

## Climate Transition: A World of Compromises

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The world has embarked on a journey to rid itself of energy sources that emit so much greenhouse gas that they warm the Earth's climate to the point of endangering the sustainability of human life. But after years of technological progress, investments, and global climate commitments, 85% of global energy consumption still comes from fossil fuels.<sup>1</sup> It is not that the transition is too hard or too expensive, but rather that this big transformation of the global economy will require a thousand compromises and trade-offs along the way.

This is because energy transition needs to hit a trifecta. The energy sources that should replace fossil fuels need to be simultaneously clean, affordable, and reliable. However, no renewable energy source today meets all three conditions. Wind and solar energies may be clean and, for some rich countries, affordable, but they are not reliable, since they depend on the wind to blow and the sun to shine. Hydropower is available only in countries endowed with mountains and rainfall. Geothermic energy, extracted from the core of the Earth, is expensive. Power derived from biomass and biofuels, through wood burning, grain fermentation or oil conversion, requires land, water, and a fair amount of fertilizer. Clean hydrogen is a promise in suspense, until electrolysis turns affordable.

Coming close to the trifecta will require making at least three difficult compromises and tempering our aspirations with hard-nosed pragmatism.

First, unlike underground fossil fuels, renewables compete for land with crops, livestock, people, and nature. Since renewables have a lower energy intensity than fossil fuels, a lot of land is needed to produce the same amount of power. It would take an area seven times the size of Paris covered in solar panels to power the city. Local communities that oppose expanding land use for renewables are not just “not in my backyard” reactionaries but often have reasonable concerns about biodiversity or the natural or cultural environment. Things get complicated when environmental concerns get in the way of saving the environment, and both sides need to compromise.

Second, the energy transition will require extracting and moving around vast amounts of underground resources. Renewables require much larger quantities of minerals and metals than the energy source they replace. An electric vehicle, its charging station, and connection to the grid require some 100kg of copper, six times more than a conventional car. It also needs 61 different metals, including lithium, nickel and cobalt.<sup>2</sup> Solar panels and wind turbines rely on copper, as well as a dozen or so other metals each. The International Energy Agency has estimated that in a scenario that would keep the global temperature rise below 2° C from pre-industrial levels, as called for in the Paris Agreement, demand for 17 minerals would increase four-fold by 2040.<sup>3</sup> Most of these minerals are abundant on the planet. But extracting them involves expensive investments and faces social, environmental, and geopolitical obstacles. A new mine takes on average seven years to come to activity. Bolivia holds the world's largest reserves of lithium but has been unable to start production due to concerns about water pollution and the governance of profits.

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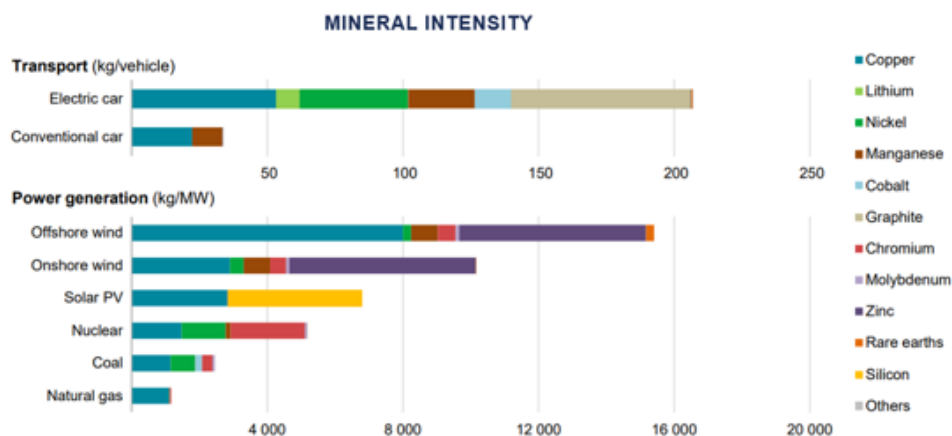
<sup>1</sup> [BP 2021 Statistical Review of Energy](#).

<sup>2</sup> International Energy Agency, 2021, [The Role of Critical Metals in Clean Energy Transitions](#).

<sup>3</sup> See footnote 2.

