



Photo: Matthew Henry

The global clean energy transition constitutes an important part of the climate agenda. The energy sector together with fossil fuels use in industry, transport and buildings contribute nearly 80 percent of the global greenhouse gas emissions.^[10] The purpose of this brief is to highlight major trends and targets in the energy sector based on internationally agreed climate policies such as the Paris Agreement. The brief focuses on what clean energy transition means for emerging market and developing economies (EMDEs).

The world's energy supply must change fundamentally in order to limit global warming to well below 2 °C and there is still a possibility to limit warming to 1.5 °C. This would require that societies become net zero emitters by 2050, meaning that 80 percent of the global energy supply must change within less than 30 years. The window of opportunity to secure a liveable and sustainable future for all is however rapidly closing. Missing this window of opportunity is foreseen to lead to a multi-millennial change in the global mean temperature beyond 1.5 °C bringing along a multitude of risks for different forms of life. ^[10]

Decisions made now regarding energy supply and end use for the coming decades, in particular in EMDEs, will be pivotal for the future global climate.

The majority of emissions in EMDEs in Central and South America, Eurasia, North America and sub-Saharan Africa are covered by net zero emissions pledges, but mostly in a non-legally binding policy document or in an oral pledge. ^[7]

Almost 700 million people still do not have access to electricity and more than a quarter of the global population depend on burning traditional biomass and waste for their cooking needs, most of which live in South Saharan Africa. ^[17] Populations are quickly growing in EMDEs. ^[9] Investments in clean¹ energy will have to sevenfold in EMDEs, excluding China, in order to meet the growing demand and also the targets of the Paris Agreement ^[8].

Based on the IPCC latest assessment report, the International Energy Agency, IEA presents a Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach. This also entails that all people should have access to clean energy by 2030.^[7]

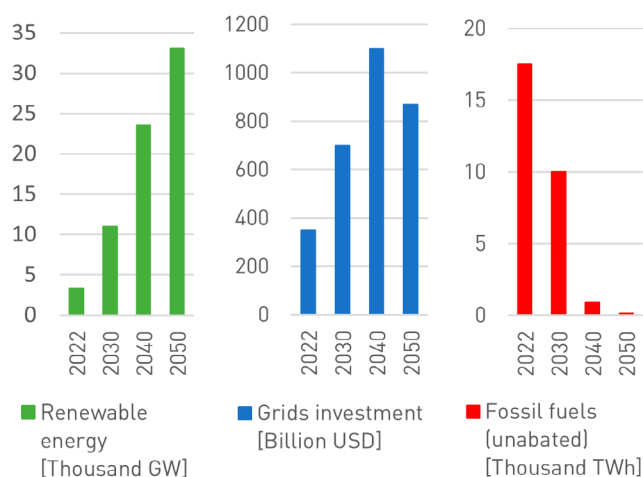
According to the IEA roadmap, a global energy transition to net zero by 2050 will require a pace up of energy efficiency measures, more energy from renewable sources and more electrification throughout numerous sectors of society. This in turn requires an increase in transmission, distribution and storage solutions. ^[9]

In all parts of the world, electricity should be the first energy sector to reach net zero emissions, creating opportunities for electrification in other sectors to further drive down emissions. ^[7]

1 Clean energy in the IEA Net Zero Roadmap: In power, clean energy includes generation from renewable sources, nuclear, fossil fuels fitted with CCUS, battery storage, and electricity grids. In efficiency, clean energy includes energy efficiency in buildings, industry, and transport excluding aviation bunkers and domestic navigation. In end use applications, clean energy includes direct use of renewables; electric vehicles; electrification in buildings, industry and international marine transport; CCUS in industry and direct air capture. In fuel supply, clean energy includes low emissions fuels

Figure 1 below shows the central global milestones within the electricity sector for the IEA net zero pathway, including a tripling of investments in renewable energy and a doubling of investments in grids by 2030, as well as a significant decrease in fossil fuels (-95 percent) by 2040. [7]

Figure 1: Key milestones in the electricity net zero pathway



The shift brings a new dimension to the global energy related trade and investment needs. Fossil fuel trading will decrease and metal trading will increase.

