

# **The impact of sanctions on global supply chains and climate change: the cases of EV batteries segment in electric car manufacturing in the EU and South Korea.**

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## **Abstract**

This chapter analyses the impact of sanctions against Russia and China on strategic value chains in the EU and in South Korea. Sanctions do not only hit target states, but also spill-over across global supply chain networks, industries, and markets, with unforeseen consequences for the EU's mission to strengthen its open strategic autonomy and industrial development plans to re-localise value chains for the production of critical products, such as EV batteries, semi-conductors, and critical raw materials (e.g. lithium, neon and palladium), as well as for South Korea's strategy of lowering dependence on China's supply chains. The main argument of the paper is that under the pressures of economic sanctions many governments and businesses, i.e. 'third parties', are caught in between. This chapter will explore the effect of sanctions on energy security and the transition into net zero target, by drawing on the impact of sanctions on the development of the EV batteries segment in the electric car manufacturing (Battery electric vehicle, or BEV) in the EU and South Korea – two cases that display some notable parallels. Current trends in EV batteries and in electric car manufacturing demonstrate how economic sanctions undermine ambitious plans for the transition to greener energy in Europe, and in Asia.

## **Introduction**

With the rise of extraterritorial sanctions that disrupt global supply chains, already shattered by the Covid-19 pandemic, the invisible hand of the state is becoming more and more visible. With the quick implementation of state sanctions, supply routes of goods, including critical raw materials, and also services (for example, in the case of travel restrictions) are disrupted. Sanctions are like earthquakes for global supply chains and in 2022 there were at least three epicentres surrounding China, Iran and Russia. The pandemic has gravely disrupted supplies across the globe, but the impact of sanctions is not only short-term, but can also have longer-term consequences as economic actors are forced not only to adjust to short-term logistics problems but to reconfigure their entire business strategies.

The number of unilateral US sanctions regimes has grown exponentially, the most prominent being the Countering America's Adversaries Through Sanctions Act (CAATSA) against Iran, Russia and North Korea, adopted in 2018, covering a wide array of restrictive measures on trade and financial transactions in military and non-military sectors. In 2018, the US withdrew from the Joint Comprehensive Plan of Action (JCPOA) and reinstated the sanctions against Iran that had been lifted in 2016. In 2022, the Republicans introduced a bill – 'Say No to the Silk Road Act' – targeting China's central bank digital currencies (CBDC), driven by concerns that China's digital yuan may be used to circumvent sanctions and compromise users' personal information ([Investing.com 2022](#)). If passed, the law will complement the constantly expanding list of anti-China sanctions that comprises the National Defense Authorization Act (NDAA) – 2019, the point of departure for the sanctions campaign against China's telecom businesses (e.g. Huawei and ZTE), the Executive Order 13959, titled 'Addressing the Threat From Securities Investments That Finance Communist Chinese Military Companies' – 2020, the Hong Kong Autonomy Act – 2021.

Sanctions do not only hit target states, but also spill-over across global supply chain networks, industries, and markets. Economic sanctions undermine the performance of non-targeted companies sharing a common supply chain with targeted enterprises, as their immediate effects are increased costs of production, transportation, transaction costs and a drop in sales. The immediate consequence of sanctions to the world economy has been a setback for the development of sustainable economies in response to climate change. The challenge is twofold, the first one being the dire situation in the gas market in Europe and Asia that spurs inflation worldwide, and the second – a strive for EV battery market consolidation and monopolisation by key players. Sanctions caused a surge in energy prices due to the shortage of Russian hydrocarbons, and surge in some EV battery raw materials, due to increased anxiety over monopolisation of control and supply disruptions.

In August 2022, after Russia reduced pipeline gas supply to Germany by 80%, explaining it as ‘needed maintenance’, the EU natural gas prices (i.e. the Dutch TTF, the European benchmark), soared to \$65 per million BTUs, or 2.7 times higher than in June 2022 (see Figure 1). This caused chain reaction in the Asian LNG markets, spilling the cost of generating electricity. This created upward pressure on inflation in such vital sectors, as car manufacturing, transportation and food and medicine production that will inevitably hurt consumption and economic growth, putting the world at risk of the worst famine since WWII. According to Bloomberg analysts, ‘prices in Europe are more than 10 times their average for this time of year, destabilizing economies, undermining the euro and heaping pressure on politicians to blunt the impact of the worst inflation in decades’ while ‘supply disruptions have worsened, intensifying competition with Asia for spare shipments of LNG as utilities scramble to secure fuel ahead of winter’ (Bloomberg 25.08 2022). Ultimately, high gas prices will have a very dangerous repercussion for energy security in Europe and Asia and for climate change.

**Figure 1. Asian prices are surging to match gains in Europe, 2022**



Source: Bloomberg, 2022

China’s President Xi Jinping announced China’s goal to achieve carbon neutrality by 2060, while the EU has adopted the Long-Term Low Greenhouse Gas Emission Development Strategy to make the EU ‘climate-neutral’ by 2050. These strategic goals are in line with states’ international commitment to ‘global climate action’ under the 2016 Paris Accords. According to IEA, to reach net-zero by 2050 the share of electricity in total final consumption should rise from its current 20% to 49% (IEA 2021). However, the surge in costs in power generation have already caused ‘twin challenges of the transition to clean energy and protecting grids against worsening climate events’ (i.e. worsening storms and more severe weather worldwide), as more than 60% of global power for electrification (necessary for a lower-carbon emissions) is generated from fossil fuels (Gaffen 2022). As Nick Akins, CEO at American Electric Power Company puts it: ‘If everyone is doing renewables at the same time, it further exacerbates that issue... Pure and simple, it’s the supply chain’ (Ibid.)

In response to sanctions, target states retaliate by turning into senders of economic sanctions (or counter-sanctions), and accelerate various economic security policies, to boost their import substitution programs, as in case of Russia<sup>1</sup> (Kirkham 2022), or aggressive measures to enhance their competitiveness and global market share, as in case of China. As the result, with such escalation of tensions between sender states and sanctioned states, lots of governments and businesses, i.e. ‘third parties’, are caught in between. Some East Asian states, such as South Korea and Japan have been caught in a dilemma. On one side, their firms are willing to continue their mutually beneficial cooperation, on another, US pressure makes it difficult for businesses to remain committed to China, as US sanctions ‘pose liability risks to third-country parties even if the underlying activity has no US touchpoint’ (Chen Zhu 2021). Meanwhile, the new comprehensive sanctions against Russia have disrupted the strategic plans of many European companies with a presence in Russia (see AALEP 2022). Such situation can be referred as a ‘pause in globalisation’ when global producers are facing a new challenge of ‘figuring out how to make supply chains more robust by adding more factories, suppliers and sources of materials’ (Mims 2022). In

