



Technology metals scarcity

Marc Grynberg, CEO

Econopolis 24 May 2011

Umicore is a global leader in...



... automotive catalysts for passenger cars



... key materials for rechargeable batteries used in hybrid & electric cars and portable electronics



... germanium substrates and other materials which are used in new PV technologies



... recycling precious metals from old mobile phones, laptops, electronic scrap and spent catalyst material

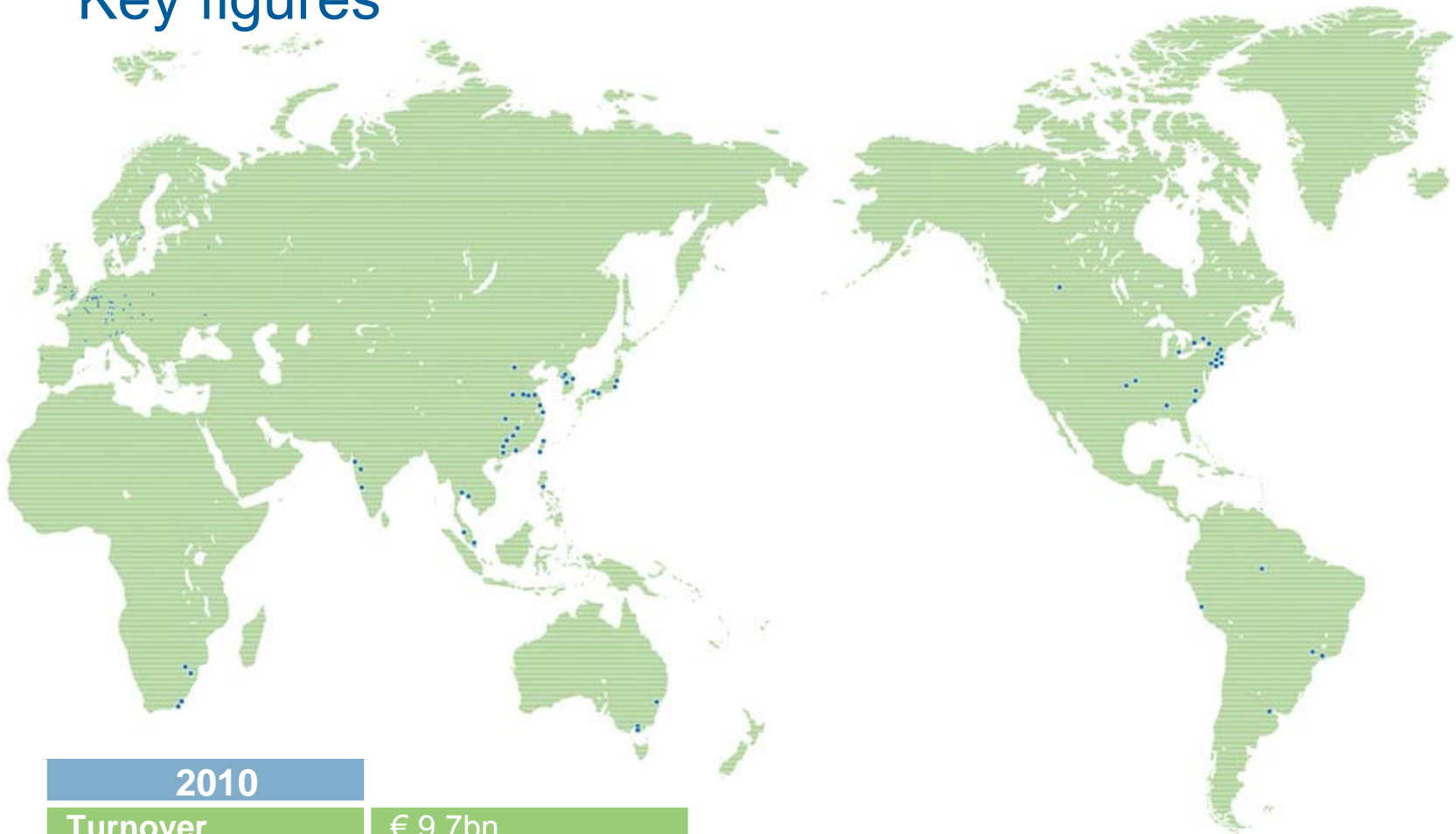
Recognized for leadership in sustainable development



World Business Council for Sustainable Development



Key figures



2010	
Turnover	€ 9.7bn
Revenues	€ 2.0bn
REBIT	€ 342 m
REBITDA	€ 469 m
ROCE	17,5 %

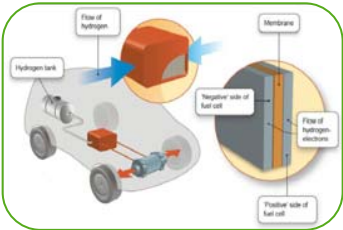

EPS	€ 2,33 / share
Dividend	€ 0,80 / share
Colleagues	14.386
Sites	78

What are technology metals?

