Recycling Waste from Electric and Electronic Equipment (WEEE)

With a view on one particular POP

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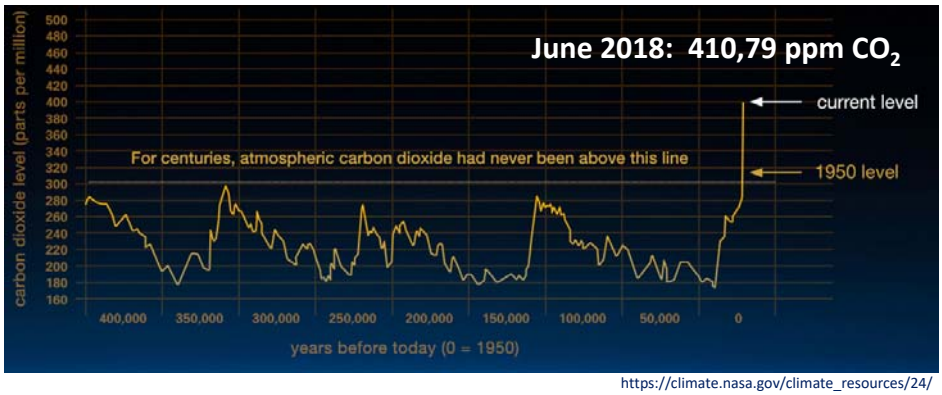
Exponential increase of CO2 Emissions



https://climate.nasa.gov/climate_resources/24/

- CO_2 is not visible and can be emitted without any costs
- Personally I consider this to be the world largest environmental threats – "Global Warming"
- And……..this CO_2 discussion is completely separated from any discussions about POPs

The WEEE Recycling Process – TAC Guidance

"Substances, preparations and components may be removed manually, mechanically or chemically, metallurgically with the result that hazardous substances, preparations, and components and those mentioned in Annex II are contained as an identifiable stream or identifiable part of a stream at the end of the treatment process. A substance, preparation or component is identifiable if it can be (is) monitored to prove environmentally safe treatment."

May I invite you to have a look at our WEEE Recycling Process?

MGG Metrec – Amstetten

May I invite you to our world of WEEE recycling....

→ De-Pollution → Batteries, Capacitors etc.

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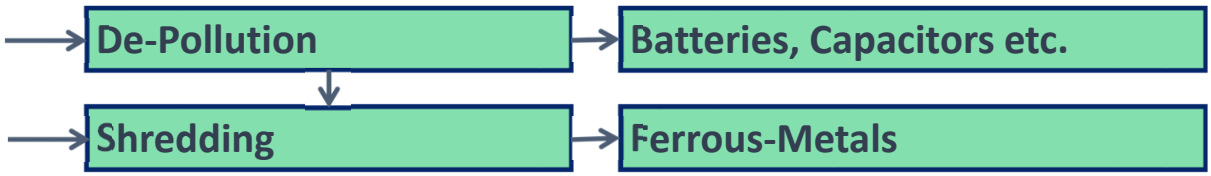
De-Pollution with Smasher 2.0

- MGG Patented "Smasher"
- Taking out
  - **Hazardous components, such as**
    - Capacitors > 25mm
    - Batteries
    - Toner Cartridges
  - **Valuable components, such as**
    - Printed Circuit Boards
    - Spools
    - E-Motors
  - **Fractions disturbing further separations, such as**
    - Wood or other fibres