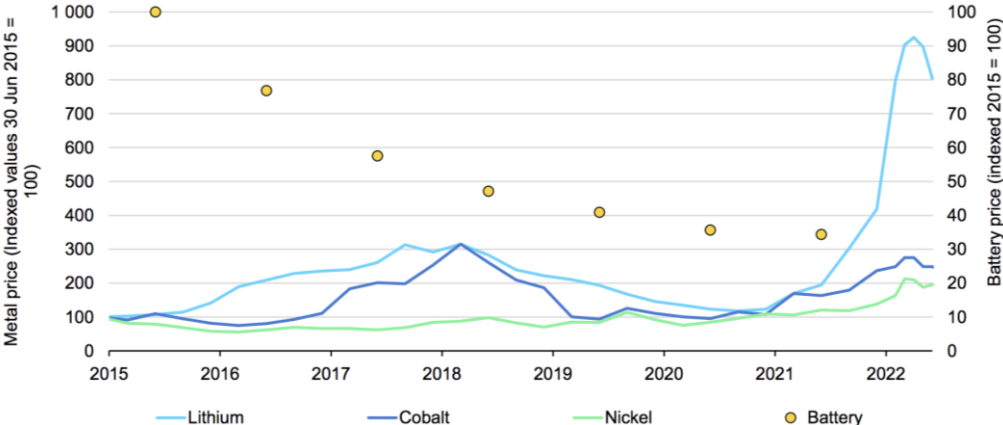
<sup>1</sup> for a detailed assessment of target states, see *The Political Economy of Sanctions: Resilience and Transformation in Russia and Iran*, <https://link.springer.com/book/10.1007/978-3-031-04055-9>

logistics, the experts call this reshuffling in global supply chains – a shift from supply chains to webs – as ‘multiple sourcing,’ which proves to be expensive and time-consuming (Mims 2022).

In this sanctions crossfire, the transition to net zero neutrality will be inevitably slowed down in many parts of the EU and other OECD countries, as further adoption of battery electric vehicles (BEV)<sup>2</sup> and other important developments technologies will be stalled. The U.S. sanctions against China cause China’s counterreaction in the form of a more aggressive strive for control of the BEV and EV batteries market, not only of the end-product, but also of the entire production process and vital raw materials. Therefore, the race to ‘net zero’ will increasingly divert attention of the practitioners in the public and private sectors to the security of supply of critical minerals and metals needed to manufacture EV batteries – a component that accounts for 30% to 40% of the value of an electric vehicles (IEA 2022).

The main argument of this chapter is that sanctions undermine transition to green energy strategy not only by causing chaos in the global gas markets, but also by challenging future development of the EU’s and South Korea’s BEV manufacturing industries, as supplies of EV batteries, and core raw materials, critical in battery production, such as lithium, cobalt and nickel<sup>3</sup> (except for manganese, which is more widely available) are severely disrupted (see Figure 2). Moreover, destabilised prices cause severe uncertainties, ‘with lithium holding strong on brisk demand and tight supply while nickel and cobalt start to fall out of favour in the crucial Chinese market’ (Nikkei Asia 2022b). For instance, the price of lithium, a crucial input in the EV supply chain, have soared nearly tenfold compared with last year. This is putting strong pressure on battery makers to pass higher costs on to customers.

**Figure 2: Battery metal prices, 2015 – July 2022**



Source: IEA (2022)

This chapter will explore the effect of sanctions on energy security and the transition to net zero neutrality target by examining the disruptions in the BEV and wider automotive industry supply chains in the EU and South Korea. These two cases display some notable parallels. Recent trends in the EV batteries segment in the electric car manufacturing demonstrate how economic sanctions have undermined the ambitious plans for the transition to greener energy in Europe (and in Asia). After a brief overview of sanctions against Russia and China, the assessment of the new trends in sanctions policies with their impact on global supply chains and business practices, the chapter will turn to the cases of the EU and South Korea, before proceeding to concluding remarks.

<sup>2</sup> BEVs are all-electric vehicles/cars that run on batteries (e.g. lithium-ion batteries are also used in smartphones, laptops, etc.).

<sup>3</sup> lithium, cobalt and nickel are used in cathodes, making up about 40% of the cost of a battery cell (the cell being one of the major EV production expenses).

## Sanctions. A brief overview

### Russia

The scope of anti-Russia sanctions widened after Russia's invasion of Ukraine in February 2022. Since 2014, different 'tiers' of sanctions were introduced by the US and the EU (Tier 1 - political and diplomatic sanctions against individuals and entities; Tier 2 - targeted sanctions against individuals and companies - in Crimea; Tier 3 – sectoral bans on three types of economic activities (financial, military and energy sectors). Over the period 2014 – 2021, the US unilaterally applied 'stringent sanctions legislation' against Russia. The most prominent acts were the Countering America's Adversaries Through Sanctions Act (CAATSA), adopted in 2017. Section 232 of CAATSA deliberately targeted persons involved in financing or contributing to the expansion Russia's gas export pipelines, such as Turk Stream and Nord Stream 2. This was followed by the Defending American Security from Kremlin Aggression Act (DASKA) and the Defending Elections from Threats by Establishing Redlines Act (DETER) in 2018, the Protecting Europe's Energy Security Act (PEESA) in 2019, amended in 2020 to broaden Nord Stream 2 sanctions (i.e. by expanding PEESA authority to companies providing services, facilities, or funding for "upgrades or installation of equipment" for vessels).

The EU recognised these sanctions and amendments as illegal in 2021, but OFAC nevertheless added 16 vessels and 7 'Russia-related' to its sanctions lists, pursuant to PEESA, along with a new general license and additional guidance (e.g. designation of the vessel Fortuna and its owner KVT-RUS). Later that year under the pressures from some EU states, Biden waived sanctions on Nord Stream 2<sup>4</sup>. Meanwhile, U.S. sanctions legislation took a different direction: Washington introduced sanctions against Russia's sovereign debt (Ruble-denominated) and other financing instruments, and more sanctions, in response to the 2020 poisoning of Aleksey Navalny (i.e. pursuant to the Chemical and Biological Weapons Control and Warfare Elimination Act of 1991). Moreover, the suggestions coming from some congressmen to cut Russia's major banks off the SWIFT messaging system became more vocal. However, in contrast to today's sanctions (*August 2022*), those sanctions were not comprehensive. For instance, the US sanctions on sovereign debt and other financing instruments were called 'cosmetic' by market analyst, as they affected mainly Ruble-denominated debt (by adding numerous Russian entities and individuals to the List of Specially Designated Nationals ("SDN List") and therefore still allowed U.S. financial institutions to purchase bonds in the secondary market.

With the outbreak of Russia's 'military operation' in Ukraine, all previous threats became a reality: the scope of anti-Russia's trade and finance sanctions has been extended to unprecedented degree. The U.S., the EU and the U.K. froze \$630bn (£470bn) of foreign currency reserves of Russia's central bank, removed the major Russian banks from the SWIFT payment system (i.e. Bank Otkritie, Novikombank, Promsvyazbank, Bank Rossiya, Sovcombank, Vnesheconombank, VTB Bank), banned the export of dual-use goods – items with both a civilian and military purpose, such as vehicle parts, sanctioned over 1,000 Russian oligarchs, and suspended all flights from their airspaces (Canada closed its airspace as well). The UK imposed sanctions on Russia's Wagner Group – a private military unit and put a 35% tax on some imports from Russia, including vodka, limit the sale of 'golden visas', which allow wealthy Russians to get British residency, and will ban the export of luxury goods to Russia – including vehicles, high-end fashion and art ([BBC 2022](#)). The EU and U.K. suspended the broadcasting activities in the EU of five Russian state-owned outlets: Sputnik, Russia Today, Rossiya RTR/RTR Planeta, Rossiya 24, TV Centre International.

