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Implications of Deglobalization on Energy and Carbon Neutrality in Asia and the Pacific Region

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Implications of Deglobalization on Energy and Carbon Neutrality in Asia and the Pacific Region

1

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Abstract

The IPCC (Intergovernmental Panel on Climate Change) special report on the impacts of global warming of 1.5 °C urged the world to move toward carbon neutrality (CN). Following the announcement by European countries of the CN target by 2050, Japan, South Korea, and the United States announced their CN targets by 2050. However, the Russian invasion of Ukraine has divided the world and drastically changed energy markets, including natural gas. Various countries have changed their attitudes towards CN because of sudden changes in energy markets. Moreover, the EU is now implementing controversial policies on carbon border adjustment mechanisms. This study discusses how global divisions may influence energy strategies and climate policy for various Asian countries.

1. Introduction

The world has been trying to address the issue of climate change under the Conference of the Parties (COP) on climate change. Since its first meeting in Berlin in 1995, COP has been held every year, except for a postponement in 2020 due to the COVID-19 pandemic. The 27th meeting was held in Sharm El-Sheikh, Egypt, in November 2022.

At COP21 in 2015, which produced the Paris Agreement, the world agreed to

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the 2 °C target. That is, the world will reduce greenhouse gas (GHG) emissions to the level where the temperature increase is contained up to 2 °C degree compared to the pre-industrial level. In 2018, however, the Intergovernmental Panel on Climate Change (IPCC) released its Special Report on global warming of 1.5 °C (IPCC, 2018) and suggested that if the temperature increased above 1.5 °C, the world would face severe and irreversible damage. Thus, it was agreed at COP26 in Glasgow in 2021 to "pursue efforts to limit the temperature increase to 1.5 °C," which means that the international community is to commit to more ambitious emission reduction targets. This movement toward the 1.5 °C target led to the race of carbon neutral pledges by developed countries and some major emitting countries.

However, in February 2022, the world faced the stunning incident of the Russian invasion of Ukraine. Russia strategically uses its natural gas exports to the EU to weaken the EU's intervention in their aggression; specifically, Russia threatens importers of their natural gas, such as Germany. This incident led to the surge of the concept of "energy security," which was a crucial and popular concept around the time of the oil crisis (Taghizadeh-Hesary et al. 2021).

Now, many countries have strong concerns about the secure and affordable supply of energies in addition to carbon neutrality. In particular, the price increase and

volatility of natural gas pose challenges to energy security and the mitigation of greenhouse gases. Natural gas is expected to play an important role in the path toward carbon neutrality, especially in the *transition* process. Roughly speaking, industries can reduce half of GHG emissions by switching from coal to natural gas before they decarbonize their energy source. Moreover, natural gas can be used to produce hydrogen, which is expected to play an important role in the steel sector, transportation, and carbon recycling. Therefore, the natural gas price increase may become a barrier to these technological changes or innovations.

However, it is unclear whether the current energy crisis hinders carbon neutrality. On the one hand, the Russian shock is slowing down the effort toward CN and may induce a "rollback" to the original 2-degree goal before the recent COP27. This type of response was observed in the Global South. Some nations belonging to the Global South expressed concerns about the 1.5°C goal. At the G20 Ministerial Meeting in 2022, China, India, and Saudi Arabia insisted on returning to the "well below 2 °C" target agreed upon in the Paris Agreement. On the other hand, it may accelerate the transition to CN because it may spur a shift to renewable energy. We observed this type of response in some northern countries that prioritize climate change as a political agenda. In this way, the current energy crisis has led to a division in the world.

This division in the attitude toward CN seems to be aligned with the response to the Russian invasion. One side, such as the United States or the EU, supports Ukraine by applying economic sanctions on Russia and even providing weapons to Ukraine. Other countries, such as China, India, and some African countries, are neither part of the economic sanctions nor explicitly criticize Russia. Thus, we observe the division in the world in many areas, including carbon neutrality, energy security, and the Russian invasion of Ukraine.

This article discusses the division of the world in the context of CN and the energy market. We focus on the Asia-Pacific region because we expect strong population growth and economic development that may entail GHG emissions. First, we review the historical global efforts toward CN in the current situation. We then review the energy market situation in the Asian-Pacific region. Finally, we conclude this study with our perspective on CN and energy markets in the Asia-Pacific region.

2. Efforts toward Carbon Neutrality

This section will discuss the effort toward CN and the division among nations. First, we review the history of COP and the two recent IPCC reports. Then, the role of natural gas toward CN is explained together with CN pledges by major emitting countries. We will then review each country's marginal abatement cost of emissions reduction targets

and their historical emissions. It is followed by a discussion of the division between North and South in CN target years. We will introduce the controversial proposal for the carbon border adjustment mechanism (CBAM) by the EU. Finally, we will close the section by discussing measures to bridge the gap between the North and South.

2.1 COP and IPCC Reports

Efforts to combat climate change have been carried out under COP. The themes of COP can be broadly classified into two categories: mitigation and adaptation. "Mitigation," the biggest theme since the first COP, centers on setting goals and methods for reducing greenhouse gas emissions. "Adaptation" pertains to adjusting to the global warming that is already occurring. Although it is a relatively new theme in the history of COP, its significance has increased in recent years as the effects of climate change have manifested.

The current international framework for mitigation is based on the Paris Agreement, which was agreed upon at COP21 in 2015. The reduction goal under the Agreement was to limit the global temperature rise to a level that is "well below 2 °C" compared to pre-industrial levels.

Under the Paris Agreement, each country is requested to submit their National Determined Contributions (NDCs) specifying their effort toward CN, including emission

reduction targets. The innovation of the Paris Agreement was the inclusion of the Global South, such as China or India, in mitigation efforts. All countries, including developing countries, must submit NDCs and their pledges to reduce emissions. This was significant progress from the Kyoto Protocol. However, when we sum up the submitted pledges, it was still far from achieving the 2-degree target of "14 to 23 GtCO₂ eq" (p477 in chapter 4. IPCC 6). Additionally, each country must review its goals and plans every five years. Thus, at COP26, which took place in Glasgow in 2021, each country was expected to revise its NDCs.

2.2 Energy Transition and Pledges toward Carbon Neutrality

Between COP21 and COP26, there has been an important update on the scientific findings. In 2018, The Intergovernmental Panel on Climate Change (IPCC) released its Special Report on global warming of 1.5 °C. It indicated that exceeding a 1.5 °C increase in global temperature from pre-industrial levels could cause the loss and degradation of ecosystems. Moreover, the IPCC AR 6 report, published in 2021, reinforced the importance of the 1.5°C target. These reports have urged the world to approach carbon neutrality and net zero GHG emissions.

What should the global economy achieve toward carbon neutrality? First, we should promote energy efficiency; second, the use of renewable energy needs to be

expanded. Therefore, solar PVs and wind power offshore must be deployed. Third, coal power generation must be phased down unless it is installed with carbon capture and storage (CCS) or carbon recycling (IEA 2021). Natural gas is crucial in phasing out coal power generation because its carbon content is almost half that of coal. Thus, by switching from coal to natural gas, carbon emissions could be reduced by half. Therefore, natural gas can be crucial in the transition toward CN. Natural gas "may remain part of the energy system through mid-century" even when we can limit the warming to 2°C or lower (P699, Chpt 6 IPCC, Clark et al. 2022). We must also develop hydrogen energy for the iron and steel or transportation sectors such as freight or bus.

Nations have made carbon-neutral pledges to approach the 1.5°C target (Table 1). The EU has *already* set the goal of achieving carbon neutrality by 2050. The US has also declared that it will reach net zero emissions by 2050, and Japan and South Korea have pledged to achieve carbon neutrality by 2050. In contrast, China and India have pledged to reach carbon neutrality by 2060 and 2070, respectively.

However, looking at the midterm target of 2030, we observe a huge gap between the targets that the nations pledged and the 1.5°C goal; the combined 2030 targets of all nations pledged as of COP26 still fall short of the 1.5°C target by 19 to 23 billion tons. Even considering Japan alone, the path to CN is long and challenging, given that its

emissions in 2020 were 1.15 billion tons.

Moreover, one can observe a gap between the North and South in the year of achieving CN. Developed countries in the North pledged to achieve CN by 2050 or before.

In contrast, the CN target year of the Global South countries is 2060 or 2070.

Table 1. NDCs and Long-Term Target of Major Emitters.

	Medium term target	Long term target
Japan	By 2030, ▲46% (Compared to 2013 levels)	Net-zero greenhouse gas emissions by 2050
United States	By 2030, ▲50-52% (Compared to 2005 levels)	Net-zero greenhouse gas emissions by 2050
United Kingdom	By 2030, ▲68% or more reduction (Compared to 1990 levels)	By 2050, at least ▲100% (Compared to 1990 levels)
EU	By 2030, ▲55% or more reduction (Compared to 1990 levels)	Net-zero greenhouse gas emissions by 2050
Germany	By 2030, ▲65% (Compared to 1990 levels)	Net-zero greenhouse gas emissions by 2045
Canada	By 2030, ▲40-45% (Compared to 2005 levels)	Net-zero greenhouse gas emissions by 2050
China	Peak CO ₂ Emissions before 2030	Net-zero greenhouse gas emissions by 2060
Korea	By 2030, ▲40% (Compared to 2018 levels)	Net-zero greenhouse gas emissions by 2050
India	By 2030, ▲45% (Compared to 2005 levels)	Net-zero greenhouse gas emissions by 2070
Indonesia	By 2030, ▲29% (Compared to BAU)	Net-zero greenhouse gas emissions by 2060

Accordingly, it was closely watched at the recent COP27 whether the reduction targets of China and India would be negotiated, as they are slower in reducing emissions

compared to other nations. Moreover, China is the world's largest emitter, so its negotiation position has attracted significant attention. However, on this front, there was no significant progress in the negotiations and, likewise, no significant initiatives to advance nations' mitigation targets.

2.3 Division between North and South

The global North-South divide in climate change, or the gap between developed and developing countries in terms of timelines to achieve carbon neutrality, has been a long-standing issue dating back to when the Kyoto Protocol was adopted in 1997. The Protocol was the first international agreement on GHG emission reductions. It set legally binding emission targets for developed countries, including the US, Japan, and Europe, as they have historically been the largest emitters of CO₂. The international community has widely acknowledged the idea of "Common but Differentiated Responsibility (CBDR)." The CBDR claims that all countries have common responsibilities because any ton of CO₂ from any country has the same impact on climate change. On the other hand, developed countries should have stronger responsibilities and obligations because they have caused the issue and have more capacity to address the issue. Thus, developed countries should take the lead in reducing emissions because of their historical

responsibility for climate change (Winkler and Rajaman, 2014).

However, in the same year as the Protocol was agreed upon, the US Senate passed the Byrd-Hagel Resolution that states the US would not participate in any international treaty to reduce emissions without the "meaningful participation" of developing countries in the negotiations to address global warming. The North-South conflict in climate change was emerging, and the view expressed in the Resolution was dominant in Congress even during the Democratic Clinton Administration, which emphasized climate change policy and became more explicit under the Republican Bush administration. As President Bush withdrew from the Kyoto Protocol, the international framework was negotiated and ratified without the participation of the US, the world's largest emitter.

