

Sustainability, Policy, and Global Impact: A Comperative Analysis

Editor

Abdullah EROL



SUSTAINABILITY, POLICY, AND GLOBAL IMPACT: A COMPERATIVE ANALYSIS

EDITOR

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PREFACE

At a time when we are facing many challenging issues around the world, the concepts of sustainability, policy and global impact could not have become more important. Climate change, resource depletion, social inequality and many other problems pose serious threats to humanity. However, there is hope to address and resolve these issues. To share this hope and raise awareness on these issues, we present the book “Sustainability, Policy and Global Impact”.

This book aims to help us understand the complex relationships of sustainability, policy and global impact. Sustainability aims to use resources wisely, respect the environment and increase social welfare, taking into account the needs of future generations. Politics plays a critical role in achieving these goals. Public policies shape the distribution of resources, environmental protection, and social justice. Global impact helps us understand how sustainability and policy decisions impact internationally.

By addressing these three basic issues, our book aims to provide a resource that will help us understand how we can contribute to the construction of a sustainable future. By bringing together experiences from different disciplines, our authors offer unique perspectives on how sustainability-related policy decisions and global impact can be combined.

We hope that as you read this book, you will develop a deeper understanding of sustainability, policy, and global impact. We also hope that these topics will inspire you to explore how we can contribute to creating a better future for individuals, societies and the world at large.

The book “Sustainability, Policy, and Global Impact: A Comparative Analysis” is here to guide you on the journey of building a sustainable world. As you read this book, we hope you will learn more and be inspired to shape a sustainable future.

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CLEAN ENERGY POLICY, CLEAN ENERGY EXPANSION AND POLITICAL DEBATE- A RECENT OUTLOOK

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ABSTRACT

Energy plays a pervasive role for the economic development of a country and fossil fuels took the responsibility as a catalyst for energy production for long days. But observing the recent environmental detrimental significances, assertive polling is accumulating for clean energy. Policy support should perform actively for the expansion of clean energy continuing the steadiness of the industrial and economic phase and balancing the global energy debate due to the energy transition.

The aim of the paper is to explore the influencing scenario of the clean energy policy on global energy politics by a qualitative screening of the studies. The paper gets that with some challenges, the clean energy expansion has started its positive contribution to the local and international economy though the fossil fuel rich countries are extending political debate for shrinking their global control. Proper comprehensive policy and regulatory & political support can irrigate a fair level playing field for declining the geopolitics steadily.

Keywords: Clean energy policy, Energy politics, RE expansion

Jel Classification: Q42, Q48, Q49

1. Introduction

In the past, the burning of fossil fuels has been the primary method for generating electricity in both developed and developing countries. This is due to the need to support economic activities and meet the growing demand for energy. The use of fossil fuels has been instrumental in shaping the socio-economic landscape of countries and driving the global industrial revolution. This is because nearly all economic activity relies on energy, making the development of sustainable energy sources a crucial priority for many nations.

Depending more on fossil fuel-based power plants the developed countries exposed thousands of tons of carbon dioxide (CO₂) and other Green House Gases (GHG) in the environment and energy sector emits 2/3 of the global GHG (Matthaus 2020). According to our present knowledge, the excessive amount of CO₂ in the air is the root cause of global warming and climate change.¹ Observing the detrimental significances of climate modification, a strong opinion is growing in the countries against using fossil fuels in power generation and paying attention to energy transition, i.e., increased usage of renewable energy sources (RES). They are investing in research and development of related technologies. International organizations and development agencies of the world also prefer and encourage investments in clean energy field. In that the universal policy makers are focusing on 100% zero carbon free clean energy generation by 2050 (IEA 2021). For making the clean energy policy successful, the policy makers are focusing three main conditions — efficiency, effectiveness and legitimacy. Those three are interdependent and cannot perform individually. The policy can be sighted as an application of green industrial policy for the practicing energy sector (Pegels et al. 2018). For expanding this broad objective in structural ways, the policy implication is being robustly prioritized not hampering the steadiness of the countries' industrial and economic phase. *“The energy transformation will be the one of the major elements that reshape geopolitics in the 21st century alongside trends in demography, inequality, urbanization, technology, environmental sustainability, military capability, and domestic politics in major states”* (IRENA—GCGET 2019, p. 24). So, the paper focuses on how clean energy policy is influencing global energy politics — positively or negatively?

