Myths are clouding the reality of our sustainable energy future

Adair Turner

Heatwaves, floods and droughts across the world are a wake-up call. We need to cut fossil fuel use fast, reducing CO_2 emissions to around zero by the middle of the century. To do that, we must electrify as much as possible, decarbonise electricity supply and use hydrogen, bioenergy, and carbon capture in applications where direct electricity use is not feasible.

Global electricity supply needs to expand by around four times; transmission grids must grow from 70mn km to around 200mn km; we must boost electric cars from 25mn to over 1bn. That implies big increases in mineral supply — seven times more lithium will be used per annum than in 2022, with copper use doubling.

Faced with this challenge, fears are multiplying — that mining will use huge quantities of scarce water, high lithium prices will make electric vehicles impossibly expensive or discarded solar panels will create a landfill disaster. We need to separate myths from real concerns — the Energy Transitions Commission's latest report aims to do that.

One thing we don't need to worry about is long-term supply: for all the key minerals, known resources easily exceed total future requirements. And one to place in context is the CO_2 or other greenhouse gases emitted when we use fossil fuel energy to produce the materials required for the first generation of wind turbines, solar panels, batteries and electrical equipment. These emissions could amount to a cumulative 15-35 gigatonnes of CO_2 equivalent over the next 30 years: but that compares with around 40 Gt CO_2 equivalent produced every year by the fossil fuel based energy system.

Land and water needs are also manageable. The roughly 5bn cubic metres of water needed annually for new mineral extraction compares with 2,700bn cubic metres used in food and fibre production; and all the solar PV farms and mine sites required would take up less than 2 per cent of the land area devoted to agriculture. Red meat consumption threatens the world's tropical rainforests; batteries for electric vehicles do not.

There are three key challenges. The first is growing supply fast enough to meet rapidly growing demand. There are enough copper and lithium sources to meet global needs in 2050 but the plans already announced for supply fall short of meeting likely demand in 2030. New mines and refineries must be built, financial flows to developing countries increased, and planning systems reformed to allow some mine and refinery development in rich countries.

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Second, new developments can have adverse local environmental effects. In aggregate, the adverse impacts will be more than offset by putting a stop to coal mining but that won't be true for some local communities. Best mining and refining practices can dramatically reduce harm — and must be required by regulation imposed on mineral producers and users. Communities should share in the profits generated, with the small additional costs accepted as the price to pay for more sustainable supply.

But environmental impacts can also be dramatically reduced via innovation and recycling, cutting the need for mining. New battery designs have reduced future cobalt needs by 50 per cent in just five years; nickel-free LFP batteries are now being used in 40 per cent of electric vehicles — up from 7 per cent in 2019; and by 2040, over 50 per cent of lithium used in new batteries could come from recycling. Regulation increasingly requires complete recycling of all battery materials.

Third, we should build more diverse supply chains. Almost 70 per cent of cobalt comes from the DRC, 48 per cent of nickel from Indonesia and 74 per cent of refined lithium from China, even though lithium resources are spread across the world. Significant concentration of mining is inevitable and decoupling completely from China would significantly increase costs — slowing progress towards a zero carbon economy. But policies to reduce reliance on imports make sense: the EU's objective to source 40 per cent of refined mineral supply domestically is a reasonable balance.

Mineral supply challenges must be clearly faced and managed. But we must also welcome the sustainable nature of the new energy system. In today's energy system, each year we burn 8bn tons of coal, 35bn barrels of oil, and 4tn cubic metres of gas, producing around 40bn tonnes of CO_2 equivalent. In the new system, we extract far smaller quantities of key minerals and place them in structures that generate, store and use clean electrical energy; and the materials are then ready to do the same again next year or to be recycled over and over again. This is an inherently renewable system, and the faster we build it the better.

The writer chairs the Energy Transitions Commission