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# New Technologies and the Geopolitics of the Global Oil Economy in the Age of Energy Transition

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**ABSTRACT**

Currently, the global community is on the threshold of a transition from fossil fuels as a result of transformations such as climate change, entailing the strict implementation of carbon setoff policies and quick progress in green technologies. A transition to clean, low-carbon energies will not only disrupt the global energy system, it will also impact the global economy and political dynamism within and without all states. Based on these transformations, the present article asks the question of how the energy transition will impact the geopolitical future of the global oil economy. The authors hypothesize the following in answer to this question: Given the superior, more advanced position of economic powers such as China and the US in clean energy technologies, we are likely to witness the weakening of traditional oil powers in a post-carbon world, such as the Middle East and North African countries (MENA) and Russia; in contrast, the balance of power will tilt heavily towards current energy consumers. Technology-savvy countries have the knowledge to reproduce and stabilize their power in the global economy. The traditional countries of the energy sector, however, face shortfalls in their infrastructure and modern technologies and will lose their geopolitical position to a large extent.

## 1. Introduction

Today, great efforts are directed towards a move to clean energies. A transition to a post-carbon era is looking increasingly possible, especially after the 2015 Paris Climate Agreement in which over 195 countries committed to preventing a rise of more than 2℃ in the earth's temperature in the present century. The global community aims to reach a steady phase of net zero carbon dioxide emissions by 2050, or shortly thereafter.

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Countries are committing to an energy transition at a time when the world is still 85% dependent on fossil fuels for its energy supplies. Nevertheless, climate change and political pressures are driving the international community towards low-carbon energy sources. As such, many technology-savvy counties have adopted policies to replace fossil fuels. The EU, China, Japan, and the US have made great investments in clean fuels. As a result, fundamental changes in the global energy system are forecast, which will impact nearly every country with widespread geopolitical outcomes. The present article asks how the energy transfer will impact the geopolitical future of the global oil economy. Given the existing macro trends, the theory of this article can be set out as follows: Significant progress in clean fuel technologies will reduce the world's dependence on oil, natural gas, and coal to a large degree in the decades to come. Apart from having a huge impact on the global economy, the transition will also greatly affect the geopolitics of global energy. China, and to a certain extent the US, are the likely winners of this huge change. On the other side, Russia and the traditional petroleum powers in the Middle East and North Africa will be the great losers. To elucidate this theory, the trend analysis technique has been used. To this end, by identifying the macro trends in the energy market, efforts are made to analyze the world's geopolitical future during the transition period. The article comprises three parts. The first part includes a conceptual framework which can serve as an input to analyze future trends in the global energy market and its geopolitics. In the second part, the authors have tried to use influential macro trends impacting the future of the energy market to trace the geopolitical landscape of energy. Finally, in part three, the future of global geopolitics in the energy transition era will be discussed. To this end, the station of actors such as China, the US, Russia, the EU, and MENA will be analyzed. In the final part, the outcome of tracing such changes in this landscape will be explained with the trend analysis technique.

## 2.Conceptual Framework: Knowledge and Power as the Structures of the International Political Economy (IPE)

Technology has always played an important role in the global community's economic, political, military, and cultural development. Human society has successfully continued to improve production and development in the global economic system with modern technology. This technology has brought about unprecedented change in economic prosperity and has improved the lives of billions of people when, all the while, also extending the scope of global destruction and armed conflict by manifold. Prime examples of this are nuclear weapons and cyber warfare. Regrettably, many technologies have had significant, and rather unwanted, side-effects, such as environmental pollution, global climate changes, and loss of biodiversity. Technology has ceaselessly shaped the structure of the global system, its actors, and their interactions, and vice versa. Even so, the role of technology as a powerful factor in explaining changes in global affairs has remained understated. Technology has often been seen implicitly as a passive side factor in theories of international relations and international political economy. But at the same time, the evolution of technology has diverse implications on global affairs.

Among analysts of international relations and international political economy, Susan Strange has paid special attention to the role of knowledge in political and international changes. She argues that exerting relational power - the ability to force someone to do something they would not otherwise do – is far less effective than exerting structural power. She considers structural power as the ability to shape and set out the structures of the global political economy within which other countries, their political institutions, economic entities, and (most importantly) their scientists and other experts must work. Structural power has more meaning beyond setting agendas for the discussion or design of international regimes, laws, and customs, which are meant to manage international economic relations. Structural power, in short, is the power of decision-making on how to get things done, the power to shape frameworks within which countries interact with one another, with the people, or with large, relevant corporations (Strange, 1994: 24-25). Based on Strange's conceptualization of structural power, the role of knowledge and technology in the future of the international economy, especially in the energy sector, can be assessed.

Susan Strange considers four dimensions for IPE: security, production, finance, and knowledge. Strange states that none of these dimensions necessarily supersedes another in advance; rather, the importance and superiority of each one must be recognized in terms of historical context and fabric. All the resources of structural power are interconnected; in other words, what takes place in one structure impacts events in the other structures. The domination of one structure means the domination of its logic over the other structures. For instance, at the time when production was the dominating factor (mostly in the 20th century), research and development was seen as an input for the manufacture of new goods. With the domination of knowledge and technology in the 21st century, this is no longer just an input but has turned into a product to buy and sell (Breznitz, 2007).

