Warwick Think Tank Report

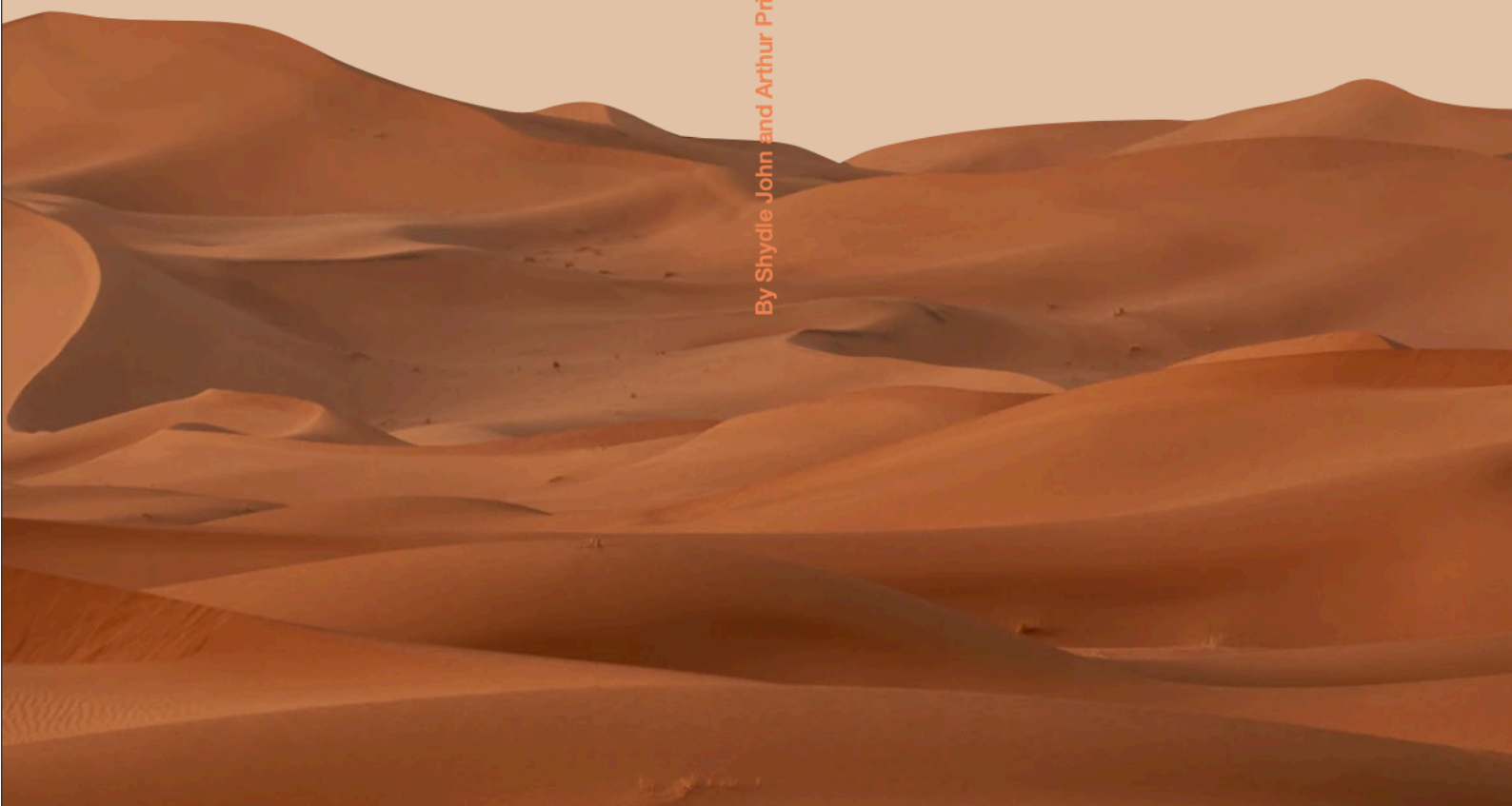
Energy & Environment

December 8, 2022

OPEC

How to control a cartel

By Shydle John and Arthur Prince



Our sponsors:

Think Tank
The IEA is the UK's original free-market think tank which was founded in 1955. Their aim is to improve the understanding of the fundamental institutions of a free society by analysing the role of free markets in solving economic and social problems. Since their inception, they have worked with prominent Nobel Prize winning economists including Frederich Hayek and Milton Friedman. They have many internship opportunities for both undergraduate and postgraduate students. These include a 3-month general internship, the Epicenter Internship, and the IEA Global internship. They also have a Summer Internship aimed at undergraduate students specifically. Additionally, they are holding an essay competition where students can win a monetary prize for debating whether the current upswing in inflation is transitory or not.

Economic Development and Regeneration Consultancy
Based in Sheffield, Manchester and Glasgow, Ekosgen is a consultancy firm focused on economic and social research. From policy development to socioeconomic impact appraisal, Ekosgen works with a variety of clients in public, private and third sectors. One particularly interesting project they have undertaken is the assessment of V&A Dundee Museum on the local economy. Ekosgen has a variety of roles for interested candidates: consultants to work on the core of their projects, and a variety of specialist associates – from urban planners to market researchers, working with their consultants to engender the most appropriate solution. If bringing life back to declining towns seems to be your calling, Ekosgen is the place to be!

Briefing note

This section takes an in-depth look at how our globalized society faces the increasing threat of energy insecurity and instability, and how in the context of climate change these problems can be addressed. Through an examination of the way in which geopolitical dynamics, global conflict and disruptions, and technological limitations disrupt the global energy market, this briefing sheds light on how acute the problem of energy insecurity is, and highlights the several roots of this pressing global issue.

Overview:

- Global geo-political dynamics have given rise to an oligarch-like institution in the form of OPEC, which ultimately acts in its own self-serving manner, with no incentive to act in the interest of global welfare.
- The weaponisation of oil and gas supplies poses an increasingly significant threat to global security and prosperity, particularly in the context of Russia's invasion of Ukraine.
- With a need for energy solutions to be clean, renewable and reliable, and how there exists an uneven distribution in different countries' ability to research and implement such solutions, the feasibility of a simultaneously climate friendly and energy secure world must be questioned and assessed.

The threat of cartels on energy security:

With an increasing series of geopolitical power plays, and a growing uncooperativeness, the transformation of OPEC into a cartel-like organization has placed energy markets into a constant state of uncertainty.

