Metals for a Green and Digital Europe

An Agenda for Action

GEF GREEN EUROPEAN FOUNDATION

WETENSCHAPPELIJK BUREAU GROENLINKS
THINK TANK OF THE DUTCH GREEN PARTY

Cover photo: Mining of lithium and other minerals in the Atacama desert, Chile. Photo by European Space Agency. CC BY-SA 2.0

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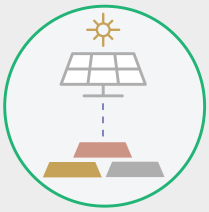
Introduction

While energy from renewable sources such as solar and wind is nearly infinite, the resources we need to capture it are not. Solar panels, wind turbines, batteries, and power cables all contain metals. Their various properties, including toughness and conductivity, make metals uniquely suitable for renewable energy technologies. But first they must be extracted from ores that are dug up from the ground. Most mining is a dirty business. Moreover, some metals are rare or becoming depleted.

The more energy we harvest from the skies above our heads, the deeper we will have to dig for the metals beneath our feet. Because of its decentralised nature, a renewable energy system requires far larger quantities of metals than a fossil energy system. It takes a whole farm of wind turbines to replace one coal-fired power station. And since the sun and wind are intermittent energy sources, part of the energy produced needs to be stored for later use. This storage also requires metals, both for batteries and for electrolysers which convert electricity into hydrogen. The strengthening of power grids and the shift to electric mobility are further pushing up the demand for metals.



350,000 Eiffel Towers
According to the World Bank, keeping global warming well below 2 degrees Celsius will require 3.5 billion tonnes of metals and other minerals for the worldwide deployment of wind, solar, and geothermal power, as well as for energy storage.[1] This is 350,000 times the weight of the Eiffel Tower.

The climate crisis leaves us no choice but to make a swift transition from fossil fuels to renewable energies, while saving as much energy as we can. Solar and wind power have already entered the phase of exponential growth, as have electric vehicles and the batteries that power them. This translates into a rapidly growing demand for so-called 'energy metals'. According to the European Commission, by 2030, the European Union (EU) will need up to 18 times more lithium and 5 times more cobalt than its total current consumption, to cover electric car batteries and energy storage alone. By 2050, this is forecast to increase to almost 60 times more lithium and 15 times more cobalt.[2]

Alongside the energy transition, the digital transition is a priority for the EU. It also relies on metals. Many digital innovations enhance our quality of life. Teleworking and videoconferencing have proven particularly useful during the coronavirus pandemic. Sensors, data, and algorithms allow a more sustainable use of resources, including energy and materials. But, in turn, all digital technologies require energy and materials. Despite the ethereal metaphor of 'the cloud', the data economy has a heavy material footprint, which includes a wide array of metals. Gains in the energy and material efficiency of devices and networks are outpaced by the exponential growth of data, which doubles every two to three years.[3]

The cleantech and digital sectors are competing for the same metals. European demand for rare earths, which are used in electric cars and wind turbines but also in digital devices[4], could rise tenfold by 2050.[5]

Since the development of technologies and markets is hard to predict, long-term demand forecasts for specific metals are uncertain. It is clear, however, that a significant portion of the metals supply will come from outside Europe. For most metals, the EU is between 75% and 100% dependent on imports. This creates risks for Europe's security of supply and for its strategic autonomy. It also raises the issue of climate justice, given that the greatest burdens of metal mining fall on the Global South. Metals can therefore be seen as the Achilles heel of the energy and digital transitions.

Should we rethink our use of joules and bytes to save metals? How do we stop valuable metals ending up as waste? Can we procure the metals we really need in a way that is equitable for both developing countries and future generations? This publication looks at the metals quandary from various angles, from sustainable development to geopolitics. It concludes with an Agenda for Action that charts a course towards a responsible sourcing of metals for a green and digital Europe.

1 World Bank, *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition*, 2020, p.11. www.worldbank.org/en/topic/extractiveindustries/brief/climate-smart-mining-minerals-for-climate-action

2 European Commission, *Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability*, 2020, p. 5. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1542 Underlying assumptions are an average GDP growth of 1.5% per year and climate neutrality in 2050.

3 ING Economics Department, *Further efficiency gains vital to limit electricity use of data*, 2019, p. 8. https://new.ingwb.com/en/insights/research-reports/data-growth-to-double-power-demand-of-data-driven-technology-by-2030

4 Currently, smartphones, laptops, and desktop PCs alone account for some 10% of the use of neodymium, one of the most important rare earths. European Commission Joint Research Centre, *Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study*, 2020, p. 57. https://ec.europa.eu/docsroom/documents/42881

5 See note 2.

Scarce metals for the energy and digital transitions

The technologies required for a green and digital Europe use the majority of the elements in the periodic table. Some of these elements – mainly metals – are scarce or may become so due to rising demand, depletion, or conflicts.[6] The list below is not exhaustive.

Cobalt

Cobalt is a metal with high energy density and high resistance to heat and wear. It has many applications, from high-performance alloys to catalysts and magnets. Its main use is in rechargeable batteries for electric vehicles, as well as smartphones and other electronic devices. Most cobalt is extracted as a by-product of copper and nickel production. About 60% of global supply comes from the Democratic Republic of the Congo, where mining is fraught with abuses. Over 60% of refining takes place in China. Within the EU, cobalt is mined in Finland, which accounts for 1% of global production.

Copper

Copper conducts electricity and heat extremely well. This makes it an essential ingredient of renewable energy production and digitalisation. However, copper is the scarcest of the base metals. Whereas in the late 19th century, the average ore grade of mined copper was between 10% and 20%, it has since dropped to 0.5%.[7] Nowadays, to obtain one tonne of copper, 200 tonnes of rock must be mined. Almost half of the mining waste ever produced comes from copper extraction.[8] The main copper-mining countries are Chile, Peru, and China. The EU's share in the global production of virgin copper is 4%, with Poland as its biggest producer.

Indium

Indium is a key ingredient in the manufacturing of thin films that combine electrical conductivity with optical transparency. These films are used in flat-panel displays and touchscreens, as well as in flexible, lightweight solar cells. Indium is produced mainly as a by-product of zinc refinement. China accounts for half of global production.

Lithium

Since lithium is the lightest-weight metal, batteries that transfer lithium ions between the electrodes have high energy density. Moreover, they are rechargeable. These properties make lithium-ion batteries ideally suited for use in portable devices and electric vehicles. The main lithium-mining countries are Australia, Chile, and China. In Chile, lithium extraction is meeting growing resistance due to the role it plays in accelerating desertification. Lithium mining projects are currently being planned at sites across the EU, from Finland to Portugal. Most lithium refining takes place in China.

Nickel

The main use of nickel is in stainless steel, to which it adds strength and corrosion resistance. Because of its high energy density, nickel is of growing importance for batteries. Some electrolysers also require nickel. Indonesia, the Philippines, and Russia are the main nickel-mining countries. The EU's share in the global production of nickel ores is 2%; Greece and Finland are the EU's biggest producers. Nickel ore grades have dropped to below 2%. As a result, waste from nickel mining and smelting poses a significant problem, often causing serious water and air pollution.

Platinum-group metals

In mineral deposits, platinum often occurs together with five other metals with similar properties, including palladium and iridium. They are powerful catalysts, meaning that they can accelerate chemical reactions without themselves being consumed. One such reaction is the splitting of water into hydrogen and oxygen via an electric current in electrolysers. The reverse reaction, whereby hydrogen reacts with oxygen to produce electricity in a fuel cell, also requires platinum-group metals. Both electrolysers and fuel cells are vital if we wish to tap the potential of green hydrogen as an energy carrier, a storage medium, a fuel, and a feedstock in a defossilised economy. One particularly efficient type of electrolyser requires both iridium and platinum. Because of its electrical conductivity and resistance to heat and corrosion, platinum is also of growing relevance for digital applications, including fast and low-power computer memories. About 60% of platinum-group metals come from mines in South Africa, where discontent among miners as a result of poor wages and working conditions often leads to strikes.

6 See section I.

7 Theo Henckens & Ernst Worrell, 'Reviewing the availability of copper and nickel for future generations. The balance between production growth, sustainability and recycling rates', *Journal of Cleaner Production* 264, 2020. https://doi.org/10.1016/j.jclepro.2020.121460

8 Nicholas LePan, 'Visualizing the size of mine tailings', *mining.com*, 17 May 2021. www.mining.com/web/visualizing-the-size-of-mine-tailings

Polysilicon metal

Silicon is a semiconductor – both a conductor and an insulator of electricity – and the base material for solar cells and computer chips. Silicon may well replace graphite in batteries in the near future as it has a far higher energy density. Polysilicon metal is produced from quartz sand, which goes through several refining stages in order to reach the purity required for photovoltaics and micro-electronics. Even though silicon is the second most abundant element in Earth's crust, it remains subject to supply risks. Two thirds of polysilicon metal is produced in China, where the dark shadow of forced labour hangs over the silicon refineries.[9]

Rare earths

Rare earths are a group of 17 metals that are not so much rare as difficult to extract. Four of them – neodymium, dysprosium, praseodymium, and terbium – are in high demand for the manufacture of super-strong permanent magnets. These reduce the weight and size of electric vehicle motors, wind turbines, and digital appliances such as hard disk drives. China accounts for 60% of the global extraction and 90% of the refinement of rare earths. The processing of rare earths often generates toxic and radioactive waste. Leakage into waterways and groundwater has prompted Beijing to tighten environmental oversight of the sector.

9 See section V.

Photo by Richard Wouters, CC0

I Three types of scarcity

Our planet is finite and so are the mineral resources we can extract from it. Also, minerals are unevenly distributed over Earth's crust. Europe's hunger for metals may therefore cause it to be confronted with three types of scarcity.

The first type is economic. It takes between 5 and 20 years to build a new mine. Some metals, such as cobalt and indium, are mined primarily as a by-product of other metals, which complicates the business case for scaling up extraction. When supply does not keep up with demand, price hikes and shortages will occur. In view of the exponential growth of renewables and data, there is a genuine risk that the energy and digital transitions will be hampered by economic scarcity of metals – not only of well-known energy metals such as lithium, cobalt, and rare earths, but also of lesser-known metals such as iridium.[10] This platinum-like element is vital for the production of hydrogen from renewable electricity.

The second type of scarcity is physical. Some metals are being extracted at such a rate that the end of mining may well be on the horizon for them. Take copper, which is vital for many energy and digital applications. If copper mining continues to increase at the current rate of 3% per year, extractable ores could well be depleted within a century.[11] Once depletion is reached, there will still be copper in the ground, but in very low concentrations, at great depth, or in vulnerable locations. Extracting the remaining ores would require too much energy, water, materials, or land, or it would cause unacceptable damage to nature and the environment, both at a local and a planetary scale. Since both geology and ecology determine the boundaries of mining, we can speak of geo-ecological scarcity.

Mining ban

In Latin America, the country of El Salvador has already hit the boundaries of mining. In 2017, as a result of the threat posed by mining-related pollution to vital freshwater resources, the Salvadoran parliament imposed a ban on the extraction of metal ores.[12]

The depletion of metal ores brings both intra- and intergenerational justice into the spotlight. It will become even more difficult for people in the poorest countries to catch up with their contemporaries in the developed world if some of the metals they need for infrastructure, energy, and digitalisation are no longer available. For future generations, a lack of metals means that certain options for survival and well-being – some of them as yet unknown – will be denied to them.

