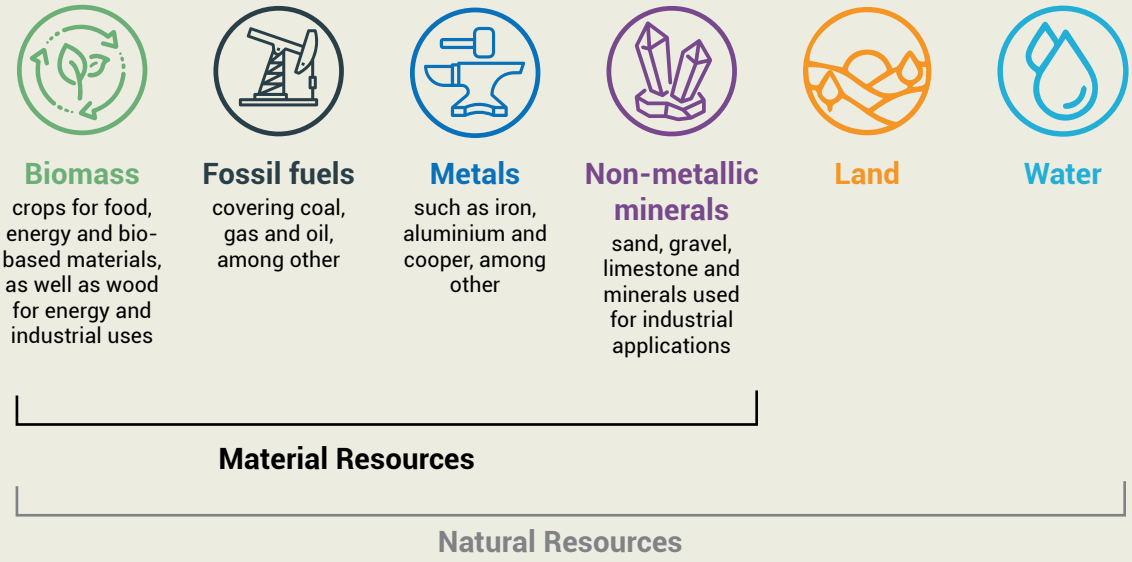
MATERIAL RESOURCES FACTSHEETS

The increasing use of material resources

People depend on natural resources for all basic needs and as a basis for well-being. How these resources are extracted, processed, traded, transformed, used and eventually disposed not only determines the trajectories of environmental impacts, but also underpins all 17 Sustainable Development Goals (SDGs).

What are resources?



Global material extraction surged from 30 billion tonnes in 1970 to 106.6 billion tonnes in 2024, an average annual growth of 2.3% per year. While large disparities exist, to satisfy global demand each person now uses on average 13.2 tonnes of materials per year. This is up from an average of just 8.4 tonnes per person fifty years ago.

The composition of material use on a global scale has also changed profoundly over the last five decades. As countries transitioned from agrarian to industrialized and urban systems, growth in materials demand reflected the minerals-based materials and energy systems that are typical of industrialized nations.

All environmental impacts are on the rise in absolute terms, and there was no absolute decoupling of any environmental impact on the global scale. Environmental impacts from resource use could derail global sustainability, climate, and biodiversity goals, as well as pollution reduction objectives.
Compared to historical trends, it is possible to reduce resource use while growing the economy, reducing inequality, improving well-being and dramatically reducing environmental impacts.

Bold policy action is critical to phase out unsustainable activities, speed up responsible and innovative ways of meeting human needs and promote social acceptance of the necessary transitions.

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BIOMASS

This factsheet provides key data and information on biomass extraction and processing including: its environmental impacts, future outlooks of extraction under two scenarios and policy recommendations for the sustainable use and management of biomass.

Biomass **(agricultural crops and forestry) covers crops, grazed biomass and fodder crops, wood and wild catch and harvest.**

Biomass extraction over time

Even though the proportion of biomass used decreased, the total tonnage of biomass demand increased. Countries in the early stages of economic development tend to rely more on biomass-based materials and energy systems.

1970 – 2020:
+12 billion tonnes
(from 13 to 25 billion tonnes),

↓

an average increase of **1.3% per year**

2021 – 2024:
+1 billion tonnes
(from 26 to 27 billion tonnes),

↓

an average increase of **1.2% per year**

Crop harvest
Grew at an annual rate of 2.2% over the last five decades and was the most important component of biomass extraction in 2020, making up around 40% of the total.