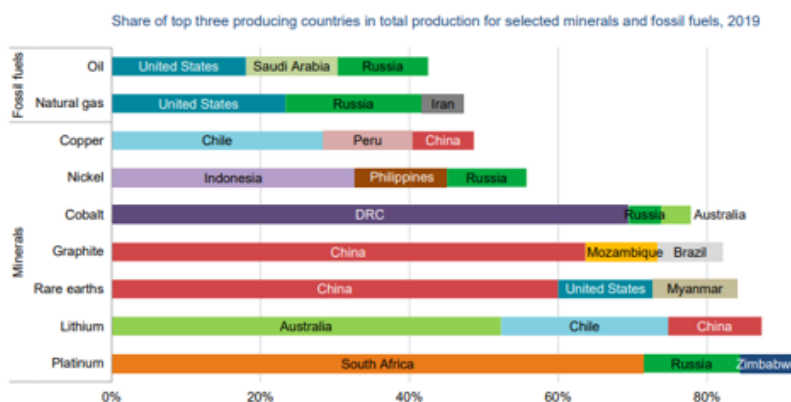
22 July 2022 | Research Note

In Europe, Portugal and Serbia had to let go of their lithium ambitions due to environmental concerns. Shortages are coming. If we are not prepared to accept and invest in more mining, there will be no energy transition.



Source: International Energy Agency, 2021

Third, the energy transition will require new partnerships and alliances. The mineral resources required for the switch to renewable energy are geographically concentrated. Australia, DR Congo, and Southeast Asia control more than 75% of the mining of lithium, cobalt, and nickel.<sup>4</sup> Chile and Peru control most of copper production. China rules the market for rare earths and dominates the process of refining the minerals. Any country that wants to expand renewable energy generation will need to invest in a completely different set of strategic partnerships than the ones they had for oil. Some mineral-rich countries, particularly in Southeast Asia and Africa, are also more exposed to climate-related disasters and would have a strong incentive to collaborate with countries that want to cut pollution.<sup>5</sup> Energy transition is not the same as energy security: it will increase interdependence and require a shift in alliances.



Source: International Energy Agency, 2021

<sup>4</sup> See footnote 2.

<sup>5</sup> Standard & Poor's, [Assessing Countries' Vulnerability to Economic Losses from Physical Climate Risks](#), 2022.

22 July 2022 | Research Note

If the energy transition calls for a comprehensive grasp of the big picture, it also needs a careful consideration of the technical details. Today, there is no clean energy source besides nuclear that is stable, transportable, and sufficiently powerful to serve as baseload. We cannot ‘green’ our energy mix unless we have a stable energy grid to plug into. The storage technology that could ensure the continuity of supply based on renewables does not yet exist. If they want 24/7 electricity, households that install solar panels on their rooftops—often financed by government subsidy—must understand they need to continue to connect to the existing grid, and finance it and its maintenance. Governments also need to make the upgrades needed to accommodate a gradually rising share of wind and solar.<sup>6</sup> There is also no clean energy solution for industrial use and for sea and air transport. Banks and asset managers that withdraw from financing fossil fuels before sustainable alternatives are available in a sufficient scale can boast that they are “greening” their balance sheet; but in reality, they are doing little to ‘green’ the broader economy that still needs those fuels.

Compromising on the use of little-loved nuclear and fossil fuel-based energy sources is inevitable in the foreseeable future. A switch to smart demand management, using the cloud to match demand and supply, could help manage scarcity during the transition, but it faces opposition from data privacy advocates. These trade-offs are hard, but refusing to face them will handicap the achievement of countries’ net-zero commitments.

What will success look like a decade from now? Looking back, we will not see a first-best solution or a one-size-fits-all optimal path. Instead, we will be looking at a lot of hard and messy compromises along the way.

- The road to energy transition will be paved with good fossil fuel intentions and management. Decarbonisation will have to be managed cautiously. A clear path of carbon pricing can help make the direction of travel clear, and carbon capture can alleviate the impact.
- Where possible, ensuring a clean and powerful baseload energy supply in the form of nuclear power will be key for a smooth transition.
- Mining will need to increase and securing supply will require making new—and sometimes uneasy—partnerships. Moreover, prices will inevitably rise to reflect scarcity and stimulate supply. Higher prices could also help address some of the environmental and social costs.

These compromises require leadership and global cooperation. Unless a momentous crisis, such as a series of climate disasters, spurs the emergence of a new mechanism for international cooperation, we will need to rely on existing structures. At the global level, the G-20 could step in and play the leading role. Without leadership and coordination, extreme climate events, competition for resources and, potentially, social unrest may undermine the transition. In the absence of coordination, it will be investors and markets that will need to drive these compromises and advance the transition. If this fails too, or takes too long, authoritarian regimes may arise.

Investors should understand that any investment they make will involve a messy compromise. Pretending the transition is too complicated and expensive is irresponsible. Betting on renewables that cannot scale yet and carry their own challenges will not pay off either. Their decisions should both deliver returns and advance the transition in the context of these trade-offs.

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<sup>6</sup> The book “Shorting the Grid” (2020) by Meredith Angwin has all the details.

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