A growing sense of antagonism to the west has been displayed, which in turn has seen OPEC engaging in retaliatory measures that ultimately prove to be disadvantageous to the global energy market.

- A prominent example of this was OPEC's recent decision to ultimately slash oil production by 2 million barrels a day,leading to oil to trade at nearly $90 per barrel.This move was widely seen to stmyie US efforts to transition to clean energy,as well as to act as political counterweight to sanctions placed on Russia. Despite a plea from the U.S, OPEC went ahead with the move.[1]

- In response to U.S shale oil production taking an increasing market share, OPEC engaged in a relentless price war, thereby lowering oil prices to the extent that it rendered U.S shale oil production unprofitable.[2]

A wave of nationalization of oil resources among OPEC members and political conflicts in the Middle East, coupled with a lack of accountability system ,allows OPEC member states to unilaterally increase oil prices and impose resolutions.

- Despite being a member of OPEC, Iraq did not observe OPEC quota pacts,owing to political instability and this in turn caused an uncertain energy market with constantly fluctuating prices.[3]

- A drawn out political conflict against Qatar from other Arab member states such as Saudi Arabia and Egypt, has resulted in unfavorable policy resolutions for Qatar and eventually led to the exit of Qatar from OPEC.[4]

The dominance of Saudi Arabia, over rival poorer members of OPEC, and their indifference towards observing rival proposals,have made any attempt at production cuts unfeasible.

- In the early 1980's ,attempts were made to halt spiraling market share among member countries,which resulted in OPEC implementing production ceilings and quotas in an attempt to balance supply. However Saudi Arabia took an

---

[1]Brower, D. *et al.* (2022) *The New Oil War: OPEC moves against the US*, *Australian Financial Review*.
[2]Crowley, K. (2021) *Shale CEO warns of OPEC+ price war if U.S. oil production surges*,).
[3] ("Iraq heads for OPEC clash over quota". *United Press International*. 5 February 2010)
[4] (Ulrichsen, Kristian Coates (10 December 2018). "Why is Qatar leaving OPEC?". *The New York Times*.).

exception to this and later embarked on a spree of production increases in order to target other member countries.[5]

- Saudi influence in oil production pacts, have given them the ability to expand its excess capacity,thereby keeping with it a stream of reserve oil barrels that it signals to use,in retaliation to other member countries opposing production cuts,a strategy that has proven to be effective.

[5] FocusEconomics (2017) *OPEC history: Has it been a success?*,

The increasing threat of global conflict for energy security

In the modern world, interconnected global economy, countries are increasingly dependent on global markets for energy to fuel advanced economies. Consequently, the threat of hostile actors weaponizing the limitation of access to energy poses an increasingly significant threat for policy makers seeking to guarantee security.

Western over-dependence on middle eastern oil has historically proven a major source of insecurity during periods of international conflict, precipitating economic crises and undermining policy independence.

- **I**n 1973, OPEC member states responded to the Nixon administration's $2.2 billion military aid package to Israel by suspending oil shipments to nations supportive of Israel. This embargo reduced traded oil supplies by 14 percent internationally, and caused petrol prices to increase by around 400%, from $2.90 a barrel before the embargo to $11.65 a barrel in January 1974. This ultimately had severe consequences for US industry and consumers – including a 4.7% drop in GDP.[6]
- A similar oil crisis, precipitated by the 1979 Iranian revolution which reduced global oil production by 7%, led to recession in the US and significantly impacted global economic growth, causing world GDP to decrease by 3% as a whole.[7]
- A renewed dependence on Saudi Arabian oil associated with Russia's weaponization of oil and gas supplies has compromised US President Joe Biden's preferred foreign policy. This is evident in his efforts to "reset relations" with the Saudi government following a campaign promise to treat it as a "pariah state" – occurring in the context of the price of petrol rising 49% between January and June 2022, inflicting considerable pain on US consumers and industry.[8]

Current European dependence on Russian gas in the context of the invasion of Ukraine, and Russia's retaliatory weaponization of supply threatens huge economic damage and likewise has undermined European policy independence.

- Prior to the invasion of Ukraine, 40% of the European Union's gas consumption was supplied by Russia. In retaliation to NATO's material support for Ukraine in the conflict, as well as sanctions placed on Russia, Russian exports of gas to the EU have been cut by 88%.[9]
- European gas prices have thus increased exponentially, setting a record of €321 per megawatt-hour in August 2022, compared to €27 in August 2021. This has severely undermined European energy security, risking recession and contributing significantly to inflation.[10]

---

[6] Corbett, M., "Oil Shock of 1973–74", Federal Reserve History, 22nd November, 2013 https://www.federalreservehistory.org/essays/oil-shock-of-1973-74

[7] Cleveland,C., Morris, C., "Dictionary of Energy (Second Edition)", 2015

[8] McKernan, B., "Fist bumps as Joe Biden arrives to reset ties with 'pariah' Saudi Arabia" The Guardian, 16th July 2022 https://www.theguardian.com/us-news/2022/jul/15/fist-bumps-as-joe-biden-arrives-to-reset-ties-with-pariah-saudi-arabia

[9] "Nord Stream 1: How Russia is cutting gas supplies to Europe" BBC News, 29th September 2022 https://www.bbc.co.uk/news/world-europe-60131520

[10] Liboreiro, J., "Europe's gas prices have broken a new record. How high can they go?" Euronews, 26th August 2022 https://www.euronews.com/my-europe/2022/08/25/europes-gas-prices-have-broken-a-new-record-how-high-can-they-go

- This has led to several European leaders advocating for a degree of compromise with Russia over Ukraine – with French President Emmanuel Macron in particular advising against the "humiliation" of Putin. This can be explained partly by domestic pressures - Harris Interactive pollster Jean-Daniel Lévy notes that "Buying power is the number one concern of French voters," – with inflation associated largely with the energy crisis significantly reducing that buying power. This demonstrates how the EU's full policy independence can be significantly constrained by the pragmatic reality of dependency on Russian oil and gas.[11]

Rising oil prices associated with conflict also affect states not directly involved in conflict - with global energy insecurity threatening to exacerbate economic weakness and political unrest to catastrophic levels in some regions.

