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The Political Economy of Sustainable Energy Transitions: A Literature Review and A Research Agenda.

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Abstract

In the last two decades, studies that analyse the political economy of sustainable energy transitions have increasingly become available. Yet very few attempts have been made to synthesize the factors discussed in the growing literature. This paper reviews the extant empirical literature on the political economy of sustainable energy transitions. Using a well-defined search strategy, a total of 36 empirical contributions covering the period 2008 to 2022 are reviewed full text. Overall, the findings highlight the role of vested interest, advocacy coalitions and green constituencies, path dependency, external shocks, policy and institutional environment, political institutions and fossil fuel resource endowments as major political economy factors influencing sustainable energy transitions across both high income countries, and low and middle income countries. In addition, the paper highlights and discusses some critical knowledge gaps in the existing literature and provides suggestions for a future research agenda.

Keywords: Political economy, Sustainable energy transition, High income countries, Low and middle income countries, Decarbonization

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1.0 Introduction

The shift towards sustainable energy systems continues to remain a very critical issue on the international policy agenda (Camacho Ballesta, 2022; REN21, 2021). For decades now, evidence from several studies increasingly underscore the fact that the unremitting reliance on fossil fuels does not only pose a great challenge to environment sustainability but as well impacts negatively on the quality of human life and welfare (Burke and Stephens, 2018; Mundaca et al., 2018; Grubler, 2012). With the Energy sector alone accounting for over two thirds of total global greenhouse emissions (IRENA, 2018), there have been calls for governments, development partners and local stakeholders to initiate urgent transformative efforts aimed at transitioning to clean and sustainable energy options (Malerba, 2022; Arent et al., 2017).

Despite the strong calls to accelerate the transition towards low carbon economies, the rate of adoption of clean energy solutions remains rather low in many countries, even in those with very high clean energy resource potentials (World Economic Forum, 2019)[1]. Several factors account for this complexity. For decades, a dominant strand of the literature seeking to understand the factors underlying the complexity of the energy transition process has been centered on the "socio-technical perspective" where explanations largely focus on the role of technological innovation and social change in accelerating the transition to a sustainable and low carbon economy (Pederson et al., 2021; Geels et al., 2017). However, it has been argued that studies that focus exclusively on socio-technical elements, amongst others tend to ignore the political dynamics inherent in the energy transition processes (Newell, 2019; Kern and Markard, 2016; Smith et al., 2010). Interestingly, in recent times, studies that factor political economy considerations into the energy transition discourse are increasingly becoming available and tend to provide an alternative or a complementing framework for understanding the role of power and politics in the energy transition process (e.g., Pederson et al., 2021; Jakob et al., 2019; Kere, 2017; Newell and Phillips, 2016; Baker et al., 2014; Jacobsson and Lauber, 2006).

In view of the above, this paper attempts to review the current state of the art specifically regarding the political economy of sustainable energy transitions in a broad context. In doing so, the paper contributes to the extant literature on the sustainable energy transitions in two main ways.

[1] For recent updates on the status of renewable energy integration into national energy system see: https://www.iea.org/reports/world-energy-outlook-2022

First of all, it attempts to synthesize the growing empirical literature on the role of political economy factors in shaping the energy transition process across high income, and low and middle countries alike, thereby contributing to a better and comprehensive understanding of energy transitions globally. Secondly, in line with the empirical review, the paper also highlights critical knowledge gaps in the existing literature, discusses these gaps in light of current research priorities and provides suggestions for a future research agenda.

The rest of the paper is structured as follows: Section two explores the main concepts. It presents some conceptual definitions of sustainable energy transition as provided in the literature. It also discusses the concept of political economy and provides an insight into the relevance of applying a political economy approach to the study of sustainable energy transitions. Section three presents an overview of the empirical literature and highlights the political economy factors commonly discussed therein. Section four highlights the critical knowledge gaps in the extant empirical literature and set forth a research agenda. Section five which is the final section of this paper provides an overall conclusion.

2.0 The Relevance of applying a Political Economy Lens to Sustainable Energy Transition

2.1 Understanding the concept of Sustainable Energy Transition

Generally, the concept of energy transition commonly describes changes or shifts in the system of energy production and use . From a narrow perspective, these changes typically involve switching from a particular type of energy source or technology to another (Fouquet, 2016; Hirsch and Jones, 2014). However, much broader definitions of energy transition transcend the focus on energy sources and technologies to include the structural changes inherent in how energy services are delivered (Sovacool, 2016). For example, Araujo (2014:112) defines energy transition as not only encompassing changes in technology but as well includes the nature or patterns of energy use within a system comprising the "constellation of energy inputs and outputs involving suppliers, distributors, and end users along with institutions of regulation, conversion and trade."

Characteristically, energy transitions are not simple and unidimensional processes. Instead, they can be described as complex and non-linear processes that are multidimensional in nature (e.g. may involve technological, economic, psychosocial and institutional change), entail a high degree of uncertainty and

are path dependent (Omri et al., 2022; Blazquez et al., 2019; Kohler et al., 2019). Energy transitions also typically involve multiple or a wide range of actors (e.g. policy makers, regulators, producers, distributors, end users, etc.) and unfold or evolve over a long period of time (ibid). In addition, energy transitions are highly context dependent and therefore show different transformation pathways in different settings. Also they tend to be largely driven by public policies and are underpinned by strong vested interest and conflicts over the specific goals of the transition process (Kern and Markard, 2016; Bergek et. al., 2015; Stirling, 2014).

Notwithstanding the diverse definitions of the concept energy transition, in the current global discourse, it tends to be largely situated within the context of decarbonization and sustainability (Blazquez et al., 2019). Basically, sustainability transitions "explore potential societal transformations in production and consumption that combine economic and social development with reduced pressures on the environment" (Pearson, 2016:13). Thus, within this framework, sustainable energy transition is then conceptualized as "involving a shift from high-carbon energy sources such as oil, gas and coal to low-carbon and zero-carbon energy sources such as renewables" (Zinecker et al., 2018: 2)[2]. This systemic shift to clean energy sources in turn offers a transformative pathway towards decarbonization of the global energy system and the attainment of international policy goals and commitments on sustainability (Chen et al. 2019; IRENA, 2018).

Interestingly, a topical issue in the current discourse on sustainable energy transition especially in low and middle income countries remains how the shift to sustainable energy sources is also shaped by the needs and preferences of the poor majority as well as those whose livelihoods depend on the fossil fuel economy. Commonly referred to as the "Just Transition", its proponents essentially argue that policy makers and all other stakeholders involved in the energy transition process must put in places measures to ensure that the systemic shift to clean or sustainable energy sources yield benefits for all segments of society , most especially those affected by such processes in a fair and equitable manner (Newell and Mulvaney, 2013).

[2] Some examples of renewable energy include Solar, Wind, Hydropower, Bioenergy and Geothermal energy.

2.2 Sustainable Energy Transition through a Political Economy Lens

The term "Political Economy" has been widely defined by various scholars in many different ways[3]. In the recent academic literature, two main types of definitions can easily be deciphered. The first group of definitions tend to be more content related and focus on describing the broad interaction between political and economic aspects. For example, Collinson (2003:3) defines political economy as predominantly "concerned with the interaction of political and economic processes within a society: the distribution of power and wealth between different groups and individuals, and the processes that create, sustain and transform these relationships over time." Similarly, for Frieden (2020), it is the integration of political and economic considerations into the analysis of various phenomena in contemporary society. Away from these, the second group of definitions tend to emphasize a methodological angle to political economy. For instance, according to Barry and Wittman (2011), political economy is a multidisciplinary field where the methodology of economics is applied to the analysis of political behavior and institutions. Likewise, Buge (2020:2) also conceptualizes political economy as the "study of how politics, policies, and polities aggregate various and heterogeneous interests and preferences regarding the distribution of scarce resources into collective action". Nevertheless, a central theme across both types of definitions pertains to the fact that political economy enables an understanding of actors, ideas, structures and institutions, and how these may hinder or promote change (Baker et al., 2014).

As briefly highlighted in the introductory section, energy transitions have long been conceptualized from the perspective of 'socio-technical transitions[4]'. This approach also sometimes referred to as the 'Multilevel Perspective' combines insights from several disciplines including innovation studies, evolutionary economic, sociology of technology and history of technology to explain the processes and patterns of transition (Geels, 2005). The approach suggest that transitions are driven by interactions among three levels namely: (i) the existing socio-technical regime itself which can potentially be replaced, (ii) the niche which serves as the avenue for radical innovations and (iii) the sociotechnical landscape which reflects exogenous developments or shocks with the potential to destabilize the system and provide an opportunity for niche innovations (Geels, 2005; Geels et al., 2017). Thus, unlike other

[3] Generally, there are different schools of thought in political economy, for examples see Stillwell (2005).

[4] For an overview of other conceptual approaches used to analyse energy transitions or sustainability transitions in general, see for example Köhler et al. (2019); Hansen et al. (2018); Savacool and Hess (2017); Andrew-Speed (2016).

approaches that emphasize single drivers, for the multilevel perspective, transitions can only occur through the alignment of processes within or amongst these three levels (Ibid).

