

The fossil-free future for mineral-rich, emerging countries

Many of the important metals required for the transition to fossil-free energy production are found in the world's low- and middle-income countries. Commodity experts Magnus Ericsson, Olof Löf and Anton Löf sort out which of these countries can be the winners in the transition. And who can be the losers.

Authors: Magnus Ericsson, Luleå University of Technology, Luleå, Sweden
Olof Löf & Anton Löf, RMG Consulting, Stockholm, Sweden

The transition to a fossil-free future is, in part, a transition from hydrocarbons to metals. In a low-carbon future, demand for specific minerals and metals like copper, cobalt, lithium, nickel, graphite and several speciality metals will increase, sometimes dramatically. This means that those countries

with the potential for mining these minerals/metals will have a unique opportunity to benefit from the expected future growth in demand. Many of these countries are to be found among the mineral-rich, emerging countries.

In a study carried out in cooperation with the United Nations University World Institute for Development Economics

(UNU-WIDER), RMG Consulting studied chromium, cobalt, copper, graphite, lithium, manganese, molybdenum, nickel, niobium, palladium, platina, tantalum and the rare earth elements – all minerals/metals for a low-carbon future – and the mineral-rich, emerging countries which are set to benefit from a surge in demand for these specific minerals/metals.

Metals for a low-carbon future

Mineral	Wind	Solar photo-voltaic	Carbon capture and storage	Nuclear power	Light emitting diodes	Electric vehicles	Energy storage	Electric motors	Hydrogen vehicles	Electronics
Chromium	X		x	x	x					
Cobalt			x	x		x	x			x
Copper	X	X	x	x	x	x		x		x
Graphite						x	x			
Lithium						x	x			
Manganese	X	X	x			x	x			
Molybdenum	X	X	x	x	x					
Nickel	X	X	x	x	x	x	x			
Niobium	X									
Palladium									x	
Platina									x	
Rare earths	X					x				x
Tantalum										x

Source: World Bank & RMG Consulting 2020.



Low- and middle-income countries with mining of the twelve important metals required for the fossil-free transition.

Most of these twelve minerals/metals and the rare earth elements are relative minor in terms of production volume and value. In 2018, for instance, production levels were; 0.16 Mt of cobalt, 0.19 Mt of lithium, 0.16 Mt of rare earth elements and 50 t of rhenium. However, these twelve minerals/metals are of major importance in making a fossil-free future happen. The two major metals among the 13, copper and nickel, had production levels in 2018 of 20.4 Mt (for the former) and 2.3 Mt (for the latter) respectively. As a comparison, some 2,353 Mt of iron ore were produced in 2018.

The German Mineral Resources Agency has estimated that, by 2035, 5.3 Mt of additional copper compared to the production volume in 2013 will be necessary to meet the demand created by 42 emerging technologies, equivalent to 30 percent of the total copper production in 2013. Of the less voluminous metals, the demand for lithium could grow by; a factor of 110, for heavy rare earth elements (HREE) including dysprosium, for terbium by a factor of 3.7, for rhenium by a factor of 2.4 and demand for tantalum by a factor of 4.2.

Among the low- and lower middle-income countries (LICs, LMICs), 40 of them have existing production and/or identified resources/reserves of the minerals and metals necessary for the low carbon future scenario. This analysis included only operating mines or more advanced projects with a well-defined, identified resource. Grassroots exploration ideas were not included.

In 2018 the value of the 13 minerals/metals produced in the 40 countries was

almost USD 34 billion. Copper was the most important valuable metal in value terms in 2018. Its value at the mining stage was USD 18.5 billion, or 55 percent of the total value for the 13 commodities chosen. Nickel was next with a value of USD 6.8 billion (20 percent), followed by manganese at USD 3.6 billion (11 percent) and cobalt at USD 2.3 billion (7 percent). The other metals/mineral together constituted only seven percent.

Globally, in an economic perspective, these minor metals might seem negligible but, as stated before, they are all vital for new technologies and also have a strategic value. Furthermore, they are of considerable importance for each individual country which produces them. In fact, just one mine might make a difference. Laos and Eritrea are examples of countries which have recently started industrial-scale mining in just one or two mines - for copper and gold, and already their production contributes considerably to exports and state revenues.

DRC in top

The three countries with the highest value for mine production of the 13 raw materials are; the Democratic Republic of the Congo (DRC) with USD 7.6 billion, Indonesia with USD 6.2 billion and Zambia with USD 4.1 billion. Zimbabwe is the only country at present which has established production of most of these metals: 7 out of 13 including graphite.

Any country with a resource/reserve of one or more of the identified metals could potentially benefit from the low-carbon future. Copper and nickel

are the metals for which future demand increases will generate the highest levels of potential income in absolute terms, given their high production volumes and relatively high prices.

