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The Impact of Energy Transition on the Geopolitical Importance of Oil-Exporting Countries

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Abstract: With the changes that have taken place in energy-related technologies, the United States has been less affected by the geopolitical risks associated with the supply of fossil fuel energy resources, especially crude oil. When the price of oil is low, the geopolitical situation of U.S. energy contrasts with that of other oil-producing countries, which are facing financial pressure due to low oil prices and a high domestic energy demand. Many other countries have been supplying crude oil compared to half a century ago, reducing the strategic importance of major oil exporters, such as key OPEC members in the Persian Gulf. The shale oil revolution in the United States and the transition of energy in countries around the world to more sustainable energy sources, especially renewable energy, have reduced the importance of security in the Arab states of the Persian Gulf for U.S. politicians, which will be intensified in the future. Especially from the middle of the Carter administration period, U.S. politicians saw the security of the Arab states of the Persian Gulf as a prerequisite for securing energy supplies for the U.S. economy, but that has changed. Despite the disruption of Russia's fossil fuel energy supply, as one of the main energy suppliers, due to sanctions from February 2022, the global energy carriers' prices are relatively under control. Energy transition is one of the main contributors to lowering the impact of fossil fuel energy supply disruptions on the global economy.

Keywords: energy transition; energy geopolitics; U.S. energy security; renewable energy; electrification; climate change

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1. Introduction

Because of the Western lifestyle and the Western economic structure requirements and their dependence on crude oil supply, U.S. politicians in the 1960s and 1970s believed that U.S. economic prosperity depended on the guaranteed access to Persian Gulf crude oil. In his annual State of the Union Address, Carter stated the principle that the Persian Gulf was the place the U.S. wanted to fight for. This is how the Carter Doctrine was unveiled. According to this doctrine, the United States pledged to be ready to protect the Persian Gulf oil fields from any threat. It acknowledged that the security of the Arab states of the Persian Gulf was of paramount importance to the United States. Subsequent U.S. presidents from both parties followed this policy, and the U.S. defined its role in protecting Persian Gulf oil exports [1]. Before the collapse of the Soviet Union, the geopolitical risks to U.S. oil security were high. The United States was heavily dependent on oil imports from the Persian Gulf, so the threat of a halt to crude oil sales by its producers was high. Following the proclamation of the Carter Doctrine, during Reagan's presidency, the Pentagon established the U.S. Central Command (CENTCOM) and gave it the task of overseeing Middle East operations. The Bahrain-based U.S. Navy Fifth Fleet was responsible for providing security in the Persian Gulf. The U.S. government annually spent billions of dollars to maintain the Carter Doctrine and the security of the Arab states of the Persian Gulf after the declaration of the Carter Doctrine [2]. However, the collapse of the Soviet Union in the early 1990s

changed the geopolitical landscape and dramatically reduced the geopolitical risks of cutting oil exports to the United States. The demand for U.S. crude oil imports from the Persian Gulf region decreased, and therefore, the geopolitical importance of these countries to the United States diminished. Thereafter, the Carter doctrine was weakened in practice. Also, recent events have shown that energy transition has changed the energy supply and demand structure and has lowered the impact of energy supply disruptions to the global economy, such as the recent disruption due to heavy sanctions on Russia, one of the main fossil fuel energy suppliers.

The relationship between renewable energy and geopolitics was studied by Vakulchuk et al. [3]. It was concluded that fossil fuel exporters will be the biggest losers of energy transition. On the other hand, renewable energy resources will overall help peace and global security. Also, Scholten et al. [4] concluded that there will be a positive disruption to international security due to energy transition. In another study, Scholten and Bosman [5] concluded that renewable energy sources have important technical and geographical characteristics, such as the availability of at least one renewable energy resource in every region of the world, the intermittent nature of renewable energy sources, and rare material requirements for power generation.

In this paper, the importance of the security of the Arab countries in the Persian Gulf and the geopolitical importance of these countries to the United States, mostly in the context of energy transition, will be analyzed. This paper will focus primarily on (I) the significant increase in U.S. crude oil production as a result of the shale oil revolution over the last decade, (II) the geopolitical ramifications of the geological diversification of the world's oil producers and consumers, and (III) the requirements of climate change policies, the development of renewable energy technologies (the economization of solar and wind energy technologies and their raw material needs), and the development of light-duty electric transportation.

2. Persian Gulf Security

"Carter Doctrine" is a term used in U.S. policy referring to maintaining Western dominance in the Persian Gulf. This dominance has been essential for the non-stop export of crude oil from the region [6]. In his 1980 State of the Union Address, Jimmy Carter referenced the Carter Doctrine: "Let our position be absolutely clear: An attempt by any outside force to gain control of the Persian Gulf region will be regarded as an assault on the vital interests of the United States of America, and such an assault will be repelled by any means necessary, including military force" [6].

In this speech, the Persian Gulf region was referred to as "two-thirds of the world's exportable oil source," and the United States was committed to maintaining "the security of this vital region" [6]. U.S. imports of crude oil from the Arab states of the Persian Gulf have not been the only reason for the U.S. alliance with Saudi Arabia and other GCC countries, or the United States' interest in maintaining a significant military presence in the Middle East, especially in the Persian Gulf. Before the collapse of the Soviet Union, Saudi Arabia and other GCC countries were important financial and ideological allies of the United States' cold war against the Soviets, especially in Afghanistan. Although the strategic areas of this cooperation diminished with the collapse of the Soviet Union, the Carter Doctrine remained intact.

