When Supply Lines Become Fault Lines

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Assessing Supply Chain Vulnerabilities Amid Tensions in the Indo-Pacific

February 2022 brought energy security back to the centre of geopolitical discourse. Over years, Europe had increasingly commodified energy and sought to separate its trade from politics. Amidst a shortage of indigenous resources, Europe turned to Russia to satisfy its energy demand, and Moscow supplied coal, oil, and natural gas that together accounted for roughly one quarter of Europe's total consumption in 2021 (Eurostat, 2022). This reliance was particularly pronounced in the natural gas sector, where Russia accounted for nearly half of all imports prior to 2022 (Yanatma,

2023). Moscow's full-scale invasion of Ukraine, however, shattered the illusion of a depoliticised external energy trade and reignited debates on energy security across Europe and beyond.

The shock to Europe's energy system should prompt concerns in South Korea and Japan. Similar to Europe, both countries cannot meet their substantial domestic energy demand through indigenous resources and must therefore rely heavily on imports of primary energy supplies. This dependency exposes them to external risks, particularly the rising tensions in the South China Sea, through which a substantial portion of their energy imports passes. These circumstances raise the question of whether their energy supply chains are resilient enough to withstand potential conflict in the region, or whether they risk facing a situation akin to Europe's experience in 2022 should a conflict break out. This article examines the energy security environment of both countries, with a focus on electricity generation, given the projected decline in oil demand and the ongoing electrification of their economies.

Energy as a Source of Leverage and Vulnerability

Energy is a complex good. It is an essential input for all state activity, as vital tasks such as defence, public services, and economic activity cannot be sustained without it (Gökçe et al., 2021). Yet, due to the uneven distribution of energy resources across the globe, some states must rely on trade to meet their energy needs.

This can raise dependencies and may render import-dependent countries prone to outside pressure (Shaffer, 2011; Smith Stegen, 2011; Stoelzel Chadwick & Long, 2023). Several cases demonstrate how resource-abundant nations utilise energy supplies as instruments for political coercion, e.g. the 1973 oil crisis, when Arab OPEC members embargoed nations supporting Israel, and various occasions on which Russia has curtailed gas deliveries to Eastern Europe (Carney, 2014; Macalister, 2014; Pifer, 2021; Yergin, 2020). However, vulnerabilities can also result from third-party conflict along the supply line. For instance, naval traffic in the Red Sea, the primary corridor between Europe and Asia, was 70% lower in the first half of 2025 compared to the same period in 2023 (Suez Canal Authority, n.d.), following repeated Houthi attacks on vessels in the Bab al-Mandab Strait (Aguiar, 2025). States dependent on energy imports must therefore develop strategies to mitigate such external risks.

The Energy Strategies of Japan and South Korea

Although Japan and South Korea rank among the world's largest consumers of energy, they lack domestic primary energy resources that could sustain their electricity generation. As a result, they must import large quantities of coal, gas, and uranium.

In 2024, Japan's electricity production was predominantly fuelled by coal and natural gas, which each accounted for approximately one-third of the overall output (Ember, n.d.-a). Fossil fuels are projected to retain a substantial share for at least the next decade, with Tokyo anticipating that thermal sources will sustain 42% of the total electricity generation by 2030, and up to 40% by 2040 (Agency for Natural Resources and Energy, 2025). Overall electricity output is expected to grow moderately during this period. Although the underlying plan does not specify the proportions of coal and natural gas by 2040, the latter will likely assume a larger share, as electricity market reforms will render coal-fired plants economically unattractive, and alternative sources such as ammonia will likely not be available in sufficient quantities (Agency for Natural Resources and Energy, 2025). Japan's commitment to advancing carbon capture storage further underlines its intention to retain thermal generation as part of the long-term energy strategy.

At the same time, Tokyo plans a return to nuclear generation, with the target of at least 20% of all electricity to be generated through new and reactivated nuclear reactors by 2030. It is uncertain, however, whether the share of nuclear power can be expanded sufficiently from the current 8% within the next five years (James, 2025). The shortfall in generation capacity could instead be accommodated by increased coal or natural gas-based production, which can be scaled up flexibly in the short run.

From an energy security perspective, this configuration means that Japan will remain dependent on energy imports in the medium- to long-term future. Government projections estimate an energy self-sufficiency rate of only 30% by 2030, and no more than 40% by 2040. Japanese authorities acknowledge this and emphasise long-term contracts and diplomatic initiatives as key measures for securing a reliable energy supply (Agency for Natural Resources and Energy, 2025).

