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Skládky ako (budúce) zdroje surovín a energie.

Ing. Marek Hrabčák
Geosofting, s.r.o., Prešov – Slovensko

Geo Soft Ing. s.r.o.
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Vítr má potenciál pokrýt polovinu světové spotřeby energie v roce 2030

?

Podle Archerové a Jacobsona by instalace čtyř milionů turbín měla mít výkon až 7,5 TW,

Energie větru by mohla uspokojit až polovinu světové poptávky po elektřině v roce 2030. Přitom na její pokrytí stačí instalace čtyř milionů turbín, které by měly výkon 7,5 TW. Tvrdí to společná studie amerických vědců z univerzit v Delaware a Stanfordu, která vypočítala celkový potenciál větrné energie v planetárním měřítku.

1,5 MW veterná turbína vyžaduje asi 350 kg prvkov vzácnych zemín (REE)

Na 7,5 TW potrebujeme cca 1 750 000 ton REE !

Súčasná celosvetová ročná ťažba je cca 124 000 ton
t.j. 14 rokov ťažby...

!

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Čo vieme z EUROSTATu ?

Table 1: Waste generation by economic activity and households, 2012 (1000 tonnes)

(1 000 tonnes)

8%

	Total	Mining and quarrying	Manufacturing	Energy	Construction	Other economic activities	Households
EU-28	2 514 220	733 980	269 630	96 480	821 160	379 560	213 410

Figure 4: Total waste landfilled by waste category, EU-28, 2012

TOTAL	**973 700 000**
Mineral waste from construction and demolition	40 960 000
Soils	112 790 000
Dredging spoils	3 630 000
Other mineral wastes (W122+W123+W125)	606 140 000
Recyclable wastes	2 700 000
Household and similar wastes	68 440 000
Combustion and mineral treatment wastes	83 400 000
Animal and vegetal wastes	7 020 000
Other waste	48 620 000

Cieľ EK znížiť skládkovanie HW z 28 na 10% znamená pokles z 974 na 927 mil. t

(- 4,8 %)

Čo vieme z EUROSTATu ?

2010-2011	Population density	Number of landfills				Landfilled waste (Eurostat 2010)	Average waste / landfill	Inhabitants per landfill	Landfill per Area	Landfilled per inhab.
	(in./ km^2)	inert waste	non haz. waste	hazardous waste	Σ	(t/year)	(t/year)		(landf./ km^2)	(kg/year)
Netherlands	406	?			22	2 126 000	96 636	765 909	1 888	126
Belgien - Flame	450	4	8	4	16	1 292 216	80 764	379 913	845	213
Czech Republic	133	76	155	31	179	4 204 000	23 486	58 690	441	400
Denmark	129	?			42	2 424 000	57 714	132 481	1 026	436
Slovakia	111	16	90	11	107	3 807 460	35 584	50 700	458	702
Poland	123	20	760	57	837	28 022 000	33 479	46 044	374	727
Germany	229	818	329	36	1 183	66 931 895	56 578	69 172	302	818
Schwitzerland	188	149	53		202	8 286 000	41 020	38 426	204	1 068
Austria	100	475	191		666	9 449 852	14 189	12 617	126	1 125
Ireland	64				48	5 853 802	121 954	93 140	1 464	1 309
France	120	628	303	14	945	113 293 936	119 888	69 653	579	1 721
Great Britain	384	179	245	23	447	89 832 000	200 966	112 081	292	1 793
Sweden	21	33	96	28	157	62 920 000	400 764	59 338	2 866	6 754

CORREL: Number of landfills / Population **0,900**
Landfilled pre inhab./Population density - 0,385

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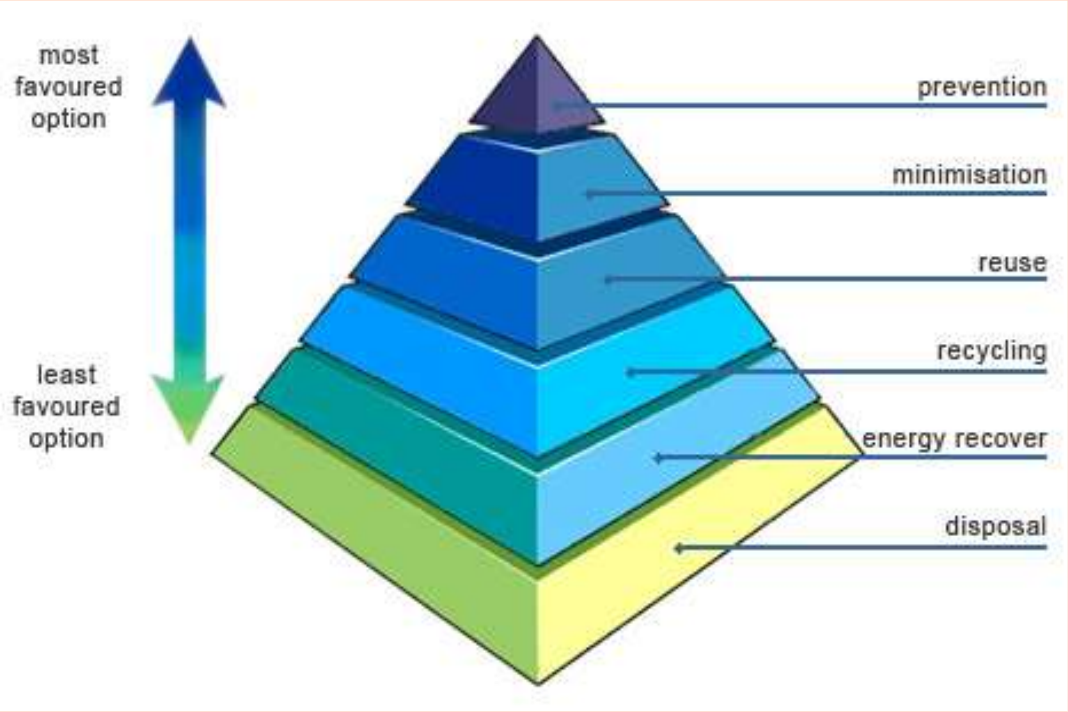
Čo vieme z EUROSTATu ?

Dánsko (2011): inert waste = 1,3 %
Nemecko (2014): inert waste 79 %

	Total waste generation	Mineral waste		Landfilled mineral waste		Land treatment MW	
Netherlands	123 613 000	83 145 971	67%	2 148 645	3%	43 569 134	**52%**
Austria	34 047 000	20 468 333	60%	11 332 312	**55%**	-	0%



One size will not fit all...