At the very least, justice within and between generations requires that we make frugal use of metals and that we do our utmost to keep them in a closed loop, instead of sending them to landfill. It also matters what we use metals for. If future generations could ask us what we plan to bequeath to them, 'a clean energy supply and a liveable climate' would surely be a more satisfying answer than 'lifelike online video games and personalised advertisements'.[13]

The third type of scarcity is linked to geopolitics. Europe's dependence on imported metals puts security of supply at risk. Certain metal ores are only present or mined in a limited number of countries. If those countries are badly governed or apply trade restrictions, the incoming flow of metals may be interrupted. The European Commission has a list of raw materials that are vital for European industry, but whose supply may be jeopardised. The list gets longer with every update. Currently, it features 30 'critical raw materials', most of which are metals.[14]

Cobalt, for example, is classified as critical because most of it is mined in the Democratic Republic of the Congo (DRC). The DRC is highly prone to conflict, corruption, and abuses in the mining sector, including child labour. Rare earths such as neodymium and dysprosium are also considered critical because the EU sources 98% of them from China, an authoritarian state that has restricted the export of rare earths in the past in order to exert pressure on foreign governments and companies.

China also supplies Europe with many other critical metals as well as with appliances such as solar panels, batteries, magnets, and smartphones which contain them. With the energy transition and digitalisation, are we exchanging one unwanted dependency – on Moscow for natural gas – for another – on Beijing for metals? Will this not damage the EU's freedom to steer its own course on the world stage? It is therefore crucial that we find ways to curb our demand and diversify our supply, if only to prevent China from gaining too much influence over Europe.

10 TNO, *Towards a green future, part 1: How raw material scarcity can hinder our ambitions for green hydrogen and the energy transition as a whole*, 2021. http://resolver.tudelft.nl/uuid:8f47a97e-8577-4998-a151-47527a87100c

11 Theo Henckens, 'Scarce mineral resources: Extraction, consumption and limits of sustainability', *Resources, Conservation & Recycling* 169, 2021, p. 5. https://doi.org/10.1016/j.resconrec.2021.105511

12 Nina Lakhani, 'El Salvador makes history as first nation to impose blanket ban on metal mining', *The Guardian online*, 30 March 2017. www.theguardian.com/global-development/2017/mar/30/el-salvador-makes-history-first-nation-to-impose-blanket-ban-on-metal-mining

13 Kathalijne Buitenweg, *Datamacht en tegenkracht – Hoe we de macht over onze gegevens kunnen terugkrijgen*, 2021, p. 209.

14 European Commission, *Critical raw materials*, 2020. https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/critical_en

II Closing the metals loop

One obvious way to become less reliant on scarce metals from foreign mining operations is to make better use of the metals that are already circulating in our economy. Metals can be recycled over and over again. As such, and in sharp contrast to fossil fuels, they are a good fit in a climate-neutral and circular economy.

Although some losses during the use and recycling of metals are inevitable, much higher recycling rates can be achieved than at present. Within the EU, only 65% of the copper in discarded products currently enters the recycling loop[15], while the recycling rate for rare earths is less than 1% – an outrage given their importance for the energy and digital transitions. Recyclability is often overlooked in the design of our most advanced devices.

Boosting the recycling of metals requires an increase in public research and investment. There is a need for new, energy efficient methods to separate metals that are mixed together, to recycle such alloys directly, and to reclaim small amounts of scarce metals from discarded devices. Public investments under the European Green Deal must guarantee that the knowledge gained gets out of the lab and into a state-of-the-art recycling infrastructure.

Dissolvable circuit boards
British start-up Jiva Materials has developed a bio-based printed circuit board for electronics. Once discarded, the circuit board can be delaminated by immersing it in hot water. This makes it easier to separate the electronic components, which contain a variety of metals, for recycling. The natural fibres from the circuit board can be composted and returned to the nutrient cycle.[16]

In parallel, an extension of the EU's ecodesign legislation should oblige producers to design for recycling. It should no longer be possible to put a product on the market without knowing how to recover its parts and materials. This requires a constant dialogue between producers and recyclers. Information on the composition and disassembly of devices should be accessible through digital product passports.[17] Toxic materials must be phased out. Ecodesign requirements should include a minimum percentage of recycled content in devices. This is paramount to making the recycling of scarce metals profitable and to spur innovation.[18] Without guaranteed demand, secondary metals risk being out-competed by virgin metals, the price of which rarely reflects the environmental and social costs of production.

Boosting copper recycling
Eight large energy, telecoms, and transport infrastructure operators in the Netherlands have joined forces to phase out the use of virgin copper for installations and cables by 2030. They also plan to make their unused copper assets available for recycling. These moves stimulate both the demand for and supply of secondary copper.[19]

Stricter legislation on producers' responsibility for discarded devices should boost collection and recycling, preventing scarce metals from being downcycled to lower-quality products or landfilled. At present, less than 40% of e-waste is recycled in the EU.[20] A substantial part of Europe's metal scrap, discarded electronics, and end-of-life vehicles is exported to Asia and Africa. This often amounts to environmental dumping. Recycling within the EU would result in less pollution and more security of supply. The increased availability of recycled metals would also facilitate the domestic production of batteries, magnets, and solar panels. The EU needs to work on a more comprehensive waste export ban, with better enforcement.

However, recycling cannot satisfy Europe's immediate need for metals.[21] There is simply not enough lithium, cobalt, or rare earths circulating in our economy at present, let alone available for recycling, to meet the demands of the energy and digital transitions. Even if it were possible to collect together all of the lithium consumed in the EU over the past decade for full

15 Frauenhofer Institute for Systems and Innovation, *New model maps copper lifecycles in the EU*, 18 December 2017. www.isi.fraunhofer.de/en/presse/2017/presseinfo-28-2017-kupferstoffstrom-modell.html

16 www.jivamaterials.com

17 Such an obligation is already contained in annex 2 of the European Commission's *Regulation on ecodesign requirements for servers and data storage products*, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0424&from=EN

18 In the European Commission's draft Battery Regulation, new batteries will be required to have a minimum recycled content as of 2030. This requirement covers lithium, cobalt, nickel, and lead. European Commission, *Proposal for a Regulation concerning batteries and waste batteries*, 2020, article 8. https://ec.europa.eu/commission/presscorner/detail/en/ip_20_231

19 www.groenenetten.org

20 European Commission, *Circular Economy Action Plan*, 2020, p. 10. https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

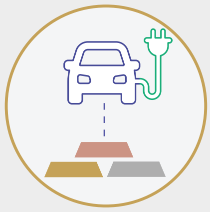
21 Benjamin Sprecher & René Kleijn, 'Tackling material constraints on the exponential growth of the energy transition', *One Earth* 4, 2021. https://doi.org/10.1016/j.oneear.2021.02.020

recycling by 2030, this would not cover even a single year of electric vehicle battery production.[22] Green NGO Transport & Environment expects that by 2030, only 6% of the lithium required for new electric vehicle batteries will be obtainable from recycled European electric vehicle batteries.[23] Even if we choose a future with fewer and smaller cars[24], we would still need virgin lithium; the same applies to cobalt and rare earths.

Besides recycling, there are other circular strategies which can lead to a more efficient use of metals. These include reuse and repair. Electric vehicle batteries that are replaced due to loss of capacity, for instance, can be repurposed for a second life as energy storage for solar or wind farms. Prolonging the lifetime of devices and giving consumers the right to repair also reduces the demand for metals.

A further strategy to decrease supply risks and avoid depletion is the substitution of scarce metals by more common materials. An example is the replacement of copper by aluminium, the third most abundant element in Earth's crust, in certain wires and cables. Similar to recycling, substitution merits a public research offensive, but it is no silver bullet. Since many metals have unique properties, their alternatives may be less effective. Furthermore, in practice, substitution may well involve simply swapping one scarce metal for another, be that in an economic, physical, or geopolitical sense.

Repairability score
The French government is aiming to increase the share of broken electronic devices that are repaired from 40% to 60% in five years. As of this year, the manufacturers of five product categories including smartphones and laptops are obliged to label their products with a repairability score. It tells consumers how easy it is to repair the device that they are considering buying.[25] Several manufacturers have already taken steps to improve the repairability of their products.[26] The Spanish and Belgian governments intend to adopt similar laws to combat the prevailing 'throwaway culture', while the Greens in the European Parliament are campaigning for an EU-wide mandatory repairability score.[27]



Dilemmas of substitution
Electric vehicle motors contain either electromagnets or permanent magnets. While the latter require rare earths, which are geopolitically scarce, the former need more copper, which could be depleted within a century.
The cobalt in electric vehicle batteries can be substituted by nickel, which has a lower supply risk than cobalt as no single country dominates provision. However, at the current rate of extraction, nickel could be depleted before cobalt.[28] Both the cobalt and the nickel in batteries can be replaced by phosphate, but this mineral is an essential nutrient for all life with no substitute in food production. The world's known reserves of phosphate rock could be depleted within a century.[29]

The steps we take today towards a circular economy will enable us, in the long run, to minimise our demand for virgin metals and preserve ores for future generations. The EU must complete the energy transition by 2040. The digitalisation of our lives and societies has, or at least should have, its limits. In the meantime, however, we are forced to face up to the challenges posed by metal mining.

22 This estimate is based on European Commission Joint Research Centre, *Critical Raw Materials Factsheets (Final)*, 2020, p. 297 https://rmis.jrc.ec.europa.eu/?page=factsheets-2020-dfe63e and *Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study*, 2020, p. 21. https://ec.europa.eu/docsroom/documents/42881

23 Assuming that 90% of the lithium in end-of-life batteries will be recycled. Transport & Environment, *From dirty oil to clean batteries*, 2021, pp. 27 & 32. www.transportenvironment.org/publications/batteries-vs-oil-comparison-raw-material-needs

24 See section VIII.

25 www.indicereparabilite.fr

26 Nicholas Six, 'Droit à la réparation des appareils électroniques: premiers succès pour l'indice de réparabilité', *lemonde.fr*, 1 February 2021. www.lemonde.fr/pixels/article/2021/02/01/droit-a-la-reparation-des-appareils-electroniques-premiers-succes-pour-l-indice-de-reparabilite_6068400_4408996.html

27 https://act.greens-efa.eu/repairscore

28 See note 1.

29 European Commission Joint Research Centre, *Critical Raw Materials Factsheets (Final)*, 2020, p. 528. https://rmis.jrc.ec.europa.eu/?page=factsheets-2020-dfe63e

III Responsible sourcing

The EU is unlikely to wean itself off virgin metals anytime soon, but can it at least source them responsibly? At present, most mining practices are dirty, especially in the Global South. All too often, mining companies wreak ecological havoc, violate the rights of workers and local communities, avoid taxes, and fuel conflict and corruption. In Chile, a major exporter of lithium, mining depletes water reserves at the expense of farmers and wildlife. And in China, the chemicals used to extract and process rare earths pollute rivers, groundwater, soil, and air.