2. Literature Review

Clean energy is such type of energy that produces power not imposing any negative impact on the environment and which does not emit or emit a negligible quantity of harmful gases

¹ <https://www.carbonbrief.org/solar-wind-nuclear-amazingly-low-carbon-footprints>

4–6 grams CO₂ emits for generating one kilowatt-hour (kWh) electricity from solar/wind. The emission range is 109 grams for coal, 78 grams for gas, 700 grams for high-speed furnace oil (HFO) and 350 grams for liquified natural gas (LNG).

like GHG, CO₂ to the environment. Wind power, solar power, and some hydro resources are widely used renewable energy sources treated as clean energy (also it is called green energy).²

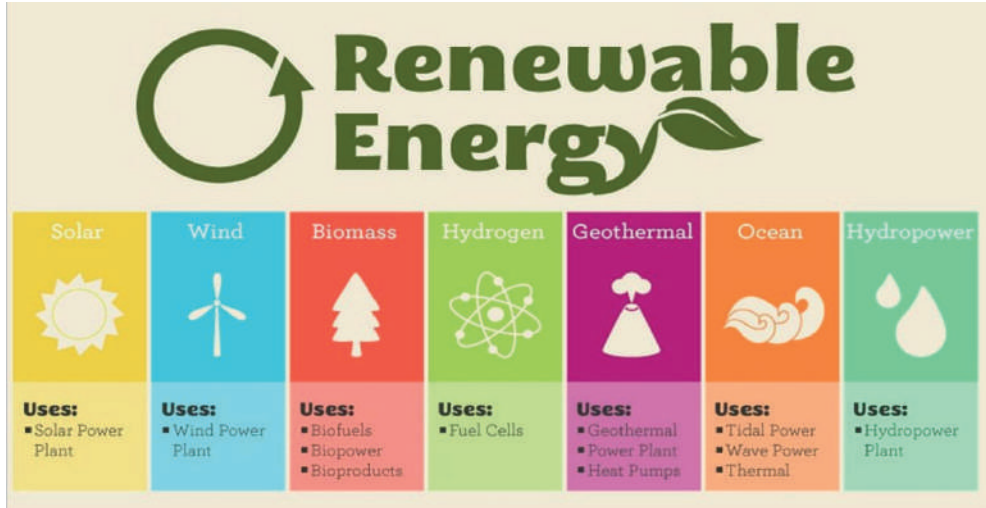


Figure 1: Sources of clean/renewable energy

Source: <https://www.twi-global.com/technical-knowledge/faqs/clean-energy>

The business case of renewable energy (RE) and cost declining of RE technologies; pollution and climate change; accelerating RE deployment target; RE technology innovation; corporate and investors' action for lessening carbon footprint; and public opinion towards RE — those six enabling trends are forcing to drive the deployment of RE (IRENA—GCGET, 2019). Gradually, clean energy is contributing to the GDP of a country. If the ratio of low-emission electricity to total electricity is increased by 1%, then the GDP will up by 0.16%, and CO₂ will decrease by 0.848% (Zhang et al., 2021). Literally, it has said that low-emission can chase the target of low-carbon economic development.

In other side, policies are rules, principles, guidelines, or frameworks that are adopted or designed by an organization or a country for chasing its long-term goals. Renewable energy, i.e., adoption of clean energy is growing robustly in the recent years and it needs to expand more and faster to bring about an energy transition that obtains the climate targets, ensures energy access for all, diminishes air pollution and advances energy security and the formatted framework highlighting the goals are mentioned as clean energy policy (IEA 2018). Supporting the IEA's statement Pegels et al. (2018) mentions that "*Green energy policy encompasses any policy measure aimed at aligning the structure of a country's energy sector with the needs*

² <https://www.twi-global.com/technical-knowledge/faqs/clean-energy>

of sustainable development within established planetary boundaries- both in terms of the absorption capability of ecosystems and the availability of natural resource” (p. 27).