Figure 1: Current and Projected Electricity Mixes of Japan and South Korea, based on current plans. Data sourced from Ember, the Institute for Sustainable Energy Policies, Japan's Agency of Natural Resources and Energy, the Korea Energy Agency, and the Korea Power Exchange. For its 2040 projection, Japan does not provide a breakdown of individual fuel sources.

South Korea's electricity production likewise relies to a large degree on imported fuels. In contrast to Japan, it maintains a substantial nuclear base, but similarly generates almost two-thirds of its electricity from coal and natural gas (Ember, n.d.-b). Looking ahead, thermal power will remain significant, though on a downward trajectory. Gas-fired output is projected to stagnate until 2030 in absolute terms before falling to about half its current level by 2038, while coal is projected to decline soon, dropping to 17% by 2030 and 10% by 2038 (Korea Energy Agency, 2025; Korea Power Exchange, 2025). In addition, Korea's strategy foresees a gradual substitution of coal with ammonia from the next decade onward (Korea Power Exchange, 2025).

Renewables are projected to expand to 29.2% of electricity generation by 2038, yet fossil fuels and nuclear will continue to dominate, jointly accounting for 74.1% in 2030 and 55.9% in 2038 (Korea Power Exchange, 2025). Further, the growing utilisation of ammonia will require large-scale imports, which will effectively only alter the composition of current import dependencies rather than reducing them. As a result, even with a growing share of carbon-neutral electricity, the bulk of Korea's primary energy resource inputs will continue to depend on imports.

South China Sea Tensions as a Threat

The Status Quo

Japan and South Korea's heavy reliance on primary energy imports renders them vulnerable to external disruptions outside their control. The greatest source of risk lies in the escalating tensions in the South China Sea, which pose a threat to the maritime routes that transport their energy supplies.

These risks primarily derive from intensifying competition between China and the United States as well as its regional allies. In recent years, China has intensified its air and naval activity around Taiwan, while its expansive claims in the South China Sea increasingly lead to confrontations with its neighbours (Davidson et al., 2025; Heydarian, 2025; Tang, 2025). At the same time, Beijing has steadily increased its defence expenditure, emphasised combat readiness and technological self-reliance, and expanded its range of military capabilities (Childs, 2018; Fan, 2022; SIPRI Military Expenditure Database, 2024; Wegener, 2025a, 2025b; Xi, 2019). In parallel, the United States has reinforced its military presence in the Indo-Pacific and pressed its allies for stronger security commitments (Kanodia, 2025; Maslow, 2024; Schulenburg, 2025).

The friction in the South China Sea mainly revolves around three issues. First, the status of Taiwan represents the most acute flashpoint. Any military attempt to seize the island would necessarily involve extensive maritime and aerial operations and would likely be accompanied by efforts to blockade the island and prevent foreign support. Such a scenario would involve extensive military activity in the surrounding waters, making them unsafe for commercial shipping. This would necessitate diversions to longer alternative routes or could even force some operations to be suspended.

Second, unresolved territorial disputes in the South China Sea carry potential for further escalation. Stakeholder states have established military facilities on numerous contested features along the Scarborough Shoal, the Paracel Islands, and the Spratly Islands, and clashes over them would impact key sea lanes, even if Tokyo and Seoul are not directly involved (Zwartz, 2025). Third, even in the absence of open conflict, China's use of "grey-zone" tactics already creates risks for energy shipments. Recent

confrontations, particularly with the Philippines, illustrate how such tactics can escalate into physical clashes (Heydarian, 2025).

Impact on Japan and Korea

These developments have deepened strategic competition in the region and elevate geopolitical risks for commercial shipping. This directly affects Japan and South Korea, as a considerable share of primary energy shipments must cross the South China Sea en route to their shores. Figure 2 illustrates the primary shipping routes of these resources from their main suppliers.

Figure 2: Shipping Lanes for Primary Energy Resources from Selected Key Suppliers to South Korea and Japan Based on Data from SynMax, Shipmap.org and Searoutes.com; Own Graphic

The commitment of both nations to gas-based electricity production renders deliveries of liquefied natural gas (LNG) a focal point. Seoul and Tokyo source their LNG imports primarily from the Middle East, Southeast Asia, Africa, and increasingly from the United States (World Bank, n.d.-b, n.d.-d). Japan, for instance, maintains long-term delivery contracts with the United Arab Emirates, Qatar, Oman, and Malaysia, among others, and saw about 47% of its LNG imports transiting the South China Sea in 2024. South Korea is even more vulnerable, with approximately 68% of its LNG deliveries in the same year crossing the contested waters.