Grazed biomass
Grazed biomass for livestock animals grew at a similar rate to crop harvest.

Share of biomass use relative to total material use over time

*While the share of biomass has gone from **41 per cent to just over 25 per cent** between 1970 and 2020, biomass extraction has increased in absolute terms, **almost doubling***

41% (1970) → **33%** (2000) → **25%** (2020)

Share of biomass use by provisioning system (2020)

Energy :
0.30 billion tonnes
(5% of the system's material demand)

Food:
20 billion tonnes
(84% of the system's material demand)

Built environment:
2 billion tonnes
(7% of the system's material demand)

Mobility:
1 billion tonnes
(4% of the system's material demand)

Other:
3 billion tonnes
(30% of the remaining systems' material demand)

Environmental impacts of (growing and harvesting) biomass

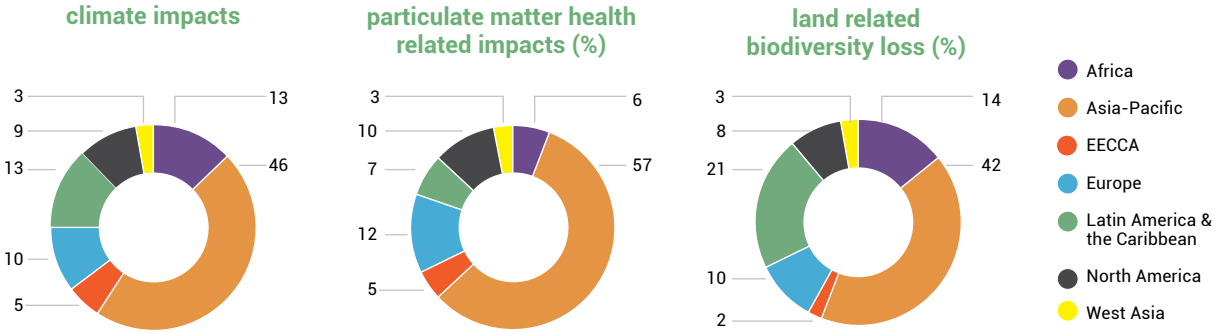
28% of global climate impacts

9% of global particulate matter health impacts

92% of global water stress

97% of global land-use related biodiversity loss

Regional shares (%) of environmental impacts of growing and harvesting biomass



- Almost 75% of land-related biodiversity impacts come from agriculture, while forestry accounts for 23%.
- Most impacts occur in Latin America, Africa and Southeast Asia and the Pacific.
- This reflects the concentration in tropical regions and islands of endemic species leading to high biodiversity loss when natural habitats are lost.

Future outlooks

Historical Trends scenario, by 2060: Continued growth of biomass use ...

- Total biomass extraction: 43 billion tonnes (+75% compared to 2020)
- Increase in biomass driven by food (80%) and energy (<16%) demand
- Area of agricultural land: +5%

Sustainability Transition scenario, by 2060: Growth peaks and then declines...

- Total biomass extraction: 32 billion tonnes (+31% compared to 2020)
- Increase in biomass driven by food (41%) and energy (<1%) demand
- Area of agricultural land: -5%

Policy recommendations

- Design a circular and sustainable bioeconomy, which uses biomass in cascades, for long-term applications, which work as biogenic carbon storage and replace materials with high impacts.
- Stop and reverse the conversion of natural ecosystems that are biodiversity- and carbon-rich.
- Direct finance and trade to promote sustainable livelihoods and remove harmful agricultural subsidies.
- Source biomass (e.g. wood) only from sustainable forestry.
- Promote regenerative agricultural practices to restore soils, sequester carbon and enhance biodiversity.
- Reduce demand for the most impactful food commodities.
- Dietary shift to move away from animal protein and reduce food loss and waste.

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MATERIAL RESOURCES FACTSHEETS

NON-METALLIC MINERALS

This factsheet displays key data and information on non-metallic minerals extraction and processing including: its environmental impacts, future outlooks of extraction under two scenarios and policy recommendations for the sustainable use and management of non-metallic minerals.

Non-metallic minerals **are materials mostly used for construction such as sand, gravel, limestone gypsum and clay, but also other materials for industrial applications.**

Non-metallic minerals extraction over time

Non-metallic minerals are the largest component of material use and posted a fivefold increase in extraction levels, from 9.6 billion tonnes to 45.3 billion tonnes between 1970 and 2024. This level is close to 50 per cent of all total global materials extracted and is related to the massive build-up of infrastructure in many parts of the world.