- The energy crisis associated with Russia's invasion of Ukraine has contributed significantly to global inflation – though this is far more acute in the mostly neutral developing world. From February to September 2022, the price of Brent crude oil in U.S. dollars actually fell nearly 6 percent. Yet, because of currency depreciations, almost 60 percent of oil-importing emerging-market and developing economies saw an increase in domestic-currency oil prices during this period. Nearly 90 percent of these economies also saw a larger increase in wheat prices in local-currency terms compared to the rise in U.S. dollars.[12]
- Oil prices have risen particularly sharply in the developing world, with petrol up 63% in Sudan, 50% in Sierra Leone and 42% in Ghana compared with 9% in Britain between February and April 2022.[13]
- The World Bank has found an exacerbating effect of energy-crisis linked inflation on existing crises in the emerging world, predicting food insecurity will be particularly aggravated. It has noted that, over the course of 2022 food-price inflation in South Asia averaged more than 20 percent, while food-price inflation in other regions already threatened by food insecurity, including Sub-Saharan Africa, averaged between 12 and 15 percent.[14]

---

[11] Vinocur, N, "Europe has met its pain threshold on Russia sanctions. It wasn't that high" Politico, 16th March 2022
https://www.politico.eu/article/europe-met-pain-threshold-russia-sanctions-not-high/

[12] "War Sets Back the Global Recovery" The International Monetary Fund, World Economic Outlook, April 2022
https://www.imf.org/en/Publications/WEO/Issues/2022/04/19/world-economic-outlook-april-2022

[13] Ahmed, K., "Inflation bites hardest in developing world as Ukraine war raises prices", The Guardian, 29th April 2022 https://www.theguardian.com/global-development/2022/apr/29/inflation-bites-hardest-in-developing-world-as-ukraine-war-raises-prices

[14] "Currency Depreciations Risk Intensifying Food, Energy Crisis in Developing Economies" The World Bank, 26th October 2022
https://www.worldbank.org/en/news/press-release/2022/10/26/commodity-markets-outlook

Challenges of transitioning to secure, renewable energy sources:

Resources vital to the energy transition are distributed highly unequally – consequently, global and domestic tensions seem poised to disrupt worldwide supply chains and exacerbate the difficulty of any transition to renewable sources, posing further challenges to global energy security.

- China produces 80% of the world's lithium and 60% of the specific rare-earth materials vital for lithium-ion battery production, which allows it to dominate current supply chains. This fact poses a challenge to policy makers in the west who must risk disruption to their ability to increase and maintain renewable domestic energy production by an unreliable China.[15]
- Russia is estimated to possess another 22% of the world's rare-earth reserves – given current tensions and existing efforts by Russia to restrict strategic resource exchange with the west, this equally challenges a global transition to renewables.[16]
- The internally insecure Democratic Republic of Congo controls 60% of the planet's cobalt – another vital component in modern batteries. This insecurity, coupled with a dominance of 80% of its industrial cobalt mines by Chinese firms, poses another significant potential threat to global supply chains.[17]

Fundamental limitations in battery technology, including association with significant expense and short battery life, mean that renewable energy provides no guarantees of reliable "baseload" power. This is ultimately vital to address if energy security is to be guaranteed.

- Analysis conducted by MIT and Argonne National Lab has identified that current batteries are too short-lived to guarantee a reliable load of power, particularly as renewable energy production can fluctuate unpredictably for long periods at a time – with solar and wind energy production falling considerably for up to 6 months at a time in Canada, for example.[18]
- Current battery infrastructure remains highly underdeveloped, with the Clean Air Task Force estimating a capacity of 36.3 million megawatt-hours of energy storage is necessary to guarantee a constant energy supply in California, should it transition to a 100% renewable grid– with current capacity reaching only 150,000 megawatt-hours. Establishing this level of renewable generation

---

[15] Jones, J. "China dominates lithium-ion battery supply chain, but Europe is on the rise" Smart Energy International, 17th September, 2020 https://www.smart-energy.com/storage/china-dominates-lithium-ion-battery-supply-chain-but-europe-is-on-the-rise/

[16] A.S. Buynovsky, A.N. Zhiganov, V.L. Sofronov, V.I. Sachkov, N.V. Daneikina, "Current State of the Rare Earth Industry in Russia and Siberia", Procedia Chemistry, Volume 11, 2014

[17] Alihian, C. "Congo's Cobalt Controversy", Global Edge, 20th April 2022 https://globaledge.msu.edu/blog/post/57136/congos-cobalt-controversy#:~:text=However%2C%20Cobalt%20is%20a%20 unique,or%20 financed%20by%20 Chinese%20 companies.

[18] Fernando J. de Sisternes, Jesse D. Jenkins, Audun Botterud – "The value of energy storage in decarbonizing the electricity sector", Applied Energy, 2016

and battery storage would increase current costs exponentially, from $49 per megawatt-hour at a level of 50 percent renewable energy, to $1,612 at 100 percent.[19]

- The limitations of battery storage infrastructure in Germany have led to the re-opening of 2 coal plants in 2022, as falling gas supply from Russia coincided with a considerable drop in wind energy production, attributed to unusually poor weather conditions. This provides another example of the limits of battery technology, coupled with exclusively renewable energies, in reliably tackling energy insecurity.[20]

Even if the electric grid can be fully transitioned to domestic sources, transport remains highly dependent on imported fossil fuels – especially in Europe. Transitioning the transport sector to other sources will involve particularly difficult financial, technological and organizational challenges.

- Transport is the biggest consumer of oil in the EU – a fact which is of considerable concern as the EU is dependent on imports for 97% of its oil products, one quarter of which is supplied by the hostile Russian government as of March 2022.[21]
- Decarbonisation of trucking, shipping and aviation represents a particularly difficult challenge, as battery electric vehicles are unlikely to be feasible for long distances. As a result, by 2050 it is likely that over 30 billion gallons per year of hydrocarbon fuel will be necessary simply to fuel trucking – three times more than is currently produced globally.[22]
- Transportation as a sector is extremely difficult to transition from fossil fuels, partly as a result of unequally distributed strategic resources necessary in the batteries of electric vehicles, as well as political instability in several of the major producers of these resources.[23]

---

[19] Temple, J. "The $2.5 trillion reason we can't rely on batteries to clean up the grid", MIT ` Technology Review, 27th July, 2018
https://www.technologyreview.com/2018/07/27/141282/the-25-trillion-reason-we-cant-rely-on-batteries-to-clean-up-the-grid/

[20] Konnoly. K. "Germany to reactivate coal power plants as Russia curbs gas flow" The `Guardian, 8th July 2022
https://www.theguardian.com/world/2022/jul/08/germany-reactivate-coal-power-plants-russia-curbs-gas-flow