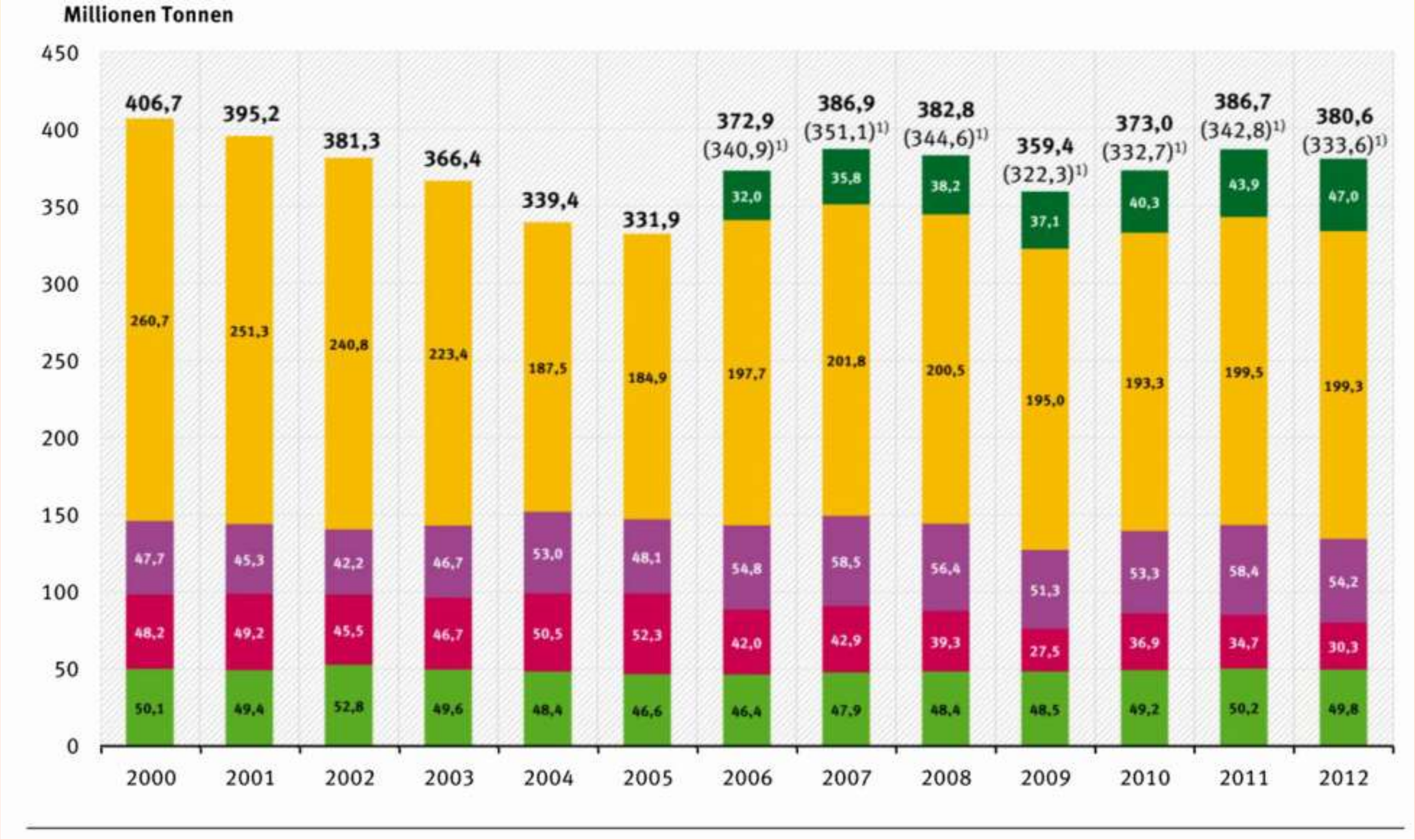


Abb. 6: Entwicklung und Zusammensetzung des Abfallaufkommens in Deutschland zwischen 2000 und 2012. Quelle: UMWELTBUNDESAMT 2014.

EURÓPSKA KOMISIA

V Bruseli 29. 2. 2012
COM(2012) 82 final

OZNÁMENIE KOMISIE EURÓPSKEMU PARLAMENTU, RADE, EURÓPSKEMU HOSPODÁRSKEMU A SOCIÁLNEMU VÝBORU A VÝBORU REGIÓNOV

SPRÍSTUPNENIE SUROVÍN PRE BUDÚCI BLAHOBYT EURÓPY

NÁVRH EURÓPSKEHO PARTNERSTVA PRE INOVÁCIE V OBLASTI SUROVÍN

{SWD(2012) 27 final}

Podiel EÚ na celosvetovom **baníctve** sa za posledných 50 rokov podstatne zmenšil. Viedlo to k strate nevyhnutnej odbornosti a zručností. Takéto zručnosti sú však potrebné, aby sa zaistila bezpečnosť baníckych činností a aby sa splnila potenciálna rastúca potreba ťažiť hlbšie, vo vzdialenejších oblastiach a za ťažších podmienok (napr. na morskom dne, v arktickej oblasti). Vysoká úroveň bezpečnejších a ekologicky priaznivejších techník ťažby predstavuje nové výzvy a zároveň vytvára nové trhové príležitosti. Znížilo by sa tak aj riziko závažných nehôd v baníctve. Táto odbornosť a zručnosti však nie sú požadované iba v oblasti ťažby, ale v celom hodnotovom reťazci (prieskum, spracovanie, recyklácia, náhrada).

Aj keď Európa ako celok urobila významný pokrok, najmä pokiaľ ide o recykláciu odpadov, dá sa urobiť viac na zabránenie plytvania cennými surovinami vo všetkých fázach ich životného cyklu. Plným uplatnením prvých krokov európskej „hierarchie odpadov“ (prevencia, po ktorej nasleduje príprava na opakované využitie a recykláciu) by sa mohlo zabrániť nenapraviteľnej strate cenných zdrojov a mohli by sa vytvoriť nové podnikateľské a pracovné príležitosti v EÚ.

„Critical raw materials for the EU 2010.“

EK analyzovala 41 minerálov a kovov -14 z nich je pre EU kritických:

antimon, berylium, fluorit, galium, germanium, grafit, indium, kobalt, Pt skupina, vzácne zeminy = REE, magnézium, niob, tantal a wolfrám

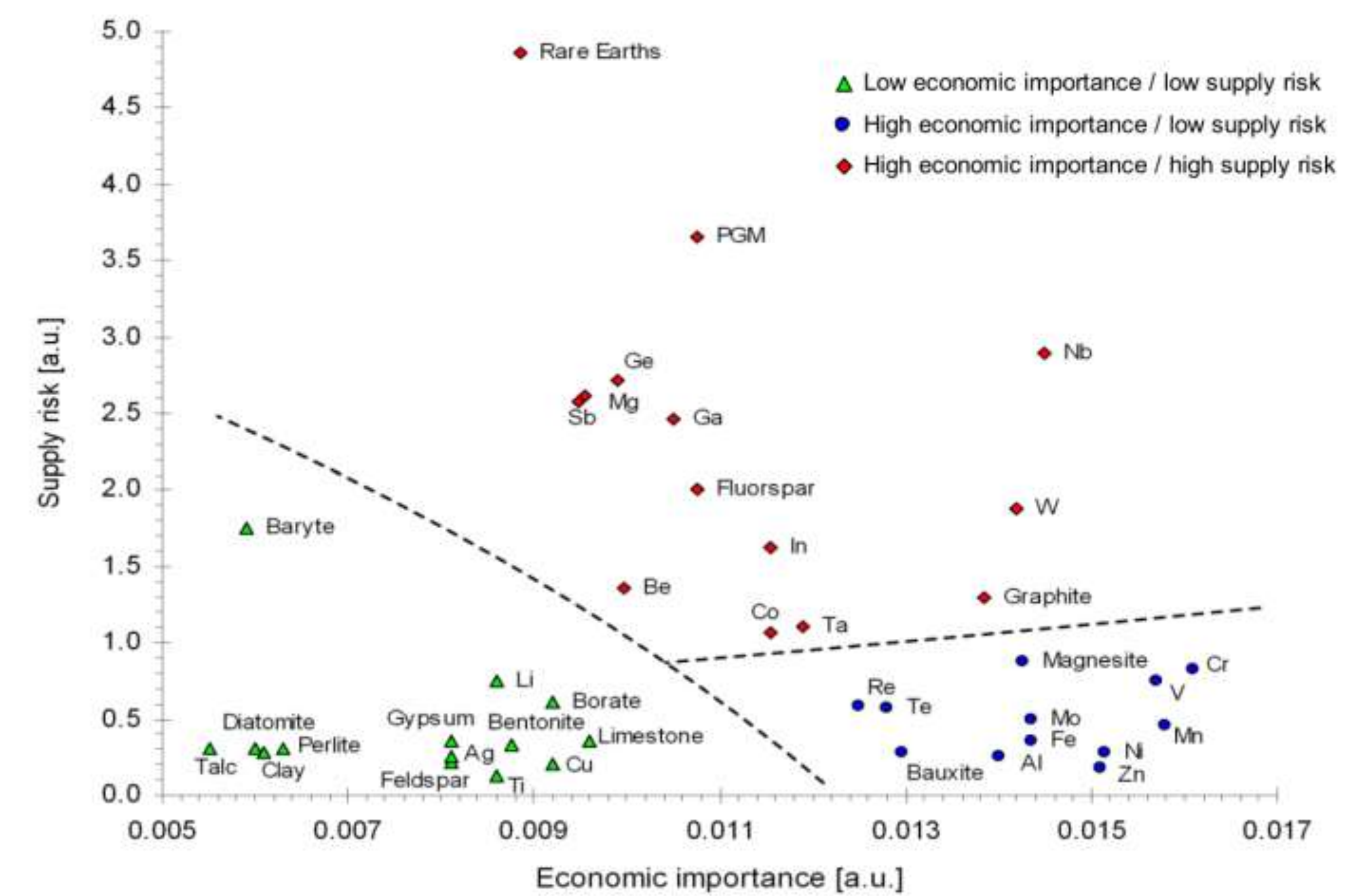


Figure 3: Economic importance and supply risk of 41 minerals and materials.