For the Democratic Republic of the Congo, mining is a curse rather than a blessing. Despite its mineral wealth, the DRC is one of the poorest and most conflict-ridden countries in the world. Mining by Chinese and Western multinationals follows an extractivist model, whereby the Congolese people deliver large amounts of raw materials at great human and environmental cost while most of the profits accrue to others. Neocolonial and ecological injustices intersect with gender injustice: mining jobs are largely occupied by men, while it is primarily women who suffer from the loss of arable land and lack of clean water caused by mining operations.

Artisanal and small-scale mining

In the DRC, metals such as cobalt and tantalum are mined not only by international companies but also by independent, small-scale miners. Artisanal and small-scale mining is carried out under perilous conditions and sometimes involves child labour. Yet it represents a significant source of livelihood for millions of people. It is for this reason that Dutch company Fairphone, unlike many other downstream cobalt users, does not shun the use of artisanal cobalt but instead attempts to source it responsibly. It has created the Fair Cobalt Alliance, which is working on the development of a transparent supply chain using a selection of artisanal mining sites. The Alliance cooperates with miners and the surrounding communities to keep children out of the mines and enrol them in school, to improve miners' health, safety, and earnings, and to create new economic opportunities.[30]

The resource curse gripping the DRC could hit the entire world. That is a lesson from the coronavirus crisis. In order to mine metal ores, people penetrate deep into the remaining habitats of wild animals. Some Congolese miners, living on the edge of destitution, are forced to hunt great apes and other wild animals for lack of other sources of protein.[31] The preparation and consumption of bushmeat does not only threaten biodiversity; it also carries a high risk of transmitting infectious diseases from animals to humans. Avoiding an era of pandemics is one more reason to take a critical look at where and how our metals are dug up.

In order to protect the interdependent health of humans, animals, and ecosystems[32], promote justice within and between generations, and reduce geopolitical supply risks, Europe needs to take a more responsible approach to metals sourcing. The EU took a first step with its Conflict Minerals Regulation, instigated by the Greens in the European Parliament. This law obliges importers of four metals – gold, tin, tungsten, and tantalum – to check their supply chains to ensure there are no links to armed conflicts or human rights abuses, and to take action where problems are found.[33] The European Commission has proposed a similar obligation, covering both social and environmental risks, for the producers and importers of batteries.[34] These steps should be followed by a generalised due diligence obligation for all companies operating in the EU market, as demanded by the European Parliament.[35] The law should require companies to identify, address, and remedy their impact on human rights, the environment, and governance throughout their value chain. It must include sanctions for non-compliance and liability for harm caused. For victims, access to remedy, including through courts, needs to be guaranteed.

Duty of vigilance

France imposes a 'duty of vigilance' on large companies since 2017.[36] The law was put forward by Greens and other elected representatives in the National Assembly. This due diligence law has paved the way for similar initiatives in other EU member states and has increased the pressure on the European Commission to act at the EU level.

30 Fairphone, *Be part of the change: Join the Fair Cobalt Alliance*, 2020. www.fairphone.com/nl/2020/08/24/be-part-of-the-change-join-the-fair-cobalt-alliance

31 Charlotte Spira et al., 'The socio-economics of artisanal mining and bushmeat hunting around protected areas: Kahuzi-Biega National Park and Itombwe Nature Reserve, eastern Democratic Republic of Congo', *Oryx*, 2017. https://doi.org/10.1017/S003060531600171X

32 This is known as the 'One Health' approach. See WHO, *One Health*, 2017. www.who.int/news-room/q-a-detail/one-health

33 European Commission, *Conflict Minerals Regulation explained.* https://ec.europa.eu/trade/policy/in-focus/conflict-minerals-regulation/regulation-explained

34 European Commission, *Batteries and Accumulators*, 2020. https://ec.europa.eu/environment/topics/waste-and-recycling/batteries-and-accumulators_en

35 European Parliament, *Resolution on corporate due diligence and corporate accountability*, 10 March 2021. www.europarl.europa.eu/doceo/document/TA-9-2021-0073_EN.html

36 France, *Loi relative au devoir de vigilance des sociétés mères et des entreprises donneuses d'ordre*, 2017. www.legifrance.gouv.fr/loda/id/JORFTEXT000034290626

Due diligence schemes for the metals value chain should only be recognised by the European Commission if they are based on the highest standards for mining, processing, and trading. These derive from international agreements, soft law instruments, multistakeholder initiatives, and national laws. Standards for industrial mining include gaining and maintaining broad support from impacted communities[37], as well as free, prior, and informed consent from indigenous peoples.[38] Participatory processes might lead to communities or workers getting a stake in the ownership of a mine[39], but must also aim for local benefits that last beyond the lifetime of the mine. Mining standards furthermore include fair and safe working conditions; preventing adverse impacts on women and girls[40]; minimising environmental damage; avoiding, minimising, restoring, and/or offsetting impacts on biodiversity; and providing financial guarantees that cover the costs of the rehabilitation of all land after a mine closes.

People living in poverty in the Global South are already hardest hit by the climate crisis for which they are not responsible. They should not also have to pay the price for its solution.

37 Initiative for Responsible Mining Assurance, *Standard for Responsible Mining.* https://responsiblemining.net/resources

38 ILO, *Indigenous and Tribal Peoples Convention* (no. 169), 1989 www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169 and United Nations, *Declaration on the Rights of Indigenous Peoples*, 2007. www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html

39 Annabelle Dawson & Thea Riofrancos, 'Where we mine: resource politics in Latin America', *Green European Journal*, 2021. www.greeneuropeanjournal.eu/where-we-mine-resource-politics-in-latin-america

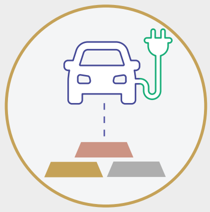
40 United Nations, *Gender Dimensions of the Guiding Principles on Business and Human Rights*, 2019. www.undp.org/publications/gender-dimensions-guiding-principles-business-and-human-rights

Creuseur digging for copper in the DRC. Photo by Fairphone. CC BY-NC 2.0

IV Beyond extractivism

Value chain due diligence alone will not bring an end to extractivism, a phenomenon by which large quantities of a country's natural resources are removed for export, with limited or no processing taking place domestically. Moving beyond extractivism requires that the developing countries that supply raw materials can choose a more sustainable path. They must be assisted in developing alternatives to large-scale mining[41] and plantation, or in acquiring the capacity to transform their raw materials into semi-finished and end products. By building up their own industry, they can capture a greater share of the value chain. This is an avenue out of poverty that many resource-rich countries in the Global South wish to take.[42]

The EU is in two minds about this development strategy. On the one hand, it supports the United Nations' Sustainable Development Goals (SDGs), which include 'inclusive and sustainable industrialisation' and 'value addition to commodities' in developing countries.[43] On the other, it intends 'to ensure undistorted trade and investment in raw materials in a manner that supports the EU's commercial interests'.[44] Its trade agreements are geared towards liberalising trade in raw materials on behalf of European industry rather than regulating it for the sake of sustainable development.[45]



Tesla woos Indonesia

One global player that has been reaching out to Indonesia is Tesla. The average Tesla e-car requires roughly 55 kilograms of nickel; Indonesia has the largest nickel reserves in the world. Recognising that Jakarta wants to build up an industry around its nickel mining, Tesla has entered talks with the Indonesian government about constructing a battery factory on the island of Java.

However, it will be challenging for Tesla to set up a responsible supply chain. Mining in Indonesia has a grim track record, comprising corruption, land grabbing from local and indigenous communities, deforestation without restoration, and the pollution of rivers, seas, and drinking water.[48]

In 2019, the European Commission went so far as to lodge a complaint with the World Trade Organisation (WTO) against Indonesia for banning the export of nickel ores.[46] The Indonesian government wants the ores to be processed domestically. This policy of value addition seems to be working: while nickel mining is slowing down, the export of refined nickel and alloys is going up.[47] Jakarta appears to be achieving its goal of making more money with less mining.

If the EU, through the WTO, manages to kill Indonesia's export ban, would that lead to a more secure supply of nickel for its nascent battery industry? That is doubtful. By sticking to the old extractivist paradigm, the EU risks alienating supplier countries in the Global South. Conversely, an offer to partner up with them for low-emission metals processing within their borders might increase goodwill and trust. It would definitely increase coherence between the EU's trade and sustainable development policies.

In the nickel dispute, both sides may have China at the forefront of their minds. In 2014, the EU won a WTO suit against Chinese restrictions on the export of rare earths.[49] Nevertheless, China's industry now spans the entire value chain for rare earths, from mining to the manufacture of electric vehicles and digital devices. Indonesia cannot be blamed for eyeing a similar trajectory. China, however, has also established a near-monopoly on rare earths by manipulating supply and prices, pushing foreign mines out the market, and leaving Western manufacturers no choice but to relocate to China.[50] This quest for dominance certainly warrants a resolute European response.

41 Costa Rica, for instance, banned open-pit mining in 2010.

42 See for instance African Union, *Africa Mining Vision*, 2009. https://au.int/en/ti/amv/about

43 United Nations, *Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation*. www.un.org/sustainabledevelopment/infrastructure-industrialization

44 See note 2, p. 15.

45 Powershift et al., *Alternatives for the 'Energy and Raw Materials Chapters' in EU trade agreements - An inclusive approach*, 2020. https://power-shift.de/alternatives-for-the-energy-and-raw-materials-chapters-in-eu-trade-agreements

46 European Commission, *EU launches WTO challenge against Indonesian restrictions on raw materials*, 22 November 2019. https://trade.ec.europa.eu/doclib/press/index.cfm?id=2086

47 N.N., 'Indonesia moving up the mining value chain', *mining.com*, 28 July 2020 www.mining.com/indonesia-moving-up-the-mining-value-chain-report and James Guild, 'Indonesia plays hardball with its nickel', *East Asia Forum*, 30 March 2021. www.eastasiaforum.org/2021/03/30/indonesia-plays-hardball-with-its-nickel

48 Jack Board, 'Indonesia is poised for EV riches as Tesla circles, but a nickel rush could hurt the environment', *Channel News Asia*, 28 February 2021. www.channelnewsasia.com/news/climatechange/tesla-indonesia-electric-vehicles-nickel-mining-environment-14256318

49 WTO, *DS432: China – Measures Related to the Exportation of Rare Earths, Tungsten and Molybdenum*. www.wto.org/english/tratop_e/dispu_e/cases_e/ds432_e.htm

50 Guillaume Pitron, *The rare metals war – The dark side of clean energy and digital technologies*, 2020, pp. 62 & 108.

V Strategic autonomy

The EU is not dependent on China for rare earths alone. It is Europe's main supplier for 10 out of 30 critical raw materials.[51] The EU is also heavily reliant on China for products containing these materials, such as solar cells, permanent magnets, batteries, and digital components and devices. This gives China leverage over the EU, not only on its energy and digital transitions but also its broader policies.

China's quest for economic dominance is intertwined with its political aspiration to become a leading global power. The nature of the Chinese regime – autocratic with tech-totalitarian and imperial leanings – makes it a systemic rival to the EU.[52] A Europe that wants to protect and promote democracy, human rights, the rule of law, and multilateralism should not allow its path towards strategic autonomy to be undermined by Beijing's 'divide and conquer' politics.

