

Introduction

Just as Michael Porter's "five forces" served for several decades to structure the analysis of competitiveness across any industry, the famous energy trilemma has dominated analyses and foresight regarding energy supply and consumption systems for at least two decades, particularly in advanced economies. This trilemma highlights the difficult balance that every energy system must strike between three fundamental variables: security of supply, affordability and environmental sustainability. The first two variables, security and cost, came to the fore with the first oil crisis in the 1970s, which highlighted the power that Middle Eastern oil-producing countries had concentrated over the supply of fossil fuels to the major Western economies. It would take almost forty more years for the variable of environmental sustainability to gain prominence, and it did so in the shadow of the *shale oil* and gas revolution in North America, which definitively resolved the security of supply challenge brought about by the first oil crisis.

The signing of the Paris Agreement on climate change at COP 20 in 2015 gave the decisive boost to the environmental sustainability variable, by enshrining as a universal mandate that the increase in the average surface temperature of the Earth should not exceed 2 °C by the end of this century, and preferably should not exceed 1.5 °C, both increases measured against the average temperature of the pre-industrial era. The 2018 special report by the IPCC (United Nations Intergovernmental Panel on Climate Change) reinforced the 1.5 °C target and set 2050 as the year by which the world should complete its energy transition towards a decarbonised and climate-neutral economy, a target better known as Net Zero by 2050. In 2021, the European Union enshrined this climate neutrality target in law through Regulation 2021/1119, in which it defined climate change as an "existential threat". A few months later, COP 26 in Glasgow endorsed the Net Zero by 2050 target, and the International Energy Agency, an OECD body, published its seminal report *Net Zero by 2050: A Roadmap for the Global Energy Sector*. This report, the largest energy foresight exercise undertaken to date, served as a guide detailing the energy transition of the various sectors of the global economy (electricity generation, transport, industry and buildings) towards climate neutrality, identifying at every stage the new technologies that would make it possible. At almost the same time, the IPCC published its Sixth Assessment Report (better known as the AR6 report), a compendium of scientific knowledge on climate change to date, which incorporated for the first time the 1.5°C target

as a necessary condition for quantifying CO₂ emission “mitigation” policies for the 21st century.

Armed with this scientific, technical, economic and legal framework, by the end of 2021 the European Union had mapped out the green transition of its energy system for the next three decades, setting binding targets for CO₂ emission reductions for the years 2030 (55%) and 2040 (90%) compared to 1990 levels. Its Green Deal was being rolled out across at least fifteen regulatory fronts, ranging from the two Emissions Trading Schemes (ETS) to the Carbon Border Adjustment Mechanism (CBAM), via the Energy Efficiency Directive and the Directive on renewable fuels of non-biological origin. But then February 2022 arrived and Russia invaded Ukraine — “events, my dear boy, events” — wiping out security of supply and affordable energy costs in the European Union in one fell swoop: Russian gas was no longer a secure source of energy. In 2021, natural gas accounted for almost 25% of the EU’s total primary energy consumption, with a very significant concentration in electricity generation, industrial heat production and domestic heating. The EU imported 85% of the gas it consumed. Russian gas, which reached Central Europe via various pipelines, accounted for 41% of the EU’s total natural gas imports.

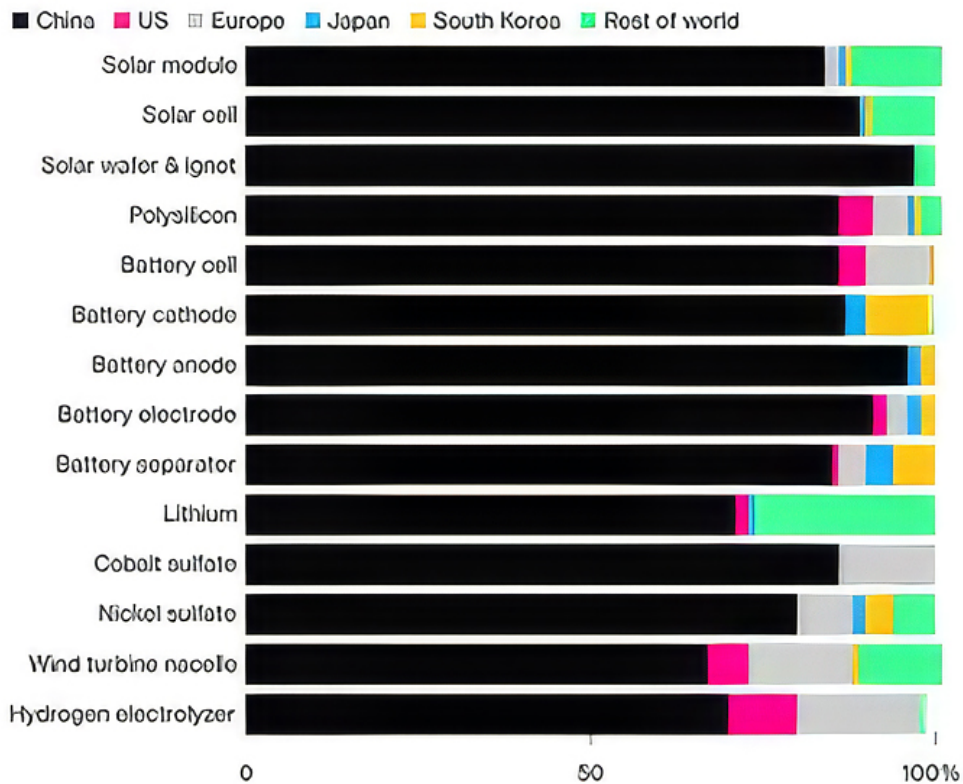
The war in Ukraine and the Russian gas crisis left solar and wind energy, however, unscathed; immune to the geopolitical risks associated with fossil fuels, these renewable energy sources emerged stronger than ever. The energy transition had found in “energy sovereignty” and “strategic autonomy” two powerful allies to accelerate the decarbonisation of our economies and the *transition away from fossil fuels* agreed at COP 28 in Dubai in December 2023. But in that same year, China once again demonstrated (it had not done so since 2010) the control it exercised over the supply chains of key technology sectors for the energy transition, calling into question the sovereignty that the energy transition seemed to bring with it. Indeed, throughout 2023, and in retaliation for the restrictions the Biden administration had imposed in October 2022 on exports to China of advanced chips for artificial intelligence applications, China imposed restrictions and controls on exports of several critical minerals (germanium, gallium, graphite and antimony) and of certain rare earths and permanent magnets to the United States. The tug-of-war between the two countries would continue into 2024 and escalate in 2025, when the Trump administration added a tariff war to the chip controls. By October of last year, China had extended its controls to twelve of the seventeen rare earths and to all intermediate and final products

containing them (primarily permanent magnets). This threw the supply chains of a multitude of industrial sectors into disarray: *high-tech* and defence, on the one hand, and other sectors key to the energy transition, such as the manufacture of electric vehicle motors, batteries and wind turbines. At this point, the Trump administration blinked first and agreed to a one-year truce with Xi Jinping, under which China lifted its controls on rare earths and the United States allowed the export of certain Nvidia chips to Chinese companies, among other concessions. China's show of strength, sustained and escalated over two years, had succeeded.

