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Changing the Conversation on Energy Transition

By Miguel Schloss

Combating Climate Change: Words or Deeds?- Advertising helps, but doesn't trigger progress

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Strictly as per the compliance and regulations of:

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I. Combating Climate Change: Words or Deeds?

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Who would have thought that after 30 years since the UN Convention on Climate Change, the gap between the agreed goals, and delivery on them remains so wide, and that consequently global warming continues unabated?

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With current known technologies, policy approaches and institutions involved, the goals agreed by the international community for mid-century are not going to be met. The Inter-governmental Panel on Climate Change (IPCC) has been indicating that to limit warming to 1.5 ° C from preindustrial times, carbon emissions needed to decline 45 percent by 2030. They did not say that the world would end, nor that civilization would collapse, if temperatures were to rise above 1.5 ° C. [i]

Moreover, in the fourth assessment report, the IPCC projected that by 2100, the global economy would be three to six times larger than it is today, and that the costs of adapting to a high (4° C) temperature rise would reduce gross domestic product (GDP) just 4.5 percent, which surely does not sound like the end of the world. ‘

In this connection, the IPCC has noted that “there is robust evidence of disasters displacing people worldwide, but limited evidence that climate change or sea level risks is the direct cause”. [ii]

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This is not to say that climate change does not require proper attention and priority, but that there are other drivers, such as low socio-economic development or limited capabilities of the state, that are judged to be just as to be equally if not substantially more influential in current and associated imbalances. [iii]

Hitherto the approach to the issue has tended to rely on setting targets for carbon emission reductions and pledging resources to achieve them. Governments have focused on top-down regulatory mandates reliant on poorly grounded views of our future, without offering good answers to what needs to be done to reverse past trends.

While such concerns have a valid place in policy and technical debates, caring and protecting the environment must also achieve universal prosperity for all — both objectives are mutually supportive and absolutely indispensable.

Polarizing discussions between emission reductions vs. economic well-being, essentially deflected attention from reconciling both objectives. The focus must shift towards paying attention to the incentives to align interests towards sustainability, efficiency, and emerging societal demands - not as abstract aggregates, but as a way of achieving economic solutions.

If incentives are right and the business is profitable, investments will flow, and carbon mitigation is going to take a hold. Efforts cannot rely exclusively on government pressures – increasing guidelines, clearance of environmental mitigation programs, setting targets, tracking compliance arrangements. On their own, they tend to stray from the interests of producers and consumers alike – the ultimate beneficiaries of sound environmental policies.

Institutional constraints, costly and time-consuming processes that oftentimes have their share of discretionary powers among regulatory agencies, can easily generate bureaucracy and conditions for corruption, as happens in other fields where anti-trust legal reforms are under consideration, where “gatekeepers” tend to prevent competitive practices through costly clearance procedures. [iv] For these reasons, having enabling conditions, with appropriate competition aimed at attracting enterprises, will be necessary for serious and scalable decarbonization.

That said, the recent UN Climate Change Conference of the Parties (COP) meeting, represented for the first time a welcome (albeit timid) dose of realism. Gone were the all-too-frequent rhetorical pronouncements about the dangers heralding the pending crisis to humanity and the self-congratulatory declarations celebrating new promises to avert such a disaster.

There was moderate recognition that the world was on the way to a rise of 2.7° C towards global warming, while experts estimate that the outlined plans could produce a trajectory of between 1.8° C and 2.4° C increase.

Consequently, taken pledges at face value, the target in the original agreements of 1.5 ° C is still in force, but barely, and it has therefore been agreed to review the commitments by the end of 2022 to steer plans for a 1.5° C warming.

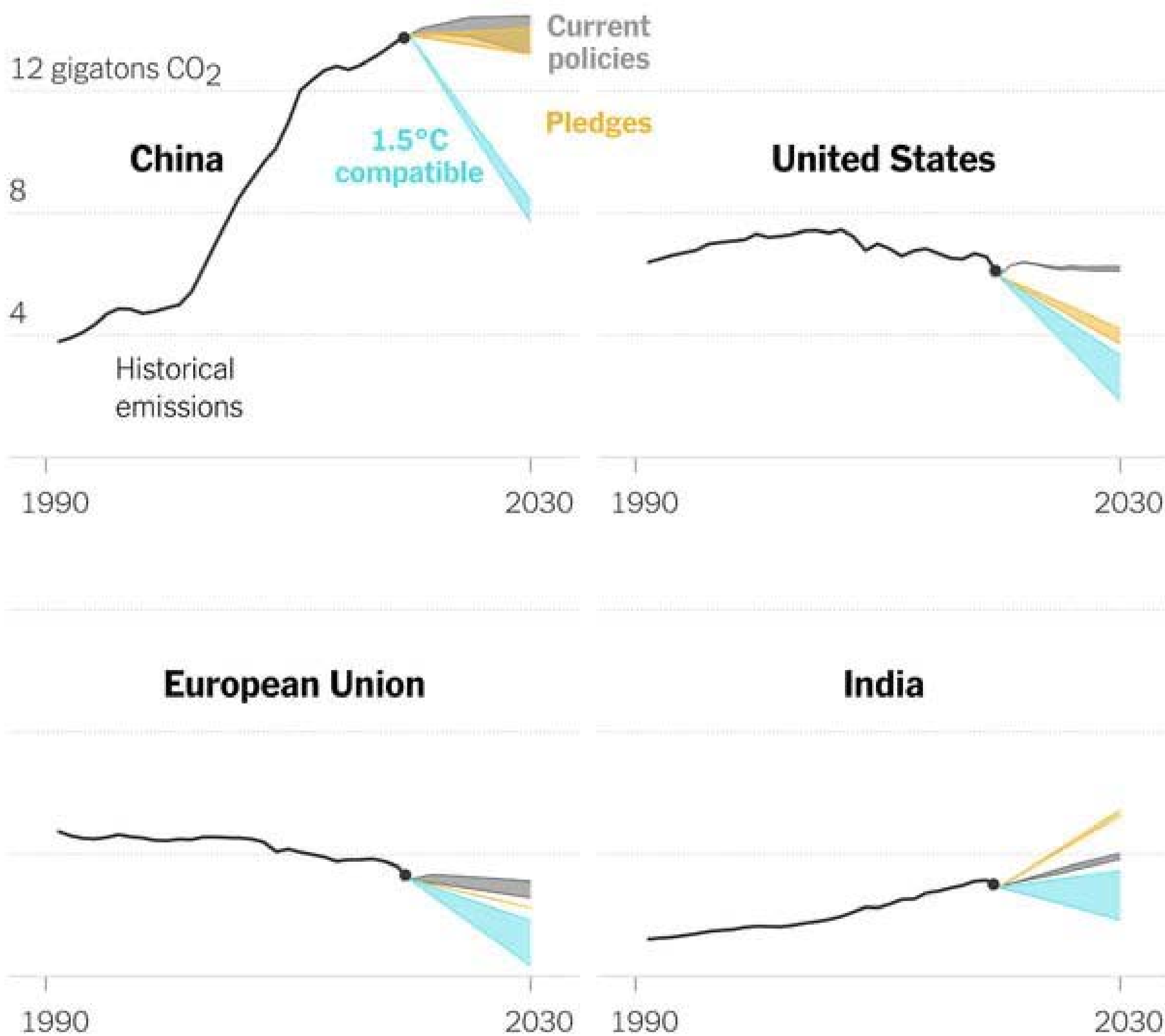
An effort of this magnitude requires a change of pace of historical proportions for energy policies and an investment of at least $ 16.5 trillion. These magnitudes will require a profound transformation in production and transportation practices, investments in renewable energy and efficiency, as well as carbon capture and storage, which at present are for the most part in their infancy [v]

Adding up pledges and programs, recent COP proceedings suggest that more than 100 countries pledged to reduce methane emissions, and another100 gave committed to ending deforestation.

A few major countries outlined plans to accelerate their shift to renewables, the bottom line is that numerous G20 countries, where volume counts, are not yet on a trajectory to reach their stated net-zero goals.

But in all, major gaps persist in achieving the right trajectory to achieve the internationally agreed targets.

This can be seen in the depiction below, showing the difference between projected emission trajectories with current policies and those to achieve the 1.5 °C goals:



Politically, it will be difficult to move faster, as this will inevitably increase the cost of living and perhaps muffle economic growth. For this reason, carbon neutrality is fundamentally a global problem that does not resonate with or respond to daily needs felt at the local level.

Accordingly, transition and adaptation programs should be developed to respond to the needs of evolution towards carbon neutral solutions while responding to development needs. In the absence of a broad political consensus to curb emissions, the political system is likely to choose fragmented, imperfect approaches, and probably more costly solutions that may well aim below the targets that have been set, requiring more interventions in the future.

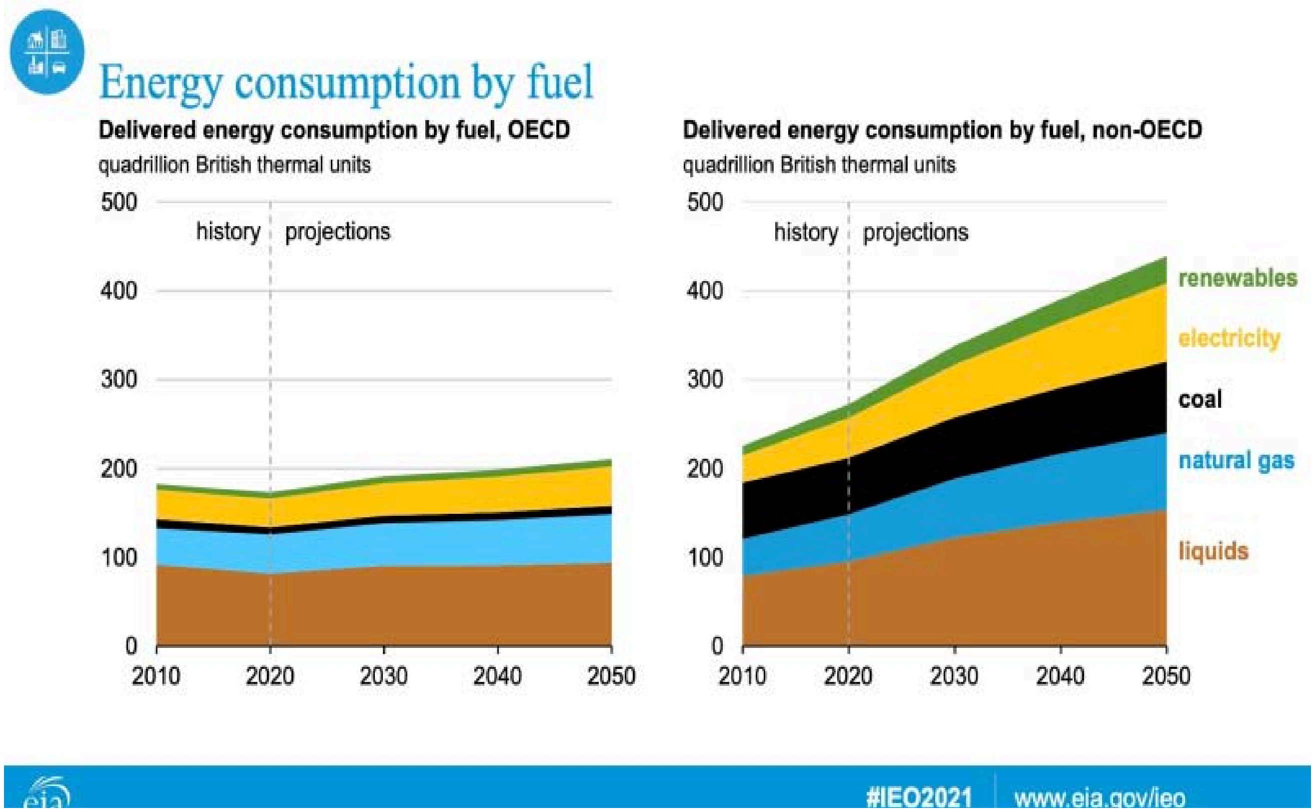
II. Expanding Renewables in Emerging Economies

Generate enabling conditions, capacity, not dependency

Most of the expanding energy demand (and CO_2 emissions) will be generated by economic growth in emerging economies (especially in Asia).

Ultimately, energy demand will be generated by economic and population growth. This will take place mainly in countries in their early stages of development, which tend to be energy-and hydrocarbons-intensive, basically to replace human and animal toil for small scale equipment driven by internal combustion engines, such as small-scale pumps, motorbikes and the like[vi]. Accordingly, attention will have to shift beyond OECD, which will constitute the largest share, both in relative and absolute energy growth.

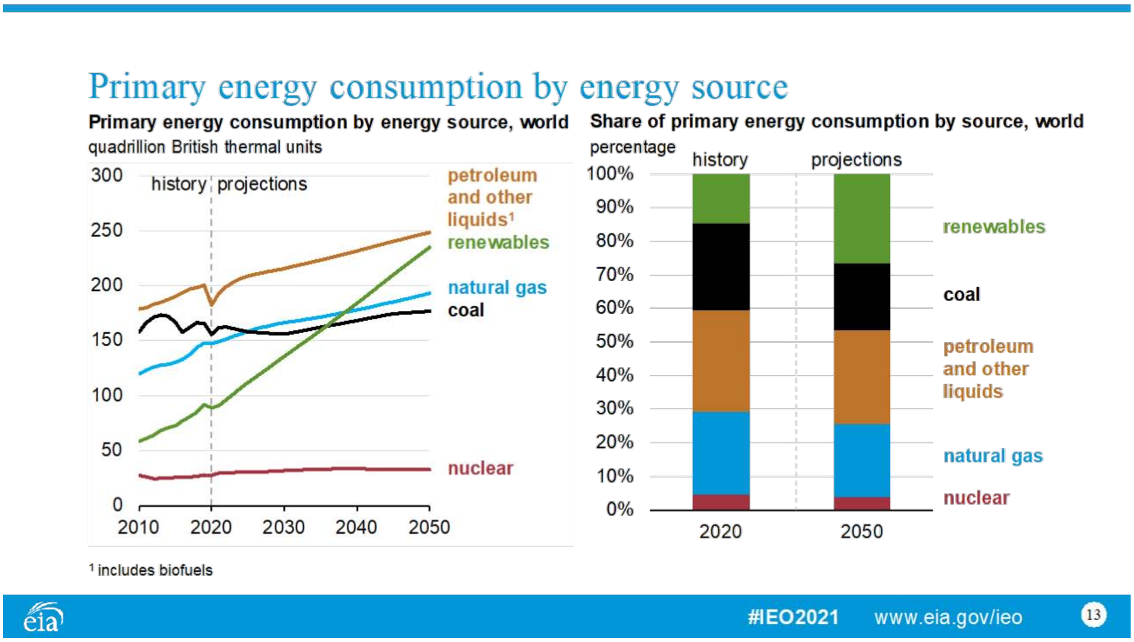
Not surprisingly, a scan be seen in the graph below, non-OECD energy consumption will constitute the largest share, in both relative and absolute growth rates over the next decades:



Accordingly, it is in non-OECD countries where attention needs to be focused -- as it is there where human, technical, organizational resources are also the weakest, and where the greatest support and adjustment will be required to achieve and effective transition.

In all, as things stand, aggregate energy consumption may change through rapid increase in renewables. However, short of a major technological breakthrough, the aggregate energy matrix will still have a significant share of traditional sources, such as petroleum and other liquids, and natural gas over the next decades.

These could provide the necessary base loads and associated reserve capacity, and a declining share of coal, as can be seen below -- which suggests that is rather unlikely that it will be possible to have a fully decarbonized economy by 2050, or the interim targets agreed 2030:



III. Decarbonization for Harder-to-Abate Sectors

If you don't like change, you will like obsolescence a lot less

At the same time, we do not have the technical solutions to meet about half of the CO2 emission goals set for mid-century, particularly to supply the energy requirements of the harder-to-abate sectors, with long replacement cycles. They need power with reserve requirements that renewable cannot provide because of their eliance on intermittent solar or wind conditions.

Manufacturing, aviation, heavy-duty transportation, mining and heavy industries are the scaffoldings for worldwide development, which are more difficult to electrify. Investments will have to be up scaled and innovation will be an absolute necessity to develop technologies for such activities through efficient and lower emitting hydrocarbons, hydrogen, carbon capture and offsets.

While such industries tend to concentrate in developed countries, extractive industries in general, and mining in particular, constitute the backbone of a large part of emerging economies. It is this sector that can generate the bulk of foreign exchange, fiscal revenues and surpluses to finance investments for economic development. Moreover, mining (particularly copper), while being both energy and carbon emitting intensive, is as well a key input for renewable power generation. Accordingly, this sector could position countries becoming an integral part of the emerging clean-tech economy and a source of growth in years to come.

Mining is both one of the most energy-intensive industry and a major source of raw materials for other industries, including renewable energy technologies. Both factors need to be reconciled to assure a viable long-term future in the mining sector.

The total global energy use by the mining industry comprises about 19% of global coal and coal products and 5% of global gas and 2% of global oil supplied. Total energy demand for mining is anticipated to grow over the near- to mid- term. A low-carbon future will be significantly more mineral intensive than a business-as-usual scenario. Global demand for "strategic minerals" such as lithium, graphite and nickel will skyrocket by 965%, 383% and 108% respectively by 2050.

Copper will also be needed for emerging technologies. While the growing demand for minerals and metals offers an opportunity for mineral-rich developing countries, it also represents a challenge: without climate-smart mining practices, the negative impacts from mining activities will increase, affecting vulnerable communities and environment.

Specifically, the mining industry is responsible for 4-7% of global greenhouse gas emissions – 1% caused directly by mining operations or indirectly through, for example, electricity consumption used to power mines; the remaining 3-6% coming from fugitive methane emissions. Emissions caused by all other indirect usage of the minerals extracted (for example coal used in coal-fueled power stations) are in turn responsible for up to 28% of global greenhouse gas emissions.

At the same time, the mining industry is bound to face increased demand for raw materials, as low-income economies shift to middle-income status, and increasing attention (and requirements) from high- and medium-income countries of emission standards in trade arrangements throughout the value chain, and ensuing increased pressure on the mining industry to reduce emission from their operations.

These tradeoffs will not be easy to manage, because mining operations must remain sensitive to both energy efficiency and security to remain competitive and viable. Continuing lowering costs of wind and solar PV technologies have enabled some inroads of renewable energy in the mining industry. Greater advances and cost reductions in storage facilities will be still necessary to provide a sustainable base load to provide energy security needed by mining companies.

Accordingly, sustainable and responsible strategies and practices across the mineral value chain may have to be instituted to assist governments to build a robust policy, regulatory and legal framework that promotes climate-smart mining and creates an enabling environment for private capital to do its part at the mining industry level.[vii]

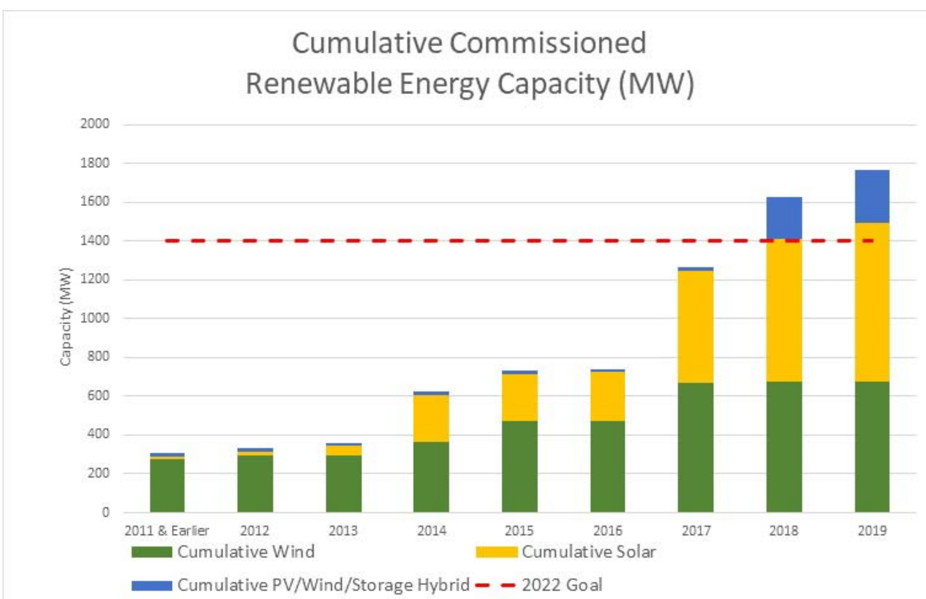
Mining companies have not ignored the need to become more environmentally responsible. Improvements in exploration and drilling equipment used to locate and extract minerals have created an unprecedented level of precision, reducing the amount of unnecessary excavation.

Elsewhere on site, the drive to reduce carbon emissions has impacted the modernization of mine vehicle fleets through hydrogen power. "Dual fuel" systems to power existing combustion engines have been introduced and new truck prototype are set to operate this year aimed at cutting carbon emissions by 2,260 tons per year.

Although not intended as a climate-smart investment per se, but as a strictly economic proposition, the El Teniente mine in central Chile (the largest copper production facility, with some 4,500 km underground corridors) is using gravity as a central source of energy by availing themselves of the major gradient existing between extraction at 2,500 to 3,000+ mts above sea level, and processing all the way through shipping at sea level in a rather narrow space.

Additional sources of low-carbon energy to generate further environment-friendly solutions still need to be developed. A low-carbon transition where mining is climate-smart and value chains are sustainable and green will enable emerging economies play a leading role in this transition.

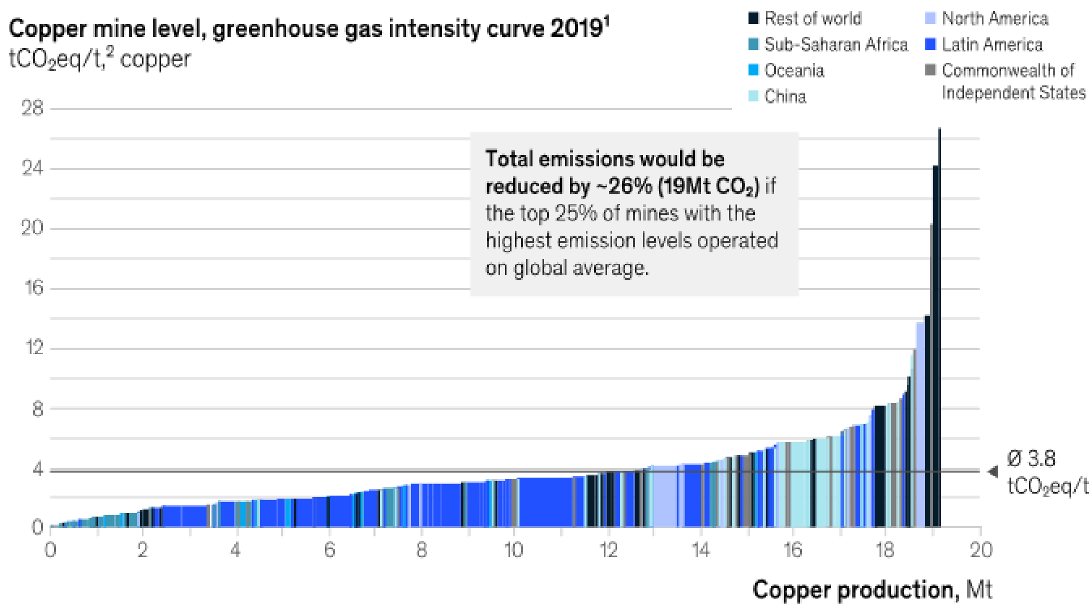
The mining sector is already availing itself of more recent opportunities for renewable use in mining operations, outpacing growth compared in many other sectors, though admittedly from a low base, with cumulative commissioned capacity surpassing 1.7 GW:



In years past, some mining companies have explored on a technology-driven "push"— advancing low carbon technologies and process design — to drive adoption of renewables and alternative energy sources.

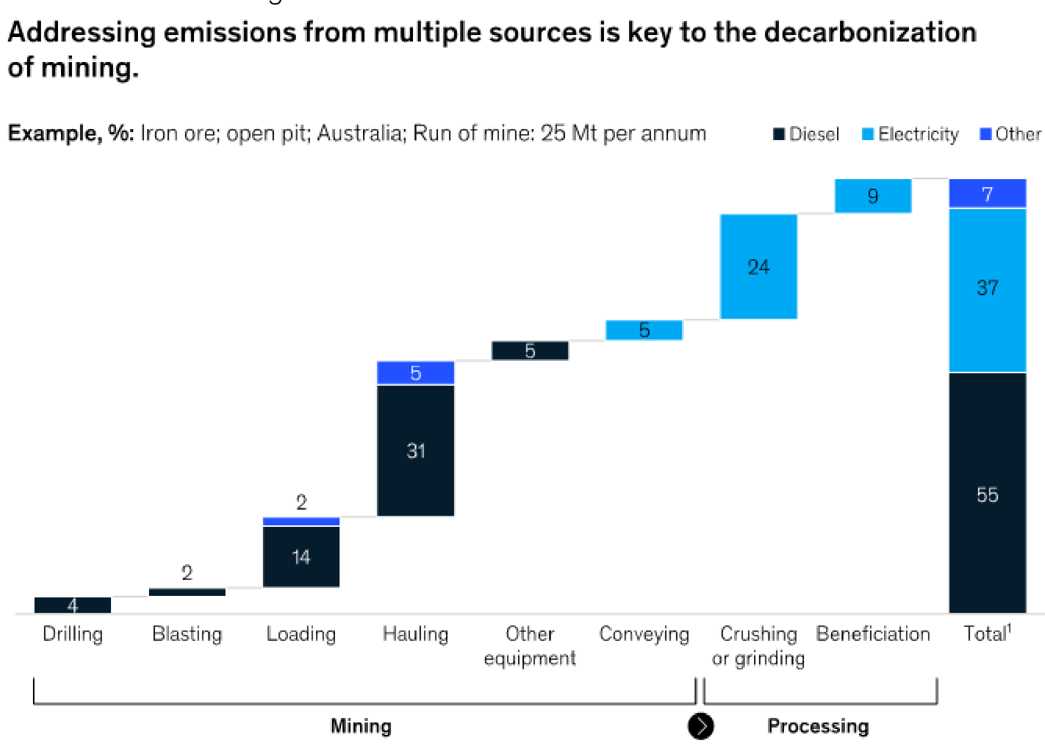
But there remains a long road ahead to overcome genuine concerns to move beyond well-established comfort zones in the sector. Emissions within mining can be broken down into three broad types: Scope 1 (emissions from diesel), Scope 2 (emissions from electricity generation), and Scope 3 (emissions from the supply chain and transport). Today 40 to 50 percent of CO_2 emissions come from diesel used in mobile equipment, with another 30 to 35 percent from nonrenewable electricity.

However, the emissions intensity varies widely across mines: for example, within copper, we see a twentyfold spread among the emissions intensity of mines, as can be seen below:



[1]Considers Scope 1 and 2 emissions.
[2]Total CO_2 equivalent per metric ton.

To understand this variation, McKinsey & Co., has created a comprehensive mine-decarbonization model. This breaks down mining emissions that assesses more than 20 decarbonization options illustrated below, to show what the world's net zero-carbon mine could look like:



[1]Figures may not sum to 100%, because of rounding.
Source: McKinsey Mine Decarbonization Model

The transition from fossil fuels to low-carbon energy sources will depend on critical minerals. Their consumption could increase six fold by 2050, according to one scenario [viii] by the International Energy Agency. In the emerging world, trade [ix] in energy-related resources will consist largely of critical minerals rather than oil and natural gas. By value, this market could top $400 billion, exceeding the value of all the coal extracted in 2020.

In all, two applications could drive three-fourths of the demand for critical minerals in 2050: electricity networks and batteries. Half of projected demand by then is for copper and a quarter is split between nickel and graphite. Then come lithium, manganese, and cobalt. In terms of value, copper accounts for a third of total in 2050, lithium and nickel each account for almost a quarter each, graphite 10 percent, and cobalt 7 percent. Copper, lithium, and nickel will account for over 80 percent [x] of the market value in 2050. The production of each mineral is concentrated, but major producers differ by commodity.

Indications are that many investors are adopting the "Toronto Principle", inducing them to selling all their fossil fuel investments. The Financial Times reported in September 2019 that the number of institutional investors pledged to completely remove fossil fuels from their portfolios by 2030 had jumped from 180 in 2014 to over 1,100, representing around US$11tn in assets. Other signs that the mining and other such industries will face an increasingly hostile investment environment include the European Central Bank's consultation, published on 20 May 2020, to guide banks to price their loan products in correlation to the environmental risks of enterprises in question.

IV. The Technological Change Route to Close the Long-Term Gaps

If it looks familiar, you've seen it in your dreams

Important as renewables may be, they are *perforce* climate-dependent given the intermittent nature of solar and wind energy sources, and ultimately location-specific. Accordingly, they are at times hindering construction of renewable power plants near heavy industry and mining sites, which oftentimes makes remote and long replacement cycle operations dependent on fossil fuels such as diesel, heavy oil fuels, and coal, for on-site generation.

Given such limitations, continuing efforts will be needed to further reduce their costs, so that they become competitive at similar load factor and at grid levels. It is, nonetheless, an absolute necessity to research and develop new sources for cleaner energy, to close the gap to achieve the agreed mid-century goals.

The Annex to this article contains a description of half a dozen options at research and development stage, and are at various experimental phases, several of them in confined environments or laboratories. There are other geo-engineering variants being considered with other compounds to scatter sunlight, aimed at reducing more directly global warming.

In all, as things stand, aggregate energy consumption may change through rapid increase in renewables. Short of a major technological breakthrough, the aggregate energy matrix will still have a significant share of traditional sources, such as petroleum and other liquids and natural gas, which is lower CO_2 emitting than other traditional sources.

V. The Policy Route towards Aligning Interests

Dead fish go with the flow

Given the urge for effective action, cooperation will be essential. However, the approach cannot succeed if it seeks uniformity, but honors diversity, to free countries try out and experiment different approaches and technologies, until effective ones are found that can demonstrably address the energy/environment conundrum.

All too often, well intentioned policies lead to unintended consequences. The proliferation of earmarked funds for renewable energy to accelerate the process has produced a multitude, oftentimes conflicting signals and distortions that required counter-measures to compensate for such distortions. Similarly, "picking winners" has led to choices that oftentimes societies have bulked to accept.

Instead, anchoring policies in non-distorting incentive (such as *carbon pricing*) mechanisms will be required to enhance investment environment and provide much-needed energy security in a period of transition and experimentation.

This is especially important when renewable energies, by definition, are dependent on (and vulnerable to) climatic factors, and their costs are still relatively high at current levels of development, particularly when adjusted by load factors.

To "level the playing field" between traditional and renewable energy sources, the cost of emissions will have to be recognized, subsidies to traditional sources discontinued, and the multiplicity of earmarked funds that distort and resource allocation will have to be avoided.

Whatever the formula to establish prices and/or methods of CO_2 *tax collections,* until a free and a functioning carbon market is established, a more forceful and rapid change of the energy matrix can take place. [xi]

At the moment, we are still far from such an objective, since in only G20 countries, application of carbon prices reached 48 percent of all polluting sector, and the average price barely reached $ 20 per emitted ton - vs. $ 70 that is estimated to prevent the temperature from rising beyond 1.5° C.

As the low-carbon transition gathers pace, voluntary carbon markets (VCMs) are growing around the world alongside and, in some places, in lieu of compliance oversight arrangements, at times in the absence of more formalized government-led schemes.
While nascent, the VCMs, where companies purchase credits to offset their emissions, surpassed last year $1 billion, covering almost 640 companies from the S&P 500 and high-emitting sectors, and some 27 percent of U.S. companies now have set net zero targets.

Together with other policies, well-designed VCMs can help reduce costs for emerging climate technologies. This is bound to enhance their chances of adoption at scale, achieve more significant decarbonization and market efficiency across regions.

In some cases, such as the European Union, carbon border adjustment (or *taxation*) mechanisms are starting to take shape as a form of carbon pricing of imported goods and the path to advancing climate action globally in the coming years.

With emerging guardrails and transparency, carbon credits generate a vital source of finance for projects that contribute to climate mitigation, resilience, and sustainable development goals, which can avoid "greenwashing" of unsubstantiated claims of emission reductions.

Admittedly, an unresolved challenge is the quality of carbon offsets that underpin this trade. With more companies adopting net-zero emissions targets, the market for fossil fuel carbon offsets (including oil [xii]as well as gas) has developed quickly. But there is great skepticism[xiii] over the consistency and quality [xiv]of carbon offsets.

Problems include the often murky distinction[xv] between carbon reductions or avoidance versus actual carbon removal, potential conflicts of interest among third-party verification agencies, and lack of governance [xvi] of carbon markets to ensure consistency.

VI. Reflecting on the Future

Sell on the what, buy on the how

As those who have been in charge of implementing major reforms well know, the distance between design and reality is long. The major fault lines that need to be pierced are centered between defining the *what* and addressing the *how*.

At the bottom of it all, the tectonic shifts taking place around the world have tended to leave governments generally misplaced in dealing with dynamic changes. In fact, it is difficult not to see the glaring gap between goals and achievements in the energy and environment debate at governmental levels, and its farcical disconnects from the more here-and-now societal concerns on energy security, affordability, and sustainability at household levels.

Nowhere has this become more evident than at the gas pump – where, for instance, 40% of European gas was supplied by Russia. It follows that since this energy flow has stopped, induced by both, policy decisions to curb hydrocarbons production delinked from geopolitical power shifts, triggering price surges to record levels in much of the world.

No technical (solar, wind or other) fixes, or push for certain aggregate goals is going to be effective, unless it provides an adequate response to consumers' real needs, and enterprises have the proper framework and incentives to operate and invest.

Ultimately, the transition to zero emissions by mid-century must be affordable, reliable, and ever cleaner. That in itself will not be easy to achieve, unless an effective and strategic way is developed to: (i)deal with unattended transitional arrangements, particularly the phase out fossil fuels, including coal, in an economic manner, and the associated repurposing and reconversions of existing power generating facilities and infrastructures to change the energy matrix; and (ii) shape institutional and other actions to ensure that they properly respond to stakeholders and citizenry to assure ultimate viability of reforms.

As to the former, special attention will be required for appropriate technical and financial assistance to support the energy security needs of coal-dependent countries like India and South Africa – the two most coal-dependent economies out of the G20 countries, with 71 and 86% of their electricity, respectively coming from coal. Discontinuing coal production will not be without its serious social and economic repercussions, and thus need more nuanced approaches for the transition.

The same can be said about countries with significant traditional power generation facilities and the manner to approach any transition that is bound to claim significant human and financial resources to ensure an evolution that will be within the absorptive capacity of the countries concerned.

Pushing harder, having good intentions, throwing money or new promises of financing to the problem for increasingly ambitious and distant goals, as has been done to date in past COP meetings, or discouraging certain technologies (on the supply side) through laborious clearance processes for individual projects will not generate progress. A more promising avenue is to act through the demand side, letting consumers and suppliers allocate resources and reach agreements through proper pricing and taxation arrangements.

Beyond that, no political, social or moral achievement is without formidable obstacles. There are vested interests to be confronted, attitudes to be changed, resistances to be overcome. The problems are immediate, the ultimate goal frustratingly far away.

The challenge to address both of them requires leadership by influence -- not about authority, but capacity to "read" citizenry, aligning incentives capable of mobilizing a myriad of strands and people, without the need of complicated coordination or farcical clearances at individual projects levels. More than anything, this requires integration and coherence of action, capable to learn from experience and be continually adaptive.

Each country has its institutional capabilities and policy framework, particularly in new and evolving forms of energy generation – no two countries are alike. A viable (and yet unproven) international framework will have to learn and accommodate each country according to their individual character and capability.

History often foretells that in times of necessity, our most precious allusions get dispelled. And this is never so much the case, as in times of crises and unattended demands. Today, with continuing concerns on pandemic, energy transition, technology revolution, we are beginning to wake up to a global paradigm shift. Generational security doctrines and economic orthodoxies that have been rooted in a post-WWII global order are faltering in the face of shifting economic and political weight, including a Sino-Russian alliance flexing its muscles.

The challenge is thus to generate sustainable development responding to changing societal demands— never forgetting that it is at the kitchen table and the tightening purse strings that are the real drivers shaping ongoing worries. A people-focused approach that responds to concerns on energy security, affordability, and sustainability may ultimately contribute to lifting people out of poverty.

Annex

Technologic Development for New Sources for Energy Supply of Hard-to-Abate Sectors and General Economic Development

Various new sources of energy are being studied, in early stages of research and development.

These include, among others the following:

- *Developing zero-carbon fuels.* As 80% of global final energy demand is currently served by high-emitting fuels, zero-carbon substitutes will be key to full decarbonization, as fuels could still serve one quarter of final energy demand by mid-century. Marine shipping, heavy-duty trucking, high-temperature industrial process heating, iron making, long-duration energy storage, and aviation are particularly difficult to electrify and will need cost-effective zero-carbon fuels.
- *Enhancing reserve capacity of new technologies* with batteries or other energy storage facilities that are for the time being rather costly, and could in time improve in cost-competitive long-term storage systems (advanced batteries, fuel cells, thermal storage, and clean hydrogen systems requiring coordination among many actors for producing, transporting, and having the equipment to use it.); scalable low-carbon firm electricity generating technologies (including possible advanced nuclear).
- *Upscaling renewable generating facilities, such as run-of-river plants*, which at present range from 8 to 50 MW capacity to plants over 500MW by connecting various water sources affluents, as currently is being constructed and tested in Chile and Australia.
- *Developing carbon-capture and storage capacity* to remove CO_2 "sinks" and facilitate carbon neutrality through removals in the event that new technologies will not be able to produce carbon-free conditions. For the time being, existing technologies are prohibitively expensive, and require considerable energy if capture is to be done from the air directly.
- *Enhancing performance of solar (and other renewable) equipment* with nanotechnologies or improvements aimed at reducing costs of solar cells and the carbon footprints of upstream production, thereby bringing photovoltaic applications to competitive levels with traditional generating technologies at grid levels.
- *Developing technologies aimed at lowering temperatures* and improving rain conditions by sowing clouds with silver iodide to induce rain; adding iron to the ocean to increase CO2-consuming phytoplankton; or reducing solar radiation with sulfates.

[i] Keywan Riahi, Arnulf Grubler, and Nebojsa Nakicenovic, "Scenarios of Long-Term, Socio-economic and Environmental Development Under Climate Stabilization, "Technological Forecasting and Social Change 74, no.7; 887-935, https://dol.org/10.1016/.j.techfore.20006.05.026

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