WEEE recycling – shredding and ferrous metal recovery



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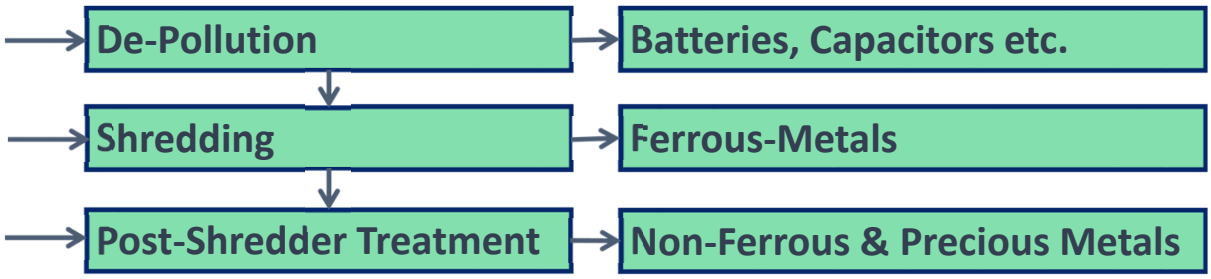
EVA Shredder, specialized for WEEE

- **Shredding**
  - Extremely efficient air treatment and fire fighting techniques
  - Very low noise shredding
- **Separation of Ferrous Metals**
- **Shredder residues**
  - Heavies
  - Lights
  - Dust fraction
  - Clean air (approx. 2 mg/m3 dust)

WEEE recycling – non-ferrous metal recovery



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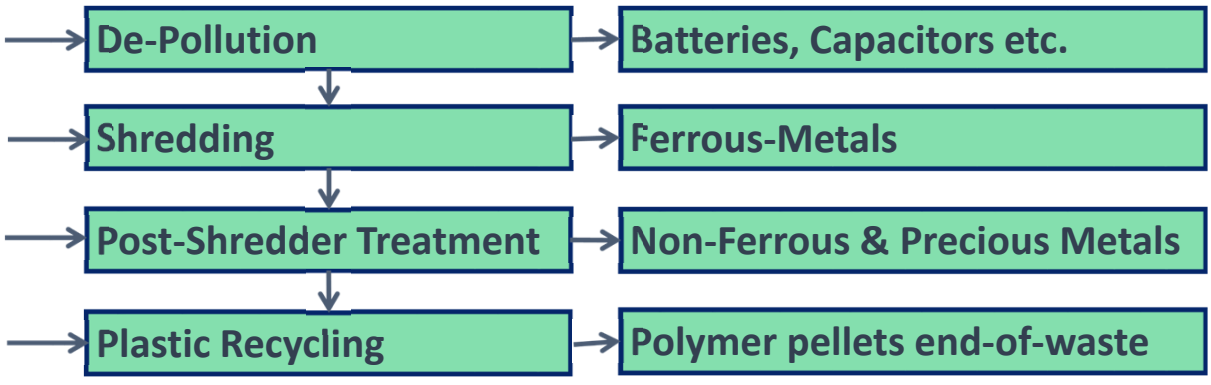
MGG Metran – Kematen/Ybbs

Treatment of WEEE Shredder Residues

- **Post-Shredder Technologies**
- **The dry and wet separation techniques consist of:**
  - Size (sieving)
  - Density separations
  - Induction
  - Colour & other sensor based
  - Surface to weight ratio's etc.

- **Resulting in concentrates of**
  - Non-Ferrous Metals (Copper, Aluminium, Brass, Stainless etc.)
  - Printed circuit boards
  - Plastics

WEEE recycling – PCR plastics recycling



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MGG Polymers – Kematen/Ybbs

MGG Polymers WEEE Plastics Recycling

- **Goods-In and Pre-processing**
  - Each receipt is assayed
  - Material cleaned from non-plastics
- **High-tech plastic separation**
  - Cleaning and separarions
  - PP, HIPS, ABS and PC-ABS
- **Blending, Extrusion and Compounding**
- **Lab Analyses RoHS Physical, Chemical & Rheologic parameters**

