Towards a sustainable and circular metals economy: the case of copper in China

Dong, D.

References

Adachi, T., Mogi, G., 2007. Life cycle inventory for base metal ingots production in Japan including mining and mineral processing processes by cost estimating system database. Transactions of Nonferrous Metals Society of China 17(s1A), s131-s135.

Allegrini, E., Vadenbo, C., Boldrin, A., Astrup, T.F., 2015. Life cycle assessment of resource recovery from municipal solid waste incineration bottom ash. Journal of Environmental Management 151, 132-143.

Alvarado, S., Maldonado, P., Barrios, A., Jaques, I., 2002. Long term energy-related environmental issues of copper production. Energy 27(2), 183-196.

Antofagasta, Barrick, Colbun, 2018. Zaldívar copper mine moves to 100% renewable power, Mining Journal, https://www.mining-journal.com/copper-news/news/1342892/zald%C3%ADvar-copper-mine-moves-to-100-renewable-power.

Ardente, F., Mathieux, F., 2014. Environmental assessment of the durability of energy-using products: method and application. Journal of cleaner production 74, 62-73.

Ardente, F., Talens Peiró, L., Mathieux, F., Polverini, D., 2018. Accounting for the environmental benefits of remanufactured products: Method and application. Journal of Cleaner Production 198, 1545-1558.

Arvidsson, R., Tillman, A.-M., Sandén, B.A., Janssen, M., Nordelöf, A., Kushnir, D., Molander, S., 2018. Environmental Assessment of Emerging Technologies: Recommendations for Prospective LCA. Journal of Industrial Ecology 22(6), 1286-1294.

Asiedu, E., 2006. Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability. The World Economy 29(1), 63-77.

Assefa, G., Björklund, A., Eriksson, O., Frostell, B., 2005. ORWARE: an aid to environmental technology chain assessment. Journal of Cleaner Production 13(3), 265-274.

Atilgan, B., Azapagic, A., 2016. An integrated life cycle sustainability assessment of electricity generation in Turkey. Energy Policy 93, 168-186.

Ayres, R.U., Ayres, L.W., Råde, I., 2003. The Life Cycle of Copper, Its Co-Products and Byproducts.

Babaei, M.J., Molaei, M.A., Dehghani, A., 2015. Estimating the function of copper consumption in Iran between 1991- 2011 using Johansen model. Journal of Mining and Environment 6(2), 183-189.

Baccini, P., Bader, H.-P., 1996. Regionaler stoffhaushalt: erfassung, bewertung und steuerung. Spektrum Akademischer Verlag Heidelberg.

Bader, H.-P., Scheidegger, R., Wittmer, D., Lichtensteiger, T., 2011. Copper flows in buildings, infrastructure and mobiles: a dynamic model and its application to Switzerland. Clean Technologies and Environmental Policy 13(1), 87-101.

Ballantyne, G., Powell, M., 2014. Benchmarking comminution energy consumption for the processing of copper and gold ores. Minerals Engineering 65, 109-114.

Batker, D., Schmidt, R., 2015. Environmental and Social Benchmarking Analysis of Nautilus Minerals Inc: Solwara 1 Project. Earth Economics.

Bertram, M., Graedel, T.E., Fuse, K., Gordon, R., Lifset, R., Rechberger, H., Spatari, S., 2003. The copper cycles of European countries. Regional Environmental Change 3(4), 119-127.

Binswanger, M., 2001. Technological progress and sustainable development: what about the rebound effect? Ecological Economics 36(1), 119-132.

Brahmst, E., 2006. Copper in end-of-life vehicle recycling, The Center for Automotive Research, Ann Arbor, MI. Center for Automotive Research.

Brunner, P.H., Rechberger, H., 2003. Practical handbook of material flow analysis. CRC press.

Buchner, H., Laner, D., Rechberger, H., Fellner, J., 2015. Dynamic material flow modeling: An effort to calibrate and validate aluminum stocks and flows in Austria. Environmental science & technology 49(9), 5546-5554.

Burchart-Korol, D., Fugiel, A., Czaplicka-Kolarz, K., Turek, M., 2016. Model of environmental life cycle assessment for coal mining operations. Science of The Total Environment 562, 61-72.

Calvo, G., Mudd, G., Valero, A., Valero, A., 2016. Decreasing ore grades in global metallic mining: A theoretical issue or a global reality? Resources 5(4), 36.

Cao, Z., Liu, G., Zhong, S., Dai, H., Pauliuk, S., 2019. Integrating Dynamic Material Flow Analysis and Computable General Equilibrium Models for Both Mass and Monetary Balances in Prospective Modeling: A Case for the

Chinese Building Sector. Environmental Science & Technology 53(1), 224-233.

CELVE, 2019. Remanufacturing of components in ELVs: from "ELV waste, component waste" to "ELV waste, component reuse". China's End-of-life-vehicles Recycling Reprocess Economy.

CGS, 2016. National Mineral Resources Planning (2016-2020). Geological Survey of China.

Chang, M.M.L., Ong, S.K., Nee, A.Y.C., 2017. Approaches and Challenges in Product Disassembly Planning for Sustainability. Procedia CIRP 60, 506-511.

CHARI, 2018. Green Supply Chain Management of Electrical and Electronic Products. CHARI of the People's Republic of China.

Charles, R.G., Douglas, P., Hallin, I.L., Matthews, I., Liversage, G., 2017. An investigation of trends in precious metal and copper content of RAM modules in WEEE: Implications for long term recycling potential. Waste Management 60, 505-520.

Chaturvedi, A., Strasser, C., Eisinger, F., Raghupathy, L., Henzler, M.P., Arora, R., 2012. The carbon footprint of e-waste recycling - Indian scenarios, 2012 Electronics Goes Green 2012+. pp. 1-6.

Chen, J., Wang, Z., Wu, Y., Li, L., Li, B., Pan, D., Zuo, T., 2019. Environmental benefits of secondary copper from primary copper based on life cycle assessment in China. Resources, Conservation and Recycling 146, 35-44.

Chen, W.-Q., Graedel, T.E., 2012. Anthropogenic Cycles of the Elements: A Critical Review. Environmental Science & Technology 46(16), 8574-8586.

Chen, W., Shi, L., Qian, Y., 2010. Substance flow analysis of aluminium in mainland China for 2001, 2004 and 2007: Exploring its initial sources, eventual sinks and the pathways linking them. Resources Conservation & Recycling 54(9), 557-570.

Chen, W., Wang, M., Li, X., 2016. Analysis of copper flows in the United States: 1975–2012. Resources, Conservation and Recycling 111, 67-76.

Chen, Y., Ding, Z., Liu, J., Ma, J., 2019. Life cycle assessment of end-of-life vehicle recycling in China: a comparative study of environmental burden and benefit. International Journal of Environmental Studies 76(6), 1019-1040.

Chen, Y., Yang, Y., Hu, S., Xie, L., Yang, Y., Huang, W., Chen, Z., 2018.

Analysis of the current situation and policy suggestions of the recycling and utilization of ELVs in China Engineering 01, 113-119.

Chi, X., Streicher-Porte, M., Wang, M.Y.L., Reuter, M.A., 2011. Informal electronic waste recycling: A sector review with special focus on China. Waste Management 31(4), 731-742.

Chi, X., Wang, M.Y.L., Reuter, M.A., 2014. E-waste collection channels and household recycling behaviors in Taizhou of China. Journal of Cleaner Production 80, 87-95.