Strange reiterates that the power of knowledge on international political economy has been ignored or less noticed. To a certain extent, this is due to the fact that knowledge is linked to beliefs, cognitive matters (what is understood or imagined), and the channels through which knowledge and beliefs are transferred or limited. Therefore, assessing its role and effect is difficult. The importance of the structure of knowledge in power is as great as the power to deny knowledge, exclude others, or transfer knowledge (Strange, 2015: 115). The framework presented by Strange presents an integrated and convincing theory on the position of knowledge in IPE. The elements of her theory help us to explain changes in the international power structure by considering the variable of technological progress. By relying on the capability of the mentioned conceptual framework, structural changes on various economic, political, and security levels can also be assessed in their broader sense which encompasses the ecosystem, environment, and energy sector.

## 3.New Innovations in Energy Technologies:

### 3.1.A Step Towards Energy Transition

Energy transition is a major structural change in the energy system and refers to changes in the global energy sector, from the production and consumption of fossil fuels – including oil, natural gas, and coal – to renewable energy sources such as wind, sun, and also lithium-ion batteries. "Energy transition" is a very important provision of the 2015 Paris Climate Agreement in which over 195 countries committed to preventing a rise of more than 2℃ in the earth's temperature in the present century and to making efforts to limit the temperature rise to under 1.5℃ compared to its pre-industrial level. In the agreement, countries undertook to reach a steady phase of net zero greenhouse gas emissions by 2050, or shortly thereafter – an objective which has already been accepted by the EU, UK, and Japan.

The main driving forces of energy transition include the increasing use of renewable energies in the combined energy supply basket, better supply of power, and improved energy storage. Reaching the objectives of the energy transition era may be time-consuming and difficult, but existing macro trends give a clear picture of the future. A future driving force for the future of global energy is the development of new technologies in the renewable energy sector. This factor, alongside more global awareness of the negative effects of using fossil fuels on health and welfare, has focused attention on energy transition as a global reality. In recent years, a larger number of renewable energy plants have been set up worldwide as compared to coal and gas. Photovoltaics [2], and wind energy in particular, have become the most important new energies of the 21st century. A report by the International Renewable Energy Agency (IRENA) published in June 2020 demonstrates that renewable energies are increasingly cheaper that fossil fuels. The cost of producing renewable energies in 2019 sho[3]wed that over half of the renewable energy capacity added in this year cost less in electricity than the cheapest new coal plants (Renewables Increasingly Beat, 2020). In terms of investment, the renewable energy sector is currently significantly ahead of traditional energy technologies.

### 3.2. New Energy Technologies and the Prospects of Reducing Global Demand for Oil

In recent years, due to advancements in clean fuel technology, increasing use of electric vehicles, improvements in efficiency, and environmental restrictions applied to the manufacture of plastics and greenhouse gas emissions, the world is likely to reach a peak in oil demand in a short period of time. This is estimated to happen from the mid-2020s until 2040, or even sooner (Figure 1). After this stage, demand for oil will drop as a result of emerging new technologies for clean and renewable fuels.

[2] Photovoltaics is the technology to convert (energy) light into electricity by using semiconductors displaying the photovoltaic effect. This phenomenon is studied in photochemistry, physics, and electrochemistry. The photovoltaic system is used in solar panels which are made of solar cells and can produce electricity.