By continuing to export oil to the United States at a reasonable price, Saudi Arabia prevented the crude oil market from being disrupted due to political tensions in other oil-producing countries and due to other supply disruptions. Recently, the military capabilities of the GCC countries, especially Saudi Arabia and the United Arab Emirates (UAE), have improved. However, these local armies alone cannot guarantee the maritime transportation security of LNG and crude oil and its products through the Strait of Hormuz.

The crude oil pipelines developed in the UAE to the Oman Sea and Saudi Arabia to the Red Sea have vulnerabilities. The United States has benefited greatly from deploying U.S. forces at bases around the Persian Gulf, many of which have nothing to do with the

Carter Doctrine. These benefits include supporting U.S. forces in the Middle East and North Africa (MENA) region and overseeing the activities of the countries in the region [7]. The U.S. domination of offshore oil pipelines allows it to exert power over its producers and importers [8]. Nevertheless, in the American political sphere and at the Middle East and world levels, some believe the U.S. is downsizing forces in the region. There are differing views on whether the almost complete withdrawal of the United States can be achieved without compromising U.S. oil security or global oil security. This setback can significantly reduce the cost to U.S. taxpayers [2]. Due to the global nature of the oil market, the security of Persian Gulf fossil fuel producers and the continuity of their supply to the global energy markets are still the U.S. government's priority to prevent the world crude oil prices from significantly fluctuating. The increase in U.S. oil security weakens the geopolitical importance of the Arab countries of the Persian Gulf.

The notable factors in this regard include the availability of new resources such as shale oil [9], the role of climate policy [10], the economization of renewable energy [11] and the electrification of final uses such as light transportation [12] (as the main drivers of crude oil demand), the geographical diversification of supplying countries, the increasing global supply of crude oil and its small-scale investment need, and the rapid return on the investment of shale oil [13], which all reduce the geopolitical importance of the GCC monarchies as major exporters of crude oil. Figure 1 shows the critical oil transit routes around the world.

Currently, the Strait of Hormuz, the Strait of Malacca, the Cape of Good Hope, the Suez Canal, and Bab al-Mandeb are of the greatest geopolitical importance among the important oil passages, respectively. As global crude oil demand declines in the 21st century, the geopolitical importance of many of these corridors to U.S. energy security will diminish. The United States has the motivation, financial, and logistical capacity to secure the Persian Gulf and the Strait of Hormuz. Only China can pay for strategic security in the region by monitoring its oil trade. However, China is still reluctant to accept the role that the U.S. military is currently playing in the region for the security of the Arab states of the Persian Gulf [14].

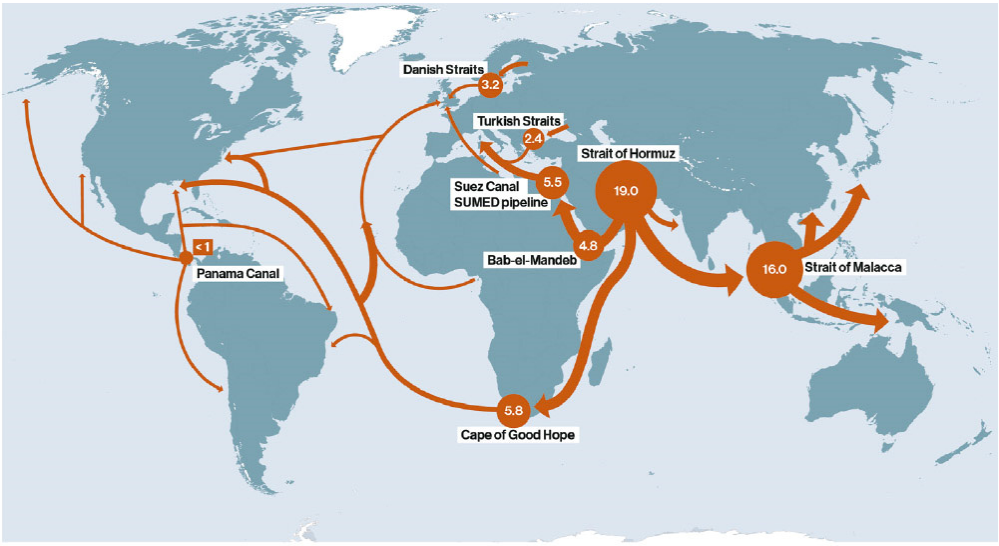

Figure 1. Strategic oil transfer straits [15].

3. Impact of Technological Change and Energy Transition on Energy Geopolitics Worldwide

3.1. Predicting Fossil Fuel Demand in the 21st Century

With the changes in the production, transmission, and use of renewable energy, the demand for fossil fuels, oil, coal, and natural gas will reach its maximum in the next few years. By contrast, changes in the production and technologies of renewable energy will

increase the demand for renewable energy in the 21st century (Figure 2), which will have geopolitical and economic consequences for oil-exporting countries, especially the Arab countries of the Persian Gulf. Also, dependencies will be created for countries that supply the raw materials for renewable fuels, as discussed in Section 4.

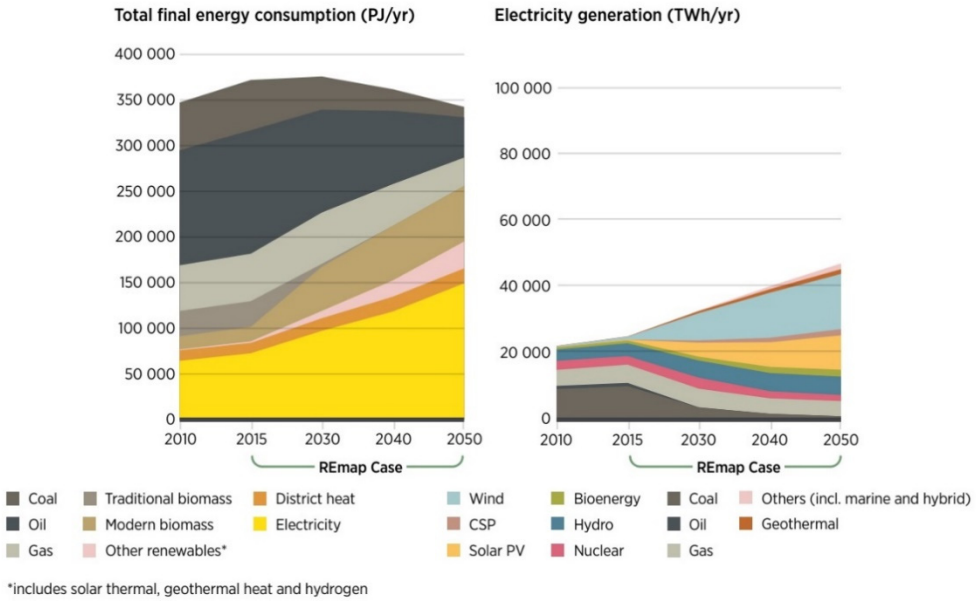

Figure 2. IRENA's prediction of fossil fuel and renewable energy demand by 2050 [16].

Demand for crude oil has not increased in developed countries such as the United States in recent years due to increased end-use efficiency and low economic growth. Given the population of developing countries and the strong prospects for their economic growth, global oil demand is still rising [10]. However, many recent predictions by reputable institutions predict the onset of peak global oil demand in the near future. These predictions suggest that the stimulus for future oil demand will shift to developing countries, especially China and India, over the next few decades. McKinsey predicts that global oil demand will slowly increase, at least until 2035, due to the high economic growth and growing population of developing countries. Rystade, BloombergNEF, and OPEC predict that peak oil demand will be reached in 2028, 2035, and 2040, respectively [10].

3.2. Solar Energy Potential Worldwide

The use of solar energy in an area is highly dependent on the amount of radiation and other factors. Figure 3 demonstrates the amount of sunlight in various parts of the world. As observed, the countries closer to the equator have a higher potential for using solar energy. The geographical distribution of regions with high sunlight is very high, so it does not bring strategic importance to a specific country. As shown in Figure 3, solar radiation is significant in most parts of the United States, and the country has adequate solar energy sources. An important consideration about using solar energy and changing the global energy paradigm is to make it economical and competitive in price compared with fossil fuels. However, these will create new dependencies on raw materials for solar energy equipment that will have global geopolitical implications (see Section 4) [17].

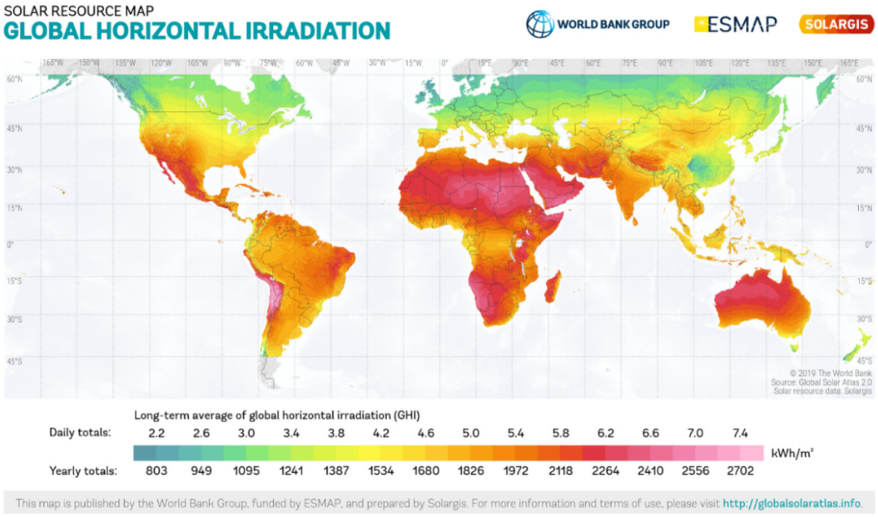

Figure 3. Global horizontal irradiation [18]. Note: Map obtained from the Global Solar Atlas 2.0, a free, web-based application is developed and operated by the company Solargis s.r.o. on behalf of the World Bank Group, utilizing Solargis data, with funding provided by the Energy Sector Management Assistance Program (ESMAP). For additional information: https://globalsolaratlas.info (accessed on 3 August 2022).

3.3. Wind Energy Potential Worldwide

Figure 4 shows the potential for the use of wind energy worldwide based on wind speed. As the figure suggests, wind energy, like solar energy, has a wide geographical distribution and, unlike many fossil fuel energy sources, is not limited to a few specific regions worldwide. The important point about using wind energy, which changes the global energy paradigm, is to make its price more competitive than that of fossil fuels. However, new dependencies on raw materials for wind energy equipment will be created that will have global geopolitical implications (see Section 4) [17].

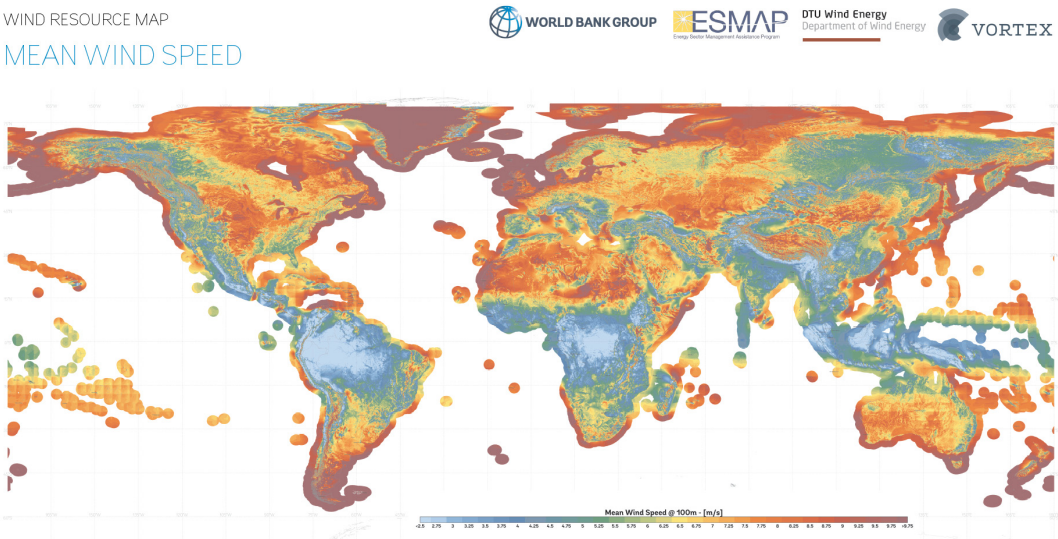

Figure 4. Wind energy potential worldwide (mean wind speed) [19]. Note: Map obtained from the Global Wind Atlas 3.0, a free, web-based application developed, owned and operated by the Technical University of Denmark (DTU). The Global Wind Atlas 3.0 is released in partnership with the World Bank Group, utilizing data provided by Vortex, using funding provided by the Energy Sector Management Assistance Program (ESMAP). For additional information: https://globalwindatlas.info (accessed on 3 August 2022).

3.4. Countries' Dependence on Oil Imports—Patents in the Field of Renewable Energy

Figure 5 shows the number of patents of fossil-fuel-exporting and -importing countries on renewable energy. As the figure suggests, China, the United States, the nations in the European Union, and Japan are the leading countries in strengthening their technological foundations in renewable energy. By developing these technologies in the medium-term and providing the necessary infrastructure, these countries will reduce their geopolitical dependence on major oil-exporting countries.

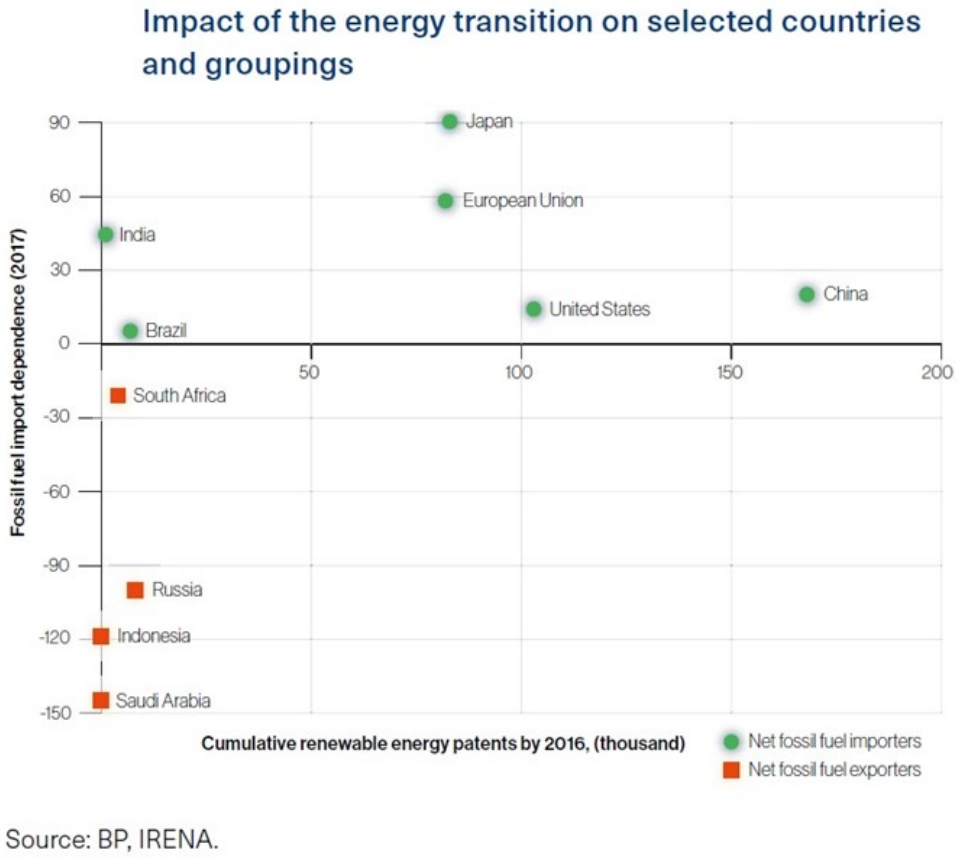

Figure 5. Renewable energy patents in fossil fuel-importing and exporting countries [15].

3.5. Development of Electric Transportation

Due to the historical role of petroleum products, such as gasoline, diesel, and jet fuel as the dominant transportation fuel, there has long been a significant relationship between energy and oil security in transportation. Therefore, energy security policies have always avoided global economic fluctuations due to unexpected geopolitical disruptions in crude oil supplies or a sudden increase in crude oil prices. The United States is less vulnerable to geopolitical threats on the international oil markets as the United States' transportation sector has become less dependent on petroleum products due to increased efficiency and the development of alternative-fuel vehicles [12]. Reducing the risk of geopolitical issues in the oil market will not entail the end of U.S. geopolitical energy risks, as new geopolitical risks related to renewable energy raw materials will inevitably arise. These hazards are related to minerals used in batteries and power grid security concerns [17]. With the development of technologies related to light-duty transportation with alternative energy sources, including electric vehicles, fuel cells, and hybrids, the long-term importance of oil as the main transportation fuel in the world will be challenged, at least in light-duty transportation, and the demand for the global oil supply will be reduced [12]. Electrification in different sectors of the economy is predicted to grow by 2050 (Figure 6).

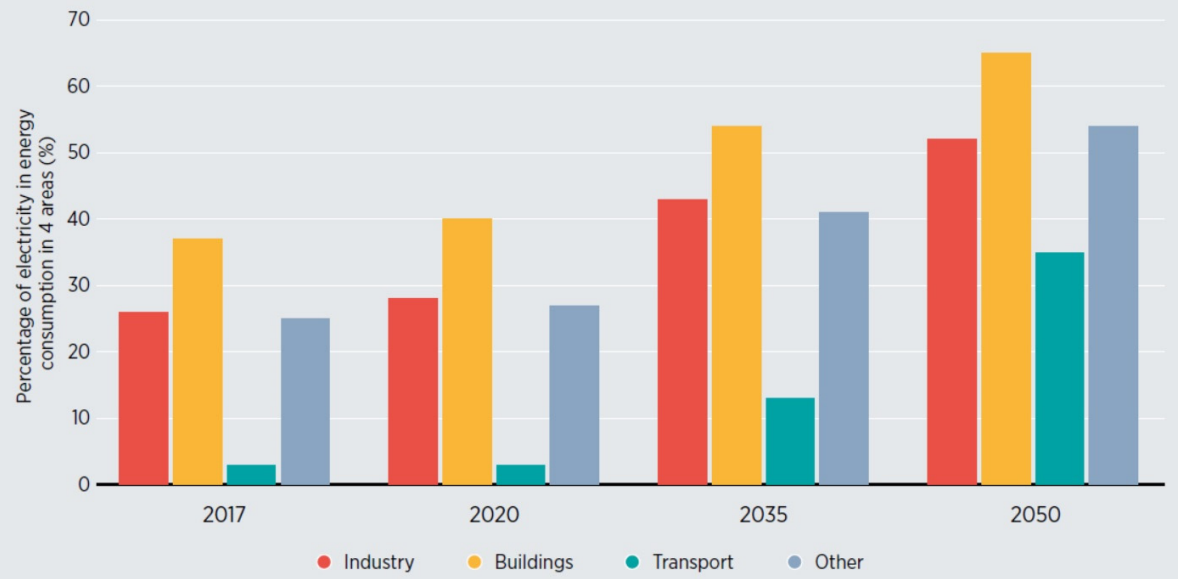

Figure 6. IRENA's forecast of electrification rate of different sectors by 2050 (Electrification Scenario) [20].

Overall, with increasing concerns about climate change due to greenhouse gas emissions, the pressure to use alternative energy sources and increase the efficiency of fossil fuels have increased. This will increase energy security in the world and the United States [12] and reduce the geopolitical importance of oil resources for governments worldwide, especially that of the United States.

3.6. Influence of Climate Change Policies

Oil cannot be excluded from the future energy portfolio due to the long time required to develop suitable alternatives and integrate them into the light transportation sector's infrastructure and the use of petroleum products in heavy transportation such as aircraft and ships. More than 90% of the world's transportation services are based on petroleum products [21,22]. According to this, the United States is expected to continue to rely on oil markets in the foreseeable future. As a result, it is vulnerable to geopolitical risks, such as oil price volatility.

In the past, renewable energy was only seriously considered when oil prices rose [23]. Now, by charging a carbon tax, most governments are trying to introduce costs related to greenhouse gas emissions in the economic calculations of emitters, increasing the cost of using oil.

