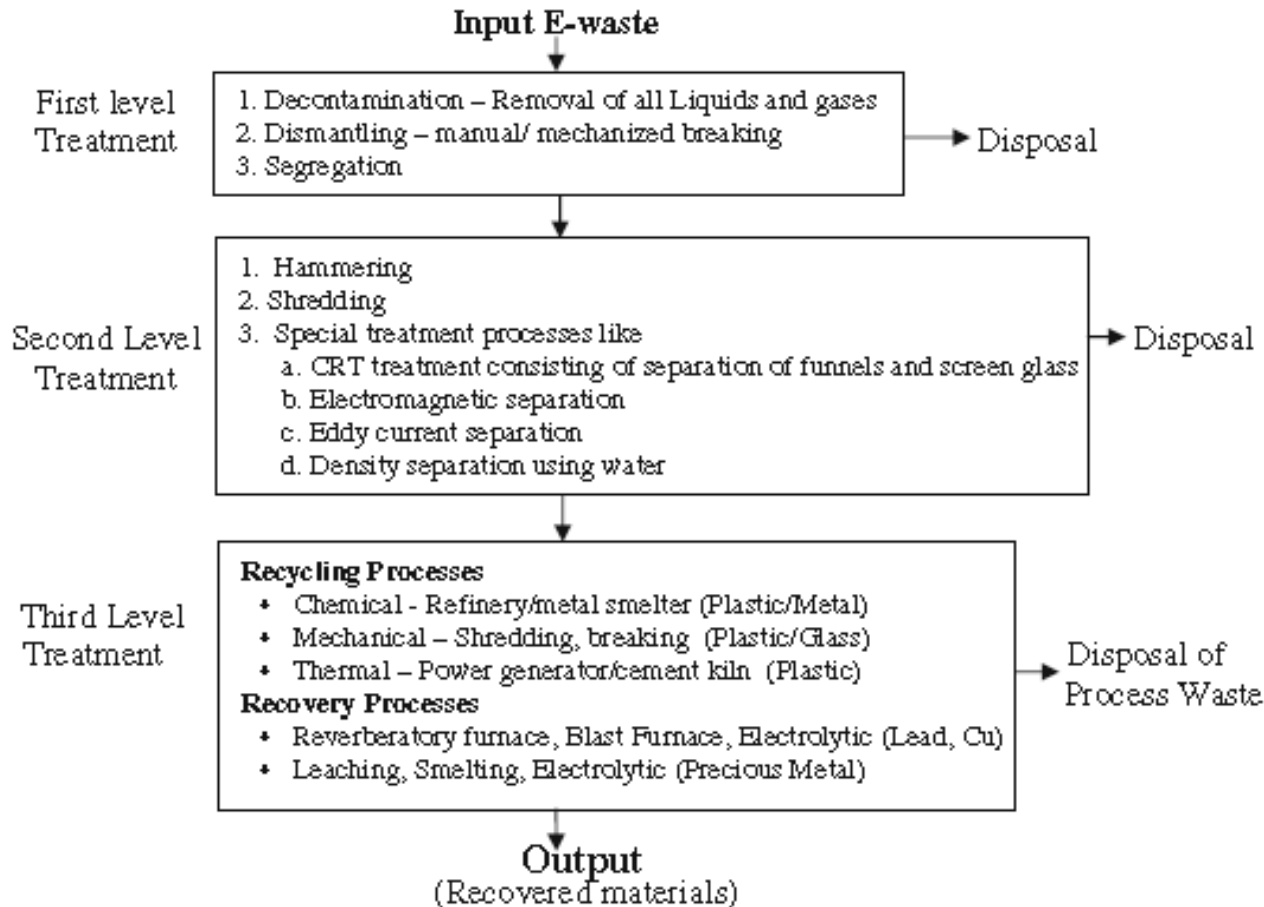
Stakeholder

Informal Sector



Opportunities for investment

Three tire treatment processes for recovery/ recycling e-waste



Opportunities for investment

Average weight and composition of WEEE of selected EEE commonly used

Appliances	Average weight (kg)	Iron (Fe) % weight (kg)	Non Fe % weight (kg)	Glass % weight (kg)	Plastic % weight (kg)	Electronic component % weight (kg)	Others % weight (kg)
Refrigerators and freezers	48	64.4	6	1.4	13		15.1
Washing machine	40 to 47	59.8	4.6	2.6	1.5		31.5
PC	29.6	53.3	8.4	15	23.3	17.3	0.7
TV sets	36.2	5.3	5.4	62	22.9	0.9	3.5
Cellular phones	0.08 to 0.1	8	20	10.6	59.6		1.8