Choi, S.G., Kim, C.S., Ko, E.M., Kim, S.Y., Jo, H.Y., 2008. Mineral Economic Index and Comprehensive Demand Prediction for Strategic Minerals: Copper, Zinc, Lead, and Nickel. Economic and Environmental Geology 41(3), 345-357.

Ciacci, L., Fishman, T., Elshkaki, A., Graedel, T.E., Vassura, I., Passarini, F., 2020. Exploring future copper demand, recycling and associated greenhouse gas emissions in the EU-28. Global Environmental Change 63, 102093.

CML, 2016. CML-IA Characterisation Factors., Department of Industrial Ecology, Leiden University. https://www.universiteitleiden.nl/en/research/research-output/science/cml-ia-characterisation-factors.

CNMIA, 2016. China Nonferrous Industry Statistical Yearbook. China Nonferrous Metals Industry Association.

CNMIA, 2019. China Nonferrous Industry Statistical Yearbook. China Nonferrous Metals Industry Association.

CNREC, 2017. China Renewable Energy Outlook 2017. Renewable Energy Center of China.

Commission, E., 2017. Study on the review of the list of critical raw materials. European Commission Brussels.

Council, N.R., 2002. Evolutionary and revolutionary technologies for mining. National Academies Press.

Crane, W., Krausmann, F., Eisenmenger, N., Giljum, S., Hennicke, P., Kemp, R., Lankao, P.R., Manalang, B.S., Sewerin, S., 2011. Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. International Resource Panel.

Crowson, P., 2012. Some observations on copper yields and ore grades. Resources Policy 37(1), 59-72.

Daigo, I., Hashimoto, S., Matsuno, Y., Adachi, Y., 2007. Dynamic analysis on material balance of copper and copper-alloy scraps in Japan. Journal of the Japan Institute of Metals 71(7), 563-569.

Daigo, I., Hashimoto, S., Matsuno, Y., Adachi, Y., 2009. Material stocks and flows accounting for copper and copper-based alloys in Japan. Resources Conservation and Recycling 53(4), 208-217.

Das, S., Lee, S.H., Kumar, P., Kim, K., Lee, S.S., Bhattacharya, S.S., 2019. Solid waste management: Scope and the challenge of sustainability. Journal of Cleaner Production 228, 658-678.

Davidson, A.J., Binks, S.P., Gediga, J., 2016. Lead industry life cycle studies: environmental impact and life cycle assessment of lead battery and architectural sheet production. The International Journal of Life Cycle Assessment 21(11), 1624-1636.

Davis, J., Geyer, R., Ley, J., He, J., Clift, R., Kwan, A., Sansom, M., Jackson, T., 2007. Time-dependent material flow analysis of iron and steel in the UK: Part 2. Scrap generation and recycling. Resources Conservation & Recycling 51(1), 118-140.

De Meester, S., Nachtergaele, P., Debaveye, S., Vos, P., Dewulf, J., 2019. Using material flow analysis and life cycle assessment in decision support: A case study on WEEE valorization in Belgium. Resources, Conservation and Recycling 142, 1-9.

Deetman, S., Pauliuk, S., van Vuuren, D.P., van der Voet, E., Tukker, A., 2018. Scenarios for Demand Growth of Metals in Electricity Generation Technologies, Cars, and Electronic Appliances. Environmental Science & Technology 52(8), 4950-4959.

Dong, D., An, H., Huang, S., 2017. The transfer of embodied carbon in copper international trade: An industry chain perspective. Resources Policy 52, 173-180.

Dong, D., Gao, X., Sun, X., Liu, X., 2018. Factors affecting the formation of copper international trade community: Based on resource dependence and network theory. Resources Policy 57, 167-185.

Dong, D., Tercero Espinoza, L.A., Loibl, A., Pfaff, M., Tukker, A., Van der Voet, E., 2020a. Scenarios for anthropogenic copper demand and supply in China: implications of a scrap import ban and a circular economy transition. Resources, Conservation and Recycling 161, 104943.

Dong, D., Tukker, A., Van der Voet, E., 2019. Modeling copper demand in

China up to 2050: A business-as-usual scenario based on dynamic stock and flow analysis. Journal of Industrial Ecology.

Dong, D., van Oers, L., Tukker, A., van der Voet, E., 2020b. Assessing the future environmental impacts of copper production in China: Implications of the energy transition. Journal of Cleaner Production 274, 122825.

Duan, H., Hou, K., Li, J., Zhu, X., 2011. Examining the technology acceptance for dismantling of waste printed circuit boards in light of recycling and environmental concerns. Journal of environmental management 92(3), 392-399.

Eheliyagoda, D., Wei, F., Shan, G., Albalghiti, E., Zeng, X., Li, J., 2019. Examining the Temporal Demand and Sustainability of Copper in China. Environmental Science & Technology 53(23), 13812-13821.

Ellen MacArthur Foundation, 2013. Towards the circular economy. Journal of Industrial Ecology 2, 23-44.

Elshkaki, A., Graedel, T., 2013. Dynamic analysis of the global metals flows and stocks in electricity generation technologies. Journal of Cleaner Production 59, 260-273.

Elshkaki, A., Graedel, T.E., Ciacci, L., Reck, B.K., 2016. Copper demand, supply, and associated energy use to 2050. Global Environmental Change-Human and Policy Dimensions 39, 305-315.

Elshkaki, A., Graedel, T.E., Ciacci, L., Reck, B.K., 2018. Resource Demand Scenarios for the Major Metals. Environmental Science & Technology 52(5), 2491-2497.

Elshkaki, A., Van der Voet, E., Timmermans, V., Holderbeke, M.V., 2005. Dynamic stock modelling: A method for the identification and estimation of future waste streams and emissions based on past production and product stock characteristics. Energy 30(8), 1353-1363.

Eriksen, M.K., Pivnenko, K., Faraca, G., Boldrin, A., Astrup, T.F., 2020. Dynamic Material Flow Analysis of PET, PE, and PP Flows in Europe: Evaluation of the Potential for Circular Economy. Environmental Science & Technology 54(24), 16166-16175.

European Commission, 2003. Communication from the commission to the council.

Fan, Y., Fang, C., 2020. Circular economy development in China-current situation, evaluation and policy implications. Environmental Impact Assessment Review 84, 106441.

Farjana, S.H., Huda, N., Mahmud, M.P., 2019a. Impacts of aluminum production: A cradle to gate investigation using life-cycle assessment. Science of the Total Environment 663, 958-970.

Farjana, S.H., Huda, N., Parvez Mahmud, M.A., Saidur, R., 2019b. A review on the impact of mining and mineral processing industries through life cycle assessment. Journal of Cleaner Production 231, 1200-1217.

Farjana, S.H., Li, W., 2021. Integrated LCA-MFA Framework for Gold Production from Primary and Secondary Sources. Procedia CIRP 98, 511-516.

Ferreira, H., Leite, M.G.P., 2015. A Life Cycle Assessment study of iron ore mining. Journal of cleaner production 108, 1081-1091.

Figge, F., Thorpe, A.S., 2019. The symbiotic rebound effect in the circular economy. Ecological Economics 163, 61-69.

Finkbeiner, M., Schau, E.M., Lehmann, A., Traverso, M., 2010. Towards life cycle sustainability assessment. Sustainability 2(10), 3309-3322.