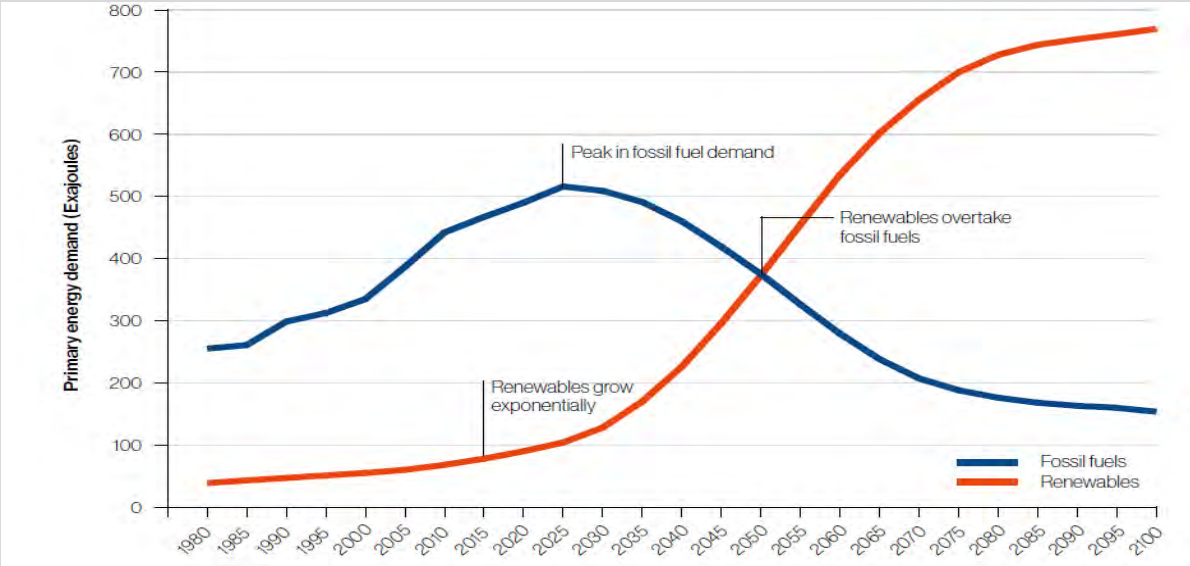


**Figure 1**: The Energy Transition Framework

Source: IRENA & DESA (2019)

Companies, including certain oil and gas companies, have promised reaching net zero carbon emissions, major pension funds are increasingly incorporating the goals of the Paris Climate Agreement in their investment criteria, banks are cutting down on loans for traditional energy projects, and the automotive industry is working on projects to manufacture all-electric cars in the 2030s. Nevertheless, history shows that energy transfer is time-consuming. For instance, during the time of the first important transition – from wood to coal – it took nearly two centuries for coal to become the world's top fuel (from the discovery of coal in 1709 to the late 19th century). Also, when oil was discovered in western Pennsylvania in 1859, it was only a century later in the 1960s when it replaced coal as the best source of energy in the world (Yergin, 2020).

Although the capabilities of countries in energy transition is presently by far superior to previous centuries and the global community now has access to progressive technologies and better financial resources than in the past, yet countries are faced with even more complexities than before. Currently, the world has an 84% reliance on fossil fuels for its energy (BP, 2020). Oil and gas, and their byproducts, continue to make up the largest share of human primary energy resources. Raw oil and natural gas provide 31.9% and 22.5% of the world's primary sources of energy respectively (Motaghi, 2019: 63).

Hence, transition will be no easy task. Concurrently, state budgets allocated to moving the transition forward may face limitations in the coming years due to the negative effects of crises like the COVID-19 pandemic. Even so, setting a 2050 deadline for a net zero carbon goal in the Paris Climate Agreement, climate change, and shifting global political pressures towards low-carbon energy sources, all lead us to analyze the geopolitical effects of technology on the future of the energy market. Based on this, it is endeavored here to analyze the future of global energy geopolitics and the global energy economy within the timeline set in the Paris Climate Agreement (2050), by taking into account important driving forces such as progress in clean technologies and strategic issues such as the vulnerability of countries in terms of energy security.

## 3.3. Energy Transition and the Geopolitical Future of the Global Economy

Undoubtedly, oil has been at the base of global energy geopolitics since WWI. The discovery of oil in the Middle East played a vital role in the transition from the use of coal and transformed the Middle East into an important geopolitical hub. Oil also became the main national security issue, to such an extent that it can be claimed that the control of oil resources played a vital role from the second half of the 20th century in a number of wars, such as the Iraq-Iran War (1980-1988), the Persian Gulf War (1990-1990), and the Iraq War (2003-2011). Over the past few decades, tensions increased between oil producers and consumers and reached a peak during the oil crises of 1973 and 1979. As a result, the price of oil was fixed at USD 32bp in 1980. But geopolitical tensions pertaining to oil continued in the following decades and, as was demonstrated during the Iraqi attack on Kuwait in 1990, prices doubled in a matter of a few months, leading to an economic downturn in the US in the early 1990s.

It is also noteworthy to say that in some parts of the world, such as Europe, natural gas has always played a vital part geopolitically. In Europe, natural gas markets have been established since the 1960s on the basis of large pipelines connecting Russia and other producers, such as Norway and Algeria. This has led to a great dependency by Europe on Russian natural gas. Even if this did not lead to geopolitical concerns – not even in the midst of the Cold War – it is considered a major geopolitical threat for Europe today, similar to the events of 2006-2009, when differences over the price of natural gas between Russia and Ukraine cut off Russian natural gas supplies to Europe via Ukraine. The construction of the Southern Gas Corridor to transport gas from the Caspian region to Europe via Turkey is a prime example of this.

If oil and natural gas have been at the center of the geopolitics of energy for more than half a century, it is perfectly logical to conduct a feasibility study on how its role will pan out in the global energy transition: a process which will act as a driving force through carbon offset policies, the rapid progress of technology for renewable energies, and the manufacture of electric cars.

Regardless of when the post-carbon era will take effect, it is evident that the transition from fossil fuels to renewable energies or net zero carbon will transform relations between global powers and the geopolitics of the 21st century. This geopolitical transformation pertains to fossil fuel producers and those consumers who also possess technology. If the world is successful in its carbon offset policies, oil producing countries will suffer losses in a number of ways. Firstly, they will suffer major capital losses they have invested in the past decades in fossil fuels. Secondly, they will suffer secondary economic losses because their treasuries can no longer cover public sector costs through fossil fuel rents. And last but not least, they will lose their relative geopolitical advantages, because despite access to fossil fuels, these countries are not in a good position when it comes to alternative energies, such as wind, sun, water, and other zero carbon resources.