Opportunities for investment

Materials recovered from refrigerators

Elements	Content (% of total wt.)	Content (g)	Recycling eff. (%)	Recoverable wt. of element (g)
Plastics	23	6250	20	1,250.69408
Lead	6	1710	5	85.66868
Aluminium	14	3850	80	3,083.89248
Germanium	0.0016	0	0	0
Gallium	0.0013	0	0	0
Iron	20	5570	80	4,454.53312
Tin	1	270	70	191.88512
Copper	7	1880	90	1,696.14376
Barium	0.0315	10	0	0
Nickel	0.8503	230	0	0
Zinc	2	600	60	359.79072
Tantalum	0.0157	0	0	0
Indium	0.0016	0	60	0.26112
Vanadium	0.0002	0	0	0
Terbium	0	0	0	0
Beryllium	0.0157	0	0	0
Gold	0.0016	0	99	0.430848
Europium	0.0002	0	0	0
Tritium	0.0157	0	0	0
Ruthenium	0.0016	0	80	0.34816
Cobalt	0.0157	0	85	3.62984
Palladium	0.0003	0	95	0.07752
Manganese	0.0315	10	0	0
Silver	0.0189	10	98	5.037984
Antimony	0.0094	0	0	0
Bismuth	0.0063	0	0	0
Chromium	0.0063	0	0	0
Cadmium	0.0094	0	0	0
Selenium	0.0016	0	70	0.30464
Niobium	0.0002	0	0	0
Yttrium	0.0002	0	0	0
Rhodium	0	0	50	0
Mercury	0.0022	0	0	0
Arsenic	0.0013	0	0	0
Silica	24.8803	6770	0	0

Compiled from data presented in
“Waste Electrical and Electronic
Equipment (WEEE),
Pilot Scheme Report, Producer
Responsibility Unit Environment
and Heritage Service,
Government of UK

Opportunities for investment

Recoverable quantity of elements in a TV

Elements	%	PPM	Recoverable Wt. of element (kg)
Aluminum	1.2		0.4344
Copper	3.4		1.2308
Lead	0.2		0.724
Zinc	0.3		0.1086
Nickel	0.038		0.013756
Iron	12		4.344
Plastic	26		9.412
Glass	53		19.186
Silver		20	0.000724
Gold		10	0.000362

Opportunities for investment

Recoverable Quantity of Elements in a PC

Material type	% Recovered
CFCs	0.20
Oil	0.32
Ferrous metals	46.61
Non-Ferrous metals	4.97
Plastics	13.84
Compressors	23.80
Cables/ plugs	0.55
Spent Pure Foam	7.60
Glass	0.81
Mixed waste	1.30
Total	100.00
Materials disposed of to incinerator	0.20
Materials disposed of to landfill	8.90
Materials sent for recovery	90.90