Element or element group	Symbol	Risk	Leading producer	Element or element group	Symbol	Risk	Leading producer
antimony	Sb	8,5	China	cadmium	Cd	5,5	China
platinum group elements	PGE	8,5	South Africa	lithium	Li	5,5	Australia
mercury	Hg	8,5	China	calcium	Ca	5,5	China
tungsten	W	8,5	China	phosphorous	P	5,0	China
rare earth elements	REE	8,0	China	barium	Ba	5,0	China
niobium	Nb	8,0	Brazil	boron	B	4,5	Turkey
strontium	Sr	7,5	China	zirconium	Zr	4,5	Australia
bismuth	Bi	7,0	China	vanadium	V	4,5	Russia
thorium	Th	7,0	India	lead	Pb	4,5	China
bromine	Br	7,0	USA	potassium	K	4,5	Canada
carbon (graphite)	C	7,0	China	gallium	Ga	4,5	China
rhenium	REE	6,5	Chile	flourine	F	4,5	China
iodine	I	6,5	Chile	copper	Cu	4,5	Chile
indium	In	6,5	China	selenium	Se	4,5	Japan
germanium	Ge	6,5	China	carbon (coal)	C	4,5	China
beryllium	Be	6,5	USA	zinc	Zn	4,0	China
molybdenum	Mo	6,5	Mexico	uranium	U	4,0	Kazakhstan
helium	He	6,5	USA	nickel	Ni	4,0	Russia
tin	Sn	6,0	China	chlorine	Cl	4,0	China
arsenic	As	6,0	China	sodium	Na	4,0	China
silver	Ag	6,0	Peru	carbn (diamonds)	C	4,0	Russia
tantalum	Ta	6,0	Rwanda	sulphur	S	3,5	China
manganese	Mn	5,5	China	iron	Fe	3,5	China
magnesium	Mg	5,5	China	chromium	Cr	3,5	Canada
cobalt	Co	5,5	DRC	aluminium	Al	3,5	Australia
gold	Au	5,5	China	titanium	Ti	2,5	Australia

: Index rizika pre kovy a prvky z hľadiska ich strategického významu (zdroj Ohrlund, 2011)

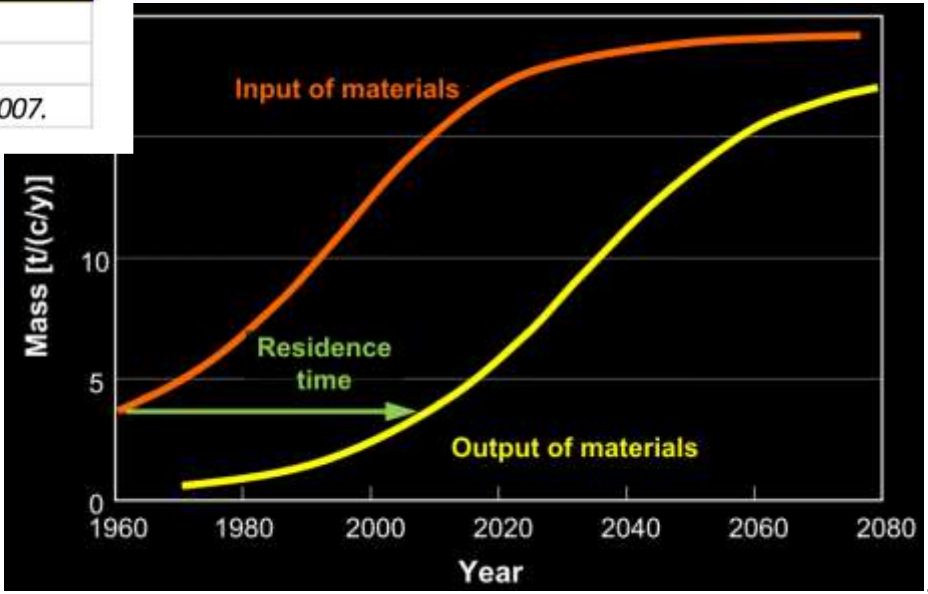
„Spiace suroviny“ v elektronike.

Metal		World Mine Production, 2007 (t/yr)	Demand from Electronics Sector (t/yr)	Electronics sector demand/mine production
Silver	Ag	20,000	6,000	30%
Gold	Au	2,500	250	10%
Palladium	Pd	215	32	15%
Platinum	Pt	220	13	6%
Ruthenium	Ru	30	6	20%
Copper	Cu	16,000,000	4,500,000	28%
Tin	Sn	275,000	90,000	33%
Antimony	Sb	130,000	65,000	50%
Cobalt	Co	58,000	11,000	19%
Bismuth	Bi	5,600	900	16%
Selenium	Se	1,400	240	17%
Indium	In	480	380	79%

Source: Christian Hageluken, Umicore Precious Metals Refining, presentation at the Basel Convention, Geneva Switzerland, 7 Sept. 2007.

Anthropogenic Metabolism and Environmental Legacies

Paul H Brunner and Helmut Rechberger

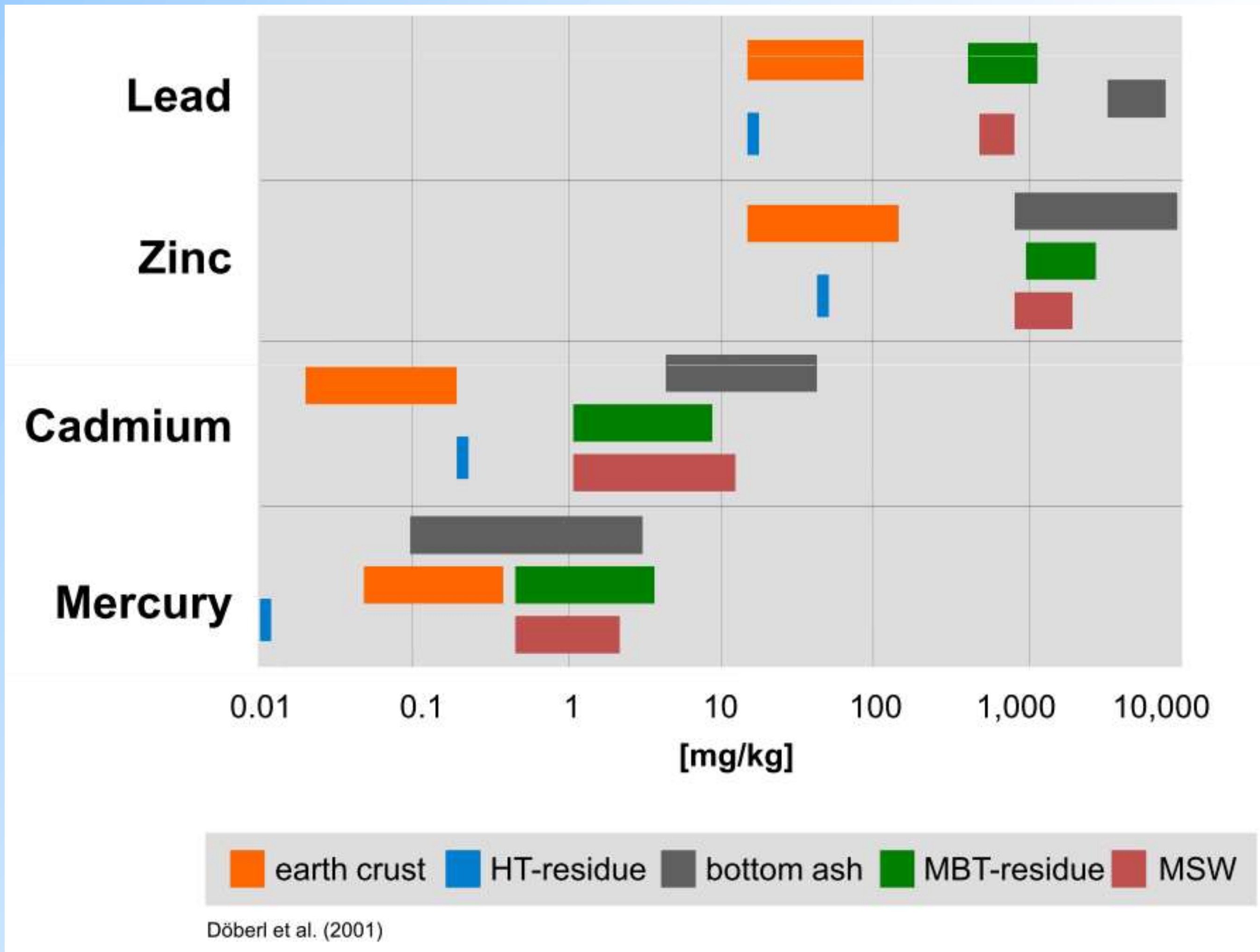


Critical raw materials for the EU 2010.