Metals used in hi-tech applications, especially in clean-tech and renewable energy



**Umicore
metals**

H																	He				
Li	Be															B	C	N	O	F	Ne
Na	Mg															Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr				
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe				
Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn				
K	Ca	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt													

What are technology metals?

Metals used in ...



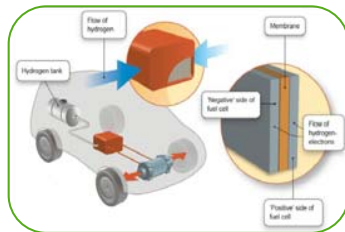
Batteries for
hybrid and
electric vehicles

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
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What are technology metals?

Metals used in ...

Fuel cells



H																		He
Li	Be											B	C	N	O	F	Ne	
Na	Mg											Al	Si	P	S	Cl	Ar	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	
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What are technology metals?

Metals used in ...

Emission
abatement



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Li	Be											B	C	N	O	F	Ne
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What are technology metals?

Metals used in ...

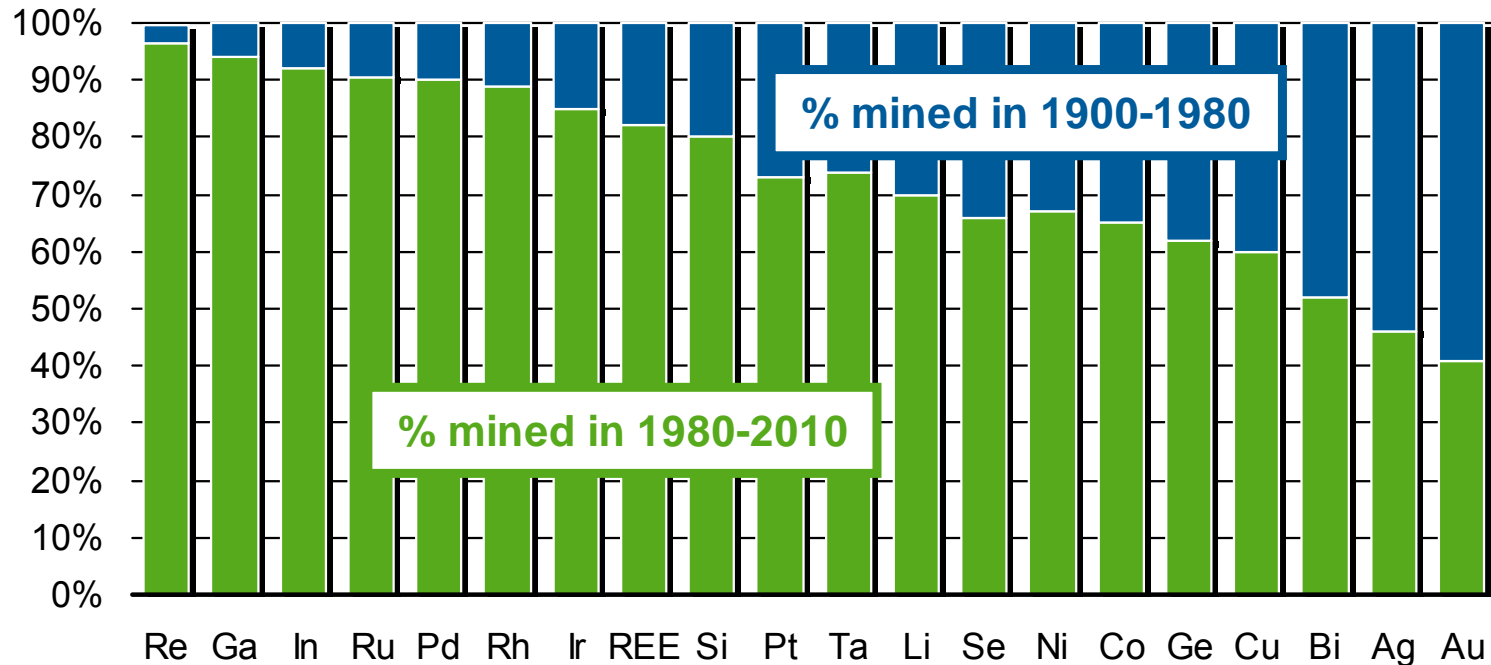
Photovoltaics



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Recent boom in demand for most technology metals

