



SUSTAINABLE RAW MATERIAL CONSUMPTION – AN ANALYSIS OF FEASIBILITY

Glopolis 2017

ABSTRACT IN ENGLISH

This case study analyses the opportunities for sustainable raw materials consumption in the production of a particular telecommunications device. It aims to uncover the geographical origins of the antimony used in the set-top boxes available in the Czech Republic, then based on direct communication with the producers, it concludes with recommendations for producers as well as client companies regarding raw materials policies in electronic devices.

ABSTRAKT ČESKY

Tato případová studie analyzuje možnosti pro udržitelné využívání surovin ve vybraném zařízení určeném pro telekomunikace. Snaží se najít řešení zkoumáním této oblasti z různých úhlů pohledu. Vybraným výrobkem jsou set-top boxy dostupné na trhu v České republice. Studie zkoumá geografický původ antimonu používaného v set-top boxech. Na základě zjištění formuluje doporučení a návrhy jak výrobcům, tak firmám v roli klienta pro udržitelnější postupy při nakládání se surovinami.

DISCLAIMER

Names of concrete providers or companies are not disclosed intentionally. Should there be interest in more details, please contact Glopolis at info@glopolis.org.

We would also like to thank following experts for providing valuable inputs:

Jan Kovanda – professor, Charles University Prague

Miloš Polák – recycling of mobile phones, Retela

Markéta Švančárová – PhD student, LCA methodology, Charles University Prague

Jan Weinzettel – scientist, expert on LCA methodology, Charles University Prague



This case study has been produced with the financial assistance of the European Union, the Czech Development Agency and Ministry of Foreign Affairs of the Czech Republic within the programme Czech Republic Development Cooperation. The contents of this report are the sole responsibility of the Beneficiaries and can under no circumstances be regarded as reflecting the position of the European Union.

TABLE OF CONTENTS

1 Definition of the selected product and reasoning of the choice	5
1.1 Set-top boxes	5
2 Definition of the materials used in the product and reasoning of their selection	5
2.1 Antimony	5
3 Analysis of the geographical origin of the selected materials – description of the method to map the materials’ origin	7
3.1 Production of Antimony	7
3.1.1 Producer of Set-top boxes number 1	7
3.1.2 Producer of Set-top boxes number 2	8
3.1.3 Producer of Set-top boxes number 3	8
4 Findings	9
5 Recommendations: Proposal for a more responsible producer	10

ABBREVIATIONS

BOM	Build of Materials
IC	Integrated Circuit
LCA	Life Cycle Assessment
PCB	Printed Circuit Board
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
ROHS	Restriction of Hazardous Substances Directive
SB	Solder Ball
WEEE	Waste Electrical and Electronic Equipment

INTRODUCTION

In November 2016, after several years of negotiations, the EU institutions reached an agreement on the final shape of an EU regulation on conflict minerals, which aims to stop the financing of armed groups in developing countries through the trade of tin, tantalum, tungsten and gold. The regulation should ensure that the vast majority of these minerals and metals imported into the EU are sourced responsibly as of 1 January 2021.

This is a welcome step in the right direction; however, the new regulation only covers a handful of minerals, meaning other valuable resources won't be checked in the same way. Furthermore, the new law only requires those companies importing raw minerals into the EU to carry out checks on their supply chains, meaning companies that bring the very same minerals into the EU as part of components and products, like mobile phones or cars, are let entirely off the hook.¹

This means the EU has also missed an opportunity to make full use of the EU's commercial leverage to drive positive change outside of the EU. There is no question that all companies have a responsibility to play their part in making sure their supply chains are transparent, sustainable, and responsible. The EU has decided to trust that the majority of companies will choose to act responsibly of their own accord.

This case study aims to test on a concrete example if this trust is well placed. Firstly, it elaborates on the definition of the selected product and the reasoning of this choice. Then, it provides analysis of particular materials used in the product and the reasoning of this selection as well. The analysis afterwards continues with an exploration of the geographical origin of the selected materials and the description of the method used to map the materials' origin.

