ASSESSING THE GLOBAL ENERGY JUSTICE: AN ANALYTICAL PERSPECTIVE

BERFU SOLAK

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ABSTRACT

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As a recently intrdocued concept in literature, energy justice seeks to ensure a just and equitable energy system in which all individuals, without any discrimination, are provided with safe, affordable and sustainable energy. On the basis of energy justice concept, this study aims to design a composite index to measure the energy justice performance of selected countries by utilizing a multidimensional analysis through eight different indicators. These indicators consist of "GDP per capita", "access to electricity", "carbon intensity", "carbon emissions per capita", "access to clean fuels and technologies for cooking", "energy use per capita", "energy use per $1000 GDP", and "the share of renewable energy in total final energy consumption". The study presents calculations regarding Energy Justice Index values of 81 countries during the time period between 2006 and 2016. The results are analysed in two different ways. Firstly, a categorization is applied. While a number of countries are classified as high energy justice performance countries, some others are clustered as low energy justice performance countries. It is seen that the majority of the sample countries has a medium energy justice score. This situation proves the fact that developed countries that pay more attention to environmental concerns and renewable energy consumption prevail developing or underdeveloped countries that are still dependent on a carbon intensive economy.

Keywords: Energy Justice, Energy Equality, Energy Justice Index

ÖZET

KÜRESEL ENERJİ ADALETİNİN DEĞERLENDİRİLMESİ: ANALİTİK BİR BAKIŞ AÇISI

Solak, Berfu

Sürdürülebilir Enerji Yüksek Lisans Programı, Lisansüstü Eