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Will the Switch to Renewable Energy Provide Fewer Instances For States to Use It as a Tool of Geopolitical Influence?

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Adapt Long Read

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WILL THE SWITCH TO RENEWABLE ENERGY PROVIDE FEWER INSTANCES FOR STATES TO USE IT AS A TOOL OF GEOPOLITICAL INFLUENCE?

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RECOMMENDATIONS

- The characteristics of the renewables will likely lead to the creation of regional energy communities, and owing to the intermittency of renewables, interdependence between neighbouring communities and countries will likely increase energy security with the potential of enhancing peace between the interconnected countries.
- With an increasing reliance on energy grids, they are likely to become "the most critical infrastructure" of the state, making them a prime target for cyber-attacks, which could shut down the whole country. However, seeing the rise of self-sustainable communities as the Energy communities in the EU or energy-independent households creates another layer of security as multiple units would have to be hacked to destabilise the system in the whole country.
- Critical minerals will play a pivotal role in the era driven by renewable energy. Consequently, legitimate concerns exist regarding whether these minerals may assume a comparable geopolitical significance to hydrocarbons. Nonetheless, the energy sector is also witnessing remarkable technological advancements and innovations, primarily focused on the creation of more resource-efficient and cost-effective technologies.

INTRODUCTION

Intergovernmental Panel on Climate Change (IPCC) special report from 2018 presents persuasive scientific evidence for the need to limit the global temperature rise to a maximum of 1.5°C (IPCC 2018). Staying below 1.5°C prevents irreversible changes and triggering of further typing points associated with the rise in global temperature (IPCC 2018; Lynas 2020). IPCC (2022) warns that 3.3 to 3.6 billion people live in settings vulnerable to climate change. With the world on track to reach 3°C by the end of the century (UNEP, 2019), the Earth would see an increasing number of areas being rendered uninhabitable and world supplies would be critically endangered (Lynas, 2021).

To limit the average global warming below 2°C, ideally to 1.5°C, the target set out by the Paris Climate Agreement, it is necessary to transition from carbon-intensive energy sources to renewable energy (Geilen et al. 2019, 38). As the analysis of Geilen (et al. 2019) indicates, energy efficiency and renewable energy will constitute the core elements of the energy transition. In this transition, predominantly electricity generated from solar and wind power (EIA 2022) will substitute for carbon-intensive fossil fuels, which currently account for approximately two-thirds of global GHG emissions (IPCC 2014). The share of renewable energy can grow to 63% of the total energy supply in 2050, which could, in combination with energy efficiency, decrease emissions by 94% - the target set out by the Paris Climate Agreement (Geilen et al. 2019, 47).

The characteristics of renewables in terms of geographical or technical character are fundamentally different from the currently dominant energy source - hydrocarbons (Scholten 2018, 1). Although intermittent, they are inexhaustible and ubiquitous. Furthermore, as transitions over a long distance prove uneconomical as they incur a significant energy loss, they will be more decentralised - regionalised (Hafner and Tagliapietra 2020). Finally, the technologies generating renewable technologies are dependent on rare earths and minerals (Hafner and Tagliapietra 2020, .ix). Fossil fuels rely on large centralised production and procession. They are easy to store and transport as there are no energy losses during shipping (Tomain 2017; Scholten 2018, 2). Such characteristics of fossil fuels have shaped the patterns of cooperation and conflict between countries (Scholten 2018).

This analysis will address the logical question that arises - will the switch to renewable energy provide fewer instances for states to use it as a tool of geopolitical influence?

I argue that the transition to renewables could provide fewer instances for states to use it as a tool of geopolitical dominance. It is important to note that this essay focuses on the end phase of the transition, which is the era when the dominant energy source will be renewables rather than the transition phase. The transition phase will likely bring geopolitical tensions (Rothkopf 2009; Westphal and Droege 2015; Westphal 2011), and as fossil fuels will still present a considerable part of the future energy mix (IRENA 2018), Yergin (2020) and Rothkopf (2009) note that in the foreseeable future, the oil-rich countries will still have considerable power. "The oil states will be rich, influential, and, paradoxically, in decline" (Rothkopf 2009). Therefore, it is viable to assume that in the transition phase, it is likely that hydrocarbons could still be used as a tool of geopolitical dominance as opposed to the end phase of the transition.

HYDROCARBONS

Contemporary geopolitics of energy is mainly associated with hydrocarbons, most importantly oil and gas, stemming from the fact that they are dominant sources in the global energy mix (Scholten 2018, 1). As BP's (2020) report indicated, coal, oil, and natural gas accounted for 83.1% of global energy consumption.

Characteristics of Hydrocarbons

The geopolitics of fossil fuels, revolving predominantly around oil and gas, can be ascribed to their specific natural characteristics. Firstly, they are finite and geographically concentrated - the amounts in which fossil fuels are economically feasible to extract are located only in a few places around the globe (Scholten 2018, 2). The extraction and processing are thus highly centralised. This leaves control over fossil fuels and effectively over 80% of energy sources to few actors, giving them leverage they occasionally used to pursue their foreign policy interests. Furthermore, as fossil fuels do not incur energy losses during transport and are easy to store, they could be shipped globally, therefore also the transport routes such as the Strait of Hormuz, through which 21% of global oil flows daily (EIA 2019), also present a tool of geopolitical dominance (Scholten 2018, 2).

Countries have intervened in oil and gas markets using it as a foreign policy tool (IRENA 2018). The first such use of oil as a geopolitical weapon occurred in 1973 during the Yom Kippur War when OAPEC imposed an embargo on countries supporting Israel in the conflict (Licklider 1988, 206). Subsequently, oil prices skyrocketed, leading to a global energy crisis (Encyclopaedia Britannica 2020).

Furthermore, the war in Ukraine in 2014 and the current conflict have exacerbated the dependence of Europe on Russia. Some countries, mostly the Eastern and Central European states, are fully dependent on Russia's energy supplies (Hockenos 2022). While sanctions were being pushed against Russia, the Energy sector was largely exempted. The EU and the US also resisted halting the SWIFT because it would be almost impossible to pay for Russian gas delivery (ibid.) Therefore, while war is still raging in Ukraine, Russian gas, although in limited amounts, is still flowing, and it is the European money that is paying the wages of Russian soldiers fighting in Ukraine. Hence Russian energy dominance has allowed it to pursue its foreign policy due to the excessive dependence of European countries on mostly gas and oil, as the harshest sanctions that could potentially hit the Russian economy even more, as shares from oil and gas account for approximately 40% of the Russian economy (Warsaw Institute 2020), could not have been fully applied (Harvey 2022). The recent invasion of Ukraine stressed the necessity of accelerating the transition to renewables which could increase European energy independence (Harvey 2022)

RENEWABLES AS A PRIMARY SOURCE OF ENERGY

Compared to an energy system based on hydrocarbons, access to resources is less important in a system powered by renewables, as they are virtually ubiquitous. In turn, for renewables, the distribution and infrastructure are crucial (Scholten and Bosman 2016). As Remap analysis (IRENA 2018) concludes, renewables will have to generate approximately 80% of energy globally to decarbonise the energy sector. If we are to abandon fossil fuels, everything needs to be electrified. As Scholten (2018) points out – electricity will assume centre stage as renewable energy overwhelmingly takes that form in supply and usage. This would then logically lead to increase electricity consumption, even in a degrowth world (Scholten 2018).

Characteristics of Renewables

One of the most significant liabilities of renewables, as opposed to fossil fuels, is their intermittency, meaning that the energy from renewables is not constant. Surely there will be various sources of renewable energy. However, EIA (2022) expects the sun (PV) and wind (Wind Turbines) to become the predominant "power generators", accounting for approximately 82% of renewable electricity generation.

As energy transport over long distances is not economically feasible due to significant power losses, as opposed to oil or coal, the electrification of energy systems will lead to the regionalisation of energy relations, shifting from the global to regional networks (Scholten and Bosman, 2018, p.308). Further, as renewables can operate in a much smaller production unit, thus on a lower scale level than fossil fuels (Criekemans 2018; Smith Stegen 2018) they present a more distributed system, which enables regionalisation (Scholten and Bosman 2018, 309).