Chinese infrastructure investments in countries such as Hungary and Greece have already provided Beijing with a foothold within the EU, enabling it to block European condemnation of its human rights violations.[53] The purchase of Chinese digital equipment for 5G networks, which comes with the risk of commercial and political espionage, has also divided the EU. In the energy sector, Europe's dependence on China creates a political headache now that Chinese manufacturers of polysilicon metal for solar cells are heavily suspected of using forced labourers from the oppressed Uighur minority.[54] The European Parliament has demanded an outright ban on imports linked to severe human rights violations such as forced labour.[55] Since the EU buys most of its solar cells and panels from China, an import ban might well slow down Europe's energy transition. While it is essential for the EU and China to cooperate in the fight against climate change, the EU must avoid trade-offs between climate protection and human rights.

The need to preserve its values and to gain strategic autonomy obliges the EU to diversify its sourcing of scarce metals and related products – including from within its borders. Improved recycling of scarce metals would represent a first step towards entirely domestic supply chains.

Expert network on rare earths
As early as 2010, Green Member of the European Parliament Reinhard Bütikofer took action to counter the risks of Europe's dependence on rare earths from China. That year, a drastic reduction in Chinese export quotas for rare earths sent prices outside China skyrocketing. In response, Bütikofer initiated the European Rare Earths Competency Network (ERECON), which brought together over a hundred European experts on rare earths.[56] They came up with a set of recommendations on research, extraction, processing, recycling, and substitution, including a call to start mining rare earths in Europe.[57]
However, once the supply crunch had come to an end, and following the decision by manufacturers of permanent magnets to move their operations to China, the rare earths issue slid off the European Commission's agenda.

Ecodesign requirements to boost the circular use of metals are all the more valuable because EU standards are followed by producers worldwide.[58] The same goes for due diligence requirements: even Chinese firms will have to clean up their act if they want to serve the European market. Thus, EU standards can help push back metals scarcity worldwide.

However, recycled metals can only gradually replace virgin metals.[59] To diversify its supply, the EU also needs to strengthen its ties with supplier countries outside China. Not by forcing them into free market economics, as in the case of Indonesia, but by marrying trade with sustainable development. More generally, the EU needs to step up its development cooperation and, via the European Investment Bank, provide an alternative to the Chinese loans that have caught several poorer countries in a debt trap, with Beijing ultimately gaining control over their natural resources.

51 See note 2, p. 4.

52 Katrin Altmeyer, *Between cooperation and systemic rivalry: The EU-China Relations*, 24 July 2020. www.boell.de/en/2020/07/24/between-cooperation-and-systemic-rivalry-eu-china-relations

53 John Chalmers & Robin Emmott, 'Hungary blocks EU statement criticising China over Hong Kong, diplomats say', *Reuters*, 16 April 2021. www.reuters.com/world/asia-pacific/hungary-blocks-eu-statement-criticising-china-over-hong-kong-diplomats-say-2021-04-16

54 Ana Swanson & Chris Buckley, 'Chinese Solar Companies Tied to Use of Forced Labor', *New York Times*, 8 January 2021. www.nytimes.com/2021/01/08/business/economy/china-solar-companies-forced-labor-xinjiang.html See also Laura Murphy & Nyrola Elimä, *In Broad Daylight: Uyghur Forced Labour and Global Solar Supply Chains*, 2021. www.shu.ac.uk/helena-kennedy-centre-international-justice/research-and-projects/all-projects/in-broad-daylight

55 See note 35.

56 Reinhard Bütikofer, *Seltene Erden und die Neuentdeckung der Rohstoffpolitik*, 2013. www.reinhardbuetikofer.eu/publikationen/seltene-erden-und-die-neuentdeckung-der-rohstoffpolitik

57 ERECON, *Strengthening of the European Rare Earths Supply Chain – Challenges and policy options*, 2015. https://ec.europa.eu/growth/sectors/raw-materials/specific-interest/erecon_en

58 Also, EU standards are often copied by non-EU governments. Anu Bradford, *The Brussels effect – How the European Union rules the world*, 2020.

59 See section II.

Assisting developing countries in adding value to their metal ores can loosen China's grip on supply chains and cut transport emissions. If the DRC were to refine more of its cobalt, it would not need to go through China before reaching Europe and other end users. But value addition in developing countries may eventually spell competition with European industries for the same resources. Indonesia, for instance, has already signed deals for the construction of battery and electric vehicle plants on its territory.[60] Will Jakarta remain willing to share its refined nickel and cobalt with the rest of the world once it has the capacity to transform them into end products?

If the Global South were to overcome its resource curse and produce its own cleantech, this would be a milestone on the road towards the SDGs. But it also raises the question of whether Europe's industry can rely on imported metals. Should we not look under our own feet instead?

60 See note 47.

Closed copper mine in Falun, Sweden. Photo by Mats Thorburn. CC BY-NC-SA 2.0

VI Mining in Europe

Despite millennia of mining, Europe still has metal deposits that are feasible for extraction. These include many of the metals that we need for the energy and digital transitions, such as lithium, cobalt, and rare earths. Stepping up metal mining and processing within EU borders would increase security of supply. It would also shrink the ecological footprint of our metal consumption, thanks to EU environmental regulations and reduced intercontinental transport.

Still, metal mining comes at a price. Open-pit mining in particular affects biodiversity, which is already in serious decline in Europe. Toxic mining waste may pose a threat to river basins and drinking water resources. Europe has not been spared from the widespread pollution caused by the failure of dams containing muddy mining waste. This is a price many Europeans are unwilling to pay. As a result, new mining projects often provoke civic protest.

One way to minimise the damage is to look at our existing mines, both active and inactive, before creating new scars on the landscape. Current mining practices often cause valuable minerals that are extracted alongside target metals to end up as waste. Unless costs, risks, or laws[61] are prohibitive, mining operators should be obliged to utilise all of the marketable minerals they dig up instead of dumping all but one of them as left-over 'tailings'. This obligation should extend to downstream processors. Thus, for instance, cobalt can be obtained as a companion metal of copper and nickel.

Rare earths as a by-product
In Sweden, state-owned mining company LKAB is planning to recover rare earths and phosphorus from the waste of its iron mines in Kiruna and Malmberget. The company wants to open a new processing facility in 2027, by which time it hopes to be capable of meeting some 10% of the EU's demand for rare earths.[62]

The tailings from abandoned mines, which can be found all over Europe, also represent a source of scarce metals. The recovery of these metals should go hand in hand with the ecological rehabilitation of the mining sites. Closed landfills can be remediated in a similar way, freeing up land, reducing pollution risks, and bringing valuable metals and minerals back into circulation.[63]

Re-mining
The Penouta tin mine in the Spanish region of Galicia was closed in 1985 without undergoing rehabilitation. Over 30 years later in 2018, a processing plant was erected to extract the minerals contained in the mining waste. The plant, which operates without the use of chemicals, provides industrial minerals such as quartz and mica as well as metals: tin, tantalum, and niobium. Of the metals, the first two are conflict metals[64], while the latter two are on the EU's list of critical raw materials.[65] The rehabilitation plan for the site includes the spreading of topsoil and the sowing of plant seeds collected locally.[66]
Recent plans to re-open the mine have, however, been meet with opposition, given the area's proximity to a Natura 2000 site and the existing leakage of heavy metals from the mine waste pond.[67]

The recovery of raw materials from extractive and industrial wastes has 'a remarkably high potential to contribute to a sustainable and secure supply', according to the European Commission's research centre.[68] But it cannot satisfy the projected demand for metals. Therefore, the Commission is pushing for the opening of new metal mines in Europe.[69]

There is a case to be made for new mining projects in terms of securing enough metals for Europe's energy and digital transitions. However, in order to minimise the social and environmental trade-offs, we must set a high bar. All stakeholders should be involved from the project's inception, first and foremost local and indigenous communities. Using their

61 In some countries, such as Sweden, uranium mining is prohibited. Charly Hultén, *Sweden bans uranium mining*, WISE International Nuclear Monitor, 10 May 2018. https://wiseinternational.org/nuclear-monitor/860/sweden-bans-uranium-mining

62 LKAB Minerals, *LKAB's exploration results confirm potential for production of phosphorus mineral fertiliser and rare earth elements*, 31 March 2021. www.lkabminerals.com/en/exploration-confirms-potential/

63 See the European Enhanced Landfill Mining Consortium. https://eurelco.org

64 See section III.

65 See section I.

66 European Commission Joint Research Centre, *Recovery of critical and other raw materials from mining waste and landfills*, 2019, pp. 55-68. https://ec.europa.eu/jrc/en/publication/recovery-critical-and-other-raw-materials-mining-waste-and-landfills

67 Ecoloxistas en Acción, *Alertan da ameaza á Red Natura "Pena Trevinca" pola mina de Penouta*, 13 April 2021. www.ecologistasenaccion.org/167777/alertan-da-ameaza-a-red-natura-pena-trevinca-pola-mina-de-penouta

68 See note 66, p. 118.

69 See note 2, pp. 11-14.

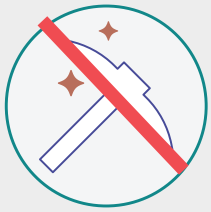
knowledge of the land and creating local benefits are key to obtaining their support. Locations belonging to Natura 2000, the EU's network of nature protection areas, should be off-limits to mining.

Mining tradition

Among the metal mining projects in Europe, the plans to extract lithium in the British county of Cornwall stand out because of the lack of organised opposition.[70] Several companies are preparing to mine lithium from either hard rock or geothermal brine. Using the heat from the brine to power the extraction brings zero carbon lithium closer.

Until the last mine closed in 1998, Cornwall had a long tradition of tin and copper mining, which still evokes pride today. Also, there is a lack of decent jobs. Cornwall is one of the poorest areas in the United Kingdom. This helps to explain the high level of public acceptance of new mining ventures.

Metal mining must fully respect the relevant EU legislation, such as the Habitats and Birds Directives for biodiversity, the Water Framework Directive for clean water, and the Extractive Waste Directive.[71] There should be no grounds for exemption. Both EU law and international standards[72] call for the cleanest possible mining operations: minimal use of hazardous and fossil-based chemicals, a closed water loop, maximal removal of toxic substances, minimal waste, and optimal restoration of biodiversity. The EU should also task its metal mining sector with becoming climate-positive within a decade. This can be achieved by switching to zero-emission machinery and locking up atmospheric CO_2 in remaining waste minerals wherever this is feasible and safe.[73] Finally, mining corporations must be made to pay fair compensation for the appropriation of common resources.[74] In summary, metal mining in the EU should be exemplary, pushing up global standards.



EU laws have teeth

A Canadian company is planning to mine rare earths in Norra Kärr, uphill from Lake Vättern in southern Sweden. The project has received financial support from the European Commission. However, the company saw its mining permit withdrawn in 2016 after a court ruled that the EU Habitats Directive had not been respected.[75] This law stipulates that a project's impact on Natura 2000 sites be assessed before a permit can be granted.