As earlier mentioned, a major criticism against the socio-technical perspective is that it pays relatively less attention to the role of power and politics which in many jurisdictions tend to be very relevant factors shaping transition pathways[5]. Given that energy transitions are essentially political in nature[6] (Köhler et al.,2019; Lockwood et al., 2016 ; Meadowcroft, 2009), applying a political economy lens ultimately enables a better and comprehensive understanding of the transition process, in particular the political and economic dynamics operating across different levels to either impede or facilitate the shift towards sustainable energy systems. For example, a political economy approach can help understand shifting power relations and the underlying interest of dominant groups, prevailing conflicts, and patterns of public support or resistance all of which are very important for accelerating the transition towards clean energy systems (Pedersen et al., 2021; Baker et al., 2014). Such an approach can also help unearth "how energy regimes serve to promote the interests of some actors and interests at the expense of others and whether and how global institutions can support transitions that are both lower carbon and socially just" (Power et al., 2016:9).

Moreover, applying a political economy lens to sustainable energy transitions can enable policy makers understand and build reform coalitions, and adopt strategies that can effectively generate the needed momentum for encouraging sustainability transitions (Meadowcroft, 2011). Furthermore, political economy analysis may also provide deep insights regarding the caliber of reforms that create positive feedbacks and further drive change, resistance strategies that are most popular with transition opponents, and how these can be countered by proponents (Ibid).

Furthermore, as highlighted by Kern and Markard (2016), given that energy transition processes also entail interactions beyond the confines of the state, perspectives from international political economy

[5] For an overview of the criticisms against the socio-technical transition theory or MLP, see for example: Geels (2019); Köhler et al. (2019); and Smith et al. (2010)

[6] Köhler et al. (2019:6) argue that transitions in general remain "inherently political processes, in the sense that different individuals and groups will disagree about desirable directions of transitions, about appropriate ways to steer such processes and in the sense that transitions potentially lead to winners and losers".

can help explain political and economic relationships at the global level taking into consideration the interaction between different political scales and how these influence different transition pathways.

3.0 Political Economy Factors influencing Sustainable Energy Transitions

3.1 Overview of the Empirical Literature Reviewed

The empirical literature employed in this review were derived from multiple sources. First, a search for published papers was conducted online in academic databases such as Scopus, SpringerLink and Web of Science. This was then complimented with a search for grey literature in the form of working papers and reports on Google Scholar. A combination of various key words and phrases such as " political economy of sustainable energy transition", "political and economic factors influencing renewable energy transition", "the politics of clean energy transitions" and " political economy of low carbon transitions" were used during the search process which covered the period 2008 to 2022. Although, the initial search results yielded 3,942 records, after a careful screening of all records and the exclusion of those did not match the search intentions, a total of 36 studies were retained for the full text review.

Out of the 36 studies reviewed, 22 are single country studies whereas 14 are cross-country studies. Also, 18 studies are centered on high incomes countries, 13 studies on low and middle income countries, and 5 studies include countries from both categories. With regards to the empirical approach adopted, the majority of studies reviewed (29) are qualitative in nature, 6 studies are quantitative and only 1 study is based on a mixed method approach. A summary of all the studies reviewed is presented in the appendix.

3.2 Political Economy Factors Discussed

3.2.1 Vested Interest

As earlier mentioned, the domain of sustainable energy transitions amongst others is inherently multi-scalar and multi-actor oriented (Kohler et al., 2019; Kern and Markard, 2016). This implies that the process often involves a wide range of different actors, with interest which maybe at conflict with one another (Jacob, 2017). For example, whereas traditional incumbents may tend to have strong vested interest in maintaining existing energy systems that are dependent on fossil fuel resources, other groups such as environmentalist and renewable energy firms may rather be interested in promoting clean energy options. This diversity of interest has strong implications for sustainable energy transitions.

