

1. Introduction

The 2020 Tokyo Olympic organizing committee has determined to make medals from urban mined metal. This is the attainment of the movement of Japanese citizens and recyclers, and the achievement of Japanese promotion of sound circulation society. This presentation covers the progress of small electric household recycling in Japan, and the prehistory of the fulfillment of the urban mined medal, including the reactions of citizens about urban mine medal. The significance of the urban mined medal for sustainable development goals is also ascertained from both viewpoint of sustainable resource management and of the prevention of E-waste. Furthermore, the development for the future will be discussed. It is important to succeed to the next and further next Olympic. And, it is also important to apply to local events, not only Olympic games, in order to widen the activity of recycling deeply into the local community.

2. Olympic and Medals

Tokyo is now preparing the second Olympic games. The first one was held at 1964, when Japan was in the developing stage from the damages of the World War II. The 1964 Tokyo Olympic gave hopes to the countries of developing or reconstruction. Tokyo 1964 was just the symbol of development. Now, the main sites of Olympic games of Tokyo 2020 are in construction in the area where was landfill site of waste. We have learned that development should change from simple and rushed one into sustainable one. Tokyo2020 should be the symbol of mutuality and sustainability. The medals of gold, silver and bronze are also an important symbol of Olympic. Then, medals should be made from sustainable material and with sustainable processes. There are many approaches on materials of sustainability. Recycled material is most symbolic one among them. Fortunately, Japan had launched the law of Sound Circulation Society from 2000, and has constructed efficient recycling systems which covers whole life of citizen. Especially metals has higher recycling rate as shown Table.1., 28% of gold, 42% of silver and 17% of copper is obtained from recycled raw material. Medals which are the symbol of sustainability should be made from recycled metals, and they are called “Urban Mined Medal”.

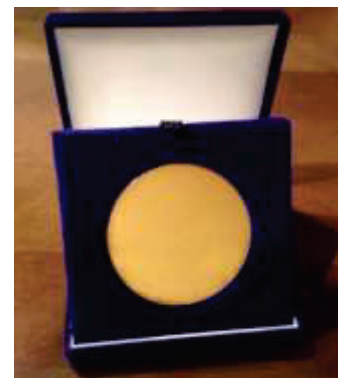


Fig.1 trial gold medal from electric households

Table1 percentage of recycled raw materials in Japan

	2014			2015		
	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

Table 2 historical approach of metals

	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%
bronze	Recycled content (1.52%)	Zinc in bronze was partially recycled	Recycled content 30%

determined that “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.” This Charter was revised at 2000, but it has been the base of Olympic medals.

The trial of urban mined medal were not limited in Tokyo2020. It is shown in Table.2. Rio2016 made silver and bronze medals from 30% of recycled raw material. It was heard that Urban Mined Medals was discussed in London2012 which insisted sustainability in preparation. But urban mined medal did not adopted. It is reported that 2010 Vancouver winter Olympic used medals from recycled raw material. However, the content of recycle were very low. Then 2020 Tokyo is the first case of fully urban mined Olympic medal and will be the vanguard of it.

How much metal is required may be a question of readers. Table 3 shows approximate estimation of the amount of metal for Olympic and Paralympic based on the result of London 2012. Gold medal is not made of only gold. 6g of gold is plated on silver medal. Olympic Charter had

Table3 required amount of metal 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	9.6kg	1,210kg	700kg		

3. Small Electric Households Recycling in Japan

The next question may be “Can recycle provide enough amount of metal for Olympic medals?” As shown Table2, total amount of recycled metal is enough, but they has their own demand in the industry. If we divert them into medal, it is only a common market dealing which does not symbolize sustainability. Baron Coubertin said “Winning medals wasn't the point of the Olympics. It's the participating that counts.” The importance of preparing medals is also participating. Not only recycling company, but also each citizen joins it is important.