3.7. Quick Return on Investment in Shale Oil Extraction

A unique feature of shale oil compared with traditional crude oils is its small-scale investment and short-time extraction cycle [13]. It can reduce grounds for political interference, especially in areas where geopolitical interference and unrest prevent proper production.

4. Changes in the Trade of Fossil Fuels and the Raw Materials Required for Renewable Energy Worldwide

4.1. Percentage of Regional Trade in Fossil Fuels to GDP

Figure 7 shows the percentage of fossil fuel trade in total regional trade in different parts of the world. As seen in this figure, the fossil fuel trade is much more important in the economies of the Middle East compared with those in North America. The price fluctuations of fossil fuels can impose significant pressure on the economies of the Middle East. By contrast, the price fluctuations of fossil fuels in the economies of North American countries, especially the United States, are more tolerable.

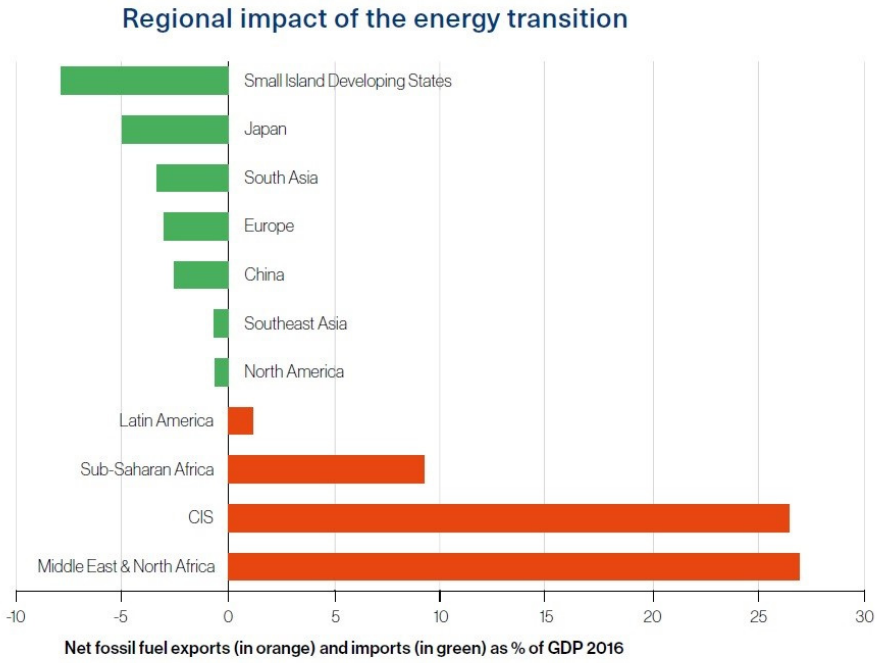

Figure 7. Percentage of regional trade in fossil fuels to GDP [15].

4.2. Changes in Global Oil Production by Country (2006–2018)

Figure 8 is based on the data from the British Petroleum report [22]. The figure shows the changes in crude oil production in different countries from 2006 to 2018. According to the figure, the United States has had the largest increase in crude oil production, followed by Iraq, Canada, Russia, and Saudi Arabia.