Ako sa uvádza v štúdii EK, **jedna tona mobilov obsahuje zhruba 300 – 350 g zlata, 140 g platiny a paládia a asi 70 kg medi.**

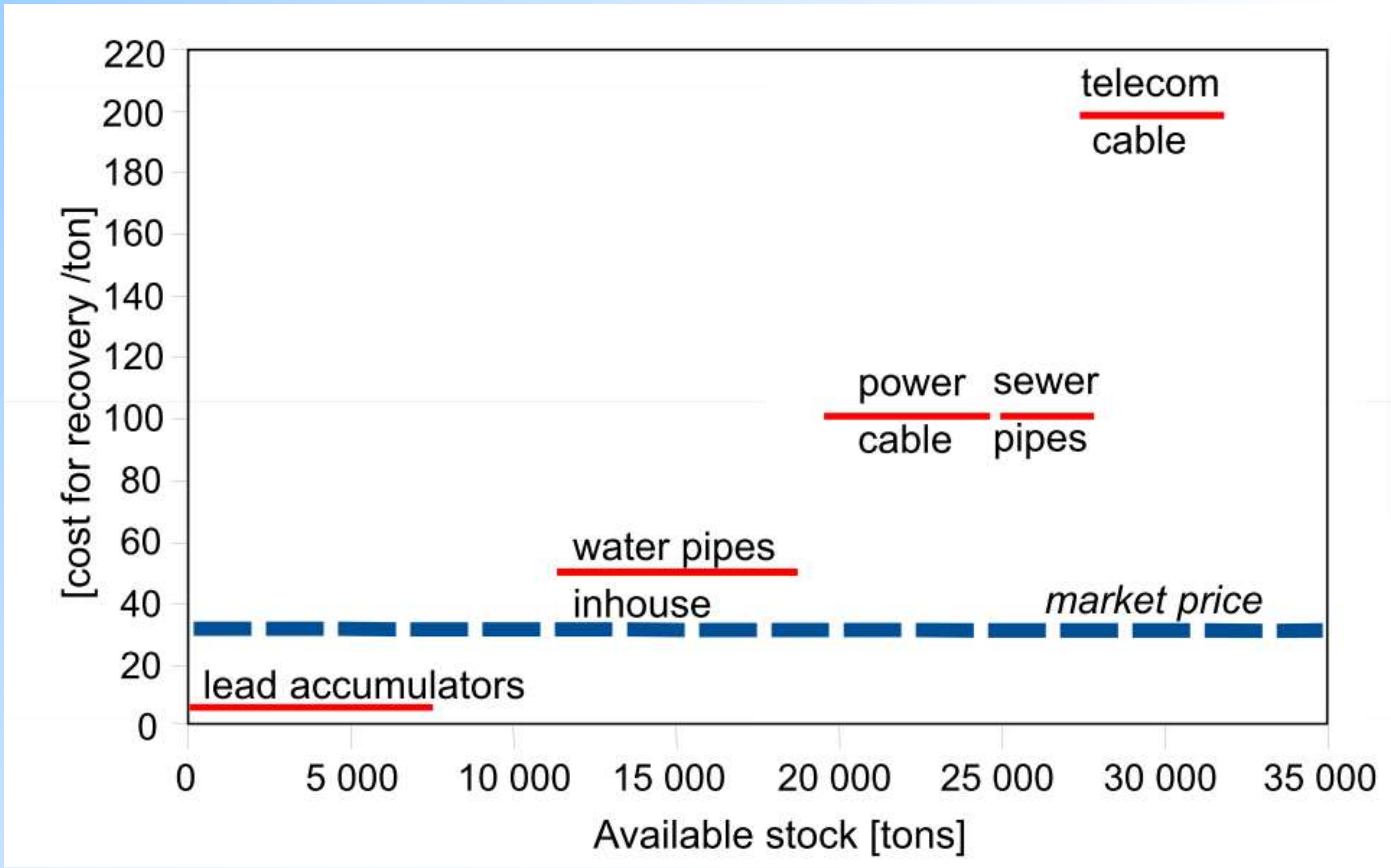
Pritom štáty EU dnes recyklujú v priemere len asi 2 % mobilov !

URBAN mining – „spiace suroviny“ v odpadoch.

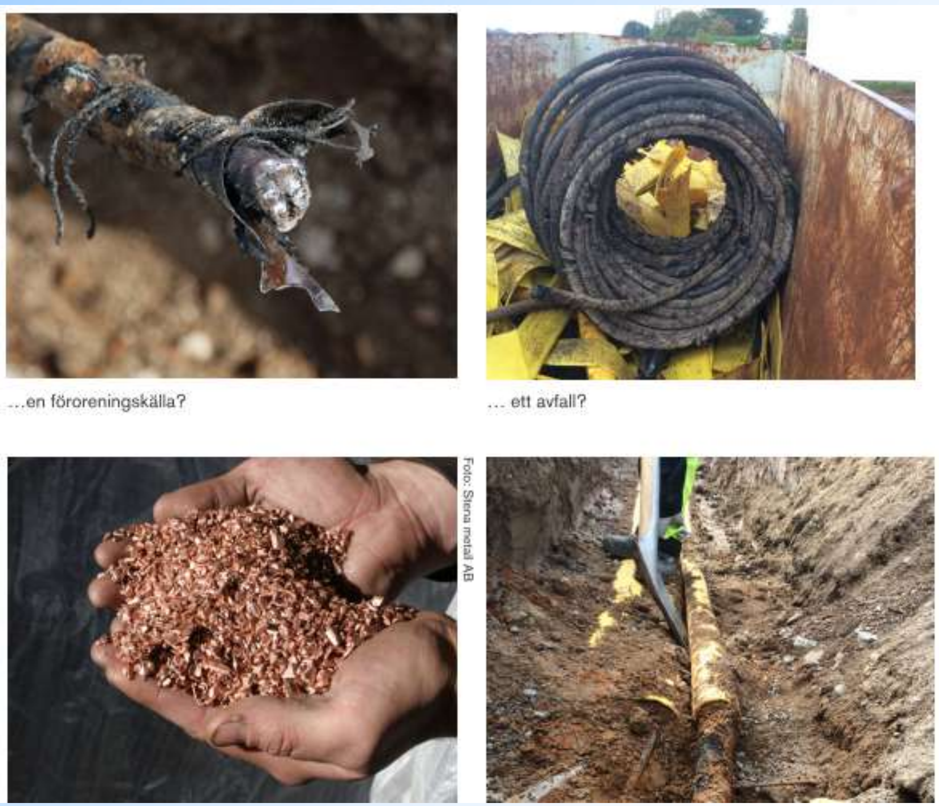


Úloha „trhovej ceny“ pri recyklácií odpadov

What is the value of these recyclables? Ex. lead



Prof. Dr. Paul H. Brunner
paul.h.brunner@tuwien.ac.at



...en föroreningskälla?

... ett avfall?

Foto: Stena metall AB

Krook, J., Svensson, N., Wallsten, B. (2015). Urban infrastructure mines: on the economic and environmental motives of cable recovery from subsurface power grids. *Journal of Cleaner Production* 104, 353–363.

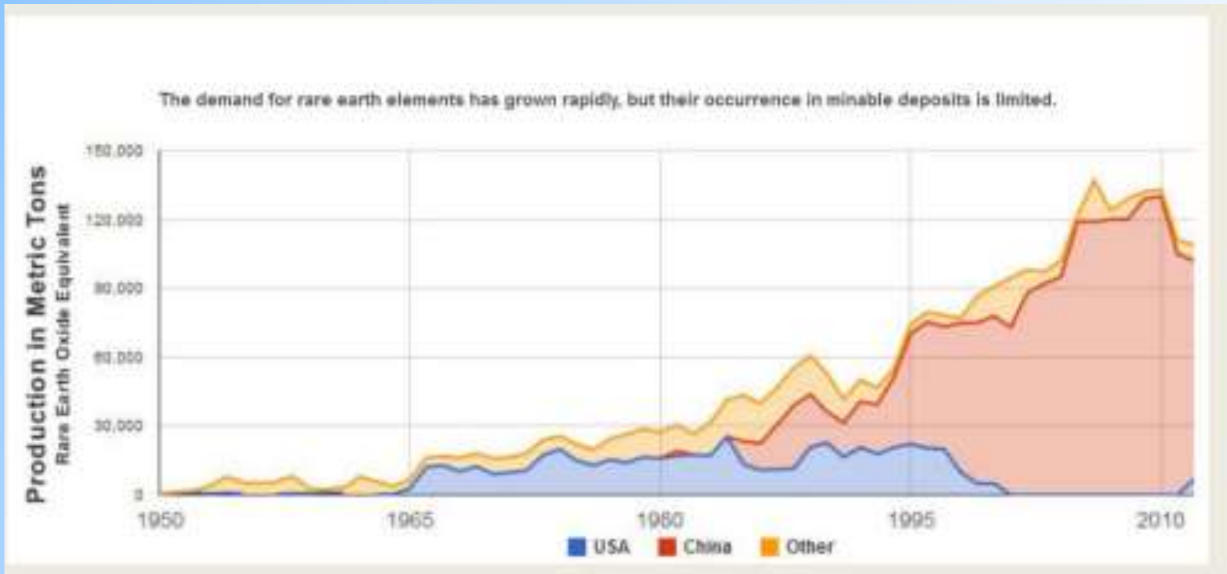
Larsson, H. *Economic and environmental conditions for extraction and recycling of ground power cables.* Examensarbete, Industriell miljöteknik, Linköpings universitet, 2015.