Fiore, S., Ibanescu, D., Teodosiu, C., Ronco, A., 2019. Improving waste electric and electronic equipment management at full-scale by using material flow analysis and life cycle assessment. Science of The Total Environment 659, 928-939.

Foelster, A.-S., Andrew, S., Kroeger, L., Bohr, P., Dettmer, T., Boehme, S., Herrmann, C., 2016. Electronics recycling as an energy efficiency measure – a Life Cycle Assessment (LCA) study on refrigerator recycling in Brazil. Journal of Cleaner Production 129, 30-42.

Font Vivanco, D., Kemp, R., van der Voet, E., 2016. How to deal with the rebound effect? A policy-oriented approach. Energy Policy 94, 114-125.

Forti, V., Balde, C.P., Kuehr, R., Bel, G., 2020. The Global E-waste Monitor 2020: Quantities, flows and the circular economy potential. United Nations.

Fu, X., Ueland, S.M., Olivetti, E., 2017. Econometric modeling of recycled copper supply. Resources, Conservation and Recycling 122, 219-226.

GACC, 2018. Catalogue for Administration of Import of Solid Wastes. General Administration of Customs of the People's Republic of China

Gan, Y., Griffin, W.M., 2018. Analysis of life-cycle GHG emissions for iron ore mining and processing in China—Uncertainty and trends. Resources Policy 58, 90-96.

García-Olivares, A., 2015. Substituting silver in solar photovoltaics is feasible and allows for decentralization in smart regional grids. Environmental

Innovation and Societal Transitions 17, 15-21.

Geng, J., Hao, H., Sun, X., Xun, D., Liu, Z., Zhao, F., 2021. Static material flow analysis of neodymium in China. Journal of Industrial Ecology 25(1), 114-124.

Geng, Y., Doberstein, B., 2008. Developing the circular economy in China: Challenges and opportunities for achieving 'leapfrog development'. International Journal of Sustainable Development & World Ecology 15(3), 231-239.

Geng, Y., Sarkis, J., Bleischwitz, R., 2019. How to globalize the circular economy. Nature Publishing Group.

Gerst, M.D., 2009. Linking material flow analysis and resource policy via future scenarios of in-use stock: an example for copper. Environmental Science & Technology 43(16), 6320.

Gharfalkar, M., Court, R., Campbell, C., Ali, Z., Hillier, G., 2015. Analysis of waste hierarchy in the European waste directive 2008/98/EC. Waste Management 39, 305-313.

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner Production 114, 11-32.

Giurco, D., Petrie, J., 2007. Strategies for reducing the carbon footprint of copper: New technologies, more recycling or demand management? Minerals Engineering 20(9), 842-853.

Giusti, L., 2009. A review of waste management practices and their impact on human health. Waste Management 29(8), 2227-2239.

Glöser, S., Soulier, M., Tercero Espinoza, L.A., 2013. Dynamic analysis of global copper flows. Global stocks, postconsumer material flows, recycling indicators, and uncertainty evaluation. Environmental Science & Technology 47(12), 6564-6572.

Gradin, K.T., Luttropp, C., Björklund, A., 2013. Investigating improved vehicle dismantling and fragmentation technology. Journal of cleaner production 54, 23-29.

Graedel, T.E., Allwood, J., Birat, J.P., Buchert, M., Hagelüken, C., Reck, B.K., Sibley, S.F., Sonnemann, G., 2011. What do we know about metal recycling rates? Journal of Industrial Ecology 15(3), 355-366.

Graedel, T.E., Bertram, M., Kapur, A., Reck, B., Spatari, S., 2004a.

Exploratory data analysis of the multilevel anthropogenic copper cycle. Environmental Science & Technology 38(4), 1253-1261.

Graedel, T.E., Harper, E.M., Nassar, N.T., Reck, B.K., 2015. On the materials basis of modern society. Proceedings of the National Academy of Sciences 112(20), 6295-6300.

Graedel, T.E., van Beers, D., Bertram, M., Fuse, K., Gordon, R.B., Gritsinin, A., Kapur, A., Klee, R.J., Lifset, R.J., Memon, L., Rechberger, H., Spatari, S., Vexler, D., 2004b. Multilevel Cycle of Anthropogenic Copper. Environmental Science & Technology 38(4), 1242-1252.

Guan, D., Meng, J., Reiner, D.M., Zhang, N., Shan, Y., Mi, Z., Shao, S., Liu, Z., Zhang, Q., Davis, S.J., 2018. Structural decline in China's CO2 emissions through transitions in industry and energy systems. Nature Geoscience 11(8), 551-555.

Guinée, J., 2016. Life cycle sustainability assessment: What is it and what are its challenges?, Taking stock of industrial ecology. Springer, Cham, pp. 45-68.

Guinée, J.B., 2002. Handbook on life cycle assessment operational guide to the ISO standards. The international journal of life cycle assessment 7(5), 311-313.

Guinee, J.B., Heijungs, R., Huppes, G., Zamagni, A., Masoni, P., Buonamici, R., Ekvall, T., Rydberg, T., 2011. Life cycle assessment: past, present, and future. ACS Publications.

Guo, X.Y., Song, Y., 2008. Substance flow analysis of copper in China. Resources Conservation and Recycling 52(6), 874-882.

Haberl, H., Wiedenhofer, D., Virág, D., Kalt, G., Plank, B., Brockway, P., Fishman, T., Hausknost, D., Krausmann, F., Leon-Gruchalski, B., Mayer, A., Pichler, M., Schaffartzik, A., Sousa, T., Streeck, J., Creutzig, F., 2020. A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: synthesizing the insights. Environmental Research Letters 15(6), 065003.

Han, H., Wang, H.W., Ouyang, M.G., Cheng, F., 2011. Vehicle survival patterns in China. Science China Technological Sciences 54(3), 625-629.

Haque, N., Norgate, T., 2014. The greenhouse gas footprint of in-situ leaching of uranium, gold and copper in Australia. Journal of cleaner production 84, 382-390.

Haupt, M., Zschokke, M., 2017. How can LCA support the circular

economy?—63rd discussion forum on life cycle assessment, Zurich, Switzerland, November 30, 2016. The International Journal of Life Cycle Assessment 22(5), 832-837.

Hedbrant, J., 2001. Stockhome: A Spreadsheet Model of Urban Heavy Metal Metabolism. Water Air & Soil Pollution Focus 1(3-4), 55-66.

Holm, O., Wollik, E., Johanna Bley, T., 2018. Recovery of copper from small grain size fractions of municipal solid waste incineration bottom ash by means of density separation. International Journal of Sustainable Engineering 11(4), 250-260.

Hong, J., Chen, Y., Liu, J., Ma, X., Qi, C., Ye, L., 2018. Life cycle assessment of copper production: a case study in China. The International Journal of Life Cycle Assessment 23(9), 1814-1824.

Hong, J., Li, X., Zhaojie, C., 2010. Life cycle assessment of four municipal solid waste management scenarios in China. Waste Management 30(11), 2362-2369.

Hong, J., Shi, W., Wang, Y., Chen, W., Li, X., 2015. Life cycle assessment of electronic waste treatment. Waste Management 38, 357-365.

Hu, M., Bergsdal, H., van der Voet, E., Huppes, G., Müller, D.B., 2010a. Dynamics of urban and rural housing stocks in China. Building Research & Information 38(3), 301-317.