The primary aim of the support policies of RE is to arouse growth in capacity and production. RE support policy is spreading day by day globally and nowadays every country has at least one RE target. The number of countries which are promoting RE via direct policy support has been tripled from at least 48 in 2004 to at least 147 by 2017 (IRENA-IEA-REN21, 2018). The energy policy is required to be —

1. Structured under the terms of technological ambiguity, i.e., focused at fostering innovative technologies toward profitable viability (Altenburg & Lütkenhorst, 2015);
2. Formulated for long-run to cover long lasting transformation process (Pegels et al., 2018); and
3. Comparatively selective than suggested by the neoclassical views of public choice theory (Falck et al., 2011) for providing directivity and tapering the technological progress strips (Altenburg & Lütkenhorst, 2015) for expanding novelty and dispersion.

Transition to green energy/clean energy from the conventional energy and for making the system fruitful, the policy paradigm has been recast to organize, plan and operate the power system. The power system cannot be isolated rather it is entrenched into the energy system, the economy, the society and the earth (figure 2) along with multiple interactions and feedbacks between these systems (IRENA, 2020). As nations strive to combat climate change, there is a growing effort to reduce the use of fossil fuels and increase the utilization of clean energy sources. This shift in energy production also involves a transformation of economies as a whole. The transition from fossil fuels to electricity marks a change in the way the world operates, with electricity becoming increasingly vital in comparison to carbon. However, as the energy industry evolves, so too will the political landscape surrounding energy (Boyer, 2014; Szeman, 2014; Szeman & Diamati, 2017).

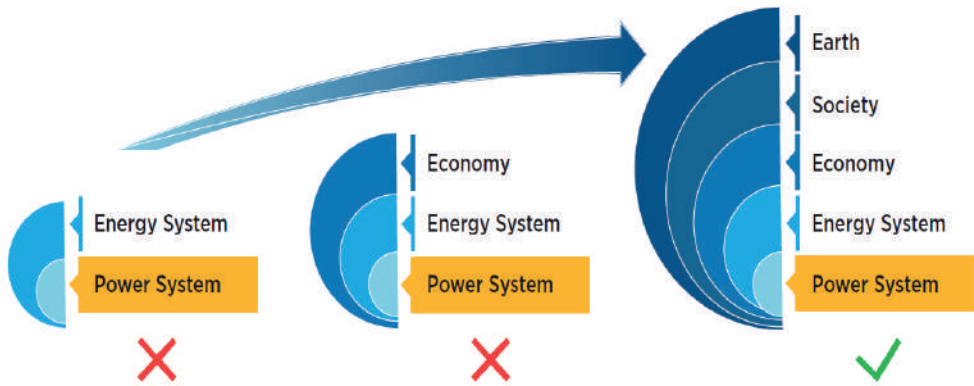


Figure 2: The embedded power system transition to clean energy
 Source: IRENA (2020), p. 6

Finding out the potentiality of solar and wind energy technologies, those are included into the energy system beset by the energy democracy as a prime site of political-economic challenges and the mentioned technologies are picked-up for deploying high volume of clean energy (Angel, 2016; Burke & Stephens, 2018).

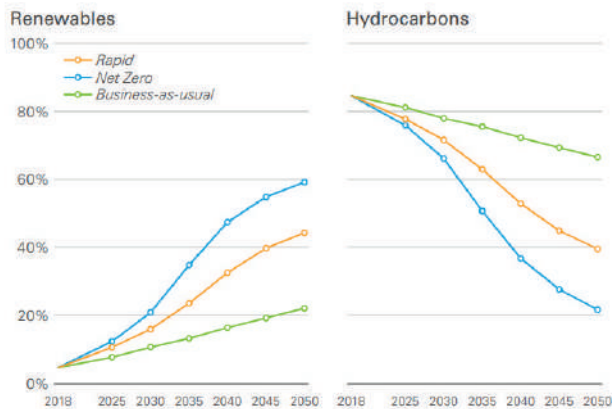


Figure 3: The world's energy transition (% of primary energy)
 Source: bp energy outlook (2020), p. 64

The clean energy is in the increasing trend and the fossil fuels are in declining mode under 3 different future scenarios like rapid, net zero and business-as-usual (figure 3). Adoption of policy support is tremendously facilitating to march it steadily.

On the contrary, the transition to clean energy poses a significant challenge for regions heavily dependent on fossil fuel exports for revenue, such as the Middle East. These nations are

already resisting the shift, with countries like Saudi Arabia and Russia frequently obstructing progress at annual UN climate talks. Saudi Arabia, in particular, has attempted to maintain its oil and gas production while also expanding its solar power sector. Similarly, Poland, a major coal producer, was hesitant to support the EU's goal of net-zero emissions. In a time when the world is already grappling with the economic impact of the coronavirus pandemic, fossil fuel-producing countries are concerned about additional job losses as the shift to clean energy accelerates (Hook & Sanderson 2021).