The EU had been an observer and a victim of this crossfire, and Commission President Ursula von der Leyen accused China of establishing a "pattern of dominance, dependency and blackmail" to drive its competitors into bankruptcy. China's control over the main supply chains of the energy transition (see Figure 1) is the result of the enormous market power of its large companies, a power they have built by applying that "pattern of dominance" under state direction that von der Leyen denounced. Europe has witnessed this with the European photovoltaic industry, which, two decades after its initial take-off, has virtually disappeared from its territory. But it would be a misdiagnosis to explain this market power solely as the result of years of public subsidies and massive *dumping* of its products. Chinese companies are dominant because the People's Republic of China itself is the world's largest consumer of its products: solar panels, rare earths and critical minerals, batteries and electric vehicles. This almost captive market and a "well-to-wheel" vertical integration built up over the years have been the main pillars of its competitive strategy, to return to Michael Porter. On these pillars, they have built economies of scale and levels of efficiency that are difficult for their Western competitors to match.

China Dominates Clean-Technology Supply Chains

Asian nation's share of global manufacturing capacity is above 80% in 11 segments



Source: BloombergNEF
 Note: Capacity is for physical facility location, not manufacturer headquarters. Lithium refers to lithium hydroxide and carbonate.

Figure 1. China dominates the supply chains for clean technologies. Source: BloombergNEF

What do these two challenges (Russian gas and Chinese dominance) that you intend to analyse have in common? From 2000 until the invasion of Ukraine (Energy Institute 2025), Europe imported between 30% and 35% of its annual gas consumption from Russia. During the same period, Germany's annual consumption accounted for between 40% and 50% of Russian imports. Russian gas was the cheapest, until the invasion of Ukraine took it off the table. If we look at the energy trilemma of security, cost and sustainability, we can conclude that Germany and much of Central Europe opted for the lowest cost at the expense of security. If we now look at the last fifteen years of the energy transition, is something similar not happening? Is the focus not on the lowest cost (the Chinese option) at the expense of security? Has Europe as a whole not reached levels of risk concentration with Chinese industry that are incompatible with its economic security? Let us look in more detail at how the EU has successfully coped with the disruption caused

by the Russian invasion of Ukraine to natural gas supplies, and at the challenges it faces in diversifying risks and improving the security of its energy transition supply chains.

The reconfiguration of the European energy system following the Russian invasion of Ukraine: the emergence of liquefied natural gas as a substitute for Russian gas

3 December 2025 in Brussels marked a turning point in European energy policy, as part of the European Union's long-term response to Russia's invasion of Ukraine. Following months of negotiations between the European Commission, the European Parliament and the Council, the Commission presented an agreement aimed at phasing out Russian gas imports, with the explicit goal of a total ban by the end of 2027. The agreement set out a phased and legally binding timetable: a ban on new contracts for Russian gas imports (both via pipeline and by ship in the form of liquefied natural gas) from 2026, clear deadlines for the phasing out of existing contracts and, as a final deadline, the complete elimination of all Russian gas imports during 2027. The proposal represented the culmination of a strategy launched following the outbreak of the war, which in three years had succeeded in reducing the share of Russian gas from 47% of imports in 2021 to 13% in 2025. The stated aim of REPowerEU was to close once and for all the "backdoor" that had allowed Moscow to use gas as a tool for economic and political pressure. Although the regulation still had to be formally ratified by the Parliament and the Council, the announcement on 3 December was welcomed as a decisive step towards a European Union that is more independent in its energy supply. But what is most interesting is understanding how such a substantial shift in the supply of such large quantities of gas could be achieved in such a short space of time, given that the roll-out of new energy supply infrastructure is typically a very long-term project. To do this, it is best to look closely at the German case, because Germany is the EU's largest gas consumer and the country that was most dependent on Russian gas supplies in 2021.

The speed with which Germany made this transition should not be underestimated. In 2021, gas imports from Russia accounted for 72% of all its gas imports from outside the EU (see Figure 2), with the remainder coming from Norway. All of Germany's gas imports (its domestic production is negligible) were via pipeline, because in 2021 it had no liquefied natural gas (LNG) regasification facilities, which severely limited its ability to

diversify its supply sources. This is how the German government passed its “LNG Acceleration Act” in May 2022 and was able to commission its first floating regasification unit (FSRU) as early as December of that same year in the port of Wilhelmshaven. The capacity of this facility was around 6.7 bcm per year, roughly 7% of national consumption in 2021 – a significant volume, yet illustrative of the scale of the challenge. Throughout 2023, two additional floating terminals were commissioned, bringing LNG reception capacity to 16.7 bcm, and in 2024 a further terminal was commissioned, reaching a total capacity of 24.7 bcm, which by then equalled 30% of national gas consumption. By 2024, pipeline imports into Germany from outside the EU had fallen to 37 bcm from 104 bcm in 2021, all of which came from Norway. Across the EU as a whole, since the invasion of Ukraine, the capacity of LNG regasification terminals had increased by 45%, an additional 75 bcm on top of the 165 bcm recorded in 2021, with Germany, the Netherlands and Italy leading this investment drive.