Hu, M., Pauliuk, S., Wang, T., Huppes, G., van der Voet, E., Müller, D.B., 2010b. Iron and steel in Chinese residential buildings: A dynamic analysis. Resources Conservation & Recycling 54(9), 591-600.

Huang, T., Shi, F., Tanikawa, H., Fei, J., Han, J., 2013. Materials demand and environmental impact of buildings construction and demolition in China based on dynamic material flow analysis. Resources, Conservation and Recycling 72, 91-101.

Hunt, A.J., 2013. Element recovery and sustainability. Royal Society of Chemistry.

ICA, 2013. Copper Recycling.

ICA, 2016. Global Copper Substitution and Regulatory Trends, International Copper Association. https://copperalliance.org/wp-content/uploads/2017/05/2017.04-Substitution-and-Regulation-Factsheet.pdf.

ICA, 2017. Global Copper Substitution and Regulatory Trends. International

Copper Association.

ICA, 2021. Stocks and flows. https://copperalliance.org/about-copper/stocks-and-flows/. (Accessed 23 March 2021).

ICGS, 2021. Latest Copper Market Forecast, in: Group, I.C.S. (Ed.).

ICSG, 2020. World Copper Factbook 2020. International Copper Study Group.

IEA, 2017. Global Energy Efficiency Report 2017, International Energy Agency.

IFs, 2017. International Futures (IFs) modeling system, Version x.xx. Frederick S. Pardee Center for International Futures, Josef Korbel School of International Studies, University of Denver, Denver, CO.

Igarashi, Y., Kakiuchi, E., Daigo, I., Matsuno, Y., Adachi, Y., 2008. Estimation of Steel Consumption and Obsolete Scrap Generation in Japan and Asian Countries in the Future. Isij International 93(12), 782-791.

Ioannidou, D., Sonnemann, G., Suh, S., 2020. Do we have enough natural sand for low-carbon infrastructure? Journal of Industrial Ecology 24(5), 1004-1015.

IRP, 2019. Global Resources Outlook 2019: Natural Resources for the Future We Want., in: Panel, I.R. (Ed.). United Nations Environment Programme.

ISO, 2006a. Environmental Management—Life Cycle Assessment—Principles and Framework. International Organization for Standardization 14040: 2006 (E) Series.

ISO, 2006b. Environmental management: Life cycle assessment; requirements and guidelines. International Organization for Standardization.

Jiang, J., Dai, J., Feng, W., Xu, J., 2006. Life cycle assessment of the processes of producing copper by pyrometallurgy and hydrometallurgy. Journal of Lanzhou University of Technology 32(1), 19-21.

Jiang, M., Behrens, P., Wang, T., Tang, Z., Yu, Y., Chen, D., Liu, L., Ren, Z., Zhou, W., Zhu, S., He, C., Tukker, A., Zhu, B., 2019. Provincial and sector-level material footprints in China. Proceedings of the National Academy of Sciences 116(52), 26484.

John, R., 2012. Energy Use in Metal Production High Temperature Processing Symposium 2012 CSIRO, Process Science and Engineering, Australia.

Kapur, A., 2006. The future of the red metal - A developing country perspective from India. Resources Conservation and Recycling 47(2), 160-182.

Kaufman, S.M., Krishnan, N., Themelis, N.J., 2010. A Screening Life Cycle Metric to Benchmark the Environmental Sustainability of Waste Management Systems. Environmental Science & Technology 44(15), 5949-5955.

Keller, H., Rettenmaier, N., Reinhardt, G.A., 2015. Integrated life cycle sustainability assessment–A practical approach applied to biorefineries. Applied Energy 154, 1072-1081.

Khoo, J.Z., Haque, N., Woodbridge, G., McDonald, R., Bhattacharya, S., 2017. A life cycle assessment of a new laterite processing technology. Journal of cleaner production 142, 1765-1777.

Kiddee, P., Naidu, R., Wong, M.H., 2013. Electronic waste management approaches: An overview. Waste Management 33(5), 1237-1250.

Kleijn, R., 2012. Materials and energy: a story of linkages Date: 2012-09-05.

Krausmann, F., Wiedenhofer, D., Lauk, C., Haas, W., Tanikawa, H., Fishman, T., Miatto, A., Schandl, H., Haberl, H., 2017. Global socioeconomic material stocks rise 23-fold over the 20th century and require half of annual resource use. Proceedings of the National Academy of Sciences 114(8), 1880-1885.

Kuipers, K.J.J., van Oers, L., Verboon, M., van der Voet, E., 2018. Assessing environmental implications associated with global copper demand and supply scenarios from 2010 to 2050. Global Environmental Change-Human and Policy Dimensions 49, 106-115.

Kulczycka, J., Lelek, Ł., Lewandowska, A., Wirth, H., Bergesen, J.D., 2016. Environmental Impacts of Energy-Efficient Pyrometallurgical Copper Smelting Technologies: The Consequences of Technological Changes from 2010 to 2050. Journal of Industrial Ecology 20(2), 304-316.

Lassesson, H., Fedje, K.K., Steenari, B.-M., 2014. Leaching for recovery of copper from municipal solid waste incineration fly ash: Influence of ash properties and metal speciation. Waste management & research 32(8), 755-762.

Li, H., Qi, Y., 2011. Comparison of China's carbon emission scenarios in 2050. Advances in Climate Change Research 2(4), 193-202.

Li, J., Liang, J., Zuo, J., Guo, H., 2020. Environmental impact assessment of mobile recycling of demolition waste in Shenzhen, China. Journal of Cleaner Production 263, 121371.

Li, Y., Guan, J., 2009. Life cycle assessment of recycling copper process from copper-slag, 2009 International Conference on Energy and Environment Technology. IEEE, pp. 198-201.

Ling, Z., Zengwei, Y., Jun, B., 2012. Estimation of Copper In-use Stocks in Nanjing, China. Journal of Industrial Ecology 16(2), 191-202.

Linzner, R., Salhofer, S., 2014. Municipal solid waste recycling and the significance of informal sector in urban China. Waste management & research 32(9), 896-907.

Liu, C., Lin, J., Cao, H., Zhang, Y., Sun, Z., 2019. Recycling of spent lithium-ion batteries in view of lithium recovery: A critical review. Journal of Cleaner Production 228, 801-813.

Liu, G., Bangs, C.E., Müller, D.B., 2013. Stock dynamics and emission pathways of the global aluminium cycle. Nature Climate Change 3(4), 338.

Liu, G., Bangs, C.E., Müller, D.B., 2011. Unearthing potentials for decarbonizing the US aluminum cycle. Environmental science & technology 45(22), 9515-9522.

Liu, M., Chen, X., Zhang, M., Lv, X., Wang, H., Chen, Z., Huang, X., Zhang, X., Zhang, S., 2020. End-of-life passenger vehicles recycling decision system in China based on dynamic material flow analysis and life cycle assessment. Waste Management 117, 81-92.

Liu, X., Tanaka, M., Matsui, Y., 2006. Electrical and electronic waste management in China: progress and the barriers to overcome. Waste Management & Research 24(1), 92-101.

Macquarie, R., 2015. Copper In China-A Bottom-up Approach To Long-term Demand, Macquarie Research

Magalini, F., Wang, F., Huisman, J., Kuehr, R., Baldé, K., van Straalen, V., Hestin, M., Lecerf, L., Sayman, U., Akpulat, O., 2014. Study on collection rates of waste electrical and electronic equipment (WEEE). EU Commission.