CLEAN ENERGY INVESTMENTS RISE

The cost of renewables, particularly solar PV and wind, has fallen sharply in the latest decade. Global investment in clean energy in early 2023 outstrip investment in fossil energy by a factor of 1.7. Five years ago the ratio was 1 to 1 and it rises to 10 to 1 in 2030 in the IEA net zero scenario, when around USD 2.5 trillion is invested in clean electricity and low-emissions fuels and around USD 1.8 trillion in energy efficiency and end-uses, while investment in fossil fuel supply falls to around USD 0.4 trillion. [7]

Many clean energy solutions have high initial costs though, and the cost of capital is about 2 to 3 times higher in EMDEs. This is challenging since a grand part of the clean energy investments will have to be debt-financed. Bringing down the cost of capital by reducing real and perceived risks is a key challenge for the clean energy transition in EMDEs. [8]

FOSSIL FUEL PEAK

For the first time since its establishment in 1973, the IEA foresees that the global demand for fossil fuels will peak no later than 2030. [9] This projection is based on demand as stated in national energy policies. Fossil fuels have been indispensable for development and economic growth throughout industrialisation and still account for the largest share of energy investment in

many EMDEs. Some of the major fossil fuel resource owners are EMDE's. On a regional basis, Middle East, Europe and Euro Asia invest more in fossil than in non-fossil energy. [8] In 2023, however, investment in oil and gas were significantly higher than the amounts needed with reference to announced pledges around the world. [8] This creates a clear risk of locking in fossil fuel use and putting the 1.5 °C goal out of reach. Also, profits were record high in 2022 as a result of geopolitical conflicts and gas price turmoil. High profits create an opportunity for the industry to diversify and invest in the energy transition. Fossil fuels will continue to be important, but the industry is foreseen to down-size considerably starting within less than a decade, and it still creates significant profits. Today, less than half of the oil and gas industry's unprecedented cash flow from the energy crisis is going back into traditional supply and only a small fraction to clean technologies. Instead dividends and net debt repayments increase. [13] Sida does not contribute financing to further investments in fossil fuel exploration, extraction and refinement.²

SIDAS ROLE AND PERSPECTIVE IN THE ENERGY TRANSITION

Sida contribute grants and mobilize capital for helping to provide individuals with access to clean reliable and affordable energy. Globally, the SDG7 co-benefits related to health and agricultural productivity are found to offset the costs of climate policy and contribute to increased global GDP. [16] By supporting access to energy, we enable economic growth and societal services, for example access to internet and early warning systems.

Links to Agenda 2030

Energy is central for both Agenda 2030 and the Paris Agreement. The Agenda 2030 Sustainable Development Goal 7 (SDG7): Affordable and Clean Energy aims to ensure that all individuals have access to reliable and affordable energy by 2030 and is strongly linked to climate change (SDG13). Further, energy has strong synergies with SDG 1-11; Poverty, Hunger, Health, Education, Gender equality, Water and sanitation, Jobs, Infrastructure, Reduced inequalities and Sustainable Cities. [16]

Clean energy is a health target as well since it helps reduce air pollutants and avoid that 3.6 million people's lives are shortened, predominately in EMDEs. [7] Also clean cooking solutions will be an important corner stone for avoiding diseases related to household air pollution, amounting to 3.2 million premature deaths in 2022, mostly among women and children. [7]

The clean energy transition creates job opportunities.

² Sida's Climate and Environment Policy was adopted in May 2022 and states that we do not support investments in energy systems based on fossil fuels.



MozCarbon fuel-efficient stove in Mozambique

According to IEA, the clean energy transition will render two new jobs in clean energy for every job that is lost in the current incumbent sector. New jobs are expected to be in low-emissions power, electric vehicles and batteries, grids and energy storage, end-use efficiency, low-emissions fuels and critical minerals. [7]

ENERGY EFFICIENCY OPPORTUNITIES

According to IEA, it will be required that energy efficiency ambitions are at least doubled for reaching net zero in by 2050. [9] This is also announced in the COP28 pledge on renewable energy and energy efficiency, which is ratified by Sweden and most of Sida's partner countries [3].

