Energy transition: Opportunities, challenges and policy actions

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Outline

- Energy transition.
- Clean energy technologies and raw materials.
- Opportunities and challenges.
- Policy actions.

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Energy transition

What is energy transition?

- The shift from fossil-based systems of energy production and consumption (oil, gas and coal) to renewable energy sources like solar wind and water, as well as lithium-ion batteries.

- A crucial enabler of sustainable development and a pathway to mitigate climate change.

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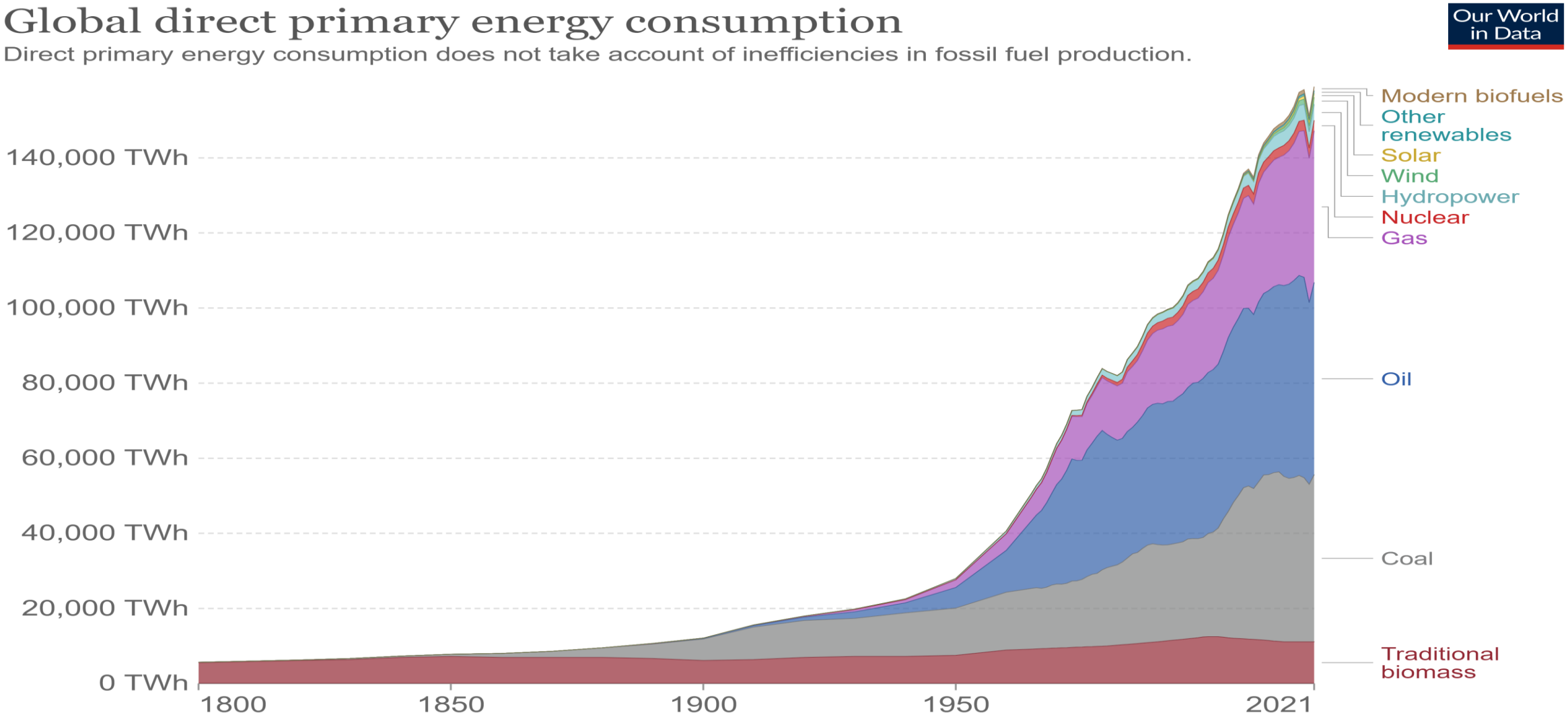
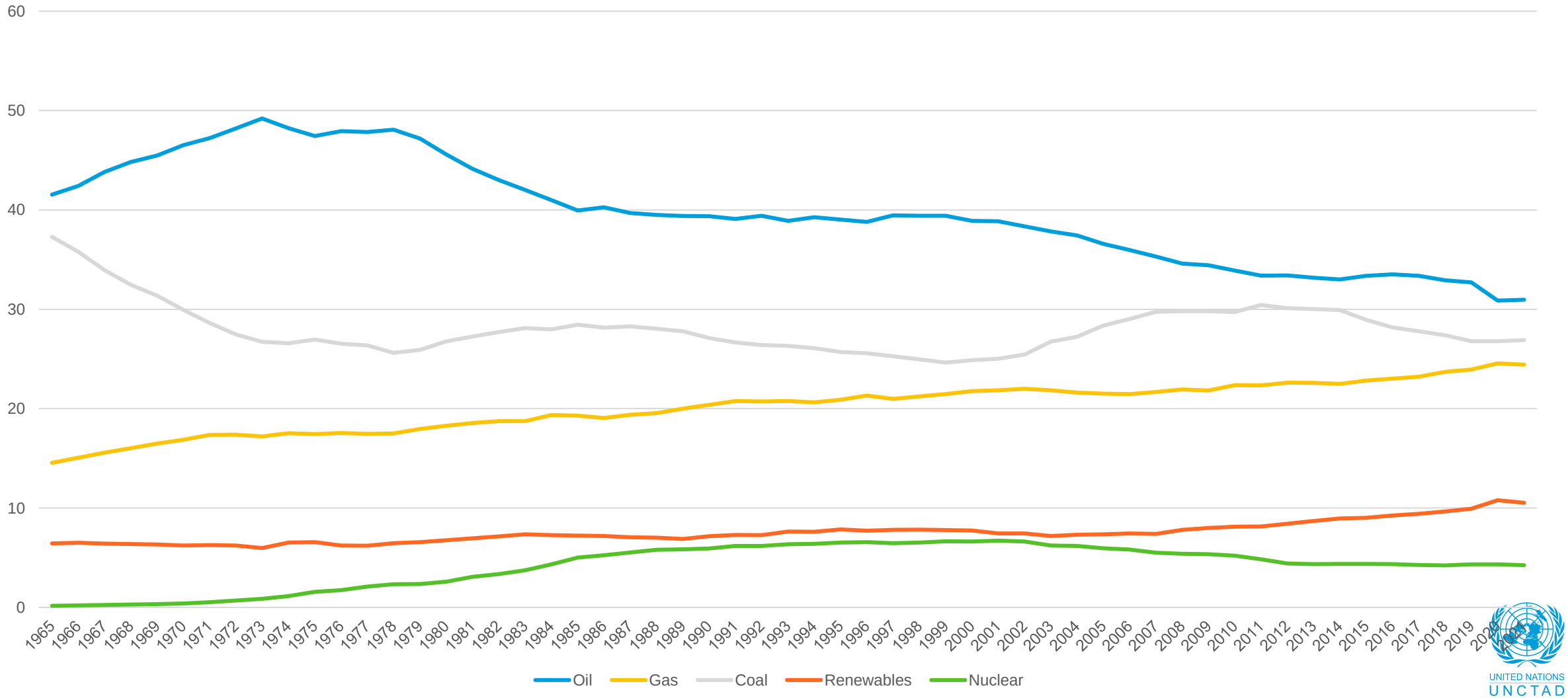
History of energy transition