The US punitive measures continued to be wider in scope than sanctions imposed by other states, especially in energy in finance. Multiple Directives (The E.O. 14024 - 14065 Directives) blocked six major financial institutions, including the Ministry of Finance, the Russian Direct Investment Fund, and Sberbank (the SDN and CAPTA Lists), restricted access to finance for Gazprom, Gazprom Neft, Transneft, Rostelecom, RusHydro, Alrosa, Sovcomflot, Russian Railways, and five banks from non-SDN

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<sup>4</sup> by invoking the "national interest" waiver to PEESA, as an amendment to National Defense Authorization Act "NDAA"

MBS List<sup>5</sup>. As the shale gas revolution turned the U.S. from the main oil and gas consumer to the main producer, an immediate ban on all Russian oil and gas imports was a very straightforward and welcoming step. To cut Russia's oil and gas from the European market, Washington introduced amendments to PEESA (Protecting Europe's Energy Security Act of 2019) – to ban entities responsible for the Nord Stream 2. Also, the scope of CAATSA and Cyber-Related sanctions was stretched to shut down individuals and entities 'connected' to Nord Stream 2, or to Russia's Government disinformation campaign.

Following the U.S. national security objective of cutting global markets from Russia's hydrocarbons, the UK set itself the target to ban all imports of Russian hydrocarbons by the end of 2022, and the EU – by 2030, while the permission for the Nord Stream 2 gas pipeline was put on hold. In June 2022, the EU agreed to ban Russian crude oil and certain petroleum products, gradually: within six months for oil and eight months for products - i.e. 90% of Russian oil imports to Europe will be suspended by the end of 2022 (the European Council 2022). The list of other products sanctioned by the EU includes also coal and other solid fossil fuels, steel and iron, gold, including jewellery, wood, cement and certain fertilisers, seafood and liquor (e.g. caviar, vodka). To reduce its dependence on Russia's gas, the EU members agreed to reduce consumption of natural gas this winter by 15% from August through March. More practical steps to achieve these goals are yet to be discussed.

### China

Sanctions are selectively used to undermine competitive business, as the case of the US sanctions against China's telecom demonstrate. As China succeeded in becoming the main producer of electronics and machinery (some components reaching more than 50% of global trade), and in becoming a major developer of 'just in time' global supply chains in information and communication technologies (13% of global exports) (Barclays 2020), Washington aims to protect the leading role of US technology in the global economy. China's high competitiveness stems not only from its cheaper labour, or from its booming consumer market (i.e. 'more than 70% of what Japanese companies' affiliates produce in China is sold there'), but also from its dramatic progress as a 'rival in sophisticated technology' (the Economist 2020). (The US does everything it can to secure its position in 'advanced microchips' (concentrated in Taiwan) and other manufacturing 'required to build everything from weapons systems to smartphones and 5G networks' (Mims 2022). The rising power of Chinese corporations, such as Huawei, ZTE, Alibaba, Baidu, BOE Telecom, Hikvision, China Mobil, China Unicom, Tencent, etc. – are seen as a threat to the hegemony of Silicon Valley (Ibid.). As Tanner Mirrlees put it (Mirrlees 2021:118):

*'Evidently, the US Empire's Federal agencies have unleashed a multi-faceted sanctions campaign that aims to punish China for pursuing technological independence at Silicon Valley's expense. These sanctions aim to put pressure on China to lower its Great Firewall so Silicon Valley can expand its digital goods and services trade in this vast market'.*

Huawei is famous for promoting its 5G network around the world, ZTE – for its smartphones and other telecommunication devices. In 2017, ZTE was fined \$1.2 billion by the US government for exporting US technology to Iran and North Korea. In 2018, US companies were banned from providing exports to ZTE for seven years, a move which paralyzed ZTE's business until the company paid a \$1.4 billion fine and replaced the board of directors (Ibid.). Huawei has been targeted for years by US laws to prevent the company from rolling out its 5G technology around the globe by prohibiting the supply of American computer chips to Huawei (European Parliament 2020). Before the introduction of direct sanctions, the functioning of Huawei was complicated by the 2018 'US Clarifying Lawful Overseas Act', or so-called CLOUD Act, that empowered America's law enforcement regulators to request data stored by major cloud providers, located outside the US, raising serious concerns about the safety of personal data (Ibid.) There has been a lot of literature on the case of Huawei that shows in what sense sanctions against this tech giant disrupt global supply chains, and experts have long predicted the rise of a technological Cold War with Chinese 5G and Western 5G competing for dominance. In 2018 – 2019, a

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<sup>5</sup> The banks delisted from SWIFT had been designated by the OFAC (i.e. as Specially Designated Nationals, or SDNs) before Russia's invasion. Therefore, all transactions with and services for these parties had been prohibited.

campaign against Huawei with a series of arrests of Huawei's top executives on accusation of violation of US sanctions against Iran, culminated with the Bureau of Industry and Security (BIS) adding 46 Huawei affiliates onto its Entity List, which prevents Huawei from accessing items produced domestically and abroad from US technology and software. In 2020, this campaign continued with Donald Trump's Executive Order 13959, 'Addressing the Threat from Securities Investments That Finance Communist Chinese Military Companies', which was extended in 2021 by Joe Biden (Mirrlees 2021). The Order prohibited any transactions with what the Department of Defense characterises as 'Communist Chinese military companies' – such as, China Electronics Technology Group Corporation, Hikvision (its subsidiary), Semiconductor Manufacturing International Corporation (SMIC). China Telecom, China Mobile and China Unicom were delisted from NYSE in 2021, while the US SEC had adopted the 'Holding Foreign Companies Accountable Act' to 'instigate a stock value slump for some Chinese technology companies' (Ibid. 118). US sanctions also hit popular Chinese-owned social media platforms, such as TikTok.

In response to U.S. sanctions, China's Ministry of Commerce ("MOFCOM") promulgated the Rules on Counteracting Unjustified Extra-Territorial Application of Foreign Legislation and Other Measures (the "Rules") in January 2021. The Rules' express aim is to counteract extraterritorial measures that seek to restrict dealings between Chinese and third-country businesses ("Extraterritorial Measures"). To avoid clear violations of free trade arrangements, China also uses 'unannounced orders sent to customs officials', among those were a suspension of exports of crucial rare metals to Japan for two months in 2010 over a territorial dispute, a halt on purchases of barley, coal, wine and other commodities from Australia in 2021, or the recent trade embargo against Lithuania, after Lithuania agreed to let Taiwan open an office in their country. Also, China is actively remodelling its macroeconomic model, making it more self-sufficient. In 2020, President Xi declared that China will "tighten the dependence of the international industrial chain on our country, so as to develop a strong countermeasure and deterrent ability against external attempts to sever our supply chains". China's strategic target is to subsidise domestic production of a complete range of industrial goods, to minimise the country's reliance on export (Bradsher, Keith; Swanson 2022). Analysts believe that US comprehensive sanctions on Russia will speed the achievement of China's top-priority goal of self-reliance in the semiconductor industry (Horwitz 2022). Sanctions are 'a sharp reminder to China' of the need for its own advanced chip manufacturing capacity.