To achieve lower energy intensity levels, three equally important global actions are needed, all of which are supported by Sida: avoid, shift and improve energy end-use (refer to the diagram above). Sida's current multifaceted engagement in different energy end-use sectors provides an opportunity to effectively support energy efficiency.

For example, deploying heat pumps and energy efficient appliances is an impactful measure in growing economies and have reduced annual electricity consumption by around 15 percent in regions with long-standing policies. [7] Minimum Energy Performance Standards (MEPS) are being established in Sub-Saharan Africa³ and development finance can support its deployment.

Construction and building installation skills will be needed, since 60 to 80 percent of the building stock in developing markets and close to 50 percent in emerging markets must meet higher efficiency standards than today by 2050. [14] Building upgrades in non-OECD cities may generate between 2–16 million net new jobs per year by 2030. [16] Electric Vehicles are booming globally, and will become increasingly important in EMDEs. [5]

RENEWABLE ENERGY OPPORTUNITIES

Renewable energy for electricity generation must triple from 2022 to 2030, adding at least another 11,000 GW globally and at least 300 GW in Africa. [1] [7] This is also announced in the COP28 pledge on renewable energy and energy efficiency. [3]

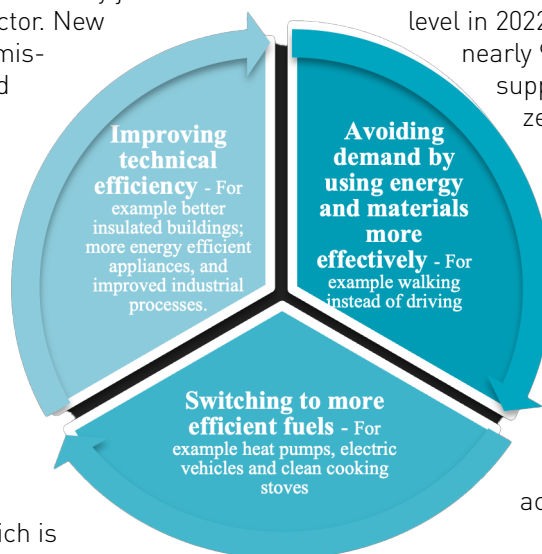


Figure 2: Three actions for lowering energy intensity

By 2050, the total installed capacity of renewables should be at least 30,000 GW, which is eight times the level in 2022. Renewables would generate nearly 90 percent of global electricity supply in 2050 according to the IEA net zero roadmap. Globally, solar PV is by far the fastest growing technology for power generation from renewable energy. [7] Independent Power Producers (IPPs) bound by Power Purchasing Agreements (PPAs) is a mature business model, but new skills are still required including for e.g. negotiating contracts, developing better agreement models, blended financing and actual technical implementation.

In the African Continental Master Plan, it is foreseen that electricity production will grow by a factor 2.4 and reach 2,375 TWh by 2040. Renewable energy will grow by a factor 14.3. Wind, (23 percent) solar (16 percent) and geothermal (1 percent) will together constitute 41 percent by 2040, according to the plan. It is estimated that more than

³ In Sub-Saharan Africa, Minimum Energy Performance Standards (MEPS) for lighting were adopted regionally in SADC and EAC by 2021 and 2022 respectively and 8 countries have already adopted these standards at national level. Lighting MEPS are adopted in DRC, Eswatini, Mozambique, Namibia and South Africa, Uganda, Kenya and Rwanda. In Namibia and Botswana, MEPS for Air Conditioners are as well adopted. (Dec. 2023)

2.3 million jobs will have been created by 2040, linked to solar PV and wind power alone. [2]