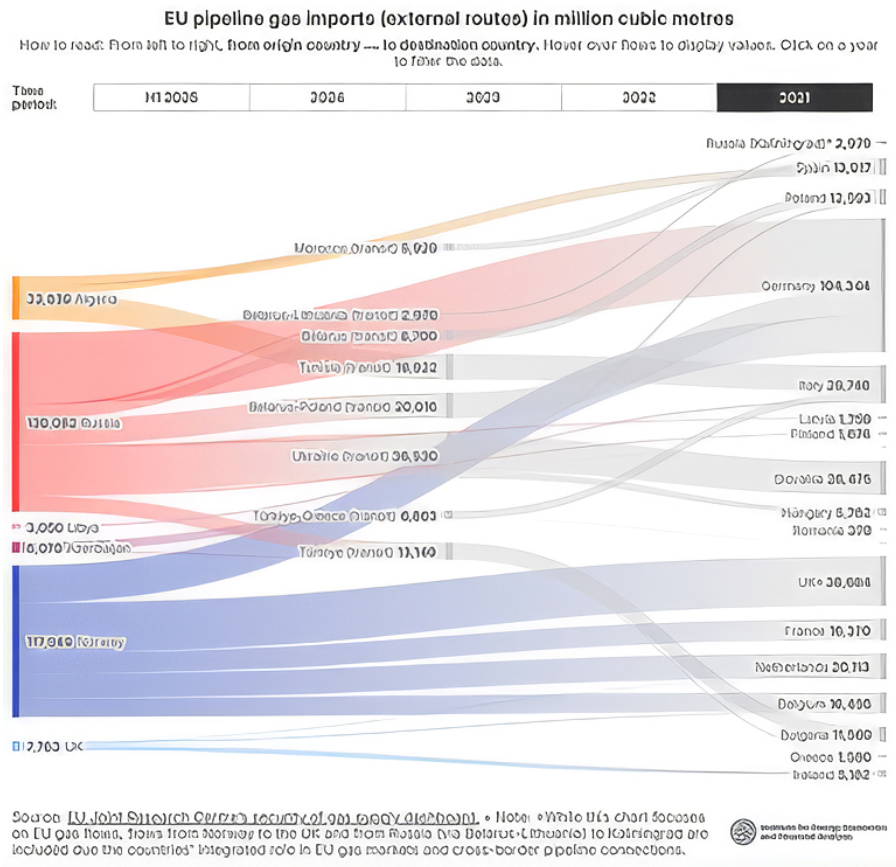


Figure 2. EU pipeline gas imports (external routes) in 2021, in million cubic metres. Source: EU JRC and IEEFA

Consequently, LNG imports into the EU rose from 23% of the total in the first half of 2021 to 48% in the first half of 2025, almost matching imports via pipeline, which were led by Norway at 55%. Over the same period, the share of Russian gas imported, whether via pipeline or by ship as LNG, fell from 47% to 13%. Today, 60% of the EU's total gas imports come from the United States (LNG), Norway (pipeline) and the United Kingdom, followed by Algeria (pipeline) and Qatar (LNG), which account for a further 16%.

The only flows of Russian gas imported by the EU that remain after these three years are those from the Turkish pipeline to Bulgaria and LNG by ship, with the main importers being France, Belgium and Spain (see Figure 3), which signed 20-year contracts in 2018 with the Russian company Novatek and its subsidiary Yamal LNG. The EU agreement of 3 December aims to phase out all these flows by the end of 2027

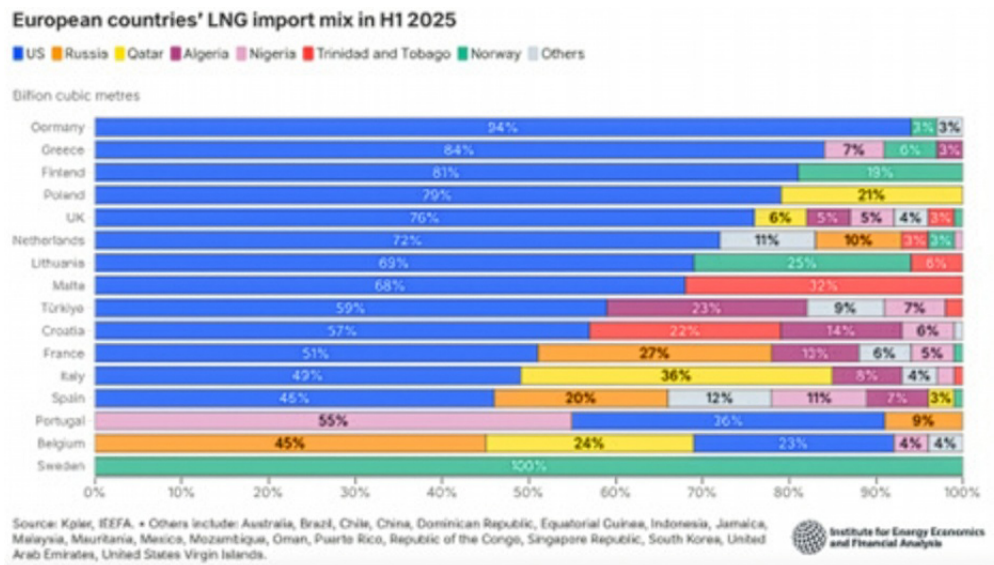


Figure 3. Mix of LNG imports by European countries in the first half of 2025. Source: IEFA

Gas accounts for around 24% of the European Union's primary energy supply, second only to oil at 33% (IEA, 2025a). In the first half of 2025, 48% of this gas arrived by ship and 52% via pipelines, mainly from Norway, the United Kingdom and Algeria. The capacity of liquefied natural gas (LNG) regasification plants on European soil is expected to exceed 350 bcm/year, well above the less than 200 bcm/year of LNG demand forecast

for the coming years (IEEFA, 2025b). To this current reality of the EU's gas supply must be added the growth prospects for LNG supply over the next ten years, which will underpin the sustained improvement in two of the variables of the energy trilemma: security of supply and affordability. The International Energy Agency (IEA), in its Gas 2025 report published last October, forecasts growth in global LNG liquefaction capacity of 300 bcm by 2030, of which expansion projects in the US and Qatar alone account for 70% (see Figure 4). However, the IEA does not believe that new global demand for LNG will exceed 250 bcm by 2030, which will add downward pressure on prices. This growth will be accompanied by greater flexibility and diversity in LNG contracts, which will bring greater liquidity to the market, bolstering security of supply in the face of new geopolitical risks. Meanwhile, the IEA forecasts that European gas demand will contract by 8% by 2030, due to the declining share of gas in electricity generation resulting from the growth of wind and solar power.