### **The impact of sanctions on global supply chains**

The combined impact of the pandemic and sanctions is a reconfiguration of vital supply chains of the 'goods we rely on for our daily existence' (Mims 2022). With the adoption of shipping containers in the 1960s, modern supply chains have become cost-effective, as transcontinental shipping has become cheaper and 'manufacturing could move to wherever wages were lowest'. Consequently, most production was moved to East Asia, and predominantly to China (Mims 2022). Flexible arrangements that suited cost-efficient business models, however, failed to withstand the pressures of economic sanctions and the pandemic without readjustments by lead firms. This is particularly true regarding the production of complex technologies, such as IT equipment (smartphones, computers, and their components), electronic components (e.g. batteries) with a complex geography of production to synthesise rare raw materials, intermediate components and advanced logistics. The following trends in the sanctions policies will continue to shape future restructuring of global supply chains.

First, the number of target states, especially with the transformation of anti-Russian sanctions into a comprehensive blockade – are likely to continue to rise. Second, existing sanctions regimes against 'contender' states, unless they are willing for immediate cooperation in joining the blockade, are expected to be strengthened. This is because competitive pressures in strategic economic sectors of the future, including AI, biotechnology and quantum physics, will continue to persist in a capitalist oriented global economy. Third, as US legislation continues to penetrate into different spheres of IPE, penalising corporations, various types of transactions, or individual behaviours, the amount of third parties affected by secondary sanctions will surge. Fourth, sanctions will disturb the supplies of agricultural products, medicine and medical equipment (categories previously exempt from restrictions) to some Asian and MENA countries. Fifth, the legal base will continue to become more complex, with vague definitions: it will be harder to understand but easier to apply to a larger number of entities. Finally, not only the

imposition but even the threat of sanctions will be disturbing for businesses, as sanctions do not even need to come into effect to increase uncertainty in the markets, disrupt investment flows and production (e.g. consider the 30% surge in the aluminium prices in response to the threat of sanctions against Rusal in 2018).

Overall, the atmosphere of struggle with sanctions compliance greatly disrupts business confidence and undermines trust in relations, already hit by the pandemic. Corporate boards, reshuffled under the claims made by investors, have not had a chance to meet in person during lockdown. Analysts suggest that global M&A activities have stalled due to the lack of connectivity, confidence, trust and a sense of collegiality. Companies are cautious about pursuing growth opportunities through acquisitions, sales or other structural changes. Sanctions disrupt long-term business connections, while the re-establishment of professional and personal ties and new trustful relations is a very time-consuming task (Herbst-Bayliss, French, and Hu 2022).

The level of trust is further disrupted by constant pressures for businesses to meet sanctions compliance requirements, not only in relation to the initial fine that might be imposed, but also concerning the risk of reputational damage and difficulty in raising capital in future. Expenditure on a well-designed, risk-based compliance business strategy is rising. Such strategies are based on the risk profiles of the company's suppliers, intermediaries and customers and on a timely identification of the most challenging sanction and export control developments. Sanctions compliance has become a very costly business on its own, necessary for a company's long-term survival. One of the most important factors is that sanctions and export control have become increasingly intertwined. Export controls exemplify the effects of sanctions as they apply to goods produced in any country as long as they use US technology (e.g. chipmakers like Taiwan Semiconductor Manufacturing and the Shanghai-based Semiconductor Manufacturing Industry Corp).

## The EU

The EU is highly dependent on Russia's hydrocarbons and planning for longer-term energy independence. While Germany relying on Russia for almost half of its gas supply, it has proved difficult to get agreement on further measures such as an outright import ban. Moreover, the supply disruption by Gazprom is forcing some EU states to use more coal-fired power plants. These developments go in stark contrast with the Green Deal - 2019 plans to take Europe to net-zero by 2050 (Kirkham 2021). As the cleanest of hydrocarbons, natural gas is part of green transition scenario, while investment in renewable energy, in microelectronics, and in EV production – are the core components of the EU net-zero strategy (as well as in South Korea).

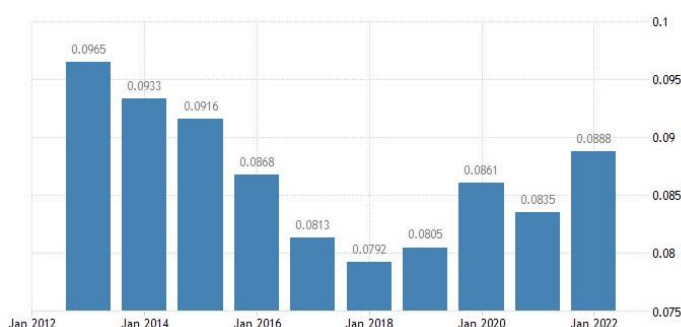
While already recognising the strategic importance of microelectronics for the European economy in 2013, it was only in December 2018 that the EU backed the public investment worth €1.75 billion by France, Germany, Italy and the UK to support research and innovation in the sector, largely in response to growing trade tensions between the US and China (European Commission 2018a). In 2017, the European Commission (EC) continued with the formation of industrial alliances and launched the European Battery Alliance (EBA). In May 2018, the EC put forward a strategic action plan to create a whole battery supply chain in Europe, including the sourcing of raw materials, cell and cell component manufacturing, battery pack manufacturing, production of electric vehicles, and recycling (European Commission 2018b). In 2020 and in light of the COVID-19 pandemic, the European Raw Materials Alliance (ERMA) was formed to support the domestic production of raw and advanced materials needed for European battery value chains (ERMA 2021). Mirroring the mission-oriented approach to innovation policy (Mazzucato 2018), these new sectors of the future became the important projects of common European interest (IPCEI), enabling member states to pull public investment together, in partnership with private investment, and bypass stringent state aid rules at the EU level.

With the acceleration of the green transition during the COVID-19 crisis, notably as part of the European Green Deal and the Recovery Plan for Europe, the EU's industrial policy embraced these economic sectors through industrial alliances with the overall objective of making the critical supply chains more resilient and reducing trade dependence on China (European Commission 2022a). The sanctions against Russia in light of its military attack on Ukraine, however, have complicated the steady progress of the green transition and achieving strategic autonomy for the European economy. In the

following two subsections, we will analyse the impact that the sanctions and trade sanctions had on (1) the energy transition and the production of key intermediate inputs in electric vehicle industry, namely semi-conductors and EV batteries.