Different policy scenarios assumes different movers where early retirement or repurposing of coal-fired power plants in Asia on the one hand and more aggressive transition policies in developed economies on the other contribute more or less to creating additional room for clean energy to expand in these regions. [7] Whichever way, to reach net zero by 2050, unabated⁴ fossil fuels for power generation must be cut significantly and by 2040, unabated coal power should be completely ceased. [7]

Appropriate policies are needed to address causes of the high cost of capital in EMDEs. In addition, well designed policies for the decommissioning, early retirement or repurposing of coal power plants will be required. [7] Unabated fossil fuels as a group should be reduced to not more than 5 percentage of the generation mix by 2040 in order to align with the Paris agreement. [7] Based on these forecasts, Sida does not support extensive investments in power generation based on fossil fuels.⁵ Nuclear will play a role in the IEA net zero roadmap as well and in particular after 2030.

POWER GRID CHALLENGES

It will be instrumental that electricity distribution and transmission grids are given higher priority in energy investments. Electricity transmission and distribution grids need to expand by around 2 million kilometres each year to 2030. Total investment need to double by 2030 to provide adequate system flexibility, without which there is a risk of rising amounts of surplus solar PV and wind power at times when output exceeds demand. Grid investment planning need to be done now, since grids require more lead time than power plants. [7] Developing business models that create mutual trust and shared benefits among countries and investors will be key.

ELECTRICITY STORAGE AND MANAGEMENT

In electricity systems with much variable renewable energy, batteries and demand response play a critical role in meeting hourly variability. [7] The integration of energy and storage systems can help overcome the challenges of intermittent power supply and improve the reliability of electricity access through digital devices such as sensors, meters, and communication systems. [15] Moreover, demand for low-emissions hydrogen will likely grow; particularly in heavy industry,

transport and for the production of hydrogen-based fuels. [6]

The demand for batteries is currently mostly driven by the car industry and is causing an increased demand for critical minerals needed in battery production. [5]

Master planning and investment prospectus

A country's Long-Term Low-Emissions Development Strategy (LT-LEDS) could include sites for large Solar PV and Wind-turbines as well as a grid master plan, including a layout of needs in transmission, distribution and storage as well as cross-border power trade, e.g. in power pooling or bilateral agreements. Decentralised renewable energy could be designed for inclusion in the grid master plan, in particular in Sub Saharan Africa. Low emission buildings and public transport will be important factors.

RISK OF RESOURCE CONSTRAINTS

Apart from long lead times for new infrastructure, there is a risk that sourcing the needed skills and materials for energy transition may be increasingly difficult. Skills development and education will be instrumental. Developed economies have increasingly recognised the concentration risks as well as human rights aspects in countries that supply material resources for the needed technologies, such as rare earth metals. Among the minerals which are crucial for the future of power systems are copper⁶, rare earth elements (REE)⁷, silicon⁸ and lithium⁹. In terms of absolute volumes, copper dominates total demand for critical minerals from the electricity sector. The current demand of over 5 million tonnes per year is foreseen to rise to 13 million tonnes. Relative to current levels, demand for lithium for battery storage systems rises most sharply, by over 20-fold by 2030 and almost 50-fold by 2050, while demand for copper, silicon and REEs rises by around three-times by 2050 relative to 2021. [7] In terms of supply, the following countries hold leading positions in the mining of key minerals: Australia (lithium), Chile (copper and lithium), China (graphite, rare earths), the Democratic Republic of the Congo (cobalt), Indonesia (nickel), and South Africa (platinum, iridium). When it comes to processing, China controls 100 percent of the refined supply of natural graphite and dysprosium (a rare earth element), 70 percent of cobalt, and roughly 60 percent of lithium and manganese. [12]

⁴ Abatement technologies typically refer to CCUS, Carbon Capture Utilisation and Storage

⁵ In June 2023, fossil fuel based power and heat generation was included in criteria on grounds for exclusion, except in limited and clearly defined circumstances that are consistent with a 1.5°C warming limit and the goals of the Paris Agreement

⁶ Copper is used extensively in the electricity transmission and distribution grids, but its conductive properties also make it an essential component for low-emissions power generation technologies such as solar PV panels, wind turbines and batteries

⁷ Rare earth elements (REEs) are used to manufacture the permanent magnets for the motors of direct drive and hybrid wind turbines (accounting for 30 percent of wind power installations in 2021).