Adding to this are the drought conditions in the Panama Canal, which have, since 2024, effectively rerouted almost all Asia-bound LNG shipments from American ports via Africa's Southern tip. This adds up to 20 days in additional travel time, and ultimately channels these cargoes through the South China Sea. Despite the partial restoration of transit capacity at the Panama Canal, LNG tanker passages have not yet fully recovered (Labrut, 2025; Miller, 2025). Further, the risk of drought remains, and sustainable alleviation can only be realised through a dam project, whose construction is expected to commence in 2027 (Garcia, 2025). In light of the growing LNG trade with the United States under their recent tariff agreements, Japan and South Korea must factor this elevated risk into their energy security planning.

Papua New Guinea and Australia, the latter being both states' largest supplier, further provide a significant share of natural gas. Depending on the port of origin, shipments either transit the South China Sea or bypass it by travelling on routes west of the Philippines. However, impediments cannot be ruled out entirely if combat were to extend to Guam, where the United States operates a major naval base. In combination, over 90% of LNG supplies to both countries could be affected by a conflict.

Figure 3: Distribution of Coal and Natural Gas Import Volumes to Japan and South Korea in 2024. Data sourced from the World Bank's World Integrated Trade Solution (WITS). Suppliers whose shipments typically travel on South China Sea Routes are coloured in blue; suppliers whose cargoes may cross or bypass the South China Sea on routes west of the Philippines, depend-

ing on port of origin, are coloured in brown; and suppliers whose deliveries typically avoid the South China Sea are highlighted in grey.

Coal imports face a lower risk of disruption. Japan sources the lion's share of its coal from Australia, while less than a quarter of its supplies transits the South China Sea (World Bank, n.d.-a). Most Australian cargoes depart from Queensland and New South Wales and typically take a route west of the Philippines, thus avoiding direct exposure to the disputed waters. Conversely, South Korea is exposed to a comparatively higher level of risk, primarily due to its greater reliance on Indonesian coal (World Bank, n.d.-c). Although Seoul maintains a larger share of low-risk suppliers, the steady decline in Russian imports and rising shipments from Indonesia have gradually shifted its coal trade towards more vulnerable routes. This dynamic will have to be observed more closely in the future.

South Korea's commitment to nuclear power adds another layer of vulnerability, as it depends on enriched uranium imports for its fuel production. Most imports currently come from Europe and Russia, though Seoul has recently signed a long-term contract with a U.S.-based enrichment firm to offset Moscow's share (Ko, 2025; Park, 2025). While it is unclear from where these shipments will depart, East Coast ports are located closest to its Ohio facility. Therefore, unless the Panama Canal can consistently accommodate these cargoes, they will likely be directed via the Cape of Good Hope and the South China Sea, similar to the European shipments. Japan, by contrast, operates a closed nuclear fuel cycle, which enables it to reprocess spent fuel and thus reduces the need for constant imports.

Furthermore, both countries are expected to incorporate ammonia into their energy mixes from the 2030s onwards, but this will likewise require large-scale imports, with likely suppliers including China, Australia, Indonesia, and Middle Eastern states (Agency for Natural Resources and Energy, 2025; Korea Power Exchange, 2025; Lim et al., 2023; Ministry of Trade, Industry and Energy, 2022). Except for supplies from Australia, a considerable amount of these cargoes would likely transit the South China Sea, thus leaving ammonia imports subject to the same geopolitical risks as other energy forms.

Of all imported fuels, natural gas poses the greatest vulnerability for Japan and South Korea in the context of South China Sea tensions. Gas will continue to fuel a significant share of electricity generation in both countries in the short and medium term, and involves the highest proportion of shipments transiting the contested waters. Furthermore, the proximity of Indonesia and Malaysia as major suppliers to potential conflict zones further heightens exposure, given that conflict could also directly affect export volumes. In comparison, coal supply chains are somewhat more robust, given the heavier reliance on Australia and other suppliers that can avoid the South China Sea. Finally, uranium deliveries are less immediately vulnerable, as nuclear fuel cycles of 18 months between refuelling offer a

certain degree of protection against short-term disruptions (J. Lee & Lee, 2023).

Nonetheless, the risks associated with South China Sea tensions extend beyond natural gas. Ultimately, all discussed fuel sources require a steady flow of imports and therefore leave little flexibility in the event of disruptions. Any such impediment could extend shipping times, inflate transport costs, raise insurance premiums, and cause greater price volatility, which would affect particularly short-term market prices. The resulting constraints on energy availability would need to be offset by limited storage capacities, or would otherwise compromise both countries' capacity to sustain economic output, public services, and military readiness.