The increase in electricity prices (see Figure 1), already starting in 2021 (European Commission 2022b), and the reduction in the supply of natural gas by Russia, with the attendant skyrocketing of gas prices on the global markets (see Figure 2), have acted both as an accelerator and a brake on the green transition. In 2019, around 24% of the total energy supply in the EU derived from natural gas (24%) and oil and petroleum (33%), both of which are for the most part imported from outside the EU (Eurostat 2022a). Moreover, in 2020, the European Commission designated natural gas as a transition fuel on the grounds of the economic viability of its supply compared to other existing alternatives and having less polluting effects compared to other fossil fuels (European Commission 2020; Gürsan and de Gooyert 2021). Alongside the chemical industry, food and non-metallic minerals (glass and ceramics) are the biggest consumers of imported natural gas in EU industry (Defauw et al. 2022). For example, the chemical industry transforms energy and other raw materials to produce intermediate inputs that are then used by many other industrial sectors to produce final products (CEFIC 2022).

**Figure 3. Euro Area – Electricity prices (Non-household, medium-sized enterprises), 2012 - 2022**



Source: Trading Economics (2022)

**Figure 4. Natural gas price dynamics, 2019-2022**



Source: Trading Economics (2022)

The progress in the implementation of measures to improve energy efficiency in production has been slow before the 2022 energy crisis. With increasing energy costs eating into European industry’s revenue, some businesses have taken measures to reduce their energy consumption, such as shifting to less energy-intensive activities and production methods and closing of inefficient units (Euractiv 2022; Eurostat 2022b). However, many companies, such as the Norwegian chemicals group Yara and the US fertiliser group CF Industries, had to temporarily or permanently close some of their plants to cope with record gas prices, whereas others have curtailed their production (Yara 2022; Bloomberg 2022). The demand to secure energy for industrial production at competitive prices will mean that the focus will be on securing reliable energy sources regardless of the carbon intensity of the energy source, at least in the short term – see, for example, Germany’s U-turn on coal production (The Federal Government 2022).



In the battery manufacturing and semi-conductor industries, which produce key inputs for the automotive and electronics industries amongst others, the supplies of materials like lithium, cobalt and nickel in battery production, and gases such as neon and hexafluoro-1,3-butadiene (C4F6) needed for micro-chip production, were also disrupted as a result of international sanctions and COVID-19 related bottlenecks in supply chains (Euroactiv 2022; Stepek 2022; Desai 2022). Lithium and nickel, manganese and cobalt (NMC) are key metals that are used in the production of batteries for most electric vehicles (e.g. Audi, BMW, Hyundai, Nissan and Renault).

Gases, such as neon and C4F6, are used in laser technology that is employed in lasers for dry etching of integrated circuits in semi-conductors. Around 50–55% of the supply of neon, a by-product in steel production, used to come from Russia and Ukraine (Russia Briefing 2022), further compounding problems for European manufacturers in automotive and electronics industries that were already facing microchip shortages due to COVID-19 related restrictions imposed in China and other East Asian countries in 2021 and 2022. After the start of the Russo-Ukrainian War in February 2014, the price of neon gas rose by 600% in early 2015, prompting semiconductor companies to diversify their supply model, develop recovery and recycling technology, and this way reduce their consumption of neon (GizChina 2022). By the time the conflict expanded in February 2022, the major semiconductor industry chain companies, such as the American Intel, Dutch ASML and South Korean SK Hynix, had secured multiple sources of neon gas supply. Despite the supply chain risk management strategies employed by companies, ASML still needed to examine alternative sources for the small amount of neon (around 20% of total gas used in production) that it procured from Ukraine and Russia (Reuters 2022). In most cases, however, the major semiconductor companies are expected to have the capability and the resources, including support from state authorities (e.g. subsidies), to mitigate the ongoing disruptions to the sourcing of critical raw materials.

The EU responded to the disruptions in the EV battery and semi-conductor supply chains and energy markets with varied measures and tools. In March 2022, the Enterprise Europe Network, managed by the European Innovation Council and SMEs Executive Agency (EISMEA), launched the Supply Chain Resilience Platform to link international suppliers with buyers of goods and services and in this way aid European SMEs to retain, restructure or replace existing supply chains (Enterprise Europe Network 2022). In response to the energy crisis in Europe, the European Commission presented the REPowerEU Plan, which is focused on: (1) diversifying the EU's energy supplies of gas, oil and coal in the short-term (increase in gas deliveries from the US, Canada and Norway; intensified cooperation with Azerbaijan, political agreements with Egypt and Israel, energy dialogue with Algeria, continued cooperation with Gulf countries, coordination with other gas buyers such as Japan, China and Korea, explore potential to increase exports from Nigeria, Senegal and Angola); (2) increasing energy efficiency and reducing energy consumption by consumers and businesses; and (3) accelerating the green transition and the use of renewable energy by 2030 (European Commission 2022c).

## South Korea

South Korea, poor in own natural resources (as it imports 97% of its energy sources), is trying to move away from fossil fuels (as well as the EU). The BEV (Battery electric vehicle) car manufacturing is part of South Korea's net zero strategy (along with its plans for hydrogen-based economy, despite growing scepticism). However, fierce market competition with other four top world BEV producers (i.e. China, Germany, Belgium and the U.S.) the economic blockade of Russia, the U.S. sanctions against China with multiple pressures on 'third parties' to decouple from the country's supply chains, along with a recent \$430 billion Climate and energy U.S. Senate bill that proposed U.S. tax credits for EVs purchases<sup>6</sup> (by lifting the cap on \$7,500 tax credit), discriminatory for foreign-made EV according to the WTO rules – all these developments undermine South Korea's plans. The U.S. 'decoupling' strategy, and sanctions crossfire have the most disturbing consequences on South Korea's economic and energy security.

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<sup>6</sup> *The \$430 billion climate and energy bill, lifts the cap on the existing \$7,500 tax credit for EV purchasers but impose restrictions for vehicles not assembled in North America to get credit.*

In 2019, the US Congress passed the National Defense Authorization Act to reinforce economic security measures and to increase pressures on its other allies, like South Korea and Japan, to accelerate their economic decoupling from China, to decrease their over-dependence on China's technologies over the long term. This is done to shut out Chinese high-tech companies from global markets, however, the business community is split over the question of economic security (Kodachi 2020). The U.S sanctions on China aim at restructuring global production into 'China-free' supply chains. In May 2021, the Presidents of South Korea and the US, Moon Jae-in and Joe Biden reiterated their willingness to strengthen cooperation in core industries (i.e. semiconductors, artificial intelligence, electronic batteries, 5G and 6G, biotechnology and quantum technology). At Cheong Wa Dae Korea's four largest business conglomerates Samsung, SK, LG, and Hyundai Motor announced investment to wean from China: Samsung will invest \$17 billion in a new semiconductor manufacturing plant, LG Energy Solution and SK Innovation – \$14 billion in battery production, and Hyundai - \$7.4 billion in the manufacturing of electric cars and charging stations (Ah-jin 2021). However, the results of these developments could be paradoxical, as by switching to domestic production, South Korea will become heavily dependent on China for the raw materials in many high-tech industries. The segments of rechargeable batteries and semiconductors are the most striking examples.