Finally, the main findings are provided as well as a recommendation in the form of a proposal for responsible companies that aim to operate sustainable supply chains.

This case study was elaborated between June 2016 and January 2017 as part of the campaign "STOP MAD MINING".



¹ <https://www.globalwitness.org/en/campaigns/conflict-minerals/conflict-minerals-europe-brief/>

1 DEFINITION OF THE SELECTED PRODUCT AND REASONING OF THE CHOICE

1.1 Set-top boxes

A set-top box is a device needed to enable a digital television to function. In the Czech Republic, one fifth of Czech households had a set-top box in the year 2009.² As such, this roughly amounts to 900 thousand terrestrial set-top boxes in the country.³ A set-top box consists of many parts and subparts and typically they come from various countries.

As part of its engagement with business, Glopolis reached out to an external expert who was leading a project integrating new set-top boxes in the Czech Republic for a telecommunications company in 2015. The expert was in a perfect position to analyze the supply chain of a selected set-top box, from producers and their subproviders, to the producers' local resellers. The telecommunications company agreed with the expert to undertake the research and to get in touch with the producers of the set-top boxes in order to find out the origin of the raw materials used in this device. The task was clear: to find as many details as possible about the composition of the set-top boxes and in case a conflict mineral was detected, focus on its geographical origin.

2 DEFINITION OF THE MATERIALS USED IN THE PRODUCT AND REASONING OF THEIR SELECTION

The analysis began with a request sent to the producers to provide information about the composition of a set-top box with respect to selected raw materials of interest (tantalum, tungsten, copper, nickel, aluminum, tin, silver, chromium, gold, palladium and zinc). The producers were also asked in which parts of HW (STB) are the materials used, how much and most importantly where they come from (which country and which provider). One of the producers provided several reports confirming antimony and lead in the product while other materials were "not detected". As the other request, to provide information about the origin of antimony and lead used in the product remained without answer; the main focus of the analysis was on antimony, a scarcer raw material. Antimony was detected in two different types of set-top boxes from one producer, in the following subparts:

Set-top box 1: Solder Ball: Antimony (Sb) 15,8 mg/kg

Set-top box 2: Solder Ball: Antimony (Sb) 15,8 mg/kg

2.1 Antimony

Antimony is mostly used in flame retardants and lead-acid batteries. While demand has increased over the 2008 to 2014 period, it has done so only at 0.9 % per year. Demand has been sluggish since the global financial crisis. Furthermore, antimony is increasingly being loaded in smaller and smaller amounts in some end-use applications, most notably in certain flame retardant formulations. These factors combined resulted in demand actually declining year-on-year between 2010 and 2014.

² [Digizone.cz](http://www.digizone.cz) [2009-05-13] <http://www.digizone.cz/clanky/petina-ceskych-domacnosti-uz-ma-terestricky/> [2017-01-15]

³ Based on number of the households in the Czech Republic in 2011: 4375122. Data retrieved from the Czech Statistical Office: [CZSO.cz](http://www.czso.cz) [2013-06-14] Table 550: Tab. 550 Hospodařící domácnosti podle počtu členů a podle typu hospodařící domácnosti a způsobu bydlení. <https://www.czso.cz/csu/czso/obyvatelstvo-domy-byty-a-domacnosti-podle-scitani-lidu-domu-a-bytu-2011-cr-kraje-okresy-so-orp-spravni-obvody-prahy-a-mesta-sidla-so-orp-2011-egrhq6c4dz> [2017-01-15]

Asia is the dominant consuming region across both metallurgical and non-metallurgical end uses.⁴ However, in recent years, the demand for it seems to be rising again: antimony has become an increasingly critical element in recent years, due to a surge in industrial demand and the Chinese domination of primary production.⁵

Antimony is a silvery, lustrous gray, rare earth metal in the metalloid group of elements. It is a conductor of heat and electricity. This metal and its compound forms can be toxic. Antimony is a rare resource - nevertheless it can be sometimes found naturally. Mostly, it is in the form of its sulfide, stibnite. An alloy of antimony and lead is used, for example (also in telecommunications) in batteries and cable sheathing.⁶ Antimony is produced from stibnite ore (Sb_2O_3) that is processed into antimony metal and antimony oxide (Sb_2O_3).