Finding ways for developing countries to engage in climate change initiatives has been a key challenge during the first commitment period of the Kyoto Protocol (2008-2012) ended. Under the Kyoto Protocol, only developed countries must reduce GHGs emissions. However, China was already the largest emitter of GHGs, surpassing the US. As a result, the COP15 held in Copenhagen in 2009 failed to reach a binding agreement. However, the Paris COP21 in 2015 succeeded in bringing countries and nations into an agreement, with China and the US, the world's biggest emitters, ratifying the agreement

and submitting climate action plans. Nevertheless, the global North and South divide continues to rear its head in various negotiations.

2.4 Economics of NDCs and historical emissions

What can economics tell us about NDCs under the Paris Agreement? One way to evaluate the emissions targets of NDCs is to examine the marginal abatement cost (MAC) of NDCs in each country. Economics suggests that GHG emissions can be efficiently reduced when marginal abatement costs are equal across countries. CO₂ is a public bad; that is, every ton of CO₂ from any country contributes to climate change in the same manner. Therefore, if we observe deviation among MACs across countries, we can achieve the same reduction at a lower cost. Summarizing the discussion from the Energy Modeling Forum study, Böhringer et al. (2021) analyzed each country's efforts to achieve NDCs under the Paris Agreement (Figure 1). They show that the MACs of emission reduction under NDCs are lower for developing countries than those of NDCs in developed countries. Therefore, from an economic perspective, it is efficient to reduce emissions in the Global South, such as China and India.

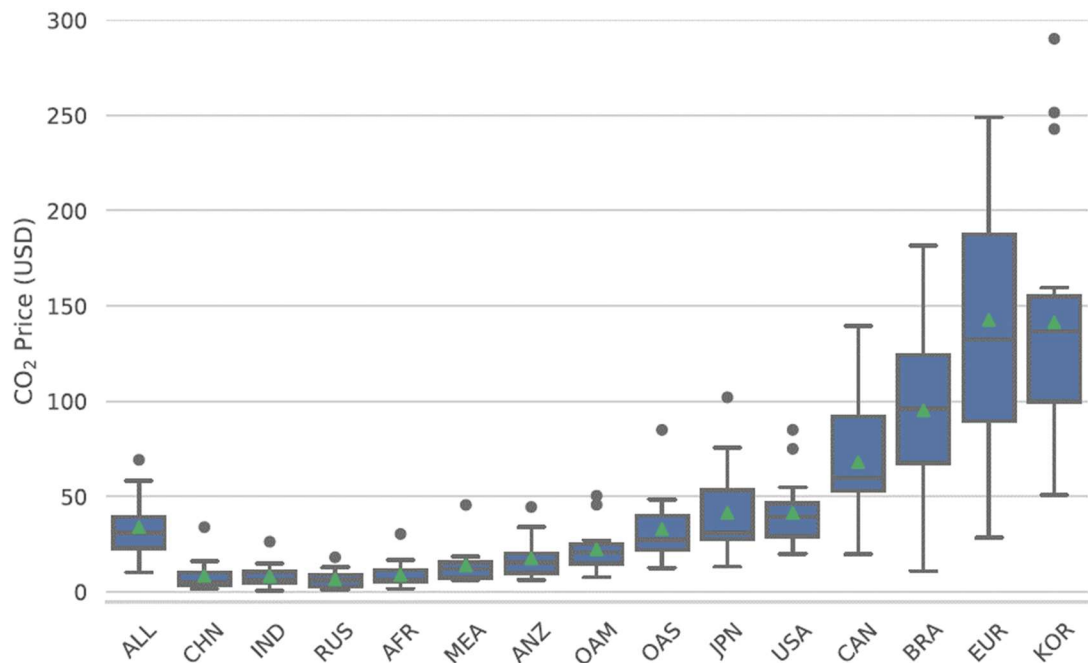


Figure 1. Regional CO₂ prices in NDCs (Fig 4 of Böhringer et al. 2021)

Thus, economics suggests that emission reduction should be initiated when the MAC is lower. Thus, developing economies should work more to reduce their GHG emissions. However, who is responsible for climate change? Indeed, China has been the largest emitter of GHG for more than a decade. Examining the past 30 years, the cumulative emissions from China are the largest among the G20 economies.

However, developed countries are believed to contribute more to climate change than developing countries. If we convert the emissions to per capita emissions, we see a different trend. We calculated per capita CO₂ emissions for the G20 countries in the past 30 years by dividing the cumulative emissions of 30 years by the latest population in Figure 2. This shows that developed countries such as Canada in the US have higher

emissions per capita (Figure 2). Figure 2 suggests that people in developed countries are still more responsible than those in the Global South.

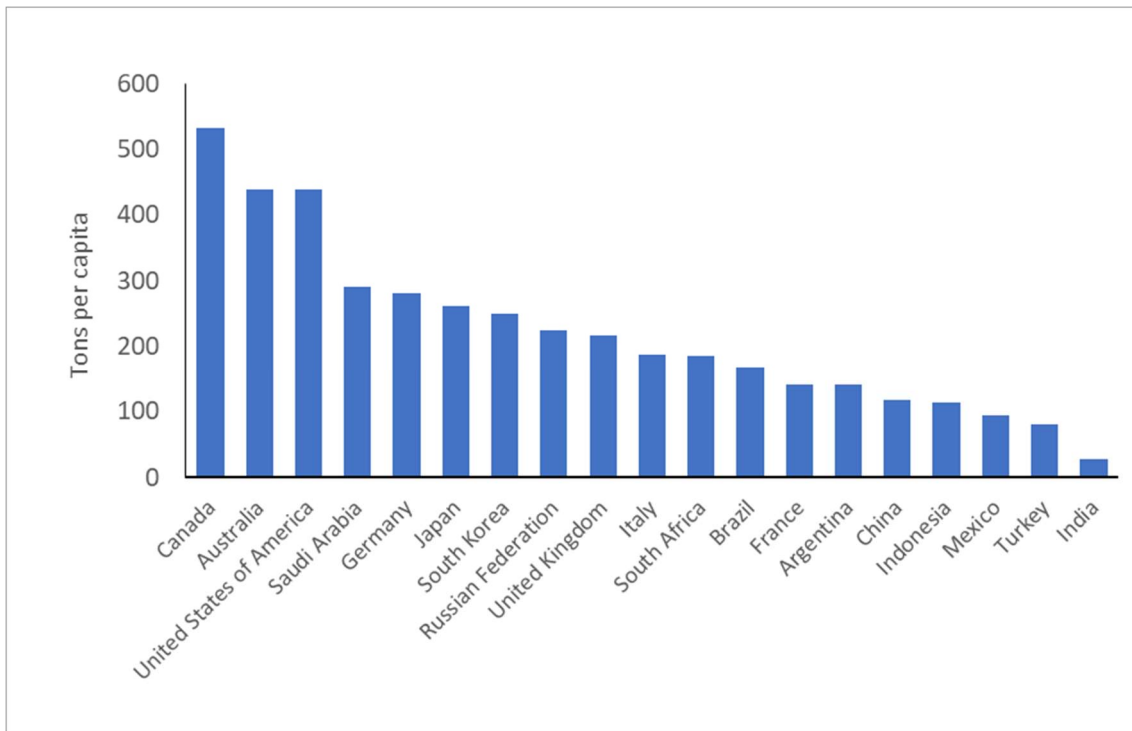


Figure 2. Historical Per Capita Emission of G20 Countries for the past 30 years

Source <https://www.climatewatchdata.org/>

2.5 Impacts of EU CBAM

Controversial climate policies have gained attention in the past few years. The EU has proposed a carbon border adjustment mechanism that imposes carbon pricing on imports to the EU. The EU has been a leading climate policy in many respects. They announced a 55% emission reduction by 2030 in the framework of Fit for 55. However, there are concerns about carbon leakage: emission increases outside the EU because of a lack of comparable regulation. In July 2021, the EU proposed a specific design for the

EU CBAM. They targeted steel, aluminum, electricity, and fertilizers. Importers must purchase certificates based on the carbon content of the imports, with the price calculated based on the EUETS. They also announced that the EU would offer a discount on the payment if the exporter had explicit carbon pricing, such as a carbon tax or ETS in their countries.

The concept of such border carbon adjustment goes back to the deviation of the Bush administration from the Kyoto Protocol. In the EU, there was a discussion on imposing carbon prices on US exports. Later, the US Congress discussed border measures for emerging economies under the American Clean Energy and Security Act of 2009, also known as the Waxman-Markey bill. However, none of these proposals lacked details; hence, the implementation of such measures was not realistic, and it was never a serious policy option until the EU developed the CBAM proposal.

EU CBAM aims to reduce carbon leakage and encourage the introduction of carbon pricing in each region. However, this policy may hurt developing economies because they may not be able to respond to it. UNCTAD (2022) examined its potential impact on developing economies by adopting computable general equilibrium analysis. The results indicate that EU CBAM has more negative welfare effects in developing countries than developed countries, whereas the impact of emission reduction is limited.

Other studies, such as Takeda and Arimura (2023), have confirmed a similar result.

2.6 Measures to Bridge the Gap

As a strategy to address this divide, the distribution of funds from developed to developing countries has been implemented and discussed at each COP meeting. It has been argued that developed countries should financially support developing countries in adapting to the effects of climate change. The rationale behind this argument is that developed countries have funds and technology that enable them to adapt to climate change effects. In contrast, developing countries are more vulnerable to their limited capacity to cope with climate impacts. Another rationale is that developed countries, which have contributed to the causes of climate change, should bear the responsibility to enhance the adaptive capacity of developing countries.

Under the COP, developed countries have worked on funding for the mitigation. The Global Environment Facility under the UNCFCC has played this role. Another scheme that transferred funds from North to South for mitigation purposes was the clean development mechanism (CDMs) under the Kyoto Protocol. In this scheme, developed countries can reduce GHG emissions in developing countries, which can be viewed as a scheme that moves funds from developed to developing countries. The CDM is now, at least partly, being replaced by a bilateral approach, such as the Joint Crediting Mechanism

(Sugino et al. 2017) is also a scheme in which developed countries invest in developing economies to reduce GHG emissions. Switzerland and South Korea are currently working on similar schemes.

It was agreed at COP 26 that developed countries would double the funds for adaptation in developing countries by 2025 compared to the 2019 levels. In addition, funding USD100 billion from public and private sources was pledged at the COP. However, according to the OECD, the finance provided by developed countries reached USD83.3 and thus fell short of the pledge, resulting in dissatisfaction among developing countries.

Another approach to addressing the North-South decision is to work on adaptation. Adaptation to climate change has become an important agenda item in COPs because it is difficult to avoid climate change by reducing emissions alone. Accordingly, adaptation efforts are underway as an essential part of climate change. A group of African nations proposed climate adaptation measures in 2013. At COP21 in 2015, the Global Goal on Adaptation (GGA) was established under the Paris Agreement. Subsequently, the Glasgow-Sharm el-Sheikh work program (GlaSS) was launched at COP26 to measure and monitor the progress in achieving GGA. In the recent COP27, Parties reached an agreement to establish "frameworks" (e.g., approaches, methods, and targets) to review

adaptation progress at the global level.