Future Metal Demand from Photovoltaic Cells and Wind Turbines

Investigating the Potential Risk of Disabling a Shift to Renewable Energy Systems

FINAL REPORT

prvok	značka	spotreba	ročná svetová ťažba[1]	sp/r.ť.	súčasné svetové zásoby[1]	sp/s.z.
		(t)	(t)	(%)	(t)	(%)
Kobalt	Co	**115**	120 000	0,10%	7 200 000	0,002%
			110 000	0,10%	7 500 000	0,002%
Indium	In	**540,7**	770	**70%**		
			670	**81%**	12 400	4,4%
Paladium	Pd	**40,6**	211	**19%**	66 000	0,062%
			222	**18%**		
Tantal	Tn	**249**	590	**42%**	100 000	0,25%
			765	**33%**	150 000	0,17%
Telur	Te	**34,4**				
			80	**43%**	24 000	0,14%
Fluorit	CaF_2	**76 052**	6 700 000	1,14%	240 000 000	0,03%
			6 850 000	1,11%	240 000 000	0,03%
REE	REE	**23 237**				
			110 000	**21%**	10 000 000	0,23%


The demand for rare earth elements has grown rapidly, but their occurrence in minable deposits is limited.
Production in Metric Tons
Rare Earth Oxide Equivalent
150,000
120,000
90,000
60,000
30,000
0
1950
1965
1980
1995
2010
USA
China
Other


Evolution of landfill mining in US
Early 1980s
Extend Life
Late 1980s
Remediation
1990s
GW Protection
2010s
Material Recovery
2020s
REE Recovery?

Future Metal Demand from Photovoltaic Cells and Wind Turbines

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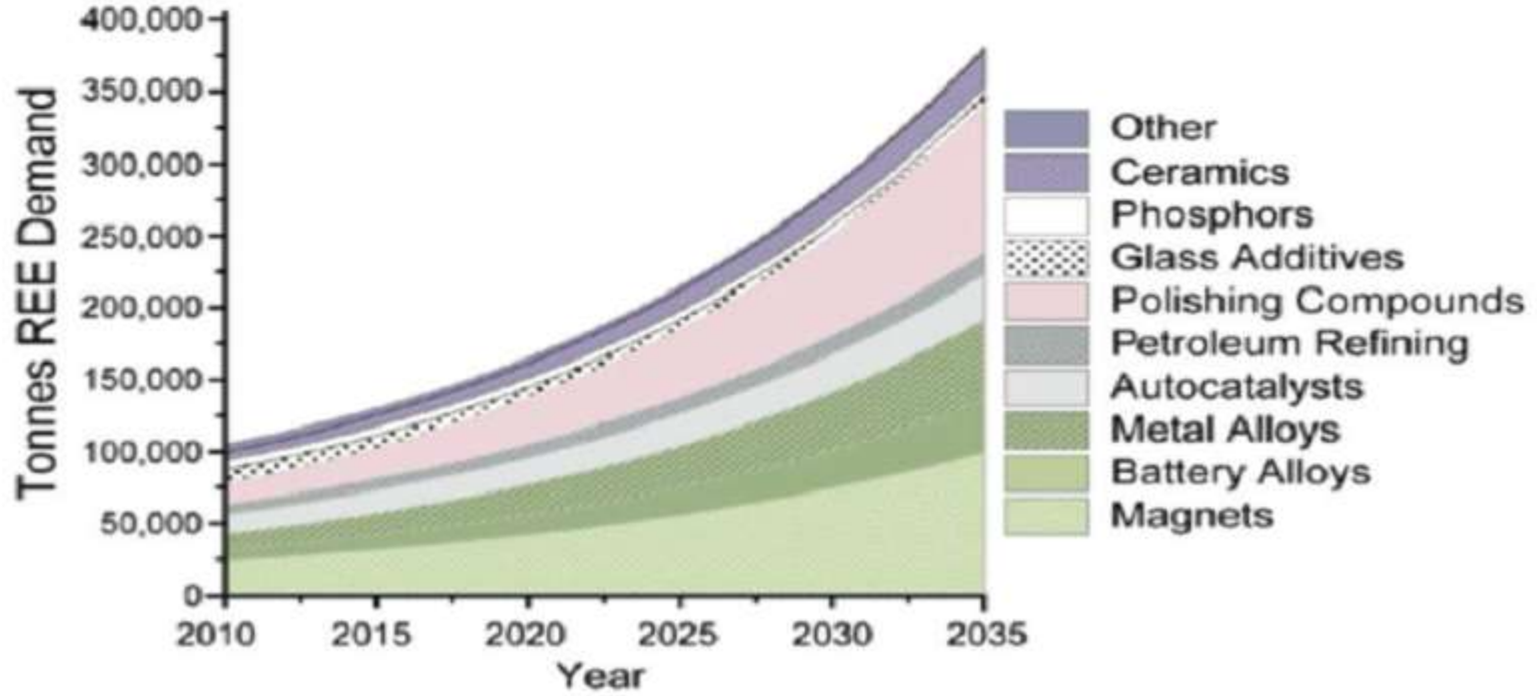
FINAL REPORT

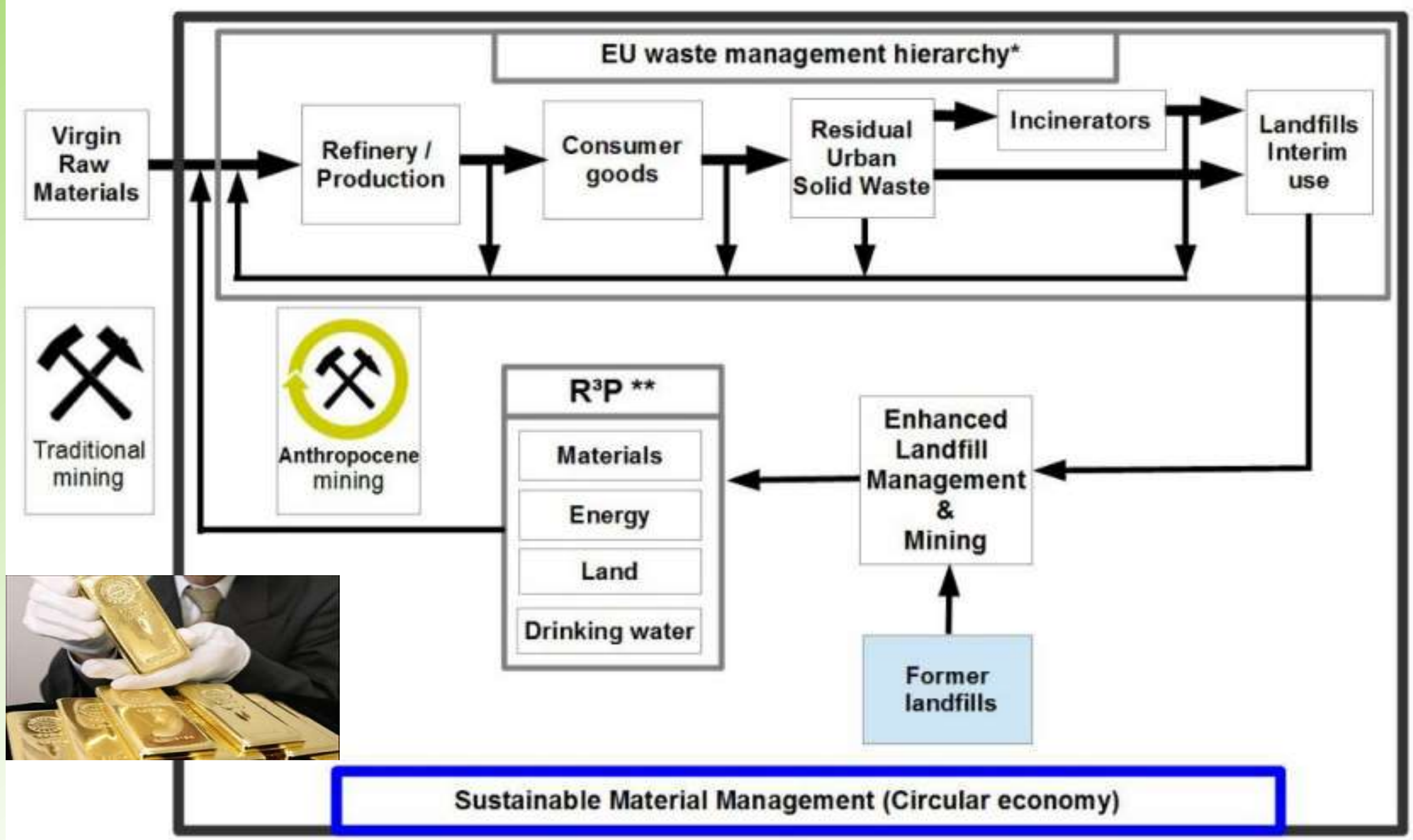


Zdroj :. Alonso et al, 2012

Sustainable stock management and landfills: introduction to Enhanced Landfill Management & Mining (ELFM²).