Mentioning some negative impacts Lockwood (2015) says that as the green energy policy involves high level of uncertainties and risk factors, considering the high commonness of political capture, there are essentially needed to implement transparent and tight monitoring. In this context, Pegels et al. (2018) added that overcoming the uncertainties and risks, a rational and transparent policy process; incessant and methodical policy erudition; selections for remedial activities and utilizing the co-benefits are of highest paybacks.

The policy paradigm is impactful on the clean energy expansion and other diversified gains. Analyzing the policy effects of clean energy, i.e., renewable energy, Böhringer et al. (2013) mentions that differentiated effects are happened like demand for labor in the market, price of electricity, reduction of subsidy in coal energy for suitable policy implication. Mu et al. (2018) finds an impact of the renewable energy policy in China on renewable energy-based employment generation. They find that there was an increase of employment due to the expansion of solar PV and wind power generation. Oh et al. (2020) gets a positive relation among renewable energy policies, renewable energy generation and GHG emission reduction (i.e., environment). The large share of renewable energy will support to emit less amount of GHG in the environment. Along with lessening the CO₂ emission, RE policy creates the socio-economic upliftment for the state (Rennkamp et al., 2017). Realizing the benefits and practicability, the European Commission has changed its state aid guidelines to the energy field in 2014 and the new guidelines established the competitive bidding (i.e., auction) as the main scheme to provide state aid for RE expansion from 2017 (Bues & Gailing, 2016; Leiren & Reimer, 2018; Botta 2019). For proving the example of EU policy issue, the author selected seven open and developing EU countries (Greece, Hungary, Italy, Poland, Portugal, Romania and Spain) who are practicing RE auction as support policy for the expansion of clean energy in those countries.

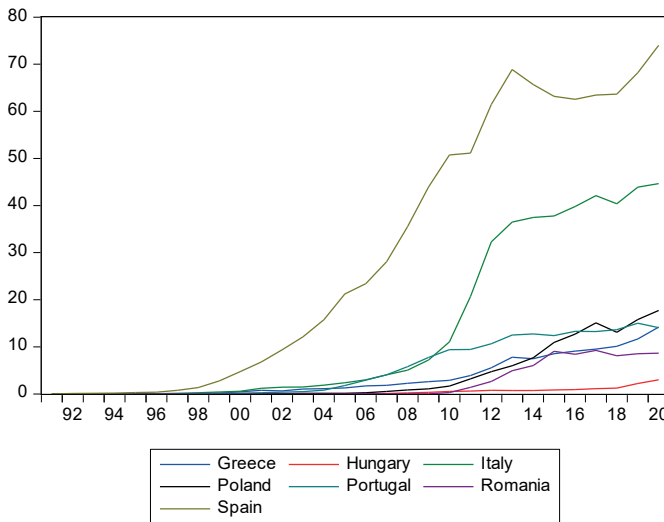


Figure 4: Total Solar & Wind Generation (Terawatt-hour)

Source: Author's edition, bp Statistical Review of World Energy July 2021³ by using Eviews 10

The graph (Figure 4) depicts that the RE visibly started in the countries in 2000s and the broad expansion was visible after 2009. The policy support guidelines of EU also help those countries to expand RE robustly from 2014 and afterwards. The growing generation trend of clean energy is also remarkable in the COVID-19, i.e., in the year 2020.

Constructing report based on the policy enablement and macro vitals, the effective policies like tariff policy amendment 2018; the wind-solar hybrid policy 2018; the National wind energy policy 2015; the feed-in-tariff policy 2018 have awarded India to the robust clean energy deployment country and given the 4th position of the renewable energy country attractiveness index (RECAI) 2018 (Kumar & Majid, 2020). In 2021, the country achieved the 3rd position in the same index.⁴ Fighting against the climate crisis, very recently Germany has reformed the biggest energy policy in the decades. The main aim of the new law (draft) is to about 100% clean energy supply by 2025 and for this, the laws propose to face-up new land for green power production, speed-up permit procedures, and robust expansion of wind and solar addition.⁵ Applying univariate order and binary probit model, Groh & Möllendorff (2020) get that for the support of the clean energy transition in Germany, the perceived importance of policy goals and framework conditions is to higher relevance. They also find that political orientation is a prime catalyst of the perceived importance of the policy goals.

