Media brief for "Circular Economy's Potential for Electronics in China" report

Key findings

1. China's waste from computers, mobile phones, and other electronics will reach 15.4 million tons by 2020 and 27.22 million tons by 2030, with a 10.4% average annual rate of increase.
2. By 2030, the value of metals extracted from discarded computers and mobile phones in China will total $23.8 billion USD.
3. If the electronics recycling rate reaches 85% in 2030:
    a. More gold and palladium would be extracted than is presently being imported.
    b. Thirty billion kilowatts (kWh) of energy -- about 22 million tons of carbon emissions -- would be saved. That's 52,000 flights between Beijing and New York on a Boeing 747-400.
4. The cost of extracting 1kg gold from mobile phone's printed circuit boards (PCBs) is as cheap as 35-80% the cost of virgin mining. Silver, aluminium and iron can also be extracted.

Background

1. Why China?

- China is both a huge maker and a huge buyer of electronics and is in a unique position to innovate its electronics market. 68% of China's population owns a smartphone[1], and the population size at that rate of consumption makes recycling viable. China is in a unique position in terms of volume, logistics, and demand for recovered resources -- the three fundamental obstacles to a circular economy.

- Recycled electronics also secure metal supply and decrease reliance on imports. In 2030, if 85% of computers and mobile phones were recycled, the amount of gold and palladium being recovered would exceed current import levels.

2. China current status of waste electronics recycling

- The current recycling rate for personal computers and mobile phone are 27% and less than 2%, respectively[2]. Other cross-sections may be unused but not yet discarded, or collected by unregulated scavengers.

- In 2014, the government expanded the waste electronics catalogue to include mobile phones, suggesting that mobile phones could soon become subsidized. However, no subsidy has yet come into effect.

Main findings

High metal consumption from industrial development and technological innovation has led to a shortage of several metals in China. E-waste, precious in already refined metals, can be one way to ease the exploitation of virgin ore.

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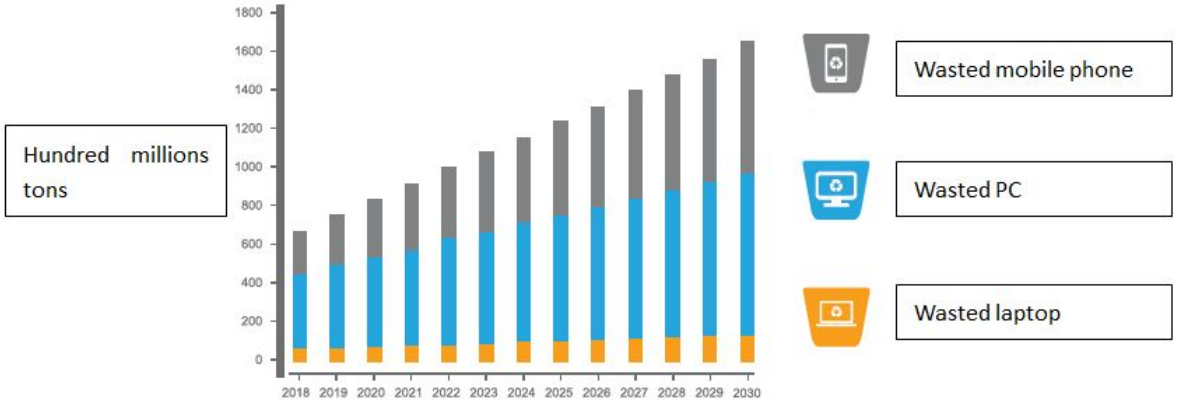
[1] Pew Research Center:
http://www.pewglobal.org/2018/06/19/2-smartphone-ownership-on-the-rise-in-emerging-economies/

[2] White paper on recycling and utilization of waste electrical and electronic products in China, 2015

- The potential value of the three main types of e-waste in China (mobile phone, laptop and PC) has increased from 13.5 billion yuan ($2.0 billion USD) in 2010 to 80 billion yuan ($11.9 billion USD) in 2019. By 2030, this number will double.



- One ton of printed circuit boards (PCBs) can yield 0.8-1.5 kg gold[3] [4] [5]. One ton of gold ore, however, only yields .020 - .1 kg.

  Our calculations show that the cost of extracting 1kg gold from PCBs is 87,000-200,000 yuan ($12,954 - $29,781) which is lower than the cost of extracting 1kg gold from gold ore, which on average costs 250,000 yuan ($37,230). Moreover, several kinds of metals, like iron, aluminium and silver can be refined by urban mining[6], while virgin mining only produces one or two types of metal in single set of processes.