Reflecting these efforts, adaptation finance has become a major theme in COPs. For example, Japan announced a contribution of USD12 million by 2022. The US pledged USD50 million but announced at COP27 to scale up its commitment to USD100 million. Apparently, COP27 helped boost funds for adaptation; the total amount pledged when COP27 took place reached USD230 million.

Building on the progress made on adaptation, Parties at COP27 agreed to establish "loss and damage" funding through which developed countries compensate "particularly vulnerable" developing countries for climate-related disasters and impacts. The specifics of the agreement will be determined at COP28, which will take place in the United Arab Emirates in 2023. Although the funding agreement was a great achievement, numerous challenges remain. For example, it is yet to be agreed as to which countries are considered particularly vulnerable to climate change and eligible to receive funds.

The initiative is a major achievement of COP27. It is driven by "climate justice," a concept not yet widely acknowledged in Japan but recognized increasingly over the past few years through the work of Greta Thunberg, a Swedish environmental activist, among others.

The concept of climate justice is based on environmental justice, which is

commonly used in the US with a broader focus. Environmental justice recognizes the reality that environmental problems disproportionately affect certain ethnic groups and low-income communities and emphasizes the importance of all stakeholders having equal opportunities to participate in solving problems. This notion is applied to the context of global climate change. It is integrated into climate justice, which has evolved into a global movement to address inequalities that exacerbate climate change impacts. Climate justice acknowledges that industrialized countries and higher-income individuals contribute to climate change, but the most severely affected are developing economies that have not contributed much to climate change. Thus, one may consider that the CBRP principle serves as the foundation for climate justice.

3. Division in Energy Supply and Energy Security

In the first phase of decarbonization, switching from coal to natural gas is essential. However, soaring global fossil fuel prices have raised concerns about energy transformation due to the vulnerability of relying on a specific energy source. The recovery from the Covid pandemic and the Russian invasion of Ukraine has been key stimulants in raising the volatility of fossil fuel prices. This section investigates the effects of rising global fossil fuel prices on Asia-Pacific countries.

3.1 Fossil fuel prices

Fossil fuel prices dropped during the Covid pandemic (Figure 3 to 5). However, economic recovery has driven fossil fuel prices back to pre-pandemic levels. Furthermore, the World Bank (2022) reports that the invasion of Ukraine by Russia pushed the nominal prices of coal and natural gas to historic highs. In real terms, the European natural gas price reached an all-time high, whereas coal prices were close to their peak in 2008.

However, oil prices remain lower than peak prices.

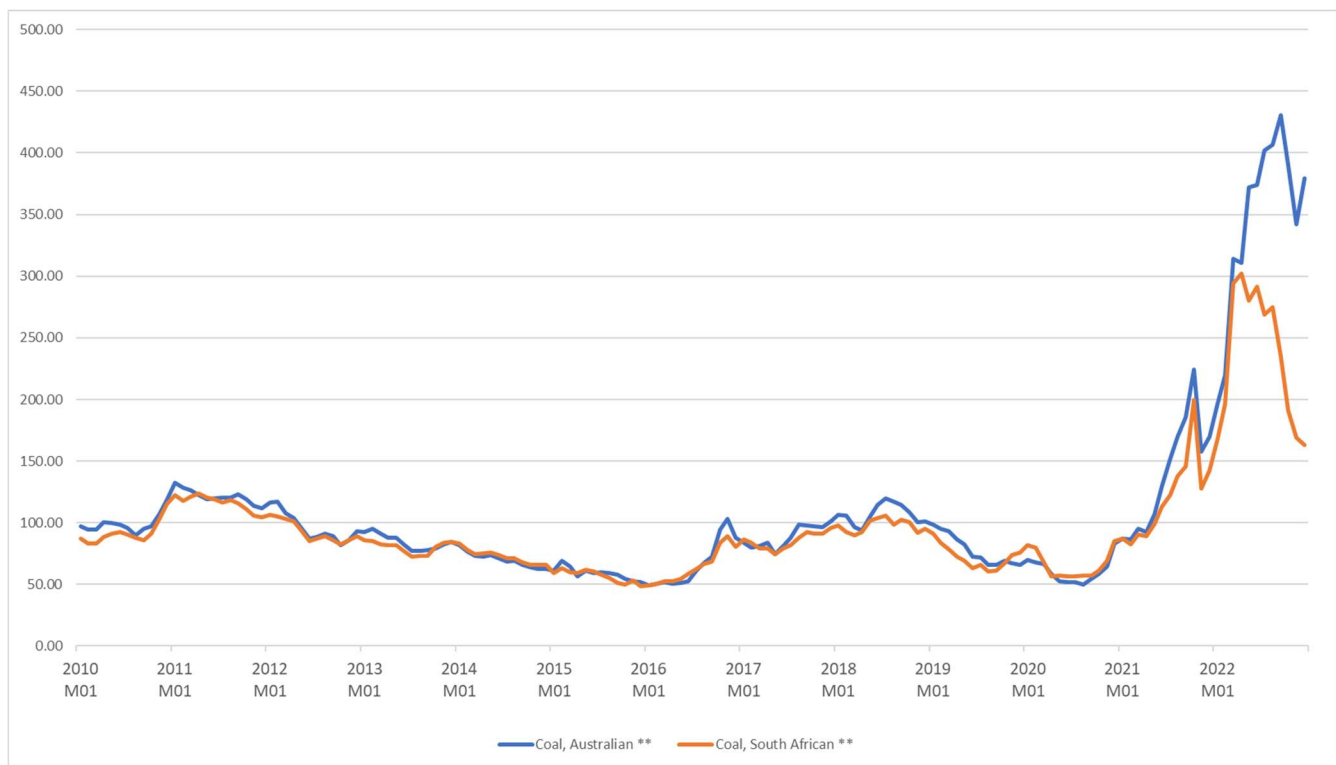


Figure 3A. Coal prices (USD/mt)

Source: World Bank (<https://www.worldbank.org/en/research/commodity-markets>)

Figures 3 to 5 show the prices of coal, oil, and natural gas from January 2010 to

January 2023. The coal price started to rise at the end of 2020 with similar movements between Australian and South African coal. The prices spiked in March 2022 due to the invasion, but the price movement has differed since, with Australian coal much higher than South African coal. Australian coal kept rising until September 2022, while South African coal has dropped ever since. On the other hand, the prices of Brent, Dubai, and West Texas Intermediate (WTI) crude oil show similar movements with each other, peaking in August 2022 and falling afterward. As for natural gas, the European price surpassed Japan's price in June 2021 due to post-pandemic recovery. In March 2022, the European price became 2.8 times higher than Japan's, reaching a maximum of 3.3 in August 2022.

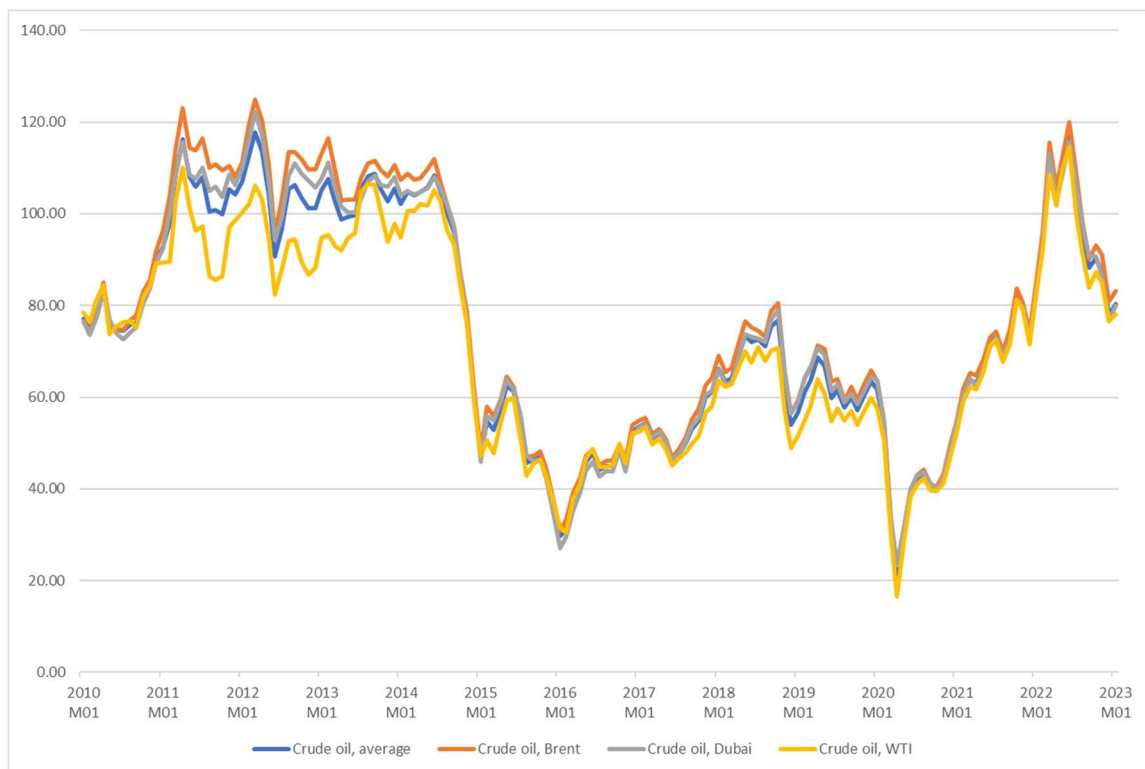


Figure 4. Crude oil prices (USD/bbl)

Source: World Bank (<https://www.worldbank.org/en/research/commodity-markets>)

