Urban mined Olympic medals go toward Resource Efficient Circulation

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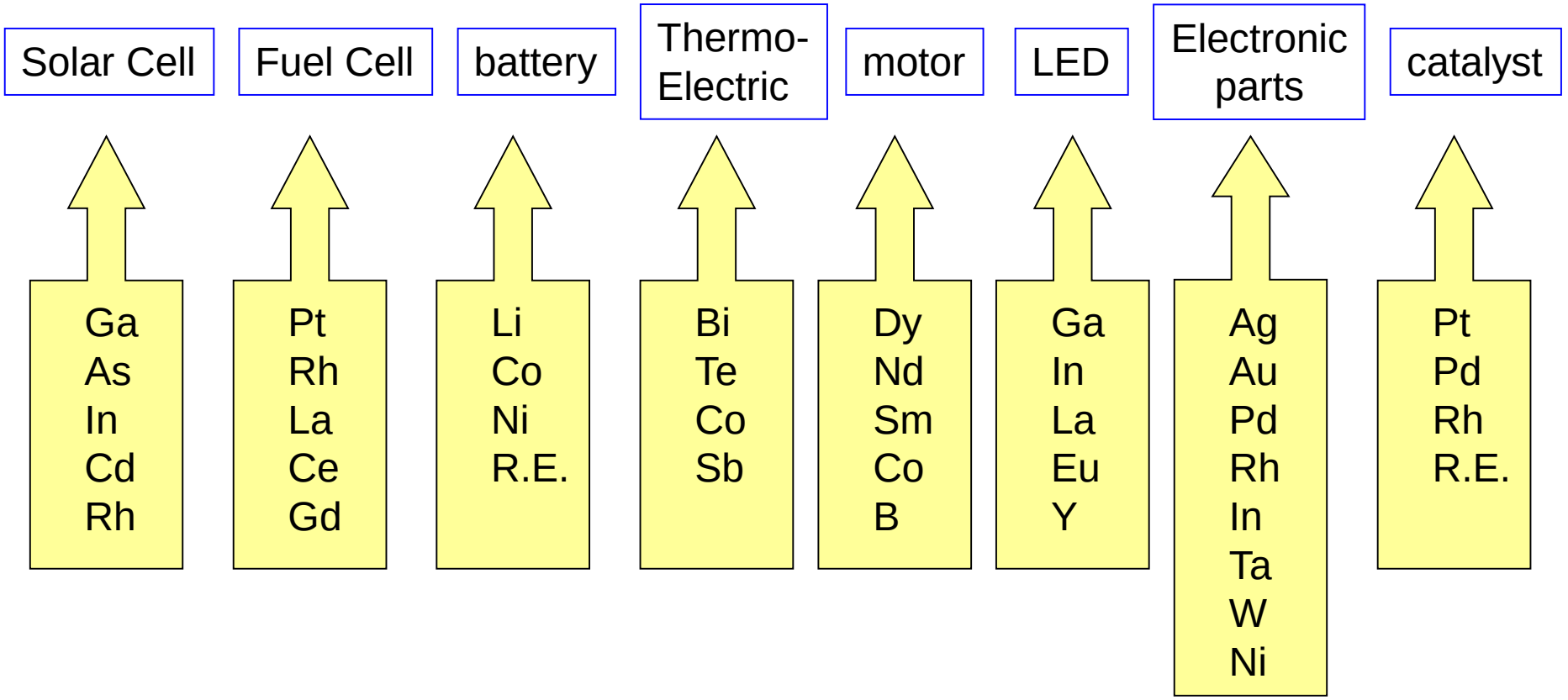
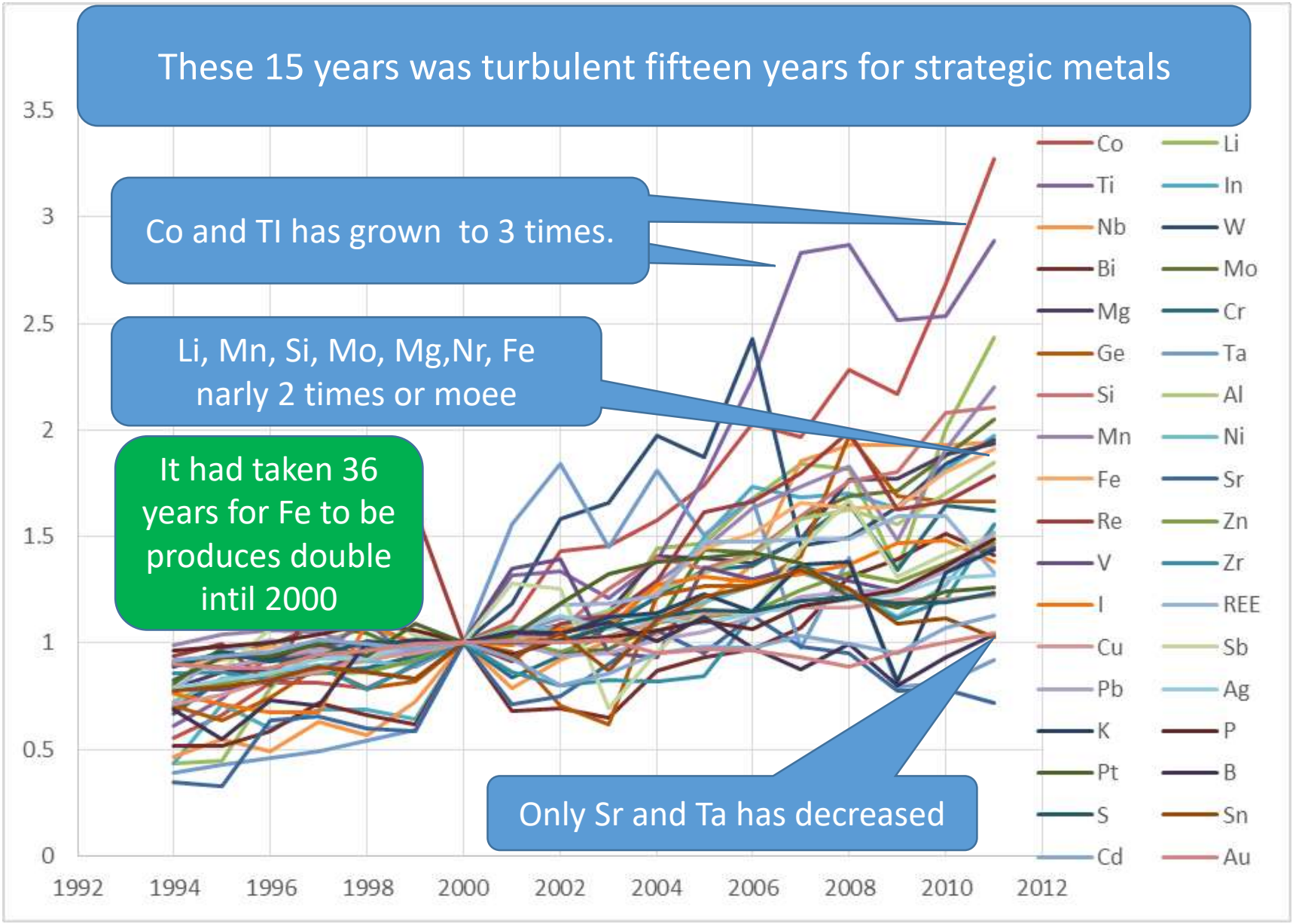
- New technologies require critical raw materials. Resource efficient application and circulation of these raw materials is important. As a symbol of the circulation of critical raw materials, Olympic Games at 2020 Tokyo adopted to use urban mined metals from used cellphones and small size electric appliances which contains gold, silver, copper and various kind of critical raw materials. Only about 100g of urban mined gold medal reduces 48tons of total material requirement in mining and 1600 tons of material requirement for restoration from E-waste(electric waste). As urban mined medal can visualize recycling for citizens, it is spreading to local sports events. NIMS (National Institute for Material Science) develop new technology of urban mined medal production with 3D technology and cyanic agent free plating for customized small number of medals of each local sports events.
- However urban mined medal is a progress toward SDGs (sustainable development goals), The level of circulation should be improved more and more. Used products retain not only raw material but also functions of the product as retained value. Used cell phone should be reused before recycling. Multi value circulation with remanufacturing, refurbishing, direct reuse and final recycling will be combined in the life-cycle of products including electric appliances. Global Multi Value Circulation is proposed from Japanese academy and industry. Global Multi Value Circulation is based on Circular Economy from Europe, but adds the essences of sound design/production technology and socially harmonizable solution technology. Global Multi Value Circulation requires durability and reliability functionally and mechanically as the physical base of life-cycle management of products. This is the new field of Materials Science and Technology

Energy Generation, conversion, storage	Energy use Heat, actuation, illumination, information	cleaning



Eco-innovation requires new demand of rare & special materials.

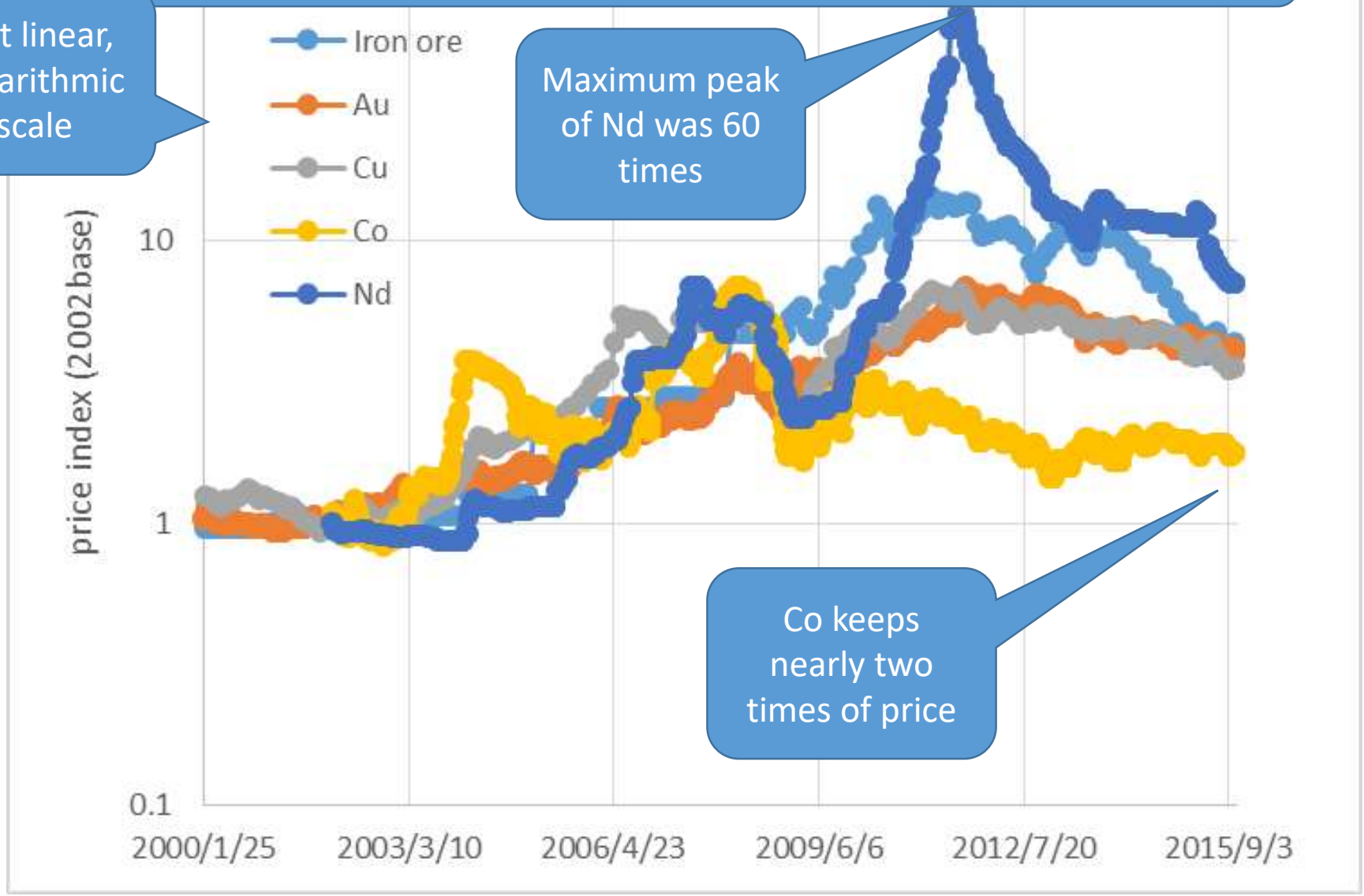

These 15 years was turbulent fifteen years for strategic metals
Co and TI has grown to 3 times.
Li, Mn, Si, Mo, Mg,Nr, Fe narly 2 times or moee
It had taken 36 years for Fe to be produces double intil 2000
Only Sr and Ta has decreased
3.5
3
2.5
2
1.5
1
0.5
0
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
Co
Li
Ti
In
Nb
W
Bi
Mo
Mg
Cr
Ge
Ta
Si
Al
Mn
Ni
Fe
Sr
Re
Zn
V
Zr
I
REE
Cu
Sb
Pb
Ag
K
P
Pt
B
S
Sn
Cd
Au