Mine production since 1980 / since 1900



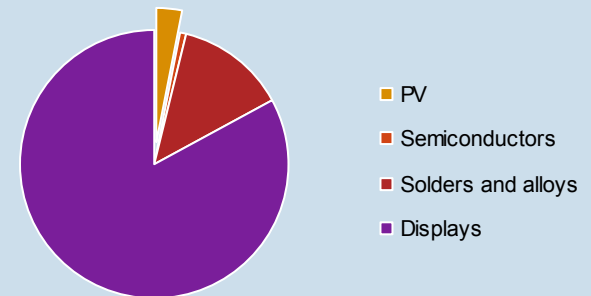
REE = Rare Earth Elements

An example: indium

2010



- total world consumption
~1,000 tonnes/yr



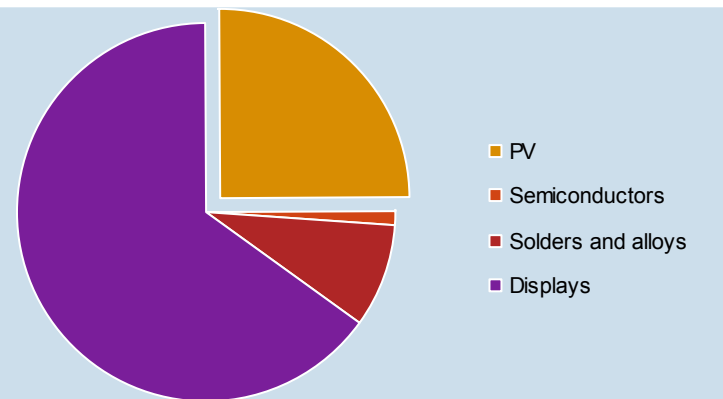
Based on Umicore scenario for PV: 80 GW/y in 2020, 35% share Thin Film PV

An example: indium

2020



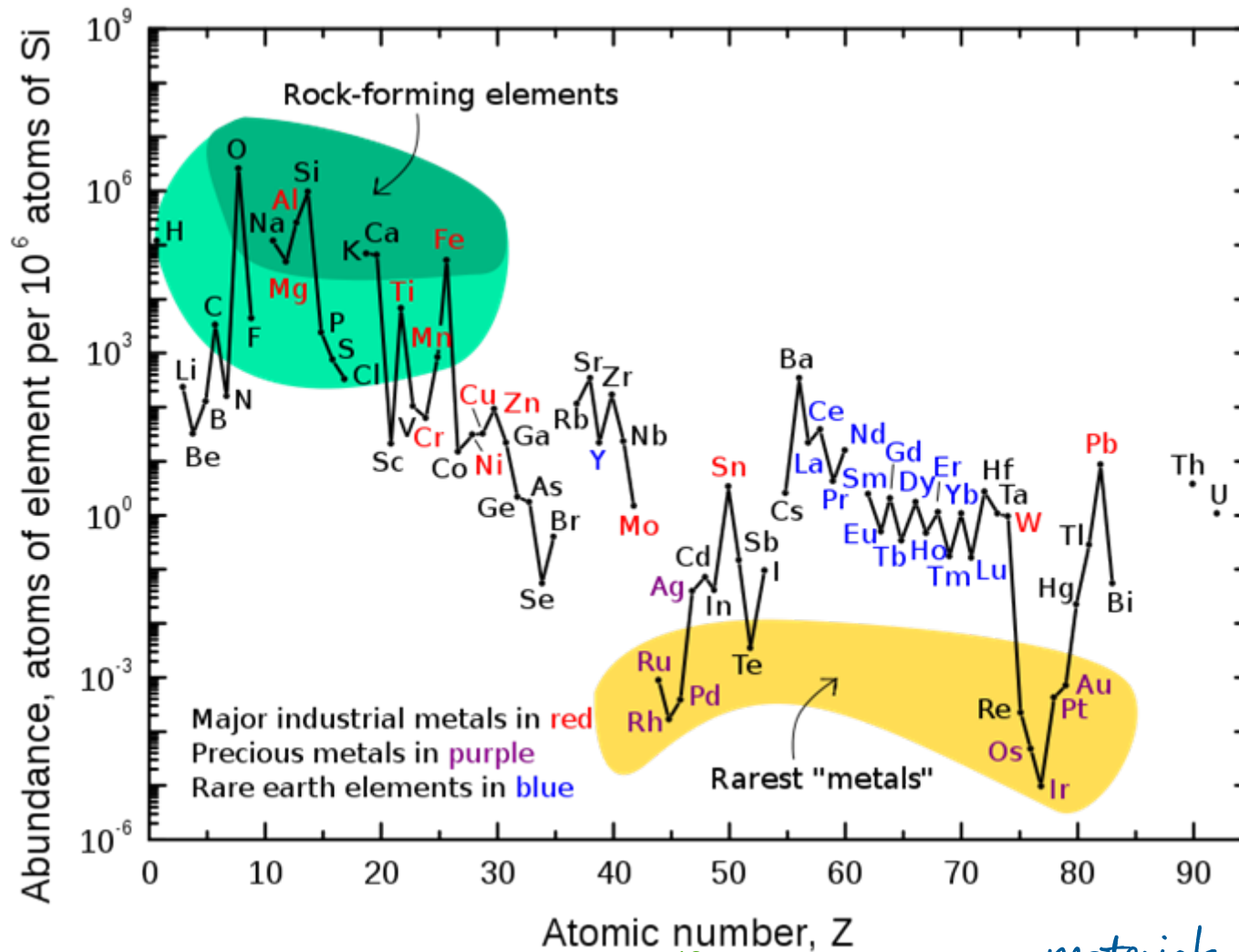
- total world consumption
~2,050 tonnes/yr