Månberger, A., Stenqvist, B., 2018. Global metal flows in the renewable energy transition: Exploring the effects of substitutes, technological mix and development. Energy Policy 119, 226-241.

Marsden, J.O., 2008. Energy efficiency and copper hydrometallurgy, Hydrometallurgy. pp. 29-42.

Maung, K.N., Hashimoto, S., Mizukami, M., Morozumi, M., Lwin, C.M., 2017. Assessment of the Secondary Copper Reserves of Nations.

Environmental Science & Technology 51(7), 3824-3832.

McMillan, C.A., Keoleian, G.A., 2009. Not all primary aluminum is created equal: life cycle greenhouse gas emissions from 1990 to 2005. Environmental science & technology 43(5), 1571-1577.

McMillan, C.A., Skerlos, S.J., Keoleian, G.A., 2012. Evaluation of the metals industry's position on recycling and its implications for environmental emissions. Journal of Industrial Ecology 16(3), 324-333.

MEEC, 2006. Discarded household appliances and electronic products pollution control technology policy. Ministry of Ecology and Environment of the People's Republic of China

MEEC, 2018. Work Plan for the Pilot Program of 'Zero-Waste City' Construction. Ministry of Ecology and Environment of the People's Republic of China

Melo, M.T., 1999. Statistical analysis of metal scrap generation: the case of aluminium in Germany. Resources, Conservation and Recycling 26(2), 91-113.

Memary, R., Giurco, D., Mudd, G., Mason, L., 2012. Life cycle assessment: a time-series analysis of copper. Journal of Cleaner Production 33, 97-108.

Mendoza, J.M.F., Sharmina, M., Gallego-Schmid, A., Heyes, G., Azapagic, A., 2017. Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. Journal of Industrial Ecology 21(3), 526-544.

Meng, L., Zhong, Y., Guo, L., Wang, Z., Chen, K., Guo, Z., 2018. High-temperature centrifugal separation of Cu from waste printed circuit boards. Journal of Cleaner Production 199, 831-839.

Mercante, I.T., Bovea, M.D., Ibáñez-Forés, V., Arena, A.P., 2011. Life cycle assessment of construction and demolition waste management systems: a Spanish case study. The International Journal of Life Cycle Assessment 17(2), 232-241.

MIIT, 2020. Requirements of the Industry Standards for the Comprehensive Utilization of Waste Power Storage Batteries of New Energy Vehicles. Ministry of Industry and Information Technology

MNR, 2016. the National Mineral Resource Planning (2016-2020). Ministry of Natural Resources.

MNR, 2018. China mineral resources, Geological Publishing House. Ministry of Natural Resources.

www.mnr.gov.cn/sj/sjfw/kc_19263/zgkczybg/201811/t20181116_2366032.html.

MNR, 2020. China mineral resources, Geological Publishing House. Ministry of Natural Resources. http://www.mnr.gov.cn/dt/ywbb/202010/t20201023_2573150.html.

Mohr, S., 2010. Projection of world fossil fuel production with supply and demand interactions. University of Newcastle.

MOHURD, 2005. Regulations on Urban Construction Waste Management. Ministry of Housing and Urban-Rural Development of the People's Republic of China

MOHURD, 2019. Technical Standards for Construction Waste Disposal. Ministry of Housing and Urban-Rural Development of the People's Republic of China

Molteni, D., 2017. Plant and process for the recovery of wires from car fluff. Google Patents.

Moreno Ruiz, E., Valsasina, L., Fitzgerald, D., Brunner, F., Vadenbo, C., Bauer, C., Bourgault, G., Symeonidis, A., Wernet, G., 2017. Documentation of changes implemented in the ecoinvent database v3. 4. ecoinvent. Zür Switz.

Muchová, L., Rem, P., 2006. Metal content and recovery of MSWI bottom ash in Amsterdam. WIT Transactions on Ecology and the Environment 92.

Mudd, G.M., Weng, Z., Jowitt, S.M., 2013. A detailed assessment of global Cu resource trends and endowments. Economic Geology 108(5), 1163-1183.

Müller, D.B., 2006. Stock dynamics for forecasting material flows—Case study for housing in The Netherlands. Ecological Economics 59(1), 142-156.

Müller, E., Hilty, L.M., Widmer, R., Schluep, M., Faulstich, M., 2014. Modeling metal stocks and flows: A review of dynamic material flow analysis methods. Environmental science & technology 48(4), 2102-2113.

Nakem, S., Pipatanatornkul, J., Papong, S., Rodcharoen, T., Nithitanakul, M., Malakul, P., 2016. Material Flow Analysis (MFA) and Life Cycle Assessment (LCA) Study for Sustainable Management of PVC Wastes in Thailand, in: Kravanja, Z., Bogataj, M. (Eds.), Computer Aided Chemical Engineering. Elsevier, pp. 1689-1694.

NDRC, 2008. Administrative Measures for Pilot Remanufacturing of Automobile Parts & Accessories. National Development and Reform Commission

NDRC, 2017. Initiative to Guide the Shift Toward Circular Development. National Development and Reform Commission

Norgate, T., 2001. A comparative Life Cycle Assessment of copper production processes. Clayton South: CSIRO Minerals.

Norgate, T., 2004. Metal recycling: an assessment using life cycle energy consumption as a sustainability indicator. CRISO Minerals Report DMR-2616.

Norgate, T., Jahanshahi, S., 2010. Low grade ores–smelt, leach or concentrate? Minerals Engineering 23(2), 65-73.

Norgate, T., Jahanshahi, S., 2011. Reducing the greenhouse gas footprint of primary metal production: Where should the focus be? Minerals Engineering 24(14), 1563-1570.

Norgate, T., Jahanshahi, S., Rankin, W., 2007. Assessing the environmental impact of metal production processes. Journal of Cleaner Production 15(8-9), 838-848.

Northey, S., Haque, N., Mudd, G., 2013. Using sustainability reporting to assess the environmental footprint of copper mining. Journal of Cleaner Production 40, 118-128.

Northey, S., Mohr, S., Mudd, G.M., Weng, Z., Giurco, D., 2014. Modelling future copper ore grade decline based on a detailed assessment of copper resources and mining. Resources Conservation and Recycling 83, 190-201.

Nunez, P., Jones, S., 2016. Cradle to gate: life cycle impact of primary aluminium production. The International Journal of Life Cycle Assessment 21(11), 1594-1604.

Nuss, P., Eckelman, M.J., 2014. Life cycle assessment of metals: a scientific synthesis. PLoS One 9(7).

Nzila, C., Dewulf, J., Spanjers, H., Tuigong, D., Kiriamiti, H., Van Langenhove, H., 2012. Multi criteria sustainability assessment of biogas production in Kenya. Applied Energy 93, 496-506.

OECD, 2018. GDP long-term forecast (indicator).

OECD, 2019. Global Material Resources Outlook to 2060.

Onat, N.C., Kucukvar, M., Tatari, O., Egilmez, G., 2016. Integration of system dynamics approach toward deepening and broadening the life cycle sustainability assessment framework: a case for electric vehicles. The International Journal of Life Cycle Assessment 21(7), 1009-1034.

Padeyanda, Y., Jang, Y.-C., Ko, Y., Yi, S., 2016. Evaluation of environmental impacts of food waste management by material flow analysis (MFA) and life cycle assessment (LCA). Journal of Material Cycles and Waste Management 18(3), 493-508.