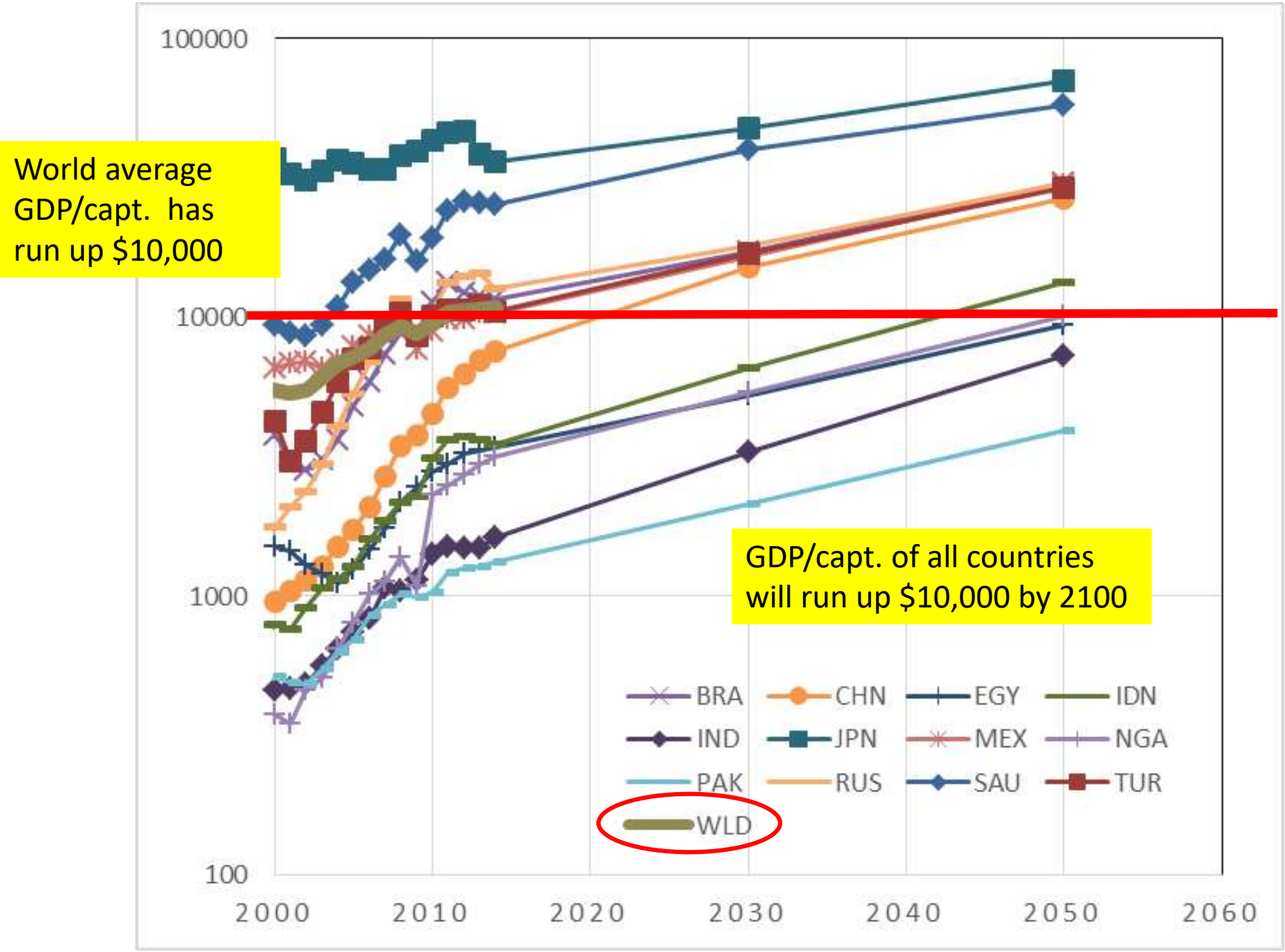
Prices have changed more drastically

Not linear, Logarithmic scale

Maximum peak of Nd was 60 times

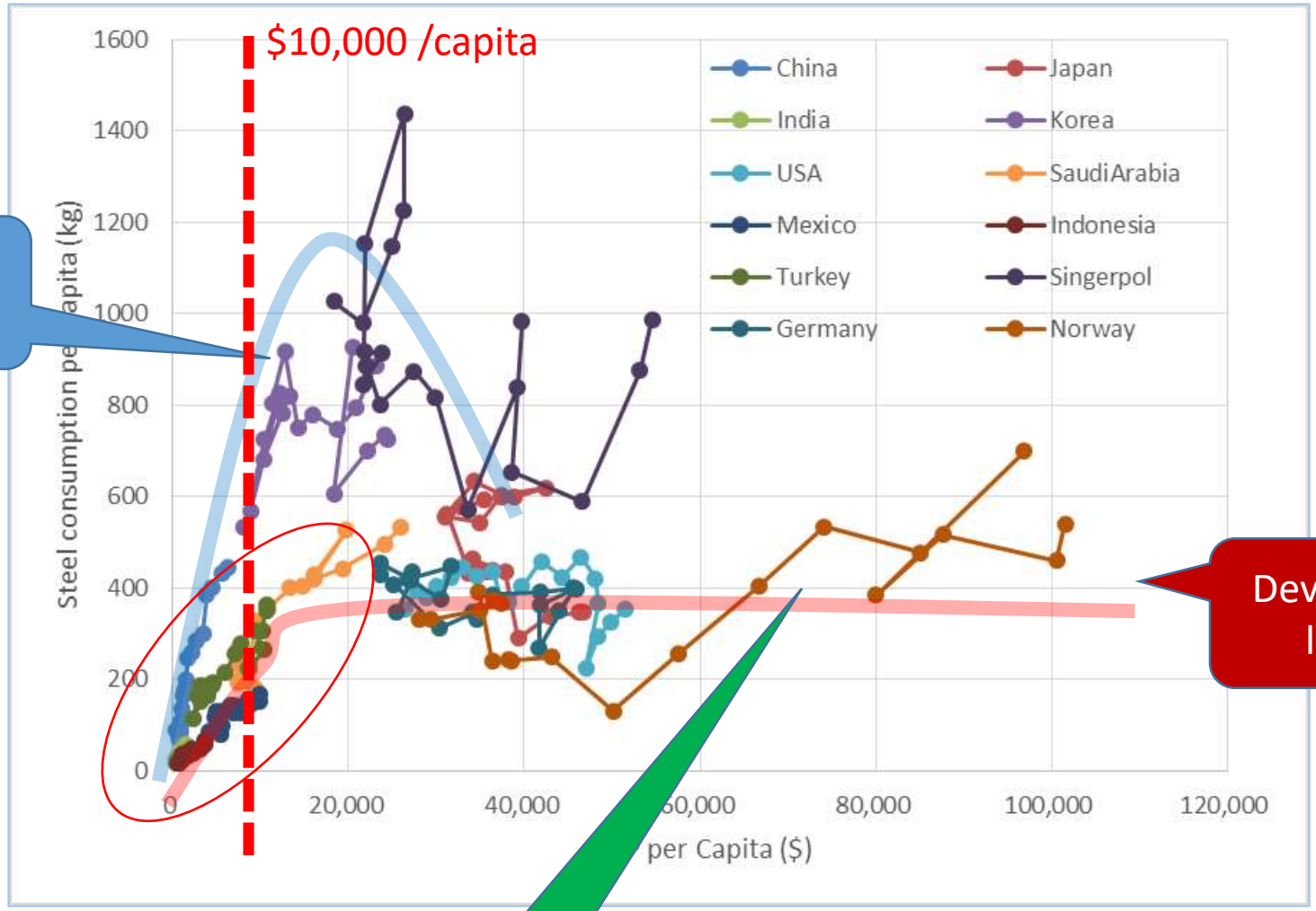
Co keeps nearly two times of price




World average GDP/capt. has run up $10,000
GDP/capt. of all countries will run up $10,000 by 2100
100000
10000
1000
100
2000
2010
2020
2030
2040
2050
2060
BRA
CHN
EGY
IDN
IND
JPN
MEX
NGA
PAK
RUS
SAU
TUR
WLD

Consumption/capt. reaches developed level when GDP capt. reaches $10,000

Fe consumption / capita v.s. GDP/ capita from 1994 to 2014



Exporting countries

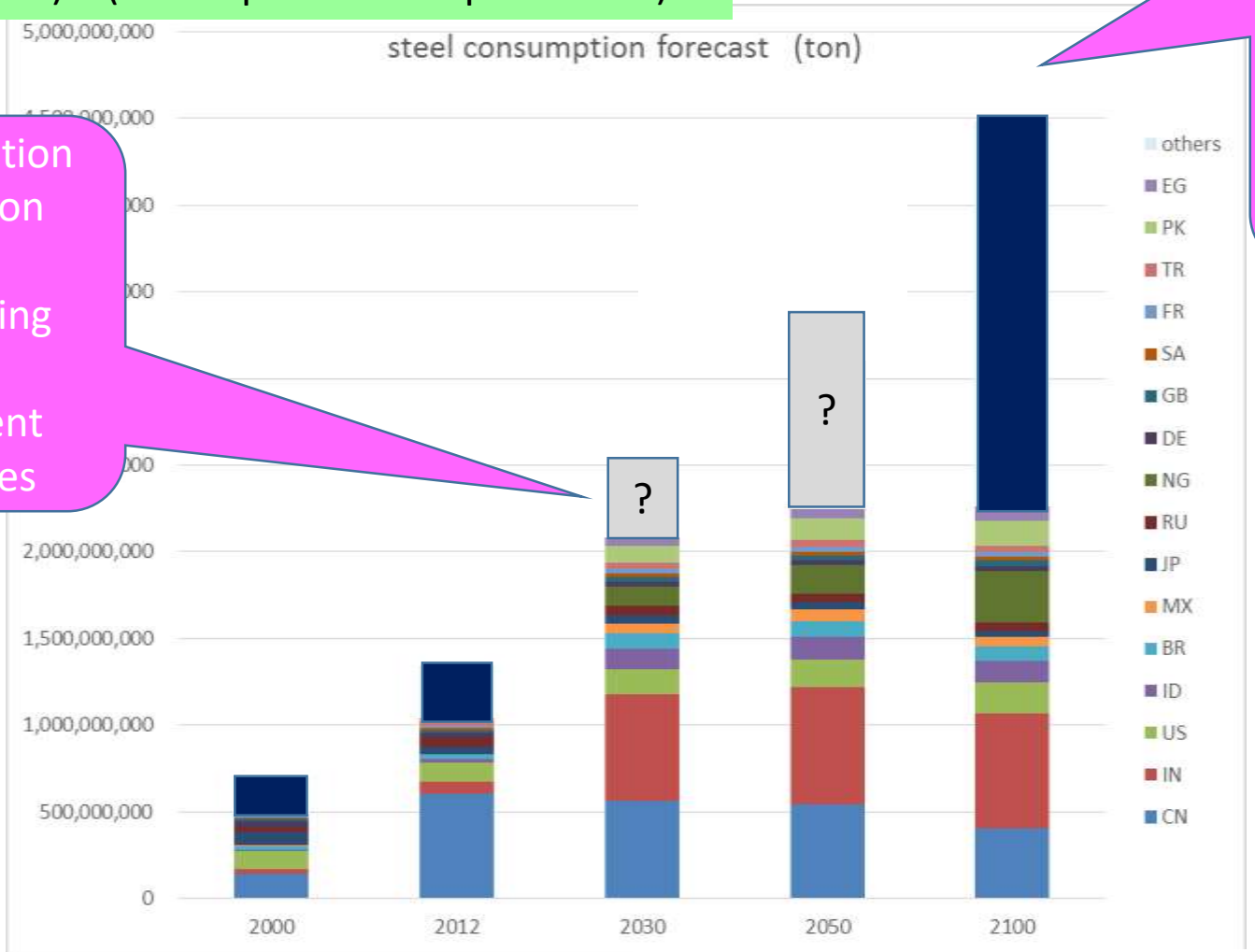
Developed level

Consuming countries

Rough forecast gets to be simpler,
(population) x (developed consumption level)