In contrast, countries with renewable energy technologies, such as China, the US, Germany, and Japan, will move into a better position. Europe, China, and Japan are presently highly dependent on the import of fossil fuels. But as the share of renewable energies grows, they will be able to promote their energy independence and reduce the geopolitical risks with reduced imports of oil and gas through the use of clean energy technologies. Those countries able to innovate in the field of renewable energies, batteries, and electric cars, will be able to reap the industrial and financial benefits of the transition with job creation and economic growth (Tagliapietra, 2019).

Given the relatively dark landscape of climate change, new economic realities, and the need for sustainable energy, the future of most advanced countries investing in the infrastructure of local renewables is clear in the geopolitics of energy. These countries, who are mainly large consumers of fossil fuels, have laws which promote the optimal use of alternative energies (REN21, 2015: 7). China, the US, and Germany have created impressive capacities for renewables and are trying to divert their needs entirely towards renewable energies by 2050.

Developing the technology for renewables creates a system of knowledge through which the owners can exert power. This structure of knowledge will not only serve as a platform to exert power, it will also help in reproducing power. Countries with technology for renewables, like China, the US, the EU, and Japan, will find it easier to stabilize their power in the geopolitics of world economy by using the technology. For a better understanding of the position of countries in the energy transition era, it is best to take a look at the landscape of energy producers and consumers based on the current trends governing their situation.

## 3.4. The Chinese Landscape in the Age of Energy Transition

Presently, China is in a position where it seems to reap the most benefits from a future energy transition. Although it has a large oil industry and is in fact the fifth biggest oil producer in the world, its production does not meet its demand as the second largest economy in the world. China imports an estimated 75% of its oil and is by far the biggest importer. In order to Beijing has assumed a leading position in the main technologies related to low-carbon industries as a result of an active strategy which is a combination of domestic support for innovation (A third of patents for low-carbon technologies belongs to China) (IRENA, 2019), industrial policies, and transfer of technology as a condition for direct foreign investment (Eyl-Mazzega & Mathieu, 2020: 37).

Having a supply chain of rare yet vital metals has given China the opportunity to stabilize its economic superiority both on its large domestic market and abroad. It is in possession of rare, vital metals, special alloys of special metals, innovation, and technology production and assembly (90% of solar panels and over 50% of onshore wind turbines), which have given the country its superior position. Moreover, it has Generation III nuclear reactors (its 1st project is under construction), batteries, private and public transport using electricity or hydrogen (Voïta, 2018), and G5 technology. Its technologies related to artificial intelligence will soon put China in a superior position in the geopolitics of global energy.

As reiterated by its former minister of technology, Wan Gang, China is set to take strategic control of the development of electric vehicles, and it has already done so in part. Yet, it is not simply the environment or air pollution propelling China towards clean fuels. The authorities in Beijing are fully aware that China is unable to compete with the world's biggest automotive companies manufacturing cars with internal combustion engines. Therefore, it can overtake the largest global automotive companies by selling electric cars which will be in demand in a post-carbon world as the country's relative advantage and be a leader in global markets. It must be noted that China is currently a world leader in producing lithium (the main substance used in electric car batteries) with more than 80% of the world's battery production capacity in the global electrical energy supply chain. The world, which is increasingly moving towards solar energy, is expected to run on made in China goods in the future. Moreover, its strong infrastructure for producing solar energy over the past decade has significantly reduced the cost of solar energy and China is now manufacturing nearly 70% of the world's solar panels (China's Solar Panel, 2019).

Overall, statistics show that China leads in renewable energy installations with a capacity of about 758.6 GW (Figure 2). This is considered a strategic victory against its rivals, especially the US. This can be better understood in terms of the Malacca Dilemma. Presently, the threat remains for Beijing that if it is involved in a face-off with US over Taiwan or the South China Sea, the US Navy may close the Strait of Malacca on Chinese tankers importing oil from the Middle East and Africa and paralyze large parts of the Chinese economy and military might. Therefore, reducing its reliance on imported oil will be a great strategic victory for China who, as a world leader in renewable energy technology, will benefit more from the energy transition than any other country.