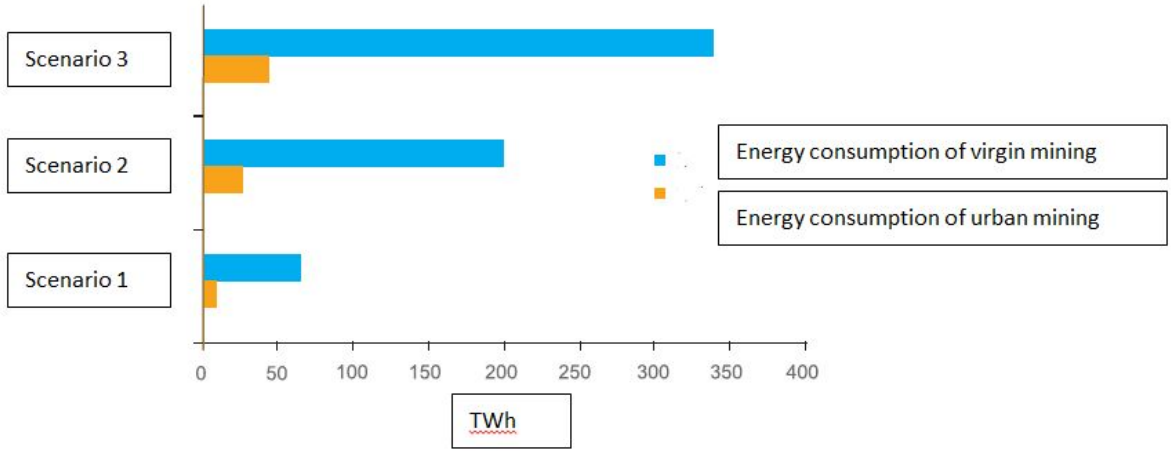
- To gage the economic potential of urban mining in China in the near future, we projected three different scenarios for e-waste recycling in China.

  - **Scenario 1 - Business as usual** : By the end of 2030, the e-waste recycling rate in China remains unchanged (27% for PC, 2% for mobile phone)
  - **Scenario 2 - US 2014 target :** By the end of 2030, the e-waste recycling rate in China is on par with the United States' rate in 2014 (62% for PC, 33% for mobile phone)
  - **Scenario 3 - EU 2019 target :** By the end of 2030, the e-waste recycling rate in China reaches the European Union's target rate for 2019 (85% for PC, 85% for mobile phone)

[3] Chancerel, P., Meskers, C. E. M., Hageluken, C., & Rotter, V. S. (2009). Assessment of Precious Metal Flows During Preprocessing of Waste Electrical and Electronic Equipment. Journal of Industrial Ecology, 13(5), 791–810
[4] Maryam, G., Maria, R., Bijan, S.(2018). Investigation into the Recovery of Valuable Metals from Waste Mobile Phone Printed Circuit Boards (PCBs): An Australian Case Study. International Journal of Waste Resources, 8(358)
[5] Oguchi, M., Murakami, S., Sakanakura, H., Kida, A., & Kameya, T. 2011. A preliminary categorization of end-of-life electrical and electronic equipment as secondary metal resources. Waste Management , 31(9-10), 2150–2160
[6] Recycle valuable metals from a large number of waste electrical appliances

	PC recycling rate (%)	Mobile phone recycling rate (%)	The amount of recycled metals (tons)	The total value (hundred millions yuan)
Scenario1	27	1	49905	251
Scenario2	62	33	128358	764
Scenario3	85		193794	1291

A higher recycling rate clearly shows greater productivity, and greater economic benefits. For key metals, like gold, silver, copper, and palladium, this productivity is particularly significant.



- If China's e-waste recycling rate reaches the EU 2019 target (85% for PC, 85% for mobile phone), the energy conservation through urban mining will be around 30 billion kWh, and the offset carbon emissions will equate to 22 million tons less than if that metal were virgin mined. That's the equivalent of 52,000 flights between Beijing and New York on a Boeing 747-400 plane[7].