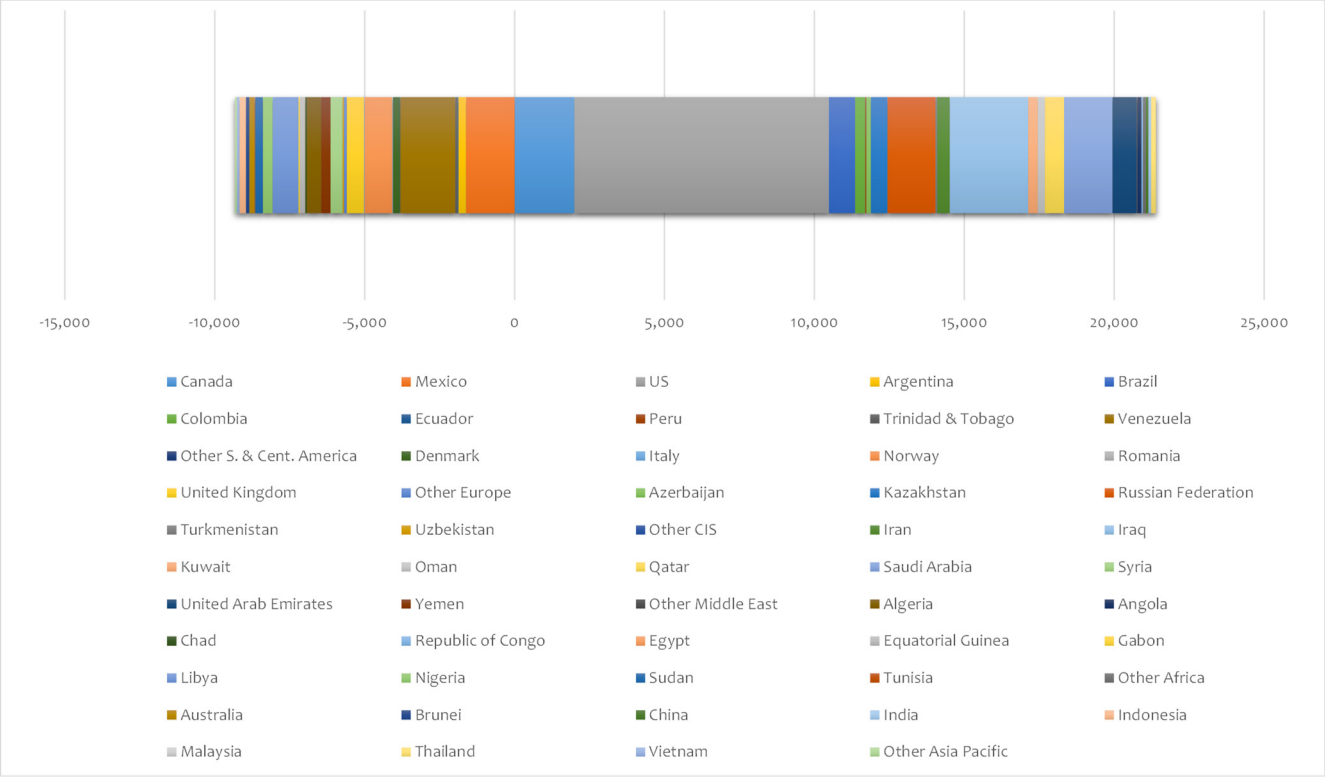

Figure 8. Changes in global oil production by country in 2006–2018 (data were collected from [22]).

4.3. Changes in Global Oil Demand by Country (2006–2018)

According to Figure 9, in the period from 2006 to 2018, the demand for crude oil in the countries of China, India, and Saudi Arabia showed the highest increase. By contrast, the demand for crude oil in most countries, especially the United States, did not significantly changed. The geopolitical importance of the Persian Gulf countries increased for China and India, and stable crude oil prices became more important for these countries. At the same time, Saudi Arabia became the third country with the highest growth in oil demand. This means that much of the country's crude oil export capacity is dedicated to domestic use.

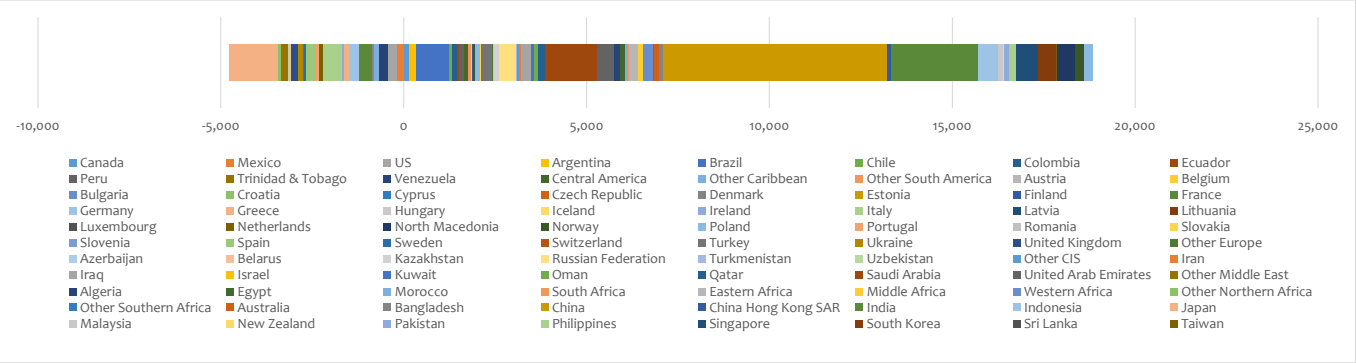

Figure 9. Change in global oil demand by country, 2006–2018 (data were collected from [22]).

4.4. Diversifying Global Oil Supply (1968–2018)

Figure 10 shows the major changes that have taken place in crude oil production and supplier diversity over the last 50 years. The supply of crude oil has increased from about 41 million to 95 million barrels per day. Also, during this period, the number of major crude oil producers has significantly increased, which has reduced the geopolitical importance of each of these oil suppliers and has led to a wider geographical distribution of these countries.