Share of energy types in total energy consumed

(1965 to 2021)



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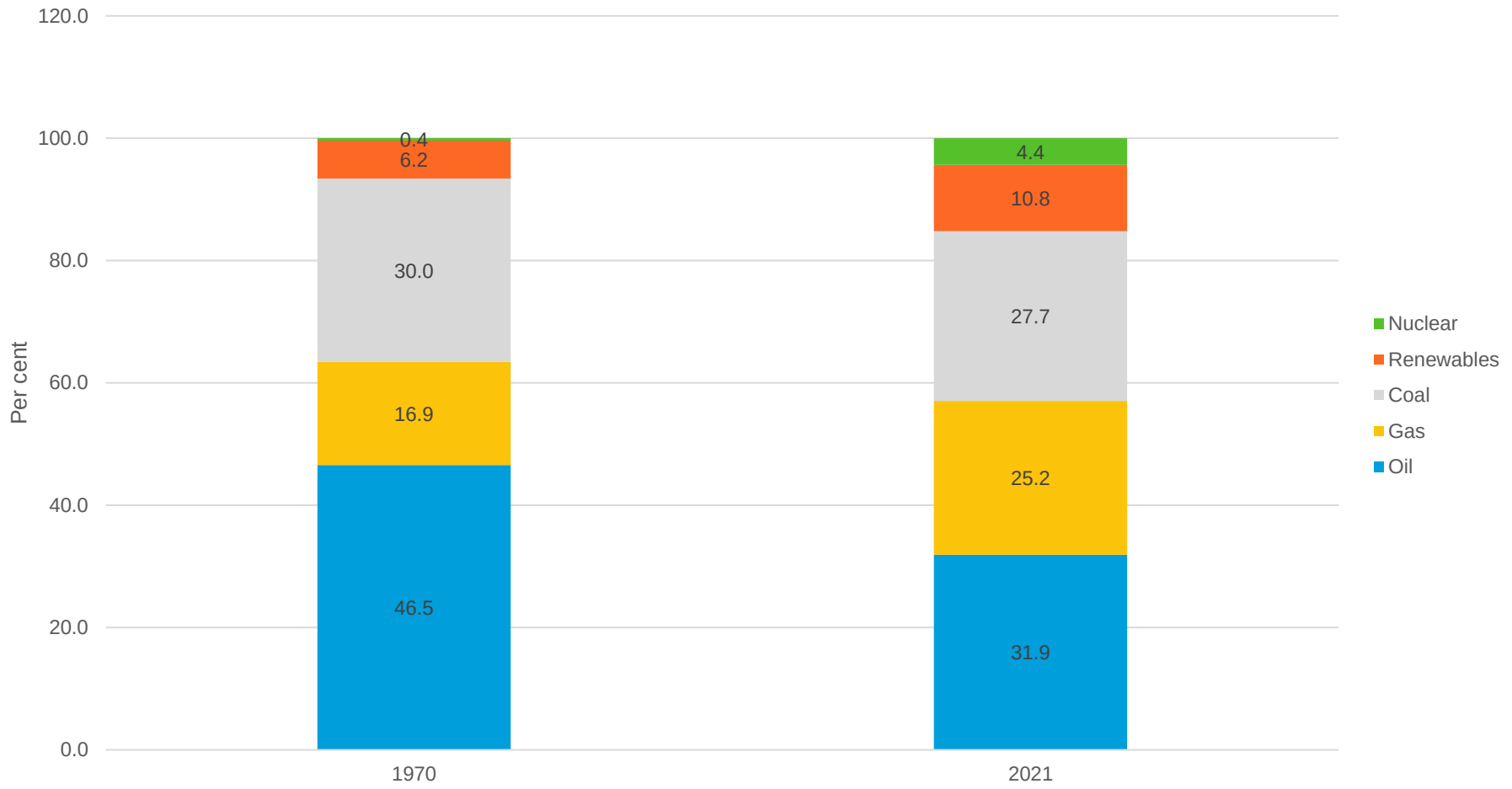
Source: BP

Comparison of energy types consumed

(1970 and 2020)



Source: BP

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The carbon cycle

- Nature's way of transferring carbon atoms between different carbon reservoirs on Earth.
- Carbon is stored in reservoirs like rocks, soil, the oceans, atmosphere, and vegetation.
- Carbon is released naturally by decomposing vegetation and other biomass, outgassing from ocean, venting volcanoes, wildfires, belches from ruminant animals.
- Excess carbon in the atmosphere warms the planet.
- Excess carbon in the ocean makes the water more acidic, putting marine life in danger.
- Human activities (eg. burning fossil fuels) raising carbon emissions, and deforestation disturbing balance to keep planet safe.