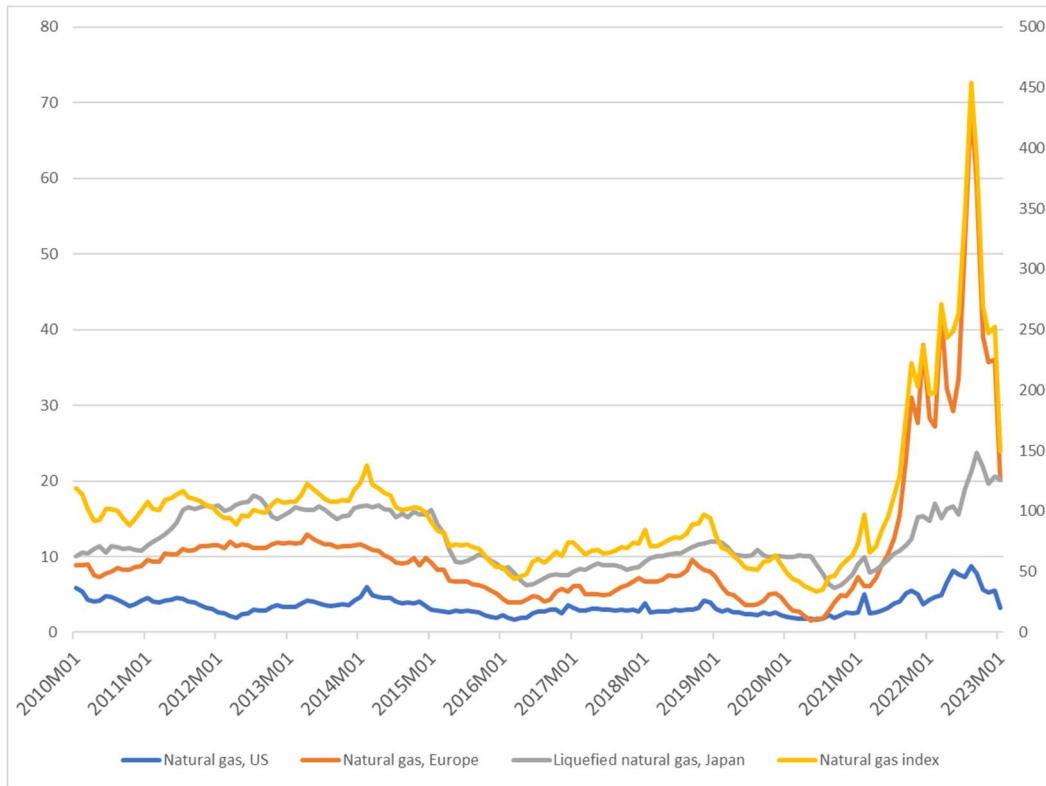


Figure 5. Natural gas prices (S/mmbtu)

Source: World Bank (<https://www.worldbank.org/en/research/commodity-markets>)

The price of fossil fuels has increased in recent years. However, price increases differ between fuels and markets. How has the relative price of natural gas and coal changed in the past two years? Answering this question is vital because countries with low budgets are expected to switch to fuels with lower relative prices. Figures 6 and 7 depict the relative price between the natural gas index and the Australian and South African coals. If the price of the natural gas index increases relative to the coal price, the relative price will rise, and vice versa. The relative price peak in Figure 6 between

November and December 2021 is related to the recovery of the global economy. The Ukrainian War did not raise the relative price in the short run. Still, the relative price increased during the summer of 2022, which is unexpected because the price of natural gas usually falls during the summer. Figure 7 shows movements similar to those shown in Figure 6 until October 2022, but it has increased rather than decreased, meaning that natural gas is relatively expensive compared to South African coal.

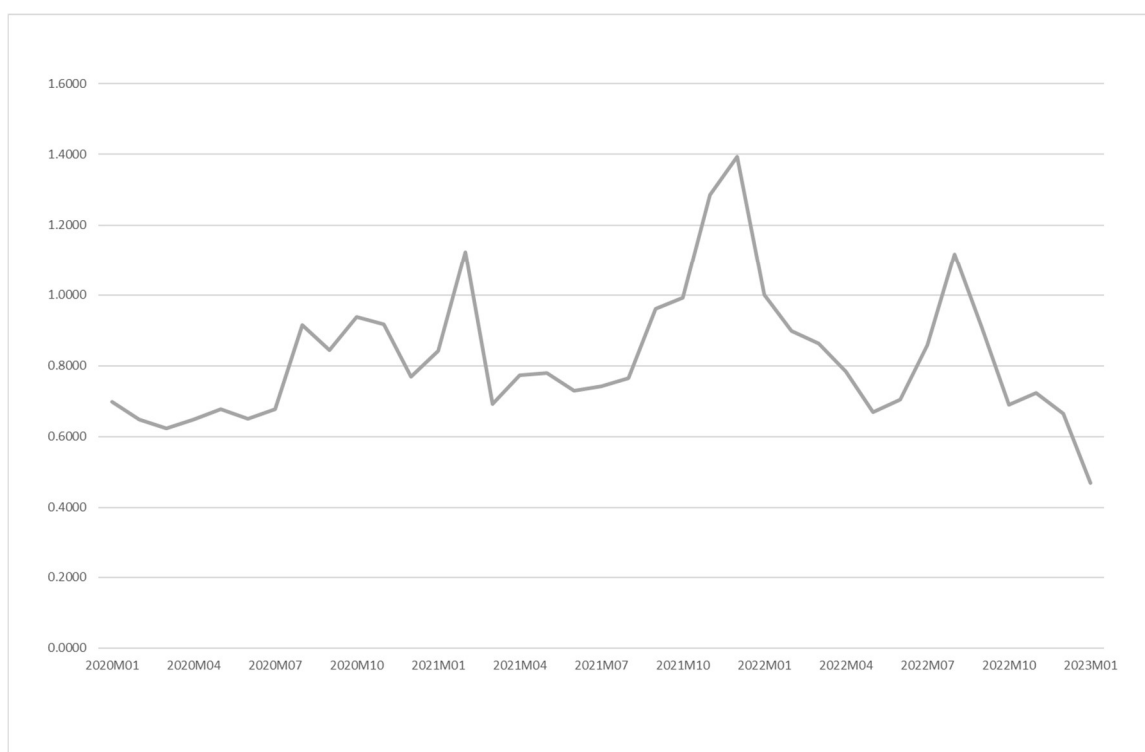


Figure 6. Natural gas index to Coal Price (Australia)

Source: World Bank (<https://www.worldbank.org/en/research/commodity-markets>)

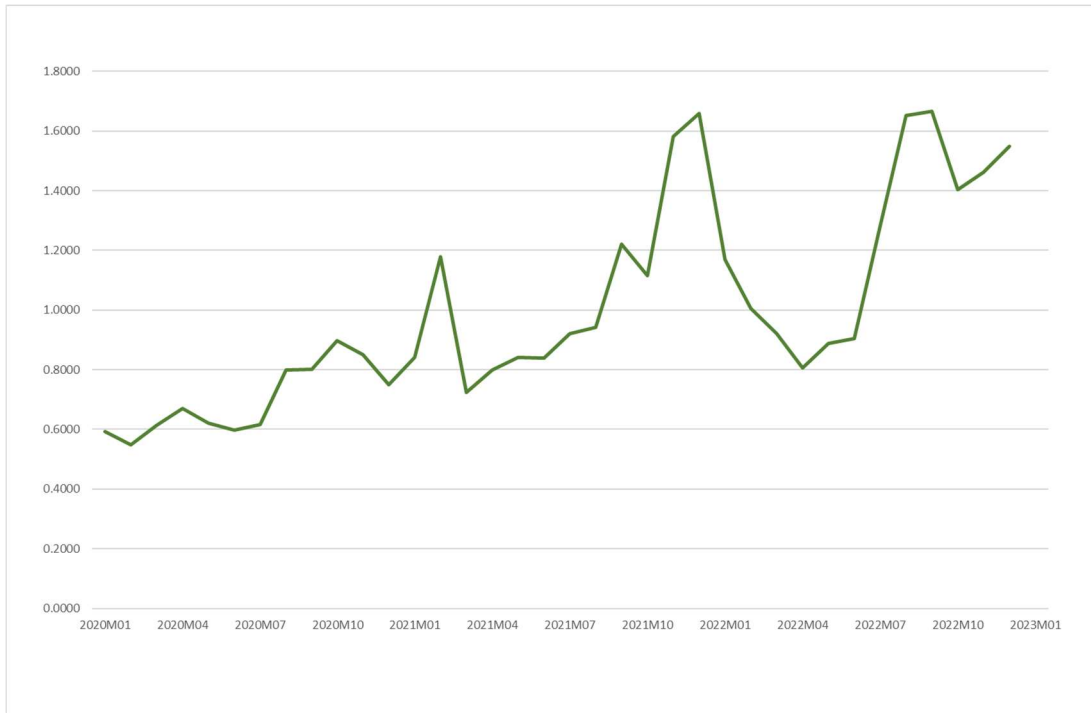


Figure 7. Natural gas index to Coal Price (South Africa)

Source: World Bank (<https://www.worldbank.org/en/research/commodity-markets>)

3.2 Inter-regional trade of fossil fuel

Tables 2 to 5 show the volume of coal, crude oil, and natural gas imports and exports. The far-left column in Table 2 is the origin of coal, and the importing countries are in the remaining columns. China is the largest coal importer, accounting for approximately one-fifth of total trade volume, followed by India and Japan, with approximately 15% of global trade. Europe and South Korea are also large coal importers, accounting for more than 10% of global trade. The main source of European coal is Russia, accounting for 48% of all imports to Europe. In contrast, China, India, and other Asia-Pacific countries rely on coal produced in Indonesia, whereas Japan and South Korea rely

on Australian-produced coal. Fifty-five percent of Russian-produced coal was imported by Asian-Pacific countries, while the remaining 35% was imported by Europe. Within the Asia-Pacific region, China was the largest importer (24.4%), followed by South Korea (9.9%) and Japan (8.6%).

Table 2. Coal trade in 2021 (units: exajoules)

Export country	US	Europe	China	India	Japan	South Korea	Other Asia Pacific	ROW	Total
Canada	0.025	0.092	0.294	0.050	0.212	0.272	0.064	0.046	1.055
US	0.000	0.594	0.299	0.349	0.248	0.083	0.009	0.561	2.142
Colombia	0.079	0.629	0.114	0.094	0.021	0.076	0.037	0.681	1.731
Europe	0.002	0.000	0.005	0.100	0.000	0.004	0.017	0.124	0.253
Russia	0.007	2.107	1.460	0.166	0.515	0.595	0.576	0.560	5.986
Other CIS	0.000	0.140	0.014	0.013	0.003	0.000	0.009	0.492	0.671
South Africa	0.019	0.078	0.178	0.805	0.005	0.078	0.514	0.256	1.933
Other Africa	0.000	0.030	0.028	0.122	0.012	0.034	0.010	0.067	0.303
Australia	0.002	0.637	0.321	1.465	3.174	1.662	2.084	0.284	9.628
China	0.003	0.021	0.000	0.054	0.078	0.017	0.093	0.024	0.289
Indonesia	0.011	0.016	3.232	1.532	0.564	0.555	2.666	0.007	8.584
Mongolia	0.000	0.000	0.454	0.000	0.000	0.000	0.000	0.000	0.454
Other Asia Pacific	0.000	0.020	0.131	0.133	0.031	0.032	0.000	0.021	0.368
Rest of World	0.000	0.018	0.009	0.013	0.000	0.002	0.005	0.027	0.075
Total imports	0.149	4.381	6.541	4.897	4.861	3.411	6.085	3.150	33.474

Source: BP statistics (<http://www.bp.com/statisticalreview>)

Crude oil imports were highest for China (525 million tons or 25.5% of global imports), followed by Europe, the US, and India. The major supplier of crude oil for the US is Canada, whereas, for Europe, Russia is the largest supplier. Countries in the Asia-Pacific region rely on crude oil from the Middle East. Approximately 50% of crude oil exports from Russia end up in Europe, and 30% in China. Unlike coal, India and Japan do not rely on Russian-produced crude oil.