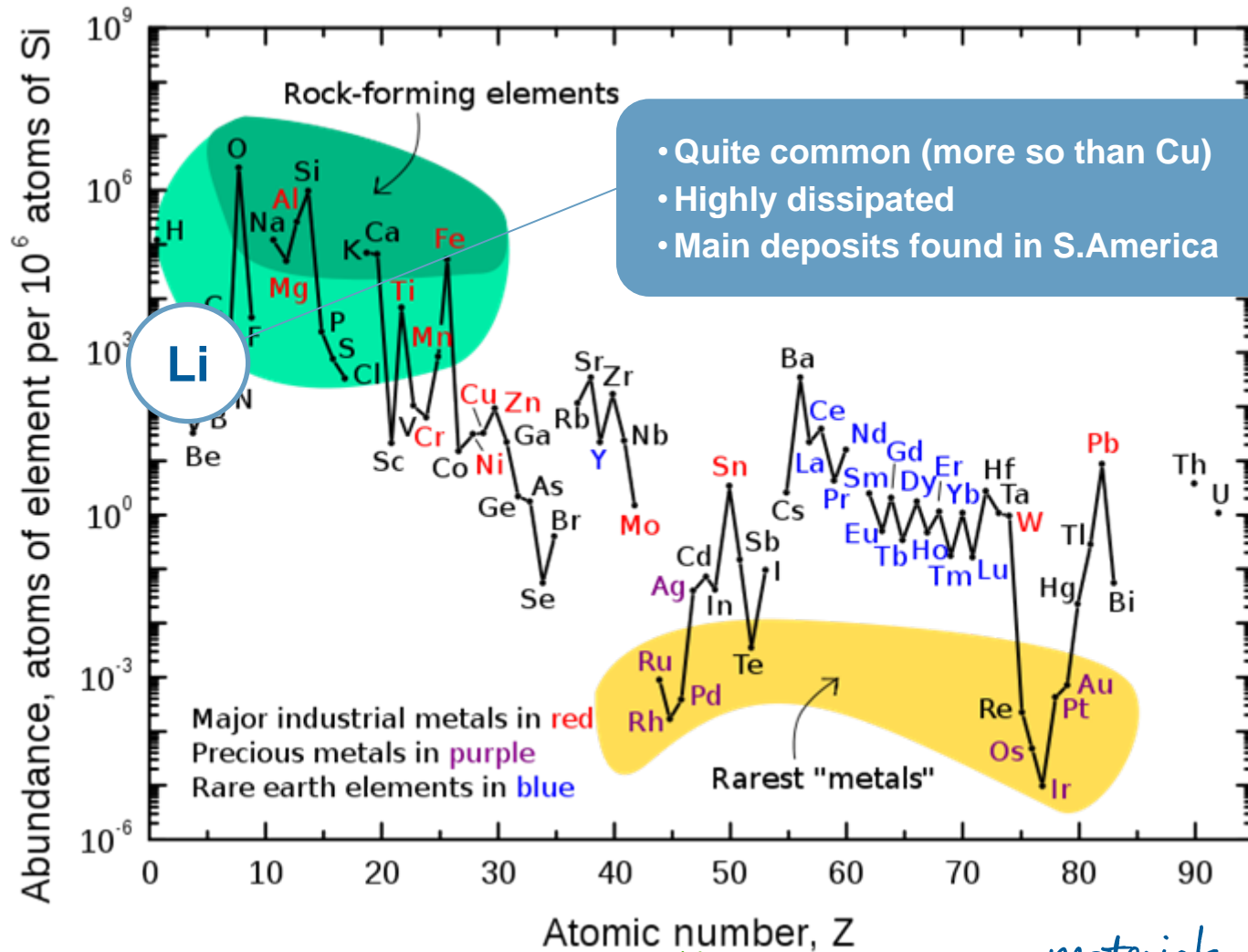
This scenario will require 56% recycling rate for indium