In the extant literature, the role of vested interest and coalitions in influencing sustainable energy transitions has received much attention. Particularly, several studies have examined the how the vested interest of fossil fuel incumbents predominantly aimed at maintaining the status quo, obstruct the transition to sustainable energy systems. The core argument here is centered around the fact that, traditional fossil fuel regimes due to their long presence and dominance tend to enjoy the backing of powerful groups and political networks, and over time form institutional structures that entrench and perpetuate their survival (Moe, 2014). For example, Hanto et al. (2022), Hochstetler (2020) and Baker et al. (2014) all argue that the limited progress made towards decarbonizing South Africa's energy sector largely dominated by coal can be attributed to the vested interest of powerful power sector incumbents including state owned utilities such as ESKOM who control and benefit from south Africa's mineral energy complex and therefore remain committed to electricity generation from coal. Similarly, in Tanzania Jacob (2017) posits that despite competing narratives for clean energy alternatives, investments in coal and other fossil fuels appear entrenched due to the interest of state bureaucrats and the ruling elites who depend on the rents from these investments for long term political survival. Also, the persistence of coal mining industry in Indonesia has been attributed to vested interest of top government officials and powerful political functionaries including members of parliament who own shares and assets in the coal mining industry (Ordonez et al., 2022). In Oman, Al-Sarihi and Cherni (2022) also show that the interest of regime actors including government and the players in the oil and gas industry to continuously benefit from domestic demand for fossil fuels largely explains the stern resistance to renewable energy investments in the country.

In spite of the above, some studies have also examined how vested interest structures may enable or facilitate the phasing in of sustainable energy sources. For example, Boute and Zhikharev (2019), analyse the role of vested interest in driving Russia's solar energy policy. They show that in an economy heavily dependent on oil, the vested interest of powerful groups including solar PV manufacturers enabled the development of a renewable energy support scheme which in turn stimulated the deployment of solar, wind and hydropower. In Kenya, Newell and Phillips (2016) also provide evidence on the influential role of donor interest towards energy transition reforms in the country. In the context of Japan, Moe (2014) argues that the success of solar PVs was largely as a result of the consistent bureaucratic support provided by the government. In Denmark, strong political support for the development of the wind energy industry by the government and its successes over the years also provides further evidence on

how vested interest structures may drive the growth and deployment of renewable energy technologies (Moe, 2014).

3.2.2 Advocacy Coalitions and Green Constituencies

The important role of advocacy coalitions and green constituencies in shaping pathways towards sustainable energy transitions cannot be over emphasized. Given that sustainable energy transitions involve different actors with diverging interest, coalitions of supporters for renewable energy are usually very necessary to counter the interest of fossil fuel incumbents, and provide a strong political incentive for governments to pursue policies towards transitioning to clean energy systems. For example, Nevzorova and Kutcherov (2021) emphasize the instrumental role of advocacy coalitions in shaping the development of the renewable energy policy in Russia. The authors argue that since 2016 the design of support schemes to boost renewable energy technologies particularly solar, wind and bioenergy can be attributed to the lobbying activities of a pro-renewables coalition led by the Russian Renewable Energy Association whose interest is to increase the share of renewables in the national energy mix.

Also, in Finland, Haukkala (2018) believes that the emergence of a green transition advocacy coalition comprising green energy industries, NGOs, individuals in academia and citizens provided a major boost to the renewable energy campaign by countering the position of industrial incumbents and placing issues of climate change and the need for a sustainable energy transition on the country's political agenda. Similarly, in the context of Chile, the development of a decarbonization policy for the energy sector including a voluntary coal-phase out agreement has been largely driven by pressure from an anti-coal coalition comprised of citizens, civil society organizations and environmental groups concerned about the negative externalities of coal production in the country (DeStephano et al., 2022). Likewise, Jacobsson and Lauber (2006) also argue that the success of renewable energy diffusion in Germany can be attributed to the efforts of advocacy coalitions and green constituencies including for example solar and wind energy industry associations, environmental organizations, farmer groups, church groups and the green party, all of whom exerted pressure on government to transition to a low carbon economy.

3.2.3 Path Dependency

The concept of path dependency simply describes how previous or past events are sustained via self-reinforcement mechanisms (Dobusch and Schussler, 2012). In the literature on sustainable energy transitions, various scholars have examined how the different transition pathways tend to be influenced

by path dependent developments in the energy sector (e.g., Barazza and Strachen, 2021; Aklin and Urpelainen, 2018; Fouquet, 2016). With regards to the slow rate of renewable energy diffusion in the energy sector, Unruh (2002) argues that the dominance of fossil fuels since the industrial revolution has resulted in a " carbon lock-in" with systematic forces perpetuating a fossil fuel economy despite the negative effects that such sources have on the environment. Consequently, the " carbon lock-in" inhibits or presents significant challenges for the emergence or transition to sustainable energy sources (Ibid). For instance, Brown et al. (2008) argue that in the US, for many years the infrastructure and institutional arrangements which were built around promoting the fossil fuel industry presented significant difficulties for the growth of renewable energy technologies by increasing the business risk and transaction cost associated with the development and deployment of such technologies. Also, Bersalli (2020) shows that in countries such as Argentina the institutional dominance of the fossil fuels industry since the start of the twentieth century has hampered the growth of renewable energy sources in the country. Despite, the known environmental externalities associated with the production and use of fossil fuels, the fossil fuel industry is continuously flagged as a key pillar for the country's economic development with large subsidies being injected into the oil and gas sector. Oels and Buschmann (2018) also argue that despite Germany's efforts at championing a renewable energy transition, it remains impossible for the country to completely phase out coal at least in the short term. This is largely because the country's long history with coal has resulted in a technological, institutional and behavioral carbon lock-in which ultimately highlights the need for coal in bridging the energy transition. Also, in Turkey and Poland, path dependencies in the energy sector tend to emphasize the dominant use of coal for energy production, and in consequence presents strong barriers to the development of renewable energy systems in both countries (Sahin, 2018).

Given that carbon lock-ins are inherently complex and difficult to untangle, in most cases path breaking measures such as external shocks become necessary to destabilize the system and provide a window for technological change towards sustainable energy systems (Aklin and Urpelainen, 2018).

3.2.4 External Shocks

The role of external shocks especially in enabling or shaping the transition to sustainable energy systems has been well studied in literature. According to Aklin and Urpelainen (2018 : 12) external shocks commonly refer to "major abrupt events that reveals the weaknesses of current policy and is not the direct product of government's own policy." As such, these events serve as "critical junctures" or

"focusing events", which threaten existing structures and provide a window of opportunity for change (Karapin, 2016; Calder, 2012).

In the sustainable energy transition discourse, external shocks are recognized as key to destabilizing carbon lock-ins or the centrality of energy systems built on fossil fuels. Abrupt events such as hikes in oil prices, accidents or extreme climatic events may draw public attention to inherent risk and cost associated with the systemic dependency on fossil fuels and thereby provide an impetus for governments to invest in clean energy alternatives (Loewen, 2022; Aklin and Urpelainen, 2018; Umbach, 2014). For example, in countries such as the USA, Germany and Denmark, the oil crisis of the 1970s and the subsequent energy crisis that ensued drew attention to the inadequacies of the fossil fuel regime and therefore provided some impetus for government to enact policies aimed at supporting the development of renewable energy technologies (Aklin and Urpelainen, 2018). Also, in Germany, although the 1986 nuclear accident in Chernobly caused widespread fear and sparked public concern about the safety of nuclear energy, the 2011 Fukushima disaster provided a breaking point for anti-nuclear coalitions to push for the total phase out of nuclear energy (Renn and Marshall, 2016; Jacobsson and Lauber,2006). Furthermore, in Japan although the country increased its import of liquefied natural gas to cater for the energy shortfalls in the aftermath of the Fukushima accident, in recent times, attention is increasingly being drawn towards the development of renewable energy sources due to a lack of public trust in nuclear energy (Umbach, 2014).

3.2.5 Policy and Institutional Environment

Existing conditions in the policy and institutional environment also remain a very important factor in influencing sustainable energy transitions. Here emphasis is placed on developments both in the domestic and international policy environments. With regards to the former, the availability of policy and regulatory frameworks for the promotion of renewable energy may level the playing field and provide positive incentives for the deployment of these technologies. For example, in countries such as Denmark and Germany the success of renewable energy technologies in particular wind and solar can be attributed to the implementation of policy support measures such as the feed-in-tariffs (Jankowska, 2014; Mendonca et al.,2009). Also in Tunisia and South Africa, Schmidt et al. (2017) argue that the development of renewable energy policies provided an entry point for low carbon technological change in an environment dominated by fossil fuels by attempting to alter the institutional structure of the energy sector and enable reforms aimed at decreasing the legitimacy of fossil fuel subsidies.

However, it is important to mention that whereas the proper design of policy and regulatory frameworks may drive the transition to sustainable energy systems, difficulties or challenges with implementation of these frameworks due to either regulatory bottlenecks or a lack of institutional capacity could as well limit the prospects of a sustainable energy transition. For instance, Gallop et al. (2021) show that amongst other factors, poor institutional capacity to implement clean energy present significant barriers to a renewable energy transition in countries such as Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, Montenegro, Macedonia, Romania and Serbia. Also for Atuguba and Tuokuu (2020) and Bawakyillenuo (2017), poor power sector regulation and clear weaknesses in the existing policy and institutional framework for renewable energy have over the years hampered the growth and deployment of renewable energy sources in Ghana.