[21] Earl, T. "How Russian oil flows to Europe Imports, dependency, trade value, ports and pipelines" Transport & Environment, 7th March 2022https://www.transportenvironment.org/wp-content/uploads/2022/03/20220303_russian_oil_in_the_EU.pdf

[22] Tamor, M. & Stechel, E. "Electrification of transportation means a lot more than a lot more electric vehicles" IScience, 7th May 2022
https://www.cell.com/iscience/fulltext/S2589-0042(22)00647-2?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2589004222006472%3Fshowall%3Dtrue

[23] de Blas, I., Mediavilla, M., Capellán-Pérez, I., Duce, C., "The limits of transport decarbonization under the current growth paradigm", Energy Strategy Reviews, 2020

Insight —— Overview

This section aims to address underlying factors which have caused and aggravated global energy insecurity. Firstly, it aims to highlight the highly detrimental impact of 'cartel-like' organisations, including OPEC, on energy security, leading to an unreliable global market for oil. It then seeks to establish the threat of international conflict for global energy supply chains, arguing that global dependence on autocratic states - which are increasingly prepared to weaponise energy supplies - now poses a crucial challenge to energy security worldwide. Finally, this section seeks to emphasise the various key challenges of improving energy security through a transition to "green" sources of power, noting significant logistical and technological obstacles.

OPEC's inherent unreliability is a symptom of its organizational structure, which causes an unstable global market for oil.

The formation of OPEC in the 1960's was designated to be an opportunity for oil producing countries (which primarily consist of developing countries in the Middle East) to break away from the oligopoly of Western oil firms that were known as the "Seven Sisters". Throughout history, it has been common to see a pattern of general exploitation of countries with significant natural resources by Western powers with significant economic and military might. Oil, being the world's most precious commodity, was no different. Prominent examples include a coup against Mohammed Mosaddegh sponsored by the U.S and the U.K for his actions in nationalizing Iran's oil production, as well as actions taken by the Seven Sisters oligopoly including slowing down oil production in states which acted against the oilgopy's interest.

In response to this, OPEC was formed, with the purpose of giving developing nations who were blessed with the natural resource of oil an opportunity to grow and develop into modern states. However with global markets being highly unstable and several international criticisms against OPEC, from both member and non member states, it is clear to see that the institution has not functioned the way its founding members intended it to.[24]

At the beginning, OPEC had tremendous success; notably demonstrated through its collective decision making process and help in ending the dominance of the "Seven Sisters". However, powered by political tensions, OPEC greatly devastated global oil security through the 1973 Oil Crisis, due to an unprecedented act of regional cohesion in oil production practices. However, this organizational cohesion would prove to be short lived and set the platform up for its present failure in having a unified plan in regards to oil production.

The founding logic and intent behind OPEC is a unified decision making process that seeks to maintain profitable oil prices through carefully managed production. However, as many scholars note, this structure has been let down by an economic rationale for individual member states to forgo production quotas and expand oil production.[25]

OPEC has often been placed with the label of being an "international cartel" due to its collective agreements about ensuring profitable oil prices and low oil production, without a reward for global energy stability. While regular cartels are subject to antitrust and competitiveness laws, the special nature of OPEC (being made up of governments) shields them from such market competition regulations through diplomatic immunities such as the Foreign Sovereign Immunities Act. This ultimately

---

[24] Colgan, Jeff D. (2021), "The Rise of OPEC", *Partial Hegemony: Oil Politics and International Order*, Oxford University)

[25] Colgan, Jeff D. (2021), "The Stagnation of OPEC", *Partial Hegemony: Oil Politics and International Order*, Oxford University Press, pp. 94–118,)

gives OPEC little incentive to act in interest of global stability and helps them to continue to have the ability to unilaterally raise oil prices.[26]

However, some dispute this label of OPEC functioning as a cartel and point out this characterization to be inaccurate due to widespread economic rationale non-commitment from member states, leading to fluctuating high oil prices, and rendering OPEC's ability to enforce collective action undermined. It can be said that these actions are more damaging than cartel behavior, due to a lack of cohesion and understanding in regards to global oil output and prices. Given that there is no recourse that OPEC can take to sanction non cooperative member states, it relies on a system of incentives to promote compliance, however these nudges are insignificant to member states and therefore ineffective.[27]

Furthermore, these differences in policy making decisions often arise due to political conflicts among member states, particularly for those located in the Middle East. A prominent example of this is Iraq failing to observe production quotas owing to political instability. Whilst one-off conflicts are unlikely to drastically affect policy effectiveness, the frequency and effectiveness of such conflicts give rise to global energy insecurity.

Finally, despite having a principle of one vote per member state, the large swath of oil resources possessed by Saudi Arabia gives it a dominant position in policy making. Saudi Arabia has occupied the position of being a swing producer to help balance global markets, and essentially driving OPEC's policies. However, it has used its position to effectively retaliate against other member states who take opposing policies to Saudi Arabia's interest, such as drastically cutting oil production in 1985.[28]

[26] (Gülen, S. Gürcan (1996). "Is OPEC a Cartel? Evidence from Cointegration and Causality Tests")

[27] Jeff D. (2021), "The Stagnation of OPEC", *Partial Hegemony: Oil Politics and International Order*, Oxford University Press, pp. 94–118,)

[28] (Claes 2018: 146)


OPEC
POWER

The weaponization of oil as a political pawn has upended energy security across the world.

Global conflicts among various regions have been commonplace since the dawn of time. However in recent times, countries have looked to economic and market tactics in order to inflict pressure on countries, and the singular significance of oil as a commodity has seen it being increasingly used as a political weapon.

To understand how oil established itself as a vital part of an economic arsenal in political conflicts, it is important to note how dependent major regions are upon oil exporting regions to meet current demand, as well as understanding the political pressures associated with oil shortages and rising prices.

Studies conducted by the EU have demonstrated that the overall dependency rate is 60 percent as of 2020, which shows a net increase from 56 percent in 2000, with the dependency rate particularly rampant in Malta, Cyprus, and Luxembourg (being close to or above 90 percent). A majority of these exports to the EU come from Russian oil production efforts.[29] American dependence on foreign oil is far more varied, with crude oil related imports coming from 73 countries, for a total of 8.47 million barrels of oil imported per day. However, the U.S primarily imports its oil from countries such as Canada, Mexico, Russia and Saudi Arabia in order to meet its high demand for oil, despite being capable of producing large amounts of oil itself. This dependency across Europe and the United States proves advantageous for oil exporting nations, as they can use it as a pawn in international conflicts.[30]

An important and recent exemplification of this can be seen in the current Russia - Ukraine war. In response to Russia's invasion of Ukraine, several nations (including those in the west, such as member states of the E.U and the United states) pushed for economic sanctions on Russia as well as Russian oligarchs in order to create pressure on the Russian economy and as a signal of support for Ukraine. However, in order to push back against these sanctions, Russian authorities decided to halt supply of gas to nations that enacted these sanctions, hoping that a climate of high energy prices would mount political pressure on European leaders to reverse sanctions.