Final Investment decisions in US LNG reached an all-time high in 2025

Final Investment decisions in the United States by project, 2012-2025

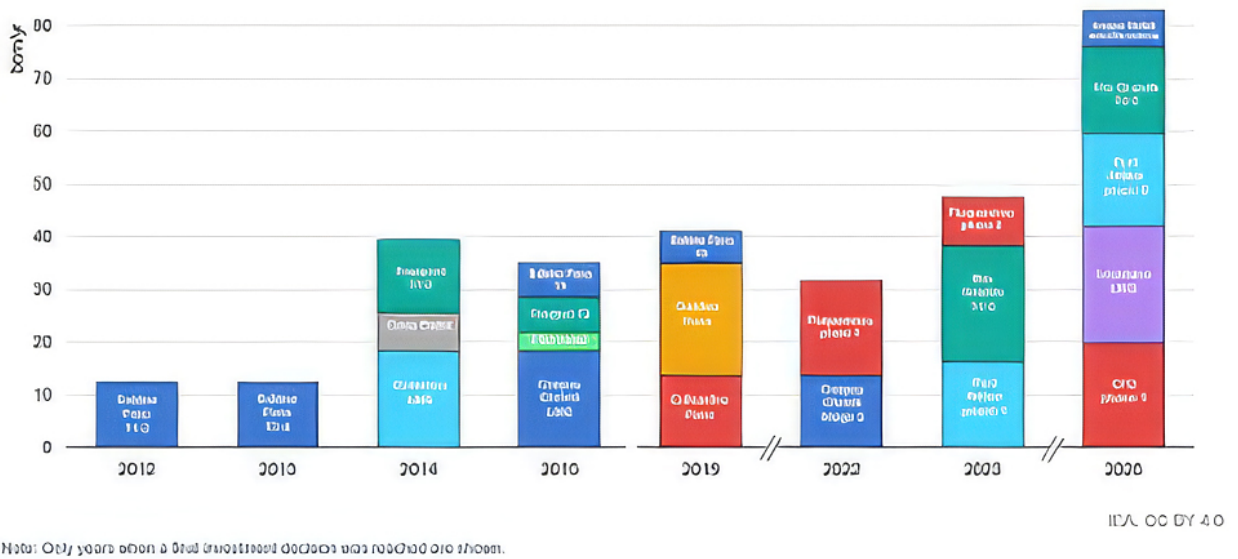


Figure 4. New gas liquefaction capacity by region, 2025–2030. Source: IEA, Gas 2025

The Trump administration's intervention in Venezuela and its oil industry does not appear likely to affect the prospects for improved security of supply and affordable fossil fuel costs in the near future. OPEC is losing one of its founding members, and the North

American bloc would come to control 30% of global oil production, according to analysts at JP Morgan. These analysts predict that it could take Venezuela a decade to recover the three million barrels per day it was producing before 2010, but that within two years it could manage to double the current level of 750,000 barrels. Increased Venezuelan production would add to the forecast (IEA, 2025e) of a five-million-barrel-a-day increase in supply between now and 2030. China is currently the leading importer of Venezuelan oil, and a significant portion of its loans to Venezuela, estimated at US\$60bn (Michal Meidan, 2025), are secured by oil contracts. Imports of Venezuelan crude account for barely 4% of the PRC's imports, meaning there would be no risk of supply shortages for China if the US were to redirect these volumes to other markets.

All of the above serves to propose a series of important conclusions, looking to the medium and long term beyond the serious turbulence that the Trump administration is causing in transatlantic relations:

- 1 The enormous capacity of the entire global gas supply chain (particularly that of liquefied natural gas and Norway) to resolve, within such a short timeframe, a disruption of the magnitude caused by the Russian invasion of Ukraine.
- 2 The great geographical diversity of liquefied natural gas supply sources and the low geopolitical risk associated with most of the European Union's gas-supplying countries.
- 3 The security and diversity of supply sources that it offers will establish LNG as an essential component of the European energy supply system in the long term, with a structural and upward impact on its costs.
- 4 The expected growth in LNG supply, led by the United States and Qatar, by 2030—which is set to outstrip projected demand—could result in a downward trend in current LNG prices for the remainder of the decade, and in increasing market liquidity that will help mitigate any new geopolitical risks that may arise.

The challenges posed by Chinese companies’ control of supply chains key to the energy transition

The background to China’s political use of its control over the rare earths value chain dates back to September 2010. In retaliation for a diplomatic incident with Japan, China responded with an undeclared embargo on its rare earths exports to the Land of the Rising Sun. At the time, Japan was the world’s leading importer and China its almost sole supplier. That *de facto* embargo lasted barely a few weeks, but it was followed by a sudden surge in international rare earth prices in 2011, a rise that saw prices increase more than tenfold compared to previous benchmarks. In 2014, the World Trade Organisation (WTO) condemned China for manipulating international markets in favour of its domestic industry through a system of licences, quotas and export tariffs that drastically reduced the availability of rare earths on international markets, causing the aforementioned price surge in 2011. But Japan’s reaction to China’s embargo was much swifter. As early as 2011, the Japanese government instructed JOGMEC (Japan Oil, Gas and Metals National Corporation) to increase the strategic reserve of rare earths and critical minerals that had been established in 1983, emulating the strategic oil reserves created in the wake of the 1970s crisis. At the same time, Japan sought to diversify its supply sources and, among other projects, financed the expansion of a large mine in Australia (Lyamas), which today remains (along with MP Materials in the US) one of the leading producers of rare earths outside China.

Between 2010 and 2020, rare earth extraction appears to have remained very stable, judging by the production figures for Chinese mines published by the US Geological Survey (USGS): 130,000 tonnes in 2010 and 140,000 in 2020. However, between 2020 and 2024, again according to the USGS, China’s production share is estimated to have almost doubled to 270,000 tonnes, accounting for 70% of global production potential. In its 2023 study on critical raw materials, the European Union attributed a 68.3% share of rare earth extraction to China. But when it comes to their further processing and incorporation into intermediate or final products such as permanent magnets, China’s global share consistently exceeds 85% (two decades ago, Japan controlled 50% of this market). It is in this dominance of the value chain downstream of rare earth extraction that China’s true position of control in the global market lies. According to the Rare Earths Industry Association (REIA), 75% of the economic value of rare earths end-use

applications is concentrated in the production of permanent magnets. According to the International Energy Agency (IEA), “China exported 58,000 tonnes of permanent magnets in 2024, enough to manufacture components for millions of cars, industrial motors or aircraft, or to build thousands of strategic military systems, data centres or wind turbines”. The explosion in growth over the last five years has been the result of rising demand for permanent magnets for electric vehicle motors, *direct-drive* wind turbines and for defence sectors such as medium-altitude long-endurance UAVs”, the unmanned aerial vehicles more commonly known as drones.

Consequently, the economic impact of the controls introduced by China in 2025 increased by several orders of magnitude when they came to cover not only raw materials, but also the intermediate and final products containing them (‘parts, components and assemblies’). The initial controls, introduced in April of that year, affected seven of the seventeen rare earth elements and their intermediate and final products, including permanent magnets, and were only mandatory for Chinese exporting companies. The granting of export licences required them to identify end-users, specify particular uses and accept a level of scrutiny that many international companies would consider incompatible with commercial confidentiality. By October (MOFCOM Decision No. 61), the controls had been extended to twelve rare earths and their derivative products, also requiring ‘foreign organisations’ to obtain a dual-use export licence for products containing rare earths of Chinese origin or manufactured using Chinese technologies. Controls were also introduced on the export of key machinery and equipment for the refining and processing of rare earths, technologies over which China maintains a virtual global monopoly. The extraterritorial nature of these measures was in the finest tradition of the US sanctions regime and, as with all measures of this kind, their success depended on the market power of the sanctioning state. Just as US sanctions are particularly effective when it comes to financial transactions in dollars, so too would China’s be in the field of rare earths. See Figure 5 for the decline in Chinese exports of permanent magnets from March 2025 onwards, which resulted in prices on the European market being up to six times those in China.