1970 – 2020:
+35.7 billion tonnes
(from 9.6 to 45.3 billion tonnes),

↓

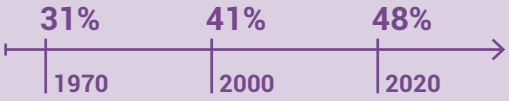
average increase of
3.2% per year

2021 – 2024:
+4.9 billion tonnes
(from 47.4 to 52.3 billion tonnes),

↓

average increase of
3.35 % per year

Share of non-metallic minerals use relative to total material use over time



Share of non-metallic minerals by provisioning system (2020)

Energy :
0.6 billion tonnes
(9% of the system's material demand)

Food:
2 billion tonnes
(8% of the system's material demand)

Built environment:
23 billion tonnes
(76% of the system's material demand)

Mobility:
18 billion tonnes
(64% of the system's material demand)

Other:
2 billion tonnes
(20% of the remaining systems' material demand)

Environmental impacts of (extraction and primary processing) of non-metallic materials

9% of global climate impacts

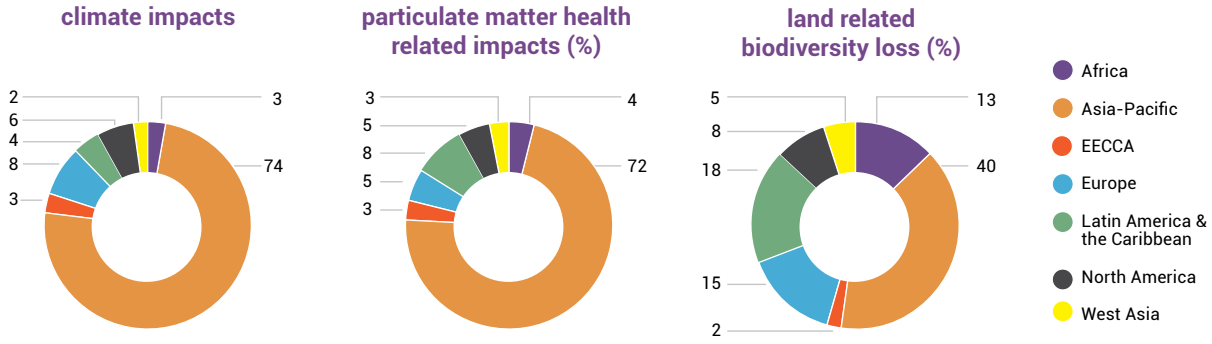
10% of global particulate matter health impacts

1% of global water stress

<1% of global land-use related biodiversity loss

Regional shares (%) of environmental impacts of extraction and primary processing of non-metallic minerals

Environmental impacts strongly differ across regions and impact categories (data for 2022):



- The built environment provisioning system - which relies up to 76% on non-metallic minerals - contributed to 17% of total global climate change impacts.
- Half of the climate footprint of the built environment is attributed to cement, bricks, and other concrete elements.

Future outlooks

Historical Trends scenario, by 2060: Continued growth of non-metallic minerals use ...

- Total non-metallic minerals extraction: 86 billion tonnes (+63% compared to 2020)

Sustainability Transition scenario, by 2060: Growth peaks and then declines...

- Total non-metallic minerals extraction: 68 billion tonnes (+28% compared to 2020)

Policy recommendations

- Sustainable construction and urbanization strategies are crucial to avoid massive increases in climate impacts. The use of carbon-intensive materials like cement or steel should be reduced and/or replaced with lower impact alternatives.
- Sustainable construction should rely on material and energy efficient building design and use of materials that can store (biogenic) carbon over long periods of time, for instance biomass whenever feasible - and always sourced at sustainable rates, from sustainable forestry at locations with low ecosystem impacts.
- Sustainable urbanization calls for urban design that maximizes the use of buildings and infrastructure and minimizes its material and environmental footprint.
- Demand-side measures are also critical, with strategies including reducing the use of floor area per person, in line with the concept of sufficiency.

MATERIAL RESOURCES FACTSHEETS

FOSSIL FUELS

This factsheet displays key data and information on fossil-fuels extraction and use, with a special focus on global trade, their major environmental impacts, future outlooks of extractions under two different scenarios and policy recommendations from both a consumption and production perspective.