The flame retardant and lead-acid battery sectors accounted for 80% of all use of the metal in 2010. Until recently, the price of antimony was surging. It has risen by more than 400% over the past 10 years. An interesting presentation by Australian company, Artemis Resources, shows how antimony can be potentially profitable at what would be low grades for other metals. At \$10,500/tonne, in order to achieve \$105 value for every tonne of ore that is mined, antimony grades need to be just 1%. Lead, though, at \$2,100/tonne would need to grade at 4.7%, gold at \$1,300/oz would need to be grading 2.5 grams/tonne, silver at \$22/oz would need to grade 148 grams/tonne and copper, using \$7,200/tonne, would require a grade of 1.5% to produce \$150 for every tonne of ore mined.⁷

Antimony was also included in the critical raw materials report of the European Commission in 2014⁸ (as the material with the largest expected supply-demand gap over the period 2015-2020). It has become an increasingly critical material in the recent years, due to an increase in industrial demand and also the Chinese domination of primary production.⁹

That is why efforts have arisen to find secondary sources of antimony through the recycling of end-of-life products or by recovering antimony from industrial process residues. "Valuable residues are obtained by processing of gold, copper, and lead ores with high contents of antimony. Most of these residues are currently discarded or stockpiled, causing environmental concerns. There is a clear need to move to a more circular economy, where waste is considered as a resource and zero-waste valorization schemes become the norm, especially for rare elements such as antimony."¹⁰

4 Roskill, 12th edition. <https://roskill.com/product/antimony-world-market-forecast-2025/> [2017-01-07]

5 Rare. *Will antimony become "the next rare earth"?* RARE³ KU Leuven publishes milestone paper on the recycling of antimony. [2016-02-13] Abstract. <http://www.kuleuven.rare3.eu/news/will-antimony-become-the-next-rare-earth-rare%C2%B3-ku-leuven-publishes-milestone-paper-on-the-recycling-of-antimony/> [2017-01-07]

6 LiveScience. [2013-06-12] <http://www.livescience.com/37390-antimony.html/> [2016-12-17]

7 InvestorIntel. [2013-12-02] <http://investorintel.com/sectors/technology-metals/technology-metals-intel/first-rare-earths-now-antimony-%e2%80%95-china-wants-control-now-faces-falling-prices/> [2016-12-16]

8 Critical Raw Materials. European Commission. https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en Revised list of CRMs (2014): <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0297> [2017-01-08]

9 Rare. *Will antimony become "the next rare earth"?* RARE³ KU Leuven publishes milestone paper on the recycling of antimony. [2016-02-13] Abstract. <http://www.kuleuven.rare3.eu/news/will-antimony-become-the-next-rare-earth-rare%C2%B3-ku-leuven-publishes-milestone-paper-on-the-recycling-of-antimony/> [2016-12-09]

10 Rare. *Will antimony become "the next rare earth"?* RARE³ KU Leuven publishes milestone paper on the recycling of antimony. [2016-02-13] Abstract. <http://www.kuleuven.rare3.eu/news/will-antimony-become-the-next-rare-earth-rare%C2%B3-ku-leuven-publishes-milestone-paper-on-the-recycling-of-antimony/> [2016-12-09]

3 ANALYSIS OF THE GEOGRAPHICAL ORIGIN OF THE SELECTED MATERIALS – DESCRIPTION OF THE METHOD TO MAP THE MATERIALS' ORIGIN

At first, an attempt was made to find out the geographical origin of more selected resources used in set-top boxes (see chapter 2 above). However, the provider of set-top boxes (a European contact based in Germany, but with a contact for production based in China) found it very difficult to get to know the origin of any material. That is why the comparatively scarcer antimony was selected as the material to focus on in order to give us the opportunity to go into detail of at least one resource. Thus, the further search focused on the geographical origin of the antimony for a particular set-top box used by a specific telecommunications company in the Czech Republic. The producers of the device were contacted directly.