China rare earth magnet exports

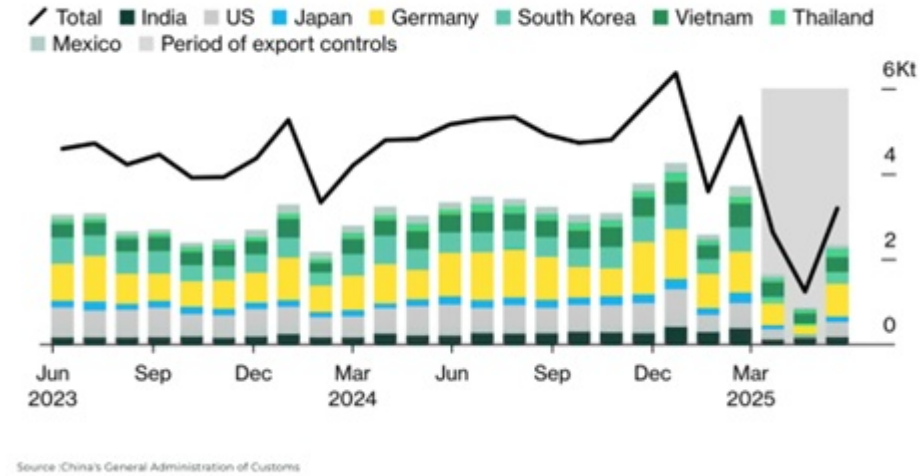


Figure 5. Chinese exports of rare-earth magnets. Source: PRC Customs Administration

However, the introduction of administrative controls in October 2025 was not limited to rare earths and their applications. On the same date, the Ministry of Commerce of the People’s Republic of China published (MOFCOM Decision No. 58) new controls on lithium-ion batteries, as well as on their components and the technology and machinery used in their manufacture. This was the first time MOFCOM had imposed export controls on the battery industry. As with rare earths, the licences required the identification of end-users and details of specific uses. As with rare earths, China maintains control over more than 80% of battery supply chains, and in some links this figure is close to 100% (see Figure 6). LFP (lithium iron phosphate) batteries account for half of the global electric vehicle market and virtually all energy storage batteries, both sectors being crucial to the progress of decarbonisation in transport and electricity generation.

The LFP battery supply chain is even more dominated by China than conventional nickel-based chemistry supply chains

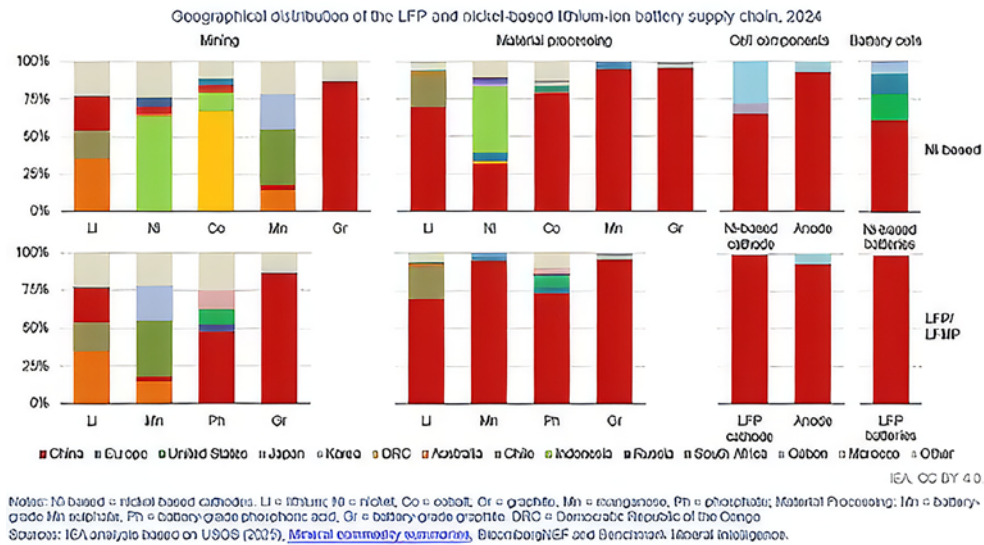


Figure 6. Geographical distribution of the lithium and nickel battery supply chain, 2024. Source: IEA

If one considers the size of the markets in question, the battery market is much larger than that for permanent magnets. According to the IEA's conservative STEPS scenario for 2030 (IEA, 2024), investment in batteries could be around US\$500bn, whilst that in permanent magnets would be between US\$35bn and US\$50bn, according to various sources. However, both industries share the systematic application of a sustained national strategy over time: the vertical integration of their activities across all links in their products' value chain, with the aim of achieving decisive influence in the markets in which they operate. This vertical integration allows them to transfer value from one link to another using internal transfer prices, with the aim of eliminating competition from companies operating in only one or several of these links. Generally, these industries are led by large companies whose shareholding is partly public or which, in any case, are subject to significant state control. The ultimate reason for the success of this strategy is that these companies enjoy a virtual monopoly over their domestic market, which generally accounts for at least 50% of global demand. The primary reason for China's export controls decades ago was to ensure that foreign competition (at that time for raw materials) did not hinder the take-off of China's nascent industries. No foreign company today has a captive market of that size, and therefore none achieves the levels of vertical

integration seen in China (see Figure 7 from the SAFE Center for Critical Minerals Strategy, 2025).