The Swedish government is now reviewing its permit process to bring it into line with EU legislation. Meanwhile, the mining sector is portraying the Habitats Directive as an obstacle to the energy transition.[76]

The displacement of massive amounts of soil and rock within their own borders instead of in distant countries would confront those living in Europe with the downside of their hunger for metals. There is some climate justice in that. It might make us think twice about our lavish consumption of joules and bytes.[77]

70 Dominic Bliss, 'In Cornwall, ruinous tin and copper mines are yielding battery-grade lithium. Here's what that means', *nationalgeographic.co.uk*, 28 May 2021. www.nationalgeographic.co.uk/science-and-technology/2021/05/in-cornwall-ruinous-tin-mines-are-yielding-battery-grade-lithium-heres-what-that-could-mean

71 Other relevant EU laws include the Strategic Environmental Assessment Directive, the Environmental Impact Assessment Directive, the Industrial Emissions Directive, the Groundwater Directive, and the Environmental Liability Directive.

72 See section III and Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, *Guidance for Governments - Environmental Management and Mining Governance*, 2021. www.igfmining.org/announcement/igf-releases-guidance-for-governments-on-environmental-management

73 Robert F. Service, 'Industrial waste can turn planet-warming carbon dioxide into stone', *sciencemag.org*, 3 September 2020. www.sciencemag.org/news/2020/09/industrial-waste-can-turn-planet-warming-carbon-dioxide-stone

74 Juho Heikkilä, *Mining operations taxed lightly in Finland*, 2021. https://gef.eu/publication/mining-operations-taxed-lightly-in-finland

75 Charley Duxbury, 'Sweden's ground zero for the EU's strategic materials plan', *Politico*, 20 November 2020. www.politico.eu/article/swedish-ground-zero-for-eu-strategic-materials-plan

76 Maria Sunér, 'Risk that access to critical minerals will be a bottleneck in climate transition', *svemin.se*, 18 May 2021. www.svemin.se/en/news/news/risk-that-access-to-crm-will-be-a-bottleneck-in-climate-transition

77 See section VIII.

VII Deep-sea and space mining

In anticipation of growing scarcity, the extractive industries are expanding the frontiers of mining to the ocean floor and into outer space. Will these pristine places provide us with the metals we so desperately need?

The deep sea is a treasure trove of minerals in high concentrations. Mining companies are already prospecting the abyssal plains of the oceans for polymetallic nodules, potato-like lumps that are rich in manganese, copper, cobalt, nickel, and rare earths. Seamounts and hydrothermal vents are also being explored for metals. Is deep-sea mining the cleaner alternative to mining on land? It is too early to tell. We know too little about the impacts of mining on marine biodiversity and the ocean carbon sink. Sponges and other deep-sea wildlife depend on polymetallic nodules, which take millions of years to grow back. Mining the ocean floor might wipe out entire species before we have even discovered them. And marine sediments are the largest pool of carbon storage; any decision to tamper with them must not be taken lightly.[78]

Ongoing research into the ecological effects of deep-sea mining will gradually reveal the extent of the damage and whether ecosystems can recover from it.[79] For the moment, the European Parliament and the European Commission are wisely advocating a moratorium on deep-sea mining.[80] However, they may find it difficult to garner enough support for such a precautionary approach within the International Seabed Authority (ISA). This intergovernmental organisation controls the areas of the ocean floor that lie beyond national jurisdictions – a third of Earth's surface. ISA is under pressure from the mining industry to finalise its Mining Code and give the go-ahead for deep-sea mining on a commercial scale.[81] This makes it all the more important to drive forward the negotiations on a global treaty to protect marine biodiversity in international waters. Marine protected areas, off-limits to industrial fishing and mining, should cover at least 30% of the oceans by 2030.[82]

Norway dives for metals
Deep-sea mining in areas of national jurisdiction can be carried out without ISA authorisation. In Europe, Norway is a frontrunner. Oslo plans to issue licences for the exploration of its extended continental shelf in the Norwegian Sea as early as 2023. The coveted metals include copper, zinc, cobalt, silver, and gold, which have been deposited on the sea floor by hydrothermal vents.[83] The mining plans are meeting opposition from environmentalists.

With regard to space mining, the technology needed to extract metals from the Moon and asteroids could be available within decades. Some of the asteroids that get close to Earth during their orbit contain trillions of Euros worth of rare metals. In the USA and elsewhere, companies backed by venture capitalists are already preparing for space mining, with governments tailoring their laws to the wishes of space miners. While the minerals in the international seabed area are recognised as the 'common heritage of humankind' and managed by the ISA, there is currently no such governance structure for minerals within celestial bodies. We are heading for a situation of 'first come, first served', whereby some countries are able to access nearby space resources while others are left to gather the crumbs.[84] This could develop into a source of conflict and exacerbate the ongoing militarisation of space. The quantity of metals gained from space mining could well be dwarfed by the resources wasted on an orbital arms race. Military tests that destroyed satellites with missiles have already made a significant contribution to space debris, the growth of which could render space inaccessible to earthlings.[85]

78 Beth N. Orcutt et al., 'Impacts of deep-sea mining on microbial ecosystem services', *Limnology and Oceanography*, 2020. https://doi.org/10.1002/lno.11403

79 See for instance https://miningimpact.geomar.de

80 N.N., 'European Commission joins calls for moratorium on deep-sea mining', *seas-at-risk.org*, 4 June 2020. https://seas-at-risk.org/general-news/european-commission-joins-calls-for-moratorium-on-deep-sea-mining

81 Kate Lyons, 'Deep-sea mining could start in two years after Pacific nation of Nauru gives UN ultimatum', *The Guardian online*, 30 June 2021. www.theguardian.com/world/2021/jun/30/deep-sea-mining-could-start-in-two-years-after-pacific-nation-of-nauru-gives-un-ultimatum

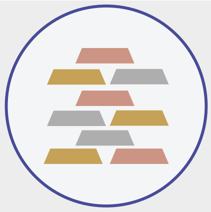
82 Tara Lohan, 'New High Seas Treaty Could Be a Gamechanger for the Ocean', *The Revelator*, 7 May 2020. https://therevelator.org/high-seas-treaty

83 Nerijus Adomaitis, 'Norway eyes sea change in deep dive for metals instead of oil', *Reuters*, 12 January 2021. www.reuters.com/business/environment/norway-eyes-sea-change-deep-dive-metals-instead-oil-2021-01-12

84 Liesbeth Beneder & Richard Wouters, 'Cosmic Bonanza – Mining in Outer Space', *Green European Journal*, 2016. www.greeneuropeanjournal.eu/cosmic-bonanza-mining-in-outer-space

85 A single missile test in 2007, whereby China destroyed one of its own satellites, increased trackable space debris by 25%, according to the European Space Agency. ESA, *About Space Debris*. www.esa.int/Safety_Security/Space_Debris/About_space_debris

We may wish that we had a treaty on space mining, but in fact, one already exists. The 1979 Moon Agreement identifies the Moon and all other celestial bodies as the common heritage of humankind. It contains an explicit ban on the appropriation of space resources and requires an 'international regime' to be set up for the purpose of resource management and benefit-sharing. But the space powers, including the USA and Russia, recoiled from this fair deal. Their failure to sign means that the agreement has so far remained a dead letter. Only 18 countries, including the Netherlands, Belgium, and Austria, are parties to it.[86] The EU, which in its most recent space programme recognised space as the common heritage of humankind[87], should encourage its member states and partners to accede to the Moon Agreement in order to increase its legal weight and reduce the threat of conflict over space resources.



Stepping stones for space travel

The costs of transport between Earth and outer space are steep. With the energy it takes to escape Earth's gravitational pull, millions of kilometres can be covered in space. Hence the appeal of building spacecraft and space stations in space using metals extracted from celestial bodies. Fuel for spacecraft can also be produced in space, using water found on the Moon or asteroids and sunlight. This is where the biggest opportunities currently lie for space miners.[88]

Given the obstacles and risks, neither deep-sea nor space mining can be counted on to provide us with the metals we need for the energy and digital transitions. Space mining holds an entirely different promise, if cooperation can win out over competition: enabling humankind to further explore our solar system and beyond without draining limited terrestrial resources.

86 United Nations, *Agreement Governing the Activities of States on the Moon and Other Celestial Bodies.* www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html

87 European Union, *Regulation establishing the Union Space Programme and the European Union Agency for the Space Programme*, 2021, article 4.1.d. https://eur-lex.europa.eu/eli/reg/2021/696/oj This reference to the Moon Agreement was inserted on the initiative of the Greens/EFA Group in the European Parliament.

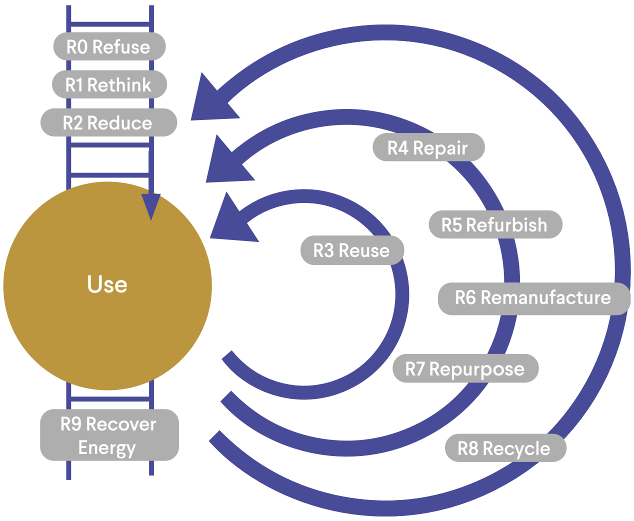
88 See note 84.

Polymetallic nodules from the ocean floor. Photo by Hannes Grobe/AWI. CC BY-SA 4.0

VIII Refuse, rethink, reduce

All sources of virgin metals – whether in Europe, China, developing countries, the depths of the oceans, or the cosmos – come with important drawbacks. While circular strategies such as reuse and recycling are crucial for the phasing-out of mining and the preservation of ores, they cannot satisfy our demand for metals in the short term. There are, however, other circular strategies which go beyond technological fixes. Those on the highest rungs of the 'circularity ladder' are the most effective: refuse, rethink, and reduce. These strategies make us question our lifestyles and the metabolism of our societies. Are all of the devices that require energy, data, and materials really indispensable? Can we meet our needs in a smarter way?

Take electric vehicles. They are key to carbon-free mobility and breathable cities. However, should every single fossil-fuel car that goes to the scrapyard really be replaced by an electric one? Even with clean propulsion, moving 1,000 kilogrammes of metal to transport an average of 1.5 human bodies takes a heavy toll on the planet. We could make do with far fewer cars if we shifted to using bicycles, public transport, and shared e-cars. The average shared car would only need a small battery, since most trips are relatively short. For the occasional long journey, shared cars with more battery range would be available.



Circularity ladder: The 10 R's of the circular economy. Source: PBL.[89]

Huge quantities of scarce metals for use in batteries and electromotors could be saved by such a mobility rethink.[90] If one e-car were enough to replace five fossil-fuel cars, the EU would only need half as much lithium and cobalt as is currently projected.[91] Reduced dependence on private cars would also save energy, allowing us to speed up the energy transition and complete it with fewer wind turbines and solar panels – once again saving metals.