Furthermore, due to the intermittency of renewables, there will likely be grid interconnectedness between countries (Scholten and Bosman 2018, 313; Overland, 2019, 38). The intermittency of renewables stems from their reliance on the weather. Thus, to cover up for the energy losses due to unfavourable weather conditions, increased mutual trade between neighbouring countries will likely take place (Arcia-Garibaldi et al. 2018; Kennedy et al. 2018; Fragkos et al. 2017; Overland 2019, 38).

The increasing importance of electrical grids and the interdependence caused by the intermittency of renewable energy have led some academics to argue that the energy transition will not reduce energy-related conflict (see Buijs and Sievers 2011; Capellan-Perez et al. 2017; Laird 2012; Rothkopf 2009; Umbach 2018). Firstly, Buijs and Sievers (2011) and Rothkopf (2009) argue that the critical materials necessary for PV or Wind Turbines could create dependencies on critical-mineral-rich countries - similar to the dependencies on fossil fuels.

Secondly, Guler et al. (2018) and Scholten and Bosman (2018) argue that the creation of "Regional Hubs" or "Grid Communities" will increase interdependence between countries and, therefore, peace and stability in the region. However, as Fischhendler (et al. 2017) contend, one state is always more dependent on the other in some cases. Hence the dominant state could potentially use the energy as a geopolitical weapon. Furthermore, O'Sullivan (et al. 2017) argue that countries that dominate electricity grids could potentially exercise undue control over the neighbouring countries. Thus, electricity cut-offs could become a foreign policy tool similar to oil and gas. However, the electricity trade is more reciprocal than oil and gas. While oil and gas flow in one direction, the electricity trade is two-way – when there are favourable conditions, the country is an exporter. When it is the other way around, the country becomes an importer (IRENA 2018, 51). On top of that, renewables help to diversify energy sources; therefore, all countries will have access to more than one source of energy source along with their own domestic production and will not likely be dependent on one state (IRENA 2018; Scholten and Bosman 2018, 309; Scholten 2018). Furthermore, thanks to the interconnectedness between neighbours, countries could swiftly switch to another source. Unlike during the Ukraine-Russia crisis in 2009, when the EU had limited options to substitute Russian gas as trade in gas requires fixed transportation infrastructure such as pipelines or LNG terminals and, as stated above, is less reciprocal than the renewables trade (IRENA 2018, 51-52). Ultimately, when the political risk of a particular energy supplier becomes high – it could lose its competitive edge over domestic production. Hence it could incentivise countries to develop national renewable energy sources, which is possible due to the abundance of renewable energy (Overland 2019, 38).

Another frequent argument on the geopolitics of renewable energy (see Umbach 2018; Stratfor 2018) claims that as grid infrastructures will be vital for national security, due to the electrification mentioned above, the grids could become a target for cyberattacks, which could have disastrous consequences. Accounts that stress the risks of cyberattacks on energy infrastructure refer predominantly to the cyber-attack on Ukraine in 2015 (Overland 2019, 38), which left 230,000 people without electricity for between 1-6 hours and was a first-of-its-kind attack setting a potentially ominous precedent for the security of power grids (Zetter 2016). This claim becomes even more pressing when we realise that the number of electrical grids will likely rapidly increase due to the increasing electrification.

However, firstly, it is important to mention that power grids are subject to frequent hacking attempts, with the Ukrainian case being the first significant and successful attempt (Overland 2019, 38). Secondly, looking at the Ukrainian case from a macro perspective, only 0.015% of Ukrainian electricity and approximately 0.5 % of its population were affected for a limited period of time (Overland 2019, 38; World Bank 2019). Further, as Van de Graaf (2016) and Overland (2019, 38) remark, this attempt succeeded due to numerous interlinked factors, such as the ageing Ukrainian infrastructure, which was insufficiently secured, along with exceptional possibilities of the Russian Federation because of the historical linkages through USSR. Furthermore, as the rising use of renewables would potentially lead to greater decentralisation (Scholten 2018), seeing the rise of self-sustainable communities as the Energy communities in the EU or energy-independent households may constitute another layer of security as multiple units would have to be hacked to destabilise the system in the whole country (Overland 2019, 38; Stratfor 2018).