Based on Umicore scenario for PV: 80 GW/y in 2020, 35% share Thin Film PV

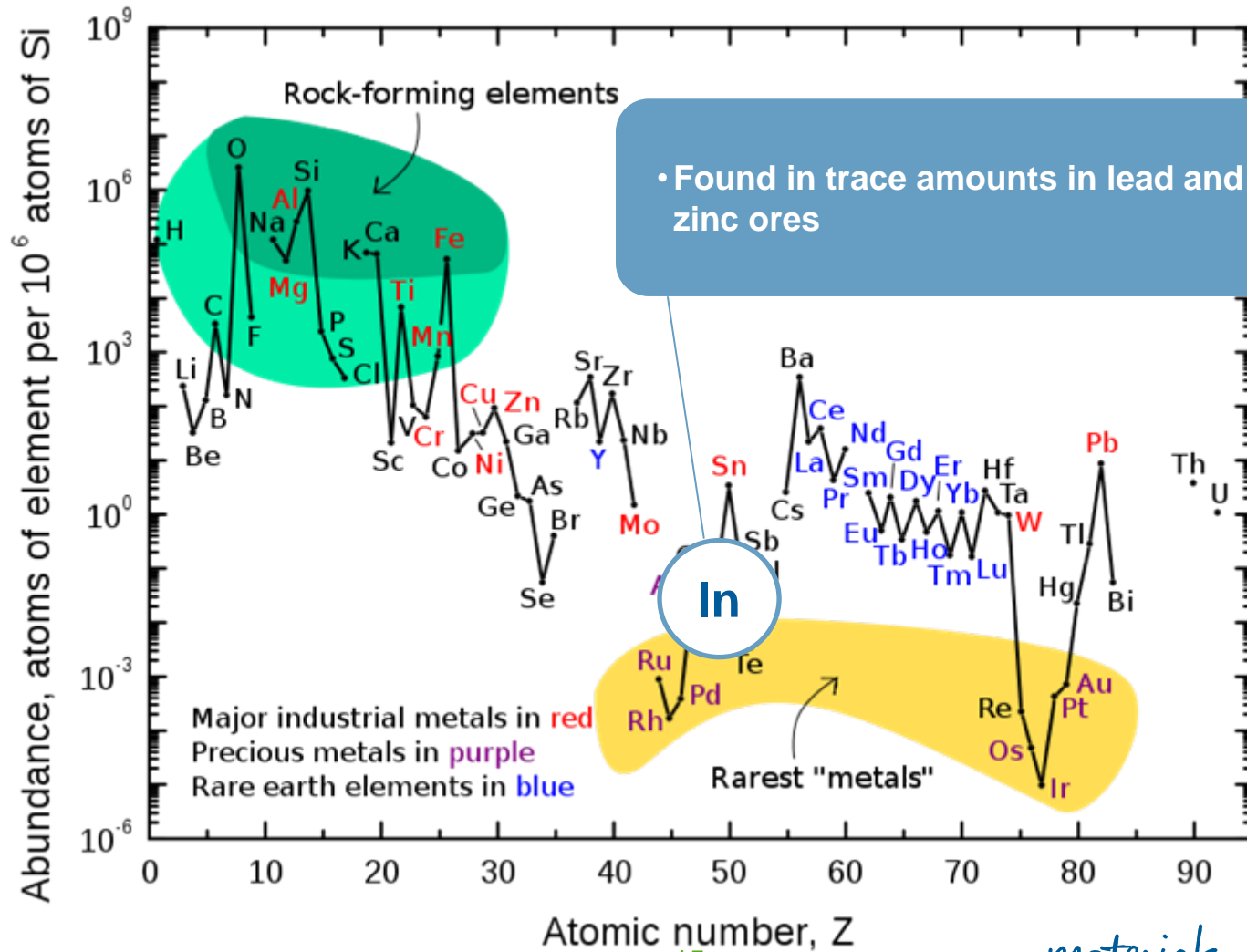
How scarce is "rare"?