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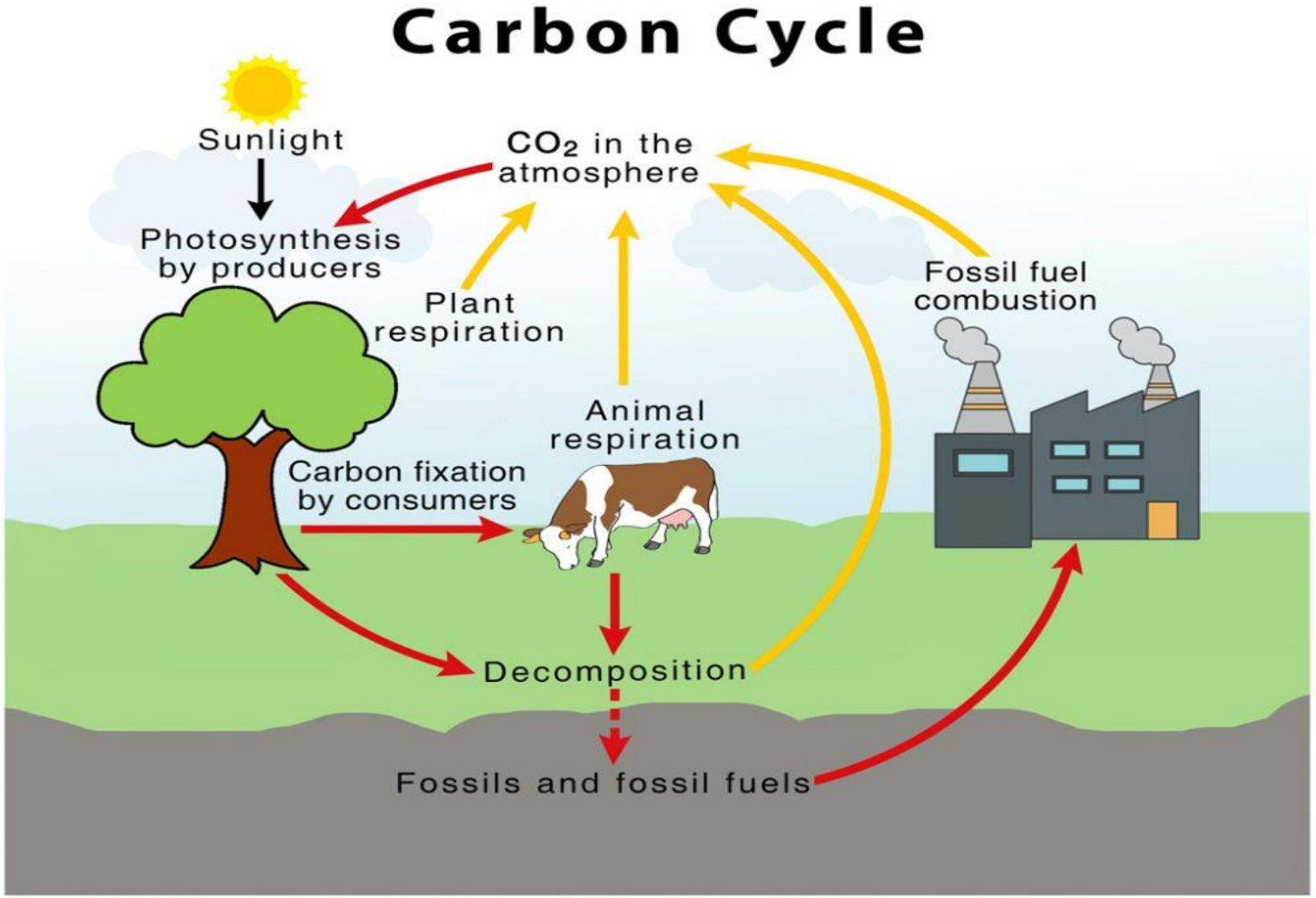
Carbon cycle



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Energy transition and climate change

- Energy sector accounts for about two thirds of global greenhouse gas emissions (IPCC).
- A substantial reduction in fossil fuel use is required to limit the increase in global average temperature.
- Affordable and reliable technologies (e.g. solar panels and wind turbines) are available to bring down global emissions and start the drive down to net zero.
- Renewable energy, coupled with energy efficiency, and widespread electrification can provide 90% of the CO2 emissions reductions needed by 2050 (IRENA).

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Clean energy technologies and raw materials

Available clean energy technologies

Renewables and electricity generation

- Approx 30 per cent of the world's electricity comes from renewable sources, compared to 20 per cent in 2011 (IEA and REN21).
- The biggest share is hydropower, followed by solar and wind, bioenergy and geothermal power (REN21).
- Ren. electricity generation grew by about 8 per cent in 2021, reaching 8,300 TWh, the fastest year-on-year growth since the 1970s (IEA).
- Renewable energy accounted for an estimated 70 per cent of the US$530 billion spent on all new power generation capacity in 2021 (IEA).

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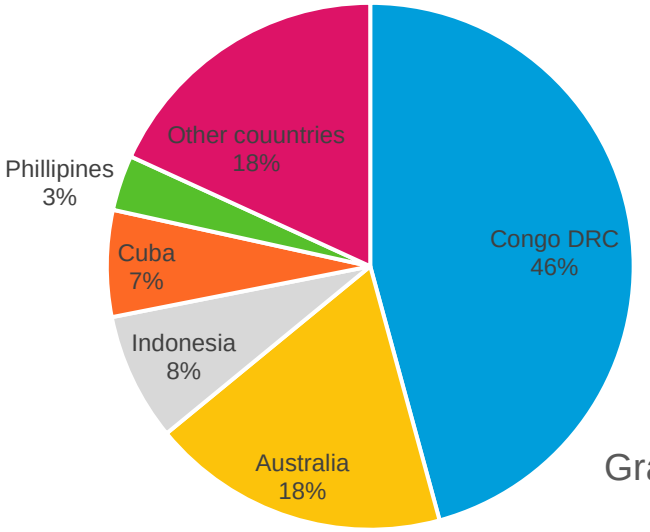
Mineral needs for clean energy technologies

	Copper	Cobalt	Nickel	Lithium	REEs	Chromium	Zinc	PGMs	Aluminium
Solar PV	High	Low	Low	Low	Low	Low	Low	Low	High
Wind	High	Low	Mod	Low	High	Mod	High	Low	Mod
Hydro	Mod	Low	Low	Low	Low	Mod	Mod	Low	Mod
CSP	Mod	Low	Mod	Low	Low	High	Mod	Low	High
Bioenergy	High	Low	Low	Low	Low	Low	Mod	Low	Mod
Geothermal	Low	Low	High	Low	Low	High	Low	Low	Low
Nuclear	Mod	Low	Mod	Low	Low	Mod	Low	Low	Low
Electricity networks	High	Low	Low	Low	Low	Low	Low	Low	High
EVs & bat. Storage	High	High	High	High	High	Low	Low	Low	High
Hydrogen	Low	Low	High	Low	Mod	Low	Low	High	Mod

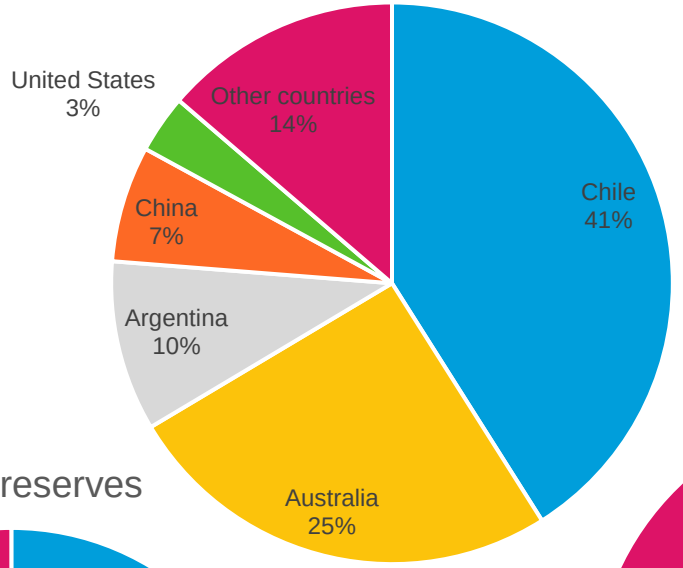
Source: IEA

Reserves

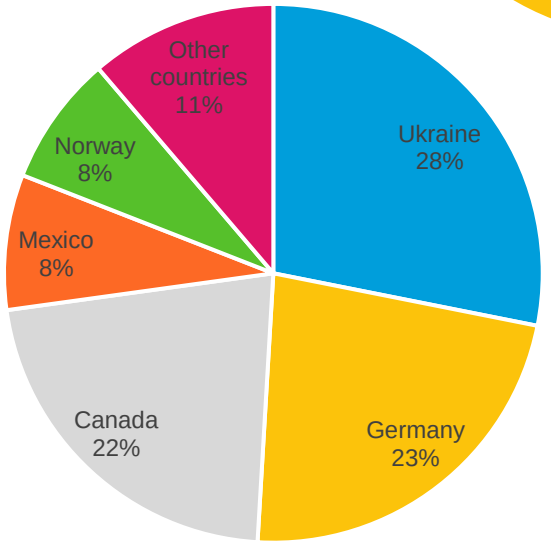
Cobalt reserves



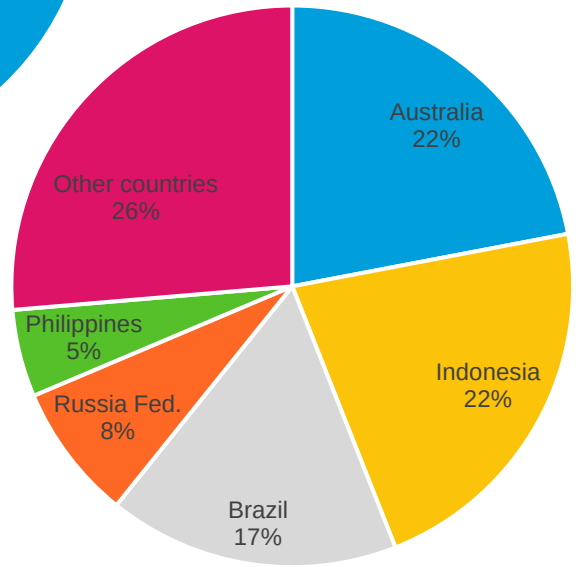
Lithium reserves



Graphite reserves



Nickel reserves



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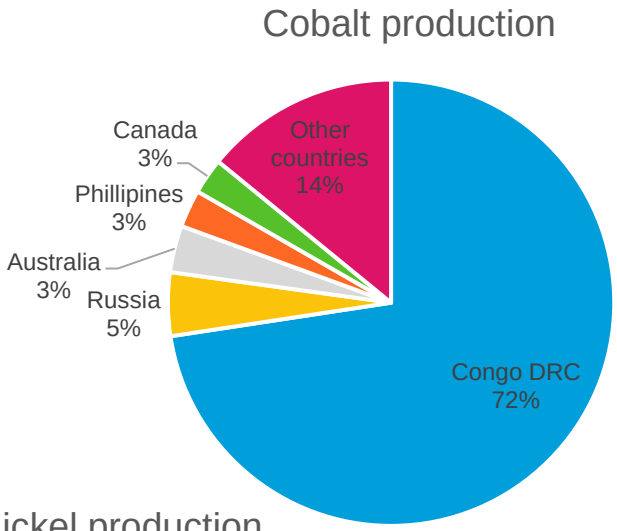
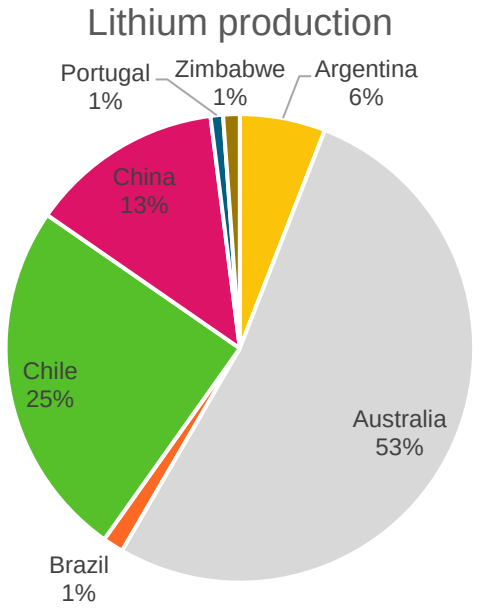
Where they are produced

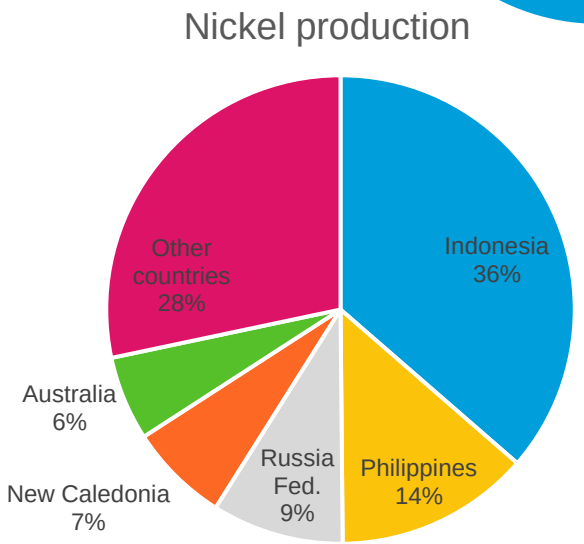
Copper	Main producers - Africa	Main producers - Rest of the world
Copper	DRC, Eritrea, Mauritania	Australia, Canada, Chile, Indonesia, Kazakhstan, Mexico, Peru, Poland, Russian Fed., US