Every country reaches developed level of consumption per capita

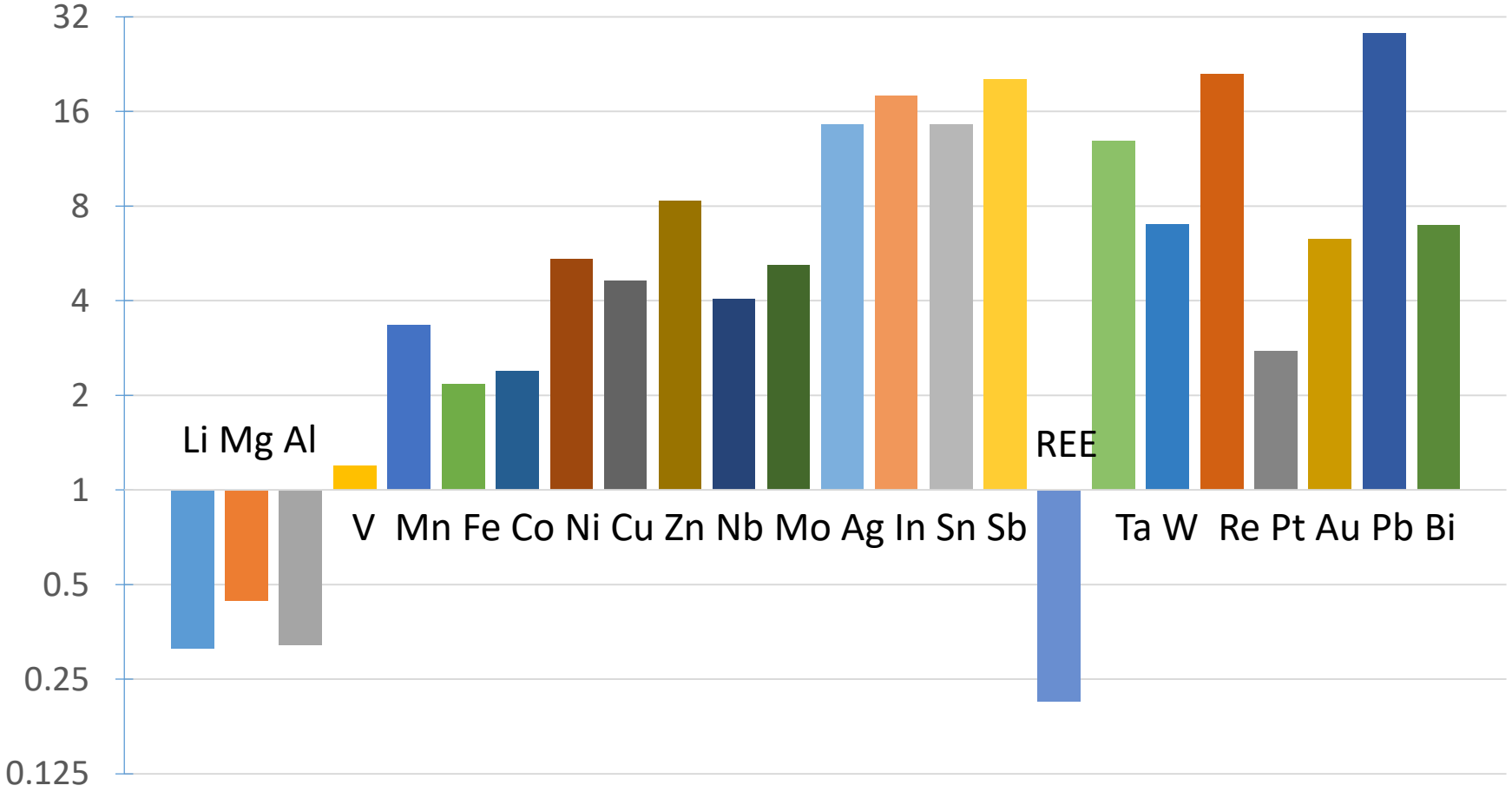
Consumption prediction with concerning only prepotent countries



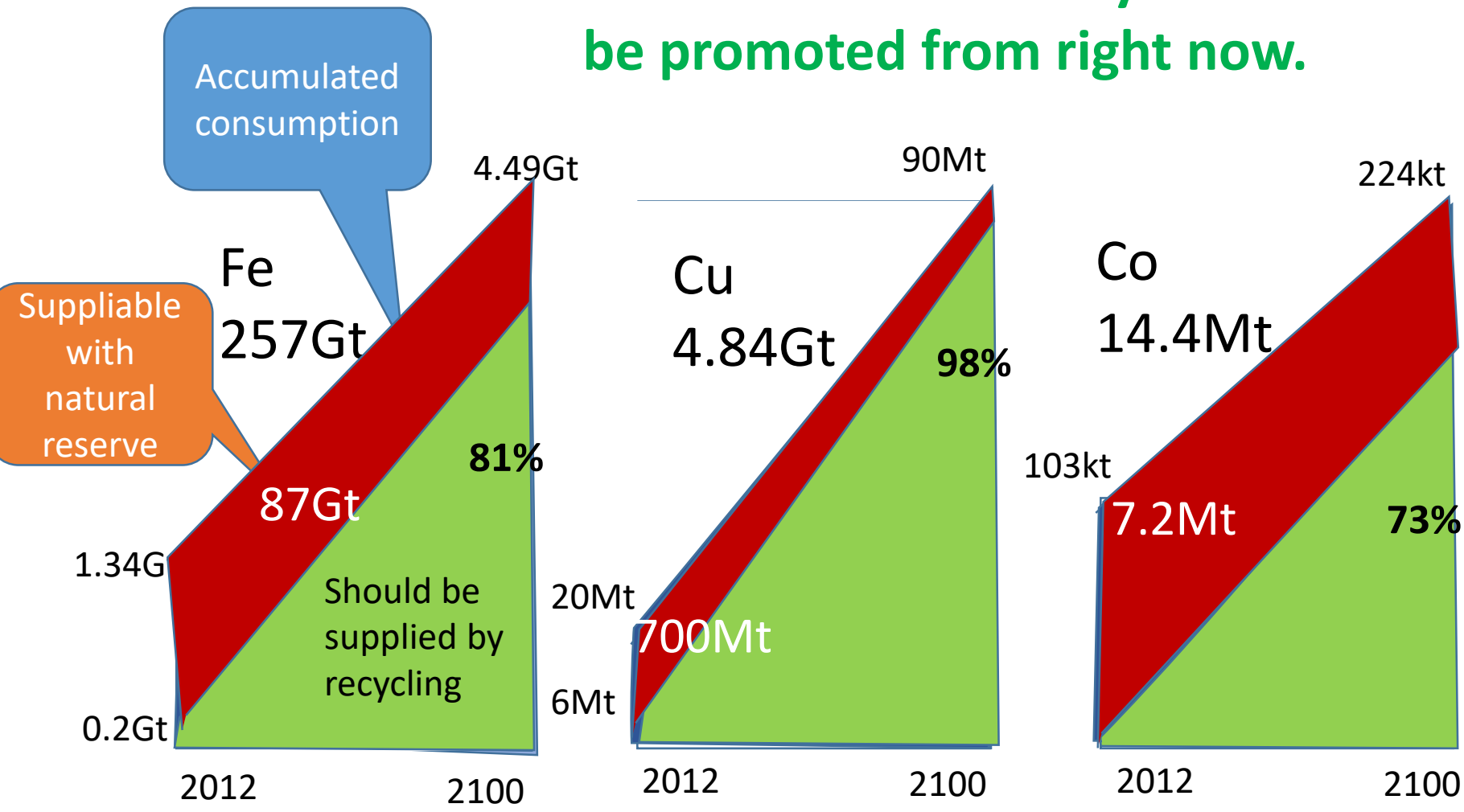
metal	Fe
Consumption/year at 10Gperson world	4.5Gton/year
Reserve	87Gton

Much more times of resources will be required by 2100.

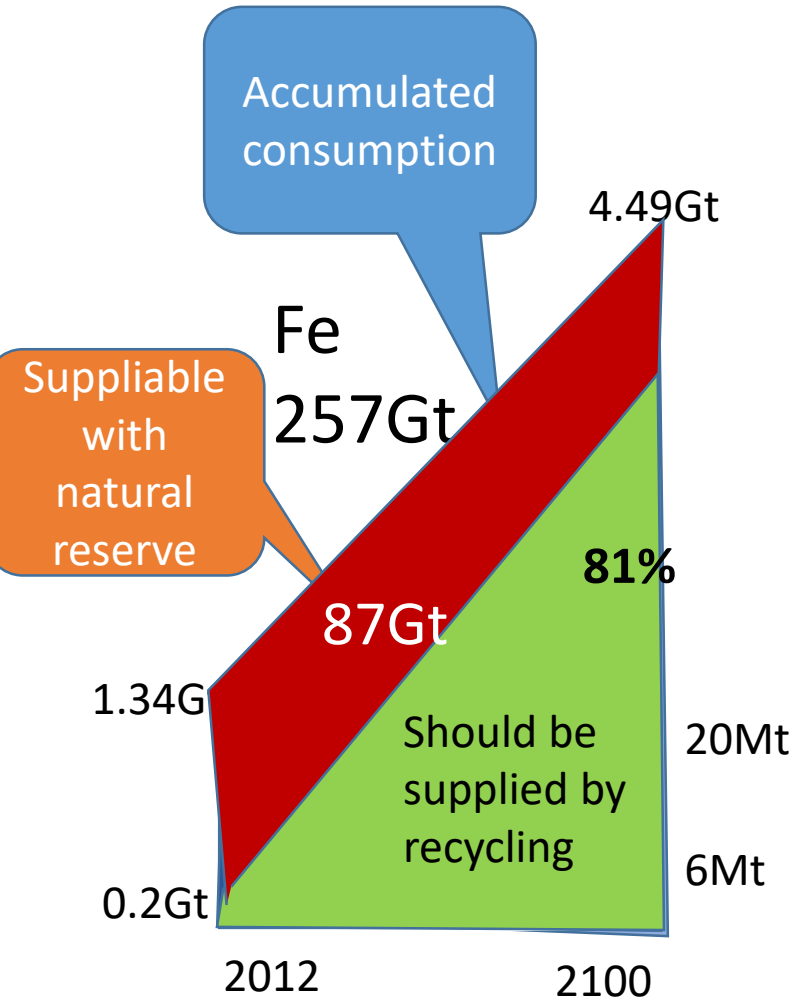
Estimated demand up to 2100 v.s. current reserve amount

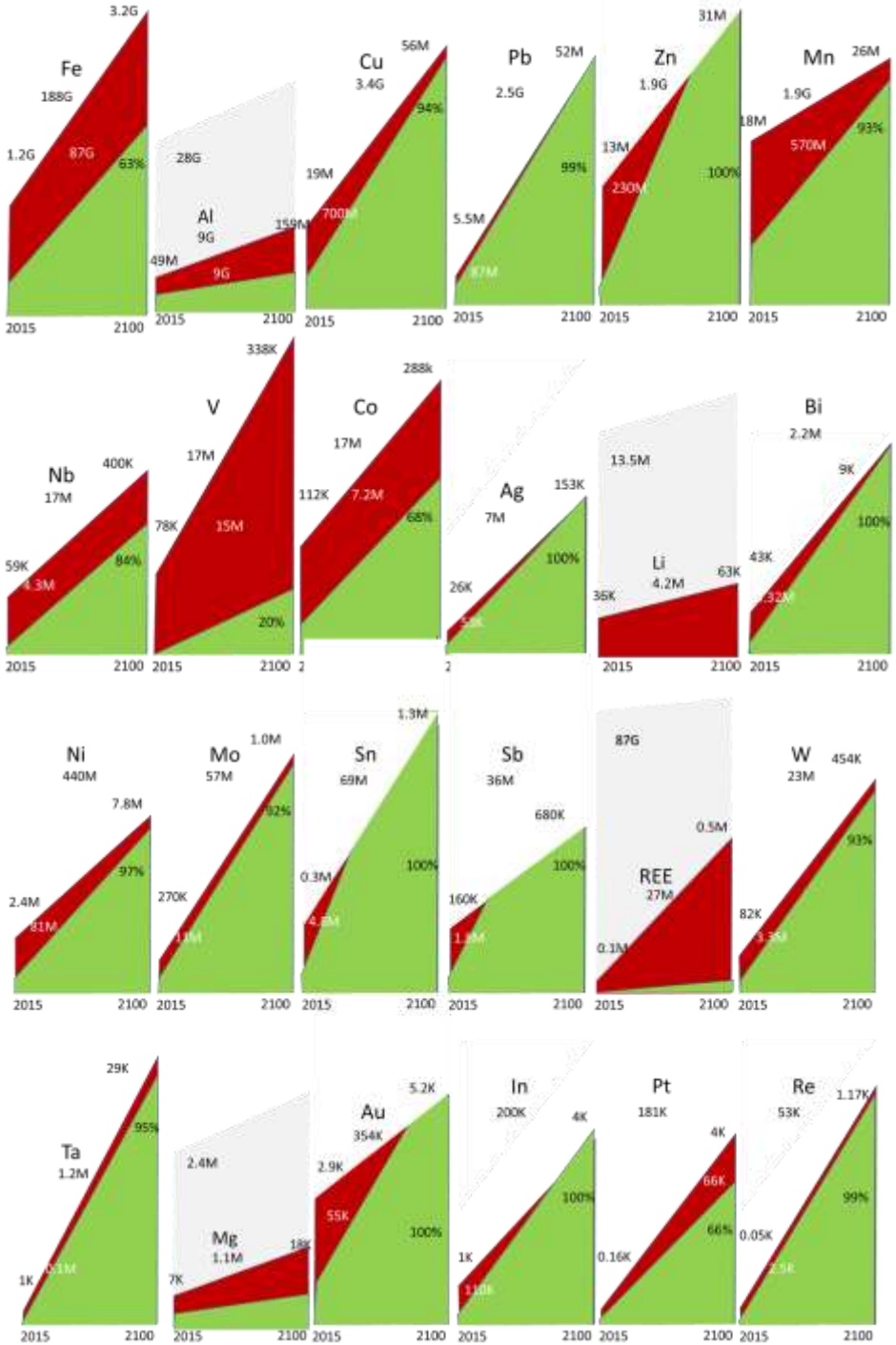


The circulation society must be promoted from right now.