Table 3. Crude oil trade in 2021 (million tons)

Exporting country	US	Europe	Australia	China	India	Japan	Singapore	Other Asia Pacific	ROW	Total
Canada	187.1	4.1	0.0	3.9	0.6	0.0	0.0	1.0	0.7	197.4
Mexico	29.0	7.6	0.0	0.4	7.9	0.1	0.0	7.7	0.2	52.9
US	0.0	51.4	0.6	11.5	20.5	0.9	3.9	25.1	24.6	138.5
S. & Cent. America	29.2	11.2	0.0	57.6	10.5	2.5	6.0	5.0	2.1	124.1
Europe	4.4	0.0	0.0	21.2	3.6	0.2	0.3	5.6	1.2	36.4
Russia	9.9	138.7	0.3	79.6	4.5	4.4	0.6	9.1	16.4	263.6
Other CIS	0.9	67.0	0.2	4.8	1.2	0.1	0.0	7.7	5.2	87.1
Middle East	27.3	77.1	4.3	257.6	130.3	112.0	26.5	163.0	32.6	830.7
Africa	15.5	110.5	1.9	67.3	30.7	0.6	3.8	25.2	22.1	277.6
Australia	0.0	0.0	0.0	0.5	0.0	0.2	2.5	5.7	0.2	9.2
China	0.0	0.0	0.0	0.0	0.1	0.0	0.1	1.4	0.0	1.6
India	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Japan	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.4
Singapore	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.4	0.0	1.0
Other Asia Pacific	1.2	0.1	6.9	21.7	3.7	1.0	3.3	0.0	0.3	38.2
Total imports	304.7	467.7	14.9	526.0	213.7	122.1	47.0	257.1	105.7	2,058.9

Source: BP statistics (<http://www.bp.com/statisticalreview>)

Regarding liquid natural gas (LNG), China had the highest import volume, closely followed by Europe and Japan. South Korea imports large quantities of LNG. Europe's main providers of LNG are Africa and the US, with approximately 30% of imports from these two providers. Russia also supplies Europe with LNG but accounts for slightly more than 15%. In China, the major supplier of LNG is Australia, which accounts for approximately 40% of the total imports. Similarly, Japan relied on LNG imports from Australia. However, the major suppliers of LNG for India and South Korea are the Middle East, accounting for 60% and 30%, respectively. Europe consumes more than 40% of Russian-produced LNG, Japan consumes 22%, China consumes 15%, and South Korea consumes 10%. Taiwan imports more than 6% of Russian-produced

liquefied natural gas (LNG).

Table 4. LNG trade of 2021 (Billion cubic meters)

Export country	US	Europe	China	India	Japan	South Korea	Taiwan	Other Asia Pacific	ROW	Total exports
US	0.00	30.81	12.45	5.62	9.63	12.15	2.44	3.54	18.40	95.03
Other Americas*	0.59	3.74	0.80	0.45	0.73	1.24	0.17	0.33	5.23	13.27
Norway	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Other Europe*	0.00	0.81	0.47	0.64	0.15	0.24	0.00	0.68	0.62	3.61
Russian Federation	0.00	17.38	6.19	0.56	8.76	3.93	2.59	0.20	0.00	39.61
Middle East	0.00	22.54	15.58	20.20	16.73	22.74	7.28	16.65	7.98	129.69
Africa	0.00	32.69	6.12	5.70	1.77	1.69	1.33	6.26	2.94	58.50
Australia	0.00	0.08	43.60	0.38	36.30	12.94	8.57	6.19	0.01	108.07
Brunei	0.00	0.00	0.85	0.00	5.85	0.27	0.09	0.55	0.00	7.61
Indonesia	0.00	0.00	6.62	0.00	2.57	3.27	1.61	0.22	0.35	14.64
Malaysia	0.00	0.00	11.74	0.08	13.87	5.33	0.68	1.81	0.00	33.50
Papua New Guinea	0.00	0.02	4.46	0.00	4.77	0.26	2.02	0.00	0.00	11.52
Other Asia Pacific*	0.00	0.00	0.59	0.00	0.19	0.08	0.00	0.05	0.07	0.99
Total imports	0.59	108.23	109.47	33.63	101.32	64.14	26.77	36.47	35.61	516.23

Source: BP statistics (<http://www.bp.com/statisticalreview>)

If a pipeline exists between the exporter and importer, converting natural gas into LNG is unnecessary. Table 5 reports the trade in natural gas between countries using pipelines. Europe is the top importing region for natural gas using pipelines at 369.1 billion metric meters, which is more than half of the total trade using pipelines. China imports 53.2 billion metric meters of natural gas, the largest in the Asia-Pacific region. Russia is the largest supplier to Europe; it accounts for more than 45% of the natural gas imported to Europe. China relies on other CIS countries to import NG using pipelines. As for Russian exports, Europe uses pipelines to consume more than 80% of its natural gas shipments.

Table 5. Pipeline natural gas trade of 2021 (billion cubic meters)

Exporting country	US	Europe	Russia	Australia	China	Malaysia	Singapore	Thailand	ROW	Total exports
US	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.29	84.29
Russian	0.00	167.03	0.00	0.00	7.58	0.00	0.00	0.00	27.10	201.71
Other CIS	0.00	19.47	15.14	0.00	41.75	0.00	0.00	0.00	0.38	76.74
Middle East	0.00	9.08	0.00	0.00	0.00	0.00	0.00	0.00	35.94	45.02
Africa	0.00	37.22	0.00	0.00	0.00	0.00	0.00	0.00	9.94	47.16
Indonesia	0.00	0.00	0.00	0.00	0.00	0.36	7.19	0.00	0.00	7.54
Myanmar	0.00	0.00	0.00	0.00	3.91	0.00	0.00	6.67	0.00	10.58
Other Asia Pacific	0.00	0.00	0.00	4.78	0.00	0.00	1.95	0.00	0.00	6.73
ROW	75.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.39	88.33
Total imports	75.94	369.10	15.14	4.78	53.24	0.36	9.14	6.67	170.04	704.41

Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3 Fuel Consumption Pattern

Figure 8 depicts the total volume of energy consumed in the Asia–Pacific region from 2000 to 2021. During the 22 years, total energy consumption has more than doubled from 112.9 to 272.4 exajoules. All six energy sources have expanded during this period, with coal as the largest contributor, increasing from 48.0 to 127.6 exajoules. In addition, the amount of natural gas increased from 10.7 to 33.0 exajoules during the same period. Renewable energy in the region has also increased from 5.5 to 17.4 exajoules. By contrast, nuclear power provided 5.1 exajoules in 2000 and 6.4 exajoules in 2021.

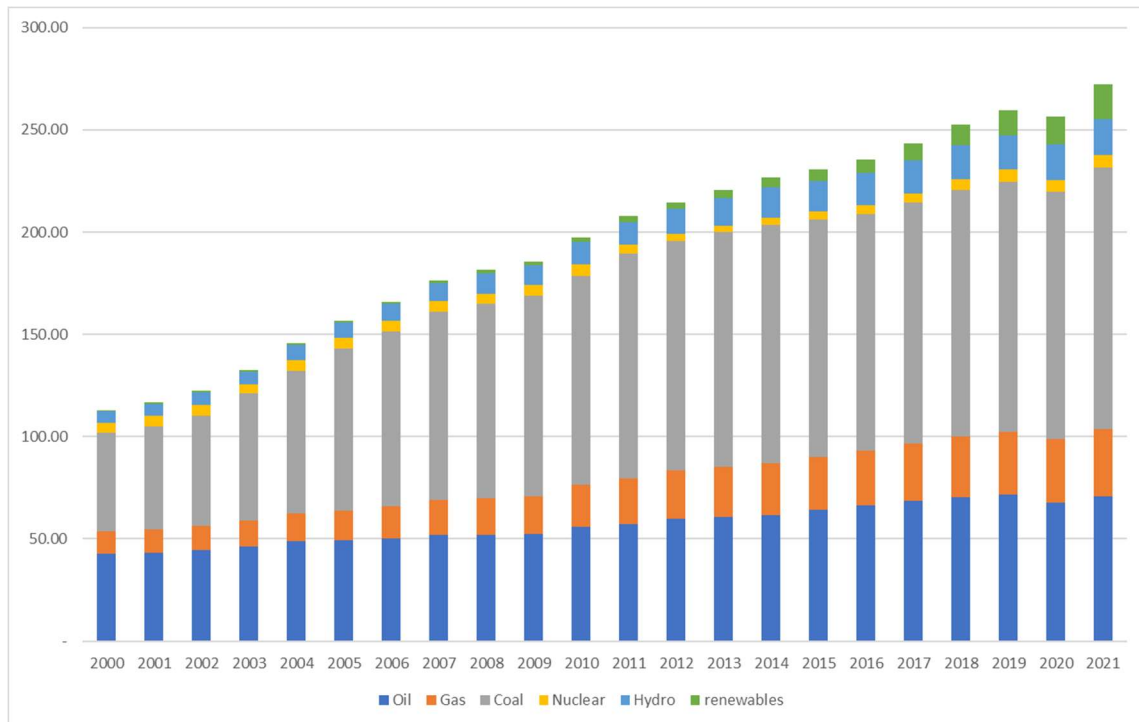


Figure 8. Energy source composition for Asian-Pacific Countries

Source: BP statistics (<http://www.bp.com/statisticalreview>)

Has dependency on fossil fuels dropped in the Asia-Pacific region? Figure 9 shows the composition of total energy consumption for this region from 2000 to 2021. The aggregate of fossil fuels declined slightly during this period. The proportion of renewables in this region has expanded and replaced fossil fuel consumption. The ratio of oil consumption has declined, pushing down total fossil fuel usage.

The following subsections will show the composition of energy consumption for G20 countries in the Asia-Pacific region. The composition of energy consumption in this region differs greatly because this region has developed countries along with emerging

countries.