Park, J., Sarkis, J., Wu, Z., 2010. Creating integrated business and environmental value within the context of China's circular economy and ecological modernization. Journal of Cleaner Production 18(15), 1494-1501.

Parker, D.J., McNaughton, C.S., Sparks, G.A., 2016. Life cycle greenhouse gas emissions from uranium mining and milling in Canada. Environmental science & technology 50(17), 9746-9753.

Pauliuk, S., 2014. Python Dynamic Stock Model; Python Software: Trondheim, Norway.

Pauliuk, S., Wang, T., Müller, D.B., 2012. Moving Toward the Circular Economy: The Role of Stocks in the Chinese Steel Cycle. Environmental Science & Technology 46(1), 148-154.

Perez, J.P.H., Folens, K., Leus, K., Vanhaecke, F., Van Der Voort, P., Du Laing, G., 2019. Progress in hydrometallurgical technologies to recover critical raw materials and precious metals from low-concentrated streams. Resources, Conservation and Recycling 142, 177-188.

Pfaff, M., Gloser-Chahoud, S., Chrubasik, L., Walz, R., 2018. Resource efficiency in the German copper cycle: Analysis of stock and flow dynamics resulting from different efficiency measures. Resources Conservation and Recycling 139, 205-218.

Piatkowski, M.M., Coste, A., Shi, L., Du, Y., Cai, Z., 2019. Enhancing China's Regulatory Framework for Eco-Industrial Parks: Comparative Analysis of Chinese and International Green Standards. The World Bank.

Pita, F., Castilho, A., 2018. Separation of copper from electric cable waste based on mineral processing methods: A case study. Minerals 8(11), 517.

Qiang, Y., WANG, H.-m., LU, Z.-w., 2012. Quantitative estimation of social stock for metals Al and Cu in China. Transactions of Nonferrous Metals Society of China 22(7), 1744-1752.

Radetzki, M., 2009. Seven thousand years in the service of humanity—the history of copper, the red metal. Resources Policy 34(4), 176-184.

Rechberger, H., Graedel, T.E., 2002. The contemporary European copper cycle: statistical entropy analysis. Ecological Economics 42(1), 59-72.

Reijnders, L., 2003. Recovery of dissipated copper and the future of copper supply. Resources Conservation and Recycling 38(1), 59-66.

Rincón, L., Castell, A., Pérez, G., Solé, C., Boer, D., Cabeza, L.F., 2013. Evaluation of the environmental impact of experimental buildings with different constructive systems using Material Flow Analysis and Life Cycle Assessment. Applied Energy 109, 544-552.

Rochat, D., Binder, C.R., Diaz, J., Jolliet, O., 2013. Combining Material Flow Analysis, Life Cycle Assessment, and Multiattribute Utility Theory. Journal of Industrial Ecology 17(5), 642-655.

Rötzer, N., Schmidt, M., 2020. Historical, Current, and Future Energy Demand from Global Copper Production and Its Impact on Climate Change. Resources 9(4), 44.

Ruan, R., Zhong, S., Wang, D., 2010. Life cycle assessment of two copper metallurgical processes: Bio-heap leaching and Flotation-flash smelting. Multipurpose Utilization of Mineral Resources.

Rubin, R.S., de Castro, M.A.S., Brandão, D., Schalch, V., Ometto, A.R., 2014. Utilization of Life Cycle Assessment methodology to compare two strategies for recovery of copper from printed circuit board scrap. Journal of Cleaner Production 64, 297-305.

Ruhrberg, M., 2006. Assessing the recycling efficiency of copper from end-of-life products in Western Europe. Resources, Conservation and Recycling 48(2), 141-165.

Salhofer, S., Steuer, B., Ramusch, R., Beigl, P., 2016. WEEE management in Europe and China – A comparison. Waste Management 57, 27-35.

Santini, A., Morselli, L., Passarini, F., Vassura, I., Di Carlo, S., Bonino, F., 2011. End-of-Life Vehicles management: Italian material and energy recovery efficiency. Waste Management 31(3), 489-494.

Sato, F.E.K., Furubayashi, T., Nakata, T., 2019. Application of energy and CO2 reduction assessments for end-of-life vehicles recycling in Japan. Applied Energy 237, 779-794.

Schäfer, P., Schmidt, M., 2020. Discrete-Point Analysis of the Energy Demand of Primary versus Secondary Metal Production. Environmental Science & Technology 54(1), 507-516.

Schandl, H., Fischer-Kowalski, M., West, J., Giljum, S., Dittrich, M., Eisenmenger, N., Geschke, A., Lieber, M., Wieland, H., Schaffartzik, A., Krausmann, F., Gierlinger, S., Hosking, K., Lenzen, M., Tanikawa, H., Miatto,

A., Fishman, T., 2018. Global Material Flows and Resource Productivity: Forty Years of Evidence. Journal of Industrial Ecology 22(4), 827-838.

Schandl, H., Hatfield-Dodds, S., Wiedmann, T., Geschke, A., Cai, Y., West, J., Newth, D., Baynes, T., Lenzen, M., Owen, A., 2016. Decoupling global environmental pressure and economic growth: scenarios for energy use, materials use and carbon emissions. Journal of Cleaner Production 132, 45-56.

Scheel, C., Aguiñaga, E., Bello, B., 2020. Decoupling Economic Development from the Consumption of Finite Resources Using Circular Economy. A Model for Developing Countries. Sustainability 12(4), 1291.

Schiller, G., Müller, F., Ortlepp, R., 2017. Mapping the anthropogenic stock in Germany: Metabolic evidence for a circular economy. Resources, Conservation and Recycling 123, 93-107.

Schipper, B.W., Lin, H.-C., Meloni, M.A., Wansleeben, K., Heijungs, R., van der Voet, E., 2018. Estimating global copper demand until 2100 with regression and stock dynamics. Resources, Conservation and Recycling 132, 28-36.

Schlesinger, M.E., King, M.J., Sole, K.C., Davenport, W.G., 2011. Extractive metallurgy of copper. Elsevier.

Schneider, L., Berger, M., Schüler-Hainsch, E., Knöfel, S., Ruhland, K., Mosig, J., Bach, V., Finkbeiner, M., 2014. The economic resource scarcity potential (ESP) for evaluating resource use based on life cycle assessment. The International Journal of Life Cycle Assessment 19(3), 601-610.

Seliger, G., Kernbaum, S., Zettl, M., 2006. Remanufacturing approaches contributing to sustainable engineering. Gestão & Produção 13, 367-384.

Seniunaite, J., Vasarevicius, S., 2017. Leaching of Copper, Lead and Zinc from Municipal Solid Waste Incineration Bottom Ash. Energy Procedia 113, 442-449.

Sevigné-Itoiz, E., Gasol, C.M., Rieradevall, J., Gabarrell, X., 2014. Environmental consequences of recycling aluminum old scrap in a global market. Resources, Conservation and Recycling 89, 94-103.

Singer, D.A., 2017. Future copper resources. Ore Geology Reviews 86, 271-279.

Song, C.H., 2005. Whole life and highgrade quality-stick to the implement housing performance certification. Housing Science 290(8), 287-302.

Song, Q., Li, J., Zeng, X., 2015. Minimizing the increasing solid waste through zero waste strategy. Journal of Cleaner Production 104, 199-210.

Song, Q., Wang, Z., Li, J., Zeng, X., 2013. The life cycle assessment of an e-waste treatment enterprise in China. Journal of Material Cycles and Waste Management 15(4), 469-475.