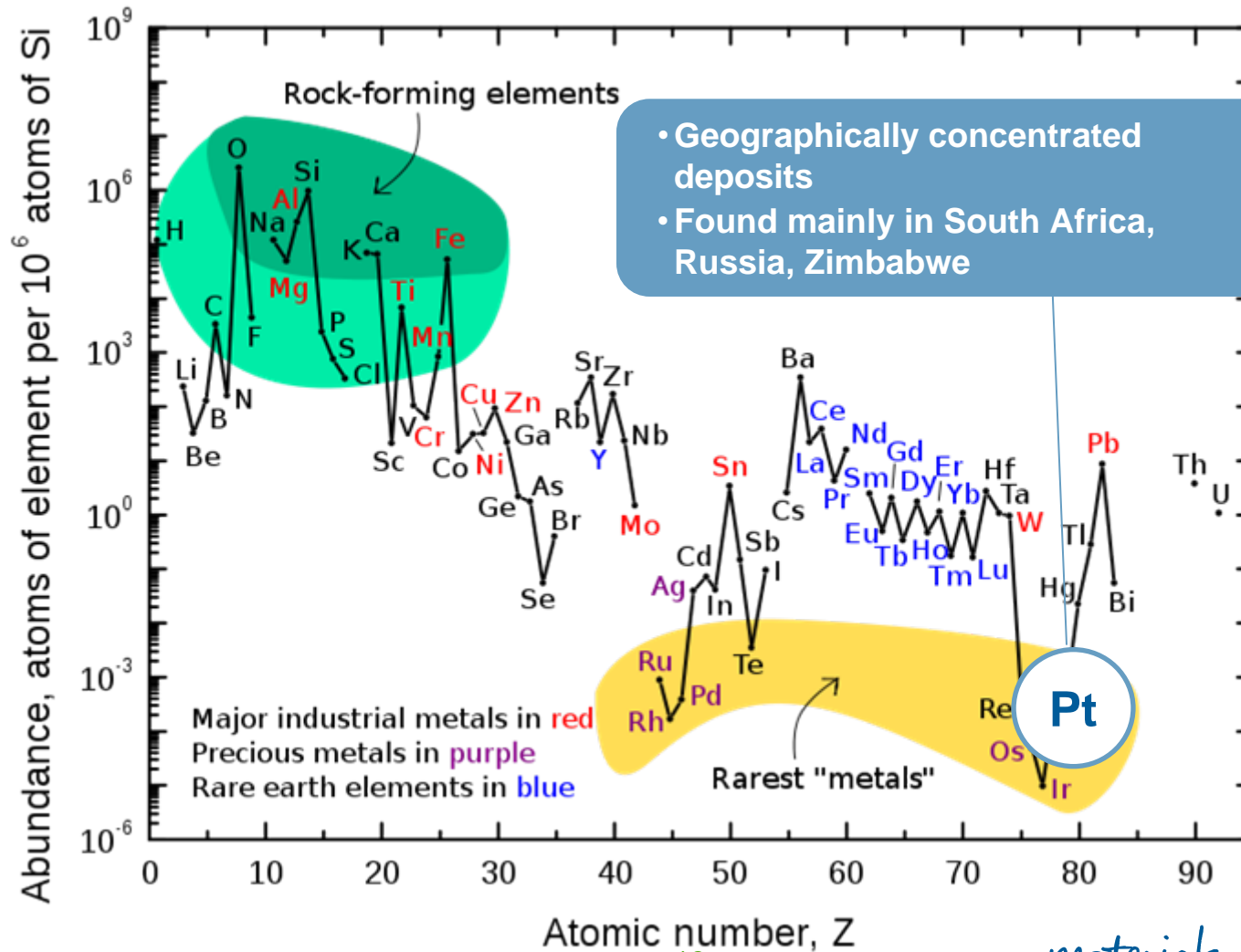
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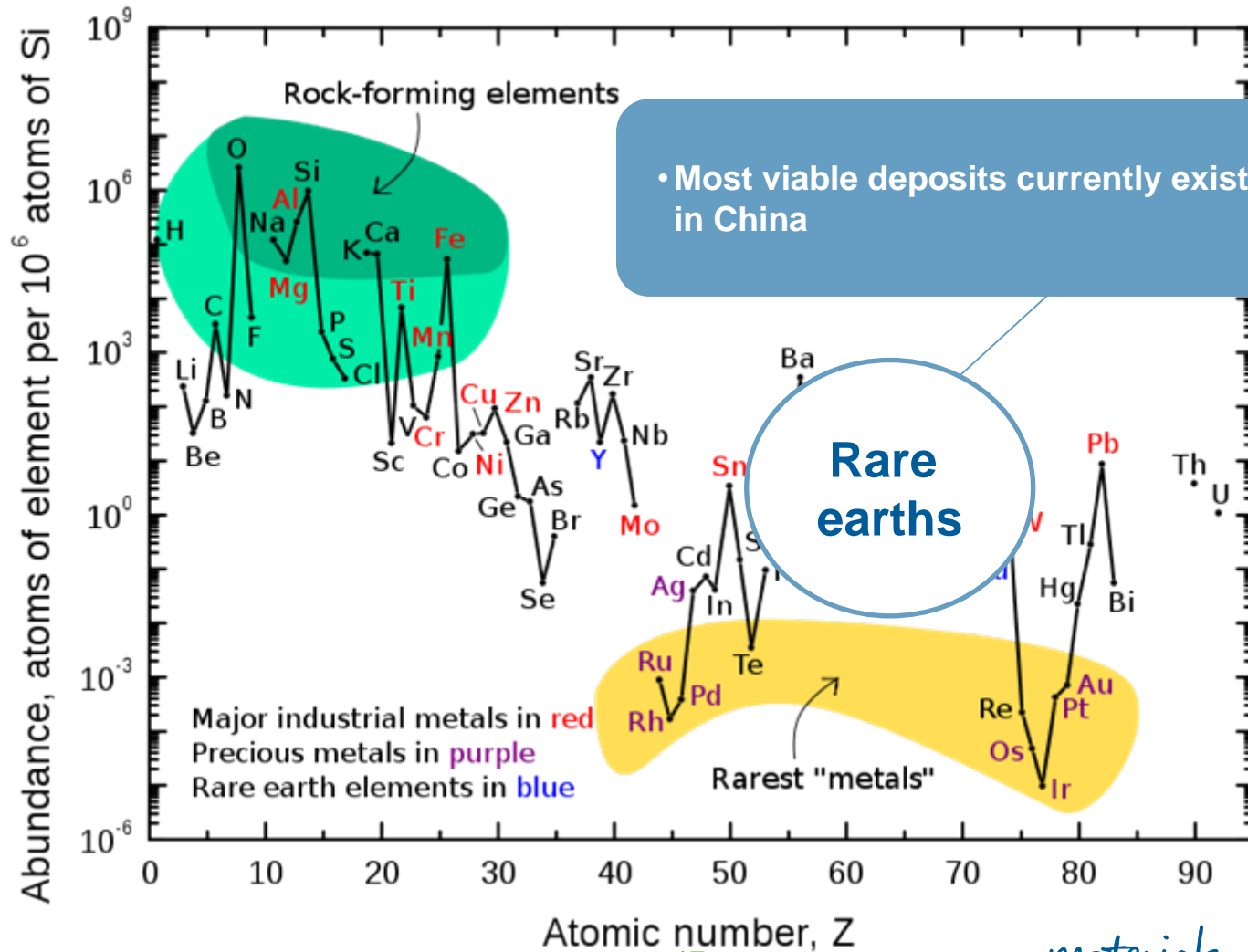