Eddy Wille[1]

[1] OVAM (Public Waste Agency of Flanders), Stationsstraat, 110 – 2800 Mechelen, Belgium, www.ovam.be

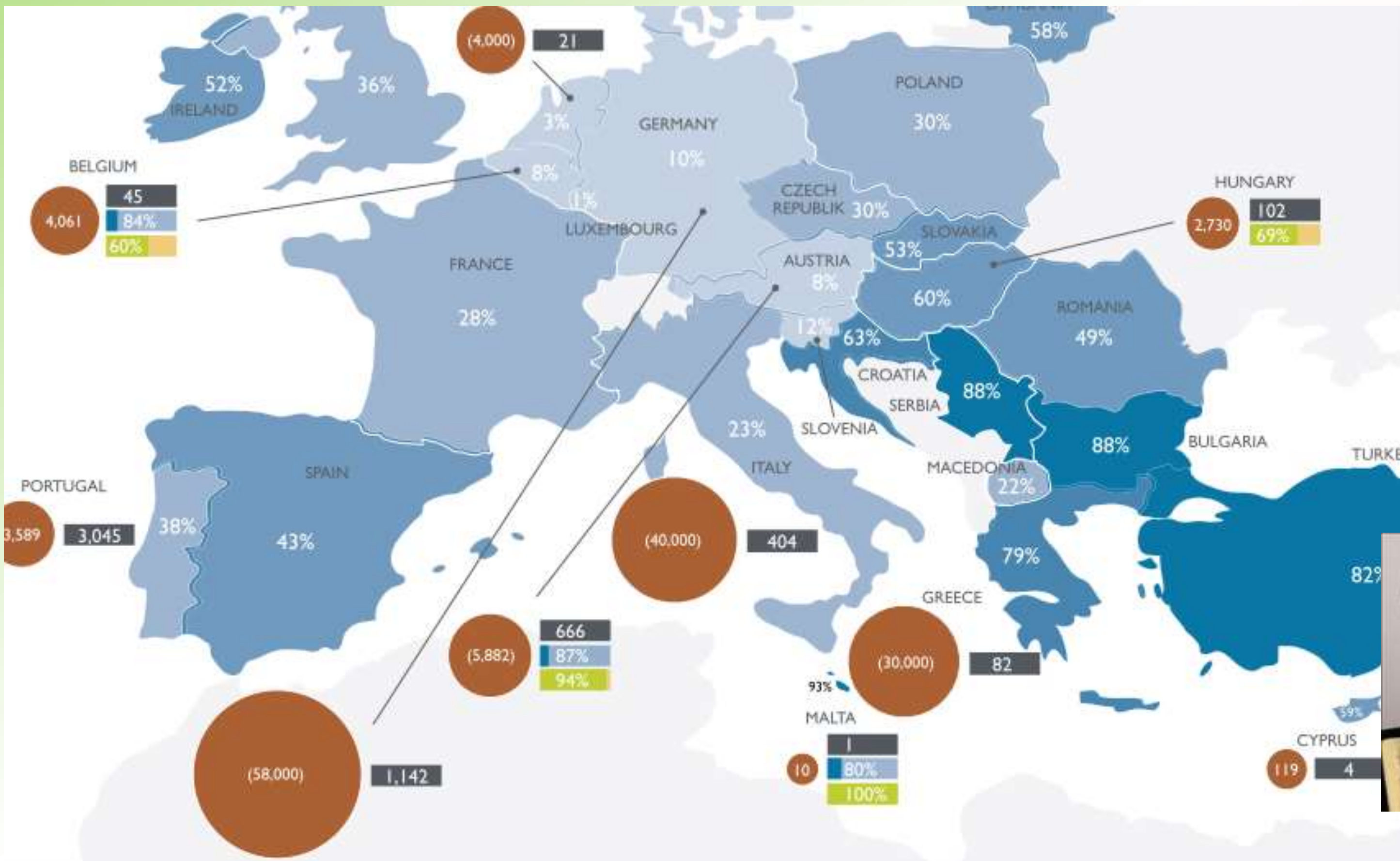


*Prevention (Ecodesign, dematerialisation,...), Reuse/ Recycling, Incineration, Landfilling (EU Waste Framework Directive)
** R³P = Recycling of Materials, Recovery of Energy, Reclaiming of Land, Preserving Drinking water supplies

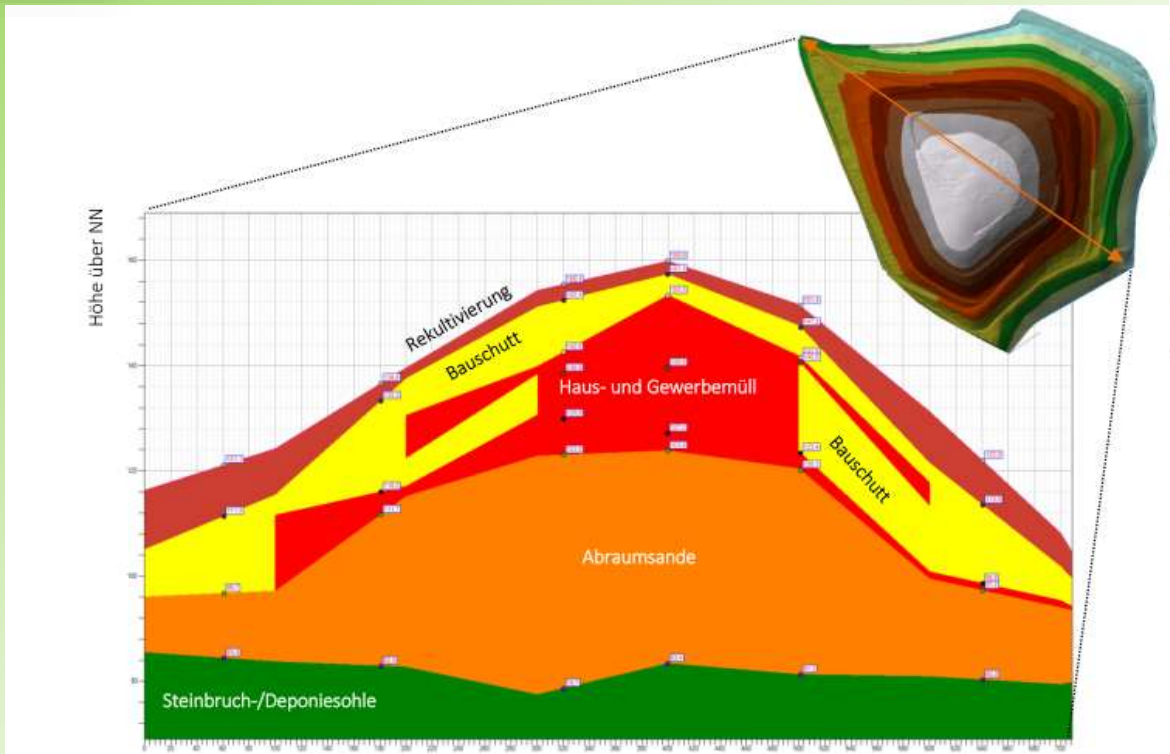
3rd Int. Symposium on Enhanced Landfill Mining, Lisboa, 8-10/2/2016

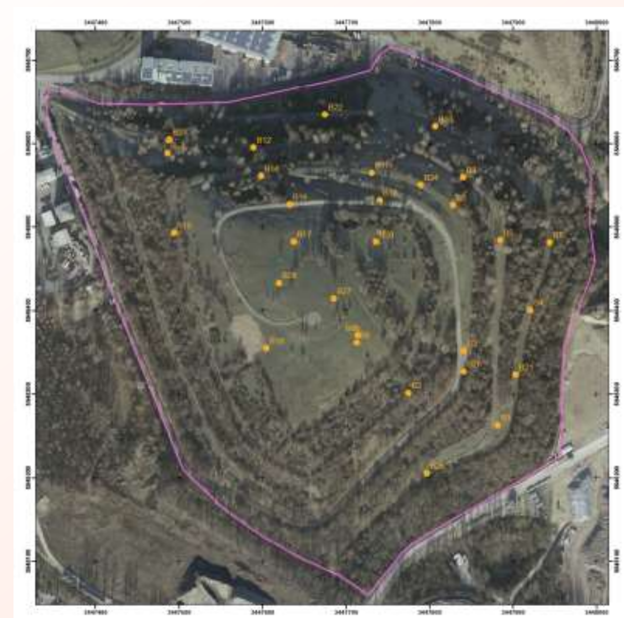
FIRST SEMINAR ABOUT ENHANCED LANDFILL MINING
20 OCTOBER 2015
EUROPEAN PARLIAMENT

In 2015 EURELCO launched a bottom-up inventory exercise to obtain better data on Europe's landfills. Data were obtained for 15 EU Member States, with respect to current landfill rates, the amount of still operational landfills, the total amount of landfills and the distribution ratios sanitary vs. non-sanitary landfills and MSW vs. industrial landfills. The results of this inventory suggest that the previously cited figure of 150,000 and 500,000 landfills is an underestimate. Furthermore, the inventory also shows that at least 90% of Europe's landfills are "non-sanitary" landfills, which predate the EU's Landfill Directive (1999), and that the majority of landfills are MSW-based landfills. Concurrently, between 0 and 40% of the landfills contain predominantly industrial waste, including critical metal containing industrial residue landfills. Critical metal recovery from these landfills is a major opportunity for Europe.