Manufacturing of batteries, especially for electric vehicles, which are in high demand due to soaring oil prices and the transition to net-zero, is currently dominated by China. The EV market accounts for 80% of lithium-ion battery demand. According to Wood Mackenzie, over the period from 2021 to 2030, global lithium-ion battery capacity is expected to rise over five-fold to 5,500 gigawatt-hours (GWh). However, electric cars will only become competitive with combustion-engine cars if battery prices drop to \$100 per 1kWh, but this is unlikely to happen until 2026 (Reuters 2022).

Business analysts warned that 'Korea's efforts to bring home the production of parts and equipment will not only paradoxically end up in its increased dependence on China. The problem is that China plays a crucial role in the global supply of raw materials, controls the lithium market through its stakes in the "lithium triangle" - Argentina, Bolivia and Chile, as well as the markets for the cobalt and nickel used in making the transmission rods. Therefore, South Korea's battery industry is 'alarmingly dependent' on China for four core materials: cathodes, graphite anodes, membranes and electrolytes (e.g. China controls 58% of the global cathode market, while South Korea only 9%) (Jung 2021).

For instance, to manufacture its own cathodes, South Korea must import from China almost all of the raw materials, such as nickel, cobalt and manganese powder. The most expensive ingredient – cobalt – is mainly produced in the Democratic Republic of the Congo (78 % of the global cobalt production), however, 72% of the Congo's cobalt industry is controlled by China. Lithium, another core component is mainly mined in Australia and Chile, where China owns over 60% of the mines, making battery production 'impossible without China', according to market experts (Jung 2021). The independent domestic production of electrolytes is even more problematic, as in 2021 'the price of Chinese-made lithium that goes into electrolytes rose from \$15 per kg early this year to \$80 recently', adding immense price volatility risks. As for graphite anodes, China accounts for 66% of its global market, and for the global market for membranes, China's Shanghai Energy New Materials Technology overtook Japan's Asahi Kasei used to dominate, becoming the leader of its production as well.

Regarding semiconductors, South Korea has become increasingly dependent on raw materials imported from China to meet the needs for the switch to domestic production, after Japan curbed exports of key semiconductor materials (e.g. hydrogen fluoride that is used to eliminate contaminants in the manufacturing process). While the imports of Japanese-made hydrogen fluoride to South Korea decreased from 42% in 2018 to 13.6% in 2021, the proportion of Chinese raw materials increased by 17.7 percentage points instead (Hyeong-tae 2022). As Ahn Ki-hyun, a member at the Korea Semiconductor Industry Association, suggested: '*We're importing Chinese raw materials to manufacture materials ourselves, but that means we'll end up even more dependent on China*'.

The dynamic in the production of the EV batteries correlates with the trends in the electronic vehicle manufacturing. In 2021, South Korean BEV 'retreated in the global market on the ascension of its Chinese and German competition': China's global export market share was up by 9.5 percentage points while Germany's - 3.8 percentage points (the Federation of Korean Industries 2022).

**Figure 5. Global BEV export market of the top five producers (%), 2021**

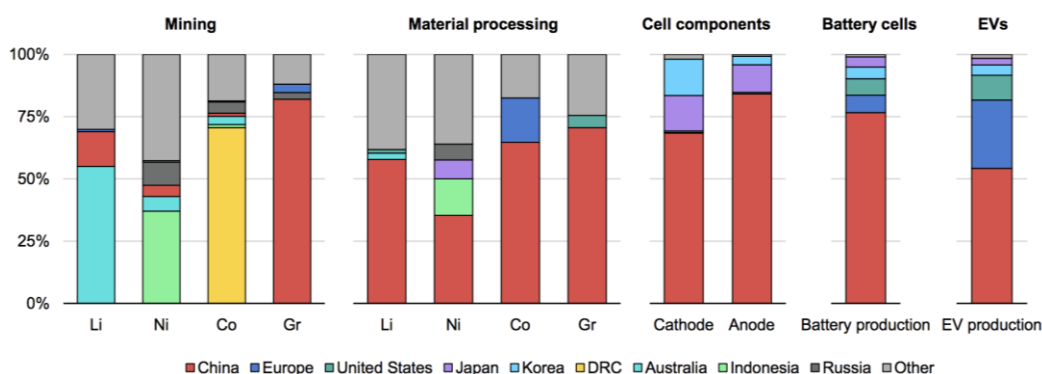


Source: ITC 2022, International Trade Centre, trade map

Moreover, sanctions against China (and against Russia) set the preconditions for China’s political leaders to reconsider its economic policies and business strategies, to boost economic competitiveness and to secure China’s leading positions in the global markets, including the BEV and EV batteries segments. Notably, the EU is the world’s largest importer of BEVs, with market share of the Chinese suppliers reaching 15.9% in 2021 (4.2% in 2020). In 2021, China’s car manufacturers, such as Tesla’s factory in Shanghai, SAIC Motor Corp. and BYD Auto Co. boosted their exports to the EU by 513.9%. As for the global EV battery market, the total share of Chinese battery companies (e.g. CATL, BYD and CALB) grew to 48.7% (38.4% in 2020), while the share of South Korean largest battery producers (e.g. LG Energy Solution, Samsung SDI and SK On) declined from 34.7 % in 2020 to 30.4% (Korea Herald 2022).

As mentioned previously, the problem with the U.S. strategy of decoupling ‘third party’ states from China’s supply chains of end-products of the EV batteries results in increasing dependency of third parties on China’s in supplies of raw materials, as China dominates the entire downstream EV battery supply chains:

**Figure 6. Geographical distribution of the global EV battery supply chain (%)**



Source IEA, 2022

Another crucial question that will impact the BEV production, as it will further boost China’s competitive advantage is the standardisation policies in the EV batteries production (i.e. the standards for measuring the purity of lithium used in EV batteries). China is working hard on securing its leading position. ISO certification helps demonstrate a product’s quality to customers. In 2020, the ISO approved a Chinese proposal to establish a technical committee for lithium standards. As China chairs this panel, some other members of the association worry that ‘the Chinese will seek to advance standards that benefit their country’s battery industry’ (Nikkei Asia 2022a).

## Conclusion

The growing enthusiasm for sanctions and countermeasures (i.e. counter-sanctions), coupled with unprecedented level of sanctions which are almost a full embargo, imposed on an economy as big as Russia, is reshaping the global political economy. No doubt the Russian economy has been hit very hard

and will face an economic contraction, spiking inflation and the risk of default. However, as Russia's \$1.5 trillion economy is the world's 11th largest, with a 6% share in the aluminium output, 7% in nickel supply, 12% in crude-oil production, 18-19% in wheat and natural-gas exports and 25% share in copper supply – 'no countries have tried pushing an economy of that size to the brink of collapse, with unknown consequences for the world' (Wong and Crowley 2022). As for the US – China economic war, U.S. sanctions and export controls (i.e. another form of sanctions) against China have been increasingly disturbing for global value chains and global supply chains.