Russia has used a series of prominent tactics in this regard, particularly targeting Germany, whose new chancellor took a strong pro Ukrainian Position. Russian authorities acting through state linked Gazprom, have regularly scheduled the closing of pipes that supply Nord Stream 1, ostensibly under the premise of maintenance or other equipment related reasons. Another significant political tactic that Russia has used is demanding the payment of oil supply to be done in Rubles. This move allows Russia to receive important currency so as to maintain economic stability at home, while also giving them an opportunity to break off oil contracts with non complying

---

[29] *From where do we import energy ? Shedding light on energy in the EU*.
https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html
[30] *Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA)*.
https://www.eia.gov/tools/faqs/

countries. So far, this strategy has proven to be slightly effective, with renegotiations starting between Russia and Hungary.[31]

This tactic of using oil as an economic weapon has become increasingly frequent, through either cutting gas production (as undertaken by Russia during the gas wars of 2006 and 2009) as well as through OPEC in 1967 (in retaliation to the Israel - Palestinaian conflict). General instability to the oil market has also taken place due to uncooperativeness in global production efforts, such as Saudi Arabia taking a stance against the west by refusing to cut oil production in 2022.[32]

Despite the frequency of such events, countries are still left unprepared in times where oil shortages or price hikes take place, often due to the sudden nature of such embargoes and shortages, as well as a lack of infrastructure and energy resources that can help bridge a country's oil demand until a resolving of the conflict.

[31]Stephen Hall (2022) *How Russia is using gas as a political tool to win support for the Ukraine War*, *The Conversation*.
[32] Aljamra, H. (2019) *The weaponization of Arab oil: A double-edged sword*, *Inside Arabia*.

China produces 80% of the world's lithium, as well as 60% of the rare-earth materials vital for lithium-ion battery production

Several key challenges to the renewable transition complicate the process of phasing out foreign fossil fuels.

Energy insecurity remains a persistent problem for policy makers worldwide as a result of several fundamental challenges which complicate any transition away from imported fossil fuels to fully renewable technologies. These include protectionism and the strategic denial of resources crucial to renewable manufacturing, the current costs and limits of battery technology, and the particular challenges of transitioning the transport sector from fossil fuel usage.

In the emerging literature which assesses the challenges to the green transition, one of the foremost threats has been identified as unequal resource distribution[33], leading to the possibility for international tensions to threaten crucial global supply chains.

Much like oil, resources crucial to a green transition are distributed highly unequally between states; China produces 80% of the world's lithium, as well as 60% of the rare-earth materials vital for lithium-ion battery production[34] - vital in any renewable grid because batteries make up for shortfalls in electricity production when conditions are unfavourable to renewable energy generation.[35] China also dominates the production of rare metals neodymium, praseodymium and dysprosium, which are essential in the production of permanent magnets for direct-drive wind turbines.

The Chinese state has proven its willingness to leverage its dominance in the supply of these crucial materials for its own ends – placing restrictions on rare earth metal exports to its rival Japan from 2010 to 2013[36], and hence significantly disrupting supply and increasing costs for Japanese manufacturers. Additionally, the Chinese government is now considering a ban on rare earth exports which form a vital part of the US' development of modern military equipment.[37] Though this is not strictly relevant to energy security, it demonstrates that a similar policy, which may severely complicate the US's green transition, is conceivable – particularly in the context of another (future) US-China trade war.

---

[33] De Ridder, M. "The geopolitics of mineral resources for renewable energy technologies", The Hague Centre for Strategic Studies, 8th August, 2013 .

[34] Jones, J. "China dominates lithium-ion battery supply chain, but Europe is on the rise" Smart Energy International, 17th September, 2020 https://www.smart-energy.com/storage/china-dominates-lithium-ion-battery-supply-chain-but-europe-is-on-the-rise/

[35] Temple, J. "The $2.5 trillion reason we can't rely on batteries to clean up the grid", MIT Technology Review, 27th July, 2018 https://www.technologyreview.com/2018/07/27/141282/the-25-trillion-reason-we-cant-rely-on-batteries-to-clean-up-the-grid/

[36] Stegen, K. "Heavy rare earths, permanent magnets, and renewable energies: An imminent crisis" Energy Policy, Volume 79, April 2015

[37] Jingyi, C. & Tulei "China released draft regulation on rare earths, including quota control, investment management", The Global Times, 15th Jan 2021 https://www.globaltimes.cn/page/202101/1212941.shtml

Meanwhile, Russia is estimated to possess another 22% of the world's rare-earth reserves.[38] Given Russia's invasion of Ukraine, and the associated efforts by Russia to restrict strategic resource exchange with the West, this equally suggests the unequal distribution of certain crucial materials may increasingly pose a threat to a renewable energy transition.

Furthermore, the internally insecure Democratic Republic of Congo (DRC) produces 60% of the planet's cobalt – a vital component in most modern Electric Vehicle (EV) batteries. Challenges to supply in the country include moral questions over mining practices – for example, 40,000 of 255,000 small-scale "artisanal" miners are estimated to be children.[39] This is combined with widespread reports of intimidation, extortion and corruption within state institutions[40] in relation to the mining sector (though this is also true of the wider economy).[41] If nothing else, these facts call the efficiency of the mining process into question – a key challenge if the soaring global demand for cobalt is to be met. Overall, it is difficult to view the fragile and ineffective government of the DRC as a strong guarantor of labour laws, property rights, contractual law, and other necessities for a reliable supply chain – further risking the green transition.

