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# The energy transition, critical minerals and industrialisation in sub-Saharan Africa.

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# The energy transition, critical minerals and industrialisation in Sub-Saharan Africa: Needs, opportunities and strategies

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Abstract
The energy transition, evidenced by continuing resolutions to limit fossil fuel production and consumption to tackle climate change, has become one of the most hotly debated contemporary geopolitical issues. On the other hand, Sub-Saharan Africa (SSA), which has an abundance of both fossil fuels and critical mineral resources, remains the least diversified continent and is highly vulnerable to external shocks, such as seen with the coronavirus (COVID-19) pandemic. Recognising the crucial role of the mining sector-specifically the role of critical minerals, this chapter adds to the energy transition literature by examining two under-explored questions: firstly, what is likely to be the longer-lasting implication of the energy transition away from fossil fuels for SSA?; and secondly, can the region leverage clean energy to drive industrialisation while learning from past failed attempts? Based on a critical analysis of several decades of industrialisation and development literature in Africa, we posit that the energy transition in the SSA context cannot and must not just be about reducing emissions or decarbonisation as the foremost objective. This is because SSA has the lowest share (less than 4%) of global greenhouse gas (GHG) emissions but faces acute energy poverty. Furthermore, while there are clear opportunities for green industrialisation and other industries without smokestacks, we demonstrate that these can co-exist with traditional resource-based industrialisation. However, there is a need to address structural bottlenecks that impede innovation, such as providing reliable and cheap power and a stable investment regime and business environment. These findings provide insights into how African policymakers can identify windows of opportunity within the energy transition to implement interventionist policies focused on developing linkages and value chains to industrialise.

Keywords: Energy transitions; industrialisation; critical minerals; oil and gas; energy poverty, Sub-Saharan Africa; COVID-19; SDG7; SDG13

## Highlights

- Tackling energy poverty in Sub-Sharan Africa is the foremost priority.
- Green industrialisation can co-exist with traditional resource-based industrialisation to drive structural transformation.
- Synergies between energy and industrial policy, evidenced by linkages and value chain development, is critical.
- African policymakers need to craft a pan-African transition strategy.

# 1 Introduction

The clean energy transition is no more a fringe idea. Whereas there are various issues associated with the energy transitions, one notable one is the relevance of the African mining sector in this energy transitions and climate change era. Africa has an abundance of the critical minerals needed for the energy transition. Metals such as copper, lithium, nickel, cobalt, manganese, and graphite are vital to the transition for sustaining battery longevity, performance, and energy density of all-electric vehicles (EV) motors, solar panels, and wind turbines. The energy transition, which is a pathway toward transforming the global energy sector to zero-carbon by 2050 and beyond, represents one way to mitigate the impacts of human-induced climate change[1]. Governments, companies, and individuals worldwide are under increasing pressure to do more to tackle the existential threat of climate change by switching to low and zero-carbon energy sources. Aside from climate change concerns, the transition is driven by (1) advances in technology, (2) new energy policies being promoted by global governments, especially in a post-COVID-19 pandemic context, and (3) evolving consumer preferences, especially with environmental, social and governance (ESG) pressures.[2] In the post-COVID-19 context, several multinational energy companies have lost landmark cases or suffered shareholder revolts on their climate plans. For example, in May 2021, Royal Dutch Shell was ordered by a Netherlands court to reduce its emissions by 45% by 2030[3] compared to 2019 baseline levels[4]. At the same time, three climate-minded activist shareholders got elected to the Exxon Mobil Board following a shareholder revolt led by Engine No. 1, a small hedge fund, while Chevron investors also passed resolutions to cut carbon emissions. The above indicates the extent to which ESG pressures concerning the need for multinationals to do more to combat climate change are beginning to be felt in company boardrooms. At the government level, the U.S. Government also announced that it would use part of its fiscal stimulus to achieve a 50%-52% reduction in GHGs by 2030 from 2005 levels under the 'building back better' theme[5]. The European Union has also announced a 55% emissions reduction by 2030 on its path to net-zero by 2050.[6] Likewise, China has set in motion plans to peak its emissions before 2030 and to achieve carbon-neutrality by 2060.[7]

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[1] IPCC (2021). Sixth Assessment Report. Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_TS.pdf (Accessed: 20 September 2021).

[2] Neofytou, H., Nikas, A., & Doukas, H. (2020). Sustainable energy transition readiness: A multicriteria assessment index. *Renewable and Sustainable Energy Reviews*, *131*, 109988.

Solomon, B. D., & Krishna, K. (2011). The coming sustainable energy transition: History, strategies, and outlook. *Energy Policy*, *39*(11), 7422-7431.

Nalule, V. & Acheampong, T. (2021). Energy Transition Indicators in African Countries: Managing the Possible Decline of Fossil Fuels and Tackling Energy Access Challenges. *The Journal of Sustainable Development, Law and Policy*, 12:1, 1-48.

Bazilian, M., Bradshaw, M., Gabriel, J., Goldthau, A., & Westphal, K. (2020). Four scenarios of the energy transition: Drivers, consequences, and implications for geopolitics. W*iley Interdisciplinary Reviews: Climate Change*, 11(2), e625.

S&P Global (2021). What is Energy Transition? Available at: https://www.spglobal.com/en/research-insights/articles/what-is-energy-transition (Accessed: 20 September 2021).

Jackson, F. (2021) Five Market Trends Driving Energy Transition, Forbes. Available at: https://www.forbes.com/sites/feliciajackson/2021/01/25/five-market-trends-driving-energy-transition/?sh=4bd2e8d15077 (Accessed: 20 September 2021)

[3] BBC News (2021a). Shell: Netherlands court orders oil giant to cut emissions Available at: https://www.bbc.co.uk/news/world-europe-57257982 (Accessed: 20 September 2021).

[4] Bacchus, J. (2021). Oil firms face more legal fights on climate change - here's why. Available at: https://www.weforum.org/agenda/2021/06/oil-shell-exxon-chevron-court-shareholders-climate (Accessed: 20 September 2021).

[5] The White House (2021b). FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies. Available at: https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies / (Accessed: 13 September 2021).

[6] European Commission (2021). European Green Deal: Commission proposes transformation of EU economy and society to meet climate ambitions. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_21_3541 (Accessed: 13 September 2021)

BBC News (2021b). Climate change: EU to cut CO2 emissions by 55% by 2030. Available at: https://www.bbc.co.uk/news/world-europe-56828383 (Accessed: 13 September 2021).

[7] BBC News (2021c). Climate change: China aims for 'carbon neutrality by 2060'. Available at: https://www.bbc.co.uk/news/science-environment-54256826 (Accessed: 13 September 2021).

The goal is to limit global warming to well below 2 degrees Celsius (°C), preferably to 1.5°C, compared to pre-industrial levels, as documented in the 2015 Paris Agreement at the Conference of the Parties (COP 21).[8] To maintain global temperature to 1.5°C, the world must therefore drastically reduce greenhouse gas (GHG) emissions emanating from its massive dependence on fossil fuels. At present, the world emits about 50 billion tonnes[9] of GHGs every year, an increase of 50% from 1990 to 2018.[10] Overwhelmingly, about 73% of GHGs come from energy use encompassing electricity, heat and transport.[11] The remainder includes agriculture, forestry and land use (18.4%), industrial processes (5.2%), and waste (3.2%). Within energy use, the three largest GHG emissions come from mainly burning fossil fuels for industrial energy (24.2%) such as iron and steel; transportation (16.2%) including road transport, aviation, shipping; and lastly buildings (17.5%), including both residential and commercial.[12]

Sub-Saharan Africa (SSA) is faced with unique energy challenges with about 570 million people or 50% of the population unpowered (without electricity access) and another 910 million or 80% of the population without access to clean fuels and technologies.[13] The continent's energy access challenges over the years have meant that industrialisation has been stifled even in the presence of other favourable factors such as trade and capital openness, institutional stability or financial sector development.[14] Typically, such industrialisation would be powered by carbon-intensive energy sources — like coal, oil and other fossil fuel options—, as has been observed with the growth of Western nations, and more recently, emerging giants like China and India. It is not surprising that China and India, for example, find these fuels (coal in this instance) necessary for their development and lobbied for the change in wording at the recent COP 26 in Glasgow, United Kingdom from "phase out" to "phase down" to reflect their own needs and challenges.[15] For some groups, this represents a considerable setback to the 1.5°C goal, with some recent analysis suggesting that "60% of oil and fossil methane gas, and 90% of coal must remain unextracted to keep within a 1.5°C carbon budget".[16] This suggestion is corroborated by the International Energy Agency (IEA) in its 'Net Zero by 2050' report, which determines that achieving the 1.5°C target necessitates "beyond projects already committed as of 2021, [that] there are no new oil and gas fields approved for development … and no new coal mines or mine extensions are required".[17] If this happens, Welsby et al. estimate that 51% of Africa's oil reserves, 49% of its fossil methane gas, and 86% of the coal reserves will be unextractable if the 2050 1.5°C scenario is to be met.[18]

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[8] UNFCCC (n.d.). The Paris Agreement. Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (Accessed: 13 September 2021).

[9] Ritchie, H., & Roser, M. (2020). $CO_2$ and greenhouse gas emissions. *Our world in data*.

[10] Ge, M., Friedrich, J. and Vigna, L. (2020). 4 Charts Explain Greenhouse Gas Emissions by Countries and Sectors, World Resources Institute. Available at: https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors (Accessed: 13 September 2021).

[11] Op cit, n 9

[12] ibid

[13] IEA, IRENA, UNSD, World Bank, WHO. 2021. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. © World Bank.
SE4ALL (2021). Five takeaways from Tracking SDG7: The Energy Progress Report 2021. Available at: https://www.seforall.org/news/five-takeaways-from-tracking-sdg7-the-energy-progress-report-2021 (Accessed: 2 December 2021)

[14] Haraguchi, N., Martorano, B., & Sanfilippo, M. (2019). What factors drive successful industrialisation? Evidence and implications for developing countries. *Structural Change and Economic Dynamics*, *49*, 266-276.

[15] Masood, E., & Tollefson, J. (2021). COP26 climate pledges: What scientists think so far, Nature.com. Available at: https://www.nature.com/articles/d41586-021-03034-z (Accessed: 2 December 2021).
Hook, L., Hodgson, C., & Pickard, J. (2021). *India and China weaken pledge to phase out coal as COP26 ends*. Available at: https://www.ft.com/content/471c7db9-925f-479e-ad57-09162310a21a (Accessed: 2 December 2021).
Russell, C. (2021) Column: Coal trajectory is set whether it's 'phase out' or 'phase down': Russell, Reuters. Available at: https://www.reuters.com/business/cop/coal-trajectory-is-set-whether-its-phase-out-or-phase-down-russell-2021-11-14 (Accessed: 2 December 2021).

[16] Welsby, D., Price, J., Pye, S. and Ekins, P., 2021. Unextractable fossil fuels in a 1.5° C world. *Nature*, *597*(7875), pp.230-234.

[17] IEA (2021), Net Zero by 2050. https://www.iea.org/reports/net-zero-by-2050 (Accessed: 25 October 2021), at p.24

[18] Op cit, n 16

In essence, many regions, including SSA, may potentially have a 20 to 30-year window to maximise the value of their hydrocarbon resources. This could have dire implications for governments reliant on these export revenues to deliver public goods such as roads and hospitals but unable to create new industries around the transition. This is highly likely to increase social pressures and challenge ruling governments, democratic or not. On the other hand, the energy transition presents opportunities for countries with mineral resources — such as copper, cobalt and lithium — which are critical to global value chains to capture a significant part of the value chain, such as by producing electric vehicles (EVs) battery components, among others. Furthermore, despite the huge renewable energy potential of the African region, many obstacles remain, such as financing, local capacity and technical expertise, among others.[19] For example, less discussed is the present state of RE supply chains, which are largely based outside Africa and the need for some continental production to reduce overdependence and create jobs. Although there are opportunities to establish such industries, many countries are beset with power challenges (price competitiveness and disruptions)[20], making it a classic chicken and egg situation.

Amidst these myriad challenges and opportunities, this review adds to the energy transition literature on Africa by exploring two critical but under-explored questions:

(1) What is likely to be the longer-lasting implication of the energy transition away from fossil fuels for SSA?

(2) Can the region leverage clean energy to drive industrialisation?

Addressing the above questions is crucial given that the continent's economies must now navigate the pandemic-induced changes in demand as well as the energy transition. The rest of this chapter is dedicated to answering these questions. The following section reviews the state of industrialisation in Africa, based on a deep-dive into 50-plus years of industrialisation and development literature in Africa. This is followed by Section 3, where we highlight and propose three policy anchors which SSA can leverage the clean energy drive to promote industrialisation. Finally, we conclude in Section 4.

# 2 Review: The state of industrialisation in Africa

Before discussing the state of industrialisation in Sub-Saharan Africa, it is essential to highlight the continents pre- and post-COVID-19 economic context. This is more so because the macro-economic environment is a key catalyst for micro-level industrial development. The most recent commodities price boom of the past 10-15 years came with significant opportunities for SSA countries to use the proceeds to diversify their economies. However, that did not happen despite the opportunities therein. Then there was the 2014-16 commodities price crash which badly exposed the economic management approaches used in

[19] Menyeh, B. O. (2021). Financing electricity access in Africa: A choice experiment study of household investor preferences for renewable energy investments in Ghana. *Renewable and Sustainable Energy Reviews*, *146*, 111132.

Alemzero, D., Acheampong, T., & Huaping, S. (2021). Prospects of wind energy deployment in Africa: Technical and economic analysis. *Renewable Energy*, *179*, 652-666.

[20] Acheampong, T., Menyeh, B. O., & Agbevivi, D. E. (2021). Ghana's Changing Electricity Supply Mix and Tariff Pricing Regime: Implications for the Energy Trilemma. *Oil, Gas & Energy Law*, *19*(3).

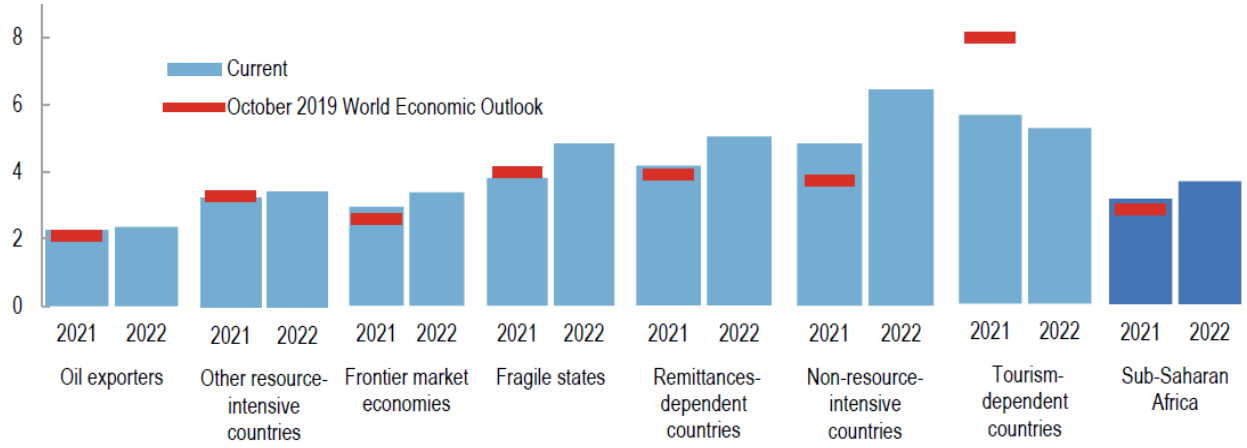
Yetano Roche, M., Verolme, H., Agbaegbu, C., Binnington, T., Fischedick, M., & Oladipo, E. O. (2020). Achieving Sustainable Development Goals in Nigeria's power sector: assessment of transition pathways. *Climate Policy*, *20*(7), 846-865.

Foster, V., Eberhard, A., & Dyson, G. (2021). The evolution of electricity sectors in Africa: ongoing obstacles and emerging opportunities to reach universal targets. In *Handbook on Electricity Markets*. Edward Elgar Publishing.

Eberhard, A., Gratwick, K., Morella, E., & Antmann, P. (2017). Accelerating investments in power in sub-Saharan Africa. *Nature Energy*, *2*(2), 1-5.

these countries. Several SSA countries struggled to cope with the impact of the commodities price crash, coupled with the fact that their economies are even more integrated into the global economy. Thus, any global systemic shock impacts local economies and often deepens inequality significantly. Moreover, we have another global downturn with the COVID-19 pandemic, which has exposed SSA economies in their ability to cope with external shocks. This time around, the impact of COVID-19 is likely to even linger for longer. As a result, per capita output is not expected to return to 2019 levels until after 2022, as Figure 1 shows.

**Fig 1 Sub-Saharan GDP growth projections, 2021-22**




Source: IMF[21]

Several SSA countries, such as Tanzania, Zambia, Ghana and Nigeria in the early post-independence days of the 1960s, sought to industrialise their economies with varied success. The early post-independence industrialisation policies aimed to position these new nation-states away from the exploitative colonial enterprise. This was predominantly by seeking to add value to their primary commodities before exporting them and import substitution. For example, countries such as Ghana under President Kwame Nkrumah (1959-1966) sought to develop the Volta River Project with the building of the Akosombo dam to provide cheap and reliable electricity to the Volta Aluminium Company's (VALCO) aluminium smelter exploiting Ghana's bauxite resources.[22] However, many of these initiatives failed for several reasons, including political instability and conflict — successive military coups —which constrained long term economic policymaking and exogenous factors such as terms of trade shocks like the 1970s oil crises and commodity price decreases.[23] Nevertheless, ineffective or rather bad policies such as the state-led import substitution

[21] IMF (2021). Regional Economic Outlook for Sub-Saharan Africa: Navigating a Long Pandemic. Available: https://www.imf.org/en/Publications/REO/SSA/Issues/2021/04/15/regional-economic-outlook-for-sub-saharan-africa-april-2021 (Accessed: 13 September 2021).

[22] Acheampong, T., & Mensah, K. A (2018). Towards an Integrated Bauxite and Aluminium Industry in Ghana: Some Policy Considerations. http://dx.doi.org/10.13140/RG.2.2.17985.40804

New York Times (1964). Ghana Advancing Aluminum Plant; Work Is Scheduled to Begin Soon on Big Smelter. Available at: https://www.nytimes.com/1964/11/22/archives/ghana-advancing-aluminum-plant-work-is-scheduled-to-begin-soon-on.html (Accessed: 18 September 2021).

[23] Page, J. (2021) *Africa's Failure to Industrialise: Bad Luck or Bad Policy?*, *Brookings*. Available at: https://www.brookings.edu/blog/africa-in-focus/2014/11/20/africas-failure-to-industrialize-bad-luck-or-bad-policy (Accessed: 19 September 2021).

with its attendant high protectionism, low managerial capabilities, inefficiencies, and heavy import dependency made African industry poorly prepared for international competition from the global North and rising Asia.[24]

The Bretton Woods institutions compounded these challenges with the structural adjustment policies of the mid-1980s, which largely disapproved of the import substitution form of industrialisation, among others.[25] These one-size-fits-all neoliberal policy prescriptions of the IMF and World Bank included prioritising fiscal adjustment, spending cuts, and privatisation. Much of the aversion for the IMF from some SSA countries is that these policies of the 1980s and 1990s constrained many African countries. Their conditionalities played a role in economic stagnation, with dire political and social consequences. These include decreases in social spending and increased poverty, periods of de-industrialisation, privatising of state-owned enterprises (SOEs), reducing pensions in the public service, and currency devaluations.[26]

The outcome of these historical paradigms is that SSA remains the least diversified continent globally and is highly vulnerable to external shocks — for example, the 2008 financial crisis and the ongoing COVID-19 pandemic. SSA has one of the least complex economic systems globally, as Fig 2 shows. Accumulating productive knowledge and using it in more complex industries is a prerequisite for economic development – that is, structurally changing an economy from low to high-productivity activities.[27] However, in SSA, several economies on the continent are still dominated by primary commodities extraction with little to show in export diversification.[28] UNCTADStats data shows that African countries have a diversification index of more than 0.5, which is higher than Europe (0.18), East Asia (0.30) and selected exporters of manufactured goods and primary commodities (0.28) – see Table 1. While the continent's export concentration — which measures the degree to which exports are concentrated on a few products instead of being more homogeneously distributed among several products[29] — has improved compared to 2000 baseline levels (from 0.35 to 0.19), it still lags other regions.

Also, overall export diversification has not improved as much (from 0.60 to 0.55). The diversification index measures the extent to which the export structure by product differs from the world patterns.[30] This indicates an increasing tendency towards export concentration in Africa at both the sectoral and product level.[31] In other words, the portfolio of exports from Africa is less diversified relative to other regions. The reliance on mostly primary commodities means that the oft-touted higher GDP growth rates on the continent have not translated proportionately into job creation and or reducing poverty, given that commodity extractions tend to be enclave activities with low employment linkages compared to the

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[24] ibid

[25] Mendes, A. P. F., Bertella, M. A., & Teixeira, R. F. (2014). Industrialisation in Sub-Saharan Africa and import substitution policy. *Brazilian Journal of Political Economy*, *34*, 120-138.

[26] Signé, L. (2018). The potential of manufacturing and industrialisation in Africa: trends, opportunities, and strategies. Available at: https://www.brookings.edu/wp-content/uploads/2018/09/Manufacturing-and-Industrialization-in-Africa-Signe-20180921.pdf

[27] Atlas of Economic Complexity (n.d.). Country & Product Complexity Rankings. Available: https://atlas.cid.harvard.edu/rankings (Accessed: 19 September 2021).

[28] Morris, M., & Fessehaie, J. (2014). The industrialisation challenge for Africa: Towards a commodities based industrialisation path. *Journal of African Trade*, *1*(1), 25-36

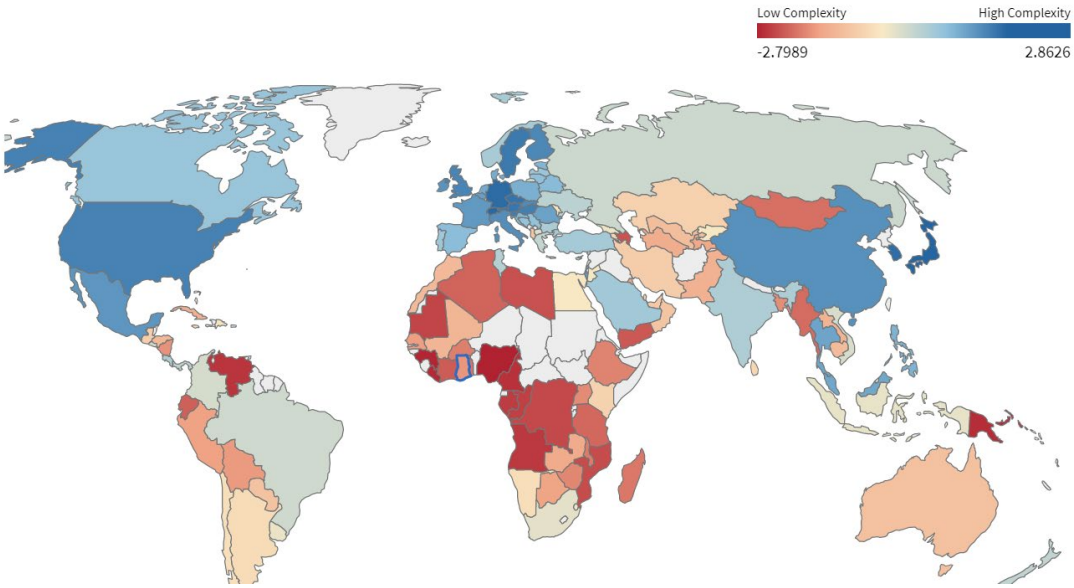
[29] UNCTAD Stat (n.d.). Merchandise: Product concentration and diversification indices of exports and imports, annua. Available at: https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=120 (Accessed: 19 September 2021).

[30] ibid

[31] UNDP (2009). Export Dependence and Export Concentration. Available: https://www1.undp.org/content/dam/undp/library/Poverty%20Reduction/Inclusive%20development/Towards%20Human%20Resilience/Towards_SustainingMDGProgress_Chapter1.pdf (Accessed: 18 September 2021)

broader manufacturing sector.[32] This has stunted the continent's manufacturing and industrial sector and damped its potential as a critical engine for inclusive growth. Again, this is in contrast to the findings in the development literature, which shows that "virtually all cases of high, rapid and sustained economic growth in modern economic development have been associated with industrialisation, particularly growth in manufacturing production".[33]

**Fig 2 Country complexity map 2019**




Source: Harvard Economic Complexity Index (ECI) [37]

[32] UNCTAD (2013). The state of industrial development in Africa: unexploited opportunities amidst growing challenges. Available: https://unctad.org/system/files/official-document/presspb2013d1_en.pdf (Accessed: 18 September 2021).
[33] Ibid, at p.1

**Table 1 Export concentration index and export diversification index of various regions**

| Region<br>Year => | Export Concentration Index | | | Export Diversification Index | | |
|---|---|---|---|---|---|---|
| | **2000** | **2010** | **2020** | **2000** | **2010** | **2020** |
| Africa | 0.35 | 0.41 | 0.19 | 0.60 | 0.56 | 0.55 |
| *Sub-Saharan Africa* | 0.34 | 0.41 | 0.21 | 0.59 | 0.58 | 0.60 |
| *Sub-Saharan Africa excl. South Africa* | 0.50 | 0.56 | 0.31 | 0.72 | 0.68 | 0.69 |
| *Northern Africa* | 0.39 | 0.42 | 0.16 | 0.72 | 0.65 | 0.55 |
| *Eastern Africa* | 0.13 | 0.15 | 0.15 | 0.71 | 0.68 | 0.65 |
| *Middle Africa* | 0.73 | 0.81 | 0.58 | 0.84 | 0.81 | 0.84 |
| *Southern Africa* | 0.15 | 0.12 | 0.15 | 0.55 | 0.54 | 0.57 |
| *Western Africa* | 0.64 | 0.59 | 0.38 | 0.78 | 0.74 | 0.76 |
| Eastern Asia | 0.10 | 0.10 | 0.12 | 0.29 | 0.33 | 0.30 |
| South-eastern Asia | 0.18 | 0.13 | 0.13 | 0.38 | 0.33 | 0.31 |
| Europe | 0.07 | 0.07 | 0.06 | 0.15 | 0.18 | 0.18 |
| Emerging markets | 0.11 | 0.11 | 0.09 | 0.22 | 0.18 | 0.16 |
| Selected exporters of petroleum | 0.66 | 0.65 | 0.49 | 0.77 | 0.71 | 0.71 |
| Selected exporters of minerals and mining products | 0.19 | 0.27 | 0.27 | 0.72 | 0.72 | 0.75 |
| Selected exporters of manufactured goods | 0.11 | 0.10 | 0.12 | 0.32 | 0.30 | 0.27 |
| Selected exporters of manufactured goods and primary commodities | 0.09 | 0.08 | 0.09 | 0.30 | 0.32 | 0.28 |

Source: Author's construct based on UNCTADStat Merchandise Trade Matrix[34]

Manufacturing sector contribution to the continent's GDP since 1990 has declined by an average of 0.24% of GDP per annum from a base of 16% of GDP to the current 11% – this is about the same as the 1970s (Fig 3).[35] This is despite the marginal improvement by the continent between 2011 and 2018. In contrast, the manufacturing sector contribution for Latin America & Caribbean countries is 16% of GDP; Lower middle-income countries (17% of GDP); European Union (16% of GDP) and East Asia & the Pacific (24% of GDP). This decline in the contribution of manufacturing to GDP has been observed in all of the continent's sub-regions.[36] Likewise, the continent's share of global manufacturing value has declined from about 3% in 1970 to less than 2% currently (Fig 3).[37] This means the African continent has been unable to fully take advantage of the emergence of global value chains, which has driven and diversified global manufacturing production with attendant productivity and employment effects. While there is evidence indicating that some East African countries such as Ethiopia and Kenya have captured some low-cost, labour-intensive activities of global value chains, many countries remain primary and intermediate inputs suppliers.[38]

[34] Op cit, n 29

[35] Newman, C., Page, J., & Tarp, F. (2021). Made in Africa – the future of production on the continent. Available at: https://www.weforum.org/agenda/2017/01/made-in-africa-the-future-of-production-on-the-continent (Accessed: 19 September 2021).

[36] ibid

[37] Edwards, L. 2020. African manufacturing firms and their participation in global trade. Available: https://iap.unido.org/articles/african-manufacturing-firms-and-their-participation-global-trade (Accessed: 25 September 2021)

[38] ibid

**Fig 3 Manufacturing as a share of GDP and value-added in selected regions**

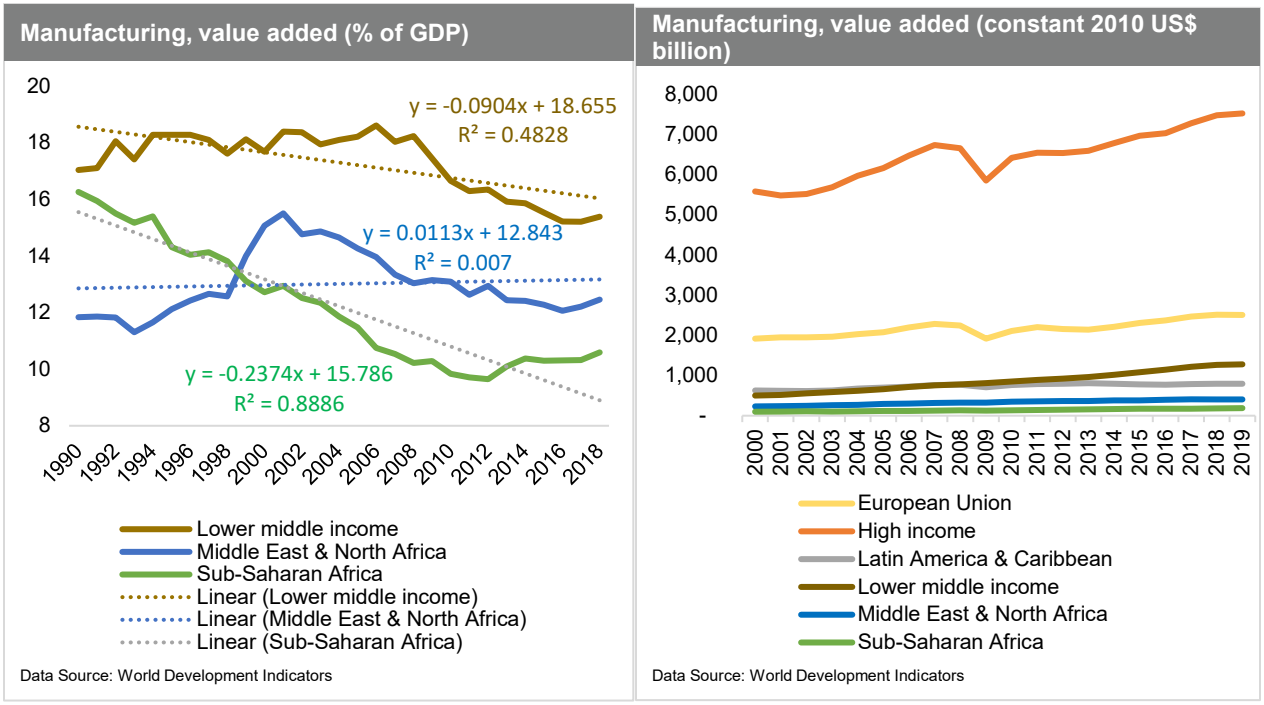
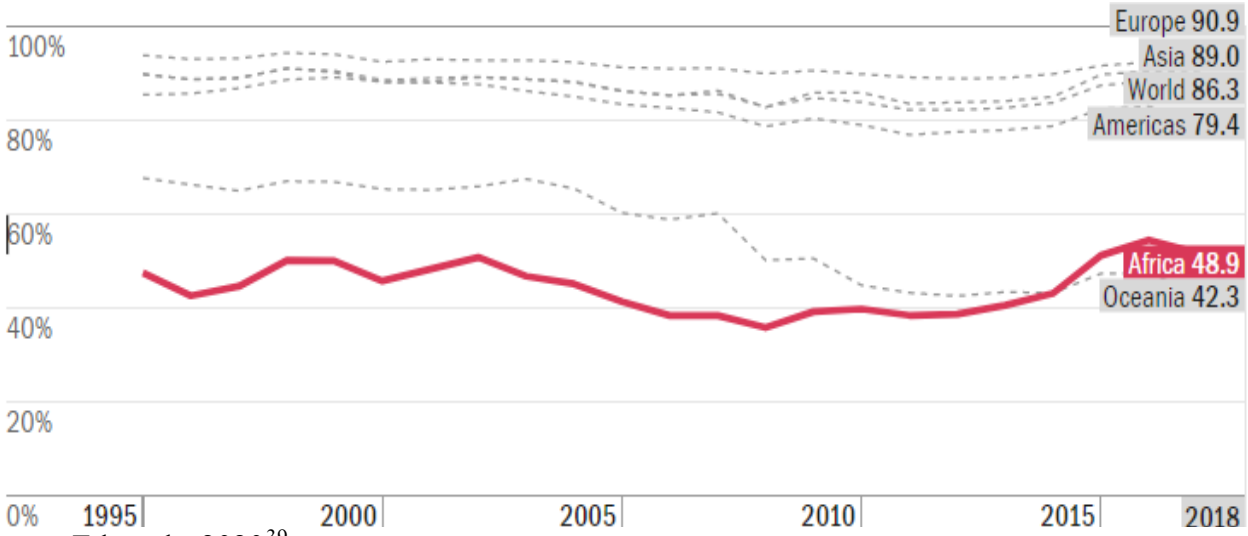



**Fig 4 Manufactured goods in total merchandise exports (%)**




Source: Edwards, 2020[39]

[39] ibid

However, since the early 2000s, several countries on the continent have sought to renew or deepen their commitments with a second attempt at industrialising. Part of the reasons for this has been to address the various interrelated external shocks, namely: (1) hikes in food prices and energy prices; (2) the 2007-2008 global financial and economic crisis, (3) 2014-2018 commodities price crash; and more recently (4) the COVID-19 pandemic and associated economic crises. This renewed commitment has been implemented through initiatives such as the Africa Union's Action Plan for the Accelerated Industrial Development of Africa (ADIA)[40] and most recently, the African Continental Free Trade Agreement (AfCFTA), which seeks to remove the barriers to and boost intra-regional trade in manufactured goods as well as catalyse the development of regional value chains.