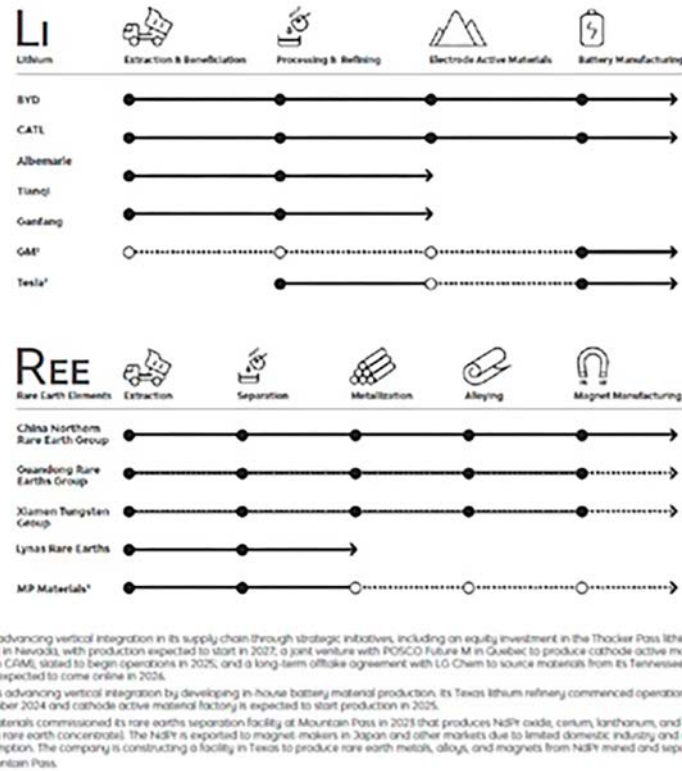


Figure 7. Vertical integration of Chinese and Western companies in the manufacture of batteries (Li) and rare earth permanent magnets (REE). Source: SAFE

This market dominance by Chinese companies is replicated in other industrial sectors highly relevant to the energy transition (see Figure 1 again), and notably in solar photovoltaics. In this sector, once again, the strategy of vertical integration and the support of the captive domestic market is replicated as indispensable tools for achieving control over supply chains. In 2024, the Chinese market accounted for 62% of new photovoltaic installations worldwide —340 GW out of a total of 550 GW (IEA, 2025f)—. At the same time, the IEA estimates (IEA, 2025f) that China dominates the four main links in the solar panel production chain (polysilicon, wafers, cells and modules) with shares of between 75% and 95% of global manufacturing capacity, and that this dominance will remain unchanged for the rest of the decade (see Figure 8).

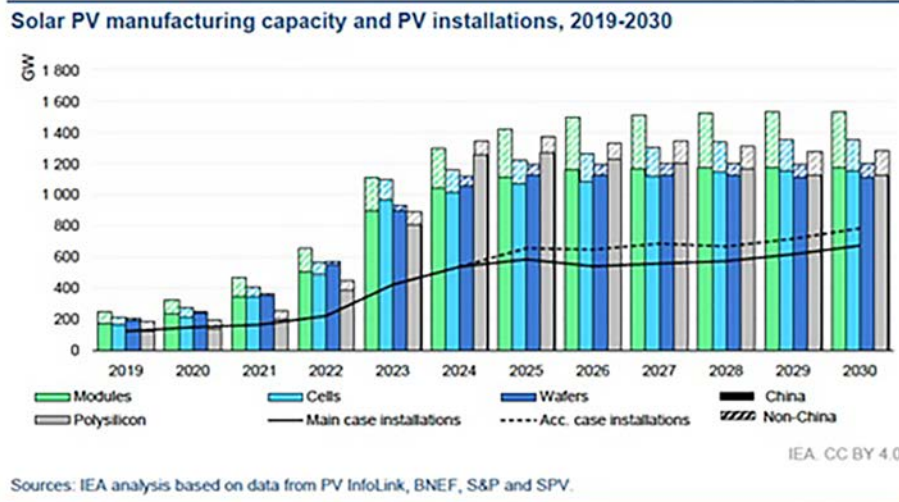


Figure 8. Annual installations and global installed capacity of the solar photovoltaic industry, 2019–2030. Source: IEA

If the figures presented so far seemed sufficiently conclusive, the competitive landscape becomes even more complicated when the spectre of excess installed capacity across these industries from 2022 onwards looms large. The IEA states that global excess production capacity in the photovoltaic industry (see also Figure 9) will more than double installed capacity by 2025 (1,400 GW of capacity compared to 585 GW installed) and that it forecasts this excess will persist for the remainder of the decade. Most of the excess capacity is currently concentrated in China. If we compare the installation of new photovoltaic capacity in China in 2024 (340 GW) with its installed module capacity (1,000 GW), we see that domestic demand covers only a third of its installed capacity, and that it therefore needs to rely on exports to survive. Hence the price cut experienced by modules in Europe between 2022 and 2025, which fell from US\$0.35 per watt in 2022 to US\$0.12 (IEA, 2025f). Faced with import tariffs that bar them from the US market, and the small scale of European demand (10% of China's in 2024), Chinese manufacturers have begun flooding the markets of developing countries (see the case of Pakistan) with their modules.

The battery sector faces the same challenge of overcapacity as the solar photovoltaic sector, with capacity forecasts for 2030 (IEA, 2024) doubling annual battery installations, both in the automotive sector and in energy storage. The IEA forecasts a global battery manufacturing capacity of around 8,000 GWh by 2030 (see chart), of which 5,500 GWh would be on Chinese soil. The projected demand by then is less than 4,000 GWh, with

3,400 GWh for electric vehicles and 400 GWh for energy storage. The reduction in average prices of battery packs over the last three years (barely 36% according to BloombergNEF) has not been as marked as for solar panels. However, the price of batteries (dollars per kWh) in Europe and the United States ended 2025 44% and 56% higher than Chinese prices, respectively. As the cost of the battery accounts for between 30% and 40% of the cost of an electric vehicle, this price difference represents a very significant competitive advantage for the Chinese automotive sector.

The realisation that excess installed capacity in key industrial sectors for the energy transition was here to stay led to the conclusion that Western companies would be unable to compete with large Chinese firms, which, with their unrivalled economies of scale and vertical integration, would eventually decimate their competitors in the developed world. This market dynamic had already played out on European soil in the solar photovoltaic sector, which grew rapidly on the back of German and Spanish subsidies during the first decade of this century. Today, there is not a single major European company left in the sector. Faced with the risk of history repeating itself in industrial sectors as significant as the automotive industry, the US Government first (2022), and the European Commission later (2024), promoted legislation offering incentives for investment in new low-carbon technologies, provided that a minimum threshold of ‘*made in America*’ or ‘*made in Europe*’ content was met.

The Biden administration took the first step in the summer of 2022 with the Inflation Reduction Act (IRA), which provided tax credits and grants for investment in a wide range of green technologies, from solar photovoltaics and offshore wind to nuclear energy, green hydrogen, batteries and carbon capture. The provisions of the Act caused alarm in the EU because the combination of extremely generous tax breaks with the ‘*Made in America*’ requirement would attract substantial investment to the US that would otherwise have gone to Europe. The EU responded to the IRA with the far less effective Net Zero Industry Act (May 2024), which set a target of 40% European content by 2030, and with the Critical Raw Materials Act (April 2024), which aimed to diversify the risk in supply chains for raw materials key to the energy transition. The Trump administration’s One Big Beautiful Bill (OBBB) cancelled many of the IRA’s tax credits in 2025, but maintained incentives for investment in new manufacturing industries (batteries, critical mineral processing, solar

components), reinforcing “*Made in America*” provisions and restrictions on *foreign entities*.