3.1 Production of Antimony

China produces the majority of antimony, about 85% of the world's production. The only other large producers are Tajikistan, Russia, South Africa and Bolivia. Simon Tonkin, analyst with Perth-based brokers Patersons, assumes that global demand for antimony will increase. However, he also sees two real threats: illegal mining in China will continue and increase, and the rising prices of antimony will force consumers to use substitute products.¹¹

The British Geological Survey in 2012 named antimony the most at risk of a supply disruption due to the high concentration of production in one country: China. According to an infographic published by Visual Capitalist, 17 percent of antimony supply is sourced from small, illegal, polluting mines in China. Like the recent crackdown on illegal rare earths concentrate, these mines are gradually being identified and shut down, resulting in fewer antimony exports.¹² Still, there are mines that are illegal and do not comply with any environmental regulations and standards. The supply is further threatened because China has nearly exhausted its supply of high-grade antimony ore.¹³

Due to the increase in the price of antimony, other locations where extraction was not economically viable in the past come now into play. To substitute this metal for something else, as Minormetals.com points out, will be difficult because alternatives to antimony are hard to find. "High prices should make previous uneconomic sources of production look more attractive, naming Armenia, Australia, Canada, China, Georgia, Italy, Laos, Russia and Turkey as potential antimony jurisdictions."¹⁴

3.1.1 Producer of Set-top boxes number 1

In total three providers of set-top boxes were contacted. The first contact was made by telephone, explaining individually the situation and what information was needed. Two producers who agreed to find out the requested details were then contacted by email, with more detailed questions and list of raw materials of interest.

Regarding timeframe, it took a few months to receive some reports from Producer 1. Despite urging by email and phone calls from time to time it took a few more months to receive further details – those were sent by a different person directly from Asia as the first contact was too busy to respond.

When the first producer was requested to provide information about the origins of the detected materials of interest and contacts to subproviders of these materials in order to be able to contact them directly, the following answer came from China:

„...it is difficult in our part to get the contact of the supplier of SB as we do not have direct business with them. I am very sorry for this. As you know we only deal with the IC maker that is inside the STB. The IC consist of many materials as you can see in the BOM. The material used in the IC like solder ball has also their own supplier

11 InvestorIntel. [2013-12-02] <http://investorintel.com/sectors/technology-metals/technology-metals-intel/first-rare-earths-now-antimony-%e2%80%95-china-wants-control-now-faces-falling-prices/> [2016-12-16]

12 Resource. Investing News. [2013-06-23] <http://investingnews.com/daily/resource-investing/antimony-put-it-on-your-radar/> [2016-12-01]

13 Resource. Investing News. [2013-06-23] <http://investingnews.com/daily/resource-investing/antimony-put-it-on-your-radar/> [2016-12-01]

14 Resource. Investing News. [2013-06-23] <http://investingnews.com/daily/resource-investing/antimony-put-it-on-your-radar/> [2016-12-01]

where it consist of SB. I cannot penetrate for example a particular provider from Japan to find where they are purchasing the SB as I do not have any means how to check with them now”...

Another reply stated:

“But there are many more (SB producers) from different countries like Malaysia, Taiwan, China and Korea. We do not purchase solder balls. It is the supplier of our supplier who purchase it. Again, we do not have direct contact with them. Other maker I know is a particular provider from Malaysia. Others I cannot remember. Solder ball is used in BGA, BALL GRID ARRAY IC that will connect to pcb pad.”