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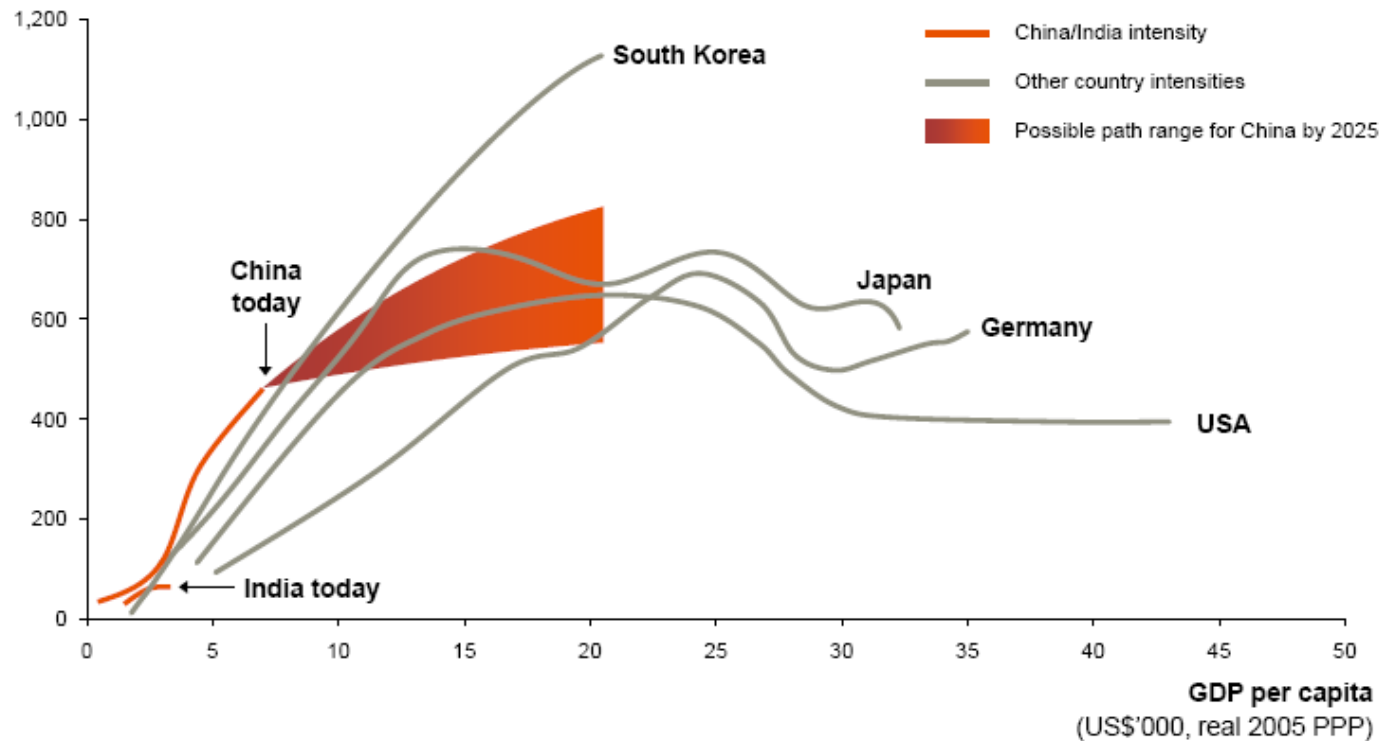