# 3 Energy transition and industrialisation options for Sub-Saharan Africa

Despite the preceding, within every crisis lies an opportunity, which makes one wonder if perhaps the COVID-19 pandemic and associated 'green recovery programmes' announced by various governments could also spur the continent to embark on its own green growth industrial transformation agenda? Could SSA have an opportunity to walk the proverbial industrialisation talk after several false dawns of failing to diversify their economies, especially through the resource-based industrialisation of the past several decades? With extractives-based industrialisation, the evidence in several SSA countries shows that extractives continue to remain enclave activities with little spillovers into the broader economy.[41] This is despite recent attempts to correct this imbalance through local content and local participation schemes.[42] Likewise, as widely documented in the extant literature, extractives have historically fuelled strife and corruption in several countries on the continent. At the same time, local political elites engage in rent capture with less appetite for serious socio-economic reforms – for example, tax reform - due to easy petro or mining dollars.

Several SSA countries face a choice between delivering sustained economic growth or growing sustainably.[43] The former encompasses using all available energy resources, be it fossil fuels or renewable energy, at its disposal to address the continent's challenges: large-scale industrialisation, create jobs for the millions of its unemployed and underemployed youth, and deliver inclusive growth and sustainable development. The latter is more about using cleaner and renewable forms of energy to power a new industrialisation drive: green industrialisation.[44] The evidence from the development literature shows, for

[40] African Union (n.d.). Action Plan for the Accelerated Industrial Development of Africa. Available: https://au.int/web/sites/default/files/documents/30985-doc-plan_of_action_of_aida.pdf (Accessed: 25 September 2021)

[41] Hansen, M. W., Buur, L., Mette Kjær, A., & Therkildsen, O. (2016, May). The economics and politics of local content in African extractives: lessons from Tanzania, Uganda and Mozambique. In *Forum for Development Studies* (Vol. 43, No. 2, pp. 201-228). Routledge.

Hansen, M. W. (2014). From enclave to linkage economies? A review of the literature on linkages between extractive multinational corporations and local industry in Africa (No. 2014: 02). DIIS Working Paper.

[42] Acheampong, T., Ashong, M., & Svanikier, V. C. (2016). An assessment of local-content policies in oil and gas producing countries. *The Journal of World Energy Law & Business*, *9*(4), 282-302.

Ovadia, J. S. (2016). Local content policies and petro-development in Sub-Saharan Africa: A comparative analysis. *Resources Policy*, *49*, 20-30.

[43] Shpitsberg, A., Berkove, D., Tesfay, N., & Bostan, R. (2021). Sub-Saharan Africa's energy transition - A choice between growing sustainably and sustained growth? Available: https://ihsmarkit.com/research-analysis/subsaharan-africas-energy-transition.html (Accessed: 26 September 2021)

[44] Luken, R. A., & Clarence-Smith, E. (2019). Green Industrialization in Sub-Saharan Africa: A Guide for Policy Makers. Available: https://media.africaportal.org/documents/Green-Industrialisation-Report_Web_compressed.pdf (Accessed: 25 September 2021)

example, that there are no "existing examples of countries that have pursued a green industrialisation pathway through a deliberate greening policy from the outset".[45]

Instead, most high-income countries of today developed by polluting their way using all forms of available energy sources, predominantly coal and hydrocarbons. As a result, environmental considerations were often an afterthought. This raises several questions: firstly, unlike the previous commodity booms, which have failed to translate into inclusive growth, can Africa take advantage of this energy transition and shift production factors — labour, capital and entrepreneurship — into the energy and manufacturing industrial sector? In other words, can and must SSA pursue green industrialisation? Second, what factors or conditions are likely to make green industrialisation work on the continent? Thirdly, can green industrialisation co-exist with the traditional resource-based industrialisation, which many countries on the continent have attempted to follow with mixed results? Lastly, must the continent adapt all forms of energy provided it is cost-competitive without worrying much about the environmental footprint?

Below, we propose three approaches which SSA can leverage the clean energy drive to promote industrialisation and critically discuss them.

## 3.1 Proposal 1: Shifting production factors — labour, capital and entrepreneurship — into green industrialisation

While a radical global energy system transformation is necessary to achieve 2050 net-zero targets, this also comes with opportunities. The IEA estimates that annual energy investment needs to rise to between US$4 to US$5 trillion by 2030 from the current US$2 trillion.[46] SSA can position itself to attract a portion of these investments; 10% of the US$50 trillion investment coming into SSA will make much difference on the continent. To put it in comparative terms, this is three times more than the region's estimated US$2.6 trillion GDP; it could spur a major economic boom and sustainable long-term industrialisation.

The necessary conditions for green industrialisation work on the continent are the same factors of production — namely labour, capital and entrepreneurship—, but which is anchored on a clearly defined industrial policy strategy. Industrial policy is essential, but other pre-conditions are also necessary for diversification. A recent important IMF paper challenges some conventional orthodoxies about industrial policy. Salinas finds that four economy-wide policies (horizontal policies), namely: governance (institutions), education, infrastructure and trade policy openness, help foster diverse exports more than narrowly targeted industrial policies.[47] Within the context of countries with natural resources, Salinas again finds that Chile, one of the world's largest copper exporters, has a similar economic profile to Malaysia's.[48] Strong education and institutions are a significant moderating factor in both countries despite the latter being much closer to the major East Asian global supply-chain hubs of China, Korea and Japan.[49] Thus, the pursuit of industrial policies to take advantage of the clean energy drive must parallel

[45] Okereke, C., Coke, A., Geebreyesus, M., Ginbo, T., Wakeford, J. J., & Mulugetta, Y. (2019). Governing green industrialisation in Africa: Assessing key parameters for a sustainable socio-technical transition in the context of Ethiopia. *World Development*, *115*, 279-290.

[46] Op cit, n 17

[47] Salinas, G., & Muñoz, S. (2021). Proximity and Horizontal Policies: The Backbone of Export Diversification and Complexity. *IMF Working Papers*, *2021*(064).

[48] Salinas, G (2021). How Countries Can Diversify Their Exports. Available: https://blogs.imf.org/2021/09/22/how-countries-can-diversify-their-exports/ (Accessed: 30 September 2021)

[49] Op cit, n 45

significant structural horizontal policy reforms, lest it risks becoming another enclave activity with negligible spillovers.

With regard to attracting both domestic and foreign capital, Africa can offer targeted tax incentives for the setup of companies dedicated to assembling green energy components such as solar PV and wind turbine modules for use on the continent and potential exports. Furthermore, these can take place in special industrial zones to take advantage of learning by doing, innovation and agglomeration effects which are important to increasing firm-level productivity. East Asia's industrial success benefited from deliberate policies[50] to develop the capacity and capabilities of domestic firms, including fostering industrial clusters (agglomeration) via special economic zones such as industrial parks, high tech zones and export-processing zones. However, these have either been largely absent or not fully implemented in several SSA countries, and there is a need to fix these if green industrialisation is to work systematically.

Corollary to the requirement for more non-enclave type activities — such as the manufacturing of solar PV components and wind turbines — to have a wider catalytic impact on the economy is also the need to deepen research, innovation and development. Several SSA countries spend less than 1% of their GDP on research and development; this must change.[51] The golden triangle of industry-academic-research institutes offers some pathways on how this could work. Firstly, entrepreneurs, governments and other donor partners could fund targeted R&D in universities and higher learning institutions localise these RE production systems. China took this approach with solar PVs, and the result is solar PV costs falling by a third in the past decade. Australia-based company SunDrive Solar[52] was formed by a PhD candidate at the University of New South Wales with a simple idea to make solar panels much cheaper by replacing the expensive silver component of the cells with relatively cheaper copper. The research ecosystem benefited from university seed funding and private funding to scale up the idea. Such an ecosystem is not beyond SSA.