***Fossil fuels* include coal, anthracite, lignite, peat, gas, oil and tar sands.**

Fossil fuels extraction over time

Fossil fuels are the most traded primary materials contributing almost half of global trade of materials in 2020. While their share of global extraction has decreased and the use of coal has stagnated, there has been an increasing reliance on coal energy to process materials, especially metals, construction materials and chemicals. More than half of global coal use was used for the production of these materials. Imports of fossil fuels have increased five times between 1970 and 2020, and continued increasing between 2021 and 2024 (5.5 % increase).

1970 – 2020:
+9.3 billion tonnes
(from 6.1 to 15.4 billion tonnes),

↓

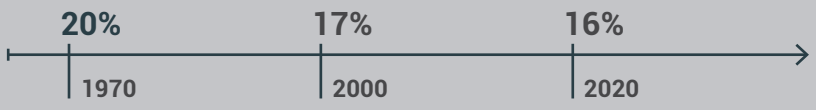
average increase of
2.1% per year

2021 – 2024:
+1 billion tonnes
(from 16 to 17 billion tonnes),

↓

average increase of
1.99 % per year

Share of biomass use relative to total material use over time



Natural gas use has had a growth rate of on average 2.8% per year, while coal had a growth rate of 2.1%, both of which were higher than petroleum, which had a growth rate of 1.3%. This is due to the expanded use of coal and gas-fired power stations for electricity generation.

In recent years, the use of coal has stagnated because of lower gas prices, an increase in renewable energy sources, and improvements in energy efficiency, contributing to a slowdown in global coal consumption.

Share of fossil fuels by provisioning system (2020)

Energy :
4 billion tonnes
(65% of the system's material demand)

Food:
1 billion tonnes
(6% of the system's material demand)

Built environment:
3 billion tonnes
(9% of the system's material demand)

Mobility:
5 billion tonnes
(19% of the system's material demand)

Other:
3 billion tonnes
(29% of the remaining systems' material demand)

Environmental impacts of (extraction and primary processing) of fossil fuels

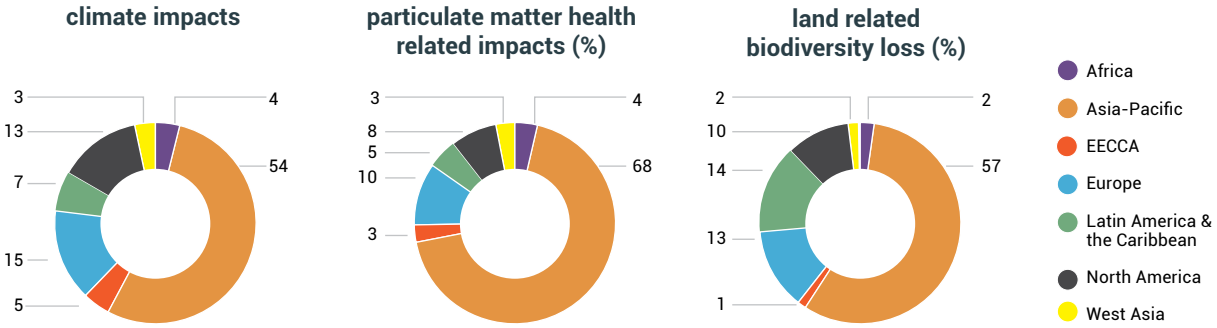
18% of global climate impacts

8% of global particulate matter health impacts

2% of global water stress

<1% of global land-use related biodiversity loss

Regional shares (%) of environmental impacts of fossil fuels use



- Almost all climate impacts of private mobility and heating, and more than 25% of the climate footprint of the built environment are attributed to fossil fuels.

Future outlooks

Historical Trends scenario, by 2060: Continued growth in fossil fuels use …

- Total fossil fuel extraction: 16 billion tonnes (+8% compared to 2020)

Sustainability Transition scenario, by 2060: Growth peaks and then declines…

- Total fossil fuel extraction: 6 billion tonnes (-57% compared to 2020)

Policy recommendations

- The energy transition is one of the main responses to climate mitigation. This includes transitioning away (phasing out / down) from the use of fossil fuels and deploying clean energy sources. These strategies are expected to have profound social and economic implications.
- Countries will need to support workers and related communities displaced from the fossil fuel industry and address possible inequities based on gender or related to access to the opportunities created by new energy technologies.
- Decreasing material requirements as part of transitions to renewable energy systems – including by applying sustainable production and consumption, resource efficiency and circular economy strategies – can contribute to achieving a clean energy transition for all countries within planetary boundaries.
- In parallel to boosting renewable solutions, it is essential to stop subsidies to fossil fuels production and investments in related infrastructure and energy-intensive industries, and to direct finance into sustainable alternatives.