Song, X., Yang, J., Lu, B., Li, B., Zeng, G., 2014. Identification and assessment of environmental burdens of Chinese copper production from a life cycle perspective. Frontiers of Environmental Science & Engineering 8(4), 580-588.

Soulier, M., Gloser-Chahoud, S., Goldmann, D., Tercero Espinoza, L.A., 2018a. Dynamic analysis of European copper flows. Resources Conservation and Recycling 129, 143-152.

Soulier, M., Pfaff, M., Goldmann, D., Walz, R., Geng, Y., Zhang, L., Tercero Espinoza, L.A., 2018b. The Chinese copper cycle: Tracing copper through the economy with dynamic substance flow and input-output analysis. Journal of Cleaner Production 195, 435-447.

Spatari, S., Bertram, M., Fuse, K., Graedel, T.E., Rechberger, H., 2002. The contemporary European copper cycle: 1 year stocks and flows. Ecological Economics 42(1-2), 27-42.

Spatari, S., Bertram, M., Gordon, R.B., Henderson, K., Graedel, T.E., 2005. Twentieth century copper stocks and flows in North America: A dynamic analysis. Ecological Economics 54(1), 37-51.

State Council, 2001. Administrative Measures for the Recycling of Scrapping Automobiles. State Council of the People's Republic of China

State Council, 2013. General Office of the State Council of the People's Republic of China, ban trash imports and reform the solid waste import management system. State Council of the People's Republic of China

State Council, 2018. Work Plan for the Pilot Program of "Zero-Waste City" Building. State Council of the People's Republic of China

State Council, 2019. Measures for the Management of End-of-Life Vehicle Recycling. State Council of the People's Republic of China.

Steuer, B., Ramusch, R., Salhofer, S., 2018. Is There a Future for the Informal Recycling Sector in Urban China? Detritus(4), 189.

Sun, X., Hao, H., Zhao, F., Liu, Z., 2017. Tracing global lithium flow: A trade-linked material flow analysis. Resources, Conservation and Recycling 124,

50-61.

Šyc, M., Simon, F.G., Hykš, J., Braga, R., Biganzoli, L., Costa, G., Funari, V., Grosso, M., 2020. Metal recovery from incineration bottom ash: State-of-the-art and recent developments. Journal of Hazardous Materials 393, 122433.

Tan, R.B., Khoo, H.H., 2005. An LCA study of a primary aluminum supply chain. Journal of Cleaner Production 13(6), 607-618.

Tanimoto, A.H., Durany, X.G., Villalba, G., Pires, A.C., 2010. Material flow accounting of the copper cycle in Brazil. Resources Conservation and Recycling 55(1), 20-28.

Tatsumi, K., Daigo, I., Matsuno, Y., Adachi, Y., 2008. Analysis on Recycling Potential of Copper in Japan. Journal of the Japan Institute of Metals 72(8), 617-624.

Terakado, R., Ichino, T.K., Daigo, I., Matsuno, Y., Adachi, Y., 2009a. Estimation of In-Use Stock of Copper in China, Korea and Taiwan. Journal of the Japan Institute of Metals 73(11), 833-838.

Terakado, R., Takahashi, K.I., Daigo, I., Matsuno, Y., Adachi, Y., 2009b. In-use stock of copper in Japan estimated by bottom-up approach. Journal of the Japan Institute of Metals 73(9), 713-719.

Tercero Espinoza, L.A., Soulier, M., 2016. An examination of copper contained in international trade flows. Mineral Economics 29(2), 47-56.

Troschinetz, A.M., Mihelcic, J.R., 2009. Sustainable recycling of municipal solid waste in developing countries. Waste Management 29(2), 915-923.

Tukker, A., 2000. Life cycle assessment as a tool in environmental impact assessment. Environmental Impact Assessment Review 20(4), 435-456.

United Nations, D.o.E.a.S.A., Population Division, 2017. World Population Prospects: The 2017 Revision. DVD Edition.

United Nations, D.o.E.a.S.A., Population Division, 2018. World Urbanization Prospects: The 2018 Revision. Online Edition.

USGS, 2021. Copper Statistics and Information. https://www.usgs.gov/centers/nmic/copper-statistics-and-information. (Accessed 23 March 2021).

Van der Voet, E., Van Oers, L., Moll, S., Schütz, H., Bringezu, S., De Bruyn, S., Sevenster, M., Warringa, G., 2005. Policy Review on Decoupling: Development of indicators to assess decoupling of economic development and environmental pressure in the EU-25 and AC-3 countries. EU

Commission, DG Environment, Brussels.

Van der Voet, E., Van Oers, L., Verboon, M., Kuipers, K., 2018. Environmental implications of future demand scenarios for metals: methodology and application to the case of seven major metals. Journal of Industrial Ecology.

Van Genderen, E., Wildnauer, M., Santero, N., Sidi, N., 2016. A global life cycle assessment for primary zinc production. The International Journal of Life Cycle Assessment 21(11), 1580-1593.

Vanegas, P., Peeters, J.R., Cattrysse, D., Tecchio, P., Ardente, F., Mathieux, F., Dewulf, W., Duflou, J.R., 2018. Ease of disassembly of products to support circular economy strategies. Resources, Conservation and Recycling 135, 323-334.

Venkatesh, G., Hammervold, J., Brattebø, H., 2009. Combined MFA-LCA for Analysis of Wastewater Pipeline Networks. Journal of Industrial Ecology 13(4), 532-550.

Vergara, S.E., Damgaard, A., Gomez, D., 2016. The Efficiency of Informality: Quantifying Greenhouse Gas Reductions from Informal Recycling in Bogotá, Colombia. Journal of Industrial Ecology 20(1), 107-119.

Verhagen, T.J., van der Voet, E., Sprecher, B., 2021. Alternatives for natural-gas-based heating systems: A quantitative GIS-based analysis of climate impacts and financial feasibility. Journal of Industrial Ecology 25(1), 219-232.

Vieira, M.D., Goedkoop, M.J., Storm, P., Huijbregts, M.A., 2012. Ore grade decrease as life cycle impact indicator for metal scarcity: the case of copper. Environmental science & technology 46(23), 12772-12778.

Villares, M., Işıldar, A., van der Giesen, C., Guinée, J., 2017. Does ex ante application enhance the usefulness of LCA? A case study on an emerging technology for metal recovery from e-waste. The International Journal of Life Cycle Assessment 22(10), 1618-1633.

Virtanen, M., Manskinen, K., Uusitalo, V., Syvänne, J., Cura, K., 2019. Regional material flow tools to promote circular economy. Journal of Cleaner Production 235, 1020-1025.

Wäger, P.A., Hischier, R., Eugster, M., 2011. Environmental impacts of the Swiss collection and recovery systems for Waste Electrical and Electronic Equipment (WEEE): A follow-up. Science of The Total Environment 409(10), 1746-1756.

Wang, b., 2012. Research on Shenzhen Construction Waste Treatment Mode

Based on Life Cycle Assessment, Huazhong University of Science and Technology.

Wang, H., Schandl, H., Wang, G., Ma, L., Wang, Y., 2019. Regional material flow accounts for China: Examining China's natural resource use at the provincial and national level. Journal of Industrial Ecology 23(6), 1425-1438.