Cobalt	DRC, Madagascar, Zambia, Morocco	Australia, Canada, China, Cuba, Indonesia, P. New Guinea, Phillipines, Russian Fed., US
Nickel	Madagascar, Zambia	Australia, Brazil, Canada, China, Indonesia, France, Phillipines, Russia Fed., US
Lithium	DRC*, Mali*, Zimbabwe	Argentina, Australia, Brazil, Chile, China, Portugal, US
REEs	Burundi, Madagascar, Tanzania, South Africa	Australia, Brazil, China, India, Russian Fed., Thailand, US, Vietnam,
Chromium	Madagascar, South Africa, Sudan	Finland, India, Kazakhstan, Turkey
PGMs	Ethiopia (platinum only), South Africa, Zimbabwe	Canada, Russian Fed., US,
Nat. Graphite	Madagascar, Mozambique, Tanzania	Austria, Brazil, Canada, China, Cuba, Indonesia, Korea (DPR), Germany, India, Mexico, Russian Fed., S. Lanka, Turkey, Ukraine, Uzbekistan, Vietnam

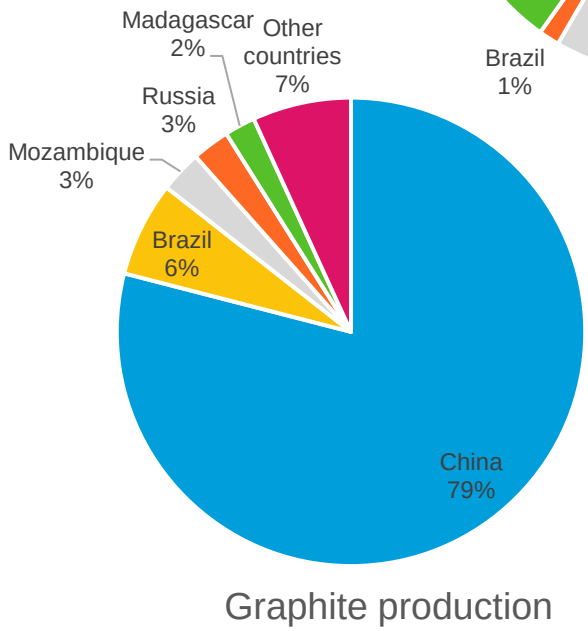
Source: UNCTAD

Production









Source: USGS (2021 est)

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Demand forecast

- Energy sector represented a small part of total demand for most minerals until the mid-2010s.