The conclusion from the responses provided by the first producer is that this producer of set-top boxes has for every part of a set-top box more providers from different countries. The producer neither has a complete overview about all of them, nor has access to information about the origin of the materials, not to mention the conditions of their extraction.

Furthermore, two other companies were directly approached – one from Japan and the other from Malaysia - and unfortunately no answer was received.

3.1.2 Producer of Set-top boxes number 2

The second producer at present cooperates with the respective telecommunications company in the Czech Republic. When asked about the origin of antimony in their product (set-top box) the second producer continued to reply for several months that either they were waiting for a relevant colleague to find the right information or they were having holidays or it was very difficult to find the information. Thus, the only information received within the period of more than half a year was a statement of compliance with all the regulations, namely the RoHS, REACH, WEEE and the Packaging directive.¹⁵ Since there is no regulation on particular materials, nobody cares until it is mandatory.

For example, the producer replied: “For the further substances as per your list, we have done some further analysis for the applicability of some material, however we cannot go in the details of the construction of the single components and parts as we are manufacturer of finished goods and the material are not subjected to restrictions. For this reason is not possible to do an exhaustive analysis.”

With regards to corporate social responsibility, however, the producer undoubtedly believes that everything is fine: “For Corporate Social Responsibility, we have Code of Ethics and behavior and it is applied also on the supply chain. Please note that the Code of Ethics and CSR and environmental guidelines are applied to the suppliers in the frame contract. Our set-top boxes are ISO 14001 certified for environmental management system (while does not have specific certification like SA8000). We participate to the ECOVADIS CSR assessment¹⁶ since several years and has been awarded a GOLD recognition level. (This excellent result includes us among the top 5% performers evaluated by EcoVadis.)”

3.1.3 Producer of Set-top boxes number 3

The third provider of Set-top boxes is active in the Czech Republic as well. However, as the respective telecommunications company does not buy any products from this producer, the company refused to provide any information, except for the statement of compliance with all necessary regulations. No relevant data was therefore obtained.

¹⁵ ROHS - Restriction of Hazardous Substances Directive: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0095>
REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1907> ; WEEE - Waste Electrical and Electronic Equipment: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0096> [2017-01-16]

¹⁶ EcoVadis.<http://www.ecovadis.com/csr-assessment/> [2017-01-16]

4 FINDINGS

The first finding since the beginning of this case study is that it is very difficult to get any relevant information regarding used raw materials from the producers. It is also very difficult to find any information about subproviders of particular parts of the set-top boxes, including the names of subproviders as well as the origin of the materials.

According to various sources, there is no other, more sustainable alternative to antimony for set-top boxes, therefore it is very important to support a circular economy and to reuse and recycle. Furthermore, the prevention is essential as recycling also requires energy and generates additional transport costs. Thus, raising awareness of the scarcity of antimony and other raw materials, and the negative effects of their extraction on the environment and affected communities is needed in order to make consumers think before they buy a new product, before they throw something away or hand it over for recycling.

Moreover, when considering prevention, not only public awareness and reduced consumption are important, but also prevention on the side of the producer is crucial. It is necessary to set specifications on how and which exact materials should be used to enhance and streamline the more efficient recovery of the secondary antimony and recycling. Such specifications should enable the reuse of antimony in the same or a completely different product after its service in a set-top box has finished.

To change the consumption patterns would require substantial time, but governments and international organisations should lead the way. One proposal under discussion is to impose taxes on raw materials based on their scarcity. The mining companies naturally do not support new taxation; however it should be society, including the regions affected by mining, not just the extractive industries that benefit.

By imposing taxes on raw materials, the general economic rule of demand and supply will apply and thus every player will have to reconsider using a particular material and become more careful about where and when it is being used. Moreover, there will be a clear incentive to search for alternatives.