Fortunately, Japan started the law of recycling of small electric households from 2013. Everybody, including children, has own small electric household such as a cell phone or a game unit. So everybody can join to prepare Olympic medals if we prepare it from small electric households. Japan had recycling system of electric households since late 1990s for TV, refrigerator, air conditioner and wash machine. The motivation of the recycling of these electric households was mainly the prevention of illegal dumping. Each economic entity, consumer, producer, recycler share the role of promotion of recycling. The recycling of small electric households aims another viewpoint, which is the activation of the resource in human economic area, namely urban mining. Following the estimation of potential of urban mining by HALADA, METI and MOE discussed more detailed estimation of the potential of recovery from small electric households. Fig.2 shows the comparison of potential amount of urban mining in Japan comparing the amount of natural reserves of each countries. Fig.3 shows the result of detailed estimation of annual amount which can be recovered from end-of-life small electric households.

The law of recycling of small size electric households hives no

Table4 Results of recycling of small electric households

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

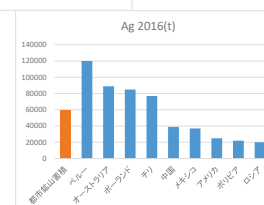
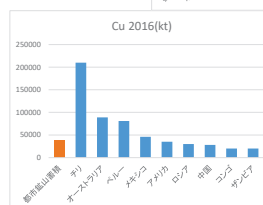
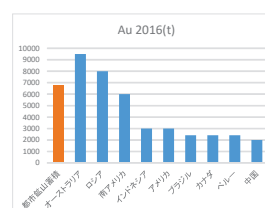


Fig.2 Japanese potential of urban mining (red) and reserves of measure resource country

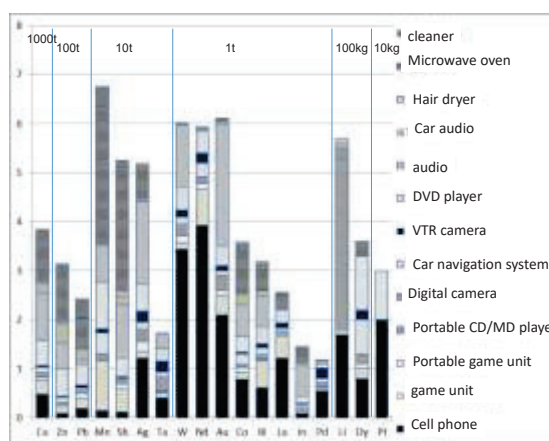


Fig.3 annual potential of recovery from End-of-life small electric households

obligation and duty to neither producer nor consumer, and gives no financial support to local governments But more than three quarter of local government in population join this recycling system, and the result of recycling is shown in Table 4. It is enough to prepare Urban mined Medal for Olympic. This means the small electric households recycling is supported by the heart of “Mottainai” with understanding the importance of resource.

4. Movements to Urban Mined Medal

It was not so easy to realize the Urban Mined Medal. Three cities at Tohoku district, Ichinoseki, Odate and Hachinohe, proposed to Japan Olympic Committee officially for the first time to prepare medals by recycled metals. But the technological and economical possibility was required to this proposal. A research group named Ecomaterial Forum supported it by reporting the investigation of feasibility. Then advisory committee on sustainability and community building for Japan Olympic Committee incorporated the inspection of Urban Mined Medal in the legacy plan of 2020 Tokyo Olympic. But it was not enough to determine. Movements occurred. Internet signature started more than 10,000 signatures gathered in only three month. Student organization, such as Environment Rodrigues in Waseda University joined the movement. Recycle companies reached out to medalists. Inquiry for the authorized recycler of small electric households was subjected to ask the possibility of joining Urban Mined Medal project, and most of authorized recycler answered they had strong interest. Among these movement, Japan Olympic Committee determined the adoption of Urban Mined Medal at November 2016, and calls “Minna no Medal Project”. “Minna no” means every one’s participation.

The structure and flow of “Minna no medal project” is roughly shown in Fig.4. There are two route for medal. One route is specialized for cell phone.

NTT docomo, a provider of cell phone, collects EoL cellphone and extract gold for medal. The other route is local government municipal recycling system. Not only cell phone but also small electric households can be subjected. Collected EoL SEHs (small electric households) are delivered to governmentally authorized recycler for SHE recycling. And it goes to copper smelter to extract copper, silver and gold.