Estimated accumulated consumptions till 2100 with simple assumption of linear growth


Accumulated consumption
Fe
257Gt
Suppliable with natural reserve
4.49Gt
87Gt
81%
1.34G
Should be supplied by recycling
20Mt
0.2Gt
6Mt
2012
2100


Fe
Al
Cu
Pb
Zn
Mn
Nb
V
Co
Ag
Li
Bi
Ni
Mo
Sn
Sb
REE
W
Ta
Mg
Au
In
Pt
Re
2015
2100

Urban mined Olympic medals


2020 Tokyo Olympic is
in preparation

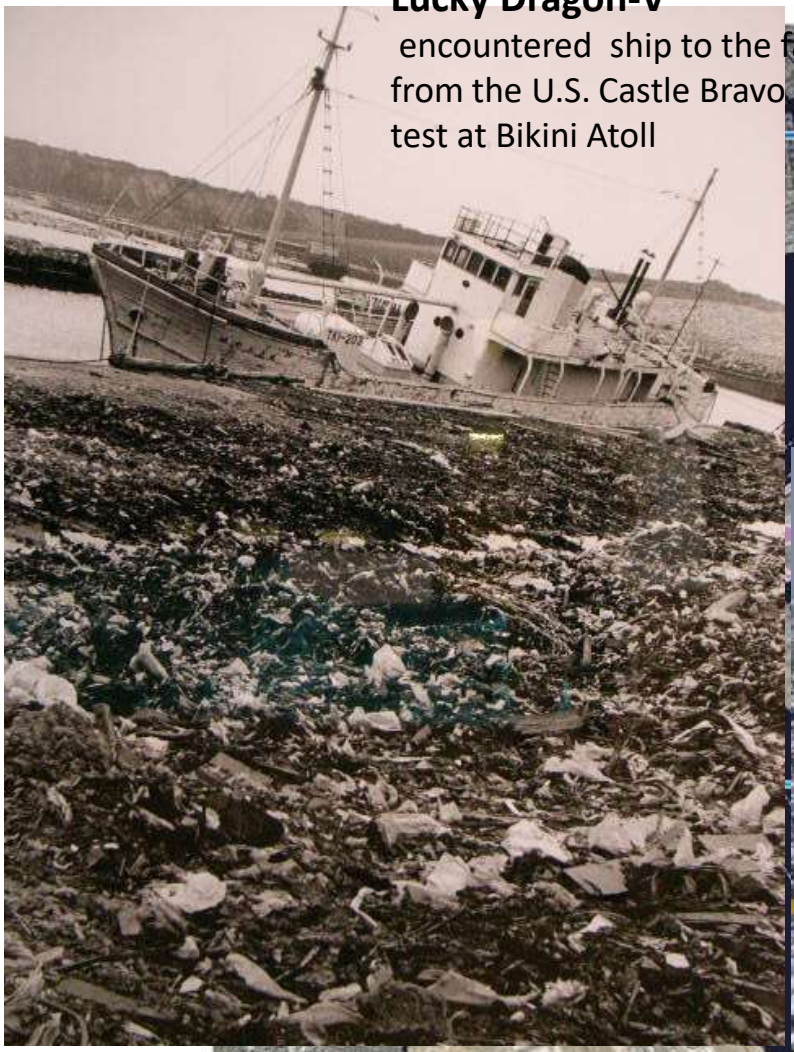
Dream Island just after Tokyo Olympic 1964.

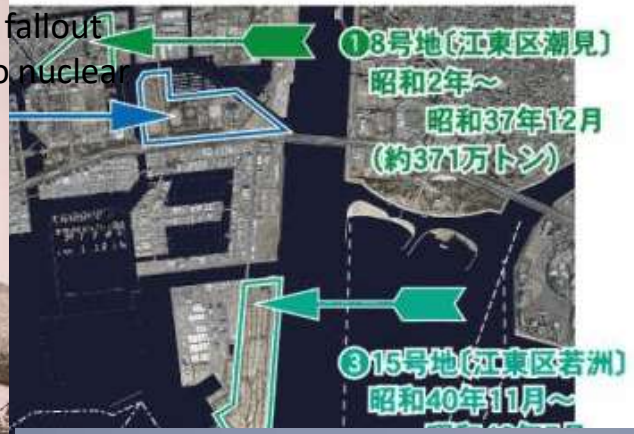
Deposit site of waste from mass consumption

We fought against fly.

Waste landfill area of Tokyo in the late 20th century.

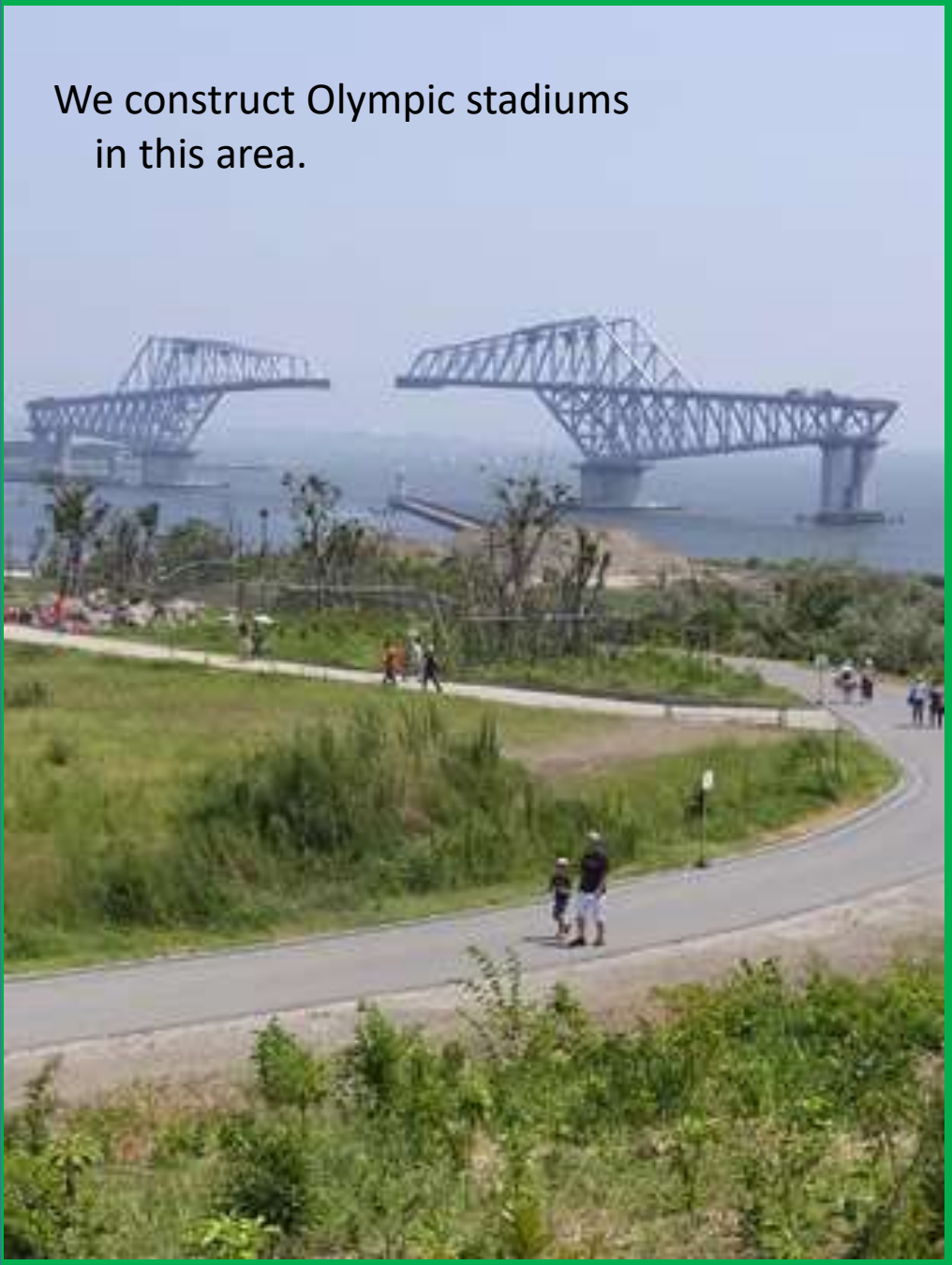
Lucky Dragon-V
encountered ship to the fallout from the U.S. Castle Bravo nuclear test at Bikini Atoll





（資料提供：東京都港湾局）

We construct Olympic stadiums
in this area.



Olympic becomes a symbol
from
Economic growth 成長
to
Mature society 成熟

Global material management
should change to be
from Economic growth
to mature society of sustainability

	Vancouver 2010	London 2012	Rio 2016
gold	Recycled content (1.11%)	Obtained from sustainable mining	extracted without the use of mercury
silver	Recycled content (0.12%)	Not mentioned	Recycled content 30%
broze	Recycled content (1.52%)	Zinc in bronze was partially recycled	Recycled content 30%

How much metals are required for Olympic medals

	London 2012		Olympic Chartar 2000				
	Olympic	Paralympic	Au	Ag	Cu	Zn	Sn
Gold	659	675	6	379	25	0	0
Silver	649	670	0	381	29	0	0
Bronze	702	687	0	0	368.5	9.5	2
Total	2010	2032	**9.6kg**	**1,210kg**	**700kg**		

Olympic Charter (-2000)

BYE-LAW TO RULE 70

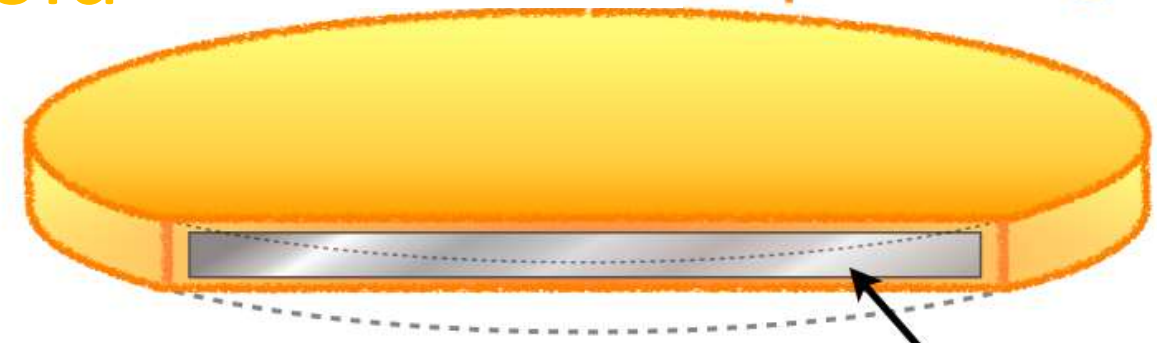
2- Medals and Diplomas

2.2 the medals shall be at least 60mm in diameter and 3mm thick. The medals for first and second places shall be of silver of at least 925-1000 grade; the medal for first place shall be gilded with at least 6g of pure gold.

Weight
95～500g

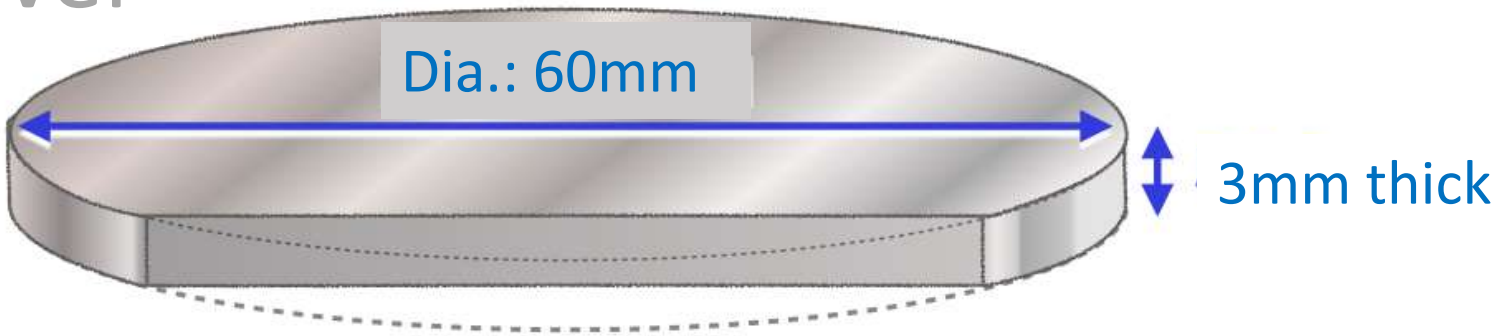
gold

Gold plated 50μm 6 g

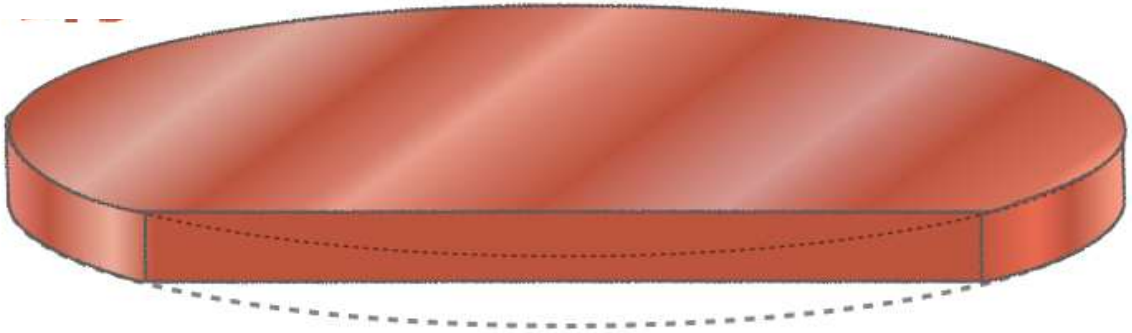


Base consists of Silver

silver



bronze



Urban mining in Japan

Recycled raw material percentage in Japan

	2014			2025		
	Recycled (t)	produced (t)	recycled %	Recycled (t)	produced (t)	recycled %
Au	29.2	106.8	27.3%	31.7	113.8	27.8%
Ag	731	1803	40.5%	817	1967	41.5%
Cu	254000	1538000	16.5%	253000	1509000	16.8%
Pb	114000	200000	57.0%			
Zn	125000	589000	21.2%			