3 <http://www.bp.com/statisticalreview>

4 <https://www.statista.com/statistics/1121004/renewable-energy-country-attractiveness-score-global/>

5 <https://www.cleanenergywire.org/news/germany-boosts-renewables-biggest-energy-policy-reform-decades>

The concept of energy transition which induces the response of energy democracy emerged as a politically loaded call for today to a process, an outcome or a goal depending on the context it is used (Szulecki & Overland, 2020) where energy democracy links with energy justice, energy sovereignty, energy citizenship and energy decolonization those are correspondingly cohesive with political prerogatives within the discussion point for clean energy transition (Burke & Stephens, 2018). Here is needed to mention that energy democracy and energy transitions are primarily political (Laird, 2013). And this system of politics used to pilot clean energy transitions will momentarily stimulus the opportunity for additional democratic prospects (Mitchell, 2009). Achieving true energy democracy involves giving the public and communities the power and ownership of renewable energy systems, such as land, renewable generation facilities, microgrids, and small to medium-scale storage technologies. This also requires implementing policies and principles that promote capacity building at the community and regional levels. To achieve this goal, we must focus on enhancing democratic practices and ensuring positive outcomes. Currently, the centralized politics of fossil fuels coexists with decentralized energy systems. However, the transition to renewable energy, distributed generation, and democratic politics are all hindered by the current centralized energy politics. To overcome this challenge, greater emphasis should be placed on decentralizing energy politics to align with the decentralized nature of renewable energy systems. (Burke & Stephens, 2018).

Hall and Klitgaard (2012) and Kunze & Becker (2015) propose a theory of energy technological politics that states that the use of concentrated energy sources, such as fossil fuels, leads to the concentration of economic and political power. This theory forms the basis of the energy democracy movement's approach to advocating for renewable energy sources. The movement argues that renewable energy sources, which are more diffuse, lead to more distributed forms of power and decentralized political relationships. The relationship between energy and politics is often described as a trade-off between concentration and decentralization. Concentrated energy sources, such as fossil fuels, tend to lead to centralized political power and weaker democracy. In contrast, decentralized energy sources, such as solar and wind power, offer more flexibility and tend to lead to distributed political power and stronger democracy. These theoretical relationships highlight the importance of energy choices in shaping political systems.

Historically, the possession and control of fossil fuels has played a significant role in determining geopolitical power. The threat of oil embargos or gas shortages has led to the formation of alliances and even wars, and those with access to oil reserves have amassed great

wealth. However, as the world shifts towards clean energy, a new set of nations and regions will rise to power. Some have even referred to it as a “clean energy space race.” Those who excel in the development and implementation of clean technology, export renewable energy, or reduce their dependence on fossil fuels stand to benefit in this new energy landscape, while nations heavily reliant on exporting fossil fuels such as the Middle East or Russia may see a decline in their power and influence (Mumford, 1934; Boyer 2011; Mitchell, 2013; Burke & Stephens 2017; Hook & Sanderson, 2021; Bordoff & O’Sullivan, 2022).

RE is different from many aspects from conventional fossil fuels and those differentiations will have geopolitical consequences (IRENA-GCGET, 2019). The report points out four specific reasons for geopolitics—

1. The fossil fuels are concerted in the specific geopolitical location where as RE sources are available in one mode or another form in the most of the countries of the world. This is lessening the standing of the continuing energy choke opinions;
2. Most of the RE are the flow sources not the stock sources like fossil fuels. The stock can be stored and used for one time; but flow sources do not deplete and tough to interrupt;
3. RE can be utilized at outmost level at any scale and it is possible to lend them better to decentralized forms of energy production and consumption which improves to the democratizing upshot of RE; and
4. RE sources have about zero marginal cost and especially solar and wind sources relish cost discount about 20% for every doubling of capacity which boosts their ability to change the geopolitics.

But the snapshots are explaining differently. Moving away from fossil fuels and towards renewable energy sources does not eliminate the need for interdependence; it simply shifts it to different aspects of the energy mix. Instead of relying on hydrocarbons, we will now depend on metals and rare earths. Countries in Africa, Asia, the Americas, and Australia are likely to become major suppliers of these minerals, and the transportation routes used to ship them may create new geopolitical opportunities (Crow & Saran, 2021).