⁸ Silicon is used to manufacture solar panels.

⁹ Lithiumion batteries are the fastest growing storage technology in the world, making lithium indispensable for future electricity systems.

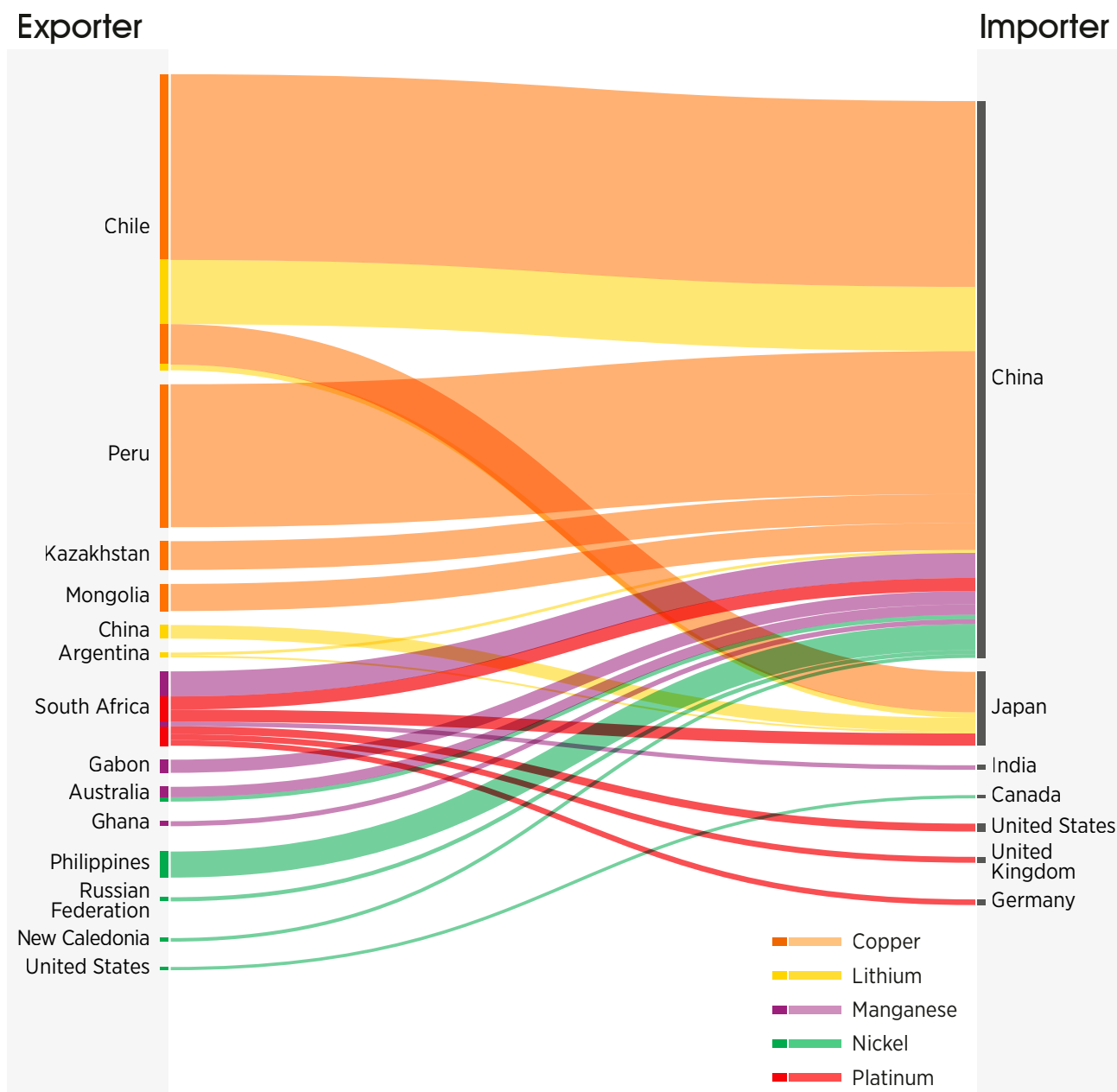


Figure 3: Top bilateral trade flows by value for five materials in 2022. © IRENA 2023