- CETS share of total demand expected to rise significantly over the next two decades – 2x in the IEA Stated Policies Scenario and 4x in the Sust. Development Scenario.

- Copper and rare earth elements used in CETS forecast to rise by over 40%, Nickel and cobalt by 60-70%; Lithium by almost 90% by 2040 (IEA).

- By 2026, global renewable electricity capacity is forecast to rise more than 60% from 2020 levels to over 4 800 GW – equivalent to the current total global power capacity of fossil fuels and nuclear combined (IEA).

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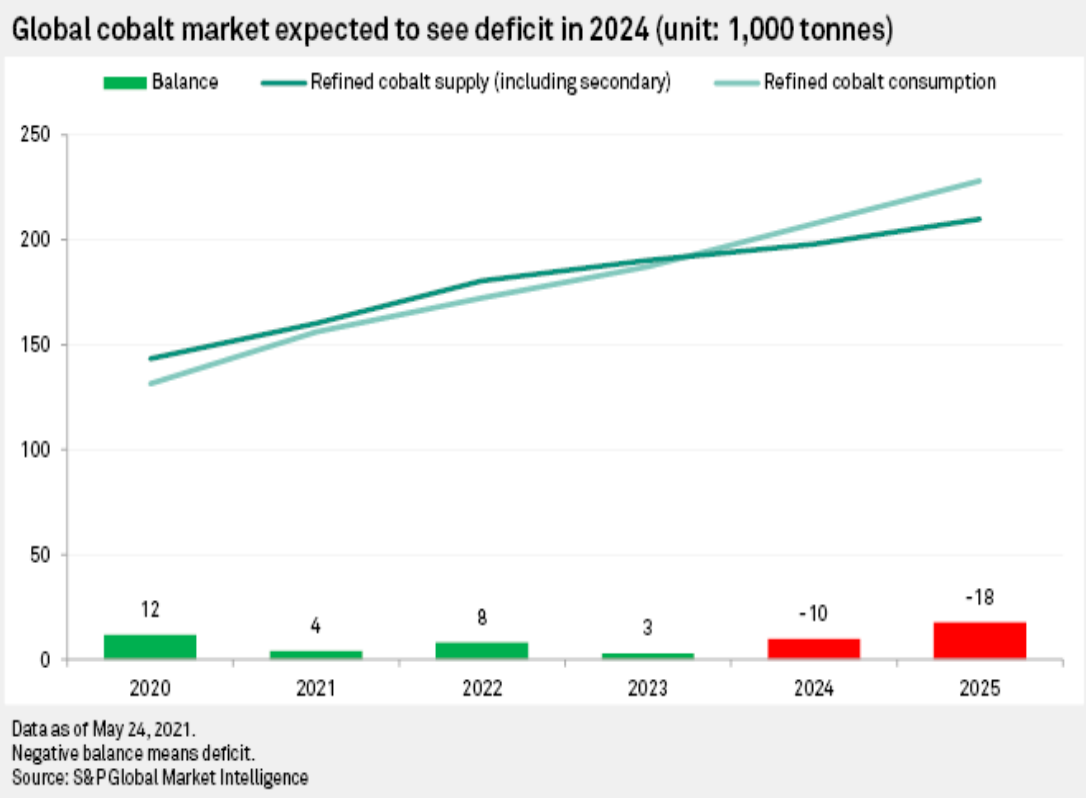
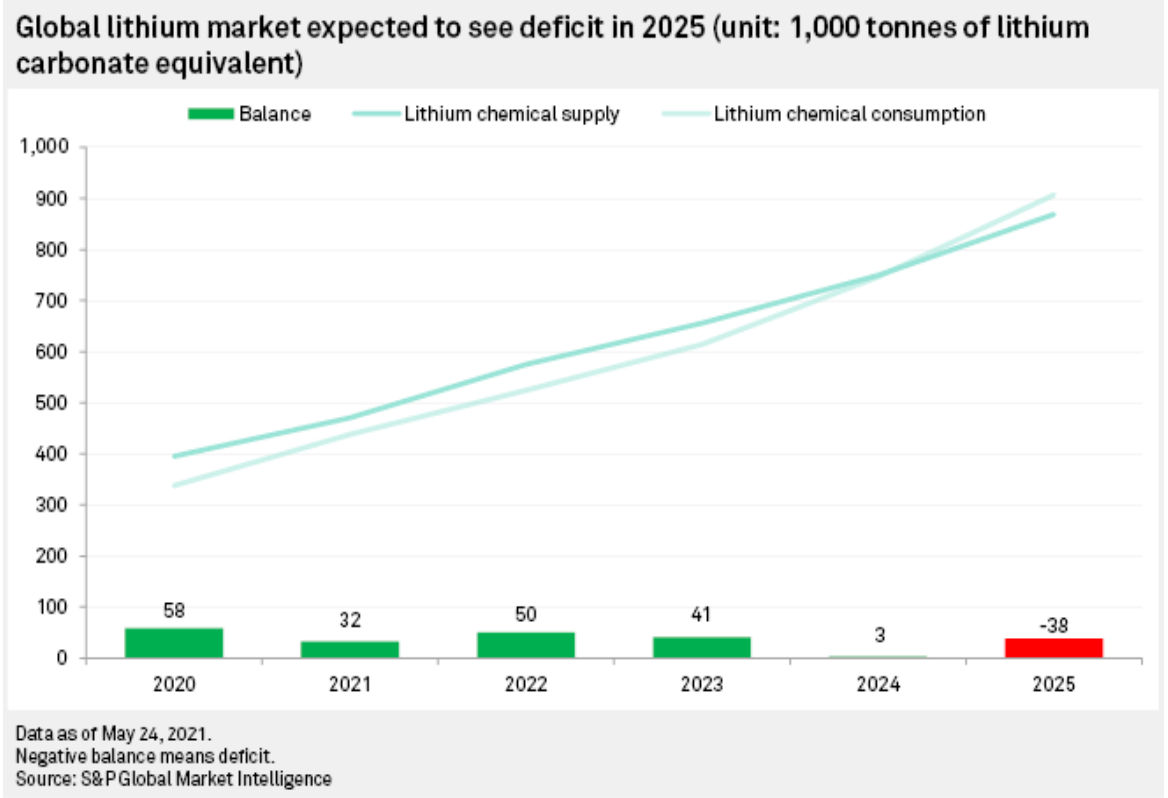
Lithium and cobalt markets