SSA countries can build and connect R&D centres of excellence on the continent to contextualise and find new scalable engineering and technical solutions to Africa's energy access challenges. These RDI centres could, for example, lead the scaling up and mass manufacturing of RE-powered agri-equipment for a new grassroots-led agricultural revolution on the continent. Solar-powered irrigation systems, combine harvesters, tills, shredders, dryers, and warehouses, can drastically improve agricultural yields and reduce post-harvest losses while shifting from the 'cutlass and hoe' model of farming into mid-scale commercial or mechanised agriculture in various communities. This will significantly improve livelihoods and reduce poverty.

## 3.2 Proposal 2: Meeting the continent's energy needs using all available energy resources

The rapid economic development of any economy is directly linked to modern and reliable energy services provision, especially electricity. Nevertheless, in SSA, access to reliable power is consistently identified as one of the most significant constraints to the continent's development. About 46% or 600 million of

[50] Op cit, n 37

[51] World Bank (n.d.). Research and development expenditure (% of GDP) - Sub-Saharan Africa. Available: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=ZG (Accessed: 30 September 2021)

[52] Vance, A. (2021). *Bloomberg - Solar Startup Born in a Garage Is Beating China to Cheaper Panel.* Available at: https://www.bloomberg.com/news/articles/2021-09-09/sundrive-solar-startup-beats-china-s-giant-manufacturers-in-efficiency-test (Accessed: 29 September 2021).

the continent's population lack access to electricity, while another 730 million lack clean fuels and cooking facilities.[53] Also, while about 78% of Africa's urban population and 31% of the rural population had electricity in 2019, they are often irregular, unreliable, and expensive in many countries in the sub-region.[54] Most rural populations continue to rely on traditional biomass and firewood to meet their domestic needs, worsening energy poverty and health disparities.[55]

Within the context of the energy trilemma, enabling access and affordability for bridging the access deficit and for accelerated industrialisation is foremost for the continent. This is because Africa's greenhouse gas (GHG) emissions are among the lowest globally on a volume and per capita basis, excluding South Africa. The continent emitted 1,308 million tonnes of CO2 in 2019, representing only 2% of global energy-stimulated CO2 emissions and only a 2% growth in the decade between 2008 and 2018.[56] However, the continent has enormous energy resources — both conventional and non-conventional — which can and must be urgently used to address the access deficit. In a report published in June 2021 to the Norwegian Parliament, the government said that "Norway's position as an energy nation will be further developed through new initiatives encompassing hydrogen, offshore wind, strengthening the power grid and a low emissions oil and gas sector".[57] The government is keen on adopting all energy resources available at their disposal to create continued economic growth and new jobs.

Thus, similar to Norway's common-sense approach, we think that SSA's response to the energy transition ought to be premised on using all energy forms at the continent's disposal to catalyse long-term and inclusive economic growth within the framework of the respective country's climate policy and commitments or nationally determined contributions (NDCs) under the Paris Agreement. The Norwegians do not say they will stop oil and gas extraction. Instead, they will focus on making the barrels have more 'green street cred' – that is, lower emissions, so it competes favourably. Furthermore, and interestingly, the ongoing variability of RE supply, especially wind energy[58] in Europe, means that several countries are muting plans to restart conventional coal[59] and nuclear power plants[60]. These had hitherto been classified for decommissioning as these did not align with their climate or net-zero commitments. What is evident in these situations is that energy security is the paramount consideration. This cannot be any different for SSA, or must it?

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[53] Africa Energy Chamber (2021). *Africa Energy Outlook 2021*. Available at: https://www.whyafrica.co.za/wp-content/uploads/2020/11/AEC-Outlook-2021.pdf (Accessed: 17 November 2021)

[54] Eberhard, A., Gratwick, K., Morella, E., & Antmann, P. (2017). Accelerating investments in power in sub-Saharan Africa. *Nature Energy*, *2*(2), 1-5.

[55] Nussbaumer, P., Nerini, F. F., Onyeji, I., & Howells, M. (2013). Global insights based on the multidimensional energy poverty index (MEPI). *Sustainability*, *5*(5), 2060-2076.

Ssennono, V. F., Ntayi, J. M., Buyinza, F., Wasswa, F., Aarakit, S. M., & Mukiza, C. N. (2021). Energy poverty in Uganda: Evidence from a multidimensional approach. *Energy Economics*, *101*, 105445.

Crentsil, A. O., Asuman, D., & Fenny, A. P. (2019). Assessing the determinants and drivers of multidimensional energy poverty in Ghana. *Energy Policy*, *133*, 110884.

[56] Op cit, n 9

[57] Norwegian Government (2021). Government publishes White Paper on long term value creation from Norway's energy resources. Available at: https://www.regjeringen.no/en/aktuelt/regjeringen-legger-frem-stortingsmelding-om-verdiskaping-fra-norske-energiressurser/id2860271 (Accessed: 13 September 2021).

[58] The Economist (2021). Why has the price of electricity in Europe reached record highs? Available at: https://www.economist.com/the-economist-explains/2021/09/15/why-has-the-price-of-electricity-in-europe-reached-record-highs (Accessed: 25 September 2021).

[59] BBC News (2021d). *UK fires up coal power plant as gas prices soar*. Available at: https://www.bbc.co.uk/news/business-58469238 (Accessed: 25 September 2021)

Ambrose, J. (2021). *Britain's last coal power stations to be paid huge sums to keep lights on* Available at: https://www.theguardian.com/business/2021/sep/13/britain-last-coal-power-stations-to-be-paid-huge-sums-to-keep-lights-on-record-energy-prices (Accessed: 25 September 2021).

[60] IRENA (2021). The Renewable Energy Transition in Africa - Powering Access, Resilience and Prosperity. Available: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable_Energy_Transition_Africa_2021.pdf (Accessed: 29 September 2021).

### *3.2.1 Natural gas*

Natural gas and the gas industry value chain are an integral part of Africa's energy future as they are cost-effective for delivering baseload power and are environmentally friendly. As of 2019, the continent had between 527 and 558 trillion cubic feet (Tcf), making it the fourth-largest gas reserves holder after North America[61]. Countries with gas supplies include established players like Nigeria, Equatorial Guinea, Ghana, and nascent players like Tanzania, Mozambique, Mauritania and Senegal. Natural gas is already the primary fuel of choice in power generation for several countries and regions on the continent. This trend is likely to continue into the foreseeable future.[62] Nevertheless, the exploitation of the fuller gas value chain opportunities on the continent for power generation and other industrial uses is stalled by the lack of infrastructure to evacuate gas from the fields to the relevant gas markets. Other constraints hindering the development of gas markets on the continent include regulatory bottlenecks such as ineffective gas pricing and non-payment issues from the inability to recoup costs of gas supplied by upstream companies.

SSA's gas value chain requires significant investments in building trans-regional pipelines to evacuate gas to domestic demand centres, and to an extent, also for LNG export markets. With an expanded pipeline network in West, East and Southern Africa, regional gas movements could double by 2030, further displacing coal in some markets. In West Africa, for example, the West African Gas Pipeline (WAGP), which runs from Nigeria's Ikoti export terminal to Takoradi in Ghana, has the potential to export gas further to Cote d'Ivoire. A possible expansion of the WAGP to Cote d'Ivoire would bring delivered gas prices far below liquid fuels for power generation and other non-power industrial uses. However, the ability to attract foreign and domestic capital is increasingly becoming difficult in the face of ESG pressures facing traditional financing sources – including concessional and non-concessional loans and guarantees by development finance institutions (DFIs). Nevertheless, some of the more resourced domestic sovereign wealth funds (SWFs) or sovereign-backed infrastructure funds can also enter the void, subject to long-term value-additive and economically profitable projects.