In recent years, as the demand for copper and cobalt has risen in response to the shift towards clean energy, China’s prior investments in these resources appear to be a smart move. Copper is crucial for electric cables and wind turbines, while cobalt is used in electric vehicle batteries. China currently leads the world in production of solar photovoltaic panels, electric

vehicles and wind power, and is also the largest producer of batteries. Additionally, China controls a significant portion of the raw materials vital for the clean technology supply chain such as cobalt, rare earth minerals, and polysilicon, which are primary component in solar panels wind turbines, and energy-efficient lighting. Russia also has potential in this area. Despite trade disputes and tariffs imposed by the US and EU on Chinese photovoltaic panels, and new regulations in Europe potentially limiting imports of Chinese batteries, China's dominant position in the clean energy sector is likely to remain. (Hook & Sanderson 2021). According to the latest figures, there was an increase in the percentage of global solar supply chains dominated by Chinese companies. In 2021, eight of the top ten solar companies in the world were Chinese, compared to 38% in 2019 (Rapoza, 2021). Additionally, China's domestic solar industry also saw significant growth. China had a total 100% production capacity of solar ingots and wafers themselves. By the end of 2020, China controlled 80% of the global solar-cell manufacturing capacity (Tagotra, 2022). So over the course of the transition, the small number of countries that supply the vast majority of critical minerals will enjoy newfound influence. The shift to renewable energy will bring new forms of competition related to the sources and technologies used as well.

During the climate summit, there were signs of disagreement regarding the promised \$100 billion in aid for developing countries that was pledged by wealthy nations in 2009, with a deadline of 2020. This commitment has yet to be fulfilled and even this large sum is a fraction of the estimated \$1 trillion to \$2 trillion required annually for investments in clean energy in developing and emerging market economies, in order to reach net-zero emissions by 2050. As the urgency and costs of decarbonization increases, the inability of wealthy nations to provide aid to poorer countries will likely become a major source of geopolitical conflict, particularly as developing nations are disproportionately affected by damages they did not cause (Bordoff & O'Sullivan, 2022).

According to Rennkamp et al. (2017), with the sufficient domestic political support, the RE policy may be executed in middle income countries. They also mention that structure of the economic incentives, participation of the private sector, policy uncertainty, policy strategy and base load power are the main political argumenta against RE policy. Supporting the statement Mazzucato (2013) mentions that green energy policy can change the whole market scenario, lessen the price and create the conducive atmosphere for profit making if the policies became favorable, and then government faces extra pressure for investment. He also mentions that long-term investment will not be effective if there are unpredictable environment of political rules and decisions. The powerful interest groups like the giant energy businessmen may

influence the outcome of supervisory accomplishment of government entities by following lobbying culture and offset the envisioned aim of incentive schemes. The government of the developing countries cannot ignore the lobbying of the giants due to weak monitoring systems, lack of transparency and poor capabilities (Pegels et al., 2018).

The transition to a net-zero global economy will require a significant level of international collaboration, but it may also result in conflicts and create winners and losers. Countries with strong economies and technology, such as China and the United States, may have a competitive advantage during the transition. On the other hand, countries heavily dependent on fossil fuel exports, such as Russia, may face challenges and potentially negative impacts on their economy and international relations. The shift towards clean energy will likely have a significant impact on Russia's relationship with other major nations.

The idea that the transition to clean energy will be seamless is unrealistic. The overhaul of the energy system, which is a fundamental aspect of the global economy and shapes the geopolitical order, will inevitably bring about significant changes. Additionally, it is not always clear who will benefit and who will be affected negatively. For example, nations heavily dependent on fossil fuels may experience temporary increases in power before ultimately facing decline. The areas of the world with the least resources will need large amounts of energy to improve their living conditions, while simultaneously dealing with the worst consequences of climate change. Clean energy will bring new opportunities for nations to gain power; but another face of a coin is also true.