Furthermore, with regards to the role of the external policy environment, prevailing ideas such as concerns about climate change and the environment which have been formalized in global frameworks and conventions such the Paris Agreement on Climate Change and the Sustainable Development Agenda, tend to as well drive the local actors to pursue policies towards a transition to clean energy systems. For example, Guo et al. (2014) argue that in the China's effort towards enabling a low carbon transition as captured in its 11th and 12th five year plans have been partly influenced by the country's global commitments to climate change mitigation Also in countries such as the UK, Germany and Chile concerns about environmental pollution and climate change has provided an additional impetus for the gradual phase out of coal (Stognief et al. 2022).

3.2.6 Political Institutions

Although relatively less explored in the literature, the structure of the political institutions in a country may also hinder or facilitate the transition to sustainable energy systems. Given that decision making regarding sustainable energy systems are inherently a political process, different types of political institutions may present different incentives for policy makers. In this regard some evidence exist to show that democratic institutions are more likely to pursue clean energy policies that autocratic governments. For example, using data from 1980 to 2020, Clulow and Reiner (2022) demonstrate that democratic political regimes are more associated with the transition to low carbon electricity generation than non-democracies. Similarly, based on an analysis of trends in 112 countries, Bayer and Urpelainen (2016) also show that democratic governments are more likely to adopt feed-in- tariffs for renewable energy than

autocratic governments given the fact that the incentives created by democratic competition allow governments to benefit from policies that are popular with the majority of electorates.

Moreover, even within democratic political institutions, systems that are based on proportional representation maybe more aligned to adopting environmentally friendly energy policies than those systems based on a simple majority (Lockwood et al., 2016). This is in view of the fact that proportional representation systems are more likely foster coalition arrangements which may include smaller parties such as those aligned to the green movement and therefore accord them the opportunity to push forward a sustainability agenda in exchange for general support (Ibid).

Furthermore, still within the context of democratic political institutions, some studies have highlighted the role of party political ideology in influencing policy decisions on sustainable energy transitions. For example, Dasgupta et al. (2017) examine the influence of political economy factors on sustainable energy innovations in 20 OECD countries. They conclude that amongst others, the political orientation of governments, specifically being centre left increases the higher likelihood of investing in innovations on clean energy technologies. Similarly, in their analysis of Eurobarometer survey data for 25 countries, McCright et al. (2015) also argue that left leaning governments tend to report stronger belief in climate change and are therefore more inclined to pursing mitigation policies including low carbon transitions.

3.2.7 Resource Endowment (Fossil Fuels)

The availability of fossil fuel resources and the structural dependency on these resources for domestic energy production, utilization, and export presents significant barriers to a sustainable energy transition. This is because in such context, the structural dependency on fossil fuels resources is perceived to be economically beneficial at least in the short term, although its long term implications tend to be obviously negative on society as a whole (Gursan and de Gooyert, 2021; Sachs and Warner, 2001). Several empirical studies show that countries that are endowed with fossil fuel resources and rely on same for meeting local energy needs and for export tend to be more focused on the exploitation of these resources rather than the development of alternative clean energy options. For example, Pedersen (2022) argues that the discovery of oil and gas resources in 2007 presented significant challenges to the development of renewable energy sources in Ghana by shifting local priorities away from decarbonization. Likewise, Puerto-Chaves and Corral-Montoya (2022) also argue that the abundance of coal resources in Colombia has over the years stifled the growth of a viable renewable energy industry. Also, Pfeiffer and Mulder

(2013) analyse trends in the diffusion of renewable energy technologies across 108 developing countries from 1980-2010. They establish that in countries with high levels of fossil fuel production, the deployment of renewable energy technologies tend to delayed. Similarly, based on data from the International Renewable Energy Agency, Pedersen et al. (2021) also show that in sub-Sahara Africa, countries endowed with fossil fuel resources such as oil and gas, and coal tend to have on the average very low rates of non-hydro renewable energy penetration than. Thus signaling the negative impact of fossil fuels on the prospects for adopting renewable energy sources on a significant scale.

However, in spite of the above, it is also prudent to highlight that not all fossil fuel resource rich countries are trapped into the low deployment of renewable energy technologies. For example countries such as Germany and Norway, although endowed with coal, and oil and gas resources respectively, are still champions in progressively promoting there still pursue clean energy technologies. Nevertheless, these examples represent a few exceptions rather than the norm.

4.0 Emerging Gaps and a Research Agenda

Generally, a methodical review of the existing empirical studies on the political economy of sustainable energy transitions as presented in the preceding section reveals that although studies in this field are recently increasing, several knowledge gaps still exist. A number of these are discussed below.