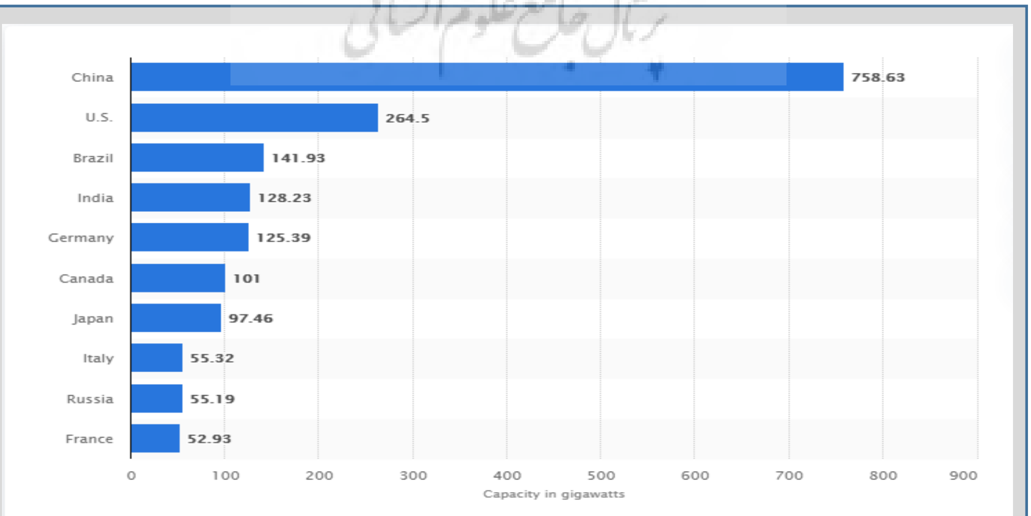


**Figure 2**: Leading Countries in Installed Renewable Energy Capacity Worldwide in 2019 (in gigawatts)
Source: Sönnichsen, 2020

## 3.5. The US landscape in the Age of Energy Transition

Currently, the US ranks second in the world in terms of greenhouse gas emissions. More than 80% of the country's greenhouse gas emissions pertain to its energy sector. In recent years, however, the US has had significant achievements in the transition to clean energies. According to the US Energy Information Administration (EIA), carbon dioxide (CO2) emissions have gone down from 2.4 to 1.8 gigatons between 2008 and 2017 (a drop of more than 25%) as a result of extensive investments and rise in the use of solar and wind energies, and reduction in the use of coal. In 2019, the annual US energy consumption rates for renewable sources exceeded the consumption of coal for the first time (EIA, 2019) (Figure 3).

Nevertheless, the US still depends greatly on oil, in particular shale oil, which will be its Achilles' heel in future energy market developments. If shale oil production is not financially feasible, it will mean a reduction in US oil production and unemployment in this sector (Shokri & Esmaeili, 2019: 19)

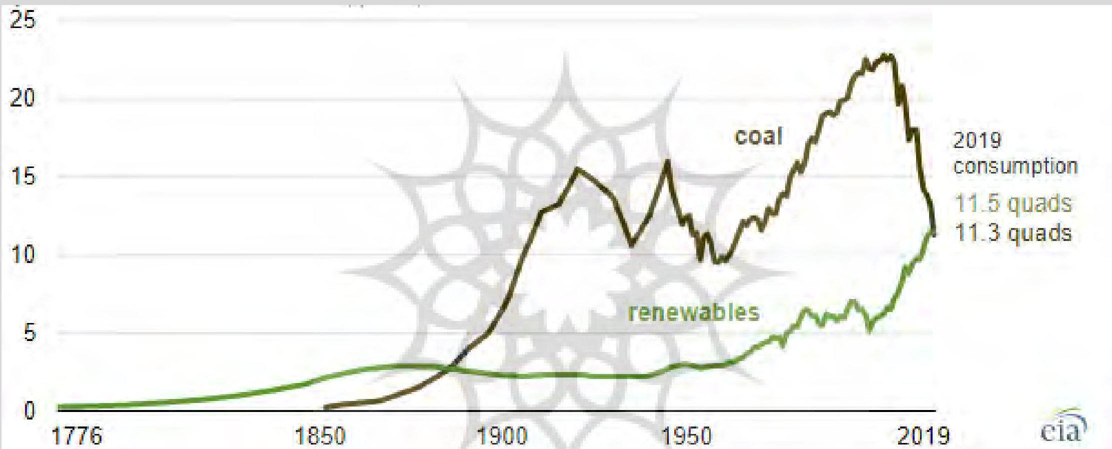


**Figure 3**: US Coal and Renewable Energy Consumption (1776-2019)

Source: US EIA (MAY 28, 2020)

After the end of Donald Trump's unilateral policies and the US rejoining the Paris Climate Agreement, it seems that it will have more concrete policies in moving towards an energy transition. At the moment, it is in a strong position in terms of scientific research and the development of new energy technologies. Achieving the goal of net zero carbon by 2050 requires innovations in the fields of chemistry, physics, and materials science; it also requires advances in carbon sequestration, hydrogen fuel, digitization, production, AI, robotics, software, data analysis, and other technologies. The US has great advantages in these areas, thanks to scientific innovations in ecosystem technology that are unique in their kind. The country has 17 national laboratories belonging to the Department of Energy, universities, research institutes, and countless companies and startups. It also has an advanced financial system which can attract more investment to more innovations in clean fuels. For instance, it has over sixty advanced nuclear energy projects in its private sector today. The Department of Energy spends over 6.5 billion dollars annually on research in basic sciences, which will be the cornerstone of future technologies (Yergin, 2020).

