



### **Resources Fever - Reloaded**

Workshop II, Resource Conservation, Green Transformation towards a Sustainable Policy for Europe, Annual International Conference of the Öko-Institut, 5 November 2009, Brussels

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### Resources Fever – Reloaded?

• In June 2007 Öko-Institut has published "Resources Fever"!



- In this age the demand and the prices were booming for the most resources!
- 2008/2009: global economic crisis: endpoint of resources fever?

No, just a pause!



### Thesis 1: The demand on resources will increase remarkably in a mid and long term perspective!

- Growing global population, growing global economy and growing relevance of emerging economies will boost the demand on bulk materials (steel, copper, concrete etc.)!
- Sustainable future technologies will enhance the demand on precious and special metals\*!
- The resource issue will achieve a new priority!

\* Other terms: specialty metals, critical metals, green minor metals, rare metals etc.



### **Thesis 2:** Special and precious metals are crucial for modern industrial societies!



Indium pearls (photo by courtesy of Umicore Precious Metals Refining)



## Critical metals for future sustainable technologies and their recycling potential

#### **Issued by United Nations Environment Programme (UNEP DTIE)**

July 2009

#### **Funded by EU**

Öko-Institut e.V.: Matthias Buchert, Daniel Bleher, Doris Schüler Assistance: Nicole Neurohr, Lorenz Hagelüken

Acknowledgement for profound and valuable information: Umicore Precious Metals Refining, Hoboken, Belgium: Christina Meskers Christian Hagelüken Thierry Van Kerckhoven Kris Van den Broeck





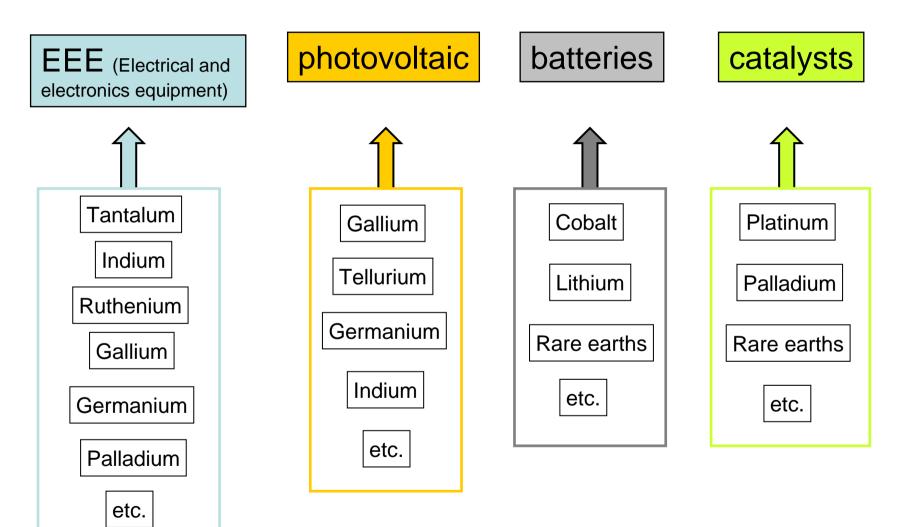
#### critical metals in focus of the study 18 1 2 0 0 H He 13 15 17 1.0079 2 14 16 4.0026 Serie 3 5 07 08 09 0 10 0 0 4 0 06 alkali metal semi-metal Be Li B С 0 F N Ne alkaline earth metal metalloid .941 9.0122 10.811 12.011 14.007 15.999 18.998 20.18 Ianthanoid nonmetal actinoid halogen 11 0 12 0 13 0 14 0 15 0 16 0 17 0 18 0 transition metal rare gas Si S Na Mq AL P CL Ar 7 22.99 24.305 3 5 8 10 11 12 26,982 28,086 30,974 32,065 35,453 39,948 4 6 28 0 29 0 30 0 31 0 32 0 33 0 34 0 19 0 20 0 21 0 22 0 23 0 24 0 25 0 26 0 27 35 0 36 0 K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr 39.098 40.078 44.956 47.867 50.942 51.996 54.938 55.845 58.933 58.693 63.546 65.38 69.723 72.64 74.922 78.96 79.904 83.798 37 0 38 0 39 0 40 0 41 0 42 0 43 2 44 45 0 46 0 47 0 48 0 49 0 50 0 51 0 52 0 53 º 54 º Rh Ag Ru Sn Rb Sr Zr Nb Mo Tc Pd Cd Sb Te Xe In [97.90] 101,07 102,91 106,42 107,87 112,41 114,82 118,71 121,76 127. 85,468 87,62 88,906 91,224 92,906 95,96 126.9 131.29 72 • 73 • 74 • 75 • 76 • 77 • 78 • 79 • 80 • 81 • 82 • 83 • 84 • 85 • 86 • 55 0 56 0 57 Hg Au TI Pb Cs Ba Hf Ta W Re 0s Ir Pt Bi Po Rn At -71 178.49 180.95 183.84 186.21 190.23 192.22 195.08 196.97 200.59 204.38 207.2 208.98 [208.9] [209.9] [222.0] 132,91 137,33 87 🐑 88 🐑 104 4 105 4 106 4 107 4 108 4 109 4 110 4 111 4 112 4 113 4 114 4 115 4 116 4 117 118 4 89 Fr Ra Rf Db Sq Bh Hs Mt Ds Rg Uub Uut Uug Uup Uuh Uus Uuo \_ 103 [263.1] [262.1] [266.1] [264.1] [269.1] [268.1] [272.1] [277.1] [277] [284] [289] [288] [292] [292] [294] [223.0] [226.0] Lanthanoid + Actinoid 57 o 58 o 59 0 60 0 61 2 62 0 63 0 64 0 65 0 66 0 67 º 68 69 0 70 0 71 0 Nd Pm Sm Eu Er Yb Ce Pr Gd Tb Dv Ho Tm Lu La 138,91 140.12 140,91 144,24 [144,9] 150,36 151,96 157,25 158,93 162,5 164,93 167,26 168,93 173,05 174,97 89 2 90 0 91 2 92 0 93 2 94 0 95 4 96 4 97 4 98 4 99 4 100 4 101 4 102 4 103 4 Pa U Np Pu Am Cm Bk Cf Es Fm Ac Th Md No Lr