But, in which countries is it most likely that mining will have the most important economic impact? In order to answer this question, a scoring system was devised. The factors used were:

1. Number of M-LCF metals with a reported resource/ reserve. Score = 1 point per metal.
2. Exploration as a percentage of total mine production value. >10% - 10 points, 5-10% - 7 points, 1-5% - 5 points, 0.5-1.0% - 3 points, 0.3-0.5% - 1 point.
3. Countries MCI-W score 2018 - Score is that number divided by 10.
4. Number of M-LCF already in production. Score = 1 point per metal.
5. An established mining industry. Score existing mine production value >USD 1 billion) - 4 points, < USD 1 billion - zero points.

The maximum score was 50, i.e. 13 + 10 + 10 + 13 + 4 points. Zimbabwe scored best with 27 points in total. Zimbabwe benefits from resources/reserves from seven different metals; exploration is 0.46 percent of total mine production, which gives 1 point; the MCI-W score was 80, divided by 10 which gives 8 points; there is an established mining industry with production of seven of the LCF metals worth more than USD one billion giving four points. The next six countries in the ranking list were: Papua New Guinea, DRC, Tanzania, Zambia, Cote d'Ivoire and the Philippines. Among the top 20 countries, there were no fewer than 14 African states. ➤➤

Given the somewhat arbitrary nature of our scoring system, the list should not be taken as a definitive ranking of the countries most likely to benefit from a low carbon future scenario. It was only a first attempt. But it does provide a useful indication as to which countries are more likely to benefit than others. Not surprisingly, it is the resource-rich countries which have an established mining industry that are the most likely to be able to use the energy transition to their benefit. Those countries which do not already have a proven mineral-rich geology, and which historically lack mining and exploration experience, are the least likely to benefit.

In fact, there are significant differences between the countries which were identified as having the potential to benefit from the energy transition. These differences relate to a variety of practical matters that together might influence a country's ability to take advantage of its potential.

Considering the relatively modest investments made globally in the 13 minerals/metals studied, it seems that higher prices for a longer period of time are needed to boost invest-



Platinum Group Metals (PGM) may take on a new role if the use of electric vehicles increases; from exhaust gas purification in "fossil engines" to other functions in hydrogen-powered vehicles. The image from the Mogalakwena platinum mine in South Africa.

ment. This will happen when demand outstrips supply. The present situation might give the resource-rich, emerging countries time to prepare. One important factor when it comes to attracting investment is an interesting geological background. In addition, there needs to be clear mineral and taxation laws, with political stability, and systems in

place with which to fight corruption, as well as the necessary infrastructure (or at least the opportunity to invest in the infrastructure). There would seem to be an opportunity here for leading mining countries and companies within the mining sphere to supply the resource-rich, emerging countries with know-how. There is a clear need in these

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Unki Mine in Zimbabwe, with platinum mining. The mine, owned by Anglo American, has one of the largest platinum reserves in the country.

countries for investments both in its institutions and in exploration.

Countries affected by falling demand for oil/gas and coal

For some countries that are dependent on coal, oil and gas exports, the effect of a transition to a fossil-free scenario could mean less income from the extractive sector and exports.

Renewables will quickly become a more important energy source in any transition scenario, although coal, gas and oil will still dominate until 2040. Of the 77 LIC and MIEC countries, three countries have important coal

exports: Mongolia, Mozambique and Indonesia.

What is likely to happen if a rapid transition scenario becomes a reality? Part of the answer is that a large fall in coal consumption would be more likely to take place initially in the more advanced economies of the EU, the US and China rather than in the LICs and LMICs. This reduced global demand for coal would not, however, hit the LICs and LMICs in the short term, since as low-cost producers they would still be able to export their production albeit possibly at a lower price. However, at present it is difficult or even impossible to guess the extent of the outcome.

Conclusion

The transition to a fossil-free future is, in part, a transition from hydrocarbons to metals. This means that a number of countries with the potential for mining the minerals and metals necessary for the production of renewable energy sources have a unique opportunity to benefit from the expected future growth in demand for these products.

It is clear that a number of Low- and Lower Middle-Income countries, in Af-

rica in particular, are well endowed with the metals needed for a low-carbon future. If these countries already have an existing mining industry, then the possibilities to benefit from the transition to a fossil-free world are bright. The extractive sector can make a difference and revenues from the industry can benefit the economy. It will not be an easy task, however, and it is not at all certain that this future potential will result in actual social and economic development to the benefit of the people in those countries unless their governance is improved.

Despite these potential problems, the opportunities and rewards presented by the decarbonization of the global economy will be considerable for those that engage. Swedish companies, authorities, universities and organisations, with their knowledge and experience of the mining industry, are at the forefront of electrification, automation, safety, environmental protection etc. This is the know-how which is essential to make the transition to a fossil-free future a reality. It could truly be a win-win situation, where Sweden can lead and build something better in partnership with the world. ■

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