Fundamental limitations to green technology also pose a significant challenge to conceptions of a fully renewable energy grid. MIT and Argonne National Lab have identified that existing batteries do not retain energy for long enough to guarantee a year-round, reliable load of power, particularly as renewable energy production can fluctuate unpredictably for long periods at a time.[42] An apt demonstration of this limitation arose in Germany, which has re-opened 2 coal plants in 2022 as falling gas supply from Russia coincided with a considerable medium-term drop in wind energy production – attributed to unusually poor weather conditions – with existing battery infrastructure unable to meet demand.[43]

Even if the electric grid can be fully transitioned to domestic sources, transport remains highly dependent on imported fossil fuels – especially in the European Union, where it is the bloc's biggest consumer of imported oil.[44]

---

[38] A.S. Buynovsky, A.N. Zhiganov, V.L. Sofronov, V.I. Sachkov, N.V. Daneikina, "Current State of the Rare Earth Industry in Russia and Siberia", Procedia Chemistry, Volume 11, 2014

[39] Lawson, M. "The DRC Mining Industry: Child Labor and Formalization of Small-Scale Mining", Wilson Center, 1st September 2021 https://www.wilsoncenter.org/blog-post/drc-mining-industry-child-labor-and-formalization-small-scale-mining

[40] Knutsen, C.H., Kotsadam, A., Olsen, E.H. and Wig, T., "Mining and Local Corruption in Africa" American Journal of Political Science, 2017

[41] Matti, Stephanie A. "The Democratic Republic of the Congo? Corruption, Patronage, and Competitive Authoritarianism in the DRC." *Africa Today* 56, no. 4 (2010): 42–61, June 2010

[42] de Sisternes, F., Jenkins, J., Botterud, A. "The value of energy storage in decarbonizing the electricity sector", Applied Energy, 2016

[43] Konnoly. K. "Germany to reactivate coal power plants as Russia curbs gas flow" The Guardian, 8th July 2022 https://www.theguardian.com/world/2022/jul/08/germany-reactivate-coal-power-plants-russia-curbs-gas-flow

[44] Earl, T. "How Russian oil flows to Europe: Imports, dependency, trade value, ports and pipelines" Transport & Environment, 7th March 2022

Transitioning the transport sector to renewable sources has proven particularly challenging largely because current battery electric vehicles are not feasible for the long distances currently covered by fossil-fuel reliant vehicles. Alternatives, which include using domestically produced "biofuels" instead of foreign-sourced fossil fuel, also have limited potential, mainly as engines must be adapted to use these fuels. Additionally, estimates indicate that global biofuel production must be scaled up to three times to match (only) the demand from trucking by 2050.[45]

Existing transport infrastructure must also be adapted for electric vehicles, at considerable expense; the British government's independent advisor, the Committee on Climate Change (CCC), calculates that 325,000 electric vehicle charging points will be necessary by the year 2030, envisioning the installation of over 30,000 charging points per year from 2020 to 2030. For context, as of 2020, only 20,000 charge points existed in the UK.[46] It is estimated that this program alone will cost up to £1.8 billion a year over the next ten years.[47] In the context of globally increasing costs to borrow, and large covid-era debts in most advanced economies, it appears that funding this essential program – and those like it – will continue to be difficult, not only in the UK, but worldwide. Ultimately, this helps elucidate the particular resilience of the transport industry to the green transition.

Overall, these key material, technological and political challenges help explain why a full renewable transition remains elusive, and why green technologies cannot – in the short term – entirely counter the threat of energy insecurity.

---

https://www.transportenvironment.org/wp-content/uploads/2022/03/20220303_russian_oil_in_the_EU.pdf

[45]Tamor, M. & Stechel, E. "Electrification of transportation means a lot more than a lot more electric vehicles" IScience, 7th May 2022 https://www.cell.com/iscience/fulltext/S2589-0042(22)00647-2?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2589004222006472%3Fshowall%3Dtrue

[46] Wills, T. "The UK's transition to electric vehicles", Climate Change Committee. 9th December 2022 https://www.theccc.org.uk/wp-content/uploads/2020/12/The-UKs-transition-to-electric-vehicles.pdf

[47]"UK EV charging infrastructure update (part 2)", Deloitte, 2020 https://www2.deloitte.com/uk/en/pages/energy-and-resources/articles/uk-ev-charging-infrastructure-update-show-me-the-money.html

Policy Recommendations

Policy recommendations

Overview

The following recommendations aim to offer a structured blueprint for tackling the pronged problems that ultimately undermine global energy security, namely geopolitical tensions and conflict, as well as the challenges which complicate a secure transition to renewable energy sources.

The specific policy recommendations are as follows

Action one

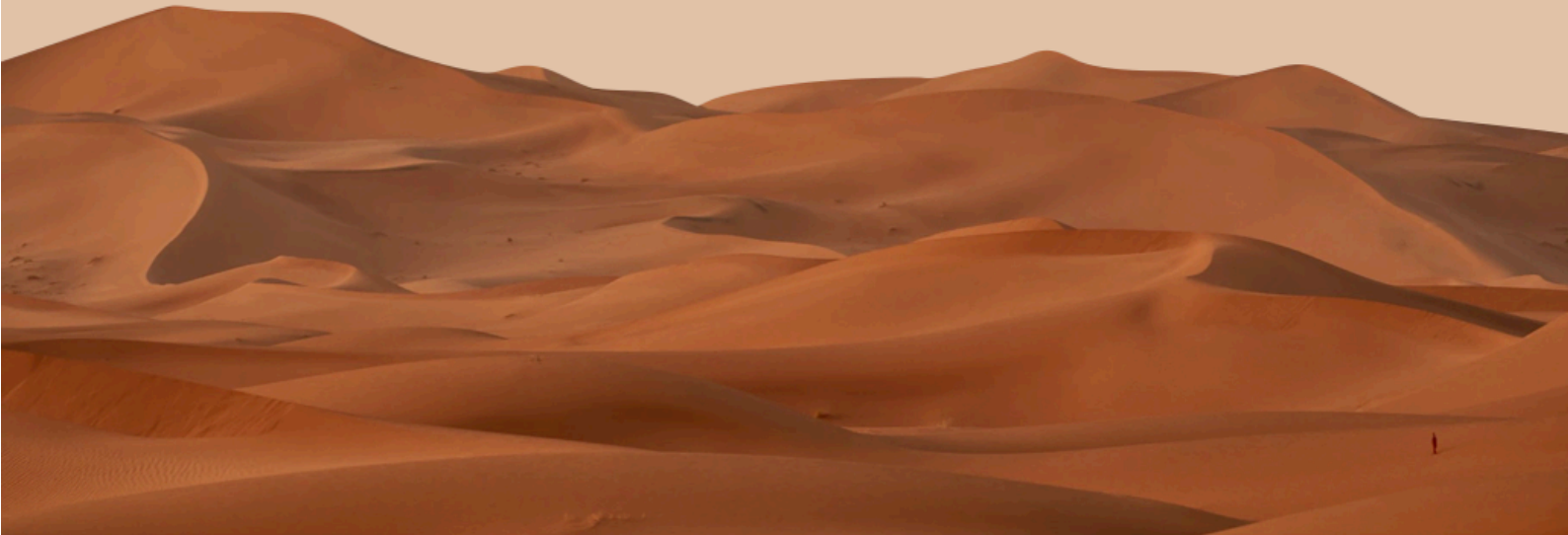
The unrestrained concentration of power within OPEC can be countered through global multilateral agreements and fostering mutually beneficial energy relationships.