How has Chinese industry reacted to these laws that favoured domestic production over imported goods? By effectively setting up operations on home soil. In the words of the IEA (2025d): “The European Union is the main destination for foreign investment by Chinese battery producers, whose share in the region could quadruple, rising from less than 10% in 2024 to over 30% in 2030” (see Figure 9). The Agency adds that whilst “these investments represent an opportunity for technology transfer and cost reduction in the region [...], concerns are growing about the ability of small European producers to grow and compete with established global players”. The prime example of this concern was the bankruptcy in November 2024 of the Swedish battery company Northvolt, which had raised a record US\$15bn in equity and debt. Despite having purchase orders worth US\$55bn from various European manufacturers, it was unable to operate its Swedish factory at more than 1% of its theoretical production capacity.

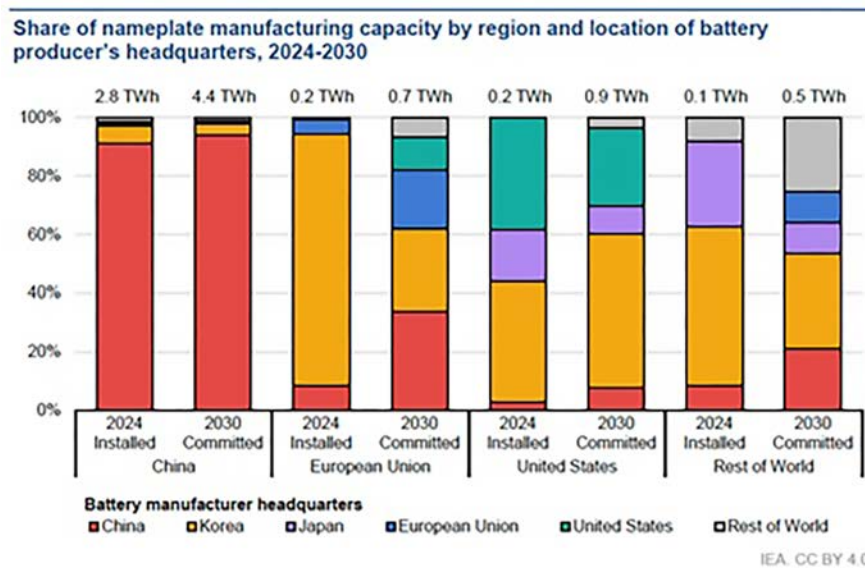


Figure 9. Battery production capacity by geography and manufacturer's country of origin, 2024–2030. Source: IEA

As the IEA notes, the establishment of Chinese companies within the European industrial fabric presents an opportunity for technology transfer in sectors where European industry lags far behind its Chinese counterpart. After all, it is the same process, with the roles reversed, that took place on Chinese soil from the 1980s onwards, whereby major

companies from the developed world set up operations in China through *joint ventures* with local firms. The challenge at hand is whether, in a market economy without state intervention such as the European one, the technology transfer mechanisms that operated in turn-of-the-century China – and which were the seed from which today’s Chinese tech giants grew – can be replicated. In this regard, the recent dispute (also in October 2025) between the Dutch government and the Dutch company Nexperia, a subsidiary of the Chinese firm Wingtech—a multinational operating in the semiconductor sector—is highly illustrative. This dispute highlighted Europe’s vulnerability in the face of Chinese companies operating within its own jurisdiction.

The Nexperia *affair* hit the headlines last October when the Dutch government decided to intervene in the company following reports that its Chinese parent company was “draining” its technological capabilities. Nexperia, which had passed into Chinese hands in 2017, manufactures chips for the European automotive industry and operates its own factories in China, where the wafers manufactured in the Netherlands are assembled. The Dutch government’s intervention came as a result of US pressure over suspicions that Nexperia was being used by its Chinese parent company to export dual-use microprocessors to China through the back door, even though these were not part of its product catalogue. Nexperia’s semiconductors are essential for the operation of a car (which may incorporate hundreds of them), but they are not advanced microprocessors. This intervention led to a retaliatory decision by the Chinese Ministry of Commerce (MOFCOM) to ban the export of Nexperia’s chips from its Chinese subsidiary back to the Netherlands. Furthermore, Nexperia halted the shipment of wafers to its Chinese factories, which had been ordered not to follow the instructions of their Dutch parent company following the government’s intervention. All this resulted in an abrupt disruption of the supply chain that brought European car manufacturers to the brink of halting their production lines. Faced with such a threat, the Dutch government decided to end its intervention in the company in November, and Nexperia’s Chinese subsidiary resumed exporting chips to its Dutch parent company.

The parallels between this case and the export controls on rare-earth permanent magnets are striking. In both instances, these are components whose economic value is minuscule compared to the value of the end products they form part of, yet without them, nothing works. Nexperia was sold to a group of Chinese investors in 2017 for US\$2.75bn. Given

how a company of that size has managed to put an entire industry such as the European automotive sector in check, the Dutch authorities (or the US CFIUS) would not have permitted the sale of Nexperia to a Chinese-owned company today.

Conclusions

It is very difficult for the Americans and Europeans to chart a course to reduce the dominance of Chinese companies in industrial sectors so crucial to the energy transition. The Biden administration's commitment to its *Inflation Reduction Act* (subsequently scaled back significantly by Trump) showed clear signs of a resurgence in new investment projects in the solar, wind, battery, nuclear fission, green hydrogen and carbon capture industries. Goldman Sachs estimated that the potential for subsidies and tax credits could exceed one trillion dollars over ten years, mobilising total investments of more than three trillion dollars by 2032. Leaving the IRA aside, both the Trump and Biden administrations have been in favour of *decoupling* from China, closing the US market to imports of photovoltaic panels and electric vehicles, for example, by imposing very high import tariffs. The 20% drop in Chinese exports to the US in 2025 is further evidence of *the decoupling* of the two economies.