Data from Japan Mining Association

Electric households contain a great amount of metals

	BD player	Cell phone	PC laptop	PC disctop
Per equipment	3.6kg	0.1kg	2.1kg	8.2kg
Discarded at 2011	60,000	40,000,000	6,700,000	5,000,000
Annual amount	211t	5600t	1400t	4000t
gols	3kg	1,900kg	2,000kg	2,500kg
silver	16kg	10,000kg	5.600kg	15,000kg
copper	4800t	510,000t	550t	2,200t

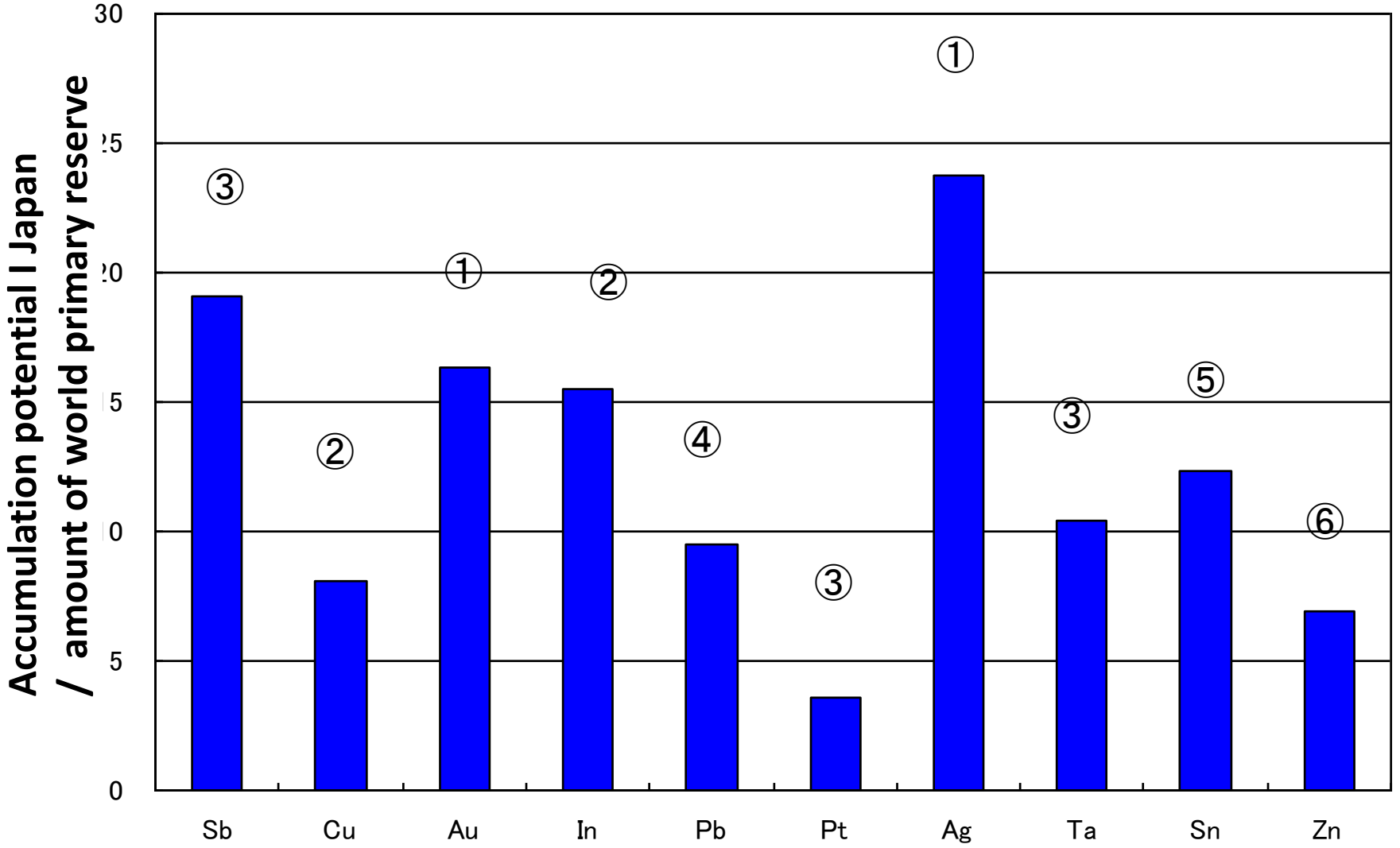
Amount of recycled metal by the law of small size electric households rcycling

	2013	2014	2015	Requisite for Olympic medals
Au	46kg	**143kg**	**214kg**	**9.8kg**
Ag	446kg	**1566kg**	**2563kg**	**1210kg**
Cu	381ton	**1,112ton**	**1469ton**	**700kg**

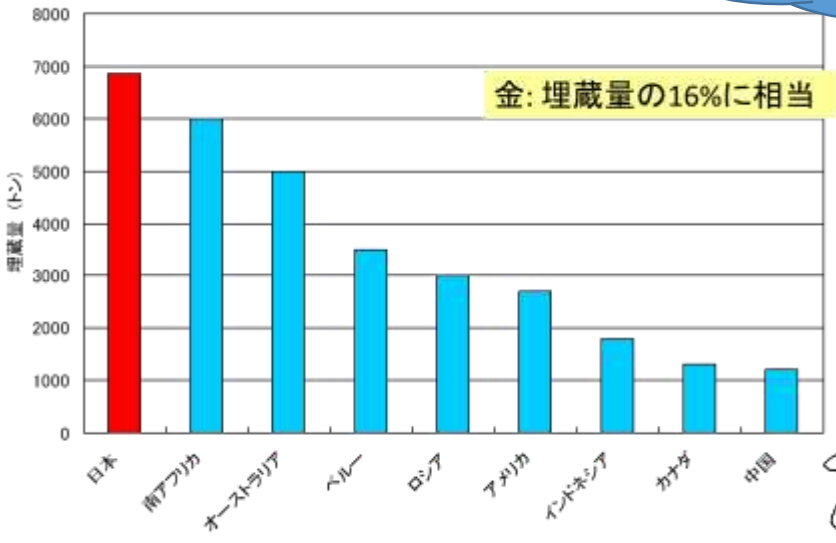
Recovery of Gold from Urban mine

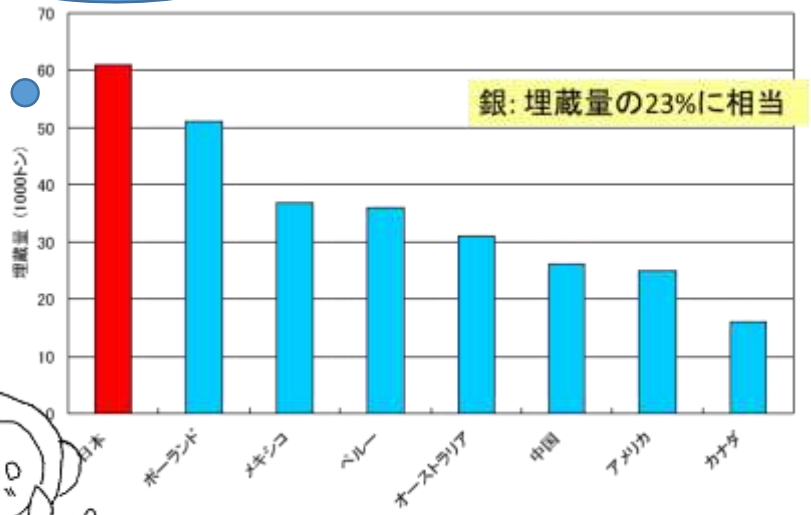
Urban mining

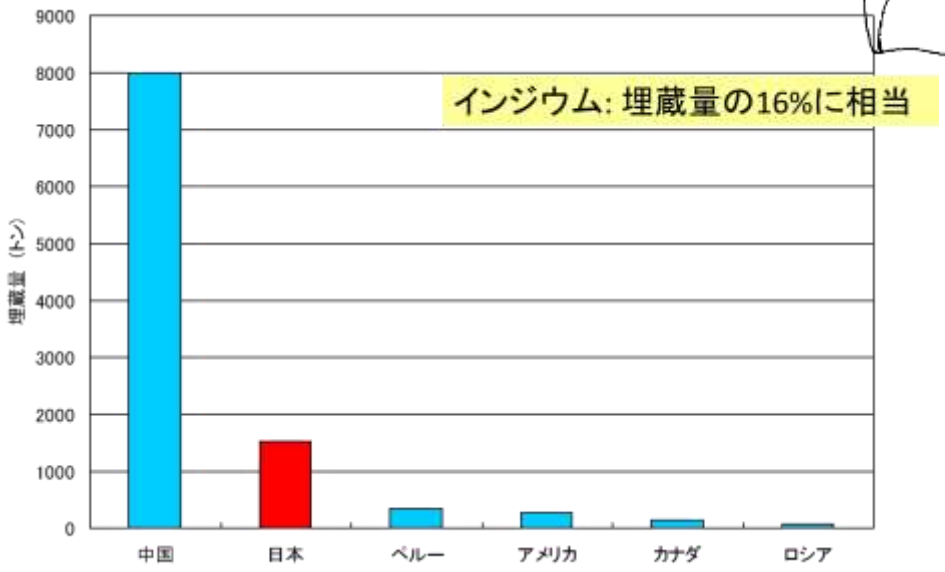
Potential of urban mine is nearly as great as reserves of resource countries.