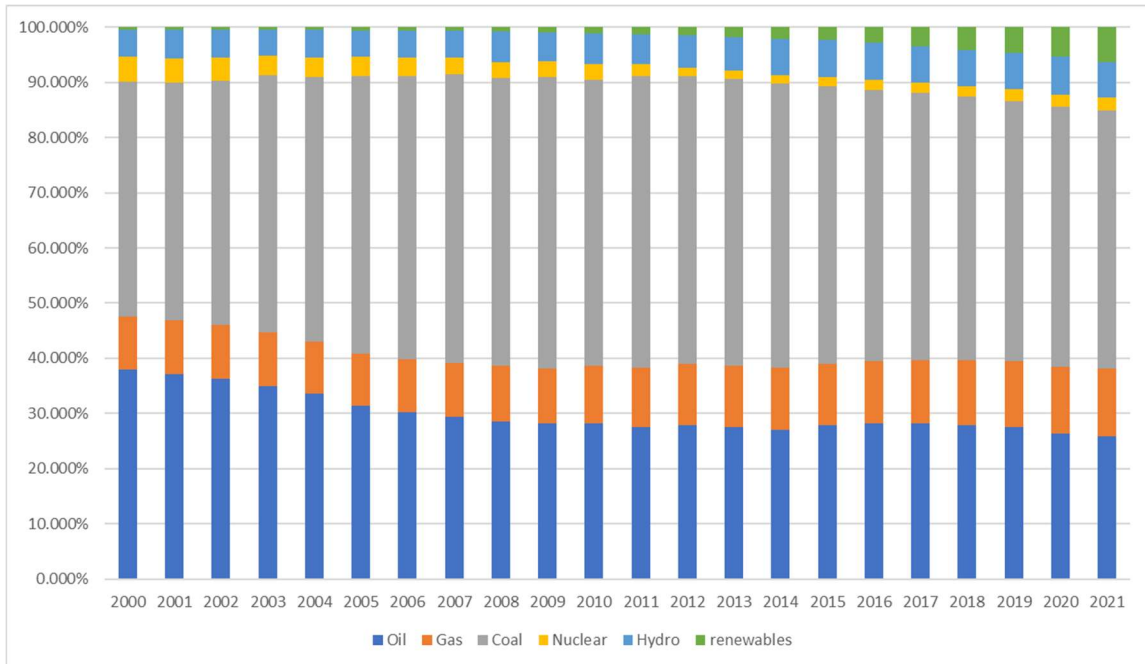


Figure 9. Energy source composition for Asian-Pacific Countries

Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.1 Australia

Australia's energy sources are shown in Figure 10. The use of fossil fuels has decreased in the past 22 years, replaced by renewables. Oil consumption did not change drastically, but the percentage of coal decreased while natural gas consumption increased.

Australia is the world's largest coal exporter. However, as the world moves towards carbon neutrality, coal demand is expected to decrease in the future. This decline is expected to damage the Australian economy. A possible solution is the utilization of CCS. CCS could be used in power plants where fossil fuels are combusted while the CO₂ is captured and stored before it is emitted into the air. Combined with CCS, coal can be

used to produce hydrogen with low carbon emissions.

In 2018, the Australian and Japanese governments invested in a pilot project utilizing brown coal to produce hydrogen. Production of hydrogen has started from 2021 and will be shipped to Japan in early 2022 (Department of Climate Change, Energy, the Environment and Water, 2022). The utilization of brown coal is expected to increase 8,000 jobs and contribute to CN because the CCS will be utilized together in the production process.

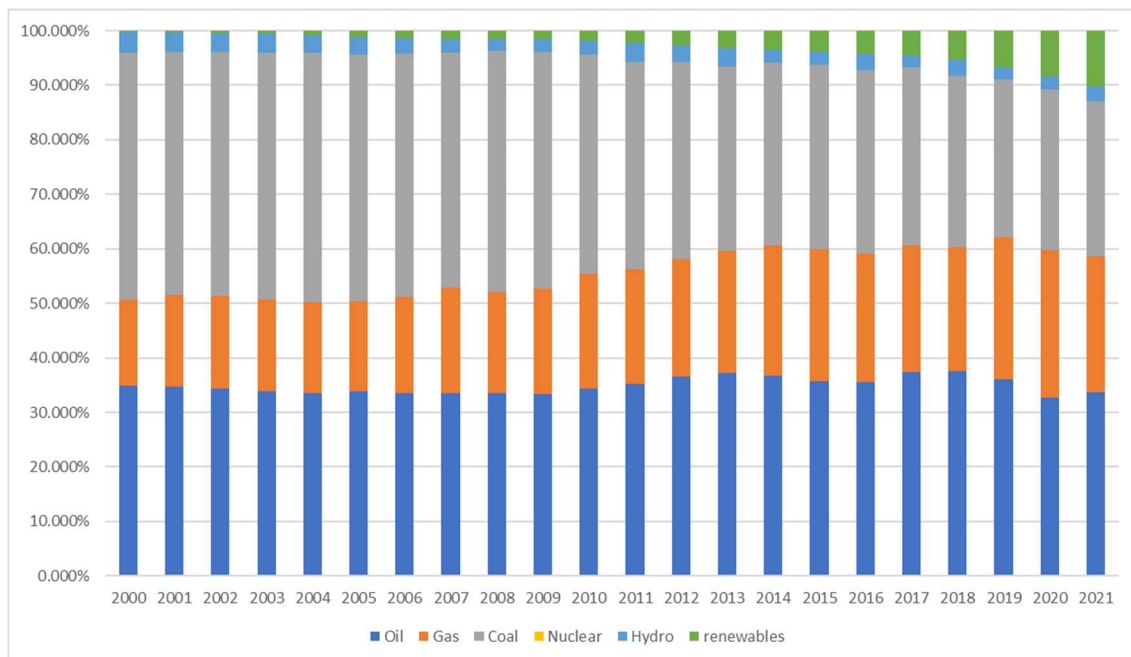


Figure 10. Energy source composition for Australia
Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.2 China

Figure 11 shows the composition of each energy source in China. China's

dependency on fossil fuels has dropped by 10% to 82% over the past 22 years.

Renewables have replaced the decrease in fossil fuels, while nuclear power has increased.

As for the changes in fossil fuels, coal has been replaced by natural gas. This can be

interpreted as a shift from carbon-intensive energy sources to relatively cleaner ones.

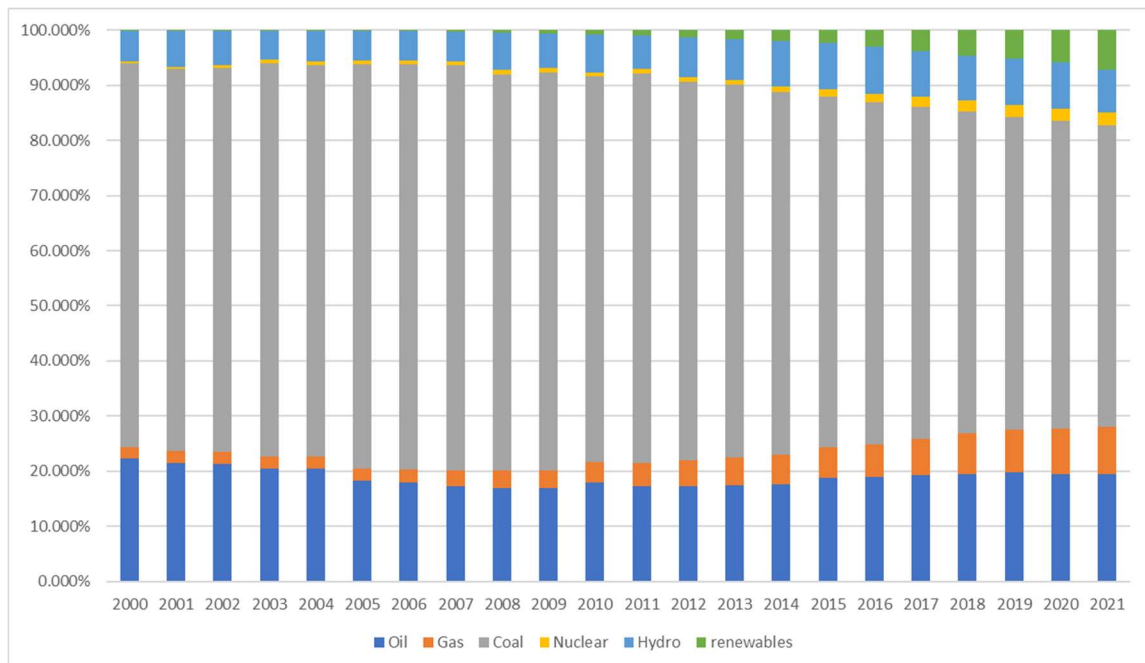


Figure 11. Energy source composition for China
Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.3 India

The composition of fossil fuels in India has dropped slightly over the past 22 years (Figure 12). Renewables can compensate for the decrease in fossil fuel usage. Coal accounts for most of the energy used in India, which has been constant over the past 22 years. The ratio of natural gas is also relatively constant during the same period, whereas the weight of the oil dropped.

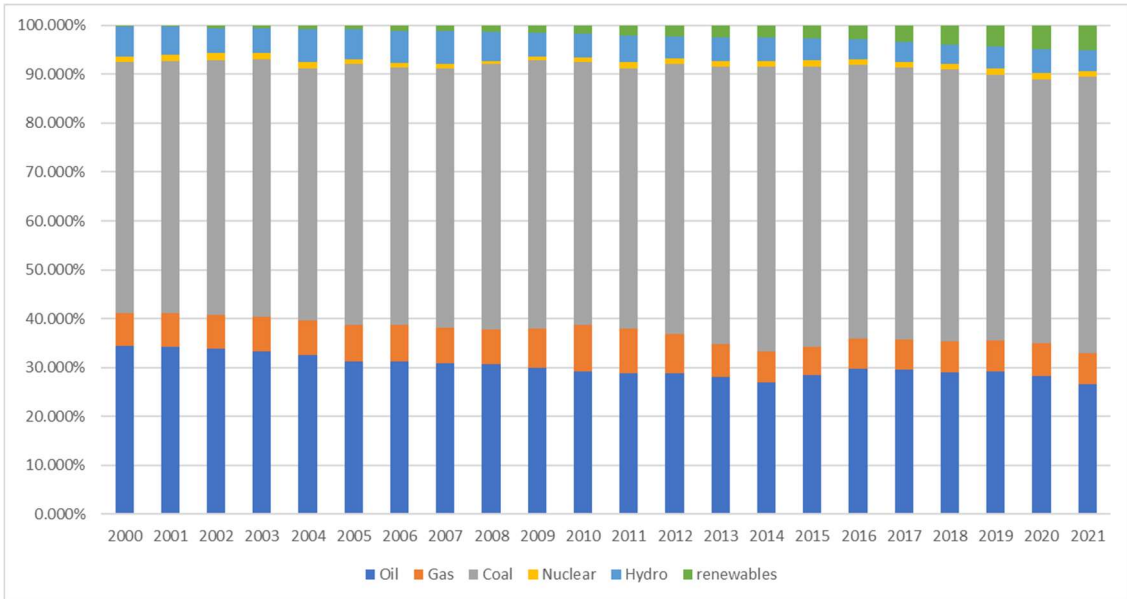


Figure 12. Energy source composition for India
 Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.4 Indonesia

Indonesia has reduced the use of fossil fuels by utilizing renewable energy sources (Figure 13). However, unlike other countries in the Asia-Pacific region, Indonesia has reduced its proportion of natural gas and increased its proportion of coal. As a result, dependency on carbon-intensive fossil fuels has increased in the past 22 years. The change in attitude expressed at the G20 meeting by the Indonesian government could result from the increase in coal consumption. Supporting the Indonesian power sector through CCS from developed countries could reduce emissions from coal consumption without raising the electricity bill (J-Power, 2021).

