

# Urban mined medal goes beyond 2020

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National Institute for Material Science

# Urban mined Olympic medals



# Medals for 2020 Tokyo Olympics to be made of recycled metal

AP 2:06 a.m. ET April 1, 2017

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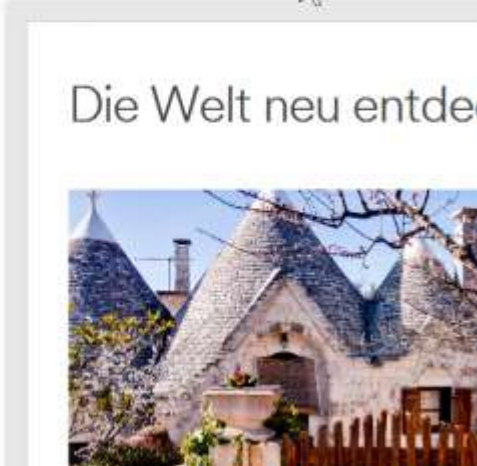


*(Photo: The Associated Press)*

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TOKYO (AP) — Organizers of the 2020 Tokyo Olympics have begun collecting discarded electronic devices that will be used in the production of the medals to be awarded to athletes.

Japanese Olympic swimmer Takeshi Matsuda and Paralympian Takuro Yamada attended a ceremony in downtown Tokyo on Saturday to kick off the campaign.





Using is believing

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**SPORTS NEWS** | Wed Feb 1, 2017 | 5:28am EST

# Tokyo Olympic medals to be made from recycled donated metal



FILE PHOTO: A woman is silhouetted against a monitor showing Tokyo 2020 Olympics and Paralympics emblems during the Olympic and Paralympic flag-raising ceremony at Tokyo Metropolitan Government Building in Tokyo, Japan, September 21, 2016. REUTERS/Toru Hanai/File Photo



2020 Tokyo Olympic is  
in preparation



# Dream Island just after Tokyo Olympic 1964.

Deposit site of waste from mass consumption



We fought against fly.

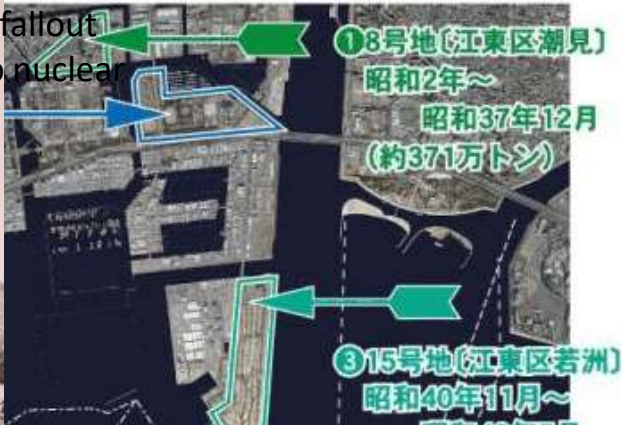
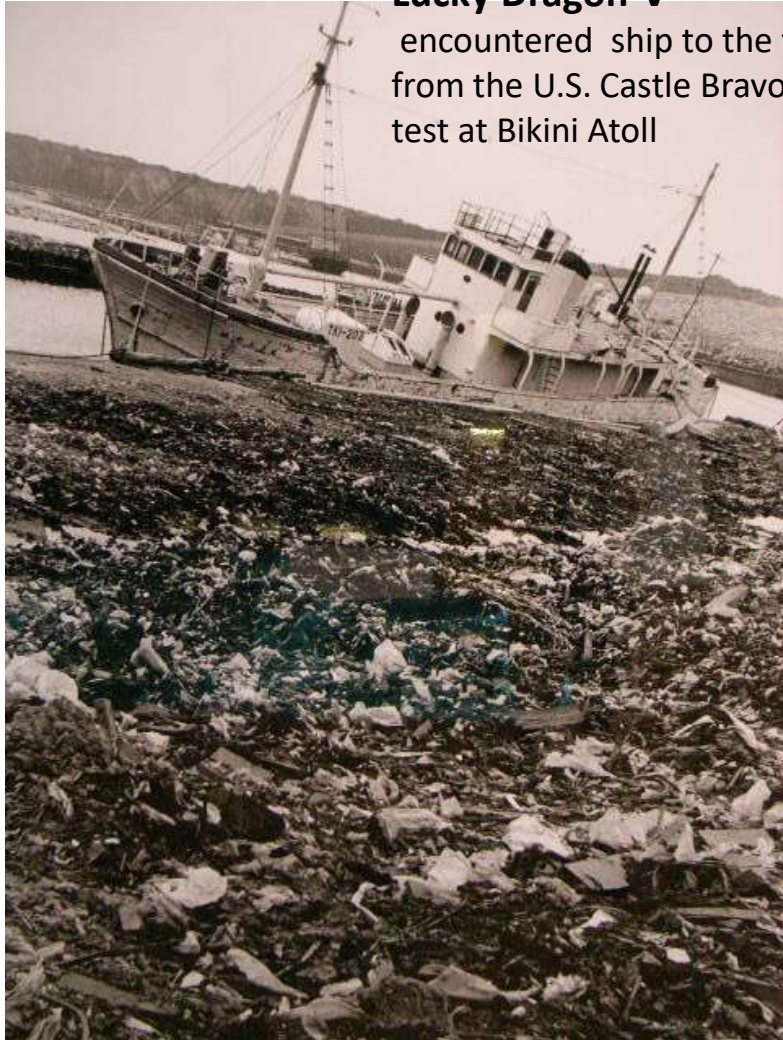




# Waste landfill area of Tokyo in late 20th century.

## Lucky Dragon-V

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



(資料提供：東京都港灣局)



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**





えっ！携帯電話から  
金メダル？

**あなたの家に眠っている  
使用済小型家電の回収にご協力下さい。**

使用済みの携帯電話やデジタルカメラ、ノートパソコンなどの小型家電には、金、銀、銅、レアメタルなどの有用金属が多く含まれています。  
東北地方で小型家電リサイクル店の認定事業者がある青森県八戸市、秋田県大館市、岩手県一関市では、使用済小型家電から回収された金属を2020年東京オリンピック・パラリンピックのメダルに活用することや、環境技術大会経費委員会や関係各庁に共同で提案しています。  
\*使用済小型家電をゴミとして処分せず、再作の資源回収にご協力いただき、市民の皆様と協力してこの提案を推進させ、日本のリサイクル技術の進歩と発展に貢献したい大会をPRしましょう！

# 使用済小型家電で 金メダルを作ろう!!

**八戸市**

〒031-0201 青森県八戸市  
〒031-0202 青森県八戸市  
〒031-0203 青森県八戸市  
〒031-0204 青森県八戸市  
〒031-0205 青森県八戸市  
〒031-0206 青森県八戸市  
〒031-0207 青森県八戸市  
〒031-0208 青森県八戸市  
〒031-0209 青森県八戸市  
〒031-0210 青森県八戸市

**大館市**

〒019-0101 秋田県大館市  
〒019-0102 秋田県大館市  
〒019-0103 秋田県大館市  
〒019-0104 秋田県大館市  
〒019-0105 秋田県大館市  
〒019-0106 秋田県大館市  
〒019-0107 秋田県大館市  
〒019-0108 秋田県大館市  
〒019-0109 秋田県大館市  
〒019-0110 秋田県大館市

**一関市**

〒985-0801 岩手県一関市  
〒985-0802 岩手県一関市  
〒985-0803 岩手県一関市  
〒985-0804 岩手県一関市  
〒985-0805 岩手県一関市  
〒985-0806 岩手県一関市  
〒985-0807 岩手県一関市  
〒985-0808 岩手県一関市  
〒985-0809 岩手県一関市  
〒985-0810 岩手県一関市

八戸、大館、一関の三市提案

「2020年東京オリンピック・パラリンピックのメダルに回収金属を活用することについての提案」

のフィージビリティに関する調査報告

2016年1月11日

未踏科学技術協会・エコマテリアルフォーラム(会長:原田幸明)

〒105-0003 東京都港区西新橋1-5-10 新橋アマノビル6F

(社)未踏科学技術協会

(窓口) 田口 Tel: 029-859-2668

メール: [ecomaterial@sntt.or.jp](mailto:ecomaterial@sntt.or.jp)





## Olympic Charter (-2000)

### ***BYE-LAW TO RULE 70***

#### 2- Medals and Diplomas

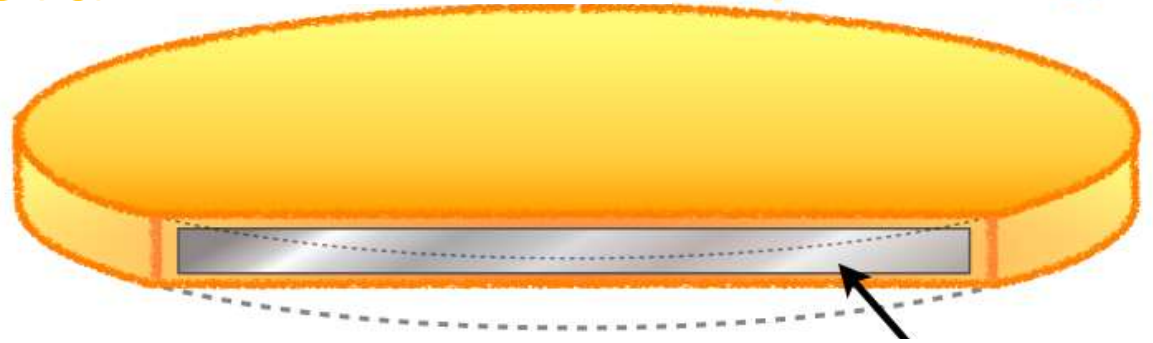
2.2 the medals shall be at least 60mm in diameter and 3mm thick. The medals for first and second places shall be of silver of at least 925-1000 grade; the medal for first place shall be gilded with at least 6g of pure gold.



Weight  
95 ~ 500g

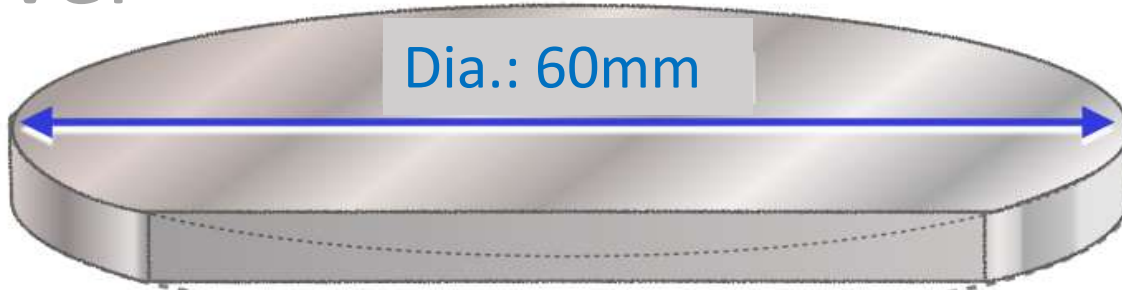
gold

Gold plated 50 $\mu$ m 6 g



Base consists of Silver

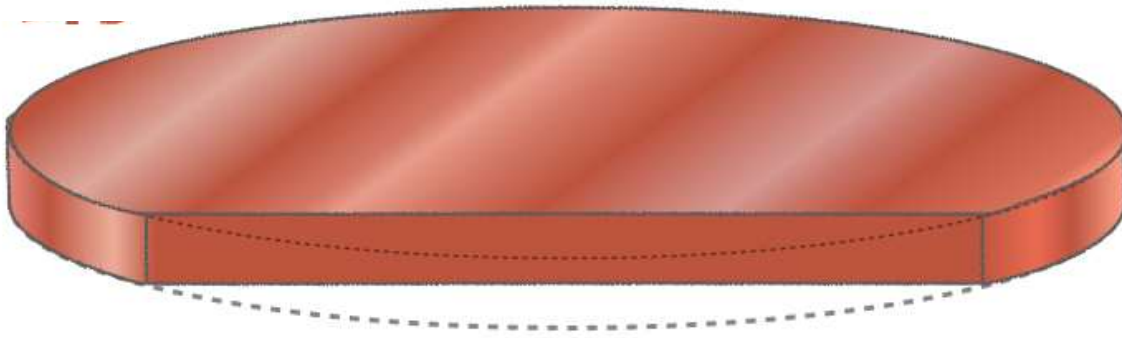
silver



Dia.: 60mm

3mm thick

bronze



	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 Charter 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	<b>9.6kg</b>	<b>1,210kg</b>	<b>700kg</b>		



# 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

## 小型家電にはたくさんの金銀銅やレアメタルが入っています

	BDプレーヤ	携帯電話	PCラップトップ	PCデスクトップ
一台平均重量	3.6kg	0.1kg	2.1kg	8.2kg
2011排出台数	60,000	40,000,000	6,700,000	5,000,000
排出量	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

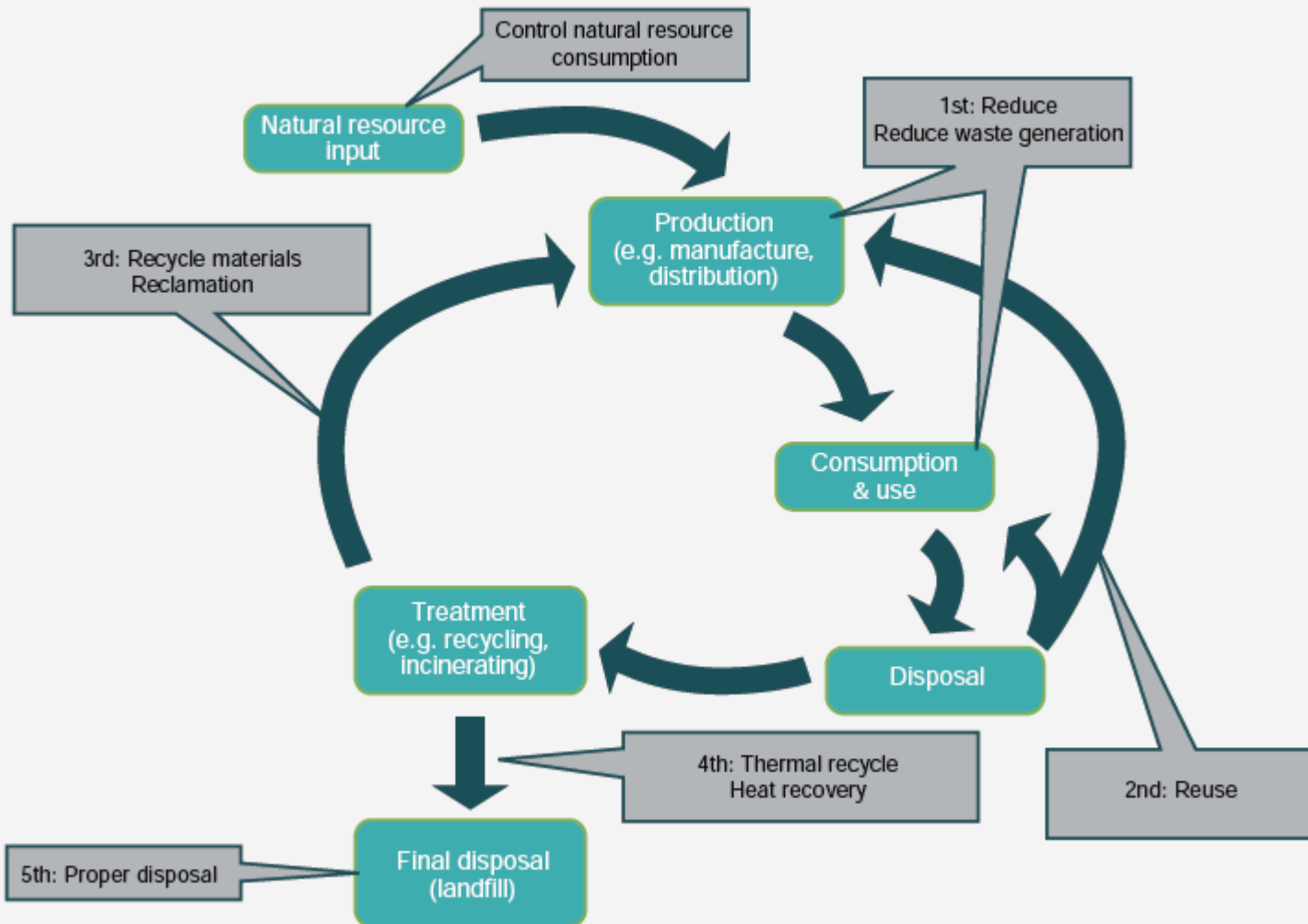
## 小型家電リサイクル法に基づく再資源化量と全リサイクル量

	2013	2014	2015	Requisit for Olympic medals
Au	46kg	<b>143kg</b>	<b>214kg</b>	<b>9.8kg</b>
Ag	446kg	<b>1566kg</b>	<b>2563kg</b>	<b>1210kg</b>
Cu	381ton	<b>1,112ton</b>	<b>1469ton</b>	<b>700kg</b>



# 3Rs in Sound material-cycle society

Figure 3-1 Flowchart for a sound material-cycle society



Source: Ministry of the Environment

Regulations according to characteristics of individual articles

Law for the Promotion of Sorted Collection and Recycling of Containers and Packaging

Completely enforced in April 2000  
Partially amended in June 2006

- Sorted collection of containers and packages by municipalities
- Recycling by container manufacturers and business operators who use containers and packages

e.g. bottles, PET bottles, paper or plastic containers and packages

Law for the Recycling of Specified Kinds of Home Appliances

Completely enforced in April 2001

- Retailers, etc. collect waste electric appliances from consumers
- Recycling by manufacturers, etc.

Air conditioners, refrigerators & freezers, TVs, washing machines

Law for the Promotion of the Utilization of Recyclable Food Resources

Completely enforced in May 2001  
Partially amended in June 2007

- Recycling of commercial food waste by food manufacturers, processors, and retailers

Food residues

Construction Materials Recycling Law

Completely enforced in May 2002

- Sorted demolition, etc. of buildings
- Recycling of construction waste materials, etc., by contractors

Timber, concrete, asphalt

Law for the Recycling of End-of-Life Vehicles

Partially enforced in January 2003  
Completely enforced in January 2005

- Collection of used vehicles, collection of CFC gas, demolition, and crushing by concerned business operators
- Recycling of airbag shredder dust, and destruction of CFCs by manufacturers

Vehicles

Completely enforced in April 2001

Law concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities  
(The State and other entities take the initiative to promote the procurement of recycled items)

Recycling law for small size electric appliances starts from April 2013.

西原さそり

小型家電リサイクル法が始まります

このロゴが目印!

小型家電を処分するときは、市町村のごみ分別ルールに従って出しましょう

※小売店が回収に協力している場合もあります。

小型家電リサイクル法の対象品目

小型家電はレアメタル等の有用金属を含む一方、鉛などの有害物質を含むものもあることから、法律に基づく適切なリサイクルが必要です。

※ご家庭の電気でおくものが幅広く制度の対象になりますが、市町村ごとに回収品目や回収の開始時期が異なります。

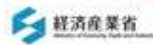
※大型の家電4品目（テレビ・エアコン、冷蔵庫・冷凍庫、洗濯機・衣類乾燥機）については処分方法が異なります。詳しくは家電小売店又は市町村へお問い合わせください。

小型家電リサイクル



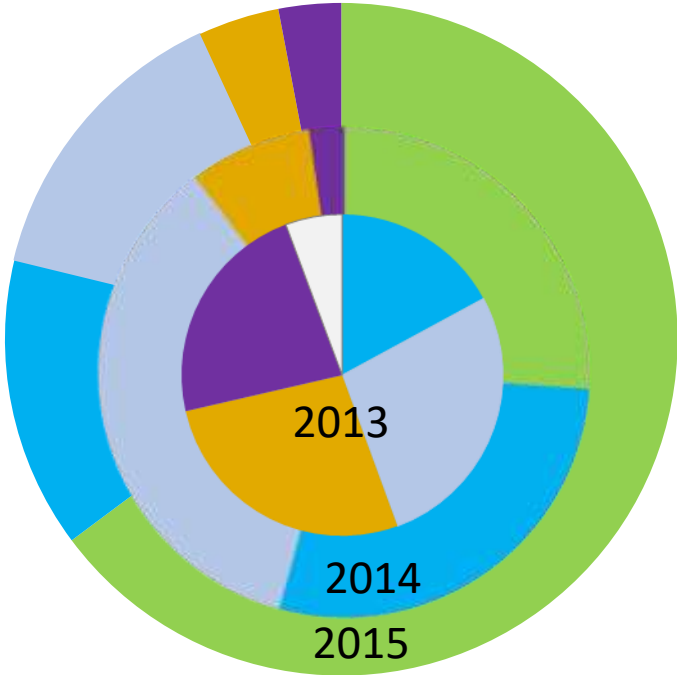
【小型電気電子機器の例】

2013.4.1

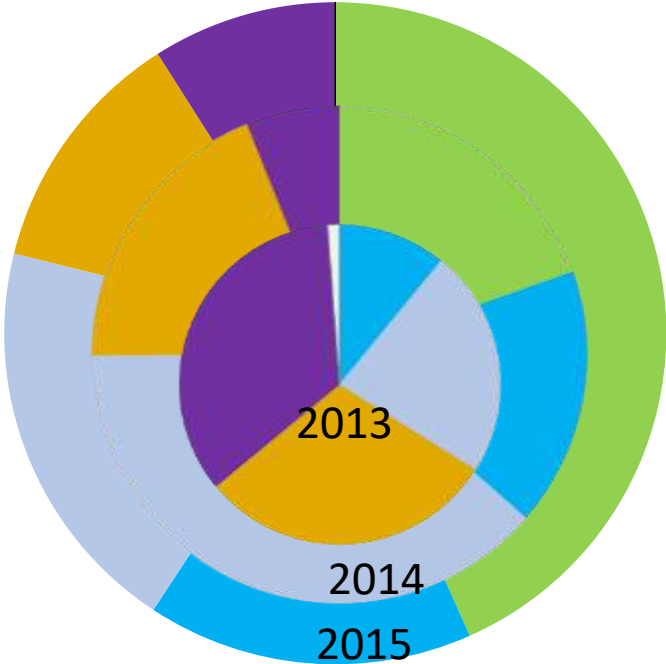


<http://www.universe-corp.jp/article/14864904.html>

**%of local government population**

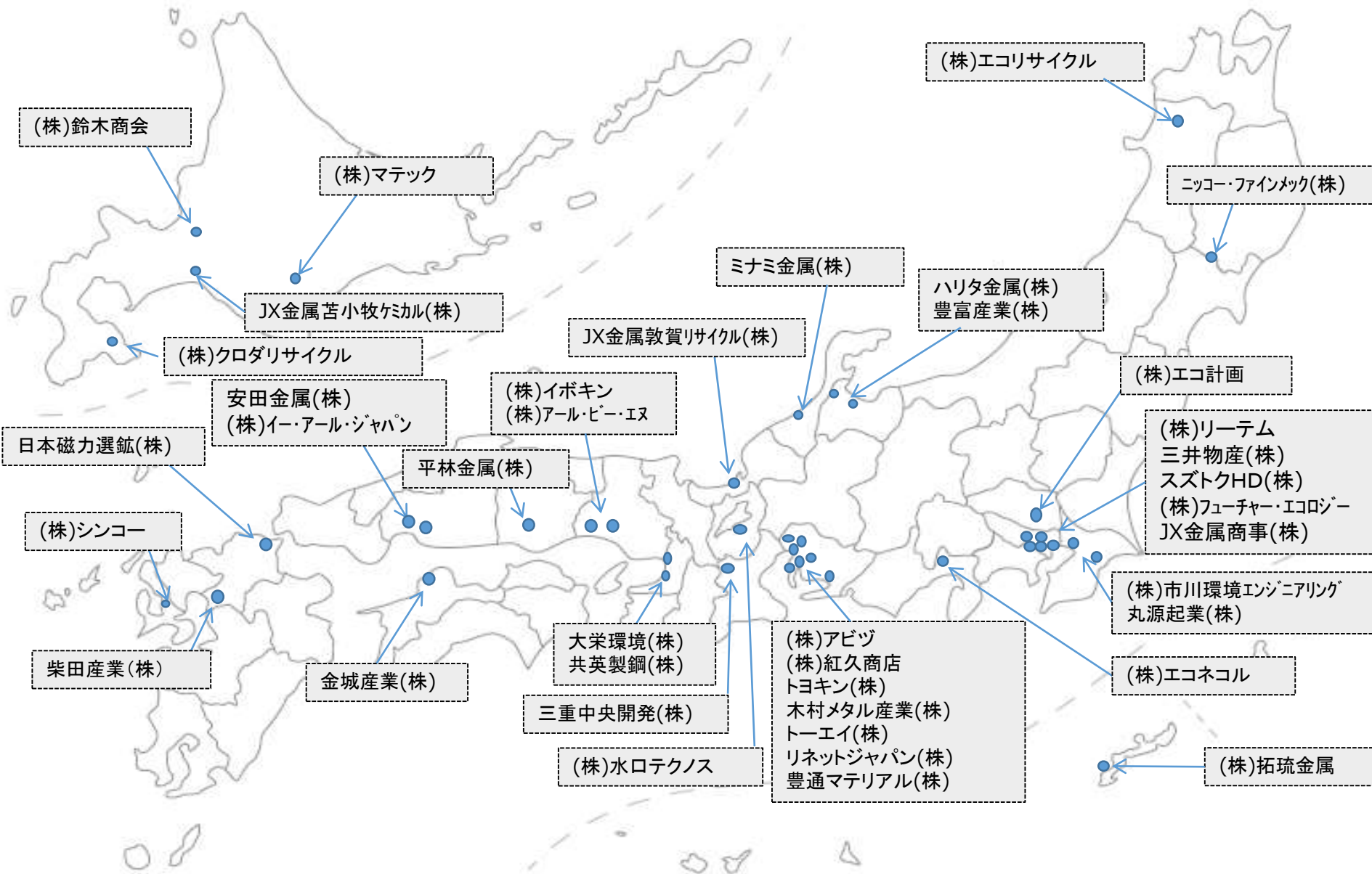


**%of local government in number**

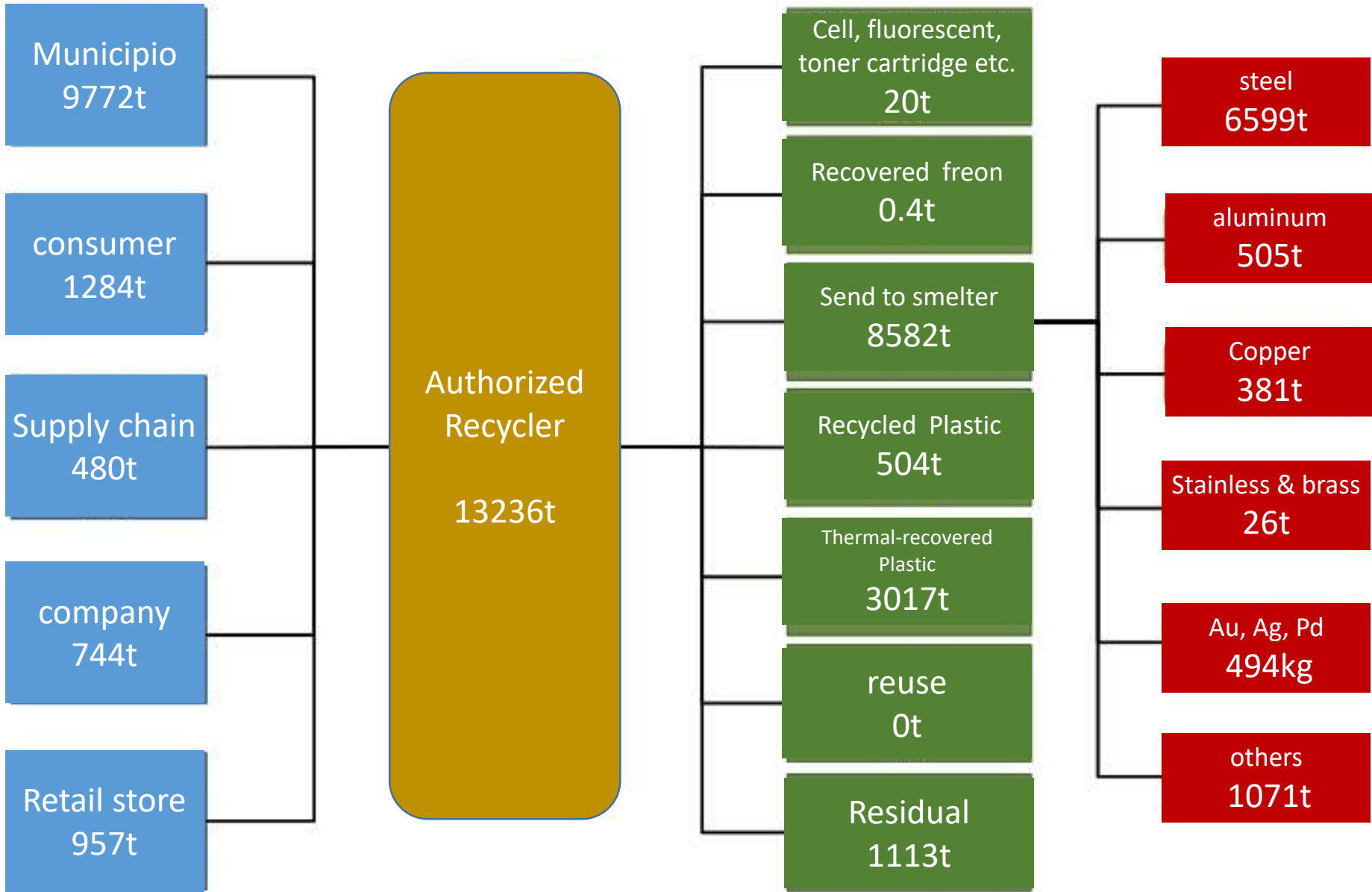


- in operation
- in preparation
- forward-looking
- passive stance
- rejection
- no answer

# 認定事業者の分布状況（平成27年6月末現在）



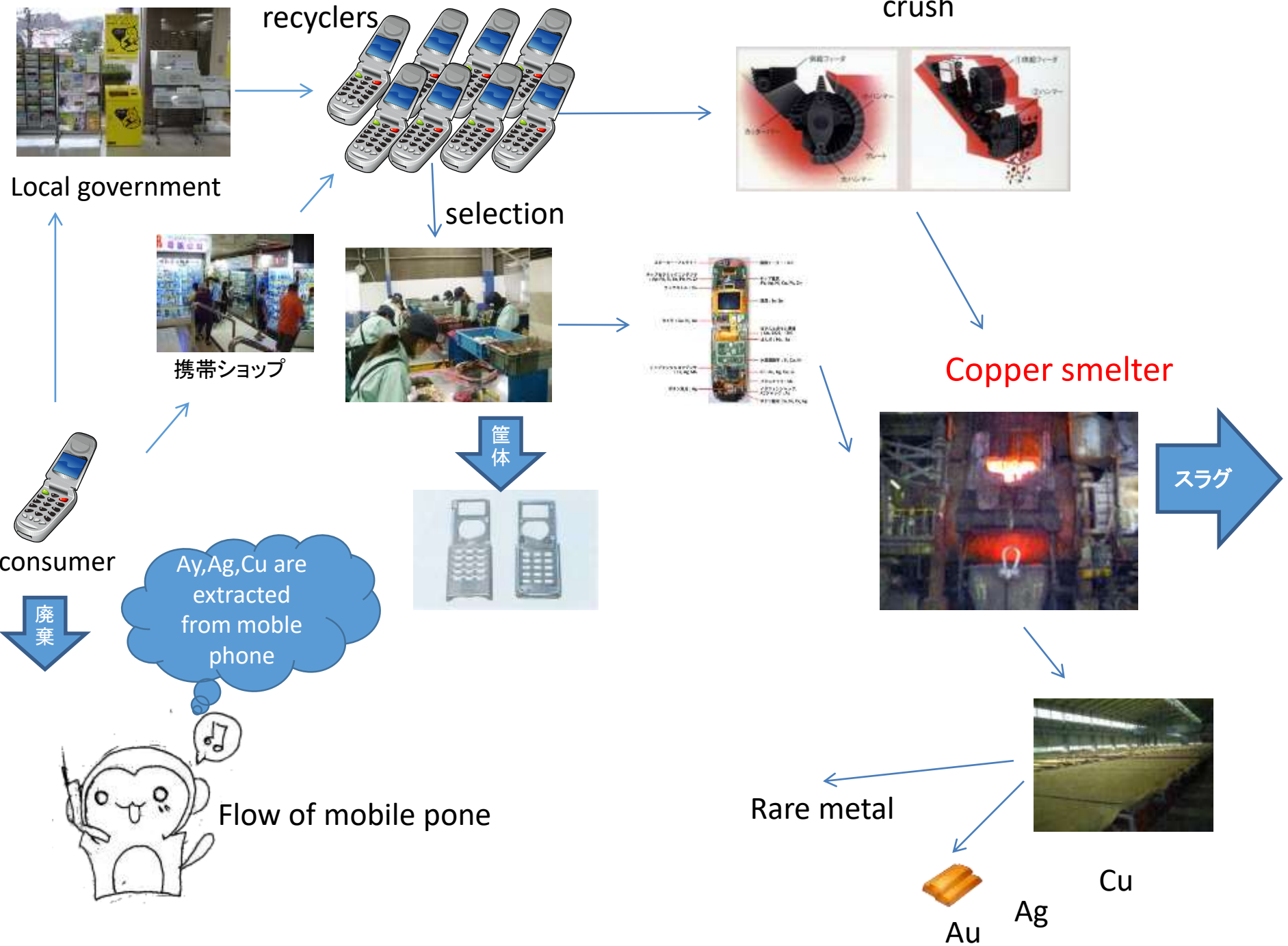




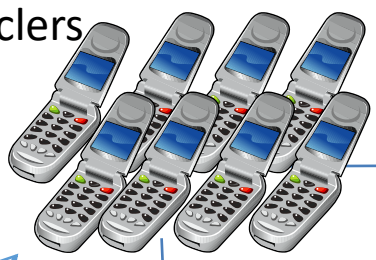
# Recovery of Gold from Urban mine



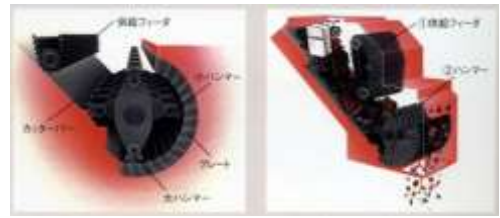
コンピュータなどの電子基板です



recyclers



crush



Local government

selection



携帯ショップ



Copper smelter



筐体



consumer

廃棄

Au, Ag, Cu are extracted from mobile phone

Flow of mobile phone

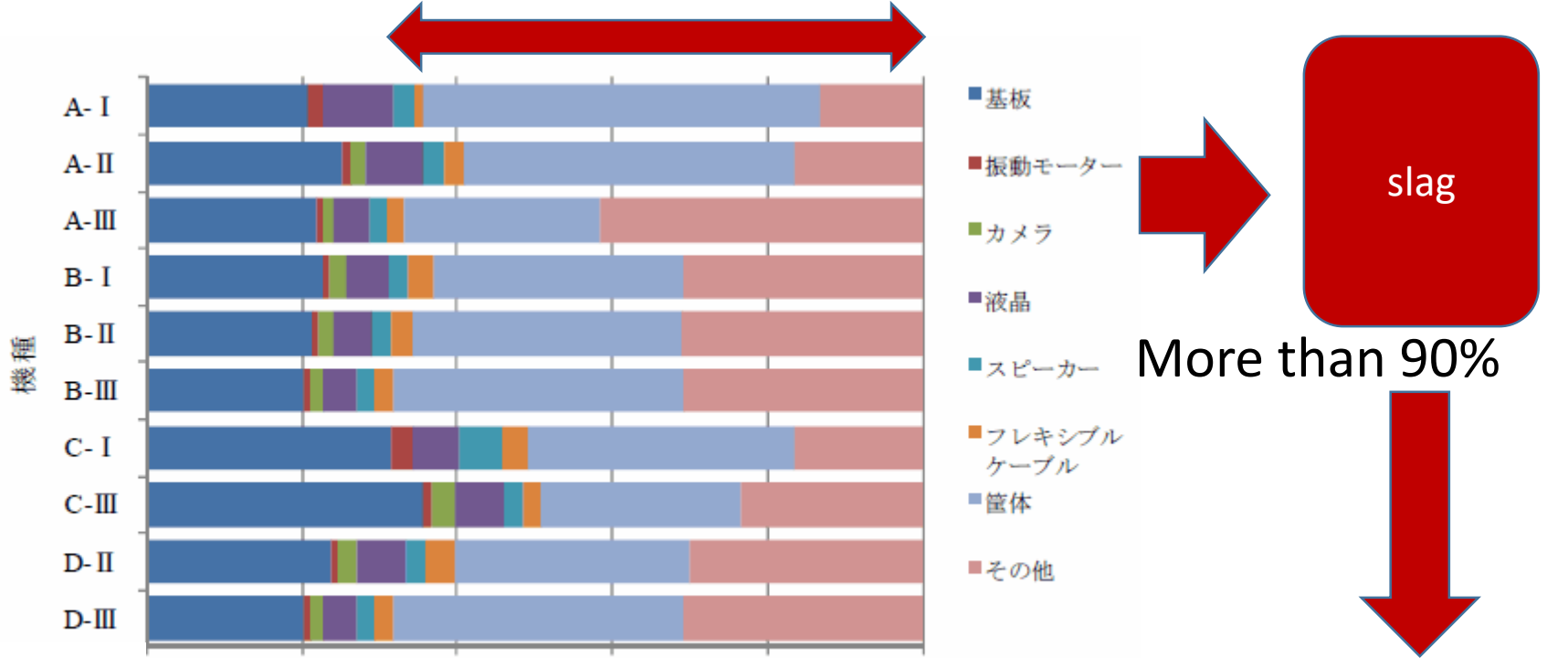
Rare metal



Au

Ag

Cu



Liquid crystal

重量割合

20% 40% 60% 80% 100%

元素	2000-2002年
Ag	A-I
Al	1~5
As	
Au	
B	1~5
Ba	0.5~3
Ca	0.5~3
Cr	
Cu	0.01~0.1
Fe	
In	0.01~0.1
Mg	0.1~1
Mn	
Mo	
Ni	
Sb	
Si	10~30
Sr	
Ti	0.005~0.05
W	
Zn	

Circuit board

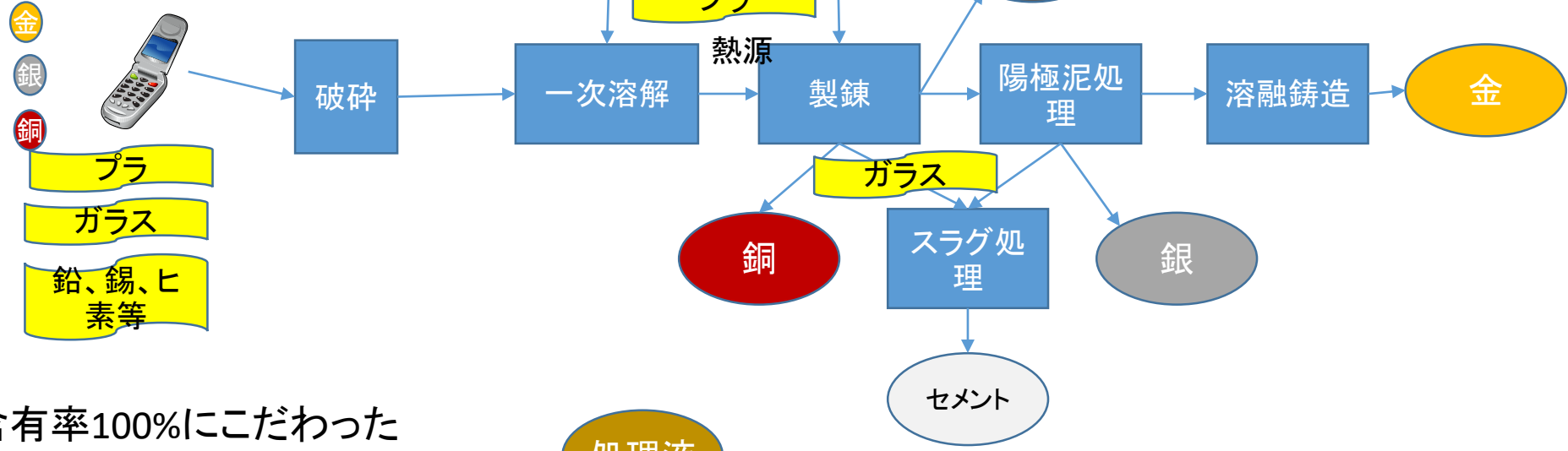
基板	A-I
元素	2000-2002年
Ag	0.262
Au	0.113
Co	0.031
Cu	25.7
Dy	0.014
In	0.008
Nd	0.112
Pd	0.012
Sm	<0.01
Ta	0.180
W	0.132

Ag 0.05%  
Au 0.02%  
Co 0.06%  
Cu 5%  
Dy 0.003%  
In 0.0015%  
Nd 0.02%  
Ta 0.04%  
W 0.025%

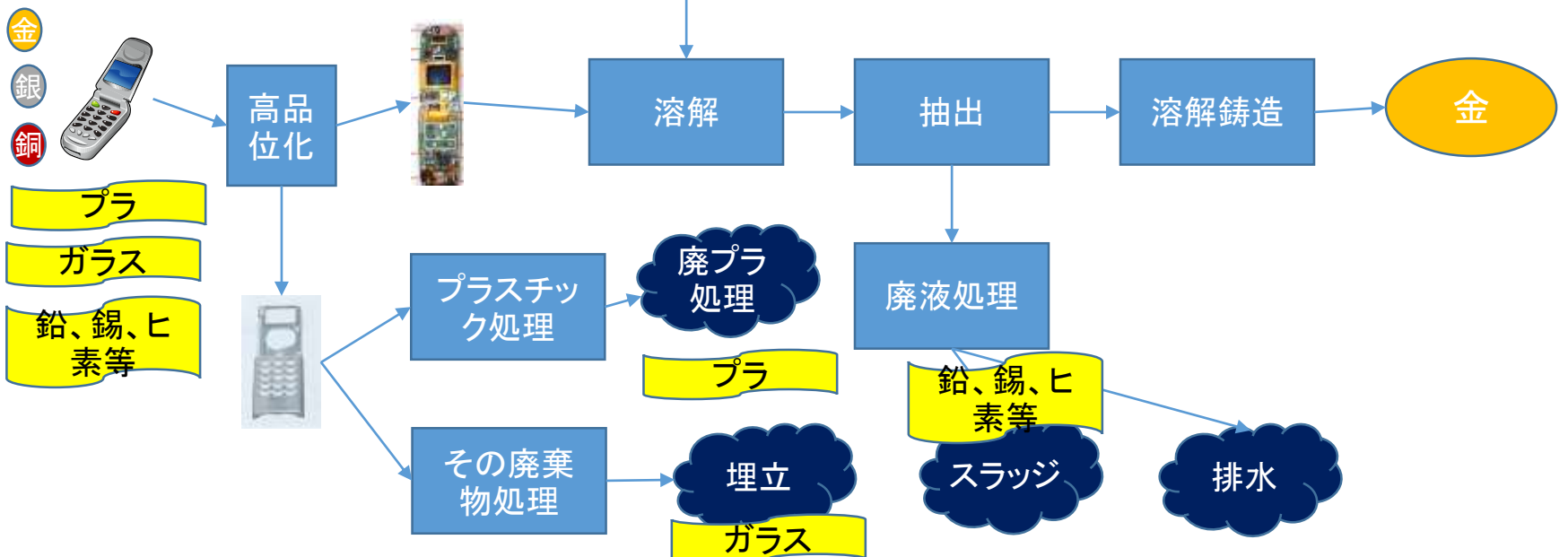
Less than 10%



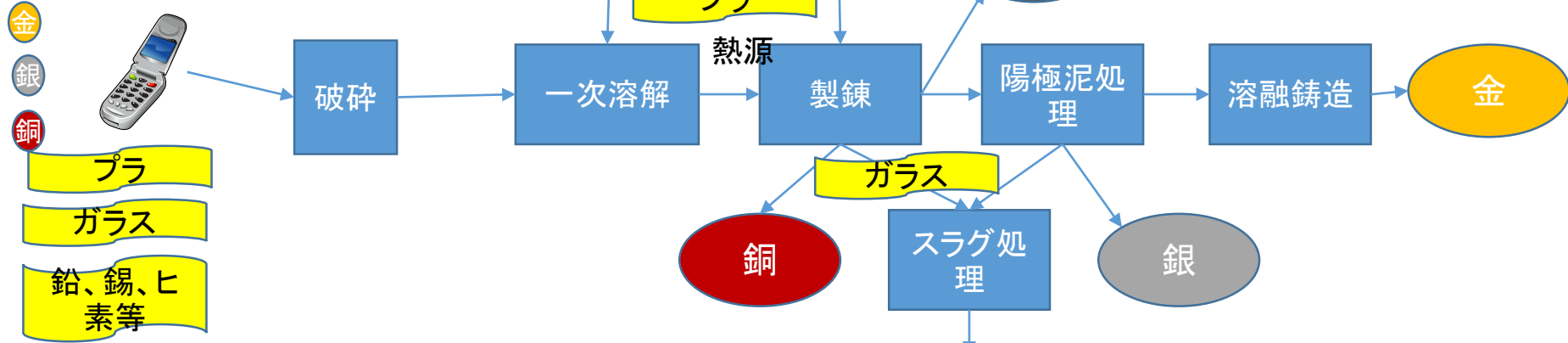
# 利用率100%の廃棄物ゼロ リサイクル



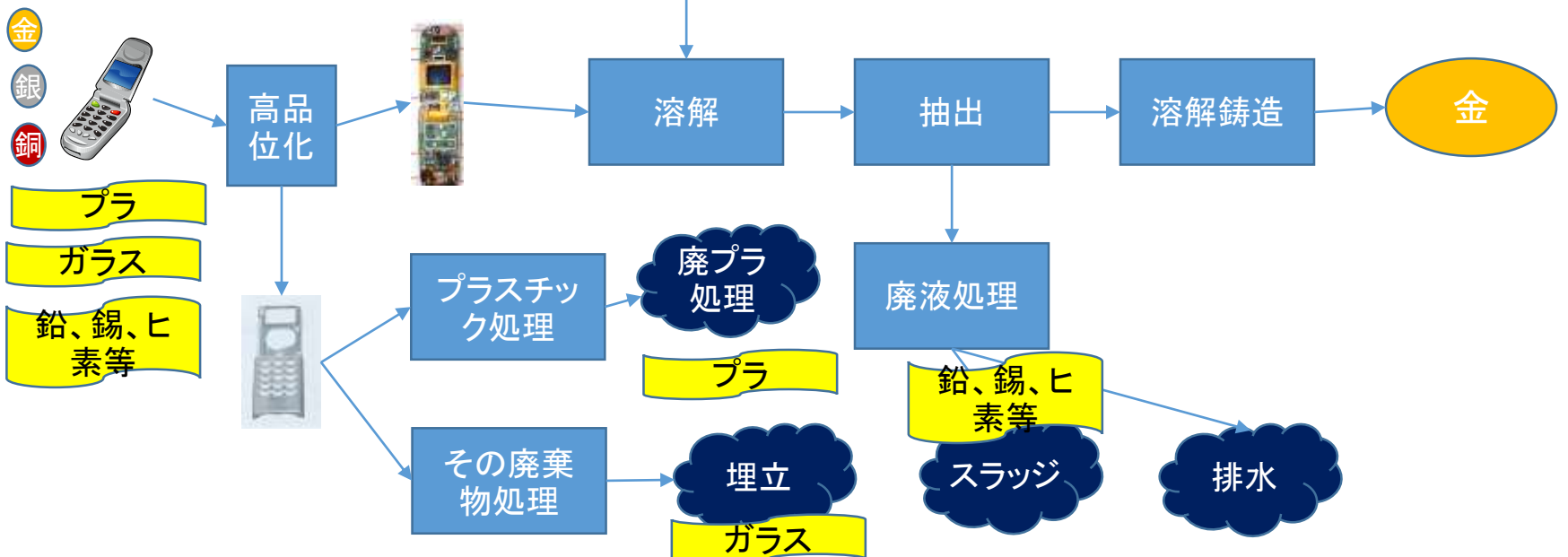
# 含有率100%にこだわった リサイクル



# 利用率100%の廃棄物ゼロ リサイクル

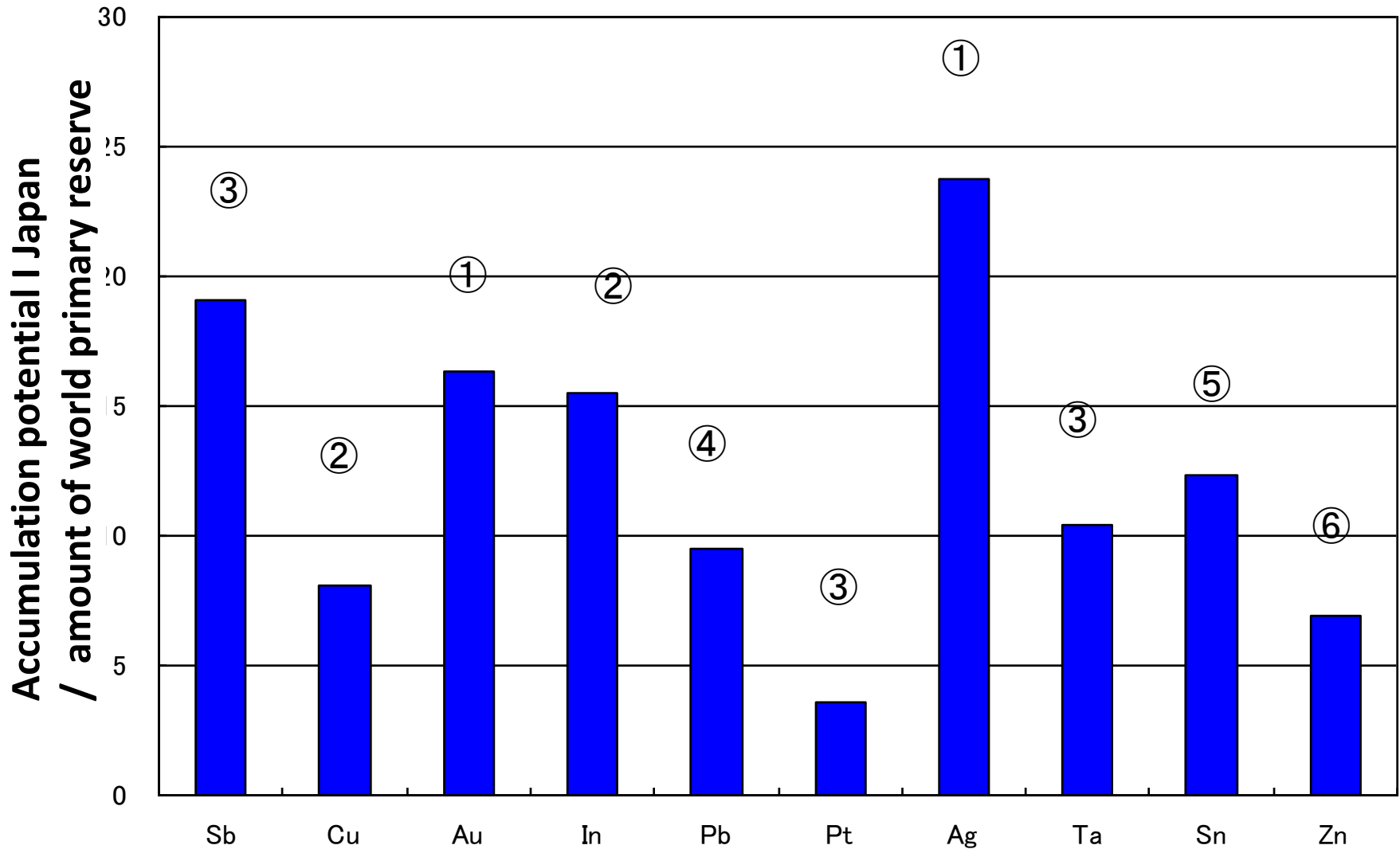


# 含有率100%にこだわった リサイクル



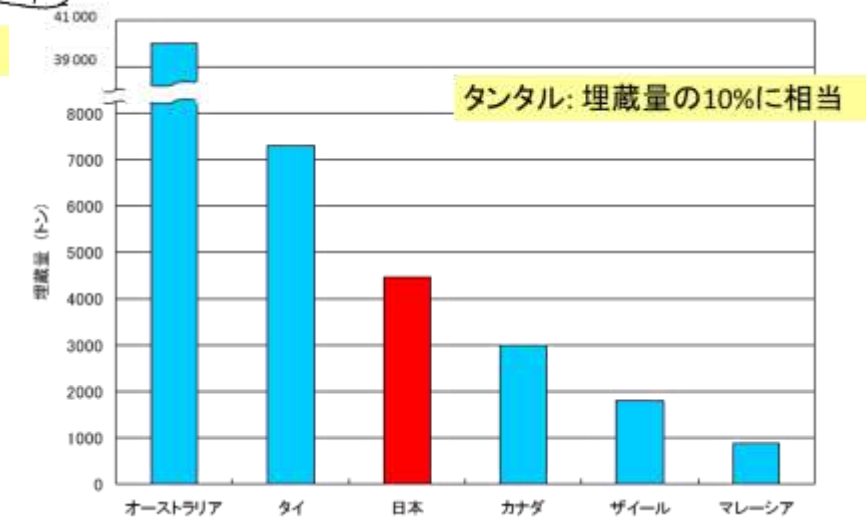
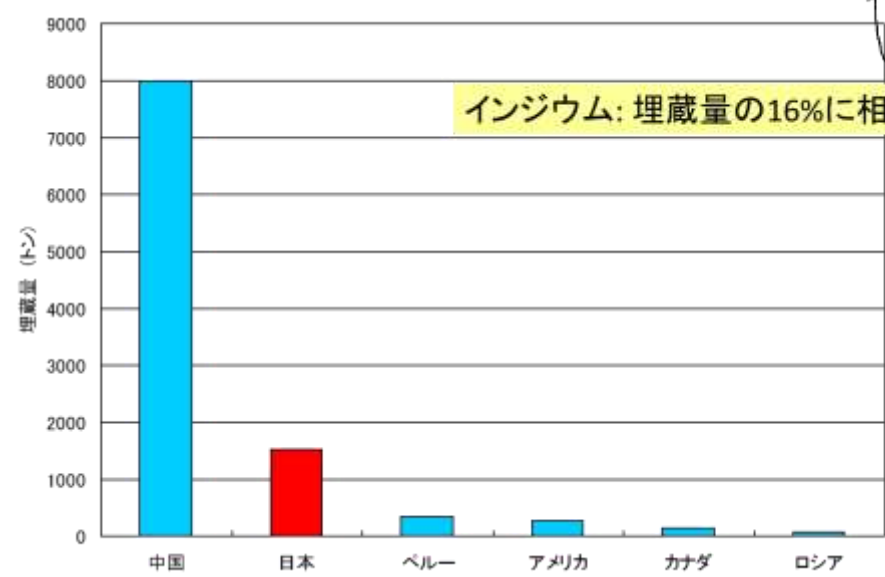
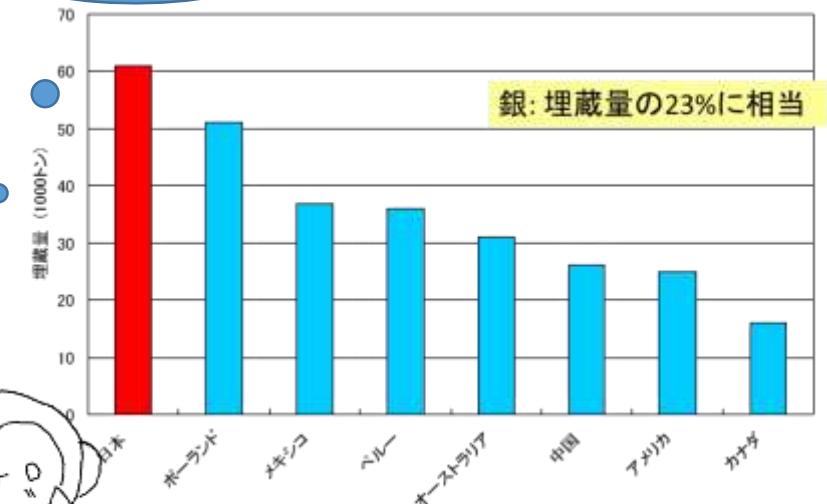
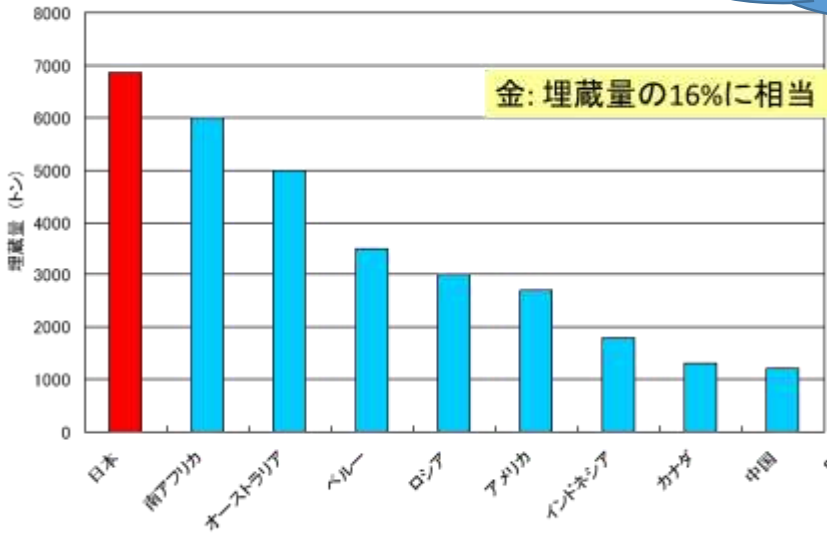
Urban mining

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

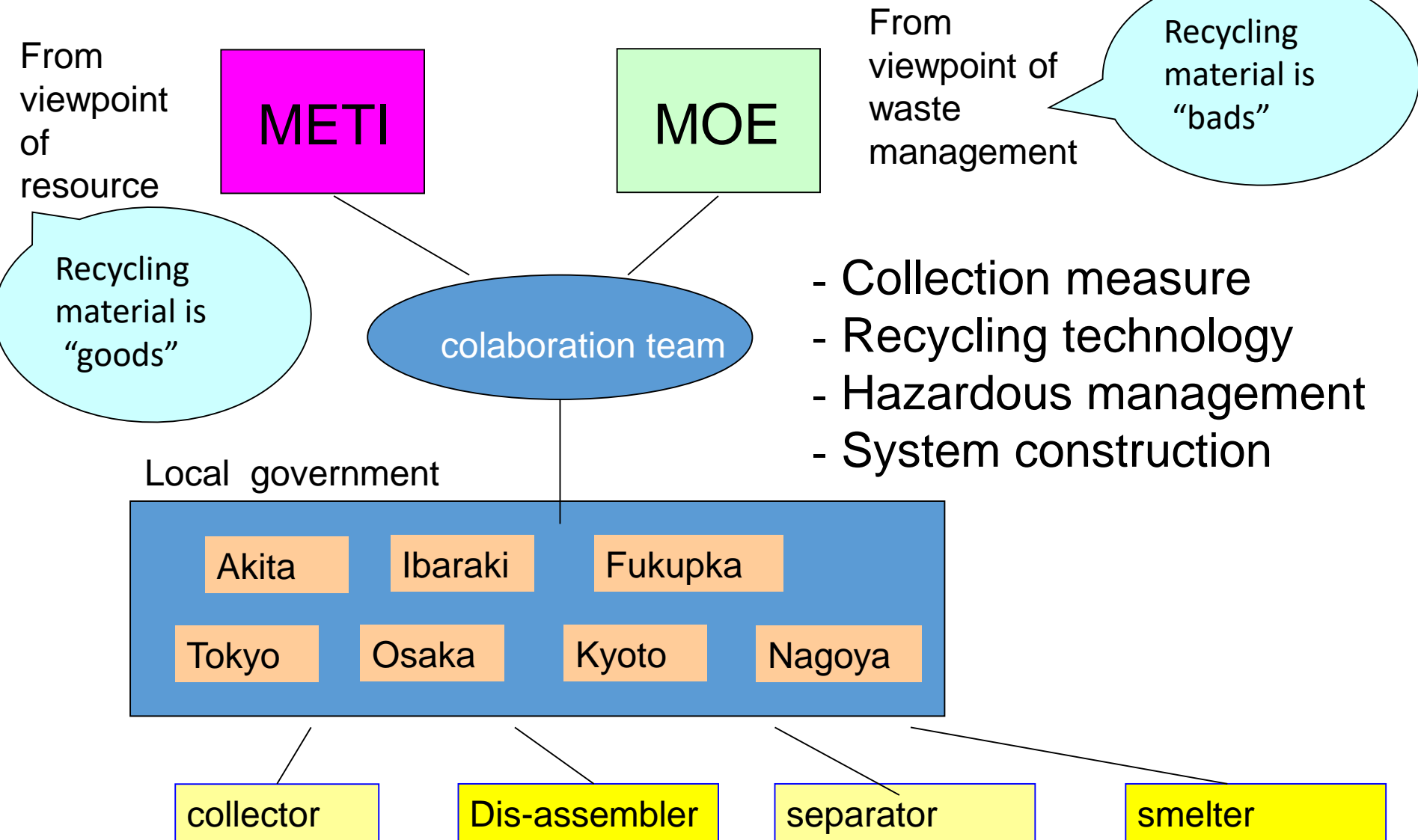




日本には資源ないてない  
とってた



# Colaboration team since 2008



Composition analysis		Total EoL		Municipally Collected		Municipal Final disposal	
		Weight (ton)	Price (M¥)	Weight (ton)	Price (M¥)	Weight (ton)	Price (M¥)
Practical waste management investigation	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	

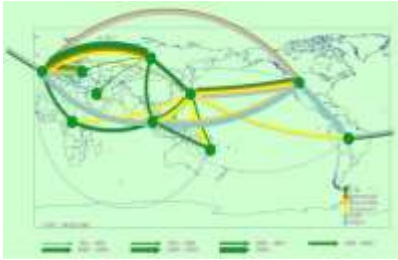
¥17Billion is disposed in municipal waste management



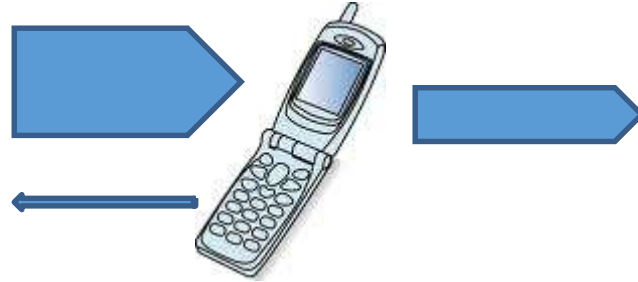


# Rout of small size electric appliance recycle

①correct resource from world



②High-tech manufactures ③produce high-tech products



④local governments collect EOLs

⑧it should be circulated!!!



⑦smelt to metal



⑥separate



⑤dismantle



⑨ sold in the market

# Collection methods

## box



回収ボックスを公共施設や商業施設等に常設し、排出者が直接投入した物を定期的に回収する手法

## station



ステーション(ごみ・資源回収場所)ごとに定期的に行っている資源回収に加えて、使用済小型電子機器等専用のコンテナを新たに設置し、回収する手法

## event



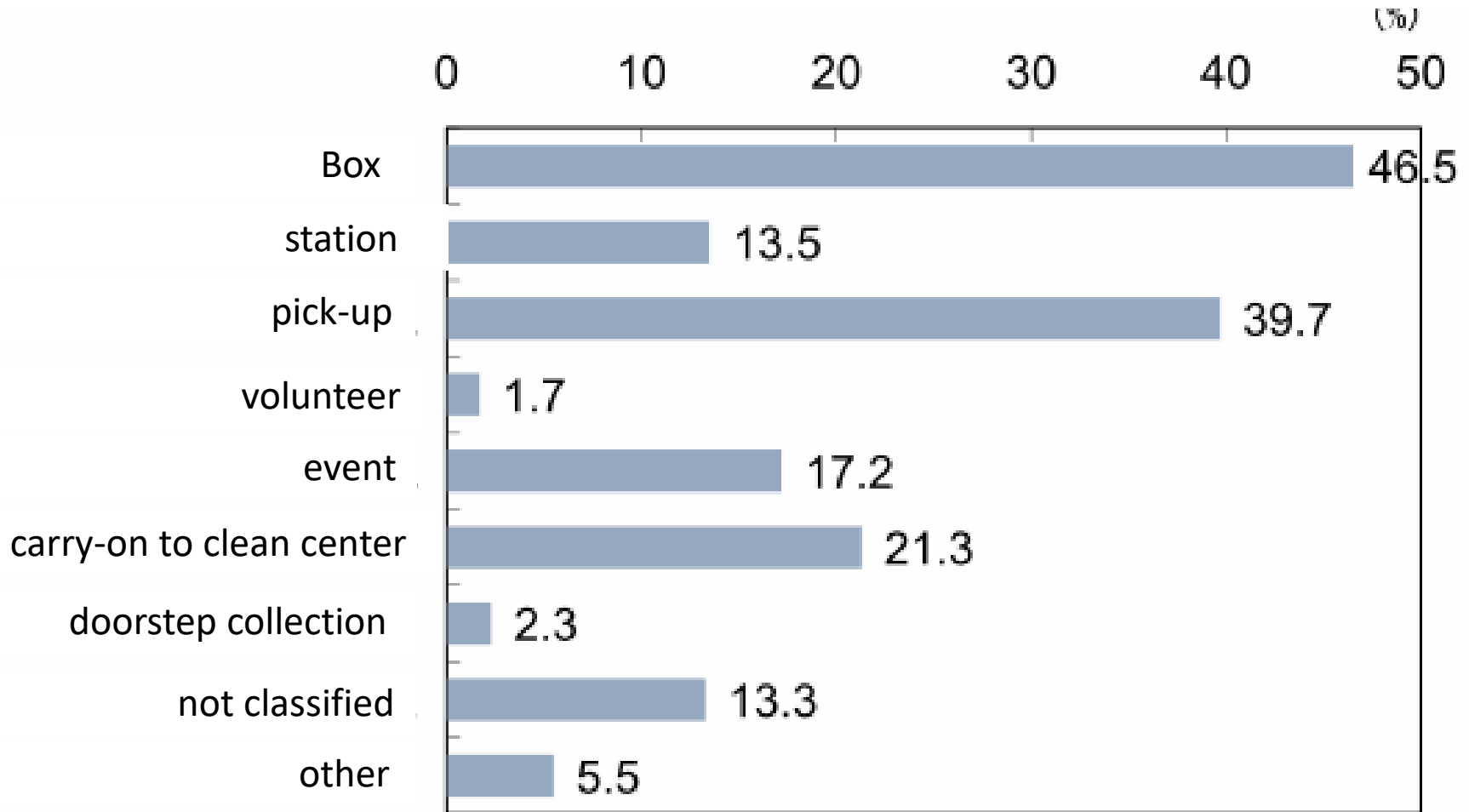
集客力の高い各種イベント会場や家電量販店にボックスを設置し、イベント開催の期間に限定してボックス回収を行う手法

## pick-up



各自治体等の従来の分別区分に従って排出されたごみや資源から、使用済小型電子機器等をリサイクルセンター等で抜き取る手法

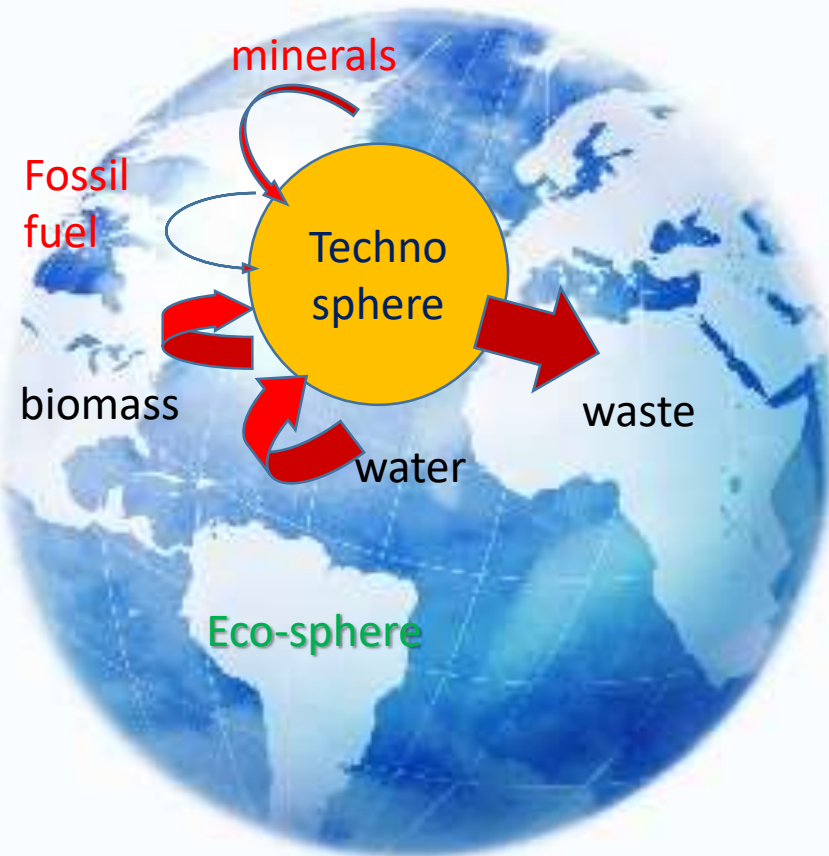
# percentages of collections by local governments



3 roles of  
Urban mining  
from the viewpoint of  
sustainability

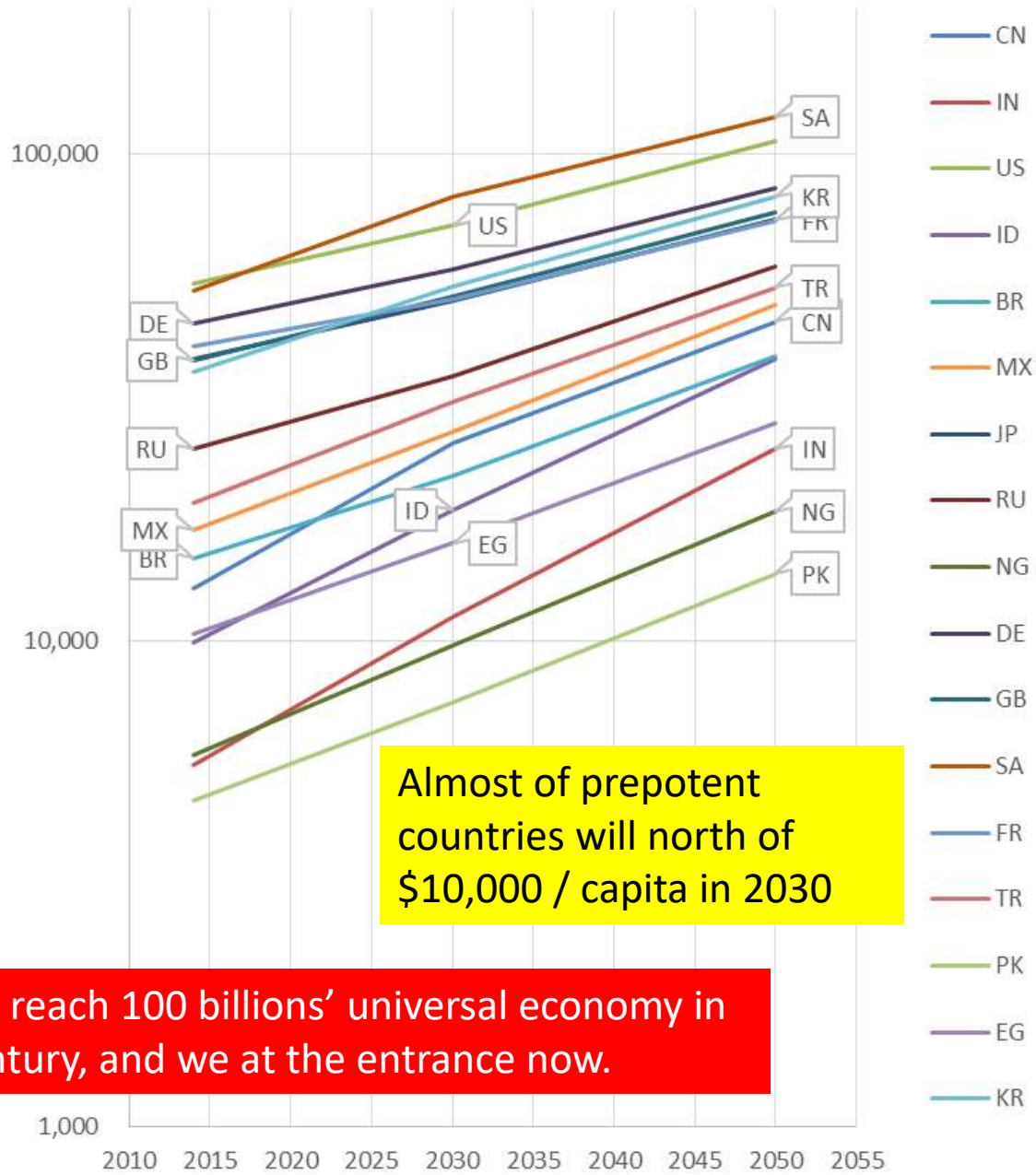
# The world at 2100

- 化石燃料と鉱物資源はほとんど天然由来はゼロ





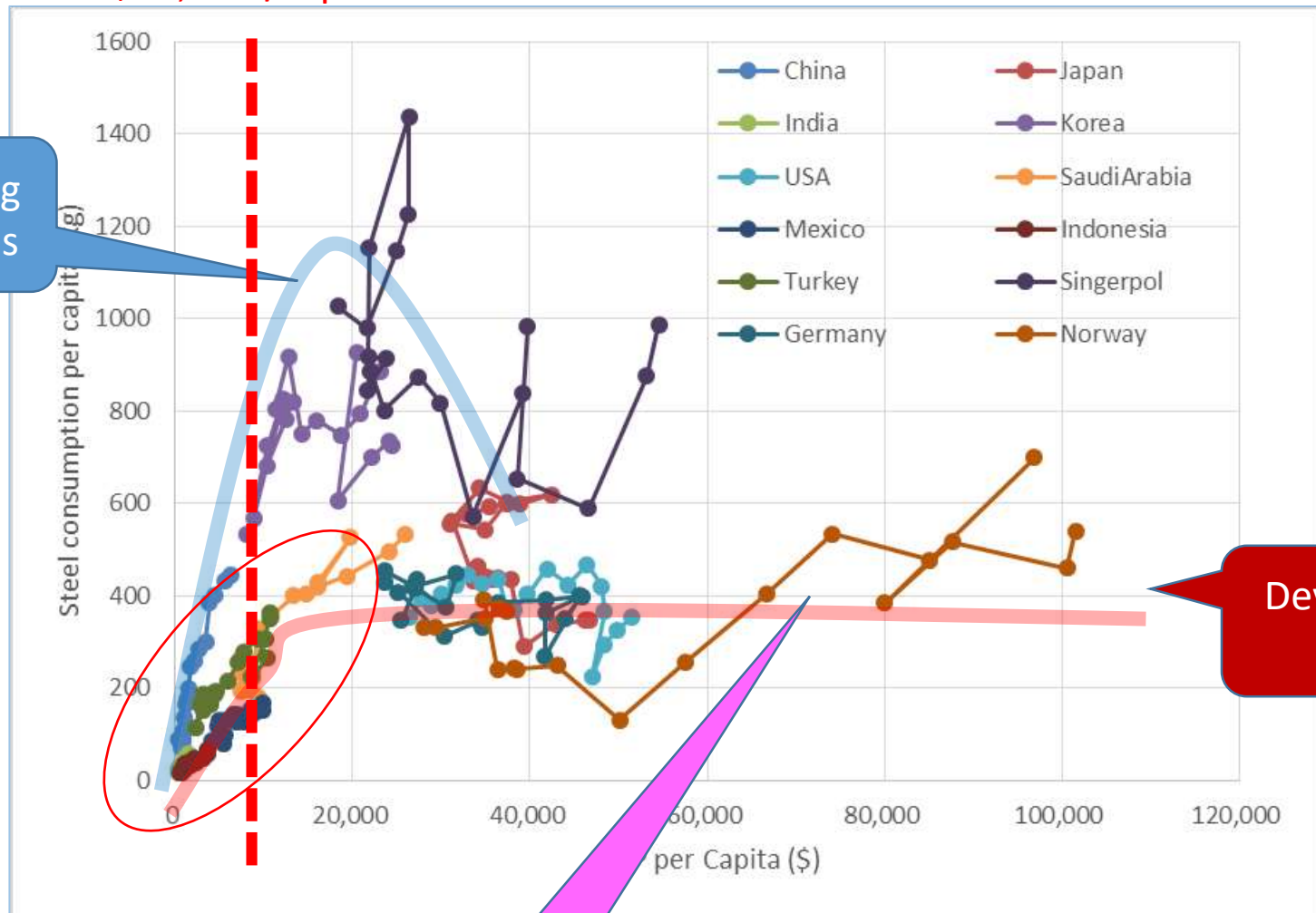
# forecasted GDP per person (PPP base)



Almost of prepotent countries will north of \$10,000 / capita in 2030

We will reach 100 billions' universal economy in this century, and we at the entrance now.

\$10,000 /capita



Exporting countries

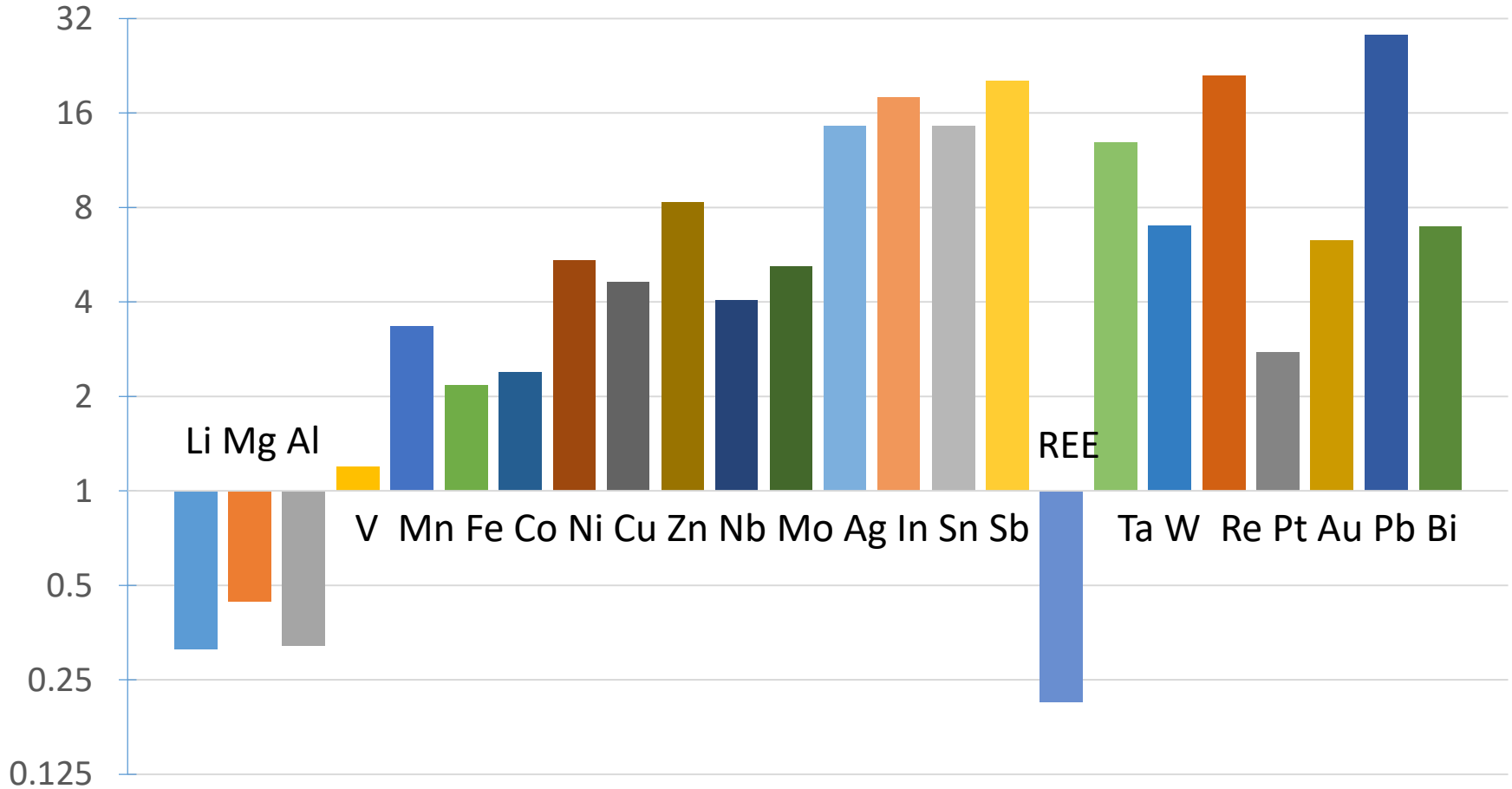
Developed level

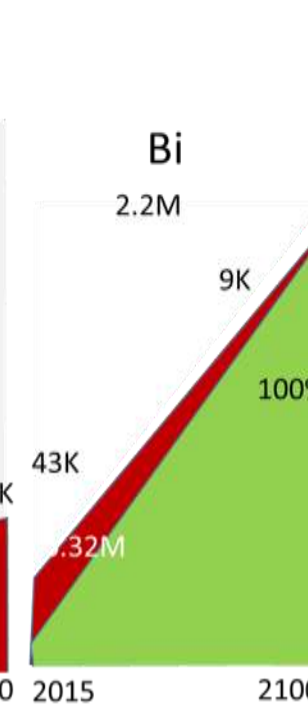
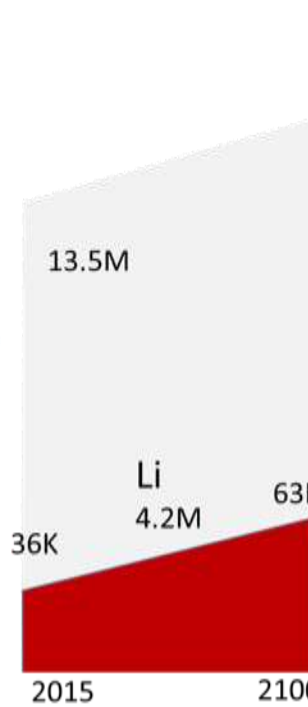
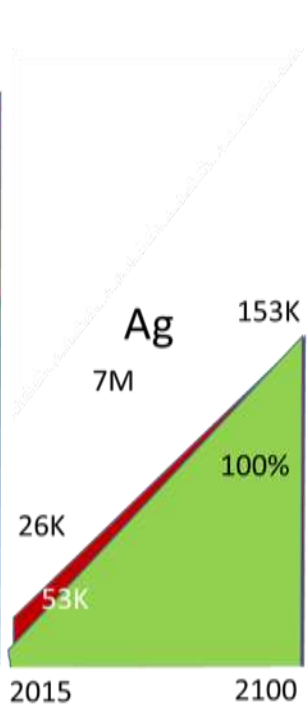
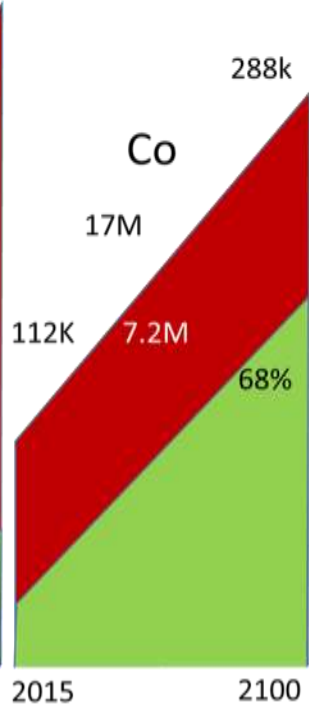
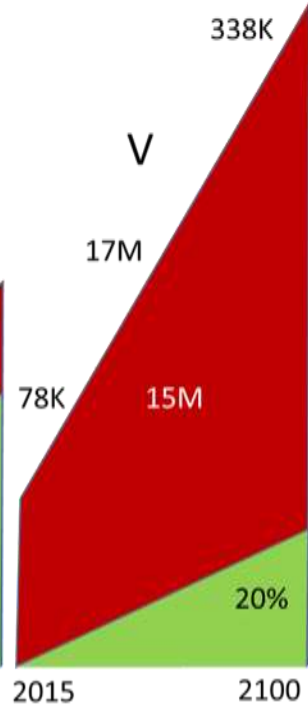
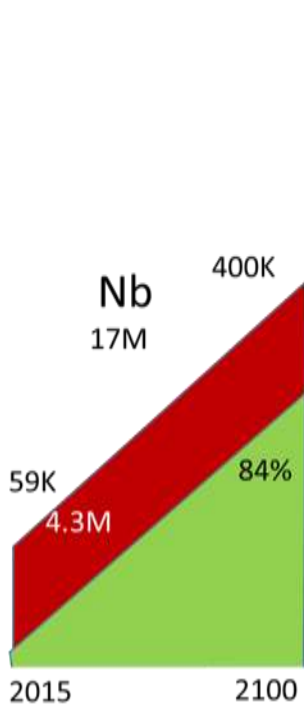
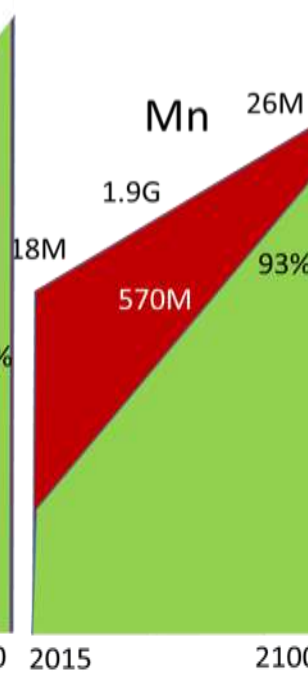
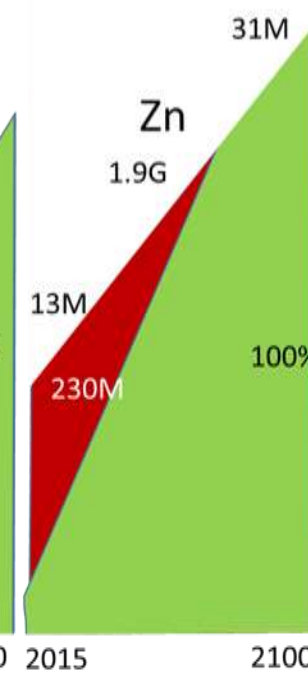
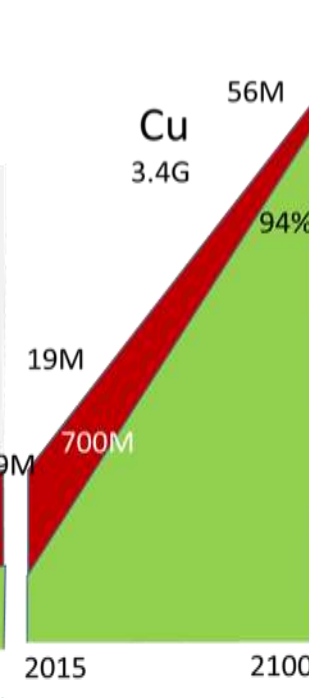
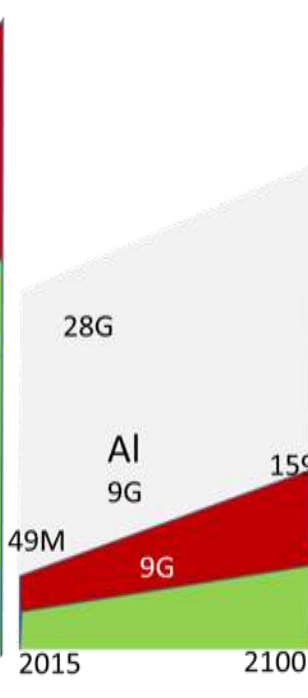
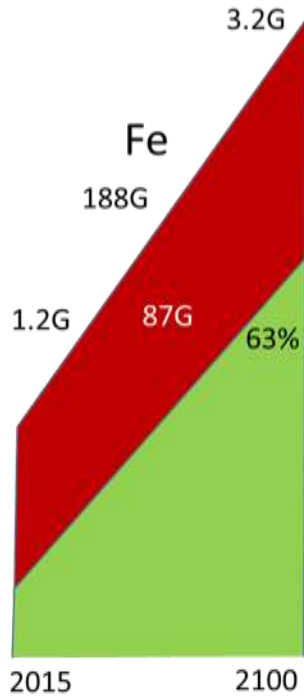
Consuming countries

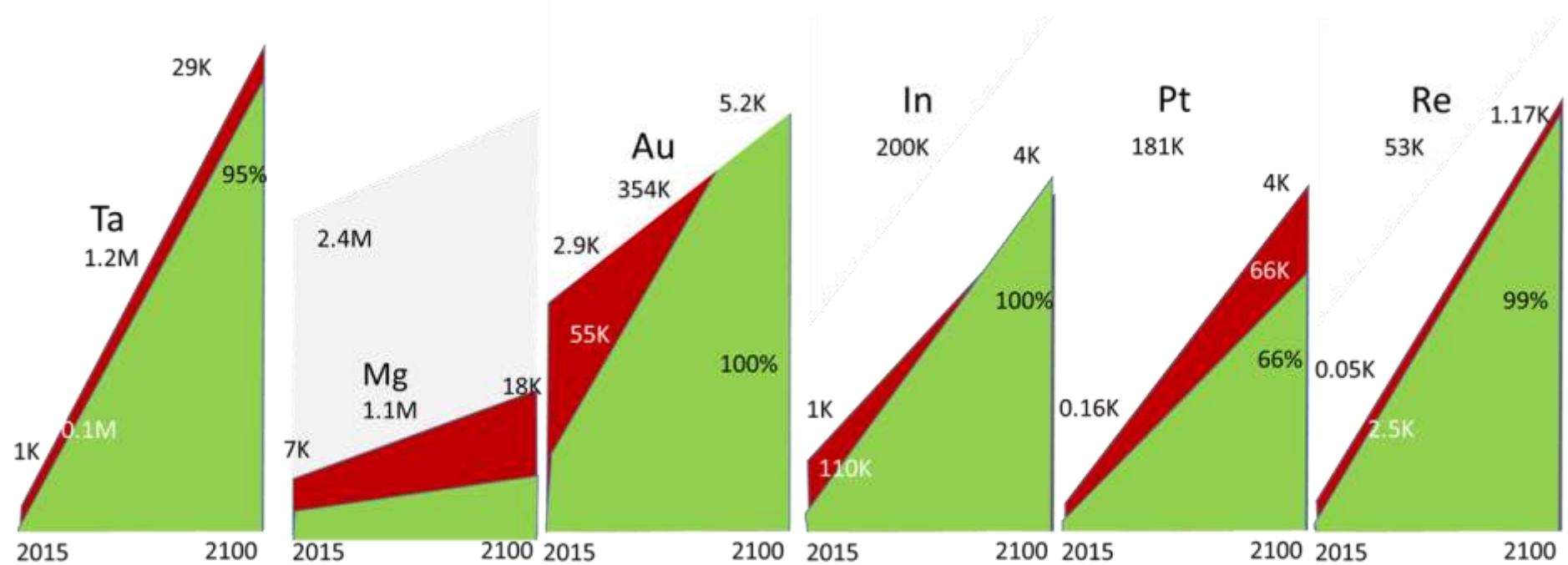
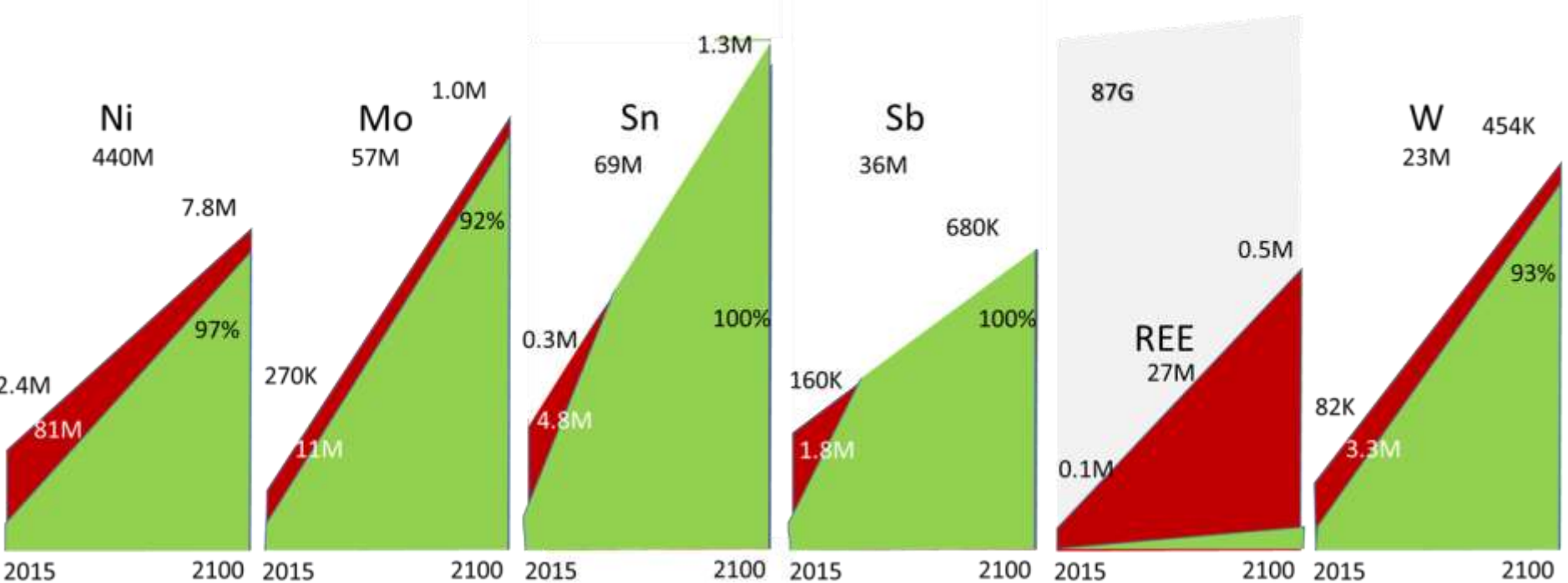
Fig.8 Fe consumption / capita v.s. GDP/ capita of several countries from 1994 to 2014

# Much more times of resources will be required by 2100.

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









# SUSTAINABLE DEVELOPMENT GOALS

世界を変えるための17の目標

1 貧困をなくそう



2 気候をゼロに



3 すべての人に健康と福祉を



4 質の高い教育をみんなに



5 ジェンダー平等を実現しよう



6 安全な水とトイレを世界中に



7 エネルギーをみんなにそしてクリーンに



8 働きがいも経済成長も



9 産業と技術革新の基盤をつくろう



10 人や国の不平等をなくそう



11 住み続けられるまちづくりを



12 つくる責任つかう責任



13 気候変動に具体的な対策を



14 海の豊かさを守ろう



15 陸の豊かさも守ろう



16 平和と公正をすべての人に



17 パートナーシップで目標を達成しよう



SUSTAINABLE DEVELOPMENT GOALS

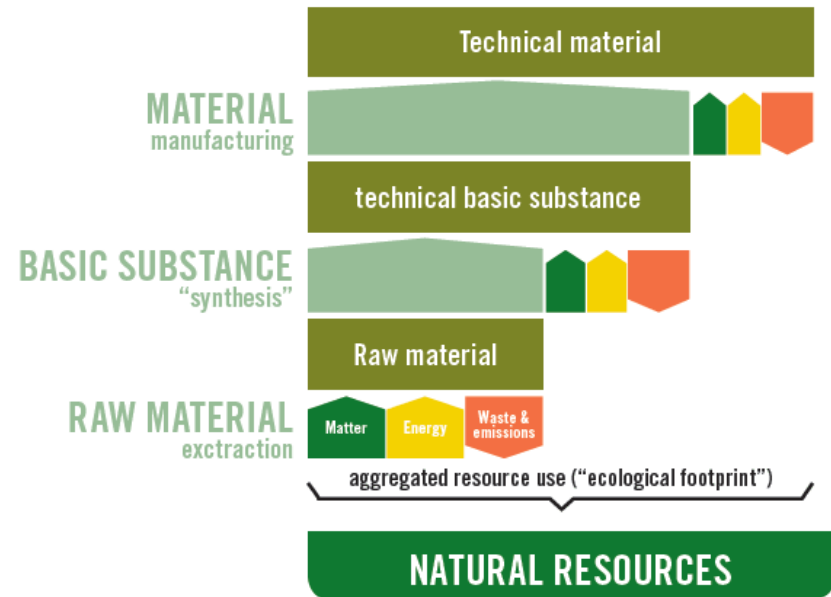
2030年に向けて  
世界が合意した  
「持続可能な開発目標」です

## 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.



Figure 4: Aggregated resource use for technical materials



 **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.

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.nimd.go.jp/kenkyu/review/h14/h14_mercury_analysis_review.html)





Consumers' view  
weight

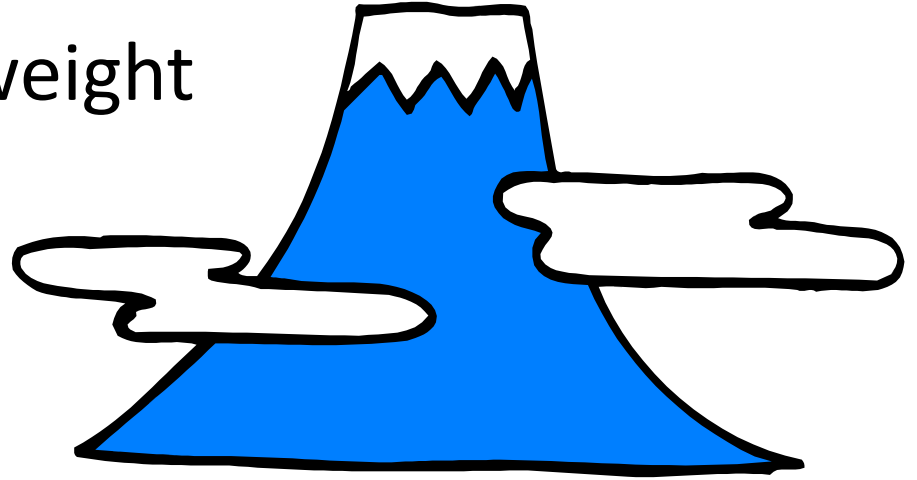


Total volume of gold which  
Human has been used is only  
Three pools of Olympic

Au



Resources' view  
weight



One Mt. Fuji

100,000,000,000ton

100G ton

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.

11,000ton



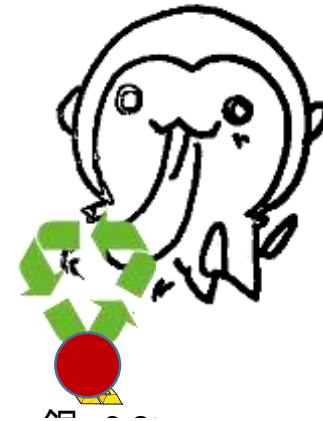
金 10kg

57,600ton



銀 1.2ton

286ton



8ton



鉄 1ton



95.1g



47.8ton

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



A view of an artisanal gold mine, seen from a hill just outside the eastern Congolese town of Kamituga, a mining town 180 km (112 miles) south west of Bukavu, January 18, 2006.





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





# アフリカのE-waste (Electric 廃棄物) 問題



Eco-rucksack of mining

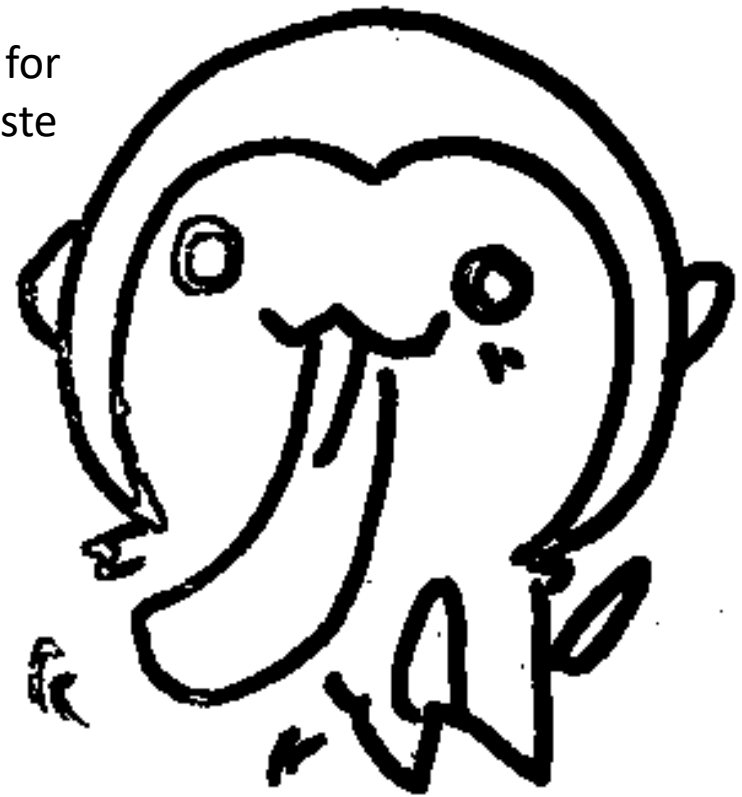


47.8ton

Eco-rucksack for Hearing E-waste



95.1g



1600ton

One recycled medal prevent the environmental value.

Urban mined medals  
go beyond 2020



Urban mined Olympic medals  
are now in mining





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







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



It contains my old  
electric households



# NIMS's Urban mined Medal beyond 2020

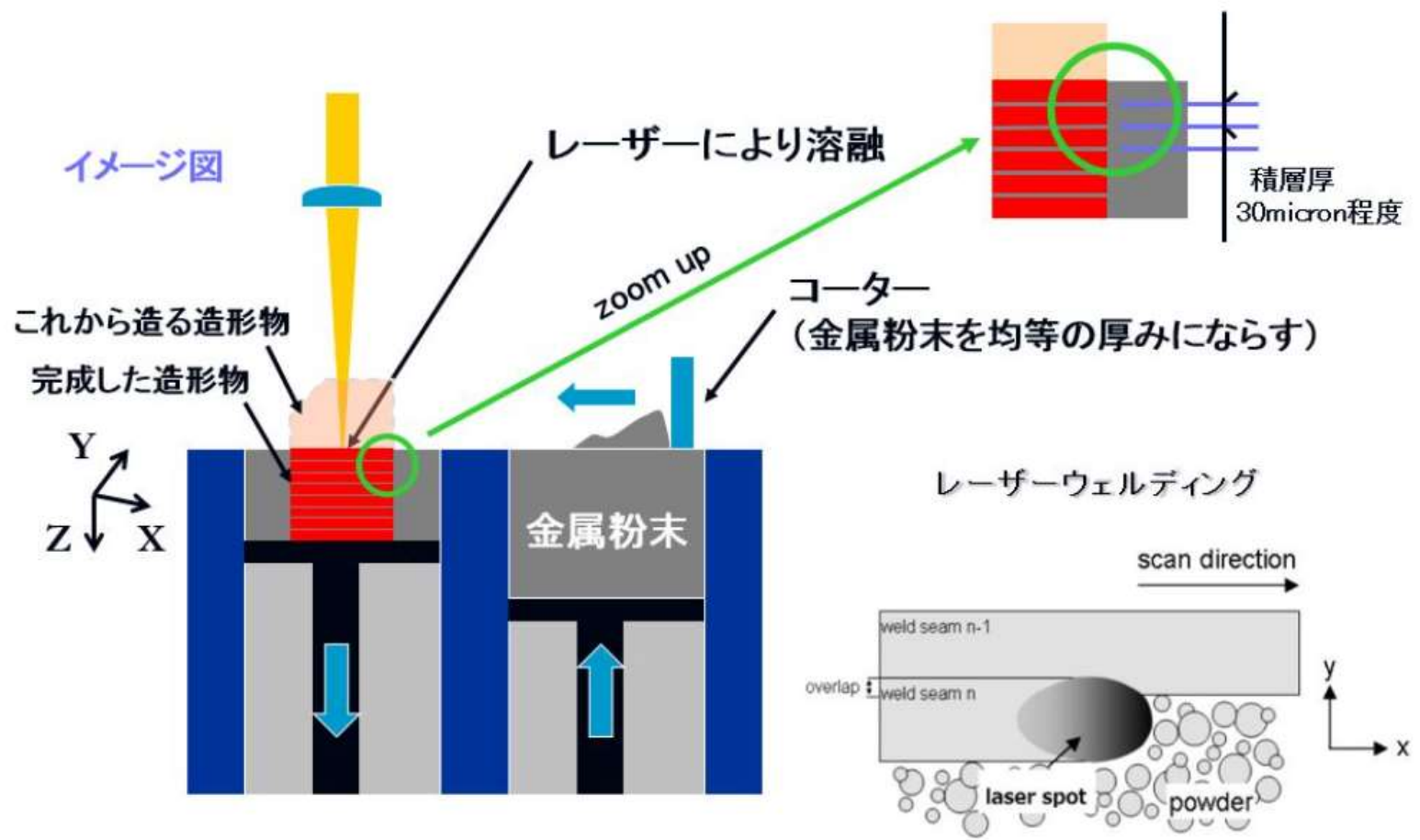
Easy customize to local events  
Lower environmental impact



NIMS 代表

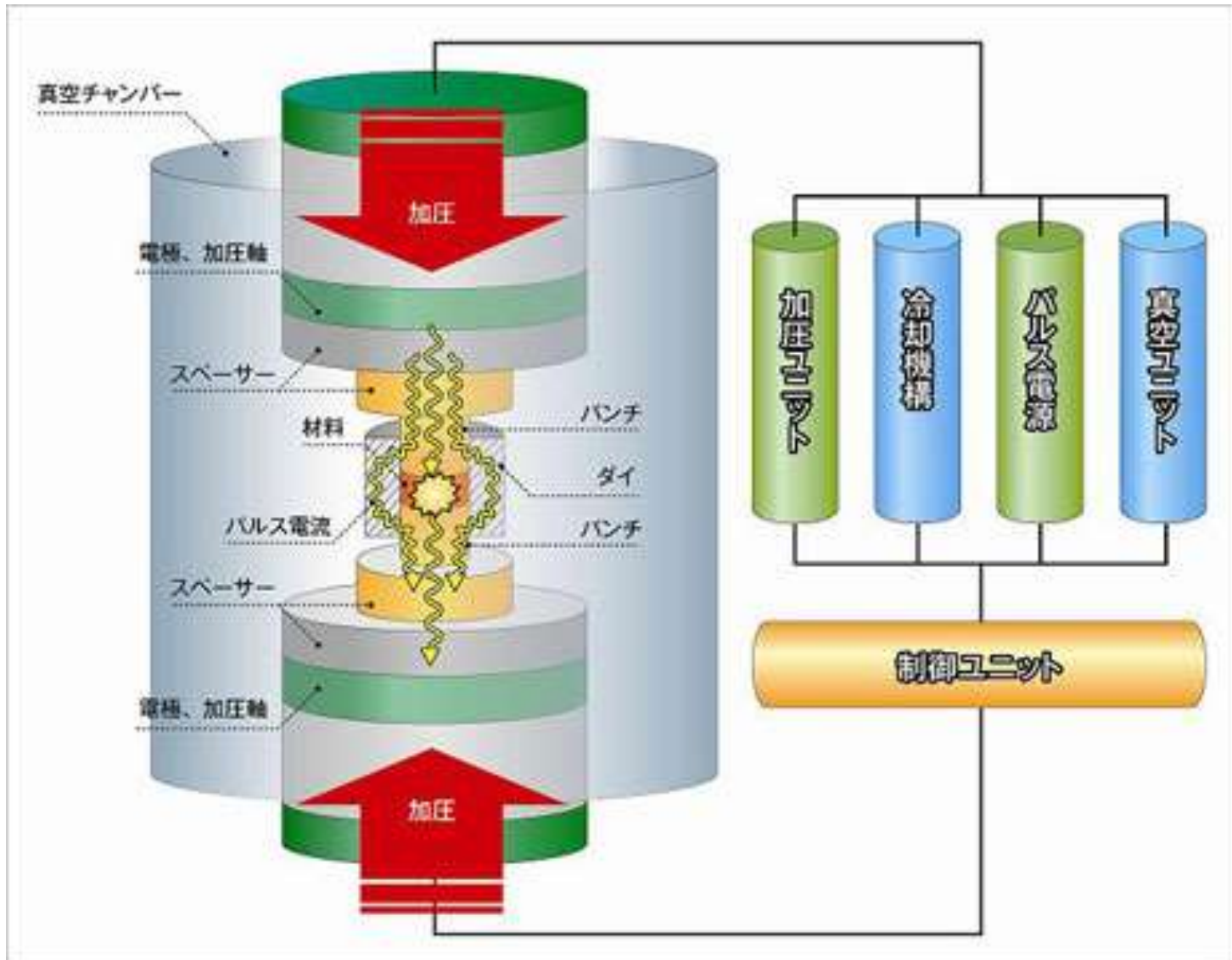
オリジナル都市鉱山メダル

# Customizable 3D printed medal based by recycled Ag powder





# Wasteless, short-time Spark Plasma Sintering



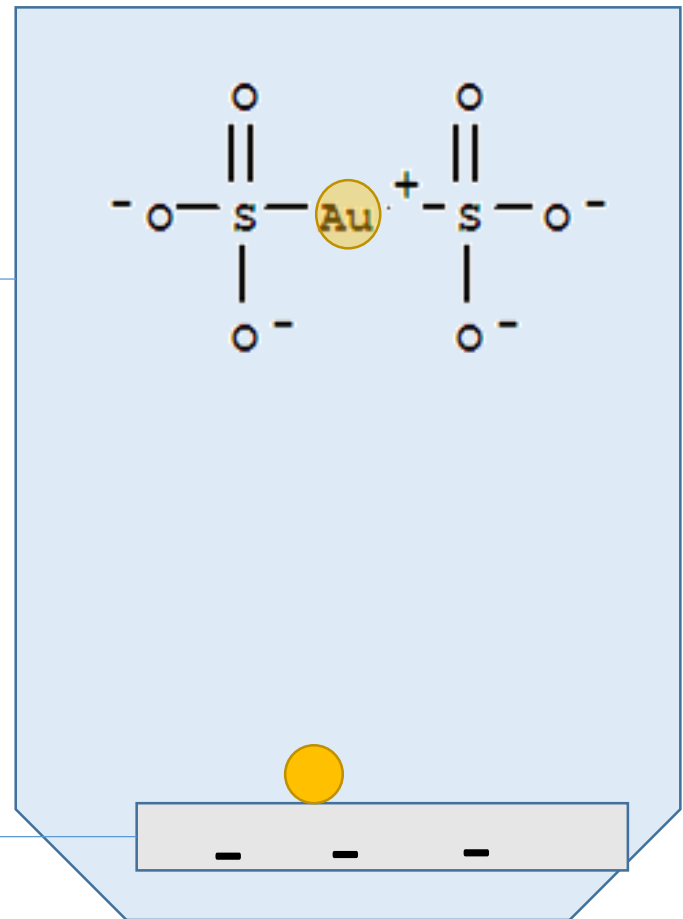
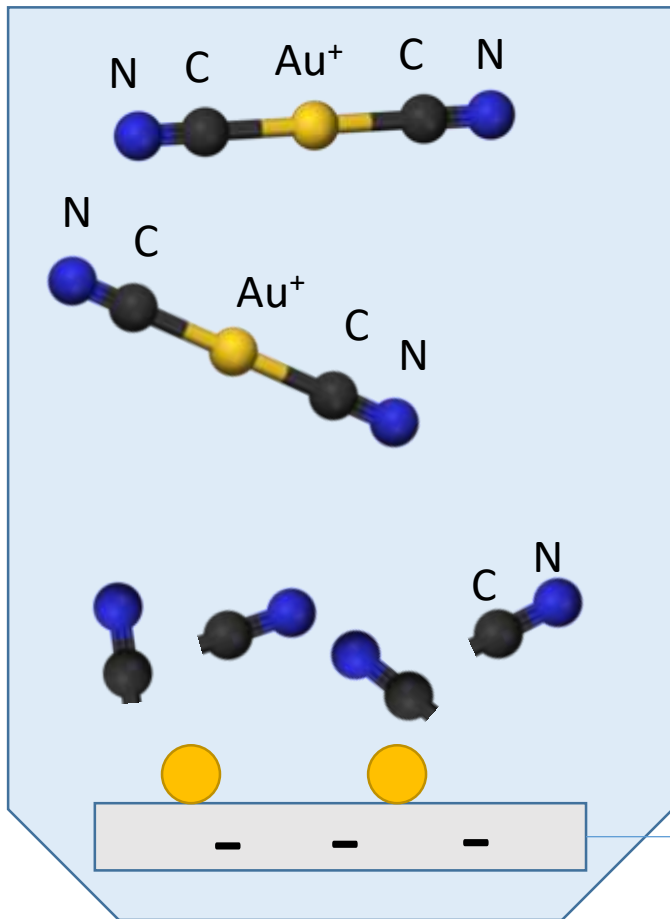


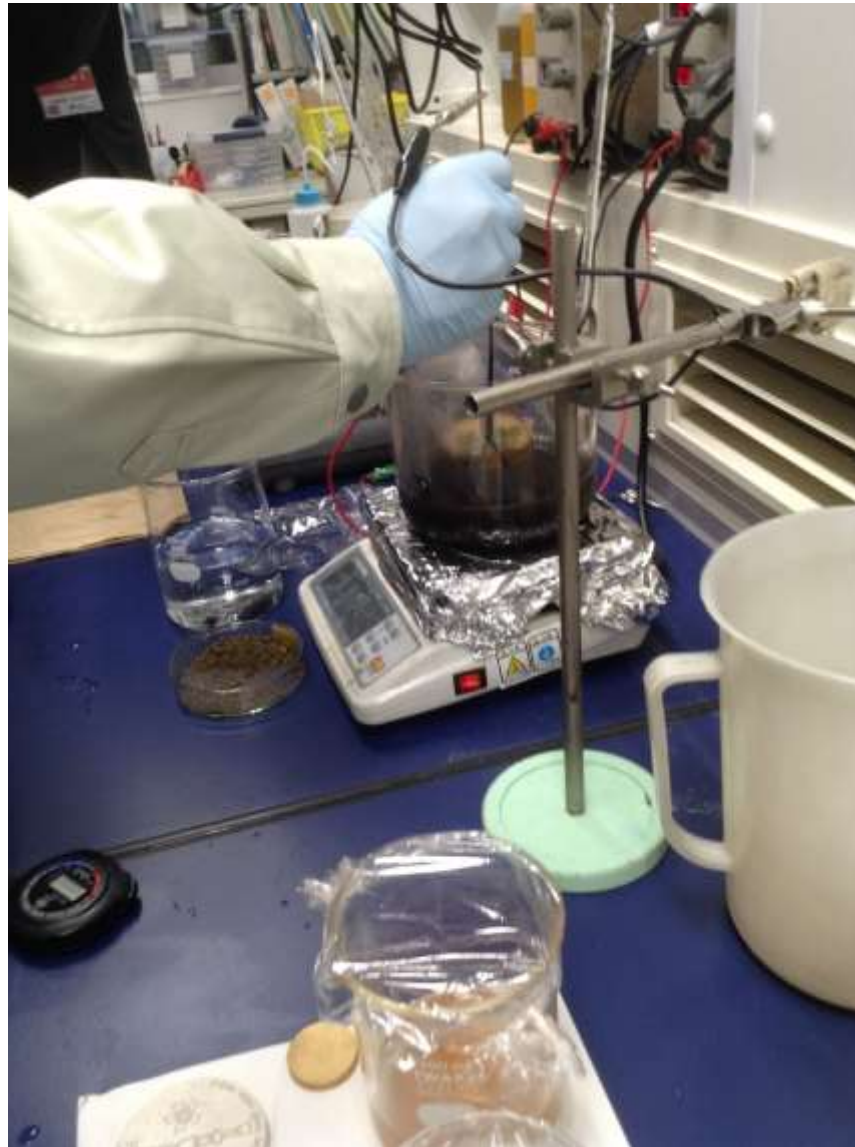
# 毒性のない非シアンメッキ

Conventional cyanide gold plating



Cyanide-free gold plating





# toward 2020 and beyond it

- Go MOTTAINAI

自然が私たちに与えてくれたものを大切に、何度でも、徹底的に

- 天然資源の大量採取による環境・生物多様性破壊の防止  
大切に使うものは自然にも大切に生まれてほしい

- 廃電子電気機器の不適正処理によるE-wasteの防止  
思い出のあるモノがどこかで環境を壊すなんていやだ

- リサイクルを通じた地域の産業活性化、多様な雇用の創出  
モノだけでなくヒトのネットワークも



Let us

fix the urban mined medal as symbol of recycling