Recommendations

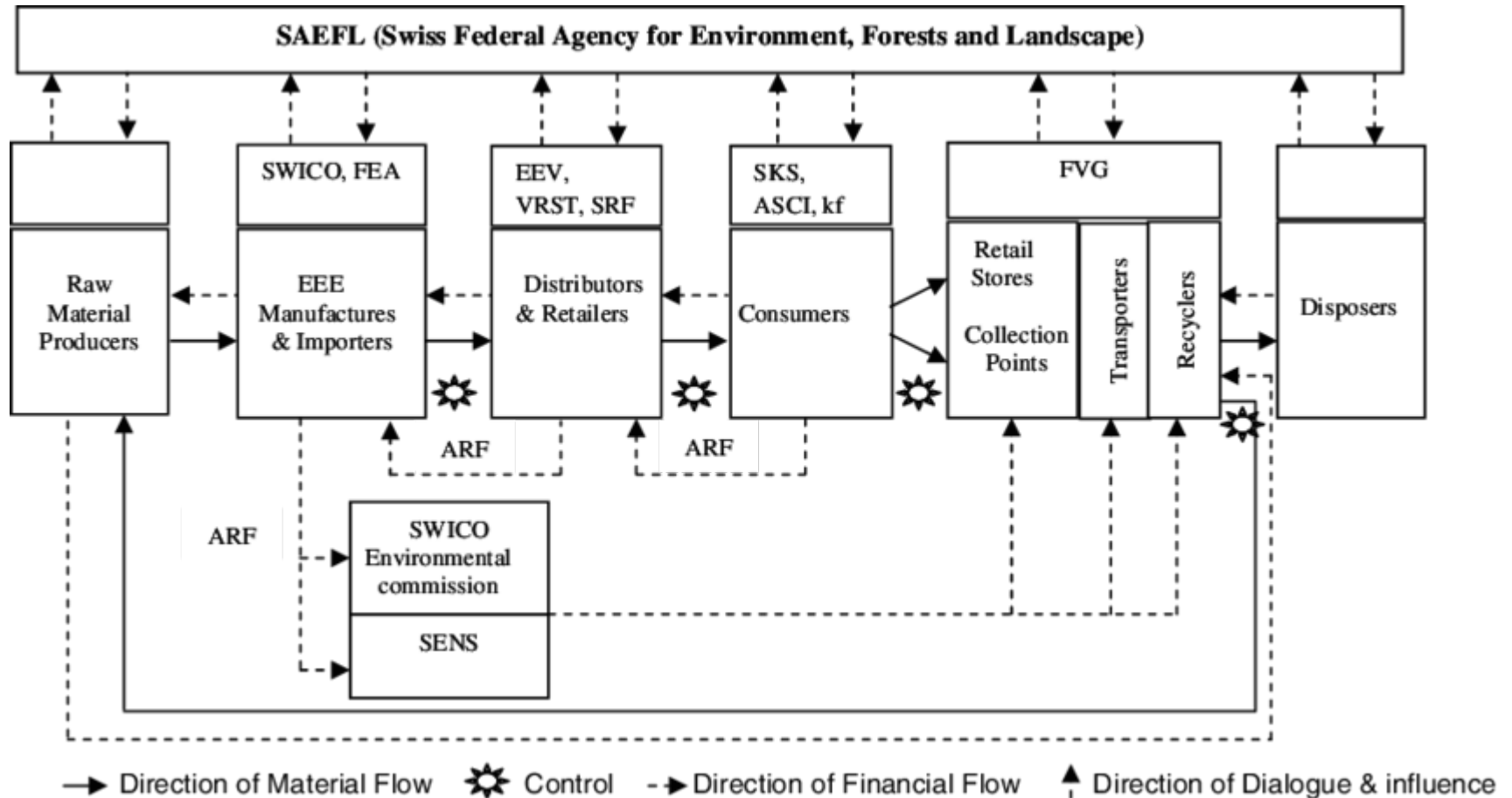
Extended Producer Responsibility (EPR)

The Extended Producer Responsibility (EPR) is an environment protection strategy that makes the producer responsible for the entire lifecycle of the product, especially for take back, recycle, and final disposal of the product. Thus, the producer's responsibility is extended to the post-consumer stage of the product life cycle. This needs to be included in the [legislative framework making EPR a mandatory activity](#) associated with the production of electronic and electrical equipment.

Switzerland is the first country in the world to have established a formal E-waste management system.

Recommendations

Extended Producer Responsibility (EPR)



Challenges and opportunities

E-waste management strategy for India has the following challenges, which need to be studied and addressed in more systematic and scientific manner:

Scientific challenges

- **Eco-friendly recovery solutions**
 - Precious metals
 - Base metals
- **Value addition to recyclables for reuse**
 - Plastics
 - Glass and other recyclables
- **Disposal of process waste and residues**
 - Size reduction
 - Toxic reduction

Challenges and opportunities

Engineering challenges

- Scientific collection, transport, handling, segregation, and disposal of E-waste
- Integrated/distributed processing facilities
 - Unorganized to organized
 - Involvement of SMEs and NGOs
- Feasible techno-economical solutions
 - Processing
 - Recycling
 - Recovery

Challenges and opportunities

Organizational challenges

- Appropriate definition for E-waste
- Inventorisation of E-waste generation, import, and its characterization
- Organization and structuring E-waste management system
- Training and awareness on safety, health, and environment

Recommendations

Laws & Regulations

Develop short and succinct law on the disposal of obsolete electrical equipment as a type of waste, and recognize it with a term such as WEEE/WEEE.

Collection

Enforce licensing and EHS regulation requirement on collectors/recyclers participating in auctions for WEEE from governmental sector and enterprises.

Recommendations

Recycling & Treatment

Empower the informal sector through trainings, technical and financial scheme. Design a business models for informal sector and incentives through better prices. Encourage civil society and development NGOs to prioritize WEEE recycling sector

Awareness & Education

Conduct mass awareness campaigns targeting specific sectors, supported by booklets and manuals on WEEE. Such campaigns should work closely with civil societies and governmental agencies working on environmental concerns to reach as much social segments as possible.



THANK YOU

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Mitigation Enabling Energy Transition in the MEDiterranean region
Together We Switch to Clean Energy - Phase II

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