Output Material some 25 000 MT of PCR plastics drop-in replacing virgin

The Sustainable Model of Re-Producing plastics from WEEE

Procurement | **Processing** | **Selling**

- Growing supply
- E-Waste recycling

↓

- Self-replenishing
- Sustainable and growing supply

- Mechanical 'mining' process
- Innovative processing

↓

- < 10% of energy
- < 10% of water consumption
- Save some 3-4 tons CO_2/ton

- "Green" products
- Virgin-like quality

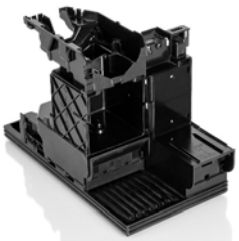
↓

- Sustainable product
- PCR plastics

Some examples of products with 100% MGG Polymers

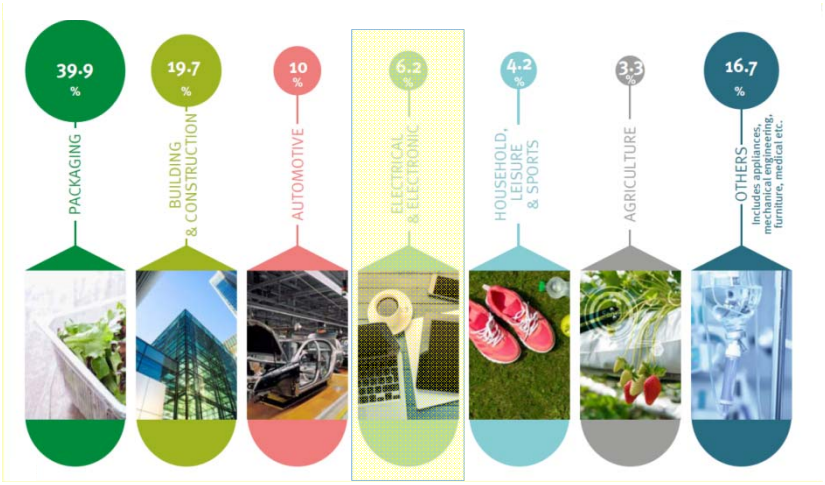
Marketed as Post-Consumer Recycled plastics (**PCR Plastics**)

Please note that this is not the same as Post-Industrial Recycled plastics (**PIR plastics**)



"Forward" Approach

Plastics volume in terms of demand for EEE



Total Converter Demand
49,9 Mio MT

Source: Plastics Europe

The demand for EEE is approx. 3.1 Mio MT's

"Reverse" Approach

Estimating the quantity of plastics in WEEE

European Market	Mio MT	in %
Placed on Market (POM) EEE	9,50	
Officially reported collections/recycling	3,30	35%
Informal collections/recycling	3,20	34%
Exports (of which 1,3 Mio MT not documented)	1,50	16%
"Scavenging" for parts	0,75	8%
Losses (such as through waste bin)	0,75	8%

WEEE Plastics some 1,2 Mio MT

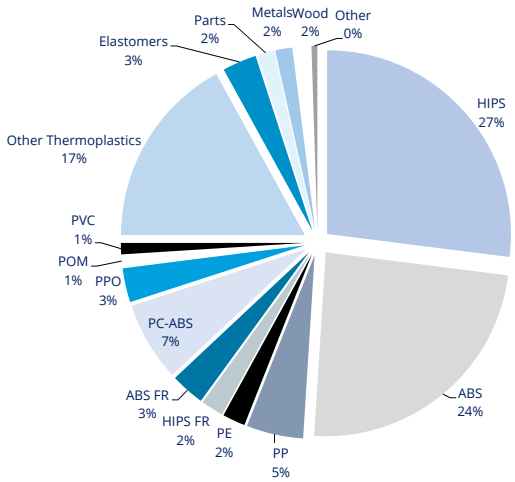
Plastic Content in WEEE per category	
SDA	30%
LDA	15%
ICT	20%
Tools	10%
Temp Control Equipm.	25%
Screens	20%

Source CWIT – MGG Polymers

Qualitative Approach

Average composition of WEEE plastics for recycling

WEEE Plastics	
ABS	24%
HIPS	27%
Polyolefines	7%
PC and PC-ABS	7%
BFR containing plastics	5%
Other plastics	24%
Other contaminants	6%