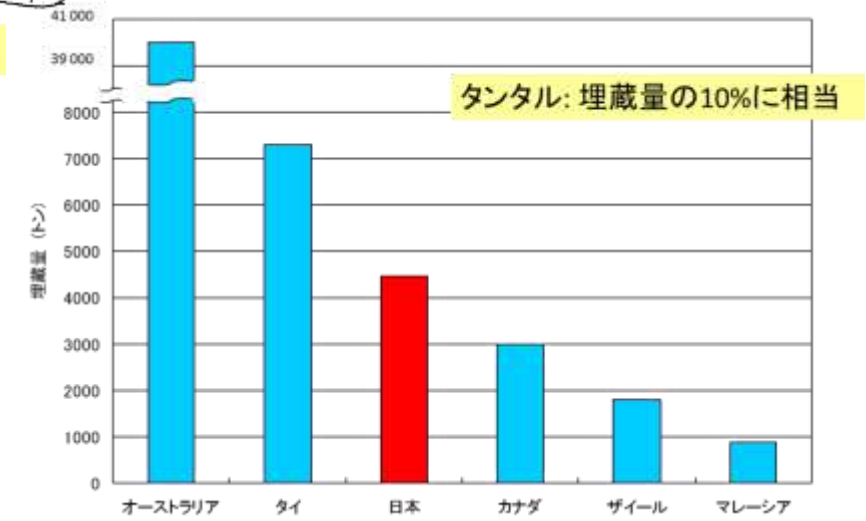


日本には資源ないてない
と思ってた

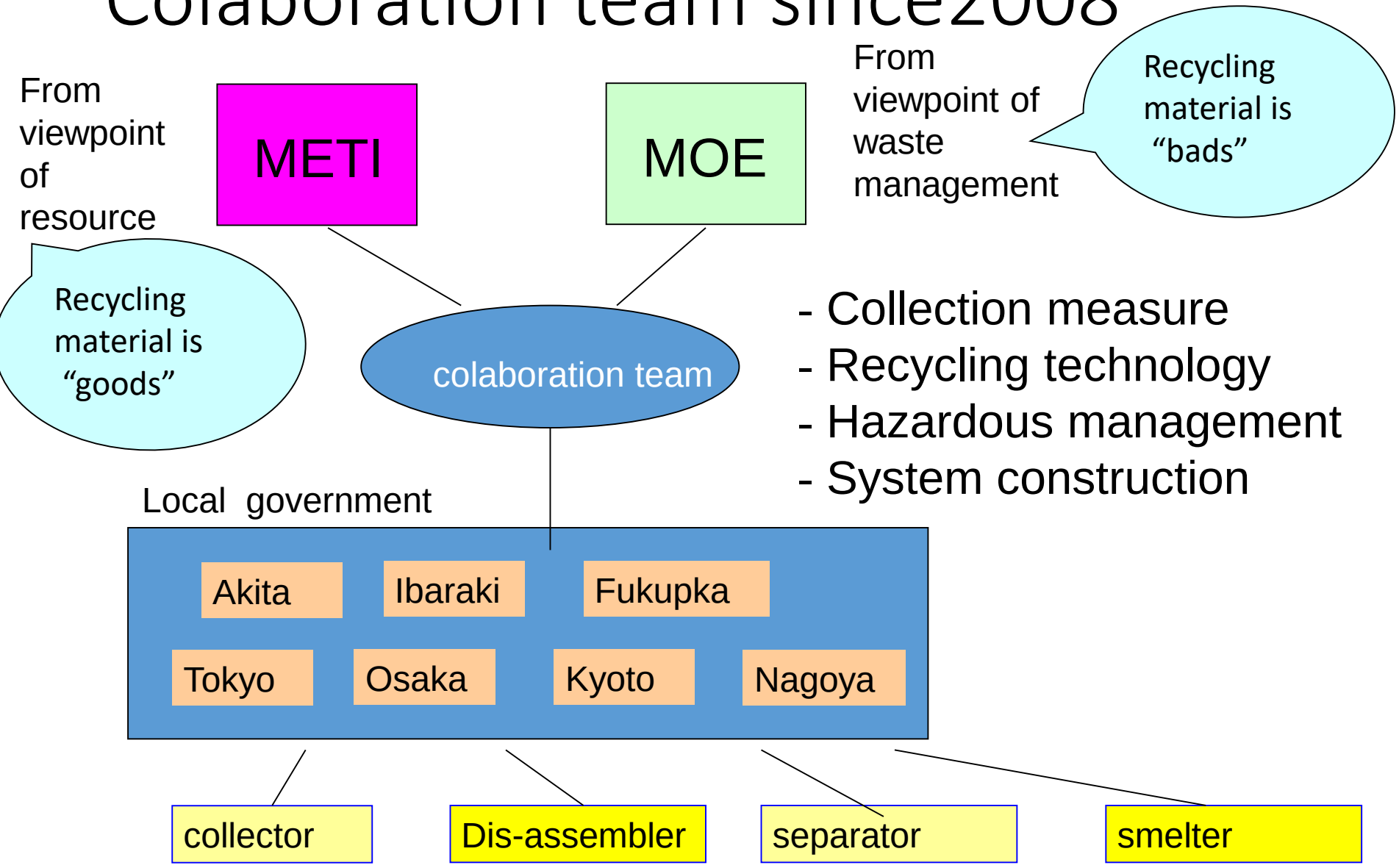








Colaboration team since2008

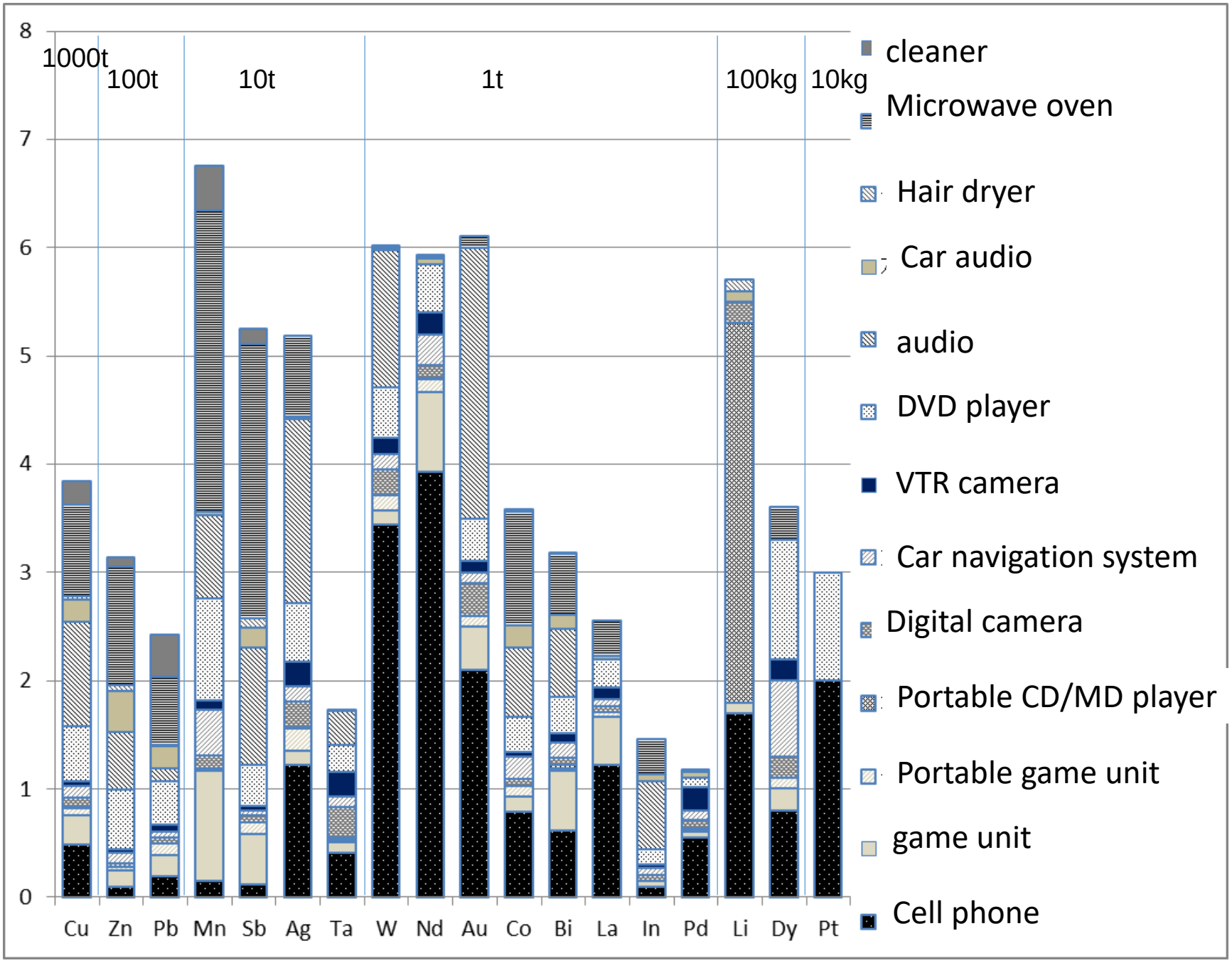


Composition analysis

Practical waste management investigation

	Total EoL		Municipally Collected		Municipal Final disposal	
	Weight (ton)	Price (M¥)	Weight (ton)	Price (M¥)	Weight (ton)	Price (M¥)
Fe	185,668	5,570	67,451	2,024	24,671	735
Cu	25,525	893	10,749	376	7,905	264
Al	17,820	13,552	6,414	4,878	5,719	4,349
Pb	613	155	164	41	157	40
Zn	543	125	135	32	129	30
Ag	44	3,989	12	1,121	12	1,098
Au	9	31,926	2	7,830	2	7,649
Sb	90	125	26	37	26	36
Ta	29	4,567	8	1,233	8	1,212
Nd	7	57	2	14	2	14
W	6	45	2	12	1	12
Co	5	19	1	5	1	5
Bi	5	10	1	3	1	3
Pd	3	6,405	1	1,467	1	1,448
sum	230,357	67,438	84,968	19,071	38,635	16,899

¥17Billion is disposed in municipal waste management


1000t
100t
10t
1t
100kg
10kg
8
7
6
5
4
3
2
1
0
Cu
Zn
Pb
Mn
Sb
Ag
Ta
W
Nd
Au
Co
Bi
La
In
Pd
Li
Dy
Pt
cleaner
Microwave oven
Hair dryer
Car audio
audio
DVD player
VTR camera
Car navigation system
Digital camera
Portable CD/MD player
Portable game unit
game unit
Cell phone

3 roles of Urban mining from the viewpoint of sustainability

1. Economic Sustainable Resource Use.

SUSTAINABLE DEVELOPMENT GOALS

世界を変えるための17の目標

Resource efficiency

How can we make our economy circular and resource efficient?

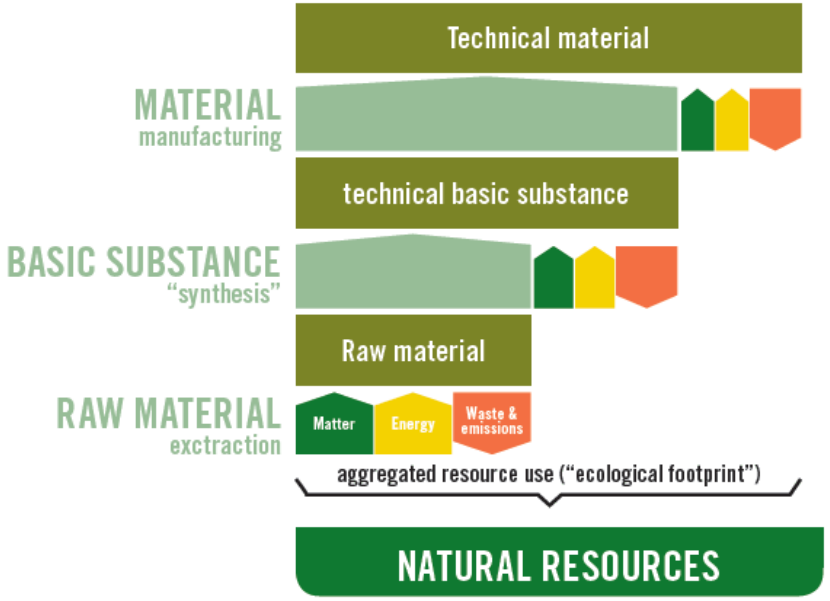
Currently, we are using more resources than our planet can produce in a given time. We need to reduce the amount of waste we generate and the amount of materials we extract.

12.4 tonnes of materials per capita were **extracted** in the EU.

3.2 tonnes of materials per capita were **imported** to the EU.

1.3 tonnes of material per capita were **exported** from the EU.

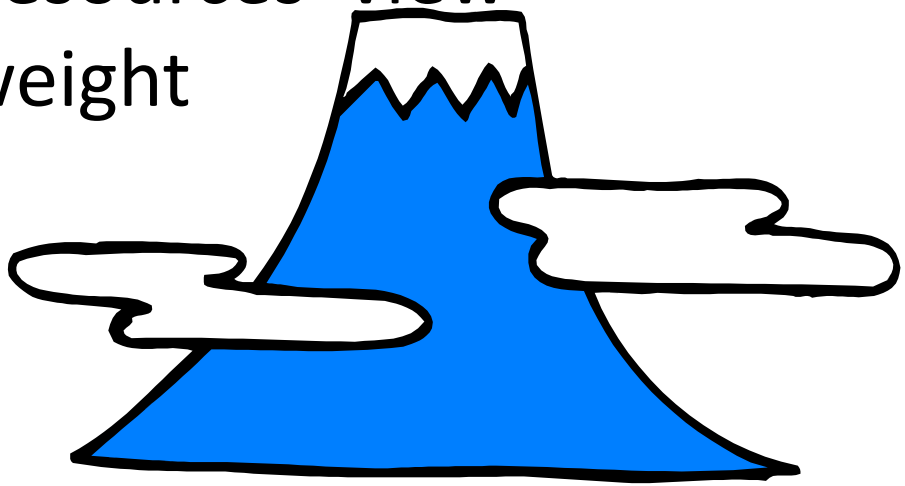
Figure 4: Aggregated resource use for technical materials



https://www.eea.europa.eu/signals/signals-2014/articles/the-economy-resource-efficient-green

Consumers' view weight

Resources' view weight



One Mt.Fuji
100,000,000,000ton
100G ton

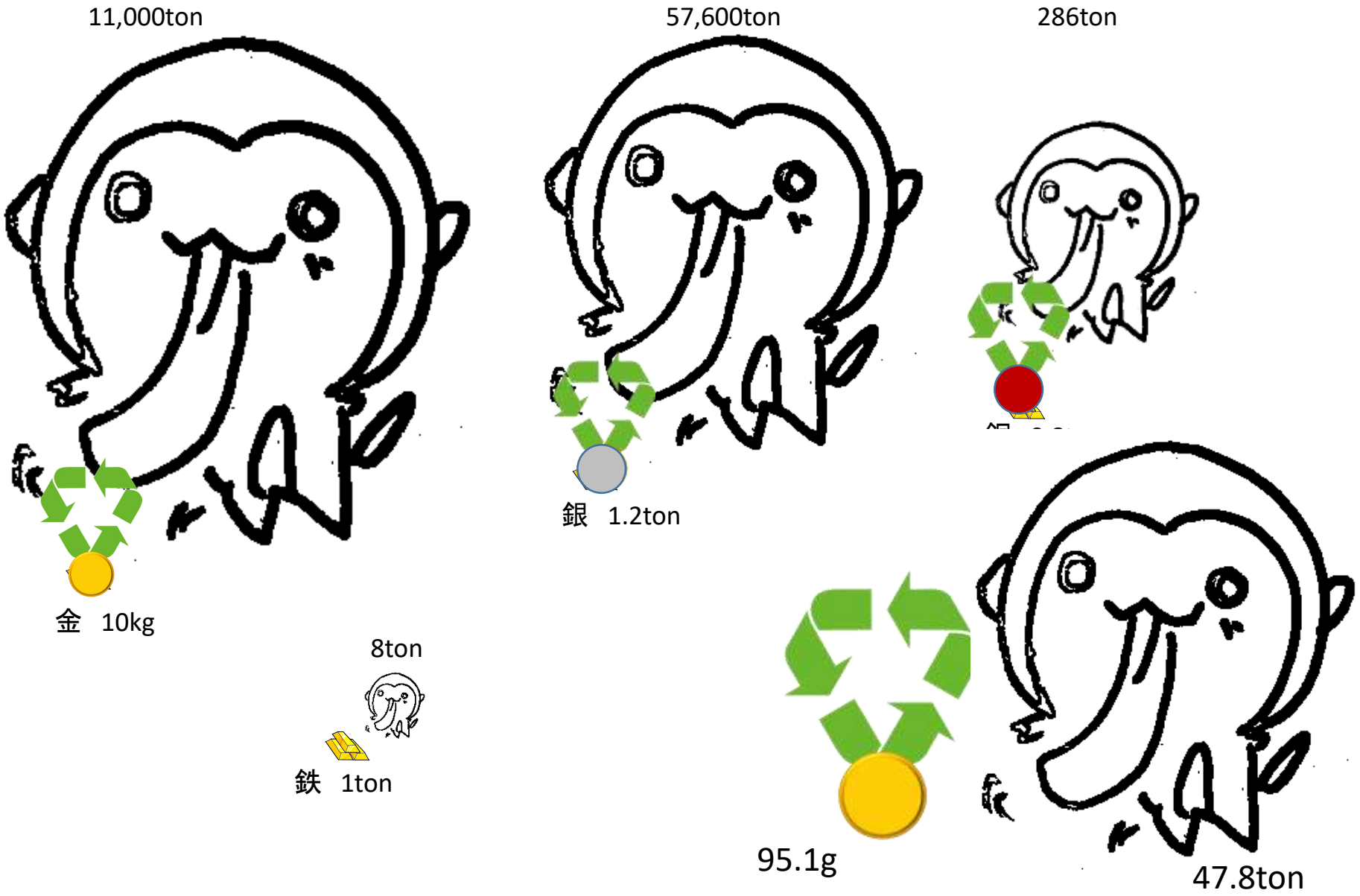
Total volume of gold which Human has been used is only Three pools of Olympic

Au 

The natinal resource which was diged for the three pools of gold.