[227.0] 232.04 231.04 238.03 [237.0] [244.0] [243.0] [247.0] [247.0] [251.0] [252.0] [257.0] [258.0] [259.1] [262.1]

#### **Examples** for sustainable



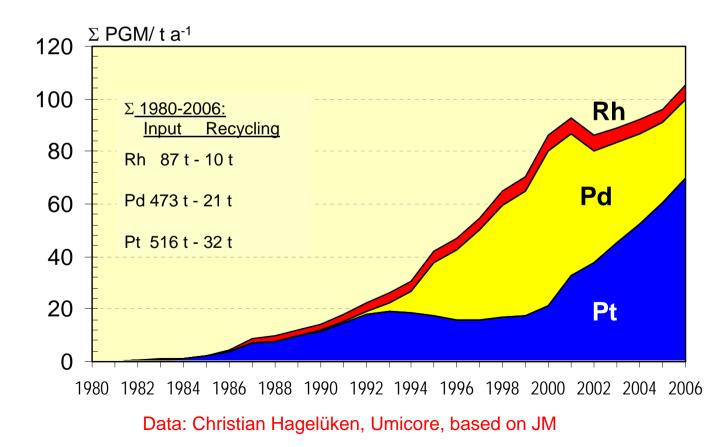
#### future technologies & therefore needed metals





### **Thesis 3:** In Europe the mines for special and precious metals are above ground!

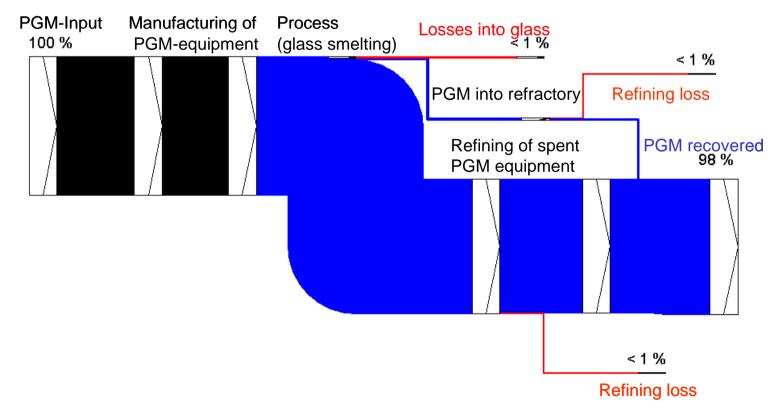
#### e.g.: Automotive catalysts: gross demand Pt,Pd,Rh in Europe





### **Thesis 4:** Europe could be the front-runner for recycling of critical metals!

Recycling streams in advanced systems e.g. platinum group metals in glass industry



Materials flow of platinum group metals, Öko-Institut, Umicore, GFMS 2005



# Thesis 5: Despite existing recycling technologies total losses of critical metals are very common in the EU and worldwide!

- mobile phones: ( < 10% EoL recycling rate: Cu, Au, Ag, Ta, Pd etc.)
- automotive catalysts: (ca. 50% PGM)
- LCDs: Indium (close to zero)
- batteries: Lithium (close to zero)
- In the future: Ga, Ge, In, Te from PV panels?





### **Thesis 6:** For green transformation Europe has to multiply the activities towards a recycling society!









### Preconditions for an optimized recycling in the future

- Enlargement of the global recycling capacities for many metals will be necessary in the next 1-2 decades! (e.g. PGM, Indium, Tellurium)
- Basic research, development and realization of new recycling technologies on metals with technical recycling problems (e.g. Tantalum, Rare earths, Lithium)
- Monitoring and controlling of illegal scrap-exports containing critical metals (e.g. WEEE)
- Know-how transfer and international cooperation regarding increasing stocks of used products in developing countries (e.g. old cars containing auto catalysts)



### Action for the next 5 – 10 years

- Platinum und Palladium: 70% EoL recycling rate should be achieved until 2020 (today about 50%)
- "New" critical metals Indium, Gallium, Germanium, Tellurium and Ruthenium: appropriate post-consumer recycling infrastructures and well-shaped pre-treatment and refining technologies will be essential
- Tantalum, Lithium and Rare Earths: basic research in suitable recycling processes



### **Conclusions and recommendations**

- Financial support by EU and other authorities regarding new recycling technologies for critical metals
- Special investment programs incl. low interest credits to support the design and realization of large scale recycling plants
- Continuous improvement of the legislation system (e.g. extension of the WEEE Directive regarding photo-voltaic modules)
- Establishment of Best Practice Guidelines for the entire recycling value-chain (knowledge input from different stakeholders)
- Know-how and technology transfer and international cooperation regarding increasing stocks of used products in developing countries (e.g. old cars containing auto catalysts)



### Thank you for your attention!



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