Source: MGG Polymers

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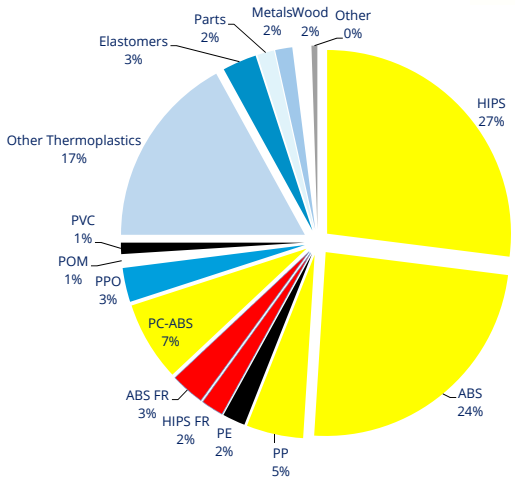


Source: MGG Polymers

Scientific Approach

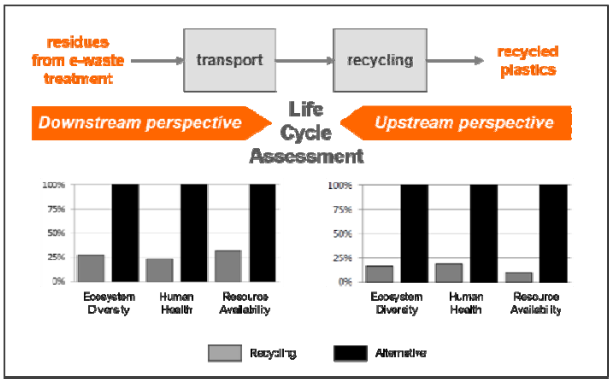
Life Cycle Analyses PCR WEEE Plastic versus

Incineration of WEEE plastic

Recycling PCR WEEE plastics 4 times better than Municipal Solid Waste Incineration.

Production virgin plastics

Recycling PCR WEEE recycling option 6-10 times better than producing virgin plastics.



Source: Science of the Total Environment 529 (2015) 158–167, Patrick Wäger, Roland Hischier EMPA

If WEEE plastics recycling makes so much sense, why is there so little of it……

- **It is difficult.....**
- **Most of the WEEE plasticmaterial disappears from Europe**
- **Very few companies invested in WEEE plastics recycling**
  - Due to the losses of material from Europe
  - As a consequence of competing pricing outside Europe
  - As consequence of an ever increasing legal complexity

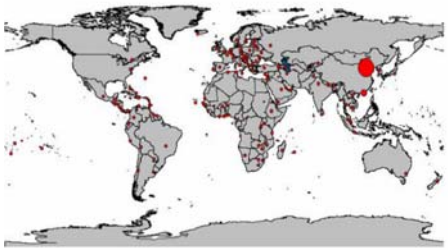
Let's look at Brominated Flame retardants as example

"The ways of WEEE plastics...."