Ressourcenpotenzial des Deponieabschnitts I der Deponie Dyckerhoffbruch in Wiesbaden





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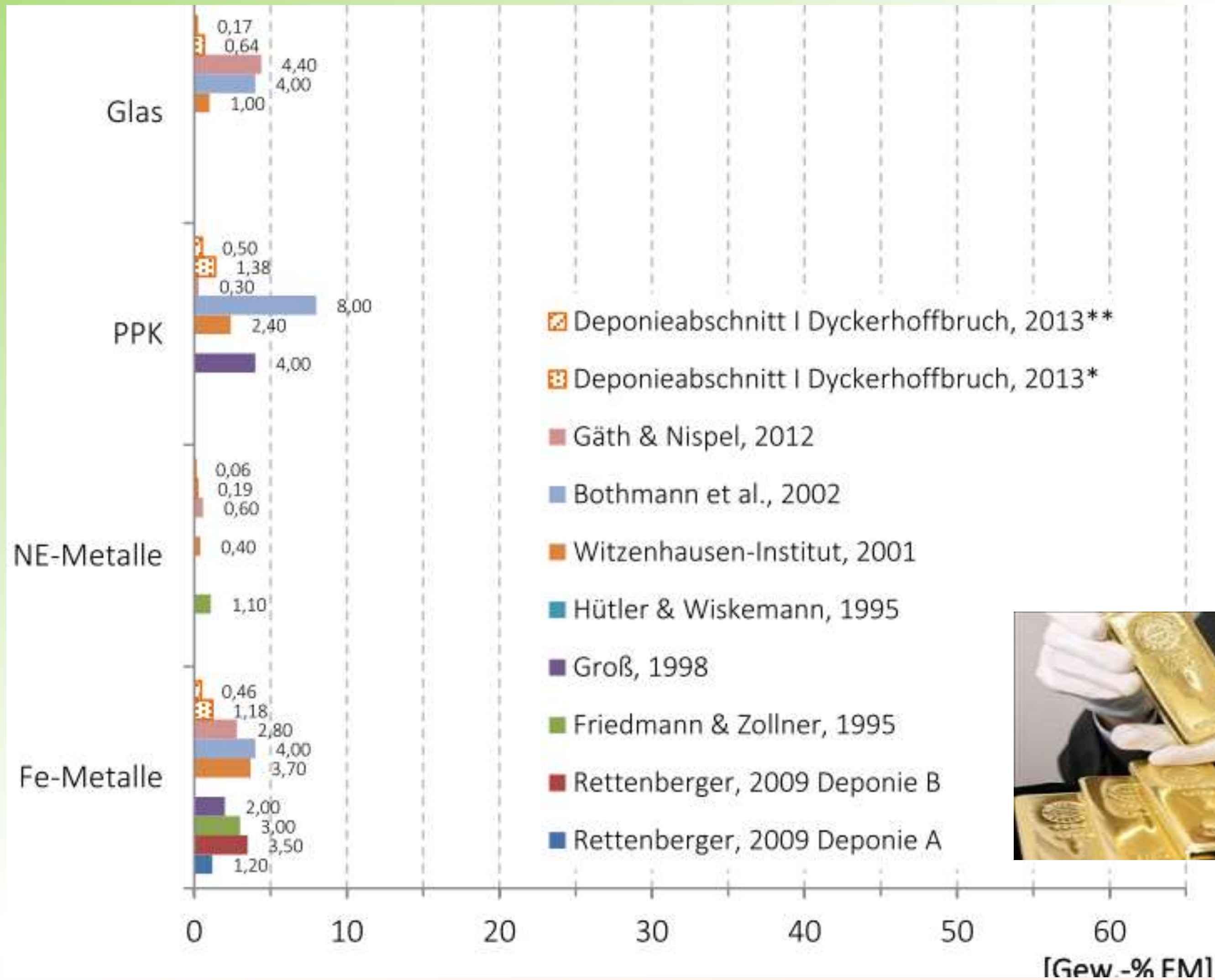

EUREKA! MINING OF METALS IN AN ASHFILL

By **Travis P. Wagner** and **Kevin Roche**

The 8 hectare ashfill contains around 725,750 tonnes of ash containing approximately 9% to 16%, by weight of post-burn ferrous metals

Travis Wagner, Ph.D.
Department of Environmental Science
University of Southern Maine

Geo Soft Ing. s.r.o.
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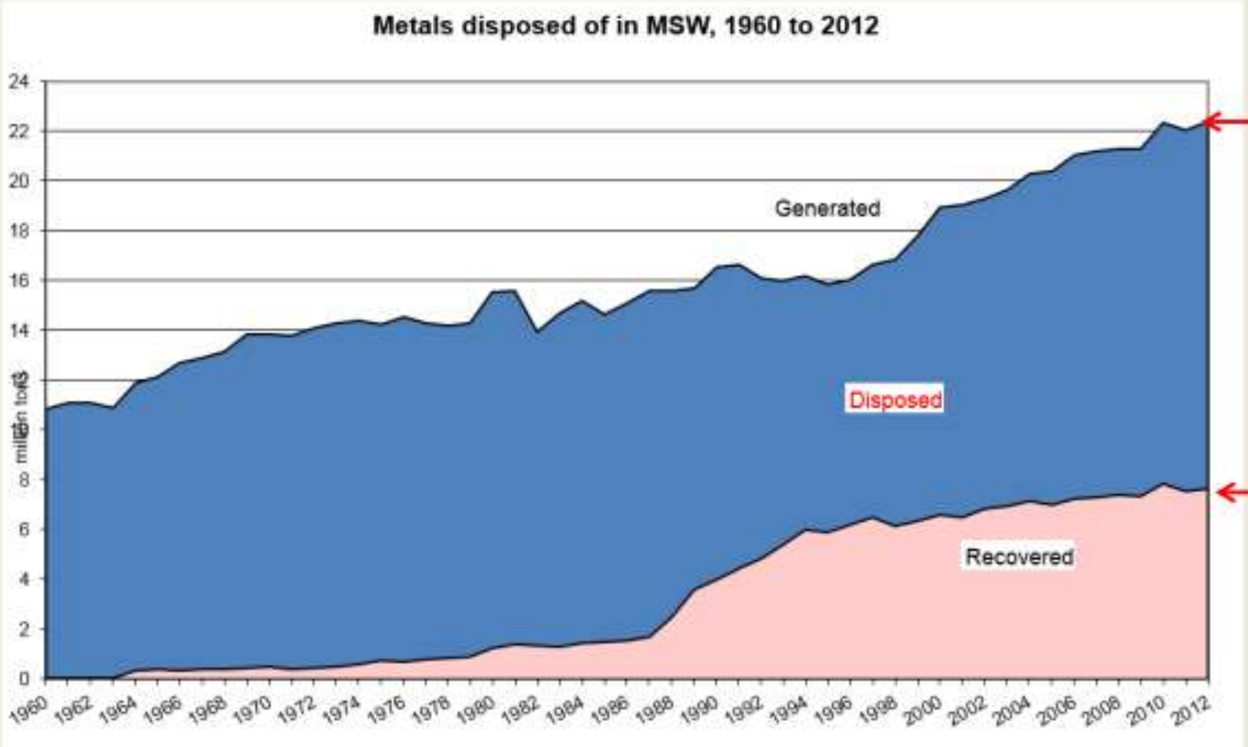


- At current market value, landfilled metal worth >**$114.2 billion**

Skládka kalov Vojtovce.