China is the staunch rival of the US in the post-carbon era. Relying on its shale oil resources for energy will allow China to overtake in clean technologies, especially the production of lithium batteries for electric vehicles. The importance of this issue becomes more apparent given the fact that the transport sector in the US has the largest share of energy consumption. Since the country lags behind China in producing electric vehicles, it seems to have a lower hand in energy geopolitics than China.

## 3.6. The EU Landscape in the Age of Energy Transition

The EU is another important region in the puzzle of geopolitics. The impact of energy on the union as one of the three poles of the economy is very important. The EU is poor in fossil fuels. As such, it has been strongly tilting towards carbon offset policies, except for a few sectors which continue to produce coal (East Europe and Spain). Since the Treaty of Lisbon (2007), the EU has improved its energy, climate, and environmental policies. It set itself sustainable energy goals for 2020 which must be achieved; it is also actively participating in the 2015 Paris Climate Agreement process. Presently, the EU is leading the way in clean fuels with a 10% share of carbon dioxide emissions. A growing consensus has taken shape in the EU since 2018 to achieve the climate goals by 2050. To this end, the union has established working mechanisms to support the energy transition: The European Investment Bank, Emissions Trading System (ETS), several infrastructure investment funds, as well as funds and innovation programs such as Horizon 2020 (Eyl-Mazzega & Mathieu, 2020: 30).

In addition, the EU presented the "Clean Energy Package for All Europeans" in 2018 in order to bring together the energy market and policies pertaining to the transition of energy. This is a comprehensive and complex tool which brings improvements to the functions of domestic energy markets. The package encourages innovation and creates a more active role for the consumers of energy. With this project, the EU is effectively fulfilling its climate commitments. Key EU objectives for 2030 include:

- A reduction of at least 40% in greenhouse gas emissions (since 1990 levels)
- An increase of at least 32% in the share of renewable energies in the energy basket
- An increase of at least 32.5% in energy efficiency (EU 2030, 2020)