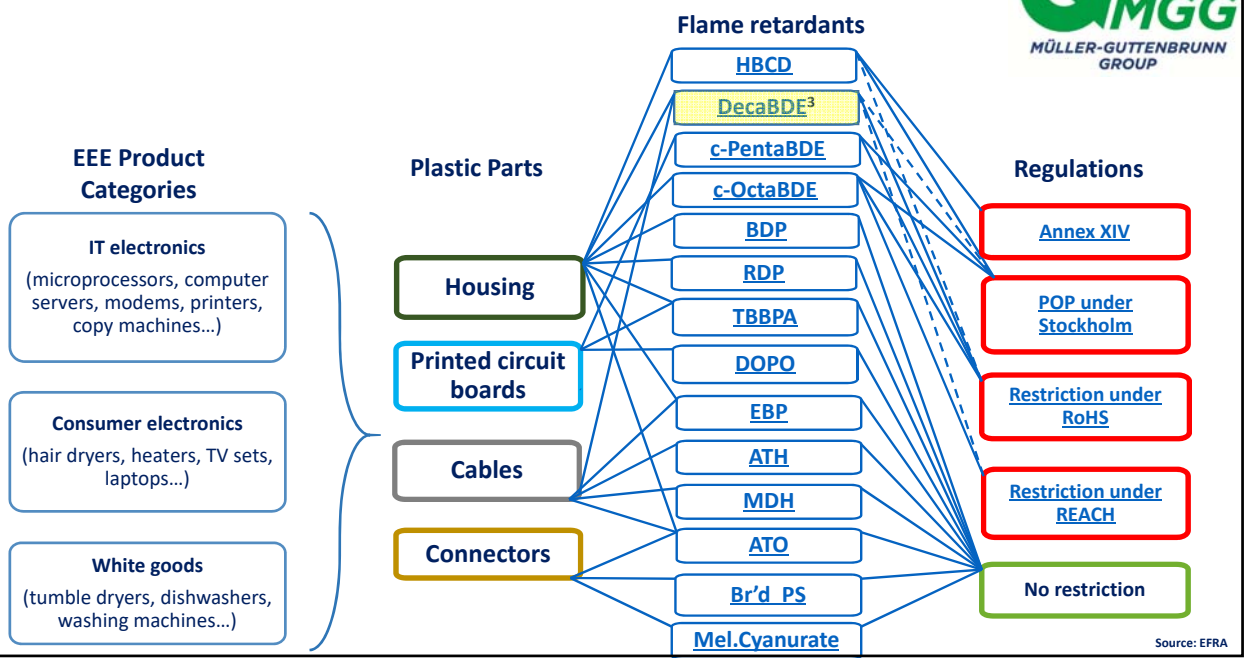
The western Africa route

Resulting in losses of well over 1 Mio MT from the EU Urban WEEE Mine

The China route



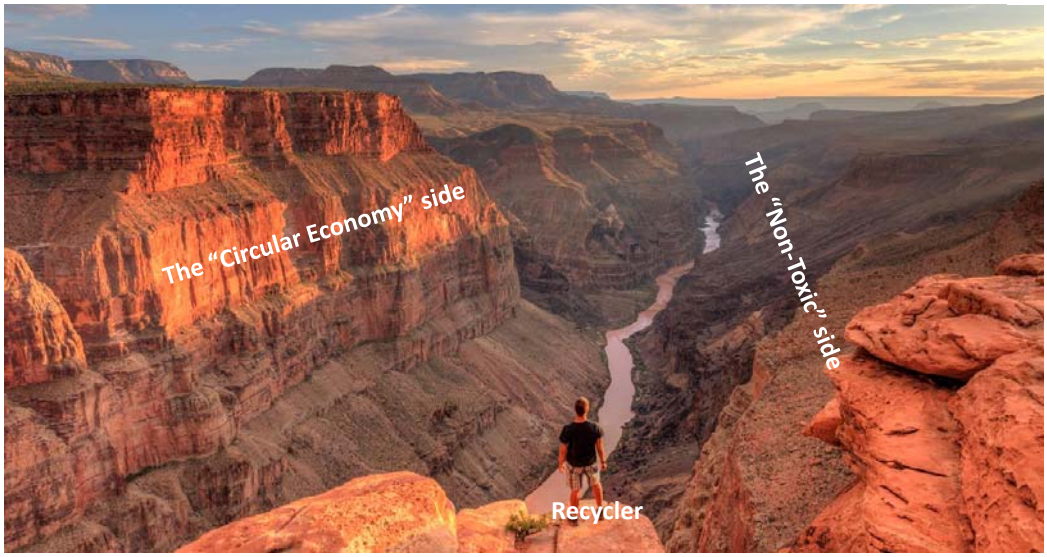
Legislation and Flame Retardants



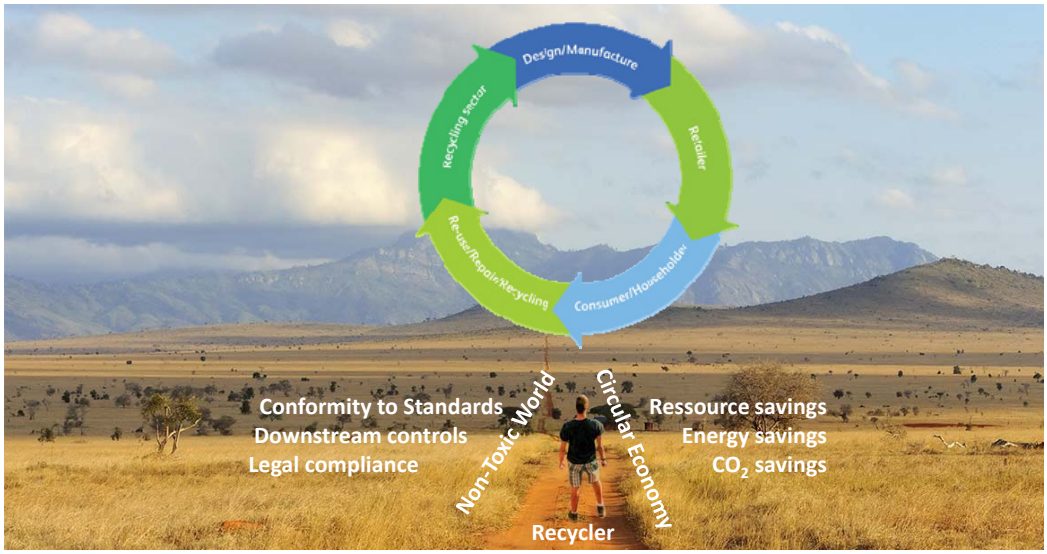
Let's talk about one flame retardant family of the PBDE's

- **First restriction under RoHS 2004** – with several re-casts ever since
- **Many legislative initiatives and guidance in national legislations and documents**
- **Subsequently two PBDE's were POP listed under the Stockholm Convention**
  - Derogation/exemption for octa- and penta-BDE
  - When implemented in EU POP Regulation Unintended Trace Contaminants 10 ppm for virgin plastics
  - And UTC 1000 ppm for c-Penta- and c-Octa-BDE in plastics when placed on the market.
- **Introduction of the PBDE's in REACH (product legislation)**
  - First c-Octa and c-Penta-BDE with 1000 ppm
  - And since February 2017 c-Deca-BDE also with 1000 ppm
- **Stockholm Convention proposed deca-BDE as POP in COP 2017**
  - Deca-BDE was listed as new POP
  - No derogation for recycling…..now discussion about Low POP Content.
- **Resulting in a proposal in the EU for a re-cast POP Regulation**
  - For deca-BDE with UTC of 10 ppm as for octa-and penta-BDE – EU Parlament plenary decides today….
  - This would mean the end of recycling of WEEE plastics.

This is how it feels……..



This is how we believe it should be……



intelligent balance between "Non-Toxic" and "Circular Economy"

What is needed to keep ony recycling and create a circular economy

- **Some legal certainty and clarity is required**
- **A threshold for POP BFR Substances such as deca-BDE –> 1.000 ppm**
  - A threshold of 10 ppm is below the practical detection limit for deca-BDE for all practicle QM purposes
  - To place this in a context: a flame retarded TV housing has 150 000 ppm
  - Recycling requires analyses to be made on industrial scale (i.e. low cost XRF methods)
  - These are validated for 1000 ppm
- **We need the recognition that POPs in WEEE plastics do not make then hazardous**
  - BFRs are firmly embedded in the polymer structure of the solid plastic
  - No plastic recycling plant has a permit to accept hazardous wastes
- **We need a practical and simple procedures for transboundary transports**
  - Fast Track Notifications
  - Allowing WEEE plastics to move out of developing nations
  - To be properly recycled
  - Right now too many BFR containing plastics are exported illegally

What is needed: an intelligent balanced approch for a "Circular Economy"