Meanwhile, the risk of political exploitation of energy supplies remains relatively low. Some key suppliers, such as Qatar or South Africa, have limited political stakes in Korea or Japan and therefore little incentive to weaponise exports. Others, including Australia and Canada, are like-minded partners or maintain close ties through trade, investment, and defence cooperation. Ammonia may present an exception, as global production is currently dominated by China (Mineral Commodity Summaries 2025, 2025). Heavy reliance on Chinese supplies could, over time, create opportunities for coercion. Overall, however, the immediate threat of deliberate supply manipulation remains limited compared to the vulnerabilities posed by maritime chokepoints.

Pathways Toward Risk Mitigation

Europe's experience demonstrates that energy-dependent countries cannot afford to wait for disruptions to materialise before strengthening their energy security. For Japan and South Korea, two options stand out by which they could strengthen the resilience of their energy systems.

In the short- to medium-term, both countries could address risks by "secure-shoring" supplies, i.e. shifting imports away from high-risk transit routes in the South China Sea towards less conflict-exposed and more secure corridors. The Alaska LNG Project offers a concrete opportunity in this regard. The project proposes the construction of a 1,300 km pipeline to transport natural gas from Alaska's northern reserves to an export terminal in the south, from where it could be exported to Asia. Shipments to Japan and South Korea would take approximately 10 days, which is less than half the time required for transport from the Gulf of America, and would avoid the contested South China Sea. Participation in the project would also support both countries in meeting energy import commitments made under recent tariff negotiations with the United States. Yet, the project requires vast capital investment, and doubts loom over its commercial viability, given the growing competition in the global LNG market (M. Kim & Hauber, 2025). Furthermore, as it would not come online before the early 2030s, its utility in reducing immediate vulnerabilities would be limited.

The most effective strategy for mitigating import risks lies in reducing dependencies on external suppliers altogether. This can be achieved best through an accelerated transition to renewable energy. Unlike thermal generation, which requires a continuous inflow of imported fuels, renewables draw on naturally available resources and thus eliminate the need for ongoing imports. At most, key technologies may need to be sourced externally once, after which they can then produce electricity for decades. Hence, even if the technologies are imported, the risk exposure is far lower than with fossil fuels (Carfora et al., 2022; J. Kim, 2024).

Japan and South Korea have yet to realise their full renewable energy potential. Grid limitations, ineffective incentive structures, and strong domestic fossil sectors have thus far constrained renewable deployment and inflated costs (Daiss, 2025; M. Kim, 2025; Miyamoto, 2025a). However, planned grid upgrades and regulatory reforms are expected to bring solar and onshore wind to cost parity with thermal generation by the end of the decade in Korea, and are already the cheaper choice in Japan (M. Kim, 2025; M. H. Lee, 2025; Miyamoto, 2025b; Zissler, 2025). Moreover, both Japan and South Korea have substantial offshore wind potential and, as technological leaders, have the capacity to develop advanced energy storage systems to address the intermittency of renewables (Seitz et al., 2023). Exploiting this potential would enable them to take steps towards greater energy autonomy and, in turn, reduce their vulnerability to disruptions arising from regional tensions. However, an expansion of renewables would require time and further development, and can therefore not remedy energy security considerations in the short term.

Conclusion

Japan and South Korea's energy systems, and thus the foundations of their industrial capacity, public services, and national defence, remain overwhelmingly dependent on foreign imports. Neither country possesses significant reserves of coal, natural gas, or uranium, yet both generate the majority of their electricity from these resources. As these inputs are sourced by sea, their energy security is effectively tied to open and stable maritime routes across the Indo-Pacific.

This reliance is becoming increasingly precarious in the face of rising tensions in the region. Europe's experience from the early stages of the Russo-Ukrainian war illustrates the costs import-dependent energy states face in the event of a supply disruption. To avoid a similar scenario, Tokyo and Seoul must devise strategies to mitigate risk related to maritime routes in the South China Sea.

Diversifying supply routes towards less exposed corridors poses one option, but existing long-term contracts and doubts over the commercial viability of projects such as Alaska LNG limit the scope of this approach. An expansion of renewable energy represents a more sustainable path, but

can only be realised as a long-term strategy. While complete isolation from global markets is unrealistic, greater energy autonomy through expanded deployment of renewables appears as the most viable route to enhanced energy security.

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