Current trends in EV batteries and in electric car manufacturing demonstrate how sanctions undermine ambitious plans for the transition to greener energy in Europe, and in Asia. While the goals towards the achievement of net zero neutrality by 2050 were adopted in a more optimistic period of global governance, exemplified by the 2015 Paris Agreement, the rising geo-political and geo-economic tensions between global powers have inadvertently complicated the execution of the green transition strategies adopted by states. If before the start of the Russo-Ukrainian war and US-China trade tensions the commercial logics of large automotive and electronics TNCs relied on horizontal expansion strategies, resulting in geographically dispersed global supply chains, the growth in the employment of economic sanctions by states for geopolitical purposes has recalibrated the supply management strategies of big manufacturers. The increasingly uncertain business and regulatory environment necessitates lead firms in the strategic economic sectors, such as the semi-conductor industry and battery manufacturing, to restructure and align their production strategies within the newly imposed parameters and ideologically motivated industrial alliances. These trends will have monumental consequences for open global trade, as the global economy is more and more fragmented into West-centred and East-centred blocs/spheres of influence.

The impact of the sanctions against Russia had a critical impact on the EU strategy to reduce CO2 emissions, which initially involved continuing reliance on natural gas imports from Russia as a transitory phase towards increasing the share of renewable energy sources in the overall energy mix. The international geopolitical situation was instead used as an opportunity to reduce the European dependence on natural gas from Russia and speed up the transition to renewable sources of energy. International alliances with allies and trading partners have been a key tool to achieve this. For example, in December 2022, the EU and the Association of Southeast Asian Nations (ASEAN) will hold a summit of national leaders for the first time to discuss expanding trade and infrastructure assistance as the EU seeks to strengthen ties with the Asian bloc and counter Russian and Chinese influence in the region. Through these alliances, the EU and South Korea will be able to restructure their critical raw materials and the EV/semi-conductor supply chains.

In terms of policy recommendations, support measures need to be focused on assisting the vulnerable parts of the economy, especially SMEs. Compared to large enterprises, SMEs are more reliant on information sharing and private or public-private institutional support structures in the face of external shocks. Policy-makers should focus their energies on assisting the different economic clusters with funding opportunities that will increase the resilience of SMEs in targeted sectors (e.g. R&D support, energy efficiency investments), while directing them towards more sustainable supply chain management. More generally, policy-makers need to implement more radical structural reforms in order to rein in unsustainable profiteering by energy traders and to regulate energy prices by intervening in global energy markets (e.g. suspending or banning commodity trading on exchange markets) and bringing key oligopolistic market players into public ownership (akin to what has been done in the banking sector post-2007) (Euronews 2022). This will not only bring the energy prices down for consumers (the electorate) and SMEs (increase their competitiveness), but will also aid the green energy transition in the long run.

## References

- Ah-jin, Kim. 2021. "Moon to Meet Tycoons Next Week." *28 May*. Retrieved January 13, 2022 ([http://english.chosun.com/site/data/html\\_dir/2021/05/28/2021052801047.html](http://english.chosun.com/site/data/html_dir/2021/05/28/2021052801047.html)).
- Barclays. 2020. "The Post-COVID Economy." Retrieved March 8, 2021 (<https://www.investmentbank.barclays.com/our-insights/The-post-COVID-economy.html?cid=paidsearch->

textads\_google\_google\_themes\_egs\_post\_covid\_uk\_research\_egs\_post\_covid\_bmm\_307153630959&gclid=Cj0KCQiAyoeCBhCTARIsAOfpKxh3XYaQ8SK7Y4EGnpse94nZPdKdP3basEMPiquYG).

- BBC. 2022. "What Sanctions Are Being Imposed on Russia over Ukraine Invasion?" *24 March*. Retrieved March 24, 2022 (<https://www.bbc.co.uk/news/world-europe-60125659>).
- Bloomberg 25.08. 2022. "Natural Gas Soars in Europe, Asia as Crisis Heats Up Competition." Retrieved (<https://www.bloomberg.com/news/articles/2022-08-24/european-natural-gas-rises-as-outages-further-tighten-market>).
- Bradsher, Keith; Swanson, Ana. 2022. "Before Ukraine Invasion, Russia and China Cemented Economic Ties." *The New York Times*. Retrieved March 26, 2022 (<https://www.nytimes.com/2022/02/26/business/china-russia-ukraine.html>).
- Chen Zhu, B. 2021. "Mounting U.S. Sanctions And Chinese Countermeasures Create New Legal And Reputational Risks For Third-Country Businesses." Retrieved March 8, 2021 (<https://www.jdsupra.com/legalnews/mounting-u-s-sanctions-and-chinese-5608489/>).
- Euronews. 2022. "Energy Crisis: Ursula von Der Leyen Calls for 'emergency Intervention' in Electricity Market." Retrieved (<https://www.euronews.com/my-europe/2022/08/29/energy-crisis-ursula-von-der-leyen-calls-for-emergency-intervention-in-electricity-market> ).
- European Parliament. 2020. "Extraterritorial Sanctions on Trade and Investments and European Responses." Retrieved March 8, 2021 ([https://www.europarl.europa.eu/RegData/etudes/STUD/2020/653618/EXPO\\_STU\(2020\)653618\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/653618/EXPO_STU(2020)653618_EN.pdf)).
- Herbst-Bayliss, Svea, David French, and Krystal Hu. 2022. "Dealmakers See M&A Pace Slow as Geopolitical Turmoil Takes Toll." *17 March*. Retrieved March 20, 2022 (<https://www.investing.com/news/stock-market-news/dealmakers-see-ma-pace-slow-as-geopolitical-turmoil-takes-toll-2787090>).
- Horwitz, Josh. 2022. "Analysis-US Sanctions on Russia Serve China a Sharp Reminder of Need for Its Own Chips." *25 February*. Retrieved (<https://www.investing.com/news/stock-market-news/analysis-us-sanctions-on-russia-serve-china-a-sharp-reminder-of-need-for-its-own-chips-2772355>).
- Hyeong-tae, Jang. 2022. "Korea Warned of Greater Dependence on China." *25 February*. Retrieved March 8, 2022 ([https://english.chosun.com/site/data/html\\_dir/2022/02/25/2022022500702.html](https://english.chosun.com/site/data/html_dir/2022/02/25/2022022500702.html)).
- IEA. 2022. "Global Supply Chains of EV Batteries." Retrieved (<https://iea.blob.core.windows.net/assets/4eb8c252-76b1-4710-8f5e-867e751c8dda/GlobalSupplyChainsOfEVBatteries.pdf>).
- Investing.com. 2022. "Republican Lawmakers Introduce Bill Targeting China's CBDC on Sanctions, Privacy." *10 March*. Retrieved March 16, 2022 (<https://www.investing.com/news/cryptocurrency-news/republican-lawmakers-introduce-bill-targeting-chinas-cbdc-on-sanctions-privacy-2782472>).
- Jung, Ryu. 2021. "Korea's Battery Industry Over-Dependent on Chinese Materials." *03 December*. Retrieved January 13, 2022 ([http://english.chosun.com/site/data/html\\_dir/2021/12/03/2021120301329.html](http://english.chosun.com/site/data/html_dir/2021/12/03/2021120301329.html)).
- Kirkham, Ksenia. 2021. "The Paradox of the New Great Game: Do Europe and China Need More Pipelines from Eurasia?" *Journal of Balkan and Near Eastern Studies* 24(01–02):1–22.
- Kirkham, Ksenia. 2022. *The Political Economy of Sanctions: Resilience and Transformation in Russia and Iran*. Palgrave Macmillan.
- Korea Herald. 2022. "Korean EVs, Batteries' Global Market Share Dips."
- Mims, Christopher. 2022. "How Sanctions on Russia, War in Ukraine and Covid in China Are Transforming Global Supply Chains." *26 March*. Retrieved March 27, 2022

(<https://www.wsj.com/articles/how-sanctions-on-russia-war-in-ukraine-and-covid-in-china-are-transforming-global-supply-chains-11648267248>).