### *3.2.2 Deploying renewable energy technologies*

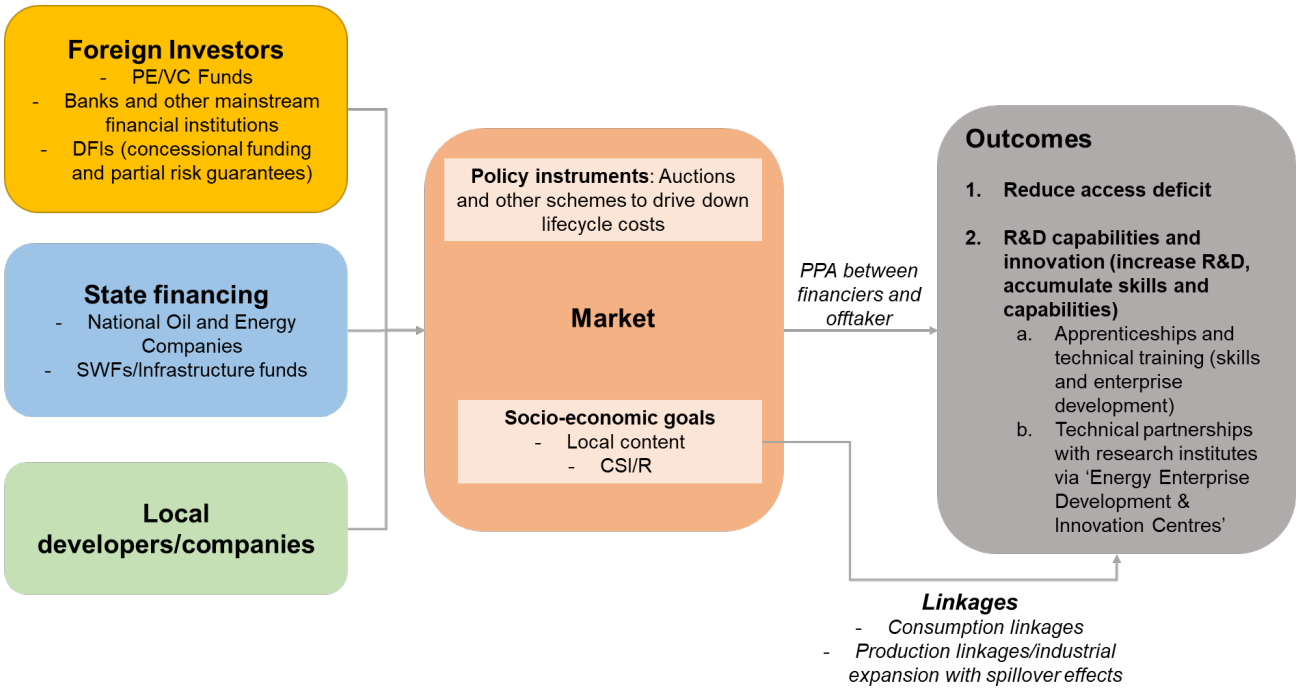
RE technologies, especially wind and solar, are important in helping bridge the electricity access deficit on the continent. Renewable costs have declined substantially over the past ten years and are even out-competing some conventional fuels as the least-cost alternative for new generation capacity. Studies show that utility-scale solar PV and onshore wind costs decreased by 82% and 40%, respectively, between 2010 and 2019.[63] This global trend is also happening in SSA, where there has been a 30% reduction in wind LCOE costs between 2010 and 2019.[64] The reduction in Solar PV tariffs has also been supported by a significant 67% drop in utility-scale battery storage.[65] This means that battery storage solutions can possibly be deployed to address the intermittency challenge of renewables, thereby allowing the provision of dispatchable power. Likewise, IRENA reports that 71% of the 2019 generation capacity added were renewable technologies, primarily solar and wind.[66] Research indicates that despite Africa installing only about 1% of its estimated wind capacity as of 2018, wind energy deployment has grown by 740%, from

[61] Op cit, n 53
[62] Op cit, n 53
[63] Op cit, n 60
[64] Alemzero, D., Acheampong, T., & Huaping, S. (2021). Prospects of wind energy deployment in Africa: Technical and economic analysis. *Renewable Energy*, *179*, 652-666.
[65] Op cit, n 60
[66] Op cit, n 60

0.74 Gigawatts (GW) to 5.5 GW between 2009 and 2018.[67] Most of this deployment has been in Southern (South Africa) and Northern Africa (Morocco, Egypt, Tunisia).

Both policy and market-based developments will be vital in extending the reach of RE more widely on the continent. Policies to drive RE deployments —renewable obligations standards (RPS), feed-in-tariffs (FiTs), auctions, wind investment and tax credit, and net metering —are currently scattered in many countries. Thus, policy coherency is needed, especially in light of the AfCFTA. Furthermore, as we propose in our renewable energy linkages ecosystem shown in Figure 5, SSA countries need to be more strategic in harnessing the linkages and value chain opportunities associated with deploying RE.

**Fig 5 Renewable energy linkages ecosystem**




Source: Authors' construct

## 3.3 Proposal 3: Deepening linkages in a new resource-based industrialisation paradigm 2.0

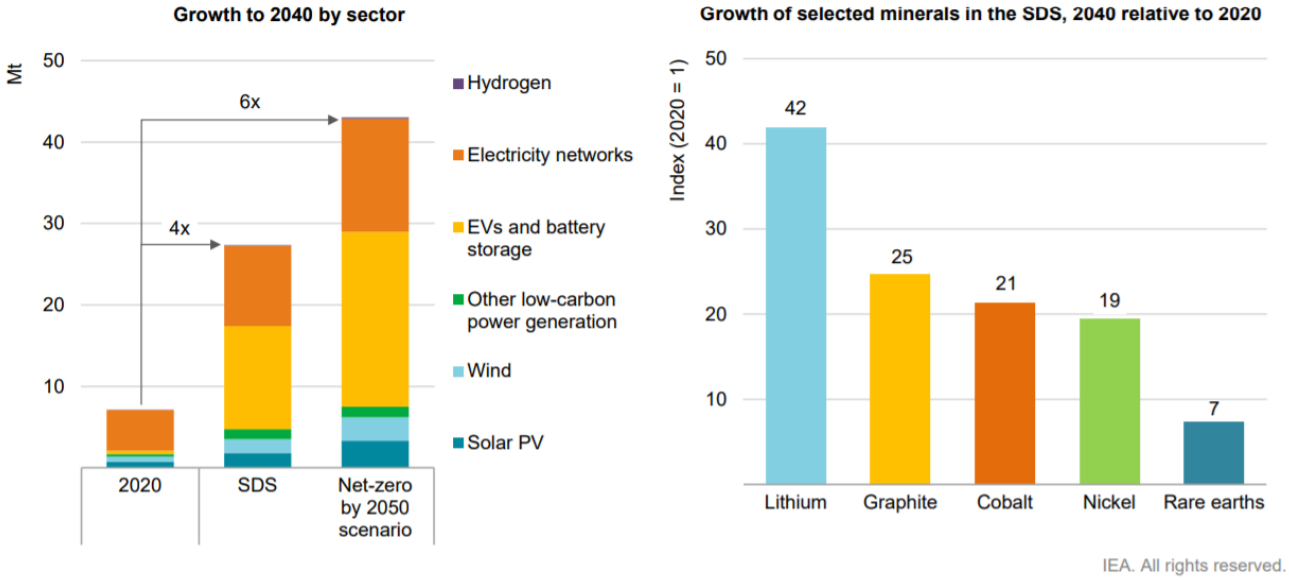
Africa has an abundance of the critical minerals needed for the energy transition. Metals such as copper, lithium, nickel, cobalt, manganese, and graphite are vital to the transition for sustaining battery longevity, performance, and energy density of all-electric vehicles (EV) motors, solar panels, and wind turbines.[68] The demand for these minerals and other and rare earth elements is forecast to increase exponentially in the coming years due to the transition. For example, soaring demand for batteries will require massive

[67] Op cit, n 64

[68] IEA (2021). The Role of Critical Minerals in Clean Energy Transitions. Available: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions

amounts of lithium, a key component. The IEA forecasts that the energy sector will become one of the leading consumers of minerals as the energy transition accelerates (Figure 6). IMF analysis also shows that the combination of soaring demand for metals and slower supply changes could push metals prices to reach historical peaks for an unprecedented length of time.[69] These mineral resources can be found in abundance in Zambia, the Democratic Republic of Congo (DRC), and South Africa, among others (Figure 7). This means that there is potential for SSA to play a significant value-adding role in the global supply chains for these critical minerals. However, this must go beyond mere extraction and intermediate processing of the minerals into battery cell manufacturing and assembly to capture a substantial share of the value chain opportunities.