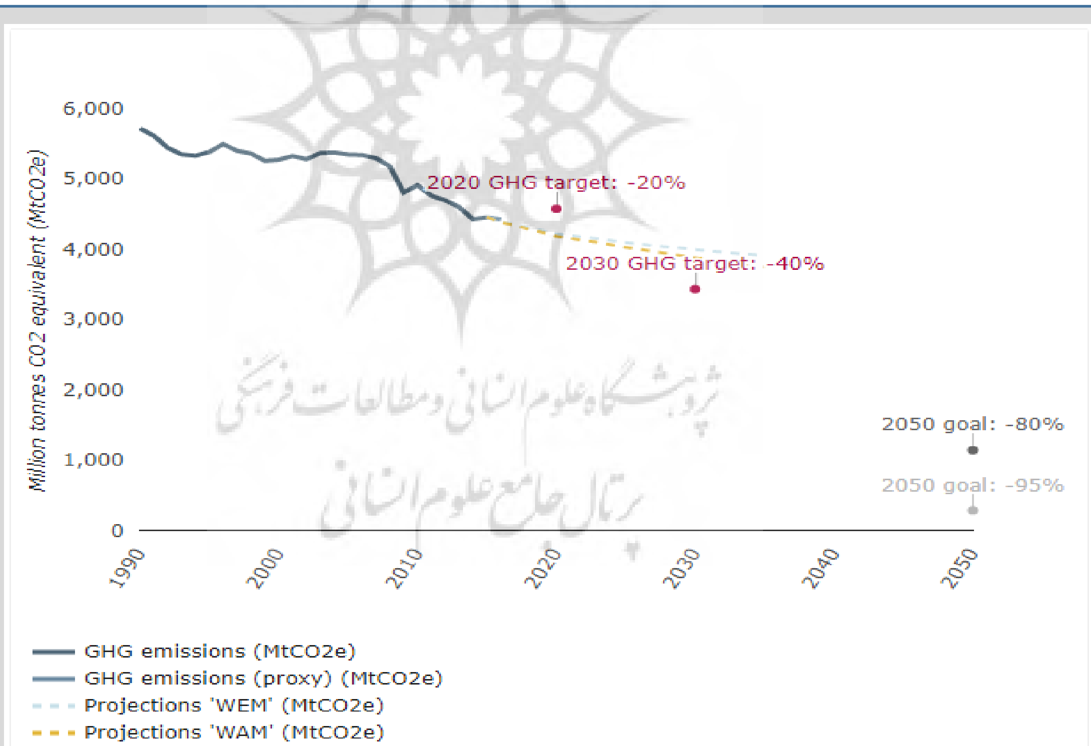


**Figure 4**: Greenhouse Gas Emission Trends, Projections and Targets in the EU

Even though EU member states have a suitable position in renewable technologies, the union still faces challenges on the path to energy transition. The cost of supporting renewable energy projects is increasing; social resistance to renewable energies and transmission lines with wind velocity of over 40,000 miles installed in Germany and 8,000 miles installed in France is growing. More importantly, the EU's carbon setoff policies have so far been focused mainly on the electricity sector and are not yet noticeable in the transport and industrial sectors. The EU's new landscape for 2030 accelerates reduction in the share of fossil fuels to produce electricity, but does not eliminate it in thermal power plants and transport, because reaching them would be difficult and will be met with the resistance of the automotive industry (Eyl-Mazzega & Mathieu, 2020: 32). The level of commitment and political will among member states is also debatable. In fact, members are reluctant to leave such a strategic issue solely to the EU; therefore, it can be said that growth trends and results obtained for EU's energy transition varies among its member states. For example, Italy and the UK have two different approaches: Italy's policies are mainly pursued through government-based programs, while UK policies are mostly market-based. As a result, these two countries are experiencing two different trends in energy transition (Hafner & Raimondi, 2020). Given the challenges ahead, the EU position in the future of energy geopolitics is ranked after the US and China.

### 3.7. The Russian Landscape in the Age of Energy Transition

Contrary to China, the US, and to a certain extent the EU, with suitable standings in the future of the energy transition era, perhaps Russia can be seen as the biggest loser in this arena. The fact is that Russia has a good position in the geopolitics of global energy today due to its abundant energy resources and its role on the global energy market. Russia is one of three big oil producers in the world and the second largest producer of natural gas; it continues to remain the biggest exporter of gas, the second exporter of oil, and the third biggest exporter of coal. The country produces energy equivalent to 1,470 million tons of oil (Mtoe) and exports more than half of its primary energy production; it supplies 16% of the interregional energy trade, making it the world's leading energy exporter (Makarov, Mitrova, & Kulagin, 2019). Its strategic behavior in the energy transition is important not only for the country itself, but also for the rest of the world.

Russia's present-day power in the geopolitics of global energy will incidentally also be its Achilles' heel in the post-carbon era. Russia's energy intensity[1] of GDP remains high despite relatively low energy prices and high capital costs in recent years. In contrast, the share of clean fuels, such as solar and wind energies, remains negligible in the energy combination and is not forecast to reach above 1% by 2035 (Henderson & Mitrova, 2020: 95).

In terms of the geopolitics of energy and as a country rich in resources, Russia is always accused of abusing its power as an energy exporter (natural gas in particular). The energy strategy of the Russian Federation until 2030 explicitly states that energy exports must help improve the country's foreign policy (Tynkkynen et al 2017). Reality, however, remains that Russia lags far behind other rivals in the domain of clean fuel technologies. Therefore, the energy transition will create long-term challenges for the country and the sustainability of its economy which is highly dependent on the income from hydrocarbon exports. The 2008 economic downturn and the lack of dollar revenues from energy sales, which led to a decline in GDP, is itself a clear witness to the deep structural problems in the country's economy. In recent years, oil and gas revenues from exports have also declined between 2008 and 2012 due to lower hydrocarbon prices (Trading Economics 2018).

Russia's reliance on its oil and gas revenues is another strategic vulnerability. A transfer from fossil fuels to low-carbon energy resources can lead to a 16% drop in fuel exports and an 8% drop in primary fuel production over the next two decades. Overall, until 2040, this can reduce the value added of fuel and energy by a quarter due to a fall in investments in this sector. As a result, it is forecast that the average GDP growth in Russia will decrease from 1.7% to 0.6% per year between 2016 and 2040, and the share of the energy sector in GDP will fall from 25% to 14%. This indicates the end of fossil fuel dominance in the Russian national economy during the energy transition period (Hafner & Tagliapietr, 2020: 100).

Aware of this strategic weakness, Russian authorities have been stressing on the need for change, diversity,

[1] Energy intensity is the measure of energy inefficiency in a country's economy and is calculated as units of energy per unit of GDP.

and reduction in oil and gas dependency for nearly two decades. According to the draft for Russia's energy strategy for the period leading up to 2035 (Prepared by the Ministry of Energy of the Russian Federation, 2017), the share of renewable energies in Russia's total primary energy consumption must increase from 3.2% to 4.9% by 2035. The plan intends to increase its photovoltaics, wind energy, and geothermal capacity to 5.9 GW by the end of 2024 (Power Technology 2018).

Nevertheless, Russia seems to be faced with many challenges. As a country with the biggest natural gas reserves and the second biggest thermal coal reserves in the world, it does not see an energy transition from fossil fuels to net zero carbon resources as viable. Despite the country's huge potential for wind and solar energies and the expanse of a land ready for development, the availability of oil, gas, and coal overshadows clean fuel policies, making it difficult to diversify the energy combination and direct it more towards net zero carbon resources. The low price of hydrocarbons, the adverse geographical dispersal of renewable resources (located mainly in unauthorized areas at long distances from consumption centers), and their relatively high costs due mostly to compulsory localization requirements, often lead to non-competitive costs per unit and act as a barrier to their development in Russia. This will make the country vulnerable in the global energy balance.