Active components such as cobalt and lithium are central to the development and deployments of renewable energy technologies





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Opportunities and challenges

Opportunities (1)

- Diversify energy supply and reduce dependence on imported fuels.
- Provide affordable energy whose price is decoupled from geopolitical events that can trigger fossil fuel supply issues and consequent price hikes.
- Energy security and stable energy prices.
- Create employment – by 2030 an estimated 24-25 million new jobs would be created by energy transition, far in excess of 6-7 million lost (ILO).
- Improve public health and access to energy.

Opportunities (2)

- Expand electrification in rural areas through stand alone electricity grid solutions (micro grids).
- Boost revenue from exports of raw materials used in CETs.
- Recover and recycle component materials to lessen demand for critical raw materials, thus reduce environmental impacts from mining.
- Domesticate supply chains and establish downstream industries in resource rich countries.

Challenges (1)

- High initial cost of investments - updating infrastructure or investing in expansion is an integral part of the energy transition and an enabler of modern technologies.
- Lack of access to technologies for a large-scale energy transition.
- Social acceptance issues – NIMBY.
- Supply is variable for some renewable energy technologies, much more than other means of energy generation.
- Expensive storage costs.

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Challenges (2)

- Availability of raw materials - Security of supply for cobalt and lithium may be problematic.
- Boosting production may lead to environmental and human rights challenges; lack of capacity.
- Potential issues of child labour associated in mining critical raw materials, with scrap collection in recycling; environmental issues with processing materials.
- Lack of government policies to support adoption of renewable energy technologies.

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Way forward

Policy actions to facilitate transition (1)

- Reform domestic policy frameworks to streamline and fast-track renewable energy projects and catalyze private sector investments.
- Increase private and public investments in renewable energy (including technology, infrastructure (new and old)) – at least $4 trillion needed until 2030 to allow us to reach net-zero emissions by 2050.
- Set ambitious renewable energy targets that provide certainty to investors, developers, consumers and producers.
- Remove fossil fuel subsidies and use the revenue gained for investment in renewable energy technologies - $5.9 trillion spent in 2020 on subsidizing the fossil fuel industry.

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Policy actions to facilitate transition (2)

- Encourage energy efficiency to decarbonize power sector and support integration of renewable energies in the energy mix for electricity generation.
- Share technologies (e.g., small modular nuclear reactors, hydrogen).
- Encourage research into storage technology.
- Develop skills needed in the renewable energy industry.
- Financial and technical support of advanced economies and multilateral institutions is needed to succeed in transitioning to low-carbon energy systems.

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Thank you!

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