Important materials have great deal of Eco-Ruecksuck

In Japanese sense,
Every material has each a great number of guardian spirits,
and frequently you waste them.



Medals shoulder great eco-ruecksuck,
if they are produced from natural resources

資源端重量が大きいと、インフォーマルな採取による環境破壊も起きやすい

https://www.hrw.org/ja/news/2015/09/30/281785

http://www.nimd.go.jp/kenkyu/review/h14/h14_mercury_analysis_review.html

http://www.circleofblue.org/2012/world/global-gold-rush-the-price-of-mining-pursuits-on-water-supply/

E-waste (Electric waste)

Eco-ruecksuck of mining

47.8ton

Eco-rucksuck for Hearing E-waste

95.1g

1600ton

One recycled medal improve the resource efficiency.

Urban mined medals go beyond 2020

Urban mined Olympic medals are now in mining

My urban mine bag to collect small size home appliances in a home

My都市鉱山バッグを日本中に流行らせよう

①使用済みの
携帯電話
やゲーム機

②金銀銅レアメタル
になるんだ

Cell phones go to medal

③でも一個ずつ持ってくのは
面倒かな
It bothers to put one by one

My都市鉱山バッグは、エコマテリアルフォーラムが考案した、都市鉱山開発のツールです。他の資源ゴミと違って巡回収集のない小型家電、それを我が家で一度貯めておいてまとめて回収場所に持ち寄るための紙袋です。

④そこで、
My都市鉱山バッグ
Here my urban mine bag!

Our都市鉱山

My都市鉱山バッグ　サイズ 約220x200x120mm

ゆくゆくは、全国の自治体で配布したり、自主回収に使ったりするといいですね。

だから、これをみんなで流行らせましょう。

⑤家中探して
バッグに入れて
たまったら
回収ボックスに

Let's mine in my home.

我が家の都市鉱山だね

(一社)未踏科学技術協会エコマテリアルフォーラム

Cloud Funding supports the fund to make 15000 bags in two month.

クラウドファンディングトップ › 社会にいいこと › 「My都市鉱山バッグ」を広め小型家電からの金銀等回収を進めたい！

「My都市鉱山バッグ」を広め小型家電からの金銀等回収を進めたい！

宮城県 茨城県 東京都 富山県 大阪府 兵庫県 福岡県 横浜 社会にいいこと 地域文化 環境保護 テクノロジ

エコマテリアル・フォーラム会長　原田幸明

支援総額	1,755,000円
達成 目標金額	1,250,000円
支援者数	122人
残り日数	終了しました

購入型　All or Nothing

プロジェクトが成立しました！
このプロジェクトは
2018年5月15日(火)23:00 に成立しました。

いいね！ 261　シェア　ツイートする　B!ブックマーク 0

プロジェクト概要　新着情報 3　応援コメント 122

Kyoto city adopt urban mined gold medal to Kyoto city marathon.

Urban mined medals of local goverments' events will be the symbol of recycling of the area.

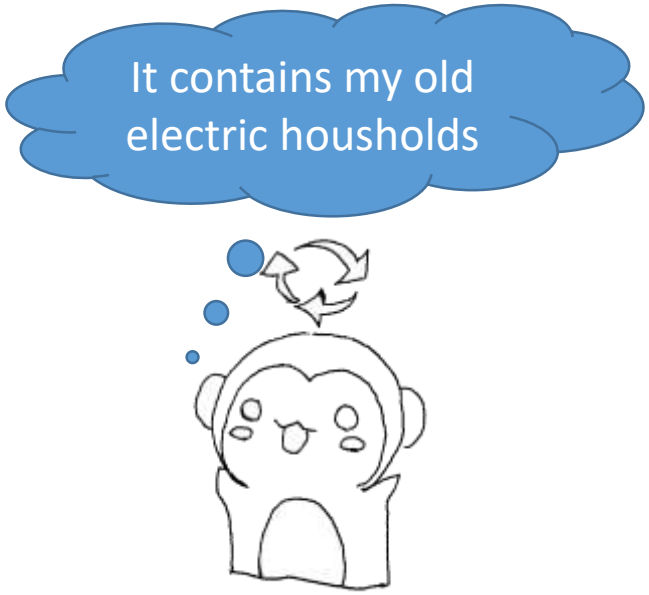
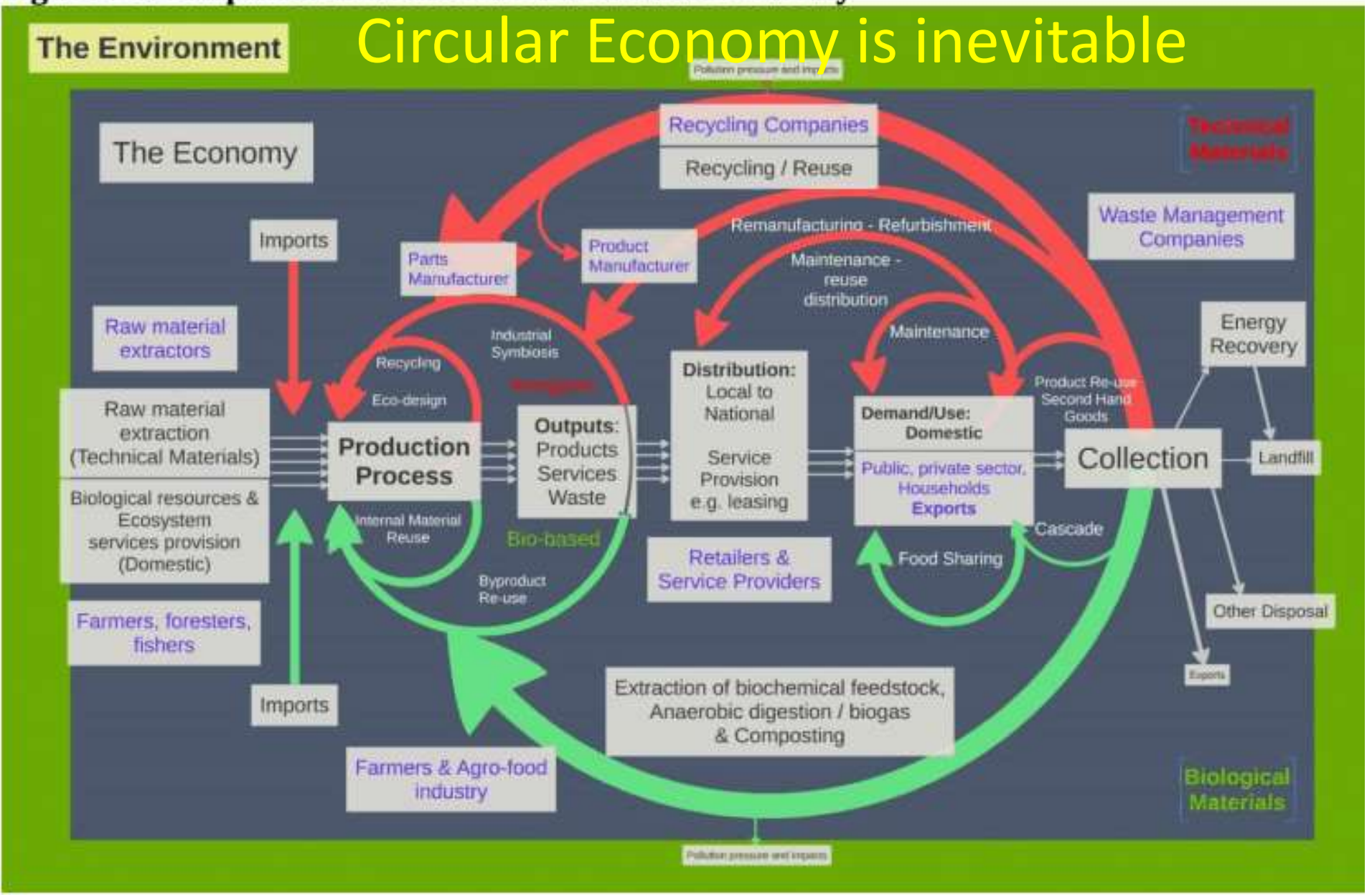


Figure E2: Simplified illustration of a circular economy



Source: Own representation, P ten Brink, P Razzini, S. Withana and E. van Dijl (IEEP), 2014

Comunication value

Behavior value

Utility value

Value as Function unit

Value as Parts

Value as Material

Value as Resource

Shared space

IoE

ICT

Co-use

repair

Service share

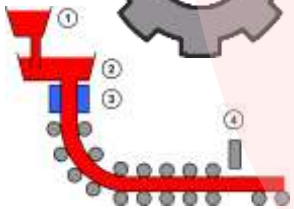
???