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METALS

This factsheet provides key data and information on metals extraction and processing including : its environmental impacts, future outlooks of extraction under two scenarios and policy recommendations for the sustainable use and management of metals.

***Metals* include major engineering metals such as iron and steel, aluminium or copper, as well as precious metals (e.g. gold or platinum) and specialty metals (e.g. cobalt or tungsten).**

Metal extraction over time

While metals are the smallest share of all material categories, they have experienced a more than threefold increase since 1970 (from 2.6 billion to 9.6 billion tonnes) and contribute significantly to global climate impacts (8 per cent) and particulate matter health related impacts (13 per cent). Fifteen per cent of the climate impacts of the built environment is attributed to metals. Urbanization is driving increases in iron ore extraction, while the key role of metals, especially those essential for energy transition technologies, is projected to lead to very high increases in metals demand up to 2050. Metal ores contribute a quarter of global trade. Imports of metals have increased more than 6 times between 1970 and 2020 and continued increasing between 2021 and 2024 (8.2% increase).

1970 – 2020:
+ 6.9 billion tonnes
(from 2.7 to 9.6 tonnes)

↓

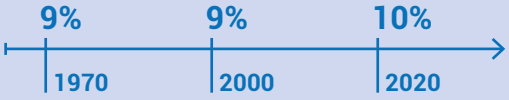
average increase of
2.6% per year

2021 – 2024:
+0.8 billion tonnes
(from 10 to 10.8 tonnes),

↓

average increase of
2.5% per year

Share of metals use relative to total material use over time



Share of metals by provisioning system (2020)

Energy :
1 billion tonnes
(21% of the system's material demand)

Food:
0.3 billion tonnes
(1% of the system's material demand)

Built environment:
2 billion tonnes
(8% of the system's material demand)

Mobility:
4 billion tonnes
(13% of the system's material demand)

Other:
2 billion tonnes
(21% of the remaining systems' material demand)

Environmental impacts of (extraction and primary processing) of metals

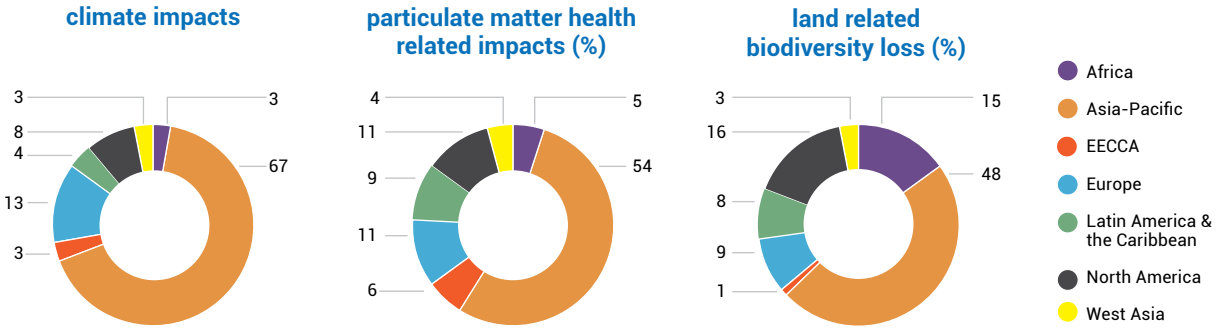
8% of global climate impacts

13% of global particulate matter health impacts

2% of global water stress

<1% of global land-use related biodiversity loss

Regional shares (%) of environmental impacts of extraction and processing of metals



Future outlooks

Historical Trends scenario, by 2060: Continued growth in metals use …

- Total metal extraction: 17 billion tonnes (+70% compared to 2020)

Sustainability Transition scenario, by 2060: Growth peaks and then declines…

- Total metal extraction: 9.4 billion tonnes (-6% compared to 2020)

Policy recommendations

- Metals will play a key role in the energy transition, with likely increases in the demand for metals, include the scaling up of renewable energies and the electrification of mobility. Developments in these systems should try to minimize the demand for the most impactful materials and make sure low-income material producing countries get a fair share of the derived socio-economic benefits.
- Taxes on resource extraction can be used to enable local areas to retain larger shares of the value of resources extracted from them. However, challenges remain: examples of implementing resource taxes remain scarce, and comprehensive feasibility assessments are currently lacking in the literature.
- Environmental and just transition considerations are to be integrated in trade agreements and finance regulations.