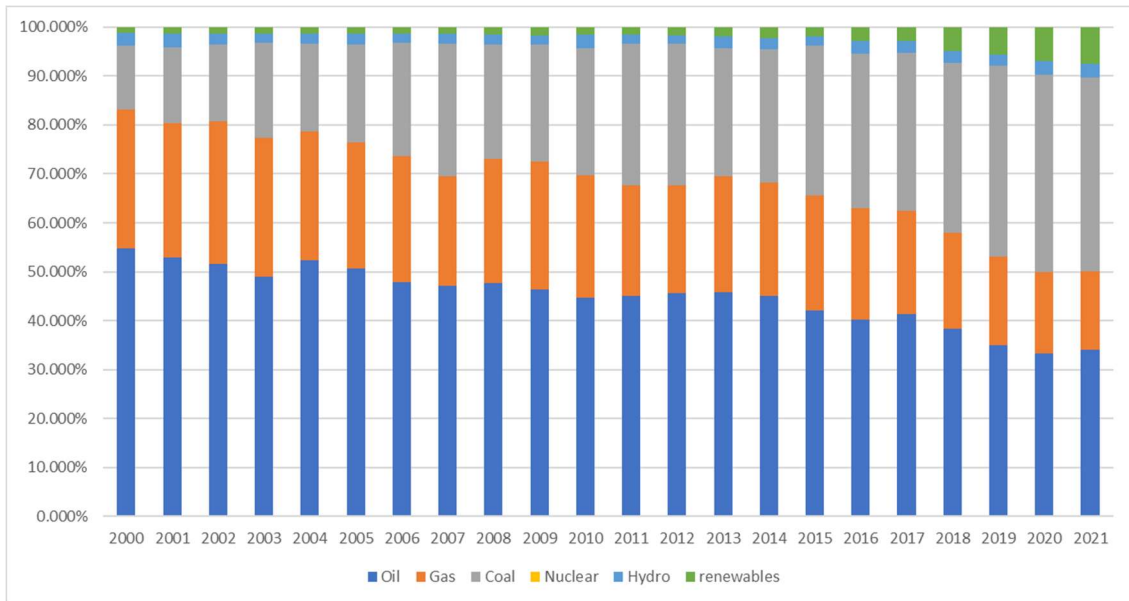


Figure 13. Energy source composition for Indonesia
 Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.5 Japan

The composition of Japan's energy source differs from that of other regions due to the 2011 earthquake. As a result of the meltdown of the Fukushima nuclear power plant, the proportion of fossil fuels increased by 10%. The total reliance on fossil fuels has declined since 2012, with renewable power replacing fossil fuels (Figure 14). Coal, natural gas, and oil contributed to the reduction in the power supply by nuclear power. Compared with other Asian Pacific countries, Japan's proportion of natural gas is high.

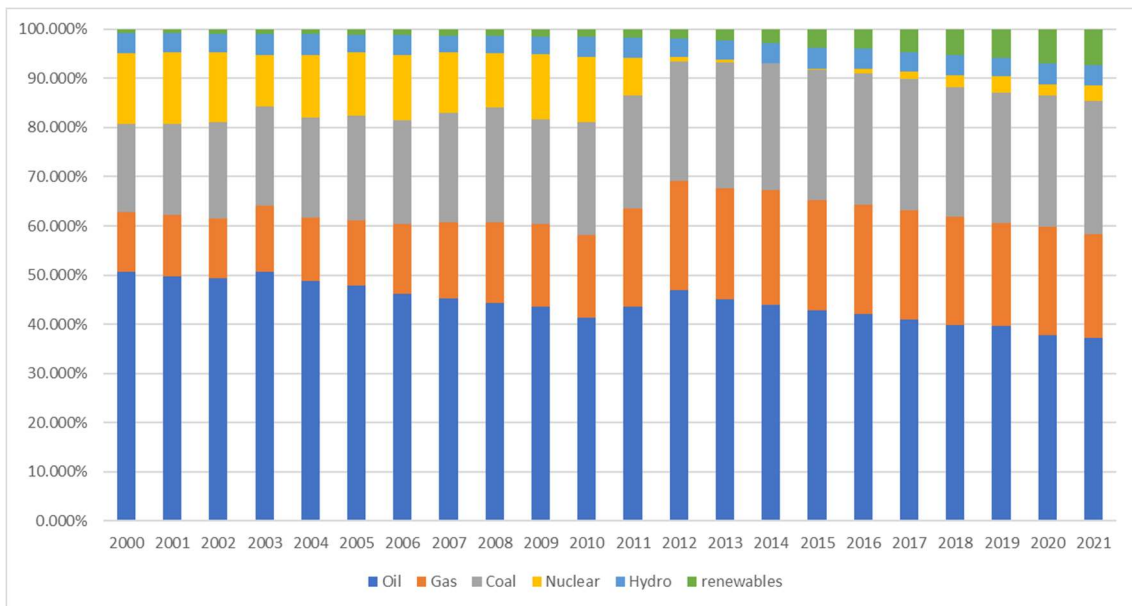


Figure 14. Energy source composition for Japan
 Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.3.6 South Korea

South Korea did not largely reduce fossil fuel usage over the past 22 years. The previous president of South Korea promised the phase-out of nuclear power, as shown in Figure 15. Renewable energy has replaced the decrease in power supply from nuclear power. Although reliance on fossil fuels has not changed in South Korea, natural gas has replaced oil; the latter has a higher carbon intensity than natural gas..

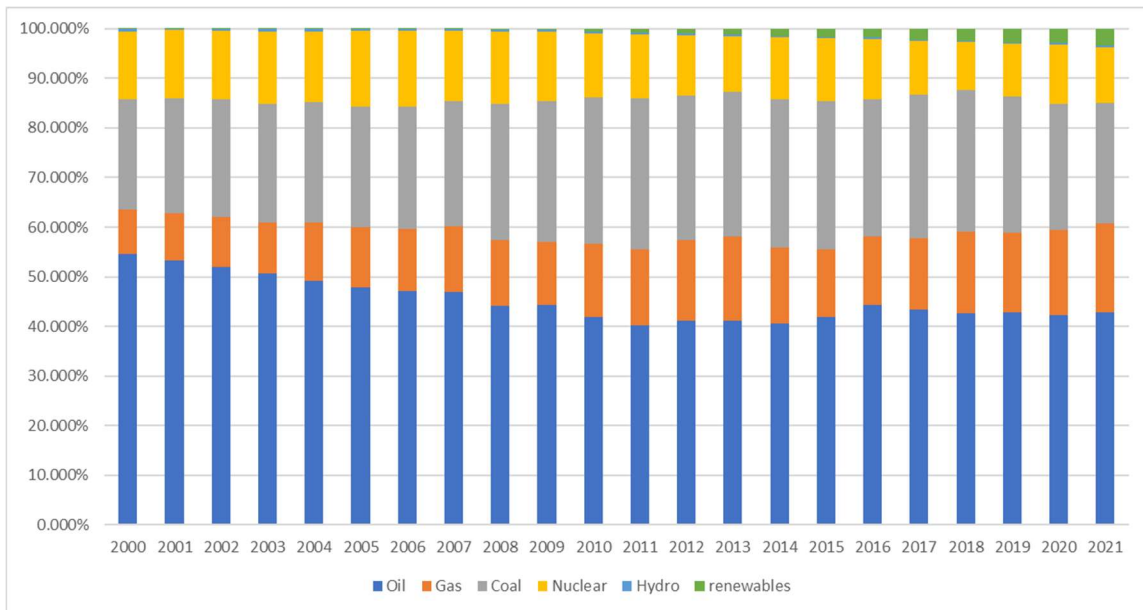


Figure 15. Energy source composition for South Korea
 Source: BP statistics (<http://www.bp.com/statisticalreview>)

3.4 Energy-related subsidy

The direct effect of trade reduction between Asian countries and Russia is limited because of the small trade volume. However, the indirect effect of the Russian invasion hit Asian countries in the form of higher energy prices, especially natural gas prices, as discussed in Section 3.1. The increase in prices threatens energy security in the Asian-Pacific region. For example, Japan and South Korea are major consumers of natural gas, leading to higher electricity bills. In addition, other Asian countries are struck hard by rising prices because of the lack of foreign exchange reserves (i.e., USD). For example, Pakistan and Bangladesh have reduced their volume of imported natural gas due to a lack of foreign exchange reserves.

Subsidies were provided to lower prices of energy use even before the Covid19 pandemic and the Russian invasion of Ukraine, mainly in developing countries (Figure 16). Direct subsidies amounted to USD 500 billion in 2021, with electricity being the most subsidized (IEA, 2023).

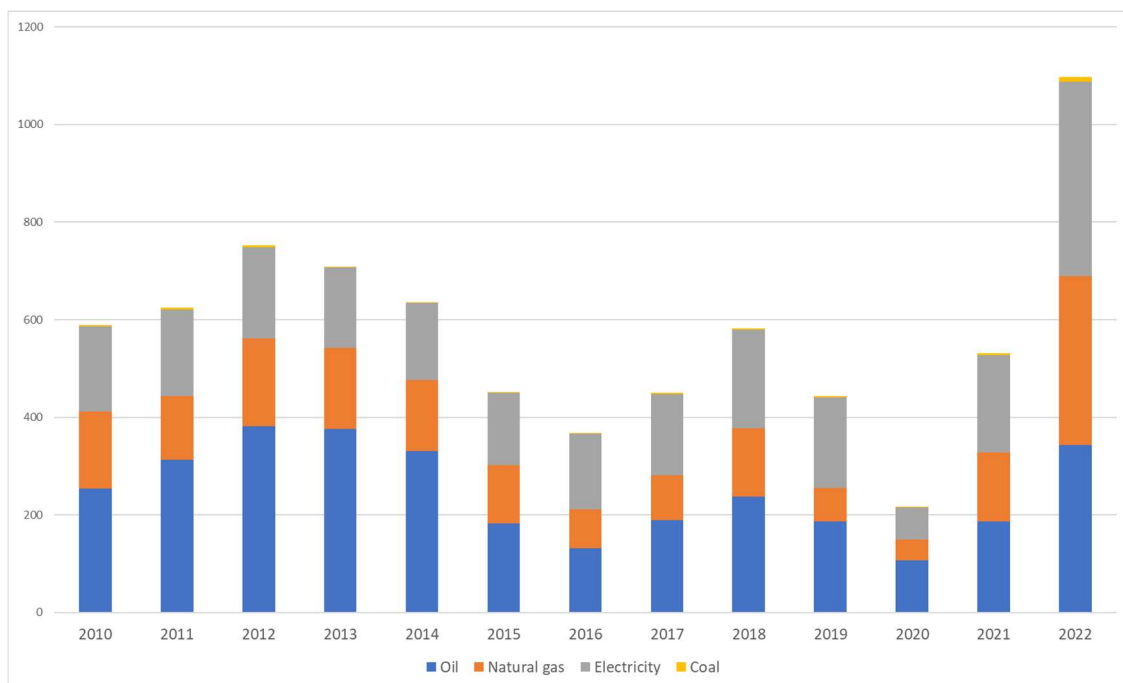


Figure 16. Fossil fuel consumption subsidies by fuel, 2010-2022

Source: IEA (2023)

Energy prices have increased due to the recovery from the pandemic and the Russian invasion. As a countermeasure, central and local governments have provided direct and indirect subsidies for vulnerable households and businesses. The IEA (2023)

estimated that worldwide subsidies for fossil fuel consumption were more than USD 1 trillion in 2022, significantly higher than in previous years.