Nevertheless, there are examples of companies that actually care about the materials in their products and recycling them. REMOBIL¹⁷ is a project used by some companies to motivate people to recycle their mobile phones and contribute to an NGO at the same time. The project REMOBIL and similar ones have their interest in people recycling more.

¹⁷ Remobil, <http://www.remobil.cz/en/> [2017-01-14]

5 RECOMMENDATIONS: PROPOSAL FOR A MORE RESPONSIBLE PRODUCER

The main recommendation for producers is to be interested in the origin of raw materials contained in the products from their providers and subproviders. When working on this case study the problem we encountered was that the producers hardly knew the names of their providers of subparts, much less where the materials to produce the subparts came from. In the case of the particular device this analysis focused on, the producer in China only remembered a few countries where the subpart including antimony came from and was able to name only two subproviders. What is more, the producer was also not sure whether the antimony used by each subprovider came from the same country as the subprovider.

Unfortunately at present at least some manufacturers (in our case producers of set-top boxes) either do not know and/or do not care where the materials they use come from. Naturally, they would rather focus on the price and logistics (the product needs to be delivered on time for the client typically over long distances in order to be sold to Europe from Asia etc.).

The client companies in Europe have to be mindful of the origin of the materials in products they resell as well. This is analogical to the above mentioned – companies (clients for the producer) usually do not know and do not care where the materials in the product (such as set-top boxes) come from. The client companies tend to care about the price and delivery time and if the product complies with EU regulations and standards (in areas such as signals or toxicity). Since there is no strict regulation to track the origin of particular raw materials, there is no tracking of them occurring. Therefore, it was very difficult to find out at least some of the subproviders of subparts and to find their origin. It seemed as if nobody else was asking. If there is no demand for such information, the producers will not provide it.

Following the above mentioned, client companies reselling products in the European Union do not know for example if the materials used in the products they sell are from conflict areas. Companies should be obliged to track their supply chains and make them more responsible. Unfortunately, many will not do so until they are forced to by law/ regulation. If clients in Europe are pushed to provide information about the whole supply chain, they would request the details from their providers who would have to demand the information from the manufacturer and so on.

In short, since the European Union currently still does not have any regulation for these matters,¹⁸ the burden of responsibility is even more on companies themselves. As this analysis tried to demonstrate, if the companies want to act responsibly, it is not easy. However they should at least try and demand from their providers information regarding the origins of their resources.

Then, in case a material from for example a conflict area is discovered, there should be a process of finding alternative locations for the acquisition of these resources, and, in the best way, looking more into recycling and lowering residues during the extraction and production processes. Additionally, innovative ways of recycling should be researched (e.g. designing the products in a way that enables full recycling) and enforced.

¹⁸ Joint Press Release. EU: Conflict Minerals agreement reached as exemptions added
http://stop-mad-mining.org/wp-content/uploads/2015/11/PR_Conflictminerals_2016-11-22.pdf [2017-01-14]