	Cu	Cr	Ni	Zn
	mg/kg = g/t			
S-1	76 645	4 554	9 032	76 048
S-2	26 216	904	16 137	25 835
S-3	20 857	1 443	2 257	24 855
Ø	41 239	2 300	9 142	42 246

Rozpočtové náklady na uzavretie a rekultiváciu skládky: **380 000 EUR**

Tržná cena kovov v kale na skládke: **1 505 000 EUR**

LANDFILL MINING

Process, Feasibility, Economy, Benefits and Limitations

July 2009

René Møller Rosendal

Motivation - Landfill Mining

LANDFILL MINING – A CONTRIBUTION TO CONSERVATION OF NATURAL RESOURCES?

Sebastian Wanka, Klaus Fricke, Kai Münnich, Anton Zeiner

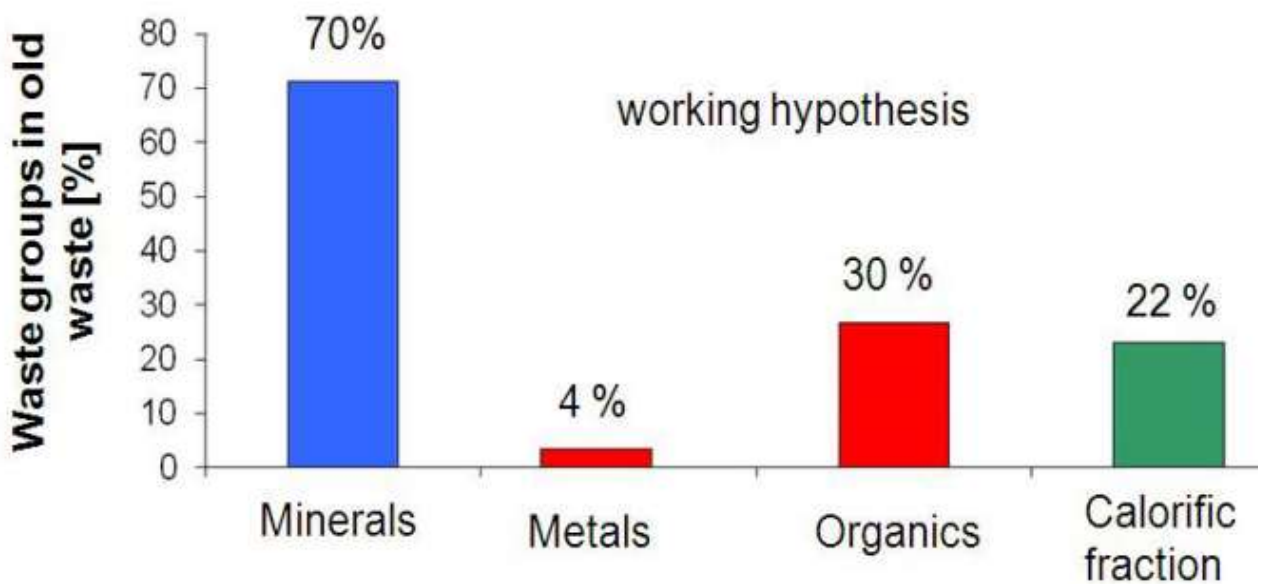
Protection of waters

Climate protection

Lifetime extension of landfill

Recycling of land area

Resource extraction



LFMR History: Principal drivers

Project Driver	UK	Europe (Excluding UK)	North America	Asia	Total
Not specified		12	4	2	18
Voidspace recovery		3	4		7
To allow site redevelopment	3	2		1	6
To mitigate pollution		2	5	1	8
To improve landfill engineering	3	1	2	1	7
Material reclamation for recycling or energy production		3	2	6	11
TOTAL PROJECTS	6	*23 projects across 8 countries*	*17 projects (1 Canada, 16 USA)*	11	57

LANDFILL MINING – A FEASIBILITY STUDY FOR SCOTLAND

David Lerpiniere – Principal Consultant

Waste Management & Resource Efficiency, Ricardo-AEA

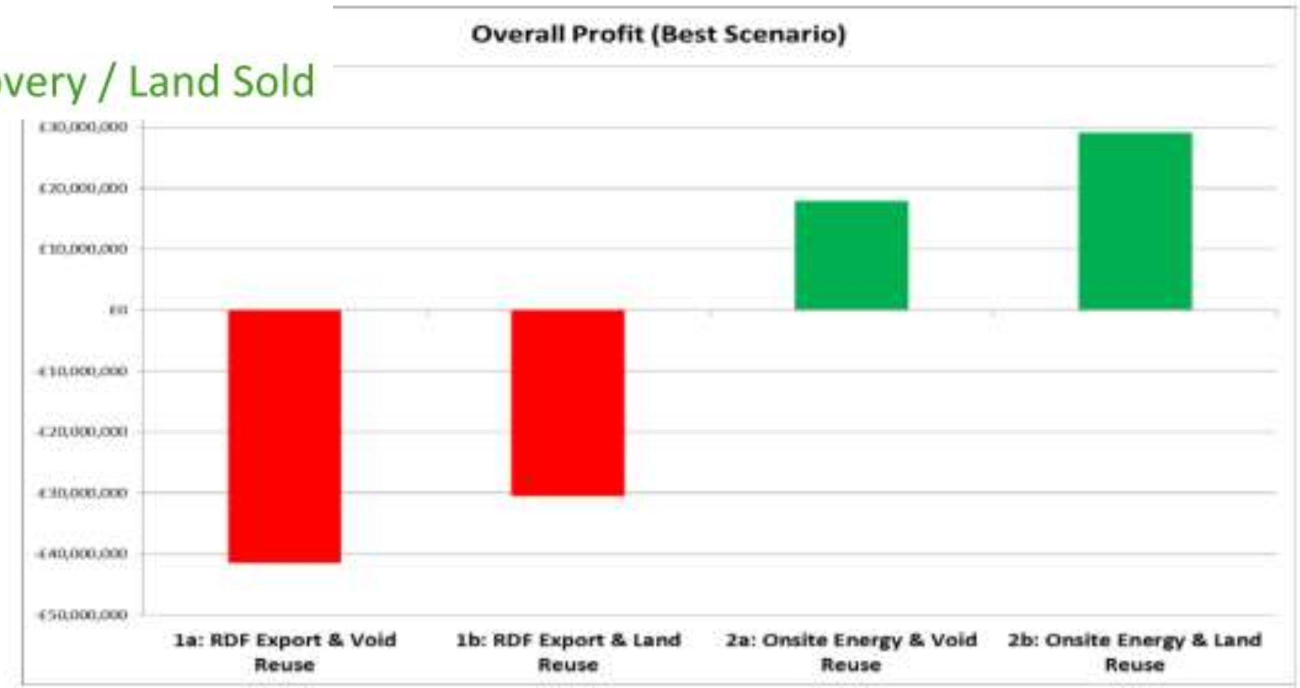
Landfill Mining

2013

Landfill mining – predstavy a skutočnosť.

Economic Issues: High Level Economic Assessment

- 4 Scenario's modelled:
  - RDF Export / Voidspace Reuse.
  - RDF Export / Land Sold
  - Onsite Energy Recovery / Voidspace Reuse
  - Onsite energy recovery / Land Sold



We need more - raw materials or energy ?

Exploring the socio-economics of Enhanced Landfill Mining

Steven VAN PASSEL[1,*], Serge DE GHELDERE[2], Maarten DUBOIS[3,4], Johan EYCKMANS[3,4], Karel VAN ACKER[5]
[1]Hasselt University, Faculty of Business Economics, Centre for Environmental Sciences, B-3590 Diepenbeek, Belgium
[2]Futureproofed, B-3000 Leuven
[3]Hogeschool-Universiteit Brussel, B-1000 Brussels, Belgium
[4]Katholieke Universiteit Leuven, Center for Economic Studies, B-3000 Leuven, Belgium
[5]Katholieke Universiteit Leuven, Department of Metallurgy and Materials Engineering, B-3001 Heverlee, Belgium
*corresponding author: steven.vanpassel@uhasselt.be

Table 3: Social Cost Benefit Analysis for ELFM in Flanders

Data		
Site surface (m^2)	20 000 000	
Costs		
Total (€)	12 779 680 000	
Benefits	**13 096 814 876**	
Total WtM (€)	1 534 382 080	12 %
Total WtE (€)	9 937 782 556	76 %
Landfill reclamation (€)	1 368 000 000	10 %
Reduced carbon footprint	256 650 240	2 %
Total (€)	**317 134 876**	

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Keď neviete, kde začať...

THE END.

Akcie išli dole.
Zisky z nehnuteľností sú hrozné.
Do čoho by som mal investovať ?

Skládky !
Jedného dňa dôjdu suroviny a my začneme ťažiť naše skládky, kam dnes ukladáme odpadky...

Skládky ?
OK, píšem si.

Ďakujem za Vašu pozornosť

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