First of all, as evident in this review , although sustainable energy transitions generally entail both processes of technological change and institutional change, a vast share of the empirical literature on political economy of sustainable energy transitions is centered on factors that drive technological change. Although some studies address factors focused on institutional change, they tend to be in the minority. Thus considering the relevance of institutional change for clean energy transitions more empirical analysis of the political economy drivers may be required. To this end, researchers may draw on insights from new institutional economics particularly game theory to provide a more tactical understanding of the strategic interaction between actors involved in the reform process, and how these facilitate or hinder efforts towards sustainable energy transitions.

Secondly, although many different types of sustainable or renewable energy technologies exist, a large chunk of the existing literature predominantly focuses on analyzing political economy issues centered on a few technologies such as wind and solar. As a matter of fact, political economy analysis that cover other non-hydro renewable energy technologies such as biomass, bioenergy, geothermal energy are still

lacking. Thus, considering that these other renewable sources also hold a huge potential to contribute to a clean energy transition, understanding the political economy factors that shape their diffusion or otherwise remain important.

Thirdly, related to the above, very few of the existing empirical studies attempt to provide a comparative analysis of the political economy factors underlying the different types of renewable energy technologies. Notable exceptions here include for example, Cetkovic and Buzogany (2022), Hochsteler (2020) and Jacobsson and Lauber, (2006) all of whom attempt to analyze factors that impact on wind energy and solar simultaneously.

Fourthly, the existing empirical studies on the political economy of sustainable energy transitions tend to focus narrowly on just the energy sector. So far studies that analyse the political economy of sustainable energy transitions in other sectors tend to be lacking. However, in many countries there are significant interlinkages between the energy sector and other sectors of the economy, for example the health and education sectors. Although the energy sector is generally bequeathed with the responsibility of supervising matters relating energy production and provision, it partly depends on other sectors for the utilization and consumption of the power produced. Thus, given that health facilities tend to be very high consumers of energy, the interest or preferences of health policy makers and other key actors within the health sector for specific sources of energy may potentially differ thus impacting on energy choices and the kind of strategic alliances or coalitions that such actors may be willing to join. Therefore, attempts to broaden the scope of existing political economy analysis of energy transitions to cover other key sectors such as the health sector may prove very useful in providing a more comprehensive understanding of the role of politics and relations of power in the energy transition process. Research in this grey area is certainly needed.

Lastly, as shown in the review, a dominant strand of the empirical literature analysing the political economy of sustainable energy transitions is predominantly centered on high income countries. Although studies focusing on low and middle income countries exist, their relative share is still limited. Moreover, a majority of the studies that exist on low and middle income countries are mainly centered on a few countries, for example, China, India, Brazil, South Africa and Kenya (e.g. Power et al. 2016, Newell and Phillips, 2016; Baker et al., 2014). Given that renewable energy options are increasing being promoted in

many low and middle income countries, more empirical research is needed especially in sub-Saharan Africa where many countries are currently experimenting with different renewable energy sources.

5.0 Conclusion

To conclude, it remains true that energy transitions are very complex in nature. Hence, to understand how such processes enfold over time, it is necessary to take into account the political and economic conditions under which energy transitions are likely to occur or not to occur. As shown in this state of the art review, although nascent, studies that analyse the political economy of sustainable energy transitions are recently increasing. Amongst these studies, the factors predominantly discussed include the role of vested interest, advocacy coalitions and green constituencies, path dependencies, external shocks, policy and institutional environment, political institutions and fossil fuel resource endowments. Furthermore, all these factors are explored in the context of high income countries as well as in low and middle income countries. Nevertheless, several gaps still exist and are yet to be fully explored in the extant literature. For example, virtually no study has yet explored the political economy of sustainable energy transition outside the energy sector. Also, very few studies explore political economy considerations outside wind and solar energy, and few studies as well attempt a comparative analysis of political economy factors underlying the different renewable energy technologies. Additionally, empirical contributions that specifically address the process of institutional change towards clean energy transitions are still very limited and mostly focused on high income countries. Thus, more empirical research along these lines may provide some new and very interesting insights for the energy transition discourse and help draw lessons which might otherwise remain hidden.