The top 25 countries that directly subsidize energy are shown in Figure 17. For example, Russia subsidizes gas and electricity, which is approximately USD 78 billion. In the Asia-Pacific region, China (USD 52 billion), India (USD 48 billion), Indonesia (USD 24 billion), Pakistan (USD 9 billion), Bangladesh (USD 7 billion), and Vietnam (USD 5 billion) are among the top 25 countries. The share of total subsidies to GDP ranges from 1 to 6% for these countries.

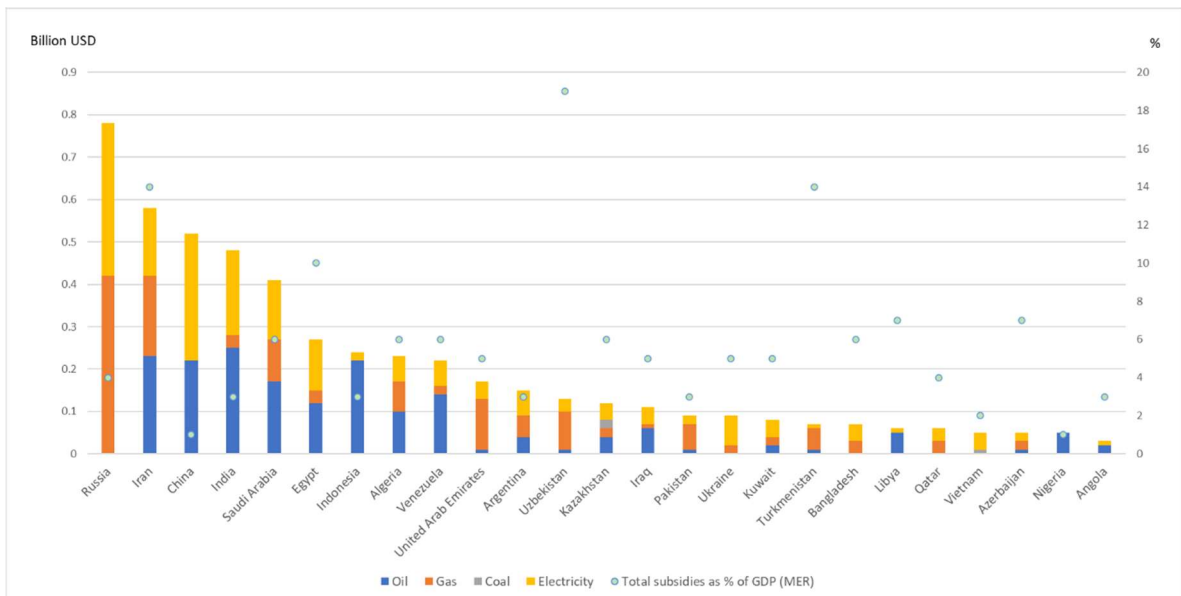


Figure 17. Volume of energy subsidies for the top 25 countries in 2021
Source: IEA (2022)

Indirect subsidies have increased during 2022. For example, in Japan, non-taxed

households are eligible for a one-time subsidy of JPY50,000 (approximately USD 350) to ease the burden of high electricity and gasoline prices. In addition, the electricity and gas consumed by small and medium-sized enterprises (SMEs) are also subsidized by the prefecture or municipality as a countermeasure for a rapid increase in fuel prices.

The IEA (2023) also reports that the indirect energy subsidies in other Asian countries include Thailand, India, South Korea, and Malaysia.³ In Thailand, a diesel price cap of THB 30 (USD 0.85) per liter was introduced in 2022, and the elimination of excise tax on diesel fuel and bunker oil for electricity generation was extended until March 2023. In India, the support for the poorest segments of the population for access to LPG rose to USD820 million. In South Korea, electricity, gas, LPG, and heating vouchers were provided to around 1.2 million vulnerable households in 2022. Malaysia spent approximately USD1 billion (equivalent to 2% of national fiscal revenue) in June 2022 and plans to reform its gasoline subsidy in 2023.

Wide-range governmental interventions in the market (i.e., energy subsidies) are undesirable from a decarbonization point of view because they dampen the price signal. However, they are necessary from equity or political perspective.

³ IEA (2023) reports that USD500 billion was spent globally to reduce the energy bill, other than energy consumption subsidies. In Europe, approximately USD350 billion was spent, with Germany spending EUR 100 billion to reduce energy bills for the first four months of 2023.

High energy prices contradict the United Nations' Sustainable Development Goals; "Ensure access to affordable, reliable, sustainable, and modern energy for all (Affordable and Clean Energy)" (United Nations, 2015). In addition, high energy prices could lead to the division between income classes within a country and between high-income and low-income countries.

3.5 Changes in energy strategies due to the Russian invasion

European coal imports from South Africa increased by 400% in 2022 and became the second largest consumer of South African coal. As shown in Table 2, India is the largest importer of extracted coal from South Africa.

Asian-Pacific countries are placed in a difficult position as Western countries shift away and place sanctions on Russia because of the invasion of Ukraine. For example, China and India have good political relations with Russia. As a result, China and India have increased the imports of cheap fossil fuels produced in Russia (Russell, 2023; Nikkei Asia, 2022)⁴. Indonesia, Pakistan, and Bangladesh could also increase imports from Russia (Russell, 2023).

South Korea increased Russian-produced coal by 24% in 2022 owing to

⁴ Other countries that have increased imports of fossil fuels produced by Russia includes United Arab Emirates, Saudi Arabia, and Egypt. Middle east countries use imported Russian fuel for electricity, whereas China and India export refined products using Russian crude oil.

discounts to increase price competitiveness. For example, Australian coal was USD409.5 per ton, while Russian coal was offered at USD244 per ton in December 2022. The increase in trade between Russia and South Korea has also been stimulated by short-transport shoulders from the Far East and relatively affordable freight rates (Argus media, 2022; Coal Hub, 2023).

Other Asia-Pacific countries could also follow in the footsteps if energy prices remain high, strengthening the influence of Russia. This could divide the world in half, similar to the Cold War era.

3.6 Policy Implications

The unstable energy prices have affected countries differently. Countries relying on energy imports have experienced high energy bills, whereas countries exporting energy are gaining from higher prices. Countries experiencing high energy bills are also divided between countries that can pay high prices and countries that cannot afford them. Thus, the division between the North and South is becoming apparent.

One possible option to reduce the division is a collaboration between the North and South. An important approach from this perspective is the Asian Energy Transition Initiative (AETI) of the Japanese government. The Japanese government is taking leadership in collaborating with ASEAN countries to support the development of energy

transition roadmaps, technology development, and demonstration with funding of JPY2 trillion. Moreover, the Japanese government is willing to contribute to capacity building on decarbonization technologies and knowledge sharing in CCUS. This type of collaboration between developed and developing economies will be useful in reducing the North–South divide and thus contribute to carbon neutrality.

Another possibility for reducing the gap is a mechanism that will increase energy efficiency in the South, financed by the North. JCM can contribute to bridging the gap if they are implemented at a larger scale. In JCM, Japanese firms and the government finance energy efficiency in partner countries. The gains in energy efficiency will reduce the total energy bill while using high-carbon content fuels.

Carbon emitted by using coal or natural gas can be collected by CCS. The Japanese government has commenced a feasibility study in Indonesia, utilizing CCS as a JCM project (J-Power, 2021). Other examples are assisting in renewables. If gas prices remain high, investing in renewables rather than building infrastructure for gas usage, such as pipelines and liquidizing facilities, would be rational. JCM projects related to renewables have been conducted since 2015 in Indonesia. These projects financed by developed countries would contribute to carbon neutrality in developing countries and reduce the possibility of a divided world by addressing energy security.

4. Conclusion and implications

The price increase and volatility of energy incurred by the Russian aggression pose challenges for many countries, including those in Asia. This energy problem is most prominent in the case of natural gas, which Russia uses strategically. Hence, this energy crisis has reminded many countries of the importance of energy security.

Consequently, decarbonization is under challenge. Furthermore, the hurdles to carbon neutrality seem to rise due to the high natural gas prices. For example, the natural gas price from South Africa has also increased, thus posing challenges to European countries, such as Germany and Italy. Moreover, the price of natural gas relative to coal increases and hinders fuel switching from coal to natural gas. Moreover, there is concern that the natural gas price will continue to rise. Therefore, the return to coal may continue to happen in some countries. Thus, carbon neutrality seems even more challenging than before the Russian invasion.

We also observe price hikes in coal markets. The coal price from Australia increased sharply, which included the relative price increase of natural gas to coal in Asia. In this sense, the obstacle of fuel switching from coal to natural gas may be relatively weaker in Asia than in EU countries. However, limited economic resources and capacity for fuel switching increased political opposition to the rapid movement toward CN, as

observed in the G20 in Indonesia in 2022

How can countries address this issue? One can respond to this situation by diversifying energy sources, including investment in renewable energies such as solar PV or wind power. In fact, the jump from coal to renewable energy without the transitional phase of natural gas may be one pathway that developing countries can take. In this way, countries do not have to invest in expensive infrastructure for natural gas, such as pipelines or ports. We observed such disruptive technological changes in the case of phones. Many people in developing countries are using mobile phones without the experience of landline phones.

Because of the price increase in energy in absolute terms, developing countries face shortages of resources they can use for carbon neutrality. Therefore, it has become imperative to achieve efficient emission reductions. Thus, adopting carbon pricing, such as carbon taxes or emissions trading, has become even more important. In this sense, China, Japan, South Korea, and Singapore can share their experience of carbon pricing in each country (Arimura et al. 2021).

Energy price increases are causing many problems for carbon neutrality and the North-South division. However, there is a bright side to this challenge. First, the price increase in energy may incentivize innovation that promotes energy efficiency or

alternative energy. We experienced such a positive change after the two oil crises in the Japanese economy: the Japanese industry successfully improved energy efficiency and obtained competitiveness in many manufacturing sectors, as in the case of the auto industry. The Chinese embargo on rare earth elements in Japan promoted the development of substitutes for rare earth elements in the long run. For example, Japanese firms invested in Australia to reduce Japanese reliance on Chinese rare earth (Nikkei Asia 2023⁵). We may observe an increasing effort to innovate low-carbon technologies and diversify energy sources.

Finally, we must pay attention to climate justice among nations and the poor and rich in each country. If the gap between the North and South widens, the effort to address climate change may collapse. Therefore, the effort to include the South in the CN is important. Recently, then "Loss and Damage" was featured at COP27 as a new key theme to compensate for the damages caused by climate change. The central issue in all these themes is "funding" from developed nations to developing nations.

From this perspective, we can emphasize the role of cooperation between the North and the South. In the context of carbon neutrality, Japanese governments are promoting the framework of JCM and AETI, which can contribute to both CN and energy

⁵ <https://asia.nikkei.com/Spotlight/Supply-Chain/Japan-takes-first-stake-in-heavy-rare-earths-to-reduce-China-reliance> (Accessed on March 14, 2023)

security issues. In addition, South Korea is also promoting a bilateral framework for carbon emission reduction. By extending these activities, we can make some progress in CN while addressing energy security.

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