REFERENCES

Online sources

1. Czech Statistical Office: [CZSO.cz https://www.czso.cz/csu/czso/obyvatelstvo-domy-byty-a-domacnosti-podle-scitani-lidu-domu-a-bytu-2011-cr-kraje-okresy-so-orp-spravni-obvody-prahy-a-mesta-sidla-so-orp-2011-egrhq6c4dz](https://www.czso.cz/csu/czso/obyvatelstvo-domy-byty-a-domacnosti-podle-scitani-lidu-domu-a-bytu-2011-cr-kraje-okresy-so-orp-spravni-obvody-prahy-a-mesta-sidla-so-orp-2011-egrhq6c4dz)
1. [Digizone.cz, http://www.digizone.cz/clanky/petina-ceskych-domacnosti-uz-ma-terestricky/](http://www.digizone.cz/clanky/petina-ceskych-domacnosti-uz-ma-terestricky/)
2. EcoVadis, <http://www.ecovadis.com/csr-assessment/>
3. *Estimating the quantities of critical metals embedded in ICT and consumer equipment*. Resources, Conservation and Recycling. March 24, 2015. Chancerel, P., Marwede, M., Nils F. Nissen, N. F., Lang, K. D. <http://www.docsford.com/document/6285723>
4. European Commission: Critical Raw Materials, https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en Revised list of CRMs (2014): <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014DC0297>
5. European Parliament News, <http://www.europarl.europa.eu/news/cs/news-room/20110121STO12292/recyklace-mobil%C5%AF-a-po%C4%8D%C3%ADta%C4%8D%C5%AF-cesta-z-nedostatku-surovin>
6. *From “strategic” tungsten to “green” neodymium: A century of critical metals at a glance*. June 20, 2014. Chakhmouradian, A. R., Smith, M. P., Kynicky J.
7. *Gallium*. U.S. Geological Survey, Mineral Commodity Summaries, January 2013 <https://minerals.usgs.gov/minerals/pubs/commodity/gallium/mcs-2013-galli.pdf>
8. Global Witness. *Conflict Minerals in Europe*. <https://www.globalwitness.org/en/campaigns/conflict-minerals/conflict-minerals-europe-brief/>
9. InvestorIntel. *First rare earths, now antimony — it’s all about China*. December 02, 2013. <http://investorintel.com/sectors/technology-metals/technology-metals-intel/first-rare-earth-s-now-antimony-%e2%80%95-china-wants-control-now-faces-falling-prices/>
10. LiveScience. *Facts About Antimony*. June 12, 2013. <http://www.livescience.com/37390-antimony.html>
11. Metal Bulletin. *China cancels antimony mining restrictions; raises rare earths quota*. Smith, Chloe. June 10, 2014. <https://www.metalbulletin.com/Article/3350361/China-cancels-antimony-mining-restrictions-raises-rare-earth-s-quota.html>
12. [Phys.org. No future without scarce metals](http://phys.org/news/2012-01-future-scarce-metals.html/). January 31, 2012. <http://phys.org/news/2012-01-future-scarce-metals.html/>
13. Rare. *Will antimony become “the next rare earth”?* RARE³ KU Leuven publishes milestone paper on the recycling of antimony. February 13, 2016. Abstract. <http://www.kuleuven.rare3.eu/news/will-antimony-become-the-next-rare-earth-rare%C2%B3-ku-leuven-publishes-milestone-paper-on-the-recycling-of-antimony/>
14. REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1907>
15. Remobil, <http://www.remobil.cz/en/>
16. Resource. Investing News. *Antimony: Put It on Your Radar*. June 06, 2013 <http://investingnews.com/daily/resource-investing/antimony-put-it-on-your-radar/>
17. ROHS - Restriction of Hazardous Substances Directive, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0095>
18. *Roskill*. 12th edition, <https://roskill.com/product/antimony-world-market-forecast-2025/>
19. WEEE - Waste Electrical and Electronic Equipment, <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32002L0096>

All online sources mentioned above were retrievable on 16th of December 2016.



Bloomberg Best of the Year 2016: A supervisor holds an Apple Inc. iPad as he checks an employee's badge during roll call at a Pegatron Corp. factory in Shanghai, China, on Friday, April 15, 2016. This is the realm in which the world's most profitable smartphones are made, part of Apple Inc.'s closely guarded supply chain.

Photographer: Qilai Shen/Bloomberg via Getty Images

Should there be interest in more details, please contact Glopolis at info@glopolis.org.



CZECH REPUBLIC
DEVELOPMENT COOPERATION



This case study has been produced with the financial assistance of the European Union, the Czech Development Agency and Ministry of Foreign Affairs of the Czech Republic within the programme Czech Republic Development Cooperation. The contents of this report are the sole responsibility of the Beneficiaries and can under no circumstances be regarded as reflecting the position of the European Union.