Action two

Governments and international political entities must promote the global diversification of rare earth resource exploitation, along with sustained recycling initiatives. This will ensure the resources necessary for the green transition are available and the supply chains crucial for future energy security are reliable.

Action three

Governments must guarantee a managed decline of fossil fuels while renewable technologies are implemented and further developed, along with medium-term alternatives like nuclear power. This will ensure energy security remains solid while the long, hard work of the green transition is conducted.



Action 1: The unrestrained concentration of power with OPEC can be countered through global multilateral agreements and fostering mutually beneficial energy relationships.

As noted over the course of this paper, OPEC has a dangerous, cartel-like influence over global oil prices. This effect is particularly distressing given the severity that the price fluctuations of oil has on society. This has stemmed from both its external power struggles with countries that produce oil and oil importing countries, as well as its internal conflicts amongst members and a lack of a unified front.

One potential solution to this is the implementation of bilateral oil sharing agreements between oil importing countries and current member states of OPEC. The rationale between pursuing bilateral oil agreements is two pronged and one would argue more beneficial for global stability. As noted, the internal dominance of countries such as Saudi Arabia in OPEC often sidelines smaller less influential member states and disadvantages them from an economic perspective by failing to maximize their economic benefit.

Through pursuing bilateral agreements, these sidelined member states would be able to freely discuss and arrange mutually beneficial agreements that would suit their country's economic interests adequately, and would also allow oil importing countries to no longer be subjugated to the unstable price fluctuations that OPEC brings.

A noted example of this that is rather encouraging for current OPEC member states would be the emergence of bilateral oil agreements in Asia, particularly those undertaken by China and India. Oil importing countries have taken an increased series of steps towards establishing extended diplomatic ties that have taken the form of new oil and gas pipelines as well as new large scale LNG export plants in the Eurasia region. This has proven to be beneficial to oil importing countries, by allowing them to dampen the negative economic effects from volatile market conditions.

Additionally, oil and gas importing countries have been notably supporting financial investment in countries that they establish trading partnerships with, such as encouragement of foreign direct investment in those countries as well as friendlier economic cooperation pacts.

Furthermore, given the importance of maintaining stable energy prices for oil importing countries as well as a desire for economic growth in oil producing member states it is not irrational to assume that such agreements are to be more commonplace. The establishment of these agreements also gives a strengthened position to sidelined member states of OPEC, which may ultimately result in organizational reform if the collective desires to meaningfully exist.

Action 2: In order to secure necessary supplies of rare earth elements (REEs), governments and international political entities must support a global diversification of resource exploitation in conjunction with a sustained recycling initiative which utilises new methods to incentivise the participation of the public.

As previously outlined, China's dominance of rare earth element production poses a potential challenge to a truly secure global energy transition. A clear solution to this would be a diversification of resource exploitation which would provide alternative suppliers and strengthen the resilience of global supply chains.

A global diversification of rare earth element (REE) extraction is both feasible and within reach; rare earth metals are highly present throughout earth's crust[48], and production has proven to be flexible in times of high prices – particularly in the years following 2011, when Chinese firms were forbidden from exporting REEs to Japan and consequently Japanese domestic production expanded greatly.[49]

Currently, Chinese firms dominate production for two main reasons – lax safety and environmental regulation (which makes it much cheaper to mine) as well as huge domestic investment and support which helped displace previously dominant US mining firms.[50]

Thus, to reintroduce diversification into the rare earth mining industry - with the goal of securing future supply chains – this strategic advantage of Chinese firms must be countered. Crucial to note is that this cannot mean mining standards in the rest of the world should be eroded, particularly as China pays a heavy toll for its lax regulations.[51]

Rather, governments must strongly support safe mining measures in their own countries – publishing clear, effective regulations while subsidising the use of specialist safety equipment, as well as funding research into the development of further methods to mitigate environmental destruction from REE extraction. As a result, there is clearly a necessity for governments to contribute significantly to R&D budgets in this field.

These subsidies and research funding must be considerable enough to counter the domination of Chinese firms, which may require investments on the scale of billions of dollars. However, ultimately, this should be considered a worthwhile investment, as those countries which can develop the most sustainable, safe mining practices

---

[48] Orris, G., Haxel, G., & Hedrick J., "Rare Earth Elements: Critical Resources for High Technology", Volume 87, Issue 2, (2002)

[49] Overland, I., "The geopolitics of renewable energy: Debunking four emerging myths", Energy Research & Social Science, Volume 49, (2019)

[50] Kalantzakos, S., 'How China Came to Dominate the Rare Earth Industry', China and the Geopolitics of Rare Earths (New York, 2018; online edn, Oxford Academic, 23 Nov. 2017),

[51] Packey, D., Kingsnorth, D., "The impact of unregulated ionic clay rare earth mining in China", Resources Policy, Volume 48, (2016)

will secure the added benefit of leading the world in an industry which is predicted to triple in value from 2020 to 2035.[52]

The need to mine REEs in the first place, along with the presence of potentially hazardous waste, can also be significantly reduced by way of expanded electronic recycling. The UN estimates that less than 20% of global electronic waste is formally recycled, while waste products containing an estimated $65 billion worth of recyclable material are wasted.[53]

Meanwhile, in the EU, a more considerable 55% of electronic waste is recycled.[54] This has been largely attributed to EU legislation which requires producers take legal responsibility for their own waste products.[55] This ultimately indicates a considerable potential for improvement globally should similar legislation be implemented globally – potentially netting billions of dollars in eventual profit.

Additionally, there is a growing body of research which shows low rates of recycling can be addressed through incentives directed towards the wider population; incentive-based recycling systems have been proven to significantly increase the domestic waste recycling rate in several large studies.[56]

Overall, the diversification of global REEs reserves through expanded safety measures and subsidies for domestic production, in conjunction with a sustained recycling campaign which integrates legal requirements for wasteful firms to recycle their products as well as public incentive mechanisms, promises to significantly address the obstacle of resource insecurity for the renewable energy transition – which will ultimately address energy insecurity.