## 3.8. Countries in the Middle East and North Africa (MENA)

The role of oil producing countries in the Middle East and North Africa (MENA) cannot be neglected in the age of energy transition. The Middle East has played a pivotal role in the geopolitics of global energy since the second half of the 20th century. The MENA region contains most of the world's oil reserves: 48.3% of the world's oil resources are in the Middle East and 3.7% in North Africa (BP, 2019). The region also ranks high in gas resources in global energy geopolitics. Nearly 38.4% of the world's natural gas resources are located in the Middle East and 4% in North Africa. It is important to note that the high-quality energy resources of this region are mainly located in large reservoirs with developed infrastructure and close to export routes (Mills, 2020: 117). But this geopolitical position has been greatly diminished in recent years with the emergence of the US as the world's largest oil producer. Oil remains essential for the economic power of the countries in the region, and the energy transition will weaken this power.

Traditional energy powers in the Middle East and North Africa will have four basic reactions to the energy transition. First, they will renew their economic structure to fit lower prices and reduce hydrocarbon rents in the long run. Second, they will try to safeguard the future of their hydrocarbon industries. Third, they will take gradual measures to speed up the reuse of their domestic energy systems for a low-carbon future. Fourth, they will counter the new geoeconomic transition.

Many MENA countries have defined a landscape for a future energy transition. But since the budget for their non-oil projects depends on oil revenues, the energy transition can end up being very costly for them. The Saudi Vision 2030 Document under the leadership of Mohammad Ben Salman (MBS) is one of the newest and most important documents in the region. It focuses more on technology, tourism, and social change, and less on the oil sector. The main Saudi objective for the energy sector in the plan is to abolish energy subsidies by 2025 (which was supposed to take place by 2020) (Mills, 2020: 124). However, achieving the objectives of Vision 2030 without reliance on oil revenues is going to be a difficult task. In a report by the International Monetary Fund (IMF), oil makes up over 40% of the country's GDP, nearly 70% of its revenues, and close to 80% of its exports. Additionally, its non-oil activities are heavily dependent on state funds which are provided through oil revenues (IMF, 2019). Therefore, changing the economic structure of MENA countries which are heavily dependent on oil revenues will be difficult in any case.

A transition from fossil fuels to renewables will also entail significant geopolitical consequences for countries in this region. Increasing focus by the international community on clean fuels raises concerns for the traditional actors of the energy market over their reduced strategic importance in the market. A number of MENA countries have turned to clean fuel technologies in recent years. Bahrain, for instance, in its Economic Vision 2030, emphasizes on diversification with focus on potential sectors and tries to transform its economy in the long run through new opportunities. Algeria has also endeavored to increase its non-carbon exports to 9% of its total exports by 2019 in its New Economic Growth Model (2016–2019). In its Sixth Development Plan, the IR of Iran has stressed to reduce the oil share in its budget to 22%. In its Vision 2030, Saudi Arabia is also trying to increase the share of its non-oil exports in its GDP from 16% to 50% (Tagliapietra, 2019: 3). But the overwhelming dependence of these countries on their oil and gas revenues, coupled with weaknesses in modern technology, will prevent them from playing a role in global geopolitics like before. While countries of the Persian Gulf have at least stated a vision for diversification and taken impressive steps towards realizing it, other MENA countries exporting carbohydrates are faced with problems. Presently, Iran enjoys a relatively diverse economy and has been pushed towards increasing self-sufficiency and less dependence on oil revenues by the sanctions. But this has led to a severe downturn in its economy. Iraq is trying to move towards progress in the oil, gas, and electricity sectors, but is rather limited in going beyond these. Algeria is also making efforts to maintain its oil exports with an extensively bureaucratic system and by fighting foreign investors. International wars in Syria, Libya, and Yemen of course impede long-term economic progress in these countries (Mills, 2020: 125). This situation will pose a challenge to the region's geopolitical future.

## 4. Conclusion

The progress of technology for renewable energies can change the geopolitics of energy dependency between the current producers, consumers, and transit countries. A drop in the price of oil in recent years is not expected to propel the situation towards renewable energies, because it has not affected investments in renewables to date. This is due to the fact that these energies are used in the electricity sector, where oil is seldom used. Also, developments in renewable energy technologies, such as photovoltaic systems, have led to a sharp drop in global prices. It must be noted that planning for wind or solar installations is calculated in circles of 20 to 30 years. Therefore, decisions made in this area are less sensitive to cyclical changes that can affect the overall context. But investments in oil have a 1–3-year planning horizon due to high volatility. Under such circumstances, a drop in the price of oil cannot be expected to turn into negative competition for renewable energies in the medium term. Given the geopolitical models, it can be said that the development of technology for renewable energies will have a great impact in global geopolitics. Such technology creates a structure of knowledge in which the owners, namely developed countries, can easily exert, reproduce, stabilize, and guarantee their power in the global economy. In a post-carbon era, countries with fossil fuels, such as those in the Middle East, North Africa, and Russia, will no longer be able to determine equations in the energy market like before. In contrast, countries which are currently consumers, also possessing modern technology for renewables, like China, the US, and European countries, will find themselves in a better position.

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