How scarce is "rare"?



Scarcity...we have been here before *emerging market growth*

Industrial development & steel consumption¹
(kg per capita)



Source: CISA; worldsteel; Global Insight; JBS; BHP Billiton analysis.
1. Steel consumption on a crude steel equivalent basis.

BHP Billiton, May 2011

Metal scarcity issues

Absolute metal scarcity

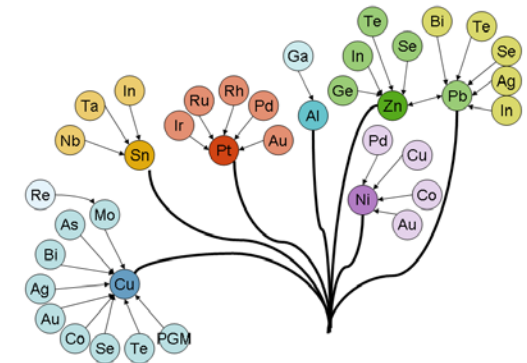
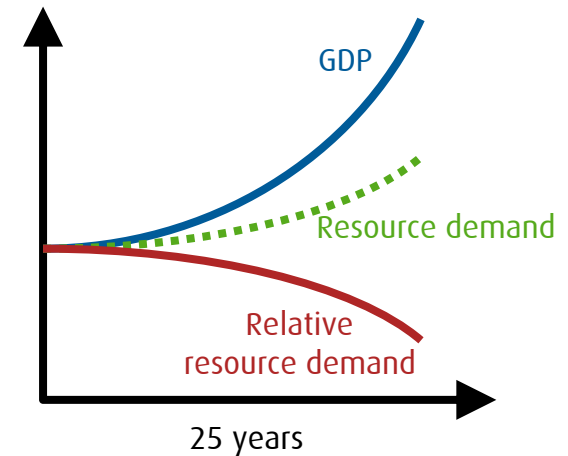
- Gradual depletion of “economically” mineable resources
- Limited number of highly concentrated sources
- Smart use of metals (Reduce – Reuse – Recycle) allows decoupling of metal consumption from GDP

Structural metal scarcity

- Coupled production of “technology” metals (e.g. In, Pd, ...) coming as by-product of base metal mining (e.g. Cu, Pb, ...)
- Smarter use of base metals creates paradox for technology metals, as relatively more of these are needed with growing GDP

Geo-political metal issues, similar to oil

- REE in China
- PGM in Southern Africa
- Lithium in the Andes



Unlike oil, metals can be infinitely recycled

a) Mobile phones

~10 bn units produced
and not recycled

X 250 mg Ag \approx 2500 t Ag

X 24 mg Au \approx 240 t Au

X 9 mg Pd \approx 90 t Pd

~10 bn Li-Ion batteries

X 3.8 g Co \approx 38,000 t Co



b) PCs & laptops

~1 bn units in use
and not recycled

X 1000 mg Ag \approx 1000 t Ag

X 220 mg Au \approx 220 t Au

X 80 mg Pd \approx 240 t Pd

~0.4 bn Li-ion batteries

X 65 g Co \approx 26,000 t Co



a+b) Urban mine

Versus annual mining
production

3500 t Ag \approx 17%

460 t Au \approx 19%

330 t Ag \approx 150%

75,000 t Co \approx 85%

Tiny metal content per piece \rightarrow Significant total volume

Resource efficiency is needed to deal with the scarcity of technology metals

- Critical for clean-tech / renewable energy
- Demand is growing:
 - Global growth
 - Demand for technology metals well above GDP
 - Limited substitution possibilities
- Supply is limited
 - Worldwide primary supply is limited
 - Coupling with base metals further limits availability
 - Mining creates geopolitical dependence
 - Short term supply often impacted by speculation on commodities



RECYCLING is essential

RESOURCE EFFICIENCY

Using less, living better