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Appendix

Appendix 1: Summary of Empirical Studies Reviewed

Author	Countries	Approach	Clean Energy Technology[7]	Political Economy Factors Discussed
Aklin and Upelainen (2018)	Brazil, Denmark, France, China, India, Germany, South Africa, Kenya, USA, UK	Qualitative	Solar, Wind, Biofuels	External shocks Path dependency Policy and institutional environment Political institutions
Al-Sarihi and Cherni (2022)	Oman	Qualitative	Solar	Vested Interest Policy and institutional environment Resource endowments
Atuguba and Tuokuu (2020)	Ghana	Qualitative	RETs in general	Vested interest Policy and institutional environment Path dependency
Bawakyillenuo (2017)	Ghana	Qualitative	RETs in general	Policy and institutional environment
Bayer and Urpelainen (2016)	112 countries	Quantitative	RETs in general	Political institutions
Bersalli (2020)	Argentina	Qualitative	Solar, Wind	Path dependency
Brown et al. (2008)	USA	Qualitative	RETs in general	Path dependency Policy and institutional environment
Boute and Zhikharev (2019)	Russia	Qualitative	Solar	Vested interest

[7] RETs refer to Renewable Energy Technologies

Cetkovic and Buzogany (2022)	Poland, Hungary, Czech Republic, Slovakia, Bulgaria and Romania	Quantitative	Solar, Wind	Path dependency Policy and institutional environment
Clulow and Reiner (2022)	135 countries	Quantitative	Solar, Wind, Hydro, Nuclear	Political institutions
Dasgupta et al. (2017)	20 OECD Countries	Quantitative	RETs in general	Political institutions Policy and institutional environment
DeStephano et al. (2022)	Chile	Qualitative	Solar, Wind	Advocacy coalitions and green constituencies Policy and institutional environment
Gallop et al. (2021)	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Kosovo, Montenegro, Macedonia, Romania and Serbia	Qualitative	RETs in general	Policy and institutional environment
Guo et al. (2014)	China	Qualitative	RETs in general	Policy and institutional environment
Hanto et al. (2020)	South Africa	Qualitative	RETs in general	Vested interest Policy and institutional environment
Hochstetler (2020)	Brazil, South Africa	Qualitative	Solar, Wind	Vested interest, Policy and institutional environment, Advocacy coalitions and green constituencies Political Institutions

Haukkala (2018)	Finland	Qualitative	Solar, Wind, Bioenergy	Advocacy coalitions and green constituencies
Jacob (2017)	Tanzania	Qualitative	RETs in general	Vested interest
Jacobsson and Lauber (2006)	Germany	Qualitative	Solar, Wind	Advocacy coalitions and green constituencies External shocks
Jankowska (2014)	Germany	Qualitative	Solar	Vested interest, Policy and institutional environment Advocacy coalitions and green constituencies Political Institutions
Karapin (2016)	USA	Mixed methods	RETs in general	Vested interest External shocks, Policy and institutional environment, Advocacy coalitions and green constituencies Path dependency Political institutions
Mendonca et al. (2009)	Denmark, USA	Qualitative	Wind, Solar	Vested interest Policy and institutional environment, Advocacy coalitions and green constituencies Political institutions
McCright et al. (2015)	25 EU Countries	Quantitative	RETs in general	Political institutions
Moe (2014)	Japan, China, Norway and Denmark.	Qualitative	Solar, wind, Hydro	Vested interest External shocks

Nevzorova and Kutcherov (2021)	Russia	Qualitative	Solar, Wind, Bioenergy	Advocacy coalitions and green constituencies
Oels and Buschmann (2018)	Germany	Qualitative	RETs in general	Path dependency
Ordonez et al. (2022)	Indonesia	Qualitative	RETs in general	Vested interest Policy and Institutional environment
Pedersen (2022)	Ghana	Qualitative	Non-hydro RETs	Vested interest Path dependency Policy and institutional environment Resource endowment
Pedersen et al. (2021)	Ghana, Kenya	Qualitative	Non-hydro RETs	Vested interest, Policy and institutional environment Resource endowment
Pfeiffer and Mulder (2013)	108 LMI Countries	Quantitative	Non-hydro RETs	Resource endowment
Puerto-Chaves and Corral-Montoya (2022)	Colombia	Qualitative	RETs in general	Vested interest Policy and institutional environment Resource endowment
Renn and Marshall (2016)	Germany	Qualitative	RETs in general	External shocks Vested interest Policy and institutional environment Advocacy coalitions and green constituencies
Sahin (2018)	Turkey, Poland, Germany	Qualitative	RETs in general	Path dependency

Schmidt et al. (2018)	Tunisia, South Africa	Qualitative	RETs in general	Path dependency Policy and institutional environment
Stognief et al. (2022)	United Kingdom	Qualitative	RETs in general	Policy and institutional environment Political institutions Advocacy coalitions and green constituencies
Umbach (2014)	Japan	Qualitative	RETs in general	External shocks Policy and institutional environment