The 15-minute city
A rethink of urban planning could also reduce the need for motorised vehicles. The city of Paris wants to become a *ville du quart d'heure* in which the majority of residents' needs can be met in their own neighbourhoods. Schools, shops, healthcare, and leisure activities should all be available within 15 minutes' walking or 5 minutes' cycling distance. According to the scientist Carlos Moreno, who coined the term, the 15-minute city requires density, proximity, diversity, and digitalisation.[92]

The pooling and sharing of vehicles can be facilitated by online platforms that bring together supply and demand. There are many other digital innovations that can help Europe become climate-neutral and circular. Smart electricity grids, for example, use data and algorithms to balance power consumption with supply from wind turbines and solar panels, thereby reducing the need for power plants and storage batteries. Digital product passports facilitate repair and recycling. Sensors and artificial intelligence improve the sorting of waste, including scrap metals. Digital ledgers such as blockchains ensure that products and the materials they contain can be traced back to their origins, thus supporting value chain due diligence.[93] Smart cameras can even protect birds from wind turbine injuries by shutting down the spinning blades when there is a risk of collision.[94]

89 José Potting & Aldert Hanemaaijer (ed.), Roel Delahaye, Jurgen Ganzevles, Rutger Hoekstra & Johannes Lijzen, *Circulaire economie: Wat we willen weten en kunnen meten. Systeem en nulmeting voor monitoring van de voortgang van de circulaire economie in Nederland*, Planbureau voor de Leefomgeving, Centraal Bureau voor de Statistiek & Rijksinstituut voor Volksgezondheid en Milieu, 2018, p. 11. CC BY 3.0 NL www.pbl.nl/publicaties/circulaire-economie-wat-willen-we-weten-en-wat-kunnen-we-meten

90 Metabolic et al., *Metal demand for electric vehicles*, 2019, pp. 28-31. www.metabolic.nl/projects/critical-metals-demand-for-electric-vehicles

91 This is a cautious estimate, taking into account extra demand for e-buses and e-bikes. It is based on European Commission Joint Research Centre, *Critical Raw Materials for Strategic Technologies and Sectors in the EU – A Foresight Study*, 2020, pp. 21 & 76. https://ec.europa.eu/docsroom/documents/42881

92 Ville de Paris, *Paris ville du quart d'heure, ou le pari de la proximité*, 22 January 2021 www.paris.fr/dossiers/paris-ville-du-quart-d-heure-ou-le-pari-de-la-proximite-37 and N.N, '15 minute city', *Wikipedia*, 2021.
https://en.wikipedia.org/wiki/15_minute_city

93 See section III.

94 Christopher McClure et al., 'Eagle fatalities are reduced by automated curtailment of wind turbines', *Journal of Applied Ecology*, 20 January 2021. https://doi.org/10.1111/1365-2664.13831

The usefulness of other aspects of digitalisation is more questionable. Do we really need a new smartphone every two years, knowing as we do that many of the metals in the phone we discard cannot at present be recycled? An upgradeable phone is so much smarter. Does watching films online in ultra-high-definition instead of high-definition – which doubles data use[95] – make our lives more fulfilling? Is a refrigerator that automatically orders more beer when it runs out a useful application of the Internet of Things or an example of wasteful excess?[96] Most of us would be glad to do without online advertisements, which are responsible for about a quarter of our data consumption when we browse the web.[97]

Data use is growing exponentially because efficiency gains in the digital sector have a strong rebound effect. As the transmission, storage, and processing of data become cheaper, new applications emerge.[98] Innovations such as 5G, connected devices, and artificial intelligence push up the demand for ICT equipment and infrastructure, from servers and routers to data cables and antennas. To prevent a resource-devouring data explosion, the EU would be well advised to adopt ecodesign rules that limit the data use of online films, videos, games, and advertisements, as well as connected devices.[99] Similar rules should prevent software from being bloated with pre-installed features that are barely used, and with updates that require excessive amounts of memory, storage, or processing power, thereby slowing down devices and pushing users to swap their old devices for new ones.

Ecodesign rules for cryptocurrencies are long overdue. Bitcoin's method of validating transactions is a huge waste of computing power. As a result, its electricity consumption approaches that of the Netherlands[100], while Bitcoin mining hardware, which becomes obsolete roughly every 18 months, generates almost as much e-waste as the country of Luxembourg.[101] By connecting climate justice and digital justice, we can identify measures that serve both sustainability and civil liberties. Prohibiting trade in personal data[102], personalised advertisements[103], live facial recognition cameras[104], and untargeted interception of telecommunications would drastically reduce the storage, transmission, and processing of personal data. This would not only temper data growth but also protect us from consumerist manipulation, political microtargeting, and mass surveillance. A more frugal use of data might actually improve our quality of life while at the same time preserving resources for our descendants.

Fewer gigabytes, more privacy
A study commissioned by the Greens in the European Parliament sheds light on the carbon footprint of surveillance capitalism. Many smartphone apps contain trackers that follow users online, often without their knowledge, in order to process their private data into a profile. This allows advertising networks to target smartphone users with personalised ads. The data traffic generated by such tracking and targeting amounts to between 30 and 50 billion gigabytes per year just for the EU. This translates into annual CO_2 emissions of 5 to 14 megatonnes. To compensate for these emissions, the EU would need to install between 90 and 260 million solar panels.[105] Or its lawmakers could simply decide to ban this violation of our privacy by the apps on our smartphones.

A further benefit of sharing arrangements, extended device lifetimes, and data frugality would be savings for consumers, companies, and governments. But policy makers should once again take the rebound effect into account. If people who give up car ownership use the money saved to take more holiday flights, their ecological footprint might actually increase.[106] Strategies for material efficiency must therefore be aligned with broader sustainability policies, including a reduction in air travel. Since economic growth also exerts an upward pressure on resource use and harmful emissions, governments should change the stars by which they navigate from gross domestic product (GDP) to well-being and sustainability.[107]

95 An increase in data use does not immediately push up resource use for most of the steps of video streaming. But as more consumers switch to streaming in ultra-high-definition, the internet network will have to be upgraded in order to handle peak data traffic load. These upgrades exert an upward pressure on energy and material use. Carbon Trust, *Carbon impact of video streaming*, 2021, p. 91. www.carbontrust.com/resources/carbon-impact-of-video-streaming

96 See for instance https://drinkshift.com

97 Estimate based on Arvind Parmer et al., *AdblockPlus Efficacy Study*, 2015 www.sfu.ca/content/dam/sfu/snfchs/pdfs/Adblock.Plus.Study.pdf and Arthur Visser, *The Effect of Ad Blockers on the Energy Consumption of Mobile Web Browsing*, 2016. https://api.semanticscholar.org/CorpusID:33233853

98 Tilman Santarius et al., 'Digitalization and the Decoupling Debate. Can ICT help to reduce environmental impacts while the economy keeps growing?', *Sustainability* 12/18, 2020. https://doi.org/10.3390/su12187496

99 See note 13, p. 207. A precedent is set by the Acceptable Ads Standard. This private initiative limits the number of pixels – and therefore bytes – in online advertisements. https://acceptableads.com/standard

100 University of Cambridge, 'Comparisons', *Cambridge Bitcoin Electricity Consumption Index*, June 2021. https://cbeci.org/cbeci/comparisons

101 Alex de Vries, 'Bitcoin electronic waste monitor', *Digiconomist*, 2021. https://digiconomist.net/bitcoin-electronic-waste-monitor

102 See note 13, pp. 81-86 and European Green Party, *Resolution on smart cities*, 2021. https://europeangreens.eu/content/smart-cities

103 See the Tracking-Free Ads Coalition initiated by Members of the European Parliament: https://trackingfreeads.eu

104 See the civil society campaign Reclaim Your Face: https://reclaimyourface.eu

105 CE Delft, *Carbon footprint of unwanted data use by smartphones – An analysis for the EU*, 2021, p.12.

106 Juudit Ottelin et al., 'Rebound Effects for Reduced Car Ownership and Driving', in: Sigríður Kristjánsdóttir (ed.), *Nordic Experiences of Sustainable Planning: Policy and Practice*, 2017.

107 Kate Raworth, *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*, 2017 and Statistics Netherlands, *Monitor of Well-being: a broader picture*, 2018. www.cbs.nl/en-gb/corporate/2018/20/monitor-of-well-being-a-broader-picture On the need for harmonised beyond-GDP metrics, see Rutger Hoekstra, *Replacing GDP by 2030 – Towards a Common Language for the Well-being and Sustainability Community*, 2019.

E-waste dump in Agbogbloshie, Ghana. Photo by Fairphone,

IX Agenda for Action

The shift to a more responsible use of metals for the green and digital transitions requires action at all political levels. This Agenda for Action lists a number of measures that take into account the interests of both developing countries and future generations, as well as the EU's quest for strategic autonomy and the protection of its values. It is inspired by numerous initiatives already taken by the Greens in the European Parliament and other green actors.

European Union

1. On the road towards a Europe that is climate-neutral by 2040 and circular by 2050, set targets for the reduction of resource use by 2030 and 2040, with sub-targets for virgin metals and other minerals, biomass, water, and land, including the phasing-out of fossil resources.[108]

2. Promote the inclusion of circular strategies and resource efficiency targets in the nationally determined contributions (NDCs) under the Paris Agreement on climate change.[109] Participatory roadmapping should identify potential winners and losers from the circular transition and help shape mechanisms for a just transition.[110]

3. In order to preserve metal ores for future generations, add the metals at the greatest risk of depletion to the EU list of critical raw materials. Taking into account both geological scarcity[111] and environmental hazards during mining[112], these would include copper, molybdenum, zinc, and nickel.

4. Work towards the establishment of an International Competence Centre on Mineral Resources Management, after the example of the Intergovernmental Panel on Climate Change.[113]

5. Advocate a United Nations (UN) agreement on the conservation and use of physically scarce mineral resources which provides for global extraction quotas and a compensation system for developing countries that place limits on extraction.[114]

Saving metals

6. Europe must turn its weakness – dependence on imported metals – into a strength by becoming a world leader in the circular use of metals and the substitution of scarce metals by more abundant materials. Step up EU funding for public research and public (co-)investment in the value chain for secondary materials. Set high requirements for ecodesign, recycling rates, and recycled content which spur innovation and support the reshoring of outsourced manufacturing, for instance of solar panels. Closed-loop industry chains should provide more and decent jobs, including for workers from fossil sectors in the framework of a just transition.

7. Set (more) ambitious, material-specific targets for the high-quality recycling of electric vehicle batteries within the proposed Battery Regulation[115]: 95% by 2025 and 98% by 2030 for cobalt, nickel, and copper; 70% by 2025 and 90% by 2030 for lithium. In parallel, set higher targets for recycled content in new batteries.[116] Add similar targets for phosphate in batteries. Review these targets regularly in the light of technological developments, such as changes in battery chemistry.

8. Set ambitious, material-specific recycling and recycled content targets for other products that contain scarce metals and minerals, through waste and ecodesign legislation. These products include electric vehicle motors, industrial motors, and wind turbines with permanent magnets containing rare earths.

9. To counter environmental dumping and increase the availability of secondary resources, tighten the export ban on waste and improve enforcement.