3. Methodology

In this review, I divided the process into two stages. First, I conducted a conceptual review of the term “energy democracy” by researching both non-academic and academic literatures that used the term. I included several peer-reviewed articles that focused on community-based renewable energy initiatives (Kunze & Becker, 2015). Starting in May 2022, I used various search engines in China, European Union, Middle East and the United States to find sources using the terms “renewable energy policy”, “renewable energy expansion”, “energy politics”, “energy democracy” and “energy and democracy,” resulting in roughly two dozen reports, articles, websites, and videos. Over the next months, I expanded my search by looking at activist group websites, commonly cited references, and participating in webinars.

During my engagement with the perspectives of the energy democracy & geopolitical movement, and inspired by Mitchell's questions about the political possibilities for the end of the oil age (Mitchell, 2013), I realized that the review should also include an examination of

the theoretical foundations of the relationships between renewable energy policy, expansion and political power. In the second stage, from June to September 2022, I expanded my search terms to include “renewable energy policy and expansion”, “energy political power”, “renewable energy democracy”, “renewable energy political power” and related terms, excluding only terms that were only similar in name (e.g. “democratic party”, “democratic republic”). I searched through academic libraries, Web of Science, Scopus, and popular search engines to find English-language peer-reviewed academic literature and published books that were related to my objective. I reviewed the sources in four iterative steps. First, I coded the sources to identify definitions, findings, conclusions, and calls for research. To further expand my research, I added sources based on references cited within my initial collection, particularly historically significant works (e.g., Mumford, 1934), resulting in a total of approximately 65 sources reviewed. My process involved repeatedly sorting through the coded materials by topic, identifying patterns and relationships, writing analytic memos, and making observations (Miles & Huberman, 2014). The topics that emerged for the conceptual review of energy policy, expansion and politics included origins and advocates, definitions, purpose, barriers, principles, and policies. The topics for the theoretical development included energy and democracy, renewable energy and political power, renewable energy policy and expansion and tensions, gaps, and ambiguities. The breadth of the work I reviewed and the topical categories that emerged led me to approach the coded material through two distinct lines of inquiry to more deeply understand the themes of energy democracy and its uptake, and the relationships between renewable energy policy, expansion and political power.

The review of the concept of energy democracy and the energy democracy movement is summarized and discussed in more detail in Burke and Stephens (2017). Through my review of existing literature, I discovered the concepts of *energopower* and *energopolitics* (Boyer, 2011; Boyer, 2014; Szeman, 2014) and used them as an analytical lens to understand the relationships between political power and *energetic* power. *Energopower* and *energopolitics* extend Foucault’s notions of *biopower*, which refers to governance over life and populations, and biopolitics, which refers to the processes by which life and populations become objects of political strategy (Foucault, 2009; Szeman, 2014). I understand *energopower* as the dynamics of power over modern life organized and enabled through energy, and conversely, the forms of energy organized and enabled through dynamics of power. *Energopolitics* is further understood as the operations of power to leverage the transformational capacity of modern energy sources (Boyer, 2011; Boyer, 2014; Szeman, 2104). These concepts support an understanding of political and *energetic* change and stability as dimensions of broader cultural dynamics,

which open up the possibility for further inquiry from different perspectives. For this reason, I have adapted these concepts for a broader audience and refer to them as energy-politics. In addition to its relevance to the energy democracy movement, I chose this analytical lens of energy-politics to emphasize the relational dimensions among energy policy & expansion, systems of energy and political power (Bues & Gailing, 2016), rather than focusing solely on energy technologies themselves, while acknowledging the unique role that fossil-based energy systems play in the governance of modern life and the shaping of modern cultures (Szeman & Diamanti, 2017). The third step involved organizing the sorted materials within a conceptual outline to guide the initial drafting of the review sections. Finally, once drafted, I revisited the analytical memos and reflections I had made throughout the process, sorted them further, and used them to synthesize and critically assess the reviews, confirm or modify topics and organization, and identify key implications and gaps to support theoretical development.

4. Findings and Recommendations

The International Energy Agency estimates that in order to achieve a net-zero carbon world by 2050, a significant portion of global electricity generation and transportation must be powered by renewable sources. Specifically, they estimate that 88% of global electricity generation and 61% of global transportation must be fueled by renewables (IEA, 2021). After analyzing the literatures, due to the change of global environment perspectives and fixed target, the policy makers are aligned with the energy transition from fossil fuel (FF) based energy generation to RE based energy generation. The policy makers admit that the power system must consider the societal as well as environmental assessment. For getting a structural return, clean energy policy and support schemes are highly required — no doubt. Yes, there are some challenges while gains are huge — clean energy expansion has already started its positive contribution to the local and global economy like increasing demand of labor market in RE field, fall of electricity prices, reduce subsidy in FF-based energy etc. The empirical evidences of the cited literatures in this paper state about the decisions and actions taken by the selected EU countries and India regarding clean energy policy and its expansion. The gains from the well-designed RE policy are summarized in figure 5.