direct Reuse

Repair

Parts Re-manufacturing

Elements Reuse/refurbish

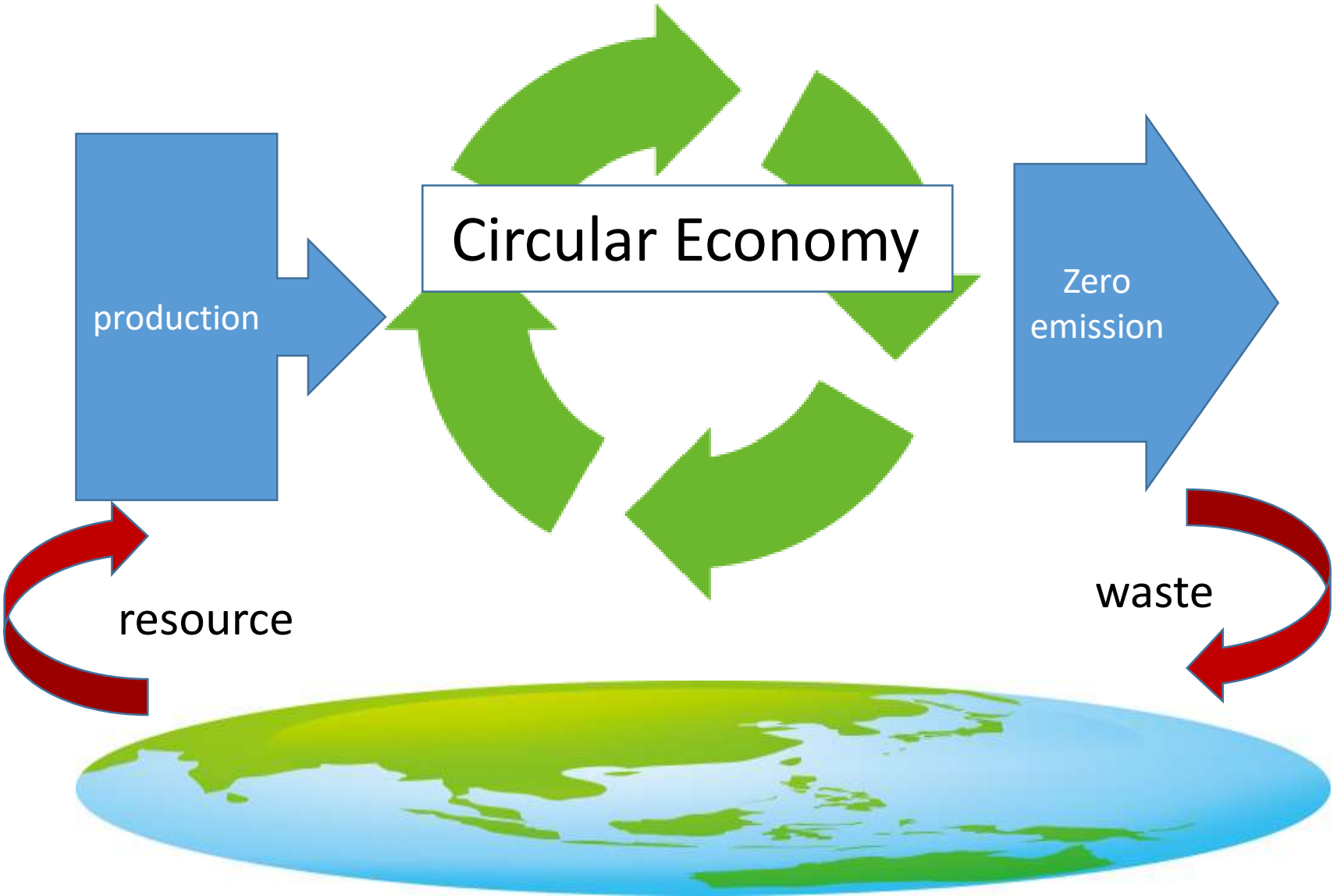


Substance-recycle

Personal space

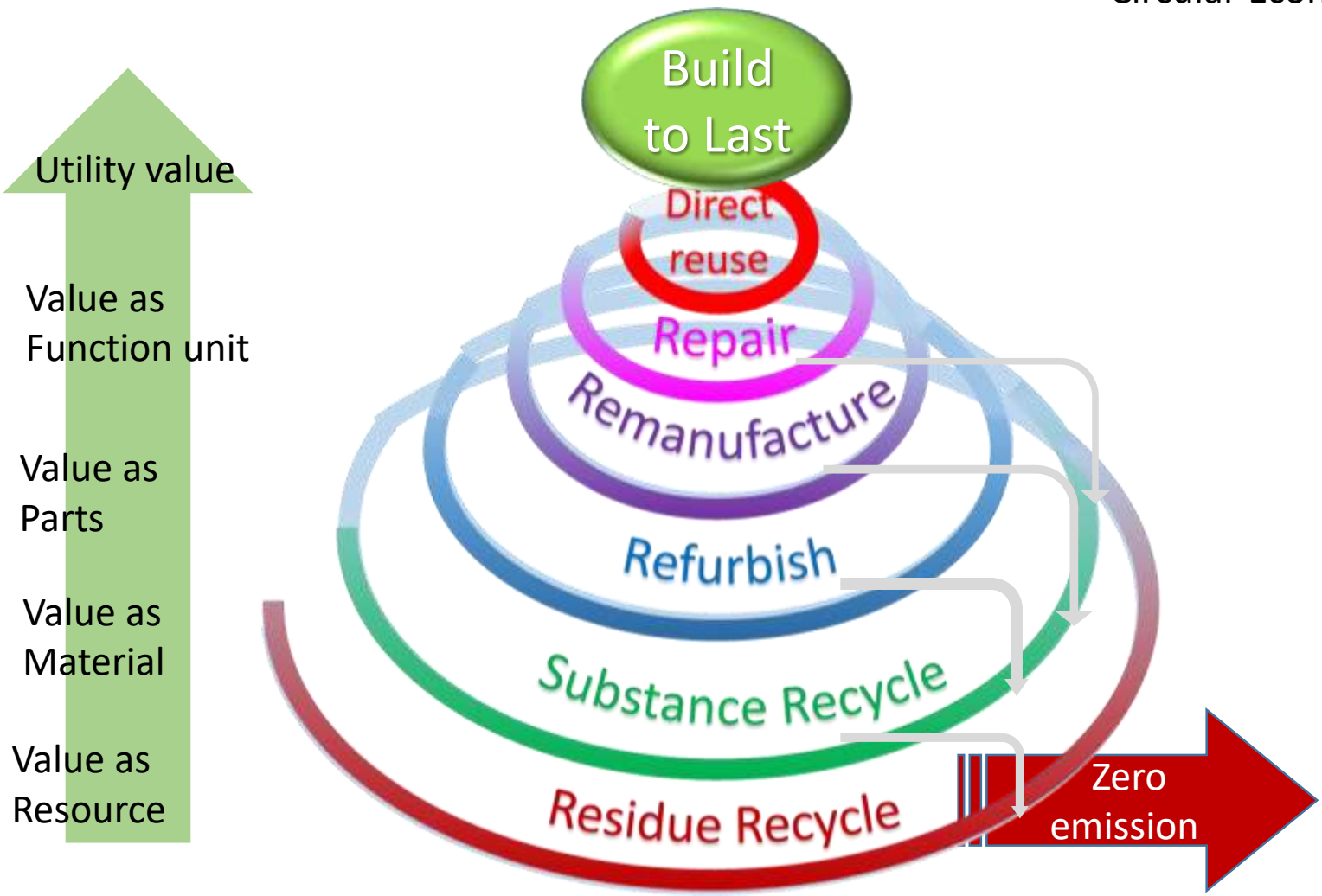
Drag out the retained value of a product throughly

Total Life-cycle management is required
for the improvement of Resource Efficiency



Multi-value Circulation

Beyond
Circular Economy I EU



Material technology needs to shift from midwifery of production to doctor of utilization

Deterioration of material

Surface treatment & Mending

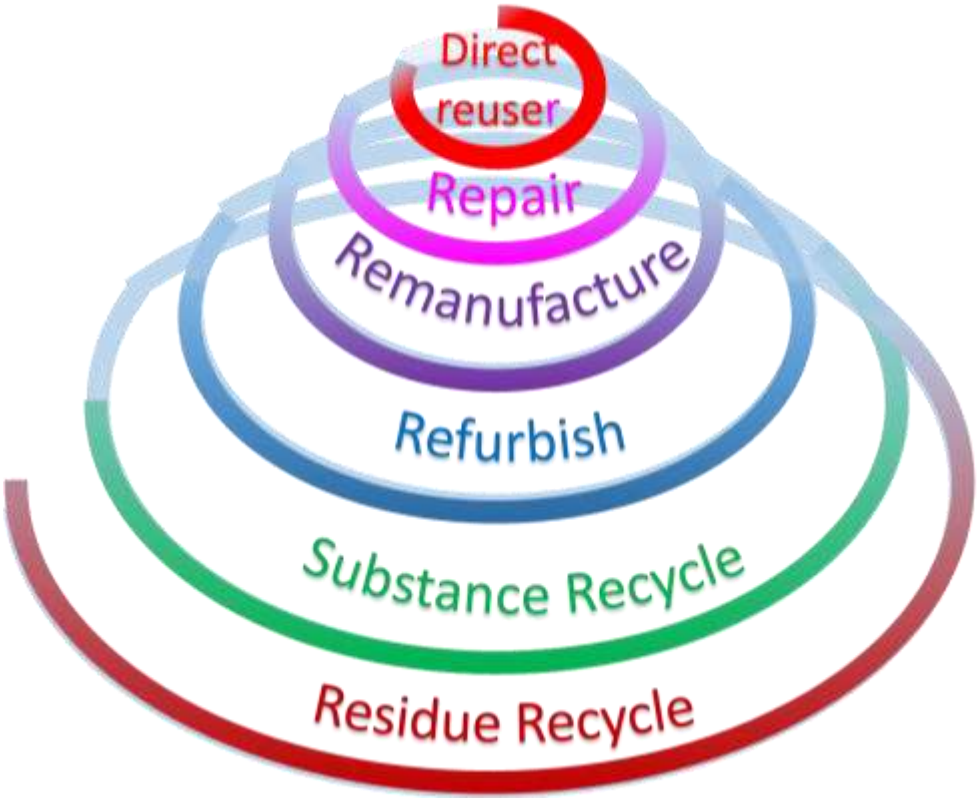
Requisite for material in the multi-value circulation society

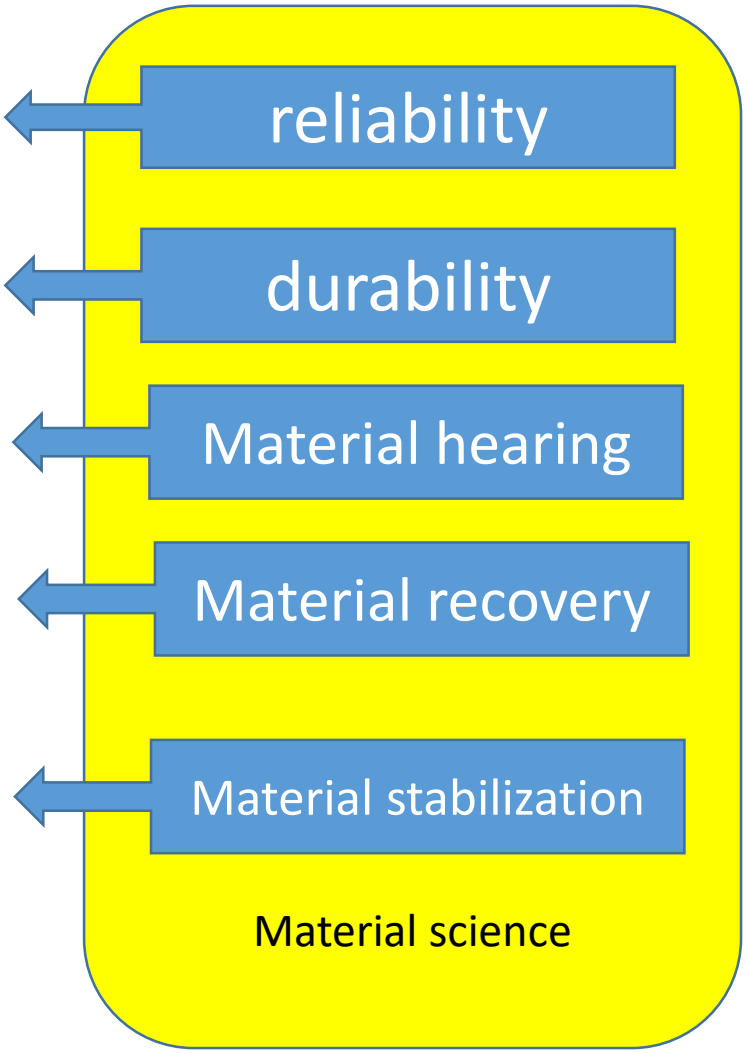
- Long-life several times longer than goods
- Higher and visible reliability indispensable for RRRDR
- Repairable : detachmentable
- Repairable : material hearing
- Repairable : localized mending
- Easy Cleansing, refreshing : dry cleansing technology etc.
- In-situ Customizing processing such as localized additive manufacturing

As a bonus

Wide-area Multi-value Circulation

Circular Economy of productive Asia



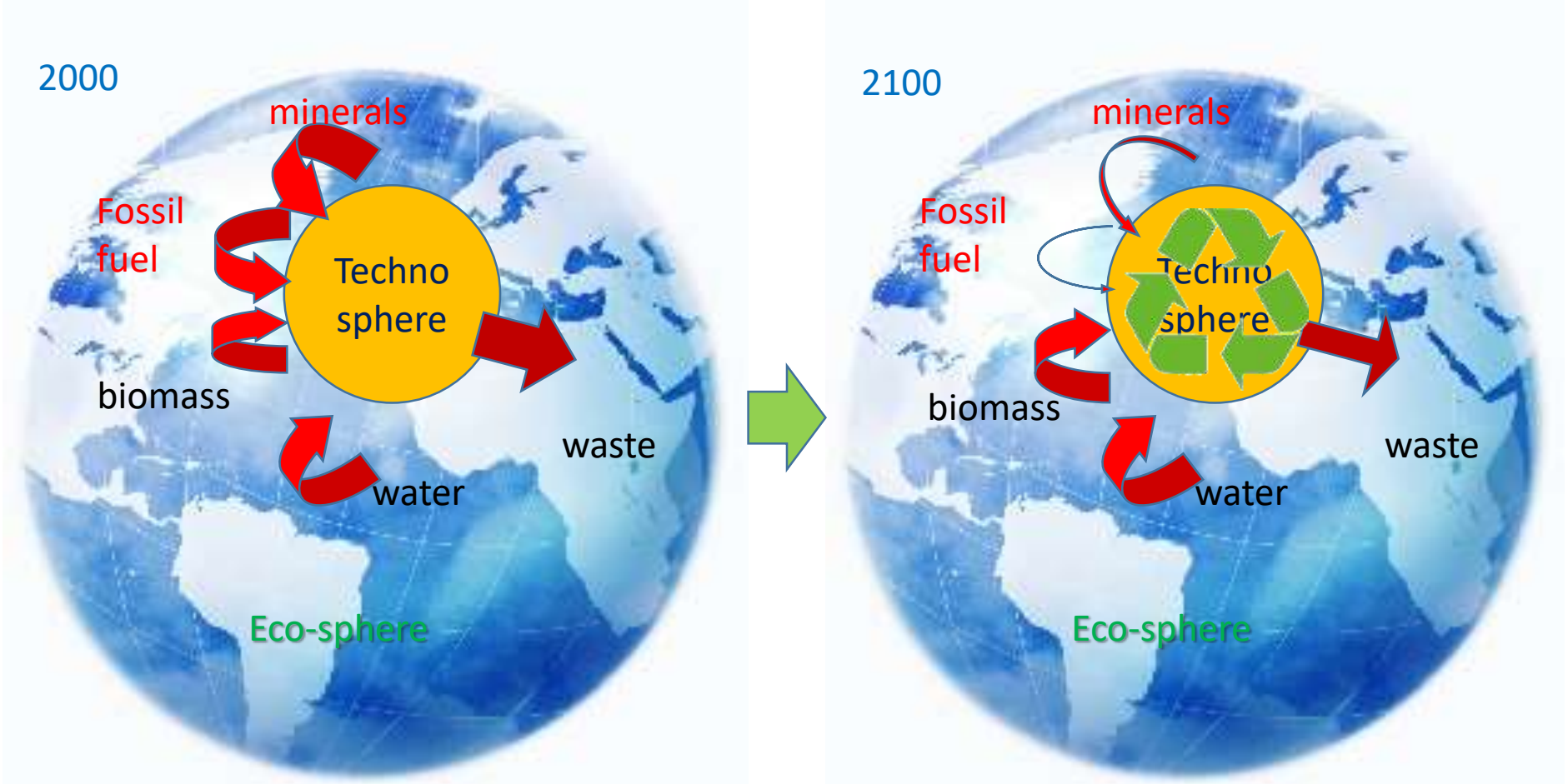


18th august, A symposium is scheduled.

http://susdi.org/wp/event/multivalueI

The world at 2100

- The minerals and fossil fuels from natural resource will be nearly zero.



Material Technology should be shift to resource efficient use.

Thank you!