Finally, the electrical grids have been secured digitally for a long time, with only one well-known success, which only lasted 1-6 hours (Overland 2019, 38).

CRITICAL MINERALS

When speaking of the energy transition, it is also necessary to consider the "enablers". The enablers of this transition are the 17 rare earth elements and minerals necessary for solar panels, wind turbines, batteries or EVs, which should replace vehicles powered by combustion engines. The World Bank estimates that the demand for the minerals required for solar panels - including copper, iron, lead, molybdenum, nickel, and zinc - could increase by 300% through 2050. If we include the materials necessary for EV and energy storage technologies, the demand for nickel will increase by up to 1,200%. The international community should stay on track to limit global warming to 2 °C (Arrobas et al. 2017).

The underlying assumption is that mineral reserves are finite similar to fossil fuels. Despite their name, rare earths are geologically widely dispersed throughout the Earth's crust (Lovins 2017). However, the availability of minerals in Earth's crust is not relevant to geopolitics (de Ridder 2013, 4). The mineral supply is limited because only a few countries can profitably mine these minerals. Furthermore, the mining itself is unsustainable.

Currently, the mining and processing of such materials into a "final product" is dominated by China due to its low-cost production costs well as lax environmental standards (Finamore 2021, 19), producing 97% of rare earth elements (de Ridder 2013, 2; Sternberg 2014). Thus, China has a promising position to leverage its mineral production as a tool for geopolitical dominance. The concerns began in 2010 when China imposed a rare earths embargo on Japan due to a territorial dispute when Japan detained a captain of a Chinese fishing trawler (Gholz 2014, 3). Japan is the largest consumer of rare earths in the world due to its high-tech industry and it is fully reliant on imports from China (de Ridder 2013, 5). Facing supply disruption, Japan swiftly released the Chinese captain (Gholz 2014, 3). This case indicates how strategic control over these minerals could become ever more crucial. Considering the World Bank's estimate of a 300% rise in materials required for the main "energy generators" - PV or Wind (Arrobas et al. 2017, EIA 2022), the monopoly over these materials could enable China to use them as a tool of geopolitical dominance.

The Abundance of Critical Materials, Market logic, Recycling

However, as mentioned above, most rare earths are geologically abundant in the Earth's crust. For instance, Cerium, a necessary element for EV (Chakravarty 2018), is more common than lead (Greenwood and Earnshaw 1997). Although they are expensive to mine, there has not been much demand until recently. With 98% of rare earth elements imported from China, the EU has rightly termed 23 as *critical resources* (European Commission n.d.) and invested over $2 billion into rare earth research, mining, production, and recycling (Behrmann 2021). With a similar percentage of imports of critical minerals from China and the announced $2 trillion Climate plan of the Biden administration, the US has also started investing in rare earth research (Subin 2021).

The energy transition is accompanied by technological breakthroughs and developments, with one of the main aims being the development of technology which uses fewer and cheaper materials. This is demonstrated by the reduction in the material intensity of several rare earths, such as neodymium, dysprosium, germanium, and others in clean energy technologies (Moss et al. 2013). It is almost certain that this tech innovation will continue (Overland 2019, 37-38), and conflicts over the minerals could further accelerate it. In 2010, the Sino-Japan conflict not only made companies discover ways to alter their products to require fewer rare earths but also triggered technological innovation (Gholz 2014, 3-8). For instance, dysprosium is a rare earth element used in substantial quantities in power trains for electric vehicles. Concerns about material shortages have led companies such as Hitachi to develop low-dysprosium magnets or Molycorp to develop dysprosium-free magnets (Gholz 2014, 8; Witkin 2012).