10. Prioritise products and devices containing scarce metals and minerals for ecodesign measures such as durability, upgradability, repairability, interoperability, recyclability, and substitution.

11. Prohibit planned obsolescence and irreparability, following the examples of France[117] and Italy.

12. Extend the right to repair to devices such as smartphones and laptops. Make this right universal: spare parts should be

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108 In line with the European Parliament's *Resolution on the new Circular Economy Action Plan*, 10 February 2021. www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html

109 International Resource Panel, *Resource efficiency and climate change – Material efficiency strategies for a low-carbon future*, 2020, p. 121. www.resourcepanel.org/reports/resource-efficiency-and-climate-change

110 Patrick Schröder, *Promoting a just transition to an inclusive circular economy*, 2020. http://dx.doi.org/10.13140/RG.2.2.24974.59204

111 See section I.

112 Günter Dehoust et al., *Environmental Criticality of Raw Materials – An assessment of environmental hazard potentials of raw materials from mining and recommendations for an ecological raw materials policy*, 2020, p. 28. www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2020-06-17_texte_80-2020_oekoressii_environmentalcriticality-report_.pdf

113 Theo Henckens, *Governance of the world's mineral resources – Beyond the foreseeable future*, 2021, chapter 9.

114 Ibid.

115 See note 18.

116 Environmental Coalition on Standards et al., *Enhancing the Sustainability of Batteries: A joint NGOs' position paper on the EU Battery Regulation proposal*, 2021, p. 20. https://ecostandard.org/publications/enhancing-the-sustainability-of-batteries-a-joint-ngos-position-paper-on-the-eu-battery-regulation-proposal

117 This ban was proposed by the Greens in the National Assembly in 2015. See www.stopobsolescence.org

available and affordable to all, and repair manuals and 3D printing models for parts should be publicly available under a free licence.[118] Conformity and security updates for software should be provided for at least eight years after purchase; when technical support or security updates end, the source code must become publicly available.[119]

13. Introduce a mandatory repairability score for consumer products and develop it into a sustainability index.[120]

14. Extend the two-year legal guarantee against faulty products proportionally to the estimated lifetime of the product and encourage repair over replacement.[121]

15. Introduce reporting requirements on circularity in the upcoming Corporate Sustainability Reporting Directive, to include the use of virgin and recycled materials, production and consumer waste, recycling rates, and recycled content rates.[122]

16. Phase out critical raw materials where these can be substituted by more abundant, non-toxic materials without loss of performance, for instance in new stationary batteries (sodium can replace cobalt, nickel, lithium, and phosphate), flame retardants (no more antimony), and mineral insulation wool (no more boron).

17. Empower the European Commission to ban the use of critical raw materials for non-essential applications in times of shortage, by means of delegated acts.[123] The demand for gadgets, jewellery, and mobile phones must not impede the energy transition.

18. Ensure a more balanced composition of the European Raw Materials Alliance, including far greater civil society representation.[124]

Saving metals by saving energy

19. Raise the 2030 energy efficiency target from 32.5%[125] to 45%. Adjust member states' targets accordingly. Make them binding. For the building sector, require an annual deep renovation rate of at least 3%.[126] The cleanest energy is the energy we do not have to produce.

20. Ensure electric vehicles and charging stations can assist in balancing the power grid through smart charging, including vehicle-to-grid (V2G) technology.

21. Promote innovations in electricity storage that reduce the demand for scarce metals, such as compressed air and gravity-based storage.

22. Adopt binding sustainability standards for data centres which include energy-efficient cooling, minimal water use, the recovery and reuse of waste heat, and the extension of hardware lifespans.

Saving metals by saving on data

23. Develop ecodesign requirements that limit the data use of online films, videos, games, and advertisements, as well as connected devices.

24. Introduce ecodesign requirements for software aimed at limiting the use of hardware resources, energy, and data.[127] These requirements should tackle software bloat by limiting non-essential pre-installed software and ensuring it can be removed by users, and by preventing software from running unnecessarily in the background. Non-essential software features that require a considerable amount of memory, storage, or processing power should be optional. Functional updates, as distinct from corrective updates, should be reversible.

25. Promote free and open-source software which enables users to adapt code to the capabilities of their hardware and to their needs without unnecessary ballast.[128]

26. Set ecodesign requirements for cryptocurrencies.[129] Ban non-compliant currencies from registered exchange platforms.

27. Develop a metric for the computational complexity of AI models, introduce a reporting requirement for AI developers, and promote the metric as a criterion in the public procurement of AI.

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118 See https://repair.eu

119 Halte à l'Obsolescence Programmée, *Durable and repairable products: 20 steps to a sustainable Europe*, 2020, p 12. www.halteobsolescence.org/wp-content/uploads/2020/11/Livre-Blanc-europeen.pdf

120 See section II.

121 See note 119, p. 19 and Greens/EFA group in the European Parliament, *E-waste is just like love – Don't throw it all away*, 2021. www.greens-efa.eu/dossier/e-waste-is-just-like-love

122 European Commission, *Proposal for a Directive on corporate sustainability reporting*, 2021. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0189

123 Delegated acts can be revoked by either the European Parliament or the Council of Ministers.

124 Friends of the Earth Europe, *The EU's Industry Alliances: The new corporate capture that threatens democracy and the environment*, 2021. https://friendsoftheearth.eu/publication/the-eus-industrial-alliances

125 Compared to the 2007 projections for 2030.

126 Greens/EFA Group in the European Parliament, *Letter to the European Commission*, 30 June 2021. http://extranet.greens-efa-service.eu/public/media/file/1/7142

127 See for instance Blauer Engel, *Resource and energy-efficient software products – Basic award criteria*, 2020. www.blauer-engel.de/en/products/electric-devices/resources-and-energy-efficient-software-products

128 See note 119, p. 12 and Erik Albers, *Freie Software – Ressourcen schonen durch Teilen*, 2014. https://blog.3rik.cc/2015/01/freie-software-ressourcen-schonen-durch-teilen

129 See section VIII.

28. Ban the trade in personal data, including personalised advertising, biometric mass surveillance, social scoring[130], and the untargeted interception of telecommunications.[131]

Responsible mining

29. Discontinue the granting of free allowances for greenhouse gas emissions to industry, including mining installations, under the Emissions Trading System (ETS). Introduce a border adjustment tax to ensure that imported emissions from metal mining and processing outside the EU do not escape carbon pricing.[132]

30. Set a trajectory for a climate-positive EU metal mining sector by 2030, by means of the mandatory use of zero-emission machinery and the sequestration of atmospheric carbon in alkaline waste minerals.[133]

31. Tighten the Extractive Waste Directive in view of the goal of zero pollution by 2050.[134] Zero pollution and minimal waste imply precise selective mining, the phasing out of hazardous and fossil-based chemicals, the maximal removal of toxic substances, the optimal and maximal utilisation of extracted minerals within legal limits, dewatering tailings, and/or moving processing steps underground and taking only marketable minerals to the surface.

32. Tighten the Habitats Directive to ensure that Natura 2000 sites are no-go zones for new mining projects.

33. Map the potential supply of secondary raw materials from stocks and wastes.[135] Devise an action plan for turning abandoned mining sites and landfills from environmental liabilities into assets through waste valorisation and site rehabilitation.

34. Extend mandatory value chain due diligence to all companies operating in the EU market. The law should require that companies identify, address, and remedy their impact on human rights (particularly women's, children's, and indigenous rights), the environment, and governance throughout their value chain. Public reporting must be mandatory. The law must also include sanctions for non-compliance, impose liability on companies for any harm they cause, and guarantee access to remedy, including judicial remedy, for victims.[136] The European Commission should only recognise due diligence schemes that are based on the highest standards, such as those of the Initiative for Responsible Mining Assurance (IRMA).[137]

35. Engage constructively in the negotiations on a UN Treaty on Business and Human Rights.

36. Promote digital systems that allow the tracing of (raw) materials and products throughout the value chain.

37. Support civil society, within and outside of Europe, in monitoring mining operations and pushing for compliance with EU and national laws as well as international standards.

38. Promote better conditions for artisanal metal mining as well as the diversification of livelihoods, including agriculture, to reduce communities' dependence on mining in countries such as the DRC.[138]

39. Step up support for value addition and economic diversification in the Global South, including through regional integration, development partnerships, and technology transfer. The domestic processing of raw materials and the related development of renewable energy and responsible recycling should provide for local ownership and create decent jobs for women and men alike, including fossil sector workers in the framework of a just transition.

40. Increase grant-based financing for the SDGs and – on the condition of debt sustainability – promote the financing facilities of the European Investment Bank (EIB) as an alternative to the Chinese loans that require developing countries to mortgage their natural resources and critical infrastructure. Anchor the SDGs more strongly in the EIB's lending policy and strengthen human rights due diligence, transparency, and accountability.[139]

41. Adopt an anti-coercion instrument that allows the EU to take economic countermeasures in the case of economic coercion by China or other powers. This should include a de-escalation mechanism.[140]

42. Work towards an EU common space law in full respect of the Outer Space Treaty, the Moon Agreement, and other international instruments.[141]

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130 European Data Protection Board & Supervisor, *Joint opinion on the proposal for an Artificial Intelligence Act*, 2021. pp. 11-12. https://edps.europa.eu/data-protection/our-work/publications/opinions/joint-opinion-edps-edps-proposal-regulation-european_en

131 See section VIII.

132 Henrike Hahn, Damien Carême & Michael Bloss, *6 ways to make EU industry climate neutral*, 2020. www.greens-efa.eu/dossier/6-ways-to-make-eu-industry-climate-neutral

133 See section VI.

134 European Commission, *EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'*, 2021. https://ec.europa.eu/commission/presscorner/detail/en/IP_21_2345

135 See note 4, p. 11.

136 See section IV and ActionAid et al., *An EU mandatory due diligence legislation to promote businesses' respect for human rights and the environment*, 2020. https://actionaid.nl/2020/09/01/an-eu-mandatory-due-diligence-legislation-to-promote-businesses-respect-for-human-rights-and-the-environment

137 See section IV and note 37.

138 Germanwatch et al., *The EU Regulation on responsible mineral supply and its accompanying measures: views from civil society from producing countries*, 2019. https://germanwatch.org/sites/germanwatch.org/files/EurAc_Workshop%20Report_Responsible%20Mineral%20Sourcing.pdf

139 Counter Balance, *European Parliament urges EIB to become more transparent and sustainable*, 7 July 2021. https://counter-balance.org/news/european-parliament-urges-eib-to-become-more-transparent-and-sustainable

140 Jonathan Hackenbroich & Pawel Zerka, 'Measured response: How to design a European instrument against economic coercion', *ecfr.eu*, 2021. https://ecfr.eu/publication/measured-response-how-to-design-a-european-instrument-against-economic-coercion

141 See section VII and Greens/EFA Group in the European Parliament, *Green European Space Policy*, 2021. www.greens-efa.eu/en/article/document/green-european-space-policy

43. Take a leading role in establishing a UN agency for the management of space resources, the scope of which would include benefit-sharing between the Global North and South.

National governments

1. Encourage circular design by means of ecomodulation within extended producer responsibility (EPR) schemes for discarded products. Differentiate the financial contributions of producers and importers according to the durability, reparability, re-usability, and recyclability of their products, as well as recycled content.