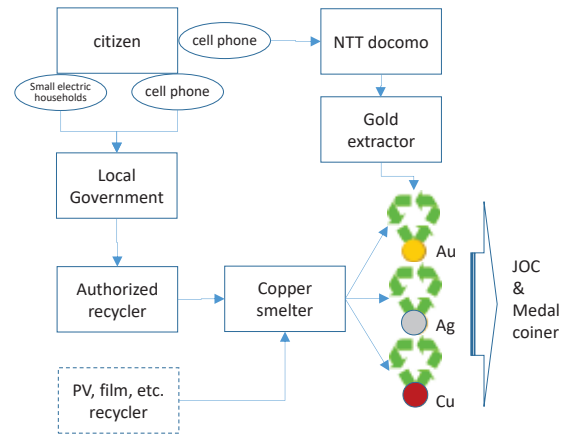


Fig.4 Flow of Urban Mined Medal in “Minna no medal project”



Fig.5 newly developed Cell Phone Opener

New technologies for recycling of SEHs are also in development. Fig.5 shows an example of new technology. It is a “cell phone opener.” The easy removal of LiB is the considerable issue on cell phone recycling. This opener is developed in to open cell phone easily and to remove LiB from cell phone.

Citizen’s movements to support “Minna no medal project” is now in preparation. One example is “Movement of My Urban Mine”, in which inventory of EoL SEHs in each house is called for. A bag for store “my urban mine” is also considered. While a citizen is only a submitter of EoL SEHs, he or she will change a communicator of recycling through delivery of the “my urban mine bag”.

5. Two meanings of Urban Mined Medal for Sustainability

Let us go back to the primitive discussion point. “Why Urban Mined Medal is the symbol of sustainability?”. It is frequently said to be the symbol of “mottainai”. But “mottainai” has two different meanings. One is from the viewpoint of economy. Some promoter of Urban Mined Medal says that it is cheap to support the management of Olympic financially. But, this is misunderstanding. It is well known recycled gold is the same price as primary mined gold if the grade is same. And, the cost for recycling is almost expensive than primary mining. Economical “mottainai” is not the aim of Urban Mined Medal.

The other “mottainai” is from the viewpoint of resource efficiency. “mottainai” is written by Japanese character as “勿体無い”. The character “勿体” means the essence of material. “無い” means the loss. “Mottainai” means “Never loss the essence of material which is Given”.

Products, material, goods they have each own value in themselves. Even if they becomes out of use, they leave retained value. Recycling, strictly speaking, substance recycling, is the recovery of the basic retained value, which is just the essence of material. As the value of a goods is created by human’s labor, the essence of material is deeply related to the burden to obtain it. One gram of gold is obtained from 1,000,000 gram of natural resource. The total amount of natural material which is required to obtain the unit of aimed material is called TMR, total material requirement. TMR can be called as the hiding “weight of resource-end”, comparing the weight of consumer-end which we can directly recognize. This TMR is a numerical expression of the essence of material. If the numerical value of TMR of the subjected material is great, the burden to obtain the material is also enormous. 10kg of gold for medal has TMR value more than 10,000ton, 1.2 tons silver for medal has 56,000tons and 0.7 tons for bronze medal has 300 tons of TMR. One gold medal, which has the consumer-end view weight of 95.1g, has 47.8 tons of TMR, namely resource-end weight. Fig.6 cartoons their TMRs as hidden monster behind material. If we make medals from urban mining, we can reduce the natural resource consumption corresponding these resource-end weight. This is the first importance of Urban Mined Medal for sustainability.

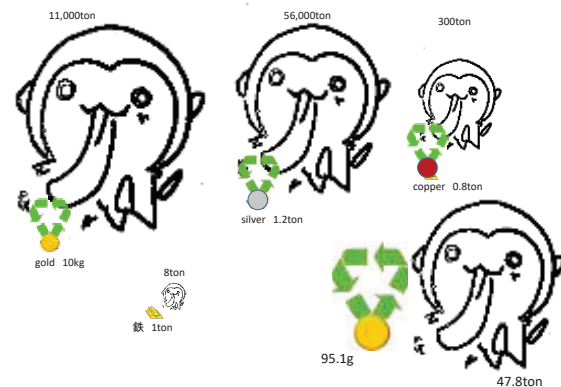


Fig.6 TMR behind medals

One gold medal, which has the consumer-end view weight of 95.1g, has 47.8 tons of TMR, namely resource-end weight. Fig.6 cartoons their TMRs as hidden monster behind material. If we make medals from urban mining, we can reduce the natural resource consumption corresponding these resource-end weight. This is the first importance of Urban Mined Medal for sustainability.