The diagram above shows the top bilateral trade flows by value for five critical materials in 2022: copper, lithium, manganese, nickel and platinum. Copper is the most valuable material by trade value. The figure shows how important mining is to several, relatively small economies such as Chile and Peru and that China is among the top importers of minerals, even though it is commonly perceived as dominating critical material supply chains. [12]

In the global metal mining sector, energy transition minerals, which used to be a small segment of the market, are moving to centre stage in the mining and metals industry. [4]

In light of the foreseen surge for minerals, Africa could position itself as a major sustainable supplier of strategic and rare minerals and products needed for large scale expansion of renewable energy. Development funding can support that environmental, social and corporate governance (ESG) concerns are addressed and that strong supply chains are established. [15] End-of-life management and recycling of renewable energy products as well presents a significant challenge and job opportunity. It's estimated that by 2050, 78 million metric tons of solar panel waste could accumulate worldwide, which could be worth as much as USD 15 billion if recovered. [11]

KEY MESSAGES

The window of opportunity for limiting global warming to 1.5 °C is rapidly closing.

Long term low emission development scenarios (LT-LEDS), including grid master planning and investment prospectus for RE power plants, power grids, low energy buildings and public transport schemes are important.

Phasing out of fossil fuels is important, for example through giving priority to electricity from non-fossil sources, and ceasing inefficient fossil fuel subsidies that do not address energy poverty. If possible, ask for certificate of origin and “green” electricity. Suggest this to partners.

Make use of Sida’s risk reduction schemes such as Challenge funds, Results Based Funding and Guarantees to lower cost of capital and pace up investments in clean energy.

Support that specific MEPS targets are included in the next NDC and engage in labelling programmes for buildings and appliances. Advise partners to opt for energy efficient appliances and buildings and encourage the deployment of MEPS.

Support skills development, education, job creation and material recycling including decent working conditions in mines and the metal value chain, buildings construction and transportation.

REFERENCES AND FURTHER READING

1. African Union (2023), The African Leaders Nairobi Declaration on Climate Change and Call to Action
2. AUDA-NEPAD (2023) Continental Master Plan SSS [Specific Support Studies](#)
3. COP28 (2023): Global Renewables And Energy Efficiency Pledge (draft Dec 8 2023, signed by 123 countries so far, including Sweden)
4. IEA (2023) Critical minerals market review, IEA, Paris
5. IEA (2023), Global EV outlook 2023: Catching up with climate ambitions
6. IEA (2023), Hydrogen, IEA, Paris
7. IEA (2023), Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach, IEA, Paris
8. IEA (2023), Scaling Up Private Finance for Clean Energy in Emerging and Developing Economies, IEA, Paris
9. IEA (2023), World Energy Outlook 2023, IEA, Paris (p 124)
10. IPCC, 2023, Climate Change 2023: Synthesis Report.
11. IRENA (2016), End of life Management Solar Photovoltaic Panels
12. IRENA (2023), Geopolitics of the energy transition: Critical Minerals
13. IRENA (2023) World Energy Investments 2023
14. IRENA (2023), World Energy Transitions Outlook 2023: 1.5 °C Pathway
15. Res4Africa Foundation (2023), Africa’s Energy Future is Renewable: Its sustainable economic development depends on it
16. UN DESA (2023) Synergy Solutions for a World in Crisis: Tackling Climate and SDG Action Together
17. WHO, UNSD, IRENA; IEA (2023), Tracking SDG7 The Energy Progress Report