The EU has sought to emulate Biden's IRA with the Net Zero Industry Act, but without Washington's fiscal muscle or the US's capacity to mobilise private capital and technological innovation, its impact to date has been far less significant. With the Critical Raw Materials Act and the RESourceEU plan, the EU has taken a first step towards diversifying its sources of supply for critical minerals, for which it will need to forge alliances with third countries that will take many years to bear fruit, as Japan has done. With regard to China, and unlike the US, the EU has not closed its markets to Chinese products, and so the European energy transition has benefited from the "imported productivity gains" from the Chinese economy, thanks to the lower cost of its products, be they solar panels, power electronics, batteries or electric vehicles. However, in 2024, Chinese exports to Europe were two and a half times higher than European exports to China and, according to figures published by the Chinese authorities on the 2025 trade balance, the EU overtook the US as the top destination for its exports, accounting for 15% (US\$560bn) of the total, compared to 11% for the United States. The EU faces the dilemma of how much to protect its industry from Chinese competition, starting with the

automotive sector (thirteen million jobs and 7% of GDP), without slowing down or making the energy transition more expensive.

The impressive trade surplus figures for 2025, which have broken through the US\$1 trillion mark, seem to suggest that Xi Jinping's China will maintain its commitment to a growth model based on investment and self-sufficiency in advanced technologies, all financed by massive exports and the devaluation of the yuan. The European Union Chamber of Commerce in China, in its report *Dealing with Supply Chain Dependencies* (December 2025), advises European companies to diversify their supply chains outside China, because if China maintains its aggressive trade stance, it is highly likely that market disruptions such as those seen last year will become the norm rather than the exception. But this is no longer just about supply chain security; it is about a broader concept: the EU's economic security. Indeed, the Nexperia *affair* and last October's litmus test regarding export controls on rare earths and batteries serve as a warning that the *playing field* is not *level*. Beyond the World Trade Organisation's common toolkit, China has other tools at its disposal that are not part of the European Union's kit.

At this stage, it is clear that enhancing the EU's economic security will involve restricting trade with China and seeking alternative supply chains, which will undoubtedly be more expensive and less efficient in the early stages. This will result in higher costs for key technologies for the energy transition, where dependence on China is particularly high. Just as with Germany and Central Europe regarding Russian gas, Europe as a whole has reached levels of risk concentration with Chinese industry that are incompatible with its economic security. And the solution, as with Russian gas, will entail higher costs. But unlike the gas crisis, the EU will not manage to reduce its excessive dependence on the Chinese hegemon in two years, nor even in two decades. It is a far more complicated undertaking, in which each industrial sector will require different approaches and distinct strategies. The EU must seek alliances (such as the recently signed agreement with Mercosur) with third countries also keen to reduce their dependence on China, not only to diversify their access to natural resources, but also to create a new industrial fabric and alternative supply chains. And it would be good news if Europe could join forces in the medium and long term with the United States (which does not seem easy in the short term), and together force China to change the course of its growth model.

Bibliography

- Argus Media. (2023). Argus White Paper: Diversifying rare earths: Building a market, not just a supply chain [online]. Argus Media. [Accessed: 2026]. Available at: <https://view.argusmedia.com/rs/584-BUW-606/images/MET-2023-09-WP-Diversifying%20Rare%20Earths%20Copy.pdf>
- . (2025). Argus launches new prices for rare earth magnets [online]. Argus Media. [Accessed: 2026]. Available at: <https://www.argusmedia.com/es/news-and-insights/market-insight-papers/argus-launches-new-prices-for-rare-earth-magnets>
- Bobba, S. *et al.* (2020). *Critical Raw Materials for Strategic Technologies and Sectors in the EU*. European Commission, Publications Office.
- Energy Institute. (2025). *Statistical Review of World Energy* [online]. Energy Institute. [Accessed: 2026]. Available at: <https://www.energyinst.org/statistical-review>
- European Chamber. (2025). *Dealing with Supply Chain Dependencies: Challenges and Choices* [online]. European Union Chamber of Commerce in China. [Accessed: 2026]. Available at: [https://european-chamber.oss-cn-beijing.aliyuncs.com/upload/documents/documents/Dealing_with_Supply_Chain_Dependencies_Challenges_and_Choices\[1377\].pdf](https://european-chamber.oss-cn-beijing.aliyuncs.com/upload/documents/documents/Dealing_with_Supply_Chain_Dependencies_Challenges_and_Choices[1377].pdf)
- European Commission. (2025). Commission selects 47 Strategic Projects to secure and diversify access to raw materials in the EU. Brussels, European Commission.
- European Court of Auditors. (2024). *Security of the supply of gas in the EU*. European Union, European Court of Auditors.
- IEA. (2024). *Batteries and Secure Energy Transitions* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/batteries-and-secure-energy-transitions>

- . (2025a). *Gas 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/gas-2025>
 - . (2025b). *Global Critical Minerals Outlook 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/global-critical-minerals-outlook-2025>
 - . (2025c). *Global Energy Review 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/global-energy-review-2025>
 - . (2025d). *Global EV Outlook 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/global-ev-outlook-2025>
 - . (2025e). *Oil 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/oil-2025>
 - . (2025f). *Renewables 2025* [online]. Paris, IEA. [Accessed: 2026]. Available at: <https://www.iea.org/reports/renewables-2025>
- Institute for Energy Economics and Financial Analysis (IEEFA). (2025a). *EU Gas Flow Tracker* [online]. IEEFA. [Accessed: 2026]. Available at: <https://ieefa.org/eu-gas-flows-tracker>
- . (2025b). *European LNG Tracker* [online]. IEEFA. [Accessed: 2026]. Available at: <https://ieefa.org/european-lng-tracker>
- Japan Organization for Metals and Energy Security (JOGMEC) [online]. (n.d.). Japan Organization for Metals and Energy Security. [Accessed: 2026]. Available at: <https://www.jogmec.go.jp/english/>
- Joint Research Centre (JRC). (2024). *Security of Supply Dashboard*. European Commission.
- Rare Earth Industry Association (REIA) [online]. (n.d.). Rare Earths Industry Association AISBL. [Accessed: 2026]. Available at: <https://global-reia.org/rare-earth/>
- SAFE Centre for Critical Minerals Strategy. (2025). *Resources for Resources: Financing Critical Minerals Supply Chains* [online]. SAFE Centre for Critical Minerals Strategy. [Accessed: 2026]. Available at: <https://secureenergy.org/wp-content/uploads/2025/01/SAFE-Center-for-Critical-Minerals-Strategy-Resources-for-Resources-Financing-Critical-Mineral-Supply-Chains-FINAL.pdf>

US Geological Survey. (n.d.). Rare Earths Statistics and Information [online]. US Geological Survey. [Accessed: 2026]. Available at:

<https://www.usgs.gov/centers/national-minerals-information-center/rare-earths-statistics-and-information>

*José María Calvo-Sotelo**

Associate Professor at IE Business School and SPEGA