Mirrlees, Tanner. 2021. "Sanctioning China's Tech Industry to 'Secure' Silicon Valley's Global Dominance In: Sanctions as War." in *Sanctions as War: Anti-Imperialist Perspectives on American Geo-Economic Strategy*, edited by S. Davis and I. Ness. Koninklijke Brill NV, Leiden.

Nikkei Asia. 2022a. "EV Supply Chain: Japan, China Vie for Power in Lithium Standards."

Nikkei Asia. 2022b. "Lithium Stays Sky-High as Other EV Battery Metals Come down to Earth."

Reuters. 2022. "Global Lithium-Ion Battery Capacity May Rise Five-Fold by 2030 - Wood Mackenzie." 23 March. Retrieved March 28, 2022 (<https://www.euronews.com/next/2022/03/23/electric-vehicles-battery>).

the Economist. 2020. "Can Japan Inc Navigate the Rift between China and America?" 05 September. Retrieved March 8, 2021 (<https://www.economist-com.libproxy.kcl.ac.uk/business/2020/09/03/can-japan-inc-navigate-the-rift-between-china-and-america>).

the Federation of Korean Industries. 2022. "Global Market Share of Korean EVs." Retrieved (<https://pulsenews.co.kr/view.php?sc=30800028&year=2022&no=502164>).

#### Other Internet sources:

AALEP. 2022. EU companies still operating in Russia, 6 April. <http://www.aalep.eu/eu-companies-still-operating-russia>

Bloomberg. 2022. High Gas Prices Force UK Fertilizer Plant to Shut for Good, 8 June. <https://www.bloomberg.com/news/articles/2022-06-08/high-gas-prices-force-uk-fertilizer-plant-to-close-for-good>

CEFIC. 2022. Energy consumption, 13 January. <https://cefic.org/a-pillar-of-the-european-economy/facts-and-figures-of-the-european-chemical-industry/energy-consumption/>

Desai, Pratima. 2022. Why sentiment in industrial metals has been crumbling, Euronews.next, 2 July. <https://www.euronews.com/next/2022/07/02/metals-prices>

Defauw, Julien, Benoit Martin and Julien Pestiaux. 2022. Opportunities to get EU industry off natural gas quickly. Climact, 16 May. <https://climact.com/en/opportunities-to-get-eu-industry-off-natural-gas-quickly/>

Enterprise Europe Network. 2022. The Supply Chain Resilience platform is now live! <https://een.ec.europa.eu/news/supply-chain-resilience-platform-now-live>

ERMA. 2021. ERMA celebrates its first anniversary working towards a more resilient and greener Europe, 23 November. <https://eitrawmaterials.eu/erma-celebrates-its-first-anniversary-working-towards-a-more-resilient-and-greener-europe/>

Euractiv. 2022. Eyes wide shut, EU industry faces energy efficiency reckoning, 13 July. <https://www.euractiv.com/section/energy-environment/news/eyes-wide-shut-eu-industry-must-face-energy-efficiency-reckoning/>

European Commission. 2018a. State aid: Commission approves plan by France, Germany, Italy and the UK to give €1.75 billion public support to join research and innovation project in microelectronics, 18 December. [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_18\\_6862](https://ec.europa.eu/commission/presscorner/detail/en/IP_18_6862)

European Commission. 2018b. Strategic Action Plan on Batteries, 17 May. [https://eur-lex.europa.eu/resource.html?uri=cellar:0e8b694e-59b5-11e8-ab41-01aa75ed71a1.0003.02/DOC\\_3&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:0e8b694e-59b5-11e8-ab41-01aa75ed71a1.0003.02/DOC_3&format=PDF)

European Commission. 2020. Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and

amending Regulation (EU) 2019/2088 (Text with EEA relevance). <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852>

European Commission. 2022a. European industrial strategy. [https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en)

European Commission. 2022b. Energy prices and security of supply, 8 August. <https://www.consilium.europa.eu/en/policies/energy-prices/>

European Commission. 2022c. REPowerEU: affordable, secure and sustainable energy for Europe. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowerEU-affordable-secure-and-sustainable-energy-europe\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowerEU-affordable-secure-and-sustainable-energy-europe_en)

Eurostat. 2022a. Complete energy balances. [https://ec.europa.eu/eurostat/databrowser/view/NRG\\_BAL\\_C\\_custom\\_3241094/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_C_custom_3241094/default/table?lang=en)

Eurostat. 2022b. Energy statistics – an overview. [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy\\_statistics\\_-\\_an\\_overview](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_statistics_-_an_overview)

GizChina. 2022. Price of high-quality neon gas has risen more than tenfold as Russia enforces ban, 10 June. <https://www.gizchina.com/2022/06/10/price-of-high-quality-neon-gas-has-risen-more-than-tenfold-as-russia-enforces-ban/>

Gürsan, C. and V. de Gooyert. 2021. The systemic impact of a transition fuel: Does natural gas help or hinder the energy transition? *Renewable and Sustainable Energy Reviews* 138 (March 2021). DOI: <https://doi.org/10.1016/j.rser.2020.110552>.

Mazzucato, Mariana. 2018. ‘Mission-Oriented Research & Innovation in the European Union: A problem-solving approach to fuel innovation-led growth.’ Luxembourg: Publications Office of the European Union.

Reuters. 2022. ASML seeking alternative sources for neon gas amid Ukraine crisis, 23 February. <https://www.reuters.com/technology/asml-seeking-alternative-sources-neon-gas-amid-ukraine-crisis-2022-02-23/>

Russia Briefing. 2022. Russia Moves to Dominate Global Neon & Inert Gases Market, 28 July. <https://www.russia-briefing.com/news/russia-moves-to-dominate-global-neon-inert-gases-market.html/>

Stepek, John. 2022. Why has the nickel price trebled since Monday? *Money Week*, 8 March. <https://moneyweek.com/investments/commodities/industrial-metals/604545/why-has-the-nickel-price-trebled-since-monday>

The Federal Government. 2022. Speech by Olaf Scholz, Chancellor of the Federal Republic of Germany and Member of the German Bundestag, at the 13th Petersberg Climate Dialogue, 18 July. <https://www.bundesregierung.de/breg-en/news/speech-by-olaf-scholz-chancellor-of-the-federal-republic-of-germany-and-member-of-the-german-bundestag-at-the-13th-petersberg-climate-dialogue-2064056>

Yara. 2022. Yara curtails production due to increased natural gas prices, 9 March. <https://www.yara.com/corporate-releases/yara-curtails-production-due-to-increased-natural-gas-prices/>