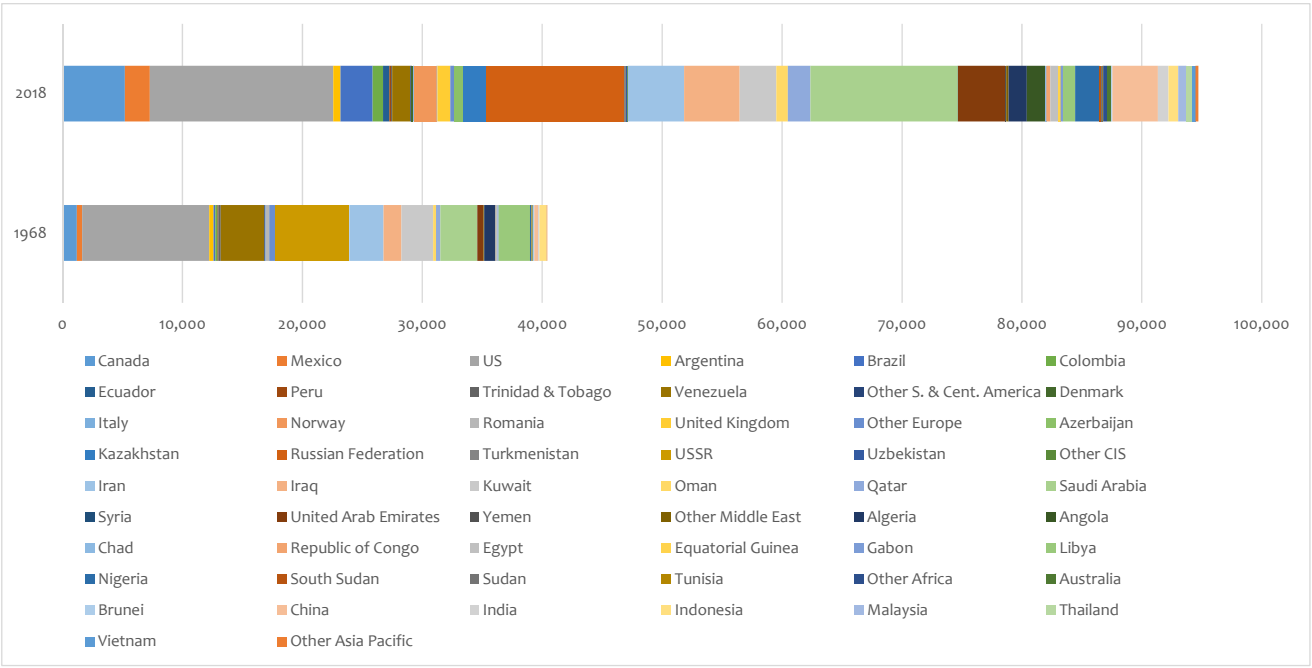

Figure 10. Diversification of global oil supply (data were collected from [22]).

4.5. Raw Materials Needed for Clean Energy

As the use of renewable energy increases, the demand for other raw materials will develop, and the geopolitical importance of the countries of origin of these raw materials will also increase (Table 1) [17]. This importance, like fossil fuels, is not exclusive and is scattered in different geographical areas. Another difference between fossil fuels and these raw materials is their use. Fossil fuels are often used in the day-to-day operation of energy systems. Still, renewable energy's raw materials are usually used to build the equipment related to renewable energy resources.

Table 1. Required raw materials for the production and consumption of clean energy [15,17,24].

	Solar Energy Technologies	Wind Energy Technologies	Electrical Vehicles/ Energy Storage	Major Reserve Holders
Cobalt		✓	✓	Congo, Australia, Cuba, Philippines
Copper	✓	✓	✓	Chile, Australia, Peru, Mexico
Lithium			✓	Chile, China, Australia, Argentina
Manganese		✓	✓	South Africa, Ukraine, Brazil
Nickel	✓		✓	Australia, Brazil, Russia, Cuba
Rare Earth Elements		✓	✓	China, Brazil, Vietnam, Russia
Selenium	✓			China, Russia, Peru, USA
Silicon	✓		✓	Australia, Brazil, Canada, China, Russia, South Africa
Silver	✓			Peru, Australia, Poland, Russia
Tellurium	✓			China, Peru, USA, Canada

5. Conclusions

The energy transition from fossil fuels to clean and sustainable energy is a changing force in global geopolitical equations and relations. As oil demand grows in developing countries such as China and India, oil trade flows will continue, uniting oil producers in the Persian Gulf with consumers in East and South Asia. Reducing dependence on oil imports from the Middle East and the geographical diversification of crude oil supplies have reduced U.S. strategic interest in the Persian Gulf and, in effect, have undermined the Carter Doctrine. With the technological and economic changes that have taken place in recent decades, it is no longer just the security of oil supply that is important, but also the security of demand for producers, and that an oil producer can use its underground wealth in the long run. There is a fear among fossil fuel producers that future climate treaties will prevent them from extracting these resources. However, the growth of oil demand in China and India has caused the effect of stagnant fossil fuel energy demands in Western countries to be felt with a delay in the global oil market. The set of factors listed in Sections 3 and 4 seems to contribute to the security of energy supply in the United States now and in the future. The age of fossil fuels is coming to an end, and it will end before the

supply of fossil fuels is depleted. There are various reasons for the end of the age of fossil fuels, including significant techno-economic progress in renewable energy technologies and the need to lower GHG emissions and thus decrease the fossil fuel demand in the 21st century. Another significant event is the significant changes that have taken place in the field of crude oil production. More countries, especially the United States, have found a significant share in the global oil market, and the market share of the Arab countries in the Persian Gulf has decreased. That is why halving Saudi crude oil production in 2019 due to the attack on the country's oil facilities only affected global oil markets for a short time and led to a relatively short-term price increase. These issues will have significant geopolitical implications, meaning a weakening of the Carter Doctrine to oblige U.S. governments to maintain the security of the Arab states of the Persian Gulf region. Also, energy transition has mitigated the effect of the energy supply disruption caused by heavy sanctions on Russia, one of the world's primary fossil fuel energy suppliers.

In contrast to the current trend in energy markets, energy transition will continuously improve the security of the energy supply in the United States and most countries. Despite a sharp decline in U.S. dependence on oil imports, due to the global nature of the oil market, the U.S. economy will be subject to changes in crude oil prices. Global trends have reduced the Persian Gulf states' disproportionate influence on the United States' energy security and, consequently, the region's geopolitical importance to the USA. Also, increasing the domestic demand for fossil fuel energy in the oil-exporting countries of the Persian Gulf will lead to their lower exports and less presence in international markets, which further reduces the geopolitical importance of these countries.

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