ERM SUSTAINABILITY INSTITUTE

RENEWABLES CONUNDRUMS

Renewable(s) Resilience: Four steps to bolster renewable energy supply chains

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Executive Summary

Renewable energy is growing rapidly. At times, it generates more energy than fossil fuel sources in certain regions, and companies around the world are increasingly turning to it to decarbonize. However, renewables must grow further still if the world is to achieve net zero by 2050 and the Paris Agreement's 1.5°C target. Accomplishing this growth will require a massive expansion in renewable energy capacity, which must be met with a substantial rise in inputs essential to building renewable energy infrastructure and products.

Critical minerals and rare earth elements are two of the inputs most needed to accelerate renewable energy adoption. As a result, demand for these materials is skyrocketing, sometimes even exceeding what global supply chains can source in a single year. To meet surging demand, production must increase.

However, critical minerals and rare earth elements are concentrated in a few geographies, complicating companies' ability to source more of them. For example, the world sources 70 percent of its cobalt from the Democratic Republic of the Congo, 60 percent of its rare earth elements from China, and 40 percent of its nickel from Indonesia.[1] With a limited number of places to source from, geopolitical and human rights issues in these geographies threaten companies' ability to scale their renewable energy ambitions.

Consider geopolitics, particularly rising protectionism. Globally, many countries are turning to critical raw material export restrictions to boost their economies, gain geopolitical advantage, or a combination of both. Human rights troubles present further difficulties to securing critical mineral and rare earth elements supplies due to the location of significant reserves and processing capacity in countries with human rights vulnerabilities such as child and forced labor.

Despite the challenges presented by geopolitics and human rights in renewable energy supply chains, with the right actions, companies can better manage risk and create benefit. We view four steps as being particularly key to risk management and benefit creation.

Step 1: Engage your supply chain and go beyond compliance

1. Introduce an extensive human rights due diligence (HRDD) process aligned with the United Nation's (UN) Guiding Principles on Business and Human Rights and the Organisation for Economic Co-operation and Development's Due Diligence Guidance for Responsible Business Conduct.
2. Develop and enforce clear codes of conduct for your suppliers that outline your company's expectations for human rights protections in its supply chains.
3. Create processes to ensure the traceability of human rights practices throughout your supply chain, including by leveraging innovative technologies such as blockchain and artificial intelligence.

Step 2: Explore alternative sourcing options

1. Evaluate local suppliers and those in areas with lower geopolitical risk who can provide needed renewable energy inputs and set targets for sourcing from these suppliers to encourage procurement flow shifts.
2. Seek out available incentives, tax breaks, and other forms of financial support for renewable energy development and supply chains from local governments and those in regions with lower geopolitical risk.

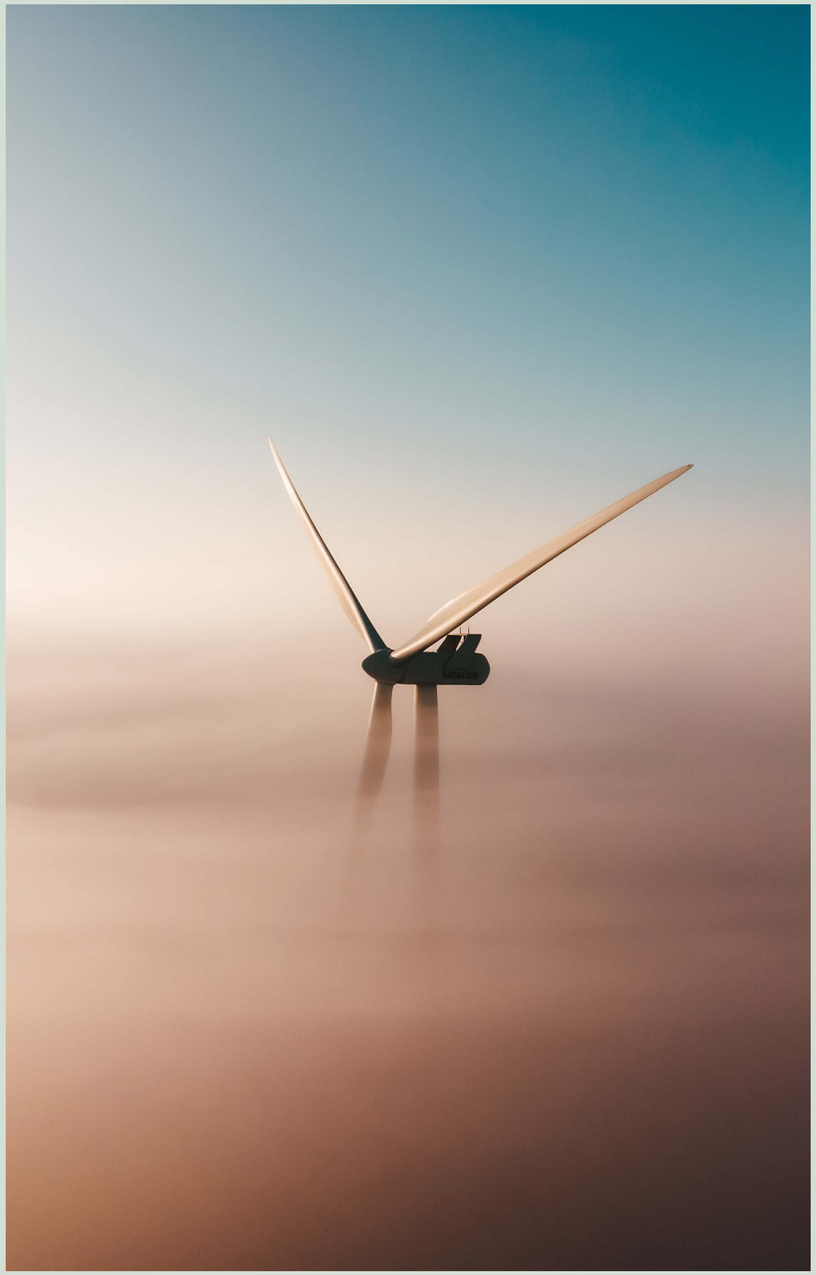
3. Seek out and invest in innovative technologies developed by local companies that reduce their exposure to geopolitical and human rights risks during renewable energy material input sourcing.

Step 3: Seek collaboration and partnerships

1. Seek deep partnerships with suppliers built on mutually beneficial solutions with clearly defined objectives and firmly aligned plans to minimize risk exposure.
2. Consider vertically integrating portions of your renewable energy supply chain to maximize control over and predictability of input availability and human rights practices.
3. Think beyond just renewable energy when seeking partnerships to maximize their impact by considering how potential partnerships can help both organizations meet other corporate sustainability goals.

Step 4: Engage with policymakers

1. Work with governments and non-governmental organizations to strengthen human rights certification schemes and trade facilitation initiatives.
2. Position your company for proactive government engagement, feeding in relevant perspectives to help shape approaches to supply chain management that are conducive to the low-carbon transition.
3. Engage in World Trade Organization (WTO) deliberations to reduce trade barriers for ‘environmental goods’ (a broad term that, by most definitions, includes all major renewables supply chain inputs).