**Fig 6 Mineral demand for clean energy technologies by scenario**



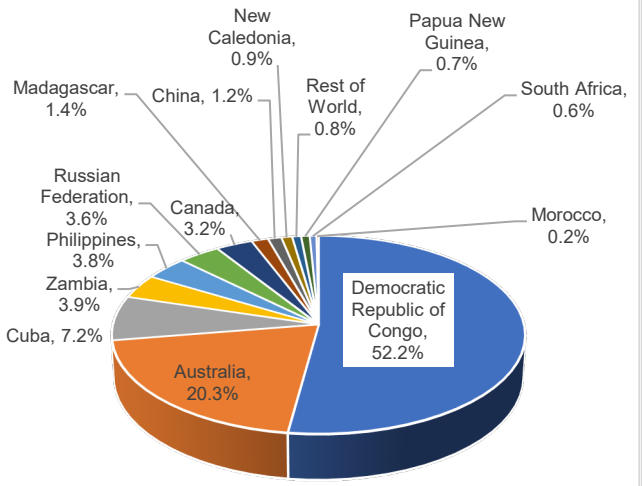

Notes: Mt = million tonnes. Includes all minerals in the scope of this report, but does not include steel and aluminium. See Annex for a full list of minerals.

Source: IEA[70]

[69] Boer, L., Pescatori, A., & Stuermer, M. (2021). Energy Transition Metals. IMF Working Paper No. 2021/243
[70] Op cit, n 68

**Fig 7 Cobalt and Lithium Production and Reserves**

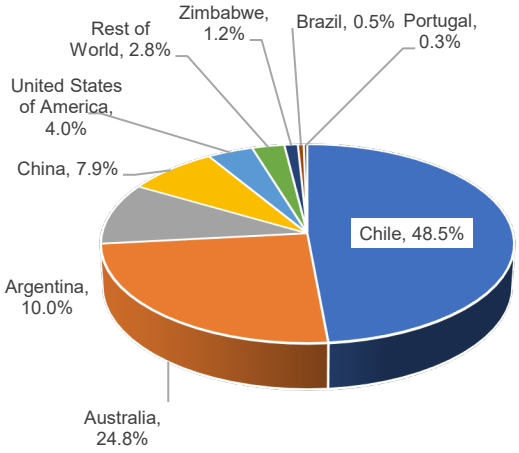
**Cobalt: Production and Reserves**




Note: Total reserves at end of 2020: 6,902 Thousand tonnes

Data source: BP Statistical Review 2021

**Lithium: Production and Reserves**




Note: Total reserves at end of 2020: 18,955 Thousand tonnes

Data source: BP Statistical Review 2021

For SSA to benefit from the transition, the development of value chains and beneficiation is key to avoid a repeat of the paradox of plenty syndrome. Developing value chains also aligns with key continental strategic imperatives such as the African Union (AU) Agenda 2063[71], the African Continental Free Trade Area (AfCFTA)[72], African Development Bank's (AfDB's) High 5s[73], and the Africa Mining Vision (AMV)[74]. These are being championed and funded by regional multilaterals and development finance institutions such as the AU, AfDB, Afreximbank, the Africa Finance Corporation (AFC), and the UN Economic Commission for Africa (UNECA), among others. In planning to take advantage of the future opportunities, past lessons should guide the continent: it is no longer justifiable to export raw minerals. However, to do this, structural bottlenecks need to be significantly addressed. These include the need for cheap and reliable dispatchable power to drive industrialisation. Likewise, good infrastructure such as roads and rail links to connect mines and spread spatial development more evenly is fundamental, especially in stemming the continent's massive urbanisation.

Finally, a stable investment regime and conducive business environment are necessary. Unfortunately, several countries where these mineral resources are abundant on the continent lag on business reforms. While some countries are thinking of special fiscal regimes to guide the extraction of these minerals, which ensures a fair share to the state, these must be balanced with the need for stability and predictability of the fiscal regime, also on a bigger industrial development agenda – that is, a combination of fiscal and industrial policy. The situation whereby Zambia, for example, desperately increased its fiscal take six times between 2012 and 2019 must be avoided, as such moves often serve as a disincentive for

[71] African Union (n.d.). Agenda 2063: The Africa We Want. Available at: https://au.int/en/agenda2063/overview (Accessed: 24 November 2021).
[72] African Union (n.d.). *African Continental Free Trade Area Questions & Answers.* Available at: https://au.int/sites/default/files/documents/36085-doc-qa_cfta_en_rev15march.pdf (Accessed: 24 November 2021).
[73] AfDB (2019). *The High 5s, African Development Bank - Building today, a better Africa tomorrow*. Available at: https://www.afdb.org/en/high5s (Accessed: 24 November 2021).
[74] African Union (2021). *AMV – Africa Mining Vision.* Available at: https://au.int/en/ti/amv/about (Accessed: 24 November 2021)

investment.[75] Chile's attempt at developing and capturing a larger share of the EV value chain can serve as a guide for SSA: In March 2018, the Chilean government signed a deal with South Korea's POSCO and electronics giant Samsung SDI to build factories in the country, which would produce EV battery parts — cathode materials such as Nickel Cobalt Aluminium and Nickel Cobalt Manganese.[76] In return, through CORFO, a government organisation that oversees the country's lithium resources, Chile would provide a guaranteed supply of lithium at an agreed fixed price for 30 years. While reports[77] indicate that the Chilean government has not been able to deliver on the promised volumes, the policy intent or signally is, in our view, the right one.

# 4 Conclusions

In the SSA context, the energy transition should not just be about reducing emissions or decarbonisation for its own sake. Instead, it crucially needs to be linked to bridging the energy access gap and encouraging productive uses of energy to create new competitive industrial clusters, which creates jobs and sustains economies. The data shows that SSA has the lowest emissions and the lowest energy intensity globally. If our economies are to develop and create better jobs, then the latter number needs to improve significantly using all forms of available energy. The framing of the energy transition matters because millions of lives and jobs are at stake, especially in developing countries such as in SSA. As Nigeria's Vice President argues: "a global transition away from carbon-based fuels must account for the economic differences between countries and allow for multiple pathways to net-zero emissions".[78]

While there are clear opportunities for green industrialisation and other 'industries without smokestacks' (IWOSS)[79], such as high-value agriculture, tourism, and business services, these can co-exist with traditional resource-based industrialisation to drive structural transformation. They must not be seen or be promoted as being mutually exclusive. The latter will become even more pertinent as Africa has an abundance of the critical minerals needed for the energy transition, such as Copper, Lithium, and Cobalt, among others. However, there is a need to craft an African strategy — especially in the context of the AfCFTA [76]— and coordinated regional and country-level strategies as industrial orientation will indicate the potential for leveraging the energy transition. SSA needs to increase its manufacturing share and have a genuinely high-tech or advanced industrial sector.

Thus, linkages and value chain development will be critical - beneficiation will be key to avoiding the paradox of plenty syndrome as it is no longer justifiable to export raw minerals. Structural bottlenecks, such as the need for reliable and cheap power, is fundamental. Also, good infrastructure is needed to connect, for example, mines and spread spatial development more evenly. Likewise, stable investment and business environment are fundamental in attracting domestic and foreign capital. At a firm level, increasing productivity will also be vital. East Asia's industrial success benefited from deliberate policies to build the capacity and capabilities of domestic firms, including fostering industrial clusters

[75] Acheampong. T. (2019). Zambian mineral royalties increase. Available at: https://ihsmarkit.com/research-analysis/zambian-mineral-royalties-increase.html (Accessed: 29 September 2021).

[76] Sherwood, D. (2021). *How lithium-rich Chile botched a plan to attract battery makers, U.S.*. Available at: https://www.reuters.com/article/us-chile-lithium-focus-idUSKCN1UC0C8 (Accessed: 29 September 2021).

Electrive.com (2018). *Chile's lithium resource redistributed through Corfo.* Available at: https://www.electrive.com/2018/03/12/consortium-to-build-54m-cathode-materials-plant-in-chile (Accessed: 29 September 2021).

[77] Op cit, n 76

[78] Osibanjo, Y. (2021). The Divestment Delusion - Why Banning Fossil Fuel Investments Would Crush Africa. Available: https://www.foreignaffairs.com/articles/africa/2021-08-31/divestment-delusion (Accessed: 01 October 2021).

[79] Newfarmer, R., Page, J., & Tarp, F. (2019). *Industries without smokestacks: Industrialisation in Africa reconsidered*. Oxford university Press.

(agglomeration) via special economic zones such as industrial parks, high tech zones and export-processing zones[80]. Unfortunately, these have been largely absent or not fully implemented in several SSA countries.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## Conflicts of Interest

The authors declare no conflict of interest.

[80] Apiko, P., Woolfrey, S., & Byiers, B. (2020). *The promise of the African Continental Free Trade Area (AfCFTA)* (No. 287). ECDPM Discussion paper.