Wang, H.T., Liu, Y., Gong, X.Z., Wang, Z.H., Gao, F., Nie, Z.R., 2015. Life cycle assessment of metallic copper produced by the pyrometallurgical technology of China, Materials Science Forum. Trans Tech Publ, pp. 559-563.

Wang, J., Ju, Y., Wang, M., Li, X., 2019. Scenario analysis of the recycled copper supply in China considering the recycling efficiency rate and waste import regulations. Resources, Conservation and Recycling 146, 580-589.

Wang, M., Chen, W., Zhou, Y., Li, X., 2017. Assessment of potential copper scrap in China and policy recommendation. Resources Policy 52, 235-244.

Wang, T., Zhang, Y., Yu, H., Wang, F., 2012. Advanced manufacturing technology in China: a roadmap to 2050. Springer.

Watari, T., Nansai, K., Giurco, D., Nakajima, K., McLellan, B., Helbig, C., 2020. Global Metal Use Targets in Line with Climate Goals. Environmental Science & Technology 54(19), 12476-12483.

Weber, R., Kaplan, S., Sokol, H., 2009. Market Analysis of Construction and Demolition Material Reuse in the Chicago Region. Chicago: University of Illinois (commissioned by the Delta Institute). Market Analysis of Used Building Materials in Metropolitan Vancouver 67.

Wei, W., Chen, D., Hu, D., 2016. Study on the evolvement of technology development and energy efficiency—A case study of the past 30 years of development in Shanghai. Sustainability 8(5), 457.

Weng, Z., Haque, N., Mudd, G.M., Jowitt, S.M., 2016. Assessing the energy requirements and global warming potential of the production of rare earth elements. Journal of cleaner production 139, 1282-1297.

Wiechmann, E.P., Morales, A.S., Aqueveque, P., 2010. Improving productivity and energy efficiency in copper electrowinning plants. IEEE Transactions on Industry Applications 46(4), 1264-1270.

Wiedenhofer, D., Steinberger, J.K., Eisenmenger, N., Haas, W., 2015. Maintenance and expansion: modeling material stocks and flows for residential buildings and transportation networks in the EU25. Journal of industrial ecology 19(4), 538-551.

World Bank, 2019. Global GDP, in: World Bank national accounts data, a.O.N.A.d.f. (Ed.). https://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

Worldometer, 2020. World Population

Wormser, F.E., 1921. The Importance of Foreign Trade in Copper and Other Metals. The ANNALS of the American Academy of Political and Social Science 94(1), 65-76.

Wu, Z., Yuan, W., Li, J., Wang, X., Liu, L., Wang, J., 2017. A critical review on the recycling of copper and precious metals from waste printed circuit boards using hydrometallurgy. Frontiers of Environmental Science & Engineering 11(5), 8.

Xiong, J., Zhu, J., He, Y., Ren, S., Huang, W., Lu, F., 2020. The application of life cycle assessment for the optimization of pipe materials of building water supply and drainage system. Sustainable Cities and Society 60, 102267.

Xu, B.-S., 2013. Progress of remanufacturing engineering and future technology expectation. Advances in Manufacturing 1(1), 8-12.

Yan, L., Wang, A., Chen, Q., Li, J., 2013. Dynamic material flow analysis of zinc resources in China. Resources Conservation & Recycling 75(2), 23-31.

Yang, J., Li, X., Liu, Q., 2017. China's Copper Demand Forecasting Based on System Dynamics Model: 2016-2030.

Yang, X., Hu, M., Heeren, N., Zhang, C., Verhagen, T., Tukker, A., Steubing, B., 2020. A combined GIS-archetype approach to model residential space heating energy: A case study for the Netherlands including validation. Applied Energy 280, 115953.

Yoshimura, A., Matsuno, Y., 2018. Dynamic Material Flow Analysis and Forecast of Copper in Global-Scale: Considering the Difference of Recovery Potential between Copper and Copper Alloy. Materials Transactions 59(6), 989-998.

Yu, X., Lu, B., Wang, R., 2018. Analysis of low carbon pilot industrial parks in China: Classification and case study. Journal of Cleaner Production 187, 763-769.

Yue, Q., Lu, Z.W., Zhi, S.K., 2009. Copper cycle in China and its entropy analysis. Resources, Conservation and Recycling 53(12), 680-687.

Zalmon, I., Carvalho, G., Ferreira, C.A., 1998. Regional population projections for China, Higher Education in Europe. pp. 351-356.

Zamagni, A., Pesonen, H.-L., Swarr, T., 2013. From LCA to Life Cycle

Sustainability Assessment: concept, practice and future directions. The international journal of life cycle assessment 18(9), 1637-1641.

Zeltner, C., Bader, H.P., Scheidegger, R., Baccini, P., 1999. Sustainable metal management exemplified by copper in the USA. Regional Environmental Change 1(1), 31-46.

Zhang, L., Cai, Z., Yang, J., Yuan, Z., Chen, Y., 2015a. The future of copper in China—A perspective based on analysis of copper flows and stocks. Science of the Total Environment 536, 142-149.

Zhang, L., Chen, T.M., Yang, J.M., Cai, Z.J., Sheng, H., Yuan, Z.W., Wu, H.J., 2017. Characterizing copper flows in international trade of China, 1975-2015. Science of the Total Environment 601, 1238-1246.

Zhang, L., Yang, J., Cai, Z., Yuan, Z., 2014. Analysis of copper flows in China from 1975 to 2010. Science of The Total Environment 478, 80-89.

Zhang, L., Yang, J., Cai, Z., Yuan, Z., 2015b. Understanding the spatial and temporal patterns of copper in-use stocks in China. Environmental science & technology 49(11), 6430-6437.

Zhang, Q., Wu, Y., Wang, W., Zhang, Y., Cheng, H., Zuo, T., 2011. Method for preparing high-purity copper oxide superfine powder from waste printed circuit boards, in: Technology, B.U.o. (Ed.). China.

Zhang, S., Ding, Y., Liu, B., Pan, D.a., Chang, C.c., Volinsky, A.A., 2015. Challenges in legislation, recycling system and technical system of waste electrical and electronic equipment in China. Waste Management 45, 361-373.

Zhang, T., He, Y., Wang, F., Ge, L., Zhu, X., Li, H., 2014. Chemical and process mineralogical characterizations of spent lithium-ion batteries: an approach by multi-analytical techniques. Waste management 34(6), 1051-1058.

Zhang, X., Zhang, M., Zhang, H., Jiang, Z., Liu, C., Cai, W., 2020. A review on energy, environment and economic assessment in remanufacturing based on life cycle assessment method. Journal of Cleaner Production 255, 120160.

Zhang, Y., Sun, M., Hong, J., Han, X., He, J., Shi, W., Li, X., 2016. Environmental footprint of aluminum production in China. Journal of Cleaner Production 133, 1242-1251.

Zhao, W., Rotter, S., 2008. The current situation of construction & demolition waste management in China, 2008 2nd International Conference on Bioinformatics and Biomedical Engineering. IEEE, pp. 4747-4750.

References

Zhu, J., Fan, C., Shi, H., Shi, L., 2019. Efforts for a Circular Economy in China: A Comprehensive Review of Policies. Journal of Industrial Ecology 23(1), 110-118.

Zink, T., Geyer, R., 2017. Circular Economy Rebound. Journal of Industrial Ecology 21(3), 593-602.

Zongguo, W., Xiaoli, J., 2013. Copper resource trends and use reduction measures in China. Journal of Tsinghua University, 09.