Renewables' insatiable appetite for materials

Across the historical timeline of the global energy market, renewable energy has matured quickly. Not long ago, solar panel installations were a newsworthy event. Today, solar and wind at times generate more power in Europe than all fossil fuel-fired power plants combined, while in the U.S., these two renewables technologies overtook coal in combined electricity production for the first time through the first five months of 2023.[2, 3]

And renewable energy capacity needs to grow further still to achieve net zero by 2050, with the International Energy Agency (IEA) forecasting that renewable energy capacity must triple by 2030 if the world is to meet its decarbonization goals.[4]

Other clean energy technologies, like green hydrogen, may not be as far along, but they also need to embark on aggressive growth paths to keep the Paris Agreement's 1.5°C target in reach. This will require huge investments in additional renewables capacity and a massive influx of materials, from raw and processed inputs to manufactured components, to build the necessary infrastructure and products. The growing demand for critical minerals, an important renewable energy infrastructure raw material, is a good example. The market for critical minerals - $320 billion in 2022 – is forecast to more than triple by 2030 under the IEA's net zero scenario.[5]

Clean energy's growing appetite for materials demands more robust supply chain management than exists today. Like conventional energy sources, the renewables sector must now navigate scarcity, price shocks, and geopolitical turmoil while the world pays increasing attention to how the sector sources materials– from environmental impact to human rights protection.

This briefing will zoom in on the unique issues that threaten supply chain resilience in renewables – like how the renewable sector is disproportionately reliant on a handful of politically unstable supplier countries with poor track records on human rights - and strategies to overcome them.

OUR RENEWABLES CONUNDRUMS SERIES EXPLAINED

This is the second briefing in our renewables conundrums series, which analyzes the biggest issues central to the success of renewables growth and corporate climate action needed to meet the Paris Agreement's target of limiting global warming to 1.5°C. These briefings explore the benefits and challenges associated with these conundrums and how effective management, based on ERM's experience and expertise, can help maximize benefits and overcome challenges.

- The first briefing introduced the series, examined what renewables conundrums are, and explored why they matter to successfully addressing the climate crisis.[6]
- The third briefing will explore the potential adverse environmental and socioeconomic impacts of renewable energy and how they must be considered alongside renewables' positive impacts.
- The fourth briefing will consider how renewable energy developments can be sited and permitted in ways that increase social acceptance and generate benefits for communities.

Fast growth puts renewable energy in a supply chain crunch

With many renewables technologies reaching critical scale and set to continue to grow aggressively, the industry's unique and persistent supply chain vulnerabilities become clear. The origin of these vulnerabilities lies in the materials vital to creating renewable energy solutions.

Materials vital to renewable energy growth

Renewable energy solutions are growing rapidly. In 2022, renewable energy sources powered 30 percent of global electricity generation, compared to 19.8 percent in 2010.[7] Electric vehicles are experiencing similar growth, with 14 percent of all new cars sold globally electric in 2022, up from less than 5 percent in 2020 and an increase of more than ten times from 2017.[8]

Clean energy solutions require various material inputs, particularly critical minerals and rare earth elements. While not a scientific designation, the term 'critical minerals' refers to a group of resources essential to the energy transition and other priorities including economic competitiveness and national security. For example, most solar PV panels today rely on copper as their primary energy conductor material and most electric vehicle batteries use a mix of critical minerals including cobalt, lithium, manganese, and nickel.

'Rare earth elements,' on the other hand, is a scientific designation. Despite what the name implies, rare earth elements are relatively abundant. They comprise a group of 17 metallic elements that are often soft, malleable, ductile, and reactive, making them especially useful in renewable energy applications.[9] Most importantly, the permanent magnetic properties of rare earth elements make them key inputs for magnets that help drive wind turbines and electric vehicles.

Table 1: Critical mineral and rare earth element examples

Critical minerals examples	Rare earth elements examples
Cobalt	Dysprosium
Copper	Neodymium
Lithium	Praseodymium
Manganese	Scandium
Nickel	Terbium

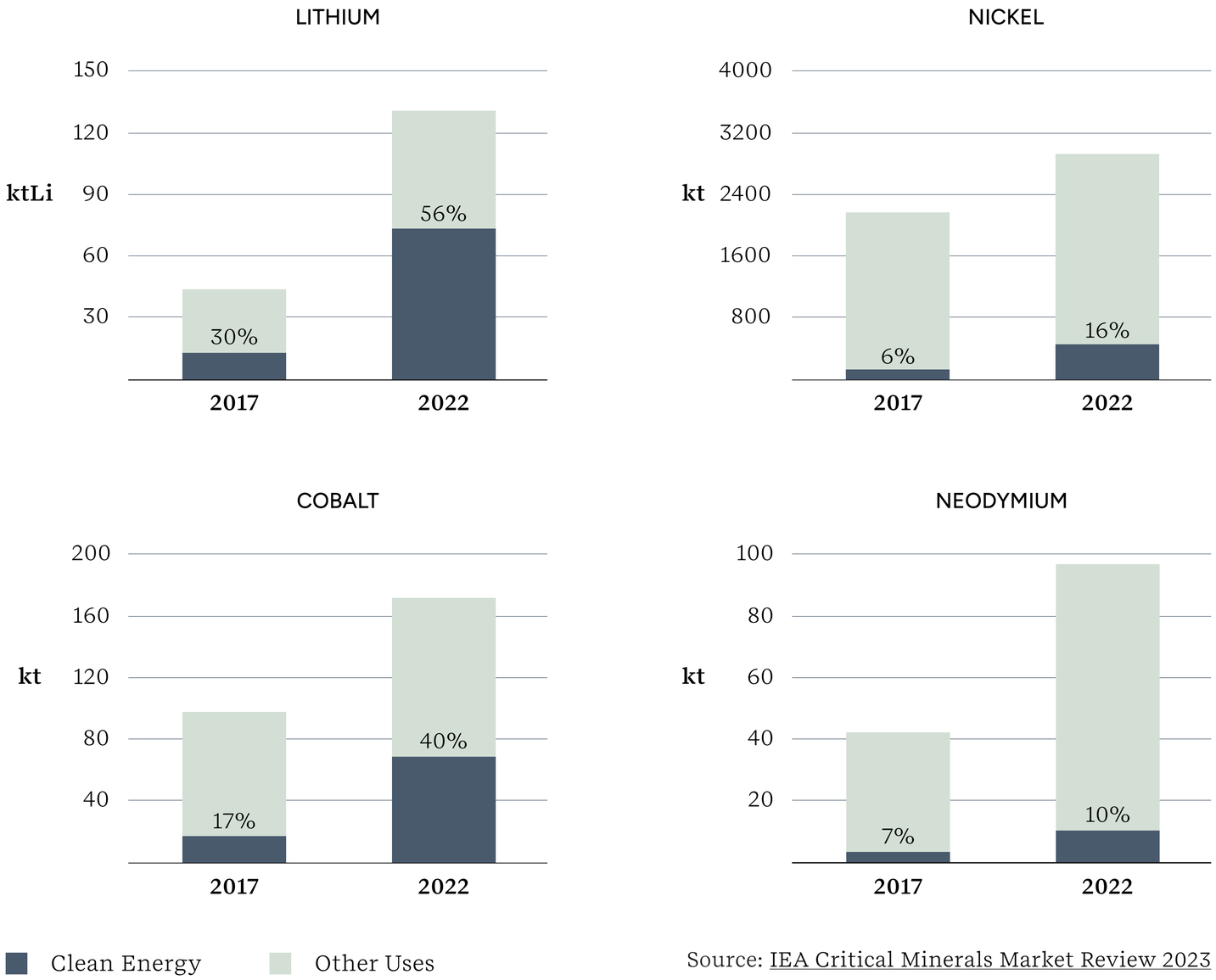
Supply chains must keep pace and need rapid development

While critical minerals and rare earth elements make many clean energy technologies possible, renewables supply chains must keep pace with the rapid growth of these technologies if the world is to achieve net zero by 2050.

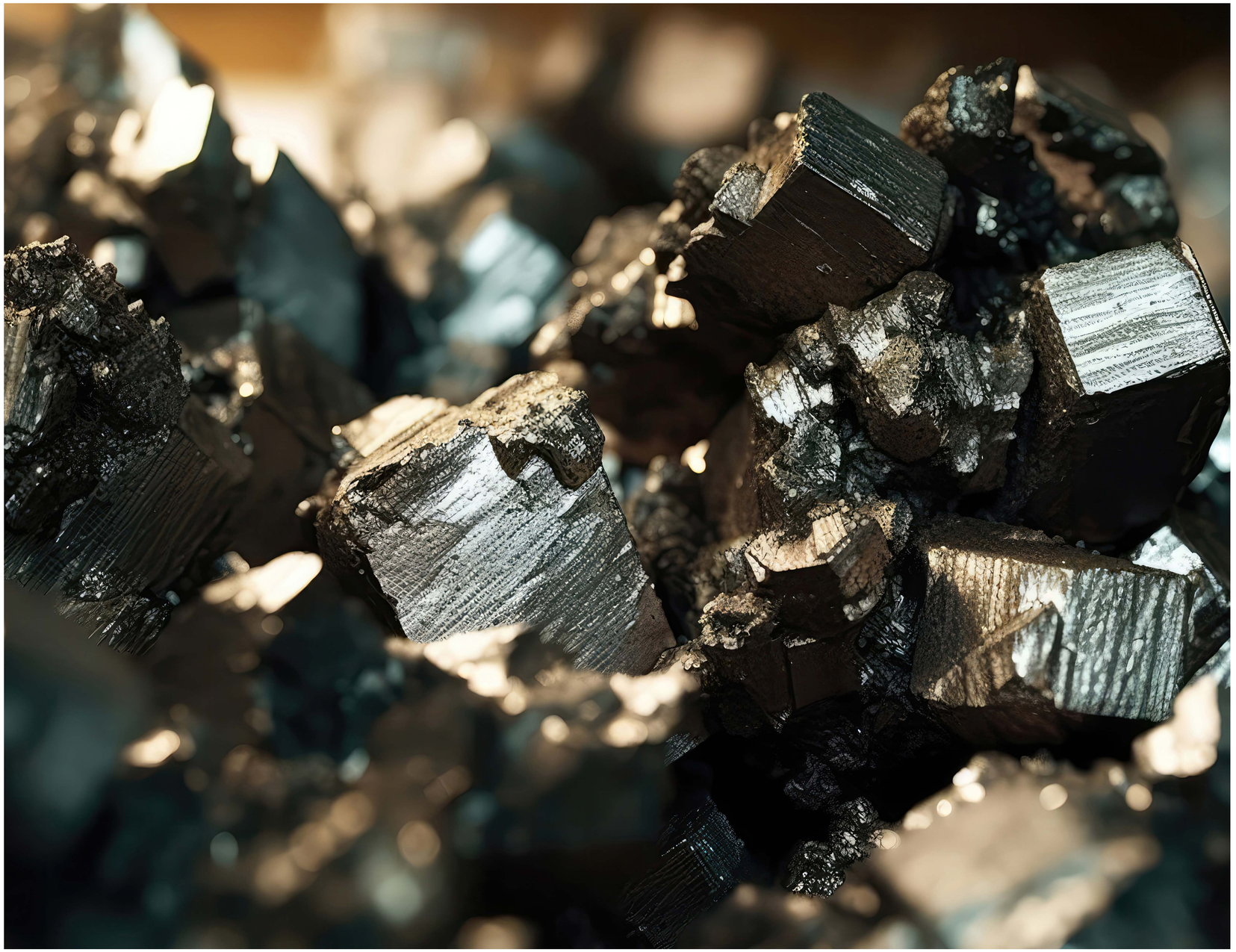
To start, clean energy technologies require considerably more critical mineral inputs than their fossil fuel counterparts. The average offshore wind farm requires 13 times more critical mineral inputs than a comparable natural gas plant, while an electric vehicle requires six times more than an internal combustion engine vehicle.[10]

These requirements are accelerating demand for critical minerals. Between 2017 and 2022, lithium demand tripled, cobalt demand grew by 70 percent, and nickel demand grew by 40 percent.[11]

Chart 1: Demand for selected critical minerals essential to clean energy applications



Source: IEA Critical Minerals Market Review 2023



Critical mineral demand is expected to continue to expand. One study finds that net zero by 2050 will require critical mineral demand to grow six-fold by 2040, while projecting that demand for rare earth elements will be three to seven times higher by 2040.[12]

Demand growth is already stretching supply chains' ability to source resources. For electric vehicle batteries alone, lithium demand exceeded supply in 2021 and 2022 even with 180 percent production growth since 2017.[13] Copper faces supply and demand mismatches too. BloombergNEF predicts that between 2023 and 2027, copper demand will outpace supply by up to 4.5 million tonnes per year, increasing prices for this clean energy essential resource as it does.[14]

Rare earth elements are also likely to face supply constraints because of rising demand. Under the IEA's Sustainable Development Scenario, which limits global temperature rise to no more than 2°C, rare earth element demand is anticipated to grow over seven times from 2021 levels by 2040, with clean energy applications accounting for up to 70 percent of that growth.[15] Shortages may occur because of this demand growth. For just neodymium, a key wind turbine magnet and electric vehicle motor input, demand will likely grow to 57,000 tons per year under a 1.5°C scenario, which is 271 percent more than the current annual global production of 21,000 tons.[16]

The concentrated distribution of critical minerals and rare earth elements

The abundant but concentrated geographic distribution of critical minerals and rare earth elements globally complicates needed critical mineral supply growth, creating dependencies not unlike those associated with geographically concentrated oil and gas production. For example, the Democratic Republic of the Congo (DRC) supplies 70 percent of all cobalt, while China supplies 60 percent of rare earth elements, Australia provides 55 percent of lithium, and Indonesia supplies 40 percent of nickel.[17] These concentrations and the market power they create, along with recent supply chain disruptions, are raising critical mineral prices, with the average price of lithium quadrupling and the average prices of cobalt and nickel doubling between 2019 and 2022.[18]

The processing of these materials is also dominated by a few countries. In the most dramatic example, just three countries process all the world's rare earth elements and graphite, with China accounting for 90 and 100 percent of the processing for each, respectively.[19] Lithium, cobalt, nickel, and copper processing are also dominated by just a few countries as well, opening the supplies of these inputs to potential bottlenecks in the future.

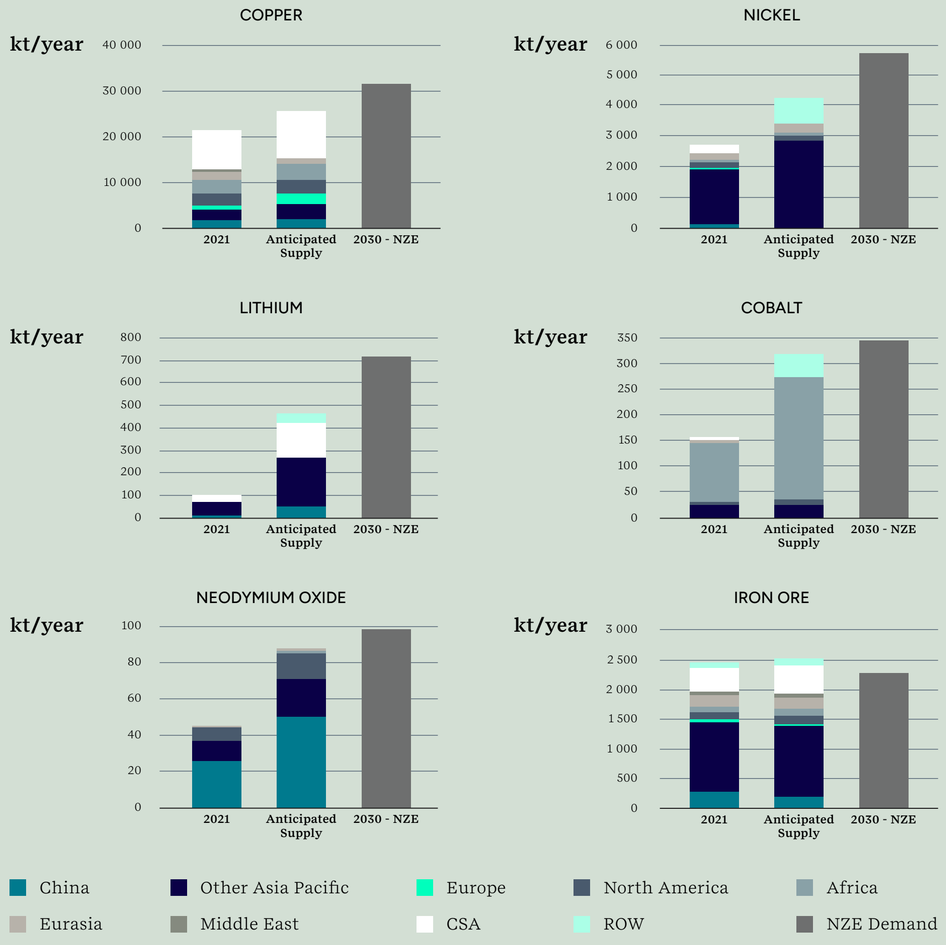
The geographic concentration of critical minerals and rare earth elements and their processing exposes the supply chains that deliver them to disruption including geopolitical events and human rights issues. For companies downstream in the renewables value chain, these risks create a new resource conundrum like those faced with oil in years past – a conundrum they must balance as they accelerate their adoption of renewable energy.

CHINA: THE DOMINANT PLAYER IN RENEWABLE ENERGY SUPPLY CHAINS

China leads in critical minerals processing, accounting for between 60 and 70 percent of lithium and cobalt processing and 30 percent of nickel processing.[20] The country also leads in rare earth elements, producing 60 percent (despite possessing less than 40 percent of total global reserves within its borders) and processing close to 90 percent of the world's total output. *See Chart 2.*

China leads in other parts of the clean energy supply chain as well, manufacturing more than 70 percent of solar PV, 55 percent of wind turbines, two-thirds of global battery cells, and 40 percent of electroyzers (key to green hydrogen production).[21]

Chart 2: Critical material production by country/region under the IEA's Net Zero Emissions by 2050 Scenario and current supply anticipation



Source: IEA Energy Technology Perspectives 2023

The renewables supply chain: Between a rock and a hard place

The ongoing growth of renewables hinges on cooperation with a small group of geopolitically complex supplier countries.

The worst of both worlds

Because critical mineral and rare earth element supply must expand to meet net zero ambitions, companies and governments are looking to secure additional sources of these materials. As they do, they run into the dual challenges of geopolitical and human rights risks that threaten to slow their efforts.

Countries become self-serving

As economic isolationism grows in some places and support for globalization weakens, numerous countries are attempting to leverage their resource wealth for economic and geopolitical advantage.

Since 2009, critical raw material export restrictions have quintupled and 10 percent of all global exports now face some type of restrictive measure.[22] Indonesia, for example, banned the export of nickel ore from January 2020 to maximize the economic benefits that the domestic processing of the battery-critical ore will bring.[23] The southeast Asian country followed-up its nickel export ban with one for bauxite, a key aluminum input, in June 2023.[24] China took a similar approach in October 2023 when it imposed export permit requirements for several graphite products used in electric vehicle batteries, echoing similar restrictions on metals essential to chip-making that were put in place in August 2023.[25,26]

Outside Asia, other countries have also moved to secure domestic resources, including Namibia, which banned exporting unprocessed critical minerals in June 2023, and Zimbabwe, which banned raw lithium exports to protect against unlawful exports by its artisanal miners.[27, 28]

With export controls rising, countries which consume significant quantities of critical minerals and rare earth elements are pursuing their own initiatives to secure supplies. For example, the European Union's Critical Raw Materials Act proposes a set of requirements for the percentage of annual critical raw material consumption that must be met by domestic production and limits the percentage of consumption that can come from a single third-party country to 65 percent.[29]

Export restrictions are not the only geopolitical risks threatening renewable energy supply chains. Geopolitics can also upend supplies through, for example, conflict-related sanctions. Companies with supply chains linked to Russia have faced major disruptions and, in some cases, effective losses of their business operations since Russia's invasion of Ukraine. Such experiences have encouraged businesses to think more strategically about other jurisdictions where similar conditions could arise.

Human rights trouble spots abound

The concentration of significant reserves and processing capacities of critical minerals and rare earth elements in countries with poor human rights records poses further supply chain challenges for both companies and governments.

As outlined previously, the mining of these resources is concentrated in a few countries, making sourcing from them sometimes unavoidable. In the DRC, which dominates cobalt mining, salient human rights risks are ever present. Many of these risks occur in artisanal mining areas, which are characterized by limited or no labor protection mechanisms and armed militia control.

Here, miners, many of whom are children, often work in harsh conditions where they are exposed to toxic metals for limited or no pay.[30] To make matters worse, some have little choice as they are forced to labor in the mines by armed militias who profit from their operation.[31] Other risks in the DRC come from external actors. A September 2023 report focused on the city of Kolwezi in southern DRC found numerous instances of multinational mining companies forcibly evicting communities to make way for mining developments – with support from the federal government.[32] Mining-related human rights abuses are also occurring beyond Africa such as in civil war-ravaged Myanmar, which had been a major source of rare earth elements before extraction was temporarily suspended in September 2023.[33] The country's northern reaches have been historically impacted by mining, with toxic chemicals leaching into ground water and armed militias threatening local villages who try to defend their homes and land from destruction.

Critical mineral and rare earth element processing is also associated with human rights violations. In China, some in the country's Uyghur minority in the Xinjiang province are allegedly forced to labor in critical mineral processing facilities that support renewable energy and electric vehicle battery supply chains.[34] One October 2023 investigation found that many Chinese electric vehicle supply chains pass through Xinjiang at one point or another.[35] For example, one aluminum and graphene supplier was found to have openly embraced Uyghur labor transfers and Mandarin language learning requirements. Another investigation from 2021 found that 90 companies from around the world source from solar panel supply chains that pass through Xinjiang and may use forced Uyghur labor.[36] Despite these issues, many companies are still involved in these supply chains.

Sourcing balsa wood, a key component of wind turbines, can also present human rights risks. For example, in Ecuador and Peru, balsa loggers have deforested land and caused other environmental damage in the Wampis indigenous group's territory.[37] There have also been circumstances where Wampis people have been held hostage by loggers and only freed when the government intervened.

Governments are not sitting idly by as risks grow in energy transition-essential supply chains. In December 2021, the United States enacted the Uyghur Forced Labor Prevention Act, which created the presumption that goods originating from Xinjiang were produced with forced labor and are thus banned from the U.S unless strong evidence is presented to the contrary.[38] The law has already affected renewable energy supply chains. By August 2023, over 3 GW of solar panels produced in Xinjiang had been seized by U.S. customs, a number that could rise to up to 12 GW by year end.[39]

Beyond geopolitical necessity, public pressure for companies to consider human rights in renewable energy supply chains is also rising due to prominent accounts of abuses such as Harvard lecturer Siddharth Kara's account of cobalt mining-related human rights abuses in the DRC, *Cobalt Red*.[40] Stakeholder initiatives to address human rights risks are also emerging. These include the Solar Stewardship Initiative, which develops standards to evaluate the environmental and human rights performance of solar panel production sites, and the Global Battery Alliance's Battery Passport, which includes information on the environmental and social sustainability of individual batteries.[41,42]

Interlinkages set up for concurrent resolution

The twin supply chain problems of geopolitics and human rights are interlinked, and companies who work to solve one will likely have positive impacts on the other. For example, seeking additional sources of renewable energy inputs such as critical minerals from regions with stronger human rights protections should reduce human rights risks as well as increase supply chain resiliency to geopolitical shocks and economic nationalism.

However, that is not to say that many of the western countries seen to have better human rights track records are perfect. For example, in Norway, a 2021 court ruling found that the construction of two wind farms violated the cultural rights of indigenous reindeer herders.[43] And it goes without saying that many of these same western countries are also pursuing their own forms of economic nationalism such as the United States' efforts to build up its domestic clean energy capacity through the generous state incentives included in laws such as the Inflation Reduction Act and the CHIPS and Science Act.

In this complicated global environment, supply chain resilience-focused actions can generate broad benefits for companies, whether through reducing supply chain costs, limiting reputational damages, or ensuring reliable sources of renewable energy inputs, among other advantages. Put simply, companies can address geopolitical and human rights risks in renewable energy supply chains concurrently.

Four steps to bolster renewable supply chain resilience

Because of the concentrated nature of renewable energy supply chains and the complexity of related challenges, there are no quick solutions. However, companies can make risks more manageable and generate positive side effects through the right actions.

Four steps to bolster renewable supply chain resilience

STEP 1:

Engage your supply chain and go beyond compliance

STEP 2:

Explore alternative sourcing options

STEP 3:

Seek collaboration and partnerships

STEP 4:

Engage with policymakers

Step 1: Engage your supply chain and go beyond compliance

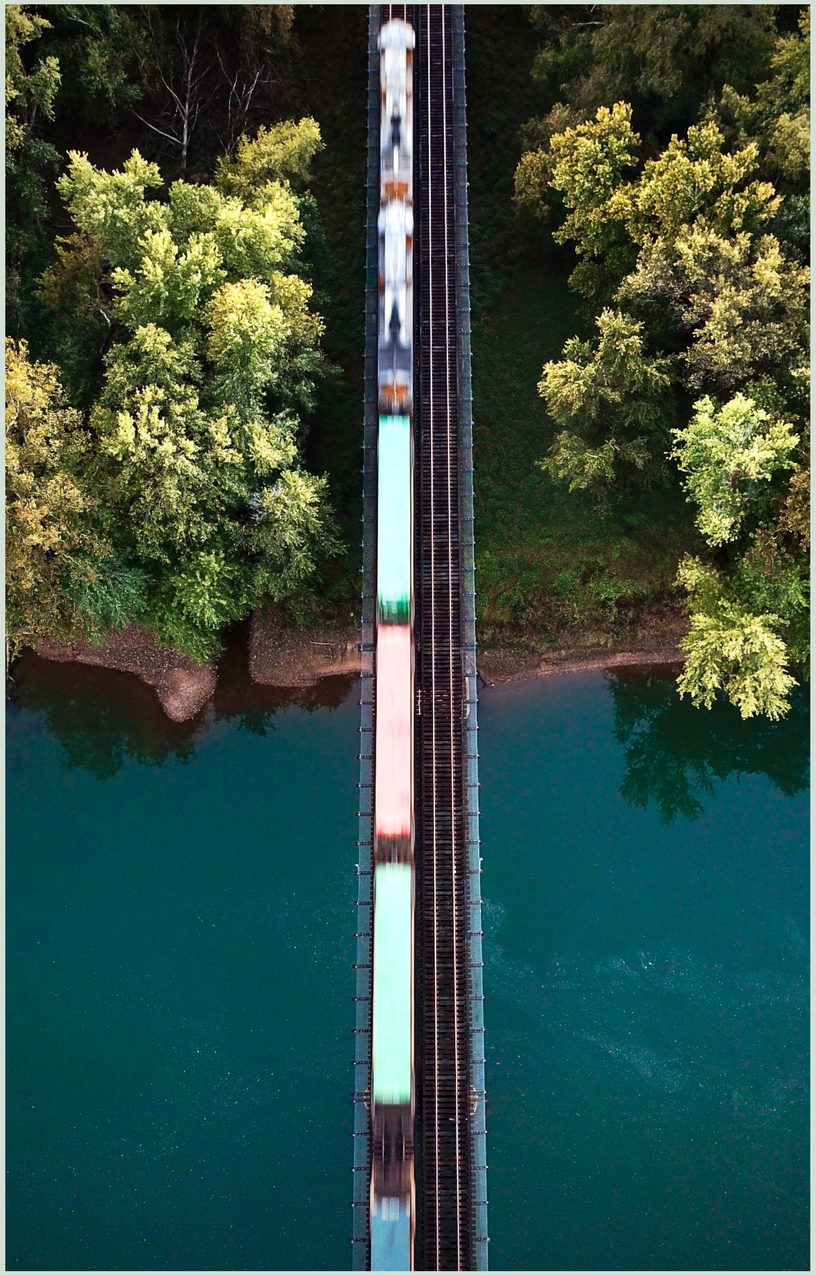
The headline

Geopolitical- and human rights-related renewable energy supply chain risks can negatively affect companies, whether through financial costs related to regulatory non-compliance, reputational damages, or both. These potential effects make it imperative that companies familiarize themselves with their supply chains and the risks present in them, as without this knowledge, appropriate management is all but impossible. Companies should also go beyond what regulations require of them as they are not likely to be as extensive as required to mitigate all potential risks.

The solutions

1. Introduce an extensive human rights due diligence (HRDD) process aligned with the United Nation's (UN) Guiding Principles on Business and Human Rights and the Organisation for Economic Co-operation and Development's Due Diligence Guidance for Responsible Business Conduct to ensure traceability and visibility of your supply chain. Do not limit due diligence to just your tier 1 and 2 suppliers, or to non-OECD countries.[44, 45] Instead, extend your tracing further upstream, including for suppliers who operate in jurisdictions where supply chain transparency is incomplete and regulations are less stringent. If you operate in a jurisdiction where due diligence is required, carefully assess these requirements and identify where you will need to go beyond them to bolster your supply chain resiliency.

Real world example: In 2021, Acciona, a Spanish infrastructure and renewable energy conglomerate, expanded its ESG-related supply chain audits, which include human rights reviews, up to its tier 3 suppliers who provide polysilicon. This was done to help prevent the company from sourcing from supply chains where human rights violations occur.[46] In addition, the conglomerate switched to a U.S. supplier of polysilicon for projects in the U.S. to comply with the country's Uyghur Forced Labor Prevention Act.



2. Develop and enforce clear codes of conduct for your suppliers that outline your company's expectations for human rights protections in its supply chains. These codes should be based on a thorough review of your supply chains and their human rights risks and should be embedded into supplier contracts. Your company should also develop defined processes for monitoring suppliers' compliance with these codes and for taking remedial actions in the case of violations.

Real world example: Statkraft, a Norwegian renewable energy company, has a Supplier Code of Conduct which highlights a key best practice element of human rights code of conduct integration – granularity.[47] The code is separated into multiple subcategories including human rights due diligence, modern slavery and forced labor, child labor, and sustainable sourcing of minerals. Within these subcategories, the code sets clear supplier expectations to prevent the use of illegally or unethically sourced materials, and lays out obligations for cases where suppliers know, or have reason to believe, that conflict minerals may be contained within supplied products to determine the source and chain of custody. For some subcategories such as child labor, the code provides definitions to eliminate uncertainty over what constitutes a violation.

3. Create processes to ensure the traceability of human rights practices throughout your supply chain, including by leveraging innovative technologies such as blockchain and artificial intelligence. Supply chain traceability is crucial to understanding and identifying potential human rights impacts, as well as enabling compliance with legislation and regulation. Still, as we noted in the first solution, compliance should only be a starting point. Going beyond and striving for full supply chain traceability will be essential to protecting against human rights risks that might not be accounted for within policies but could still generate significant negative impact.

Real world example: Launched in October 2023, the Solar Stewardship Initiative (SSI) is a solar-specific sustainability programme that seeks to establish and provide verifiable solar value chain transparency and ESG performance data.[48] The SSI is expected to launch its SSI Assurance Scheme in December 2023. The SSI will also begin developing a Supply Chain Traceability Standard in January 2024, aiming for launch in late 2024 following a public consultation period.

The benefits

1. Diligently monitoring human rights and labor conditions at the individual supplier level will help protect against financial and reputation risks that may result from incidents with all other suppliers, particularly those who operate in countries with elevated human rights risks.
2. Comprehensive oversight of supply chains can help companies foresee potential negative supply chain impacts – for example, a sanction resulting from geopolitical fallout – and create contingency plans which limit their material impacts to people and business.
3. Appropriate human rights due diligence can help your company comply with human rights-related laws and regulations that block or limit the importation of products without accurate human rights assurances.
4. A proactive approach to human rights risk management can prepare your company for future, potentially more stringent human rights requirements and can boost your reputation with stakeholders who are increasingly concerned with how companies protect against human rights violations in their supply chains.

Step 2: Explore alternative sourcing options

The headline

The high geographic concentration of renewable energy-essential critical minerals and rare earth elements means companies often have limited choices when it comes to sourcing these resources. However, limited choice does not mean sourcing diversification is impossible. With the right actions, companies can identify and help develop alternative sourcing options that are less exposed to geopolitical and human rights risks.

The solutions

1. Evaluate local suppliers and those in areas with lower geopolitical risk who can provide needed renewable energy inputs and set targets for sourcing from these suppliers to encourage procurement flow shifts. These suppliers may be costlier in the short-term, however, they will help increase resilience to major supply chain disruptions that may occur in the future. Sourcing from these suppliers will also support their ability to expand and compete with suppliers in other regions, further bolstering supply resilience via market maturity.

Real world example: U.S.-based First Solar produces thin film PV modules without relying on Chinese-sourced raw materials or manufactured products. It currently has the largest solar manufacturing footprint in the Western Hemisphere, with planned expansions positioned to boost its production capacity to over 10 GW by 2025.[49] First Solar has intentionally set out to build American supply chains through US manufacturing investments. For example, it invested in glass and steel production in Ohio and tellurium processing in Utah, which are also supported by supplementary supply chains in the U.S.[50]

2. Seek out available incentives, tax breaks, and other forms of financial support for renewable energy development and supply chains from local governments and those in regions with lower geopolitical risk. These types of support are increasingly made available by governments as they view expanding domestic sourcing capacity as a key political priority to combat increasing economic and resource nationalism globally.