2. Introduce return premiums or deposits on all electronics, portable batteries, beverage cans, and other products containing metals in order to push up end-of-life collection rates.

3. Ensure that EPR schemes not only focus on collection and recycling but also contribute to waste prevention. Set targets for repair, refurbishment, and reuse, to be achieved by means of a repair fund. The fund would be financed by producers and importers and would give consumers a discount on repairs, following the example of France.[142]

4. Utilise the (current and future)[143] flexibility of the EU Value Added Tax (VAT) regime to lower or abolish VAT on repair and maintenance services as well as on the sale of second-hand goods.

5. Integrate the acquisition of basic repair skills into school curricula.

6. Apply circularity, energy efficiency, data frugality, and fair-trade criteria within public procurement. Take circularity and responsible sourcing into account when putting projects for the generation and storage of renewable energy out to tender.

7. Drive forward energy efficiency in the building, industry, business, digital, transport, and agricultural sectors, inter alia through (near) zero-energy building renovation, mandatory no-regret energy-saving measures, and the promotion of cycling, public transport, car-sharing, and smaller cars.

8. Phase out energy tax rebates for major consumers, including the metals industry and data centres. Reward demand response, which helps balance electricity supply and demand.

9. Ensure the timely roll-out of the infrastructure needed for the defossilisation of energy-intensive industries, including metallurgy. This includes sufficient grid connections as well as pipeline capacity for hydrogen and CO_2.[144]

10. Provide investment security for the defossilisation of energy-intensive industries with carbon contracts for difference (CCfDs), which bridge the gap between the prevailing price of CO_2 emissions and the actual costs of abating emissions.[145]

11. Promote the sharing of networks and infrastructure by (mobile) telecom operators while protecting consumers.

12. Promote data deletion campaigns, also within government, while respecting archiving obligations.[146]

13. Ensure compliance with EU laws such as the Habitats and Birds Directives, the Water Framework Directive, and the Extractive Waste Directive, as well as with international standards, when dealing with permit applications for metal (re-)mining. Prohibit the development of new mining projects on Natura 2000 sites. Require mining companies to obtain broad support from impacted communities.

14. Publish a list of the national importers subject to the EU Conflict Minerals Regulation for the purpose of compliance monitoring by civil society organisations.[147]

15. Join and implement the Extractive Industries Transparency Initiative (EITI) on the public disclosure of information such as revenues, taxes, royalties, permits, and contracts along the extractive industry value chain.[148]

16. Support indigenous peoples' right to free, prior, and informed consent by ratifying the International Labour Organisation's Indigenous and Tribal Peoples Convention.[149]

17. Work towards making ecocide an international crime within the jurisdiction of the International Criminal Court.[150]

18. Stop export finance for fossil fuel projects and support renewable energy in the Global South, thereby reducing the carbon intensity of Europe's imports.

19. In parliament, withhold approval of the Comprehensive Economic and Trade Agreement (CETA) between the

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142 See note 119, p. 26.

143 European Commission, *VAT: More flexibility on VAT rates, less red tape for small businesses*, 18 January 2020. https://ec.europa.eu/commission/presscorner/detail/en/IP_18_185

144 Bram van de Glind & Evert Nieuwenhuis, *Blockers and enablers for decarbonising the Dutch chemistry, refinery and basic metals industries*, 2020, p. 16. https://gef.eu/publication/blockers-and-enablers-for-decarbonising-the-dutch-chemistry-refinery-and-basic-metals-industries

145 Bündnis 90/Die Grünen, *Deutschland. Alles ist drin. Bundestagswahlprogramm 2021*, p. 30. www.gruene.de/artikel/wahlprogramm-zur-bundestagswahl-2021

146 See for instance https://deletionday.com

147 European Network for Central Africa et al., *Civil society calls for transparency on the companies subjected to the European Union's Regulation on the supply of 3TG minerals*, 2 March 2020. www.eurac-network.org/en/press-releases/press-release-civil-society-calls-transparency-companies-subjected-european-unions

148 https://eiti.org

149 See section III.

150 See www.stopecocide.earth

EU and Canada. Its Investment Court System would give Canada-based mining multinationals additional leverage to pressure European governments into granting mining permits.[151]

20. Support a moratorium on deep-sea mining until its effects have been sufficiently researched and it can be demonstrated that extraction can be managed in a way that effectively protects the marine environment, biodiversity, and the ocean carbon sink.

21. Accede to or ratify the Moon Agreement and – in the case of Luxembourg – adapt national space mining legislation accordingly.[152] Foster talks within the UN on an international regime for the management of space resources.

Local and regional governments

1. Work on an ambitious reduction of private car ownership in urban areas. Aim for a 15-minute city[153] and avoid urban sprawl. Reduce parking availability for private cars. Improve cycling infrastructure and public transport. Set up mobility hubs that include shared e-cars and e-bikes. In rural areas, introduce demand-driven public transport. Adopt 'privacy by design' apps for Mobility-as-a-Service (MaaS).

2. Promote other forms of pooling and sharing that reduce our material footprint, including the use of metals: from peer-to-peer sharing of electric tools and the common use of household appliances in apartment blocks to the sharing of office space and equipment.

3. Apply circularity, energy efficiency, data frugality, and fair-trade criteria within public procurement.[154] Act as a launching customer for circular business models, including Product-as-a-Service (PaaS). Take circularity and responsible sourcing into account when putting projects for the generation and storage of renewable energy out to tender.

4. Promote the separate collection of e-waste, in cooperation with producers' organisations. Task municipal waste collection services to rescue products whose lifespan can be extended, in cooperation with reuse and repair shops.

5. Promote repair services that are accessible and affordable for all, including repair cafés. Shopping areas should offer not just new products, but also options for repair and reuse.

6. Provide repair vouchers to consumers to make repairs more affordable, after the Austrian example.[155]

7. Connect the circular and social economy by creating jobs in repair and disassembly for people who are vulnerable to poverty and exclusion, as well as internships for students.

8. Create a contact point for circular initiatives to assist those interested in using waste streams as a resource in obtaining legal advice, finding funding, and connecting with value chain partners.

9. Raise the issue of material efficiency in the public debate on the integration of renewable energy sources in the landscape.[156] Combining wind and solar power reduces the need for the storage and long-distance transport of electricity and enables the sharing of grid connections, thus saving scarce metals.

151 Charles Berkow, *EU och gruvorna – Hot eller möjlighet för miljön?*, 2017. http://media1.maxandersson.eu/2017/07/Gruvrapport-_3-juli.pdf

152 See section VII.

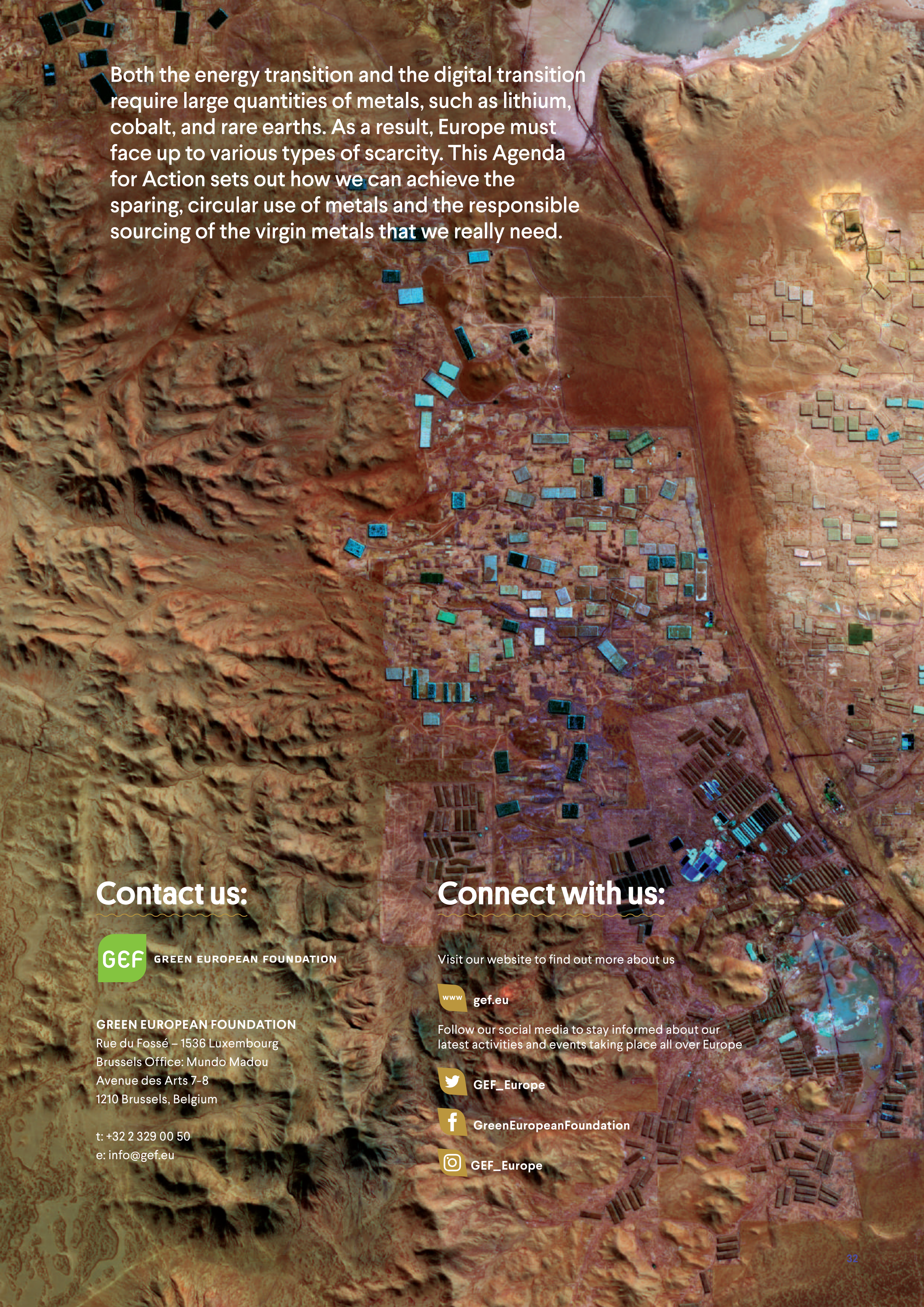
153 See section VIII.

154 See https://procuraplus.org and https://electronicswatch.org

155 Markus Piringer & Irene Schanda, 'Austria makes repair more affordable', *repair.eu*, 22 September 2020. https://repair.eu/news/austria-makes-repair-more-affordable

156 Metabolic et al., *Een circulaire energietransitie. Verkenning naar de metaalvraag van het Nederlandse energiesysteem en kansen voor de industrie*, 2021, pp. 10-11. www.metabolic.nl/publications/een-circulaire-energietransitie

Electronics factory in Indonesia. Photo by ILO. CC BY-NC-ND 2.0



Both the energy transition and the digital transition require large quantities of metals, such as lithium, cobalt, and rare earths. As a result, Europe must face up to various types of scarcity. This Agenda for Action sets out how we can achieve the sparing, circular use of metals and the responsible sourcing of the virgin metals that we really need.

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