---

[52] Mitchell, J., "China's stranglehold of the rare earths supply chain will last another decade" Mining Technology, 26th April 2022 https://www.mining-technology.com/analysis/china-rare-earths-dominance-mining/

[53] "UN report: Time to seize opportunity, tackle the challenge of e-waste" The United Nations, 24th January 2019 https://www.unep.org/news-and-stories/press-release/un-report-time-seize-opportunity-tackle-challenge-e-waste

[54] "International E-Waste Day: 57.4M Tonnes Expected in 2021", WEEE Forum, January 2021 https://weee-forum.org/ws_news/international-e-waste-day-2021/#:~:text=Last%20year's%20Global%20E%2Dwaste,to%2074%20Mt%20by%202030).

[55] "E-waste in the EU: facts and figures (infographic)" The European Parliament, 26th April 2022 https://www.europarl.europa.eu/news/en/headlines/society/20201208STO93325/e-waste-in-the-eu-facts-and-figures-infographic

[56] Yang, J., Jiang, P., Zheng, M., Zhou, J., Liu, X., "Investigating the influencing factors of incentive-based household waste recycling using structural equation modelling," Waste Management, Volume 142, (2022)

Action 3: Governments must oversee a managed decline of fossil fuels as alternative energy sources are supported and implemented, in order to guarantee a secure energy transition.

Meanwhile, Russia's ongoing weaponization of petrol and gas supplies serves to prove Western dependence on fossil fuels and, crucially, the inadequacy of current renewable infrastructure to fully replace this dependence.

As a result, a managed decline of fossil fuel usage is clearly necessary if energy security is to be guaranteed over the course of a renewable energy transition.

That said, neither expanded oil extraction nor fracking can be said to be a solution to energy insecurity. This is for two main reasons; firstly, oil extraction projects take on average 7-10 years from initial planning to the beginning of extraction[57] - a rate which is simply too slow to address sudden changes in energy demand. Additionally, current research has established that, to limit catastrophic climate change by staying under 2 degrees of warming, no new exploitation of oil or shale supplies can be allowed – as currently available supplies already deplete the world's entire "carbon budget".[58]

In the medium term, this means that energy supplies must be diversified, with governments promoting the adoption of hydroelectric, geothermal, wind, tidal, solar and nuclear power. This has the key benefit of addressing renewable energy's key weakness – a lack of baseload power – by providing a wide, reliable range of energy sources which produce electricity independently of one another.

Government should take a leading role in the construction of these energy sources, but private investment must also be courted and directed, particularly post-covid in the context of strained national budgets. This has proven successful in both the EU and the UK, with the EU's "Invest EU" fund expected to leverage €610bn of private investment through a guarantee of €38bn of public money (much of which will be directed to the green transition)[59], while a £700 million investment in Sizewell point C nuclear reactor by the UK government is expected to secure up to £20bn in private finance for a project which will power six million homes when complete.[60]

Additionally, new technologies including hydrogen batteries and fuel cells can address key weaknesses with current electric vehicle batteries, including lack of

---

[57] Altawell, N., "Project management in oil and gas", Rural Electrification, Academic Press, (2021)
[58] McKinnon, H. "A Managed Decline of Fossil Fuel Production" Oil Change International, 1st November 2017
[59] "The InvestEU Programme: Questions and Answers" The European Commission, 18th April 2019 https://ec.europa.eu/commission/presscorner/detail/en/MEMO_19_2135
[60] Mathis, W., Morison, R., and Donaldson, K., "UK State Funds for EDF's Sizewell Nuclear Plant Remove China" Bloomberg, 28th November 2022

https://www.bloomberg.com/news/articles/2022-11-28/uk-s-nuclear-push-advances-with-financing-model-for-sizewell-c#xj4y7vzkg

range.[61] Governments should combine supply-side subsidies and cheap loans with a demand-side carbon tax to promote a wider, competitive "hydrogen economy" (with additional applications in industry and heating) which will complement the wider green transition – possibly even becoming the cheapest fuel available, if current patterns continue.[62]

Governments must ensure that domestic energy production is robust – though this does not necessarily mean every nation must adopt an "autarky" style energy policy. Rather, governments should pursue domestic production because this will reshape energy markets, making them far more secure. This is because, in a world in which every country has an energy-producing base, nations will be able to supplement each other in times of low production in certain sectors or regions, creating a new, far more equal "prosumer" relationship which will replace the current insecure producer-consumer paradigm.[63]

Ultimately, a scale-down of fossil fuel usage in combination with a corresponding increase in energy production by alternate, low carbon sources must be conducted. This must be directed primarily by national governments, by means of supply side subsidies and loans, as well as some private finance, along with demand-side measures – including carbon taxes which increase the competitiveness of low-carbon sources in the critical short term stage, as renewable infrastructure continues to be implemented.

[61] Tillier, N., Hieminga, G.,"Governments are shaping their hydrogen ambitions" ING, 28th October 2021
https://think.ing.com/articles/hold-3of4-governments-are-shaping-their-hydrogen-ambitions/#a3
[62] Silverstein, K., "Electric Vehicles Or Hydrogen Fuel Cell Cars? The Inflation Reduction Act Will Fuel Both" Forbes, 10th August, 2022
https://www.forbes.com/sites/kensilverstein/2022/08/10/electric-vehicles-or-hydrogen-fuel-cell-cars-the-inflation-reduction-act-will-fuel-both/?sh=60a0e9a84d01
[63] Overland, I., "The geopolitics of renewable energy: Debunking four emerging myths", Energy Research & Social Science, Volume 49, (2019)

Conclusion

These policies, though ambitious, ultimately promise to go a long way to address many of the long-term causes of energy insecurity. While some of these causes – particularly international conflict – seem poised to continue to challenge energy security and do not have any easy or apparent solutions, these policies seek to effectively mitigate the potential disruption which may be caused as a result. Consequently, it appears likely that several of these policies will be implemented or are already in the early stages of implementation, as nation governments increasingly prioritise energy security in the context of today's insecure energy supply.

Energy insecurity now stands as one of the main challenges to contemporary governments and societies. Accordingly, bold action must be taken in response, and though the myriad problems which have led to today's fraught energy markets may appear insurmountable, with the application of these policies, as well as new and promising technological advancements, much progress can be made in tackling energy insecurity.