Real world example: In the first 12 months after the U.S. enacted the Inflation Reduction Act (IRA), companies announced approximately 155 GW of new domestic solar production capacity covering solar modules, cells, silicon ingots and wafers, and inverters.[51] Because strengthening the U.S.' domestic supply chain of raw materials used for low-carbon technologies is one of the IRA's objectives, it includes stipulations that portions of a project's supply chains should reside in North America. This requirement has led to the emergence of international partnerships to build assembly capacity, such as the American company Invenergy and Chinese solar panel manufacturer Longi's planned 5 GW solar factory in Ohio.[52]

3. Companies with greater ability to make capital investments could seek out and invest in innovative technologies developed by local companies that reduce their exposure to geopolitical and human rights risks during renewable energy material input sourcing.

Real world example: Research and development aimed at improving 3D printing technology has already been used by some energy companies in their planning processes to create prototypes and scale models. However, as 3D printing technology matures, there is growing interest as to how it might be applied to help localize renewable energy parts production. For example, GE Renewable Energy recently unveiled new research and development efforts at a facility in Bergen, Norway, to explore how to 3D print the concrete base of towers used in wind turbines on site rather than relying on a third-party.[53]

The benefits

1. Localizing your renewable energy-supporting supply chains will help mitigate the sourcing risks that arise from geopolitical shocks like conflict, trade disputes, and economic and resource nationalism.
2. Near-shoring your renewable energy-supporting supply chains in politically stable countries or regions with robust labor protections is likely to decrease your exposure to human rights abuses and simplify your ability to monitor whether these abuses occur.
3. Investing in local suppliers can help demonstrate commitment to the communities in which you operate. Supply chains which integrate existing local suppliers have the dual benefit of being more protected from geopolitical and human rights risks while demonstrating commitment to being a ‘good neighbor’ as they generate employment opportunities, capacity building, and small business investment.
4. Localizing supply chains can also provide commercial benefits to companies by drastically reducing or even eliminating the transportation of parts. These benefits may translate into increased profit or enable companies to pass transportation cost savings onto the consumer to create a more competitively priced product.
5. Localization may also reduce your supply chain’s carbon footprint due to the reduced transportation of goods, which can decrease costs associated with carbon pricing scheme compliance and generate reputational benefits.

Step 3. Seek collaboration and partnerships

The headline

Creative and innovative supplier partnerships focused on easing resource constraints and developing manufacturing capacity are key to boosting your company's renewable energy uptake. However, collaboration is just one piece of the puzzle. Pursuing vertical integration can also help solve supply uncertainties by delivering reliability and resiliency benefits.

The solutions

1. Seek deep partnerships with suppliers built on mutually beneficial solutions with clearly defined objectives and firmly aligned plans to minimize risk exposure. While forming these partnerships, evaluate your collaboration plans for areas that could be interpreted as collusion by policymakers and regulators. For example, a number of companies dropped out of the Net Zero Insurance Alliance in 2023 over legal concerns that coordinated climate action could be interpreted as a broader effort to influence markets.[54]

Real world example: Ørsted entered into a partnership with Salzgitter in 2022 to supply it with offshore wind-generated energy in exchange for using Salzgitter's low carbon steel to construct the offshore wind farms.[55] Though not focused on critical minerals or rare earth elements, this "closed value chain" partnership can provide essential lessons to companies sourcing these materials. Specifically, the partnership will help Ørsted secure a reliable supply of a key input, low carbon steel, from a partner in a geopolitically stable region with low human rights risk.

2. Consider vertically integrating portions of your renewable energy supply chain to maximize control over and predictability of input availability and human rights practices. As with partnerships, be careful to avoid integration that policymakers may find anti-competitive such as actions that limit competitor access to material inputs, particularly as regulators such as those in the U.S. and Europe increasingly pursue anti-trust actions.

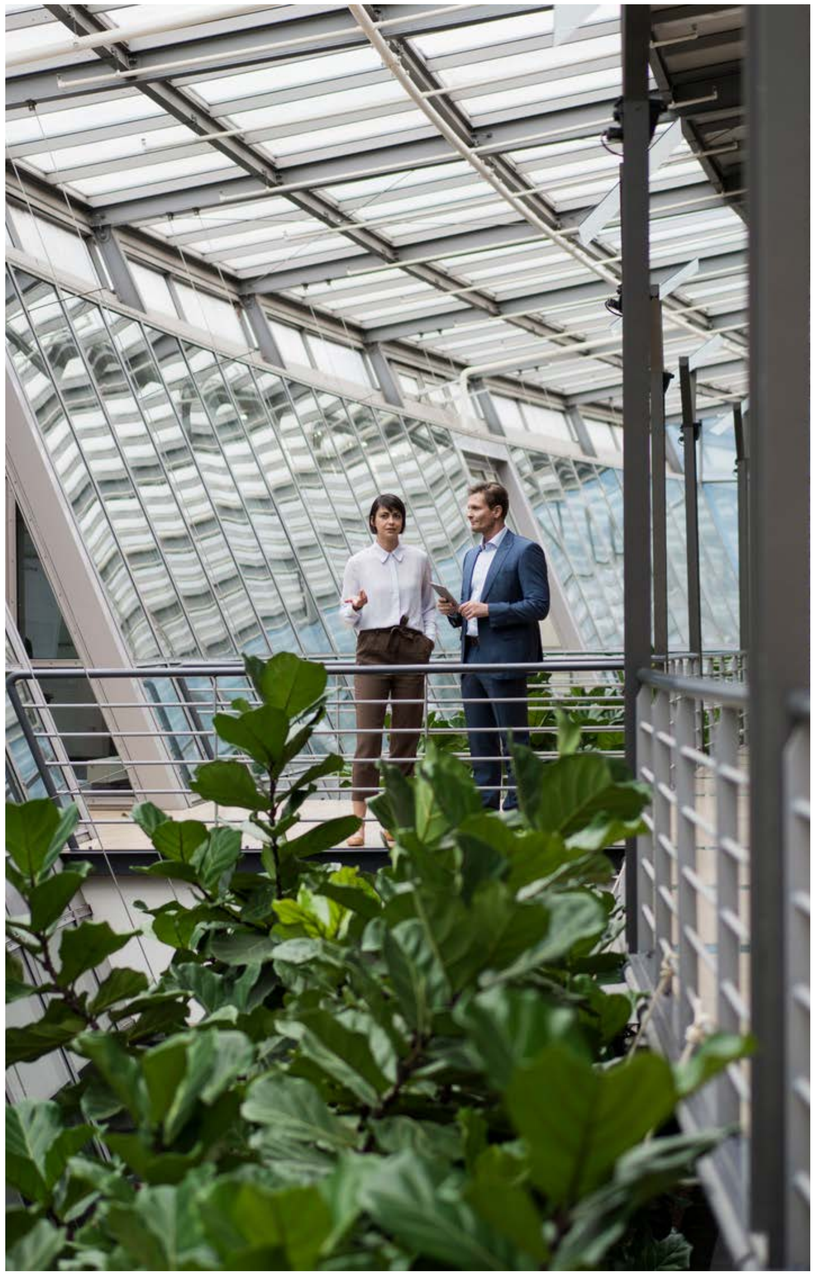
Real world example: One of the most high-profile examples of vertical integration has been Tesla's long-term purchase agreement with Vale S.A to source nickel from the Brazilian mining company's Canadian operations.[56] Tesla made this decision after identifying that nickel supply vulnerability was a key supply chain concern for the company given its previous dependency on Russia for the mineral and because securing its own reliable supply would generate commercial advantages.[57]

3. Think beyond just renewable energy when seeking partnerships to maximize their impact by considering how potential partnerships can help both organizations meet other corporate sustainability goals. Because companies whose business models and values align with your own are likely to share similar sustainability ambitions, partnerships can be a great way to work toward other goals where action by your company alone will be insufficient to achieve them.