Greenpeace calls for:

1. Boost the recycling rate and slow down the replacement rate for electronic products.
2. Governments, brands, and financiers should invest in the urban mining industry. This is crucial to let the industry scale up.
3. Industry and government should work together to provide reliable and transparent data of the recycling market and stock flow, such as sales analysis and projection, and geographic data on regional rates and movement of recyclables. This gives

[7] Christian, N. J. (2009). Calculating The Carbon Dioxide Emissions of Flights. Oxford University.

investors the confidence to make sensible business decisions and helps industry players to operate more efficiently.

4. Electronics manufacturers and brands should focus on design, and make products more durable, repairable, and recyclable.
5. Establish industry frameworks and standards to ensure quality of work.

Greenpeace East Asia has been campaigning since 2016 for the electronics sector to reduce the consumption of resources and transform into a circular production model. Since 2003, we have focused on e-waste in China. The organization will continue engaging different stakeholders to speed up China's transition to a more viable model.

Appendix

Methodology

As precious metals like gold, silver, and palladium mainly exist in PCBs of e-waste, and the price of these precious metals are much higher than that of other materials. This analysis focuses on PCBs.

1. The potential value of e-waste recycling in China from 2010 to 2030 was described as:

The value of the metals in PCBs PC, laptop, or mobile e-waste = Σ（The weight of the e-waste[8] * the proportional amount of PCB per weighted unit of e-waste * the total metal content of PCBs[9] * the price of those metals[10]）

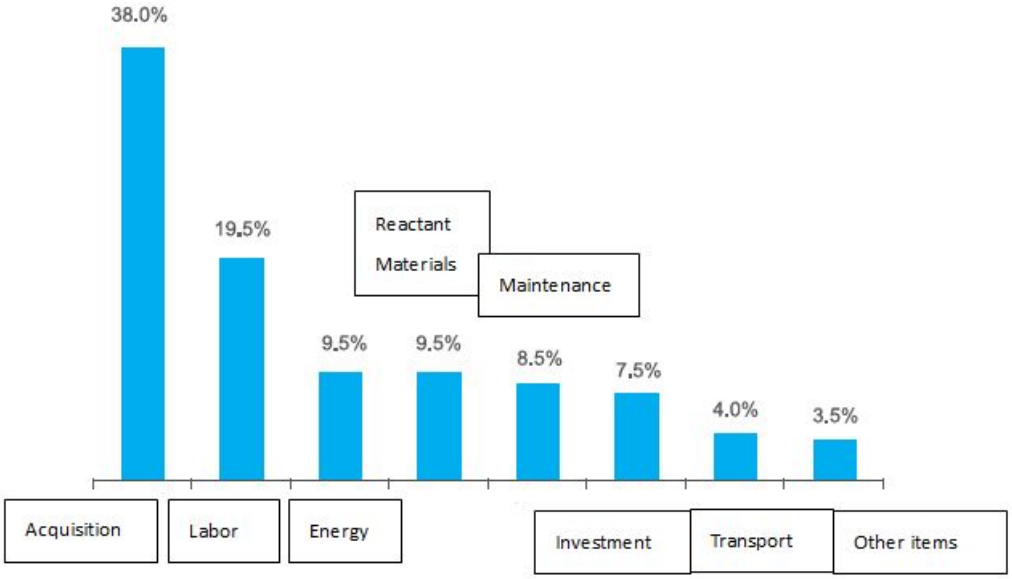
2**.** PCBs from mobile phones were used as an example to calculate the cost of PCB recycling. According to the market price, 50,000-60,000 yuan/ton is the average acquisition price of PCBs in mobile phones (the cost of mobile phone acquisition and dismantling is included) and the cost distribution of PCB processing is shown below[11].

[8] Zeng, X., Gong, R., Chen, W.-Q., & Li, J. 2016. Uncovering the Recycling Potential of “New” WEEE in China. Environmental Science & Technology, 50(3), 1347–1358.

[9] Duan, H., Hu, J., Tan, Q., Liu, L., Wang, Y., & Li, J. 2016. Systematic characterization of generation and management of e-waste in China. Environmental Science and Pollution Research International, 23(2), 1929–1943

[10] http://www.infomine.com

[11] Cucchiella, F., D’Adamo, I., Lenny Koh, S. C., & Rosa, P. 2016. A profitability assessment of European recycling processes treating printed circuit boards from waste electrical and electronic equipments. Renewable and Sustainable Energy Reviews, 64, 749–760.



The cost of metal refinery from PCBs = the average acquisition price of PCBs in mobile phones/the cost proportion of PCB acquisition