Furthermore, mining technologies have been evolving – increasing efficiency, lowering the costs of mining as well as reducing its environmental impact (Gholz 2014, 10). For instance, Molycorp's reopened mine uses new technologies that increased the purity of extracted rare earth products, substantially reduced the environmental impact of mining and subsequent processing, and ultimately drastically lowered production costs compared with the past (ibid.). These cases show how the shortages could push for innovations and mines that lower dependence on the dominant producer of rare earths and minerals.

Furthermore, with the increases in demand for rare earths well before 2010, projects in rare earth mining attracted investor interest which was further accelerated by the 2010 surge in rare earths prices due to the conflict between China and Japan (Gholz 2014, 4; Sternberg 2014). The increased investor interest could lead to new mines and thus again weaken China's grip on the critical minerals (Gholz 2014). Further investments into the sector were incentivised in 2011 when China announced export restrictions on rare earths, officially under the guise of environmental protection, leading to a global increase in the prices of rare earths. The leaked Pentagon report in 2014 shows that China's share in global production decreased from 95% in 2010 to 80% (ibid.). China's advantage was already diminishing due to normal market behaviours. However, the embargo on exports to Japan has spurred further investors and companies to invest in rare earths. As Lovins (2017) rightly contends: "Rare earths are simply another commodity - unusual, significant, but unable to transcend the realities of economics, innovation, and trade."

Finally, the substantial difference between fossil fuels and critical minerals is that the latter could be recycled. Again, when China announced export restrictions on rare earth elements, the recycling rates increased (Habib et al. 2015, 852). Recycling remains expensive, with approximately 1% of rare earths recycled in 2011 (Saleem 2014, 128) and 1-5% recycled in 2020 (Babbitt in Rao 2022).

Considering the previous figures and despite the remarks of some that recycling could account for 25% of the rare earths market (Kinch 2021), it is difficult to predict whether the recycling of rare earths will increase. However, with the right incentives, recycling could potentially significantly lower the geopolitical supply risk, as recycling is not fixed to a particular geographic location. Hence recycling could prove profitable to countries with no significant reserves of rare earths feasible for extraction and, at the same time, vulnerable to supply cut-offs (Habib et al. 2015, 855).

CONCLUSION

This essay argued that the transition to renewable energy will provide fewer instances for states to use it as a tool of geopolitical dominance. Owing to its characteristics as ubiquity would lead to the decentralisation of production and thus to regionalisation. Furthermore, the intermittency of renewables is likely to create interdependencies between countries, which should contribute to peaceful relations among them. This argument was challenged because, despite the interdependency between countries, one country is still dominant in some respects and could potentially cut off the supplies, using the energy source as a tool of geopolitical dominance. However, even if such a situation occurs, the "subservient" country could either opt for its own resources to generate electricity or import it from another source due to ubiquitous renewable energy.

With the electrical grids becoming vital for national security, cyberattacks could pose a threat. This claim was refuted because of the low success of cyberattacks against energy infrastructure, as demonstrated in the case of the Russian cyberattack on Ukraine in 2015. Further, the decentralised energy infrastructure presents another layer of security.

However, with the increasing number of solar panels, wind turbines and EVs, the demand for minerals and rare earths would increase by 1200%, according to the WB projections. This would put countries with an abundance of rare earth mines and production in a dominant position vis-á-vis the rest of the world. It was established that China would, in the short term, assume a dominant position in rare earth and mineral production. However, in the long term, the vision of profitability could potentially lead to new sources of these critical materials. With R&D, the material intensity should decrease, and, on the other hand, the economic feasibility of recycling should increase. As proved above, every crisis concerning the shortage of minerals or rare earths provided incentives to decrease dependence on China through new sources or technological breakthroughs. Therefore, while in the transition phase, the critical minerals could be used as a tool of geopolitical dominance, in the end, phase, the power of this tool should weaken. It can be argued that the era of renewable energy will not only help us preserve the planet but it could also provide greater independence for countries in terms of energy security, which is a perk that can spur policymakers to accelerate the transition to renewable energy.

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