Real world example: The Suppliers Partnership for the Environment brings together global automotive companies to advance positive environmental, economic, and community impacts.[58] Spearheaded by the U.S. Environmental Protection Agency, this group works together to develop forward-looking practices for issues such as biodiversity protection, carbon emissions reductions, and circular material advancement. More specifically, companies in the partnership are developing strategies to grow demand for circular materials and incentivize innovation when using them. These efforts have led partnership companies to employ soybean-based foam in car seating and recycled plastic bottles in engine insulation, to name a couple initiatives.

The benefits

1. Building deep supplier relationships decreases the risks of human rights controversies as they provide better insight into the innerworkings of your supply chains, enabling you to more quickly identify labor issues that may arise.
2. Developing reliable partnerships with suppliers based in regions with low geopolitical risk will minimize the probability that shocks such as conflicts and trade disputes will disrupt the supply of renewable energy-critical inputs. And, if these shocks do occur, a trusted partner is more likely to work with you to develop solutions to supply issues that may arise because of your established relationship and their intimate knowledge of your business and its needs.
3. Vertically integrating your supply chain will limit your exposure to both geopolitical machinations and human rights problems as it will enable you to better control where you operate and the operational practices employed at these locations.



Step 4: Engage with policymakers

The headline

The geopolitical circumstances shaping the energy transition and human rights issues are a central focus among policymakers as countries look to position themselves for the low carbon economy of tomorrow. With government focus growing, companies have a unique opportunity to work with policymakers to ensure the actions they take foster a global environment where supply chains are able to deliver the inputs they need to scale renewable energy growth and accelerate decarbonization.

The solutions

1. Work with governments and non-governmental organizations to strengthen human rights certification schemes and trade facilitation initiatives. Although stricter regulations run the risk of slowing trade, they can better protect against human rights risks and supply chain disruptions by bolstering assurance processes and defining which suppliers companies can work with.

Real world example: In February 2022, more than 100 companies, investors, and business associations called on the European Union (EU) to adopt its proposal requiring large companies operating in the bloc to conduct human rights and environmental due diligence.[59] More than just calling for adoption, the statement outlined five strategies to strengthen the proposal, including aligning it with the UN Guiding Principles on Business and Human Rights and extending due diligence requirements across companies' full value chains. This statement and a follow-up released in August 2023 go beyond what is included in the version of the rule that passed the European Parliament in June 2023. It remains to be seen whether the EU will bolster the rule as a result.[60]

2. Tap into the increasing desire within countries to develop their local renewables industries. Governments are in a powerful position to encourage beneficial supply chain policies. To do so, monitor regulatory trends through dedicated teams focused on understanding policy developments and the business opportunities they may generate. Companies must also position themselves for proactive government engagement, feeding in relevant perspectives to help shape approaches to supply chain management that are conducive to the low-carbon transition.

Real world example: In its 2023 budget, India allocated $4.3 billion to support its clean energy goals, which include net zero emissions by 2070 and meeting 50 percent of its electricity demand with renewables by 2050.[61] Beyond strictly financial investment, India is also incentivizing the domestic production of renewable energy technologies to reduce its reliance on imports.[62] Its production linked incentive scheme for high-efficiency solar PV modules sets aside approximately $2.4 billion to encourage the development of up to 65 GW of annual solar PV module manufacturing capacity.[63]

3. Engage in World Trade Organization (WTO) deliberations to reduce trade barriers for 'environmental goods' (a broad term that, by most definitions, includes all major renewables supply chain inputs). The WTO's Trade and Environmental Sustainability Structured Discussions (TESSD) has 80 members, including the US, China, and the EU, and is a space where practical accounts from companies of how policy can be reformed to ease supply chain constraints would be valuable.

Real world example: The latest informal meetings of TESSD in May 2023 saw China present on its green subsidy policy and the EU present on its green industrial strategy and its subsidy framework.[64]

The International Fertilizer Association – a principally private-sector membership group – presented to policymakers, calling for policy support to unlock decarbonization routes and offering to help the WTO to better assess decarbonization opportunities. Renewable companies should position themselves to participate in these conversations to interact directly with global policymakers to influence the direction of future supply chain policy.

The benefits

1. Policy engagement helps companies shape a more stable and predictable supply chain future and ensure future growth will not be ensnared by geopolitical instability or human rights controversies.
2. With policymaker interest in the energy transition at an all-time high, political process involvement can enable your company to benefit from new policies aimed at protecting existing and developing new domestic and regional renewable energy supply chain capacity.
3. Developing active relationships with policymakers helps protect against being blindsided by new government regulations that may slow down supply chain processes, increase supply chain expenses, and expose your company to increased compliance costs if advanced planning for these regulations is not completed.

GEOPOLITICAL TENSIONS AND CHANGING GOVERNMENT NORMS COMPLICATE THE WIND INDUSTRY

The energy transition is coinciding with the most acute period of geopolitical tension since the end of the Cold War. As tensions rise and free trade norms brought about by globalization recede, governments are increasingly intervening in their economies and turning to industrial policy. Because of these changes, companies must ensure they are attuned with how policy and political trends may affect their business strategies, compliance requirements, and reputations.

Wind turbines are at the center of this new environment. Specifically, European producers are struggling to compete with Chinese manufacturers in an arms race to produce larger and cheaper turbines. China's wind turbines are increasingly cheaper than those of their European counterparts thanks to generous state financial support, helping them to gain market share in Europe.[65] To protect European manufacturing, the European Commission introduced the European Wind Power Package to support the domestic wind industry through measures to help finance new factories, speed up wind farm permitting, and monitor unfair trade practices.[66]

Achieving ambition through resilience

In a time of compounding business risks, resilience, or the capacity to bounce back from shocks, is a term used by many companies but realized by few. When it comes to the renewables supply chain conundrum, companies who realize resilience will be more likely to achieve their growing renewables ambitions.

As we show in this report, increasing demand for material inputs vital to renewable energy expansion is exposing companies to unique geopolitical- and human rights-related supply chain risks that are exacerbated by the concentration of these material inputs in just a few countries. Further, the lack of readily available material and supply alternatives means that companies have little choice but to work within existing supply chains to source the critical minerals and rare earth elements they need.

Despite these supply chain challenges, with the right measures, companies can indeed realize resilience by limiting their risk exposures and securing the material inputs they need to increase their renewable energy uptake. The four steps outlined here showcase numerous solutions aimed at helping companies do just that and secure benefits in the process.

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