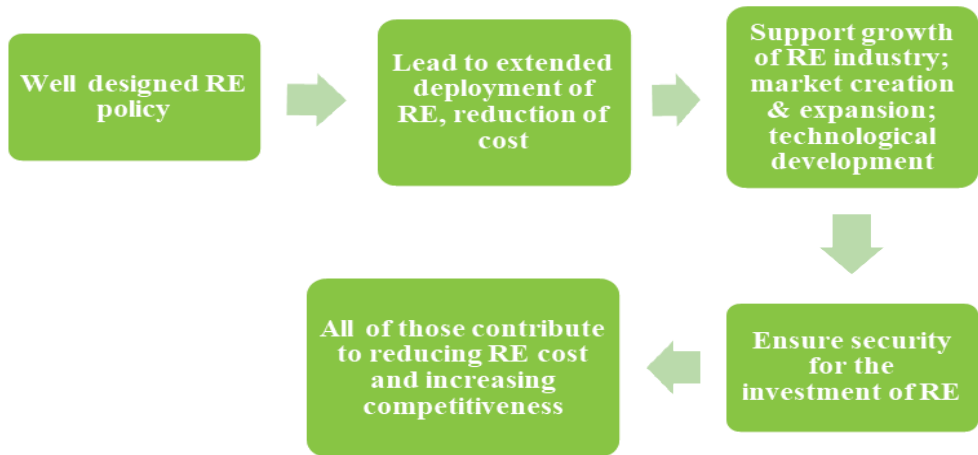


Figure 5: Gains from well-designed RE policy
Source: Author's own creation from reviewed literatures

Renewable energy policy promotes energy democracy and access to low-cost energy for low-income and middle-income countries. Unlike fossil fuels, which are often concentrated in specific locations and subject to volatile costs, renewable energy sources are widely available and relatively stable. However, some countries that currently control fossil fuel resources may resist the adoption of renewable energy due to concerns about losing their influence. For example, China's investment in renewable energy technologies may increase its global influence. On the other hand, countries that rely heavily on fossil fuel exports and do not transition to renewables may risk losing influence and facing economic challenges (IRENA-GCGET, 2019). The global giant energy business entities are running their lobbying for stopping the robust deployment of RE.

The current scenario says that the energy transition is not abolishing the need for interdependence. Rather it becomes a new dimension of influence (like the gigantic majority of perilous minerals) and competition (like sources and technologies used). If the situation does not change, then the under developed and developing countries will be the prime sources of geopolitical conflict.

Global power structure and relationship dynamics might be changed for the clean energy transition. Power will become more decentralized and diffused assertively for the poor and middle-income countries. For the wellbeing of the society, strong monitoring, transparency, upgrading of technology and bilateral cooperation can help countries to become self-sufficient and to face the upcoming geopolitical challenges related to clean energy expansion.

A comprehensive approach to the future of energy, which necessitates the involvement of leaders from major nations to establish a new framework that aligns with the evolving energy landscape. Organizations such as the International Energy Agency (IEA), OPEC, and commodity exchanges have played a significant role in shaping the hydrocarbon industry. However, the shift towards renewable energy requires new structures, organizations, and political agreements that take into account the perspectives of multiple stakeholders in both the public and private sectors. Otherwise, it will be a result in geopolitical conflict that tends to craft winners and losers.

5. Conclusion

Ultimately, the world requires a new institutional framework to ensure a reliable clean energy supply in the 21st century. The clean energy industry still faces a variety of challenges, both related to the technology itself and to policy and regulation. A lack of comprehensive policy and regulations can make it difficult for governments to fully invest in the clean energy market. Without government support, it can be hard to fill key positions and reduce environmental degradation. To address these issues, measures must be implemented in a reliable and transparent manner, and actions taken to gain the trust of individuals. With systematic political support, a transition to clean energy can be made economically viable and help to shape the future of renewable energy, reducing the impact of global energy politics.

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