Another importance of Urban Mined Medal is the reduction of E-waste. The problem of E-waste, electric appliance waste, is getting considerable matter, especially in Africa and southeast Asia area. Cell phones and other electric appliances contain valuable metals such as gold. On the other hand they are consisted of amorous amount of residue material such as mixed plastics. These residues are frequently left out on the limb of economy. Urban mining not only reduce the natural resource consumption, but also reduce E-waste to be disposed.

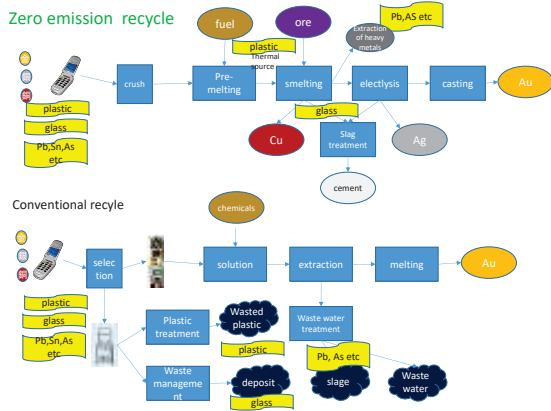


Fig.7 Zero-emission recycling is required in Au,Ag,Cu recycling residue, it will occur E-waste problem. It is very important to extract object elements without residue. It is called Zero-emission recycling. Copper smelter makes slag by residue. Slag can be used cement or other utilizations. The difference is illustrated in Fig. . While somebody insist the recycling content rate such as natural resource free, zero-emission recycle is essentially important in the case of extraction type recycling such as gold, silver and copper. The zero-emission recycling, namely combination of residue recycling with substance recycling will be the base of Multi-Value Circulation system, which is newly proposed by HALADA to cover week point od Circular Economy from Europe For the reference the conceptual picture of Multi-Value Circulation is illustrated in Fig.8 as an addition.

In the viewpoint of the reduction of E-waste, the role of copper smelter is very important. We need to remember that recovery of material in recycling has two different types. One is Dilute type, in which impurities and damaged structures are diluted or reinforced by adding virgin material. The other is Extraction type, in which objective element is extracted from recycled raw material. The case of recycling gold, silver copper is extraction type. In the extraction type, almost amount of recycled raw material goes into residue of extraction. If we leave the

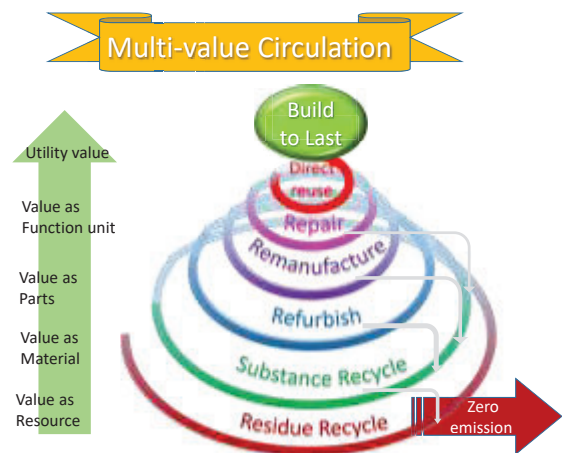


Fig.8 conceptual picture of newly proposed Multi-Value Circulation

5. Urban Mined Medal goes beyond 2020

Urban mined Olympic Medal should be token over Olympic games in future from the viewpoint of sustainable resource management. Furthermore, urban mined medal is not only for Olympic. A now new movement is spreading in Japan. The new movement is to adopt Urban Mined Medal to award medal of local events. Kyoto city announced the adoption of Urban Mined Medal for winners of Kyoto city marathon. Other local governments have great interest on it. As used small electric households are collected by local government, Urban Mined Medals for local governments is clear to the citizen to what he provides to recycle is used.

Urban Mined Medal will not fulfill the role at 2020 Tokyo Olympic. It will develop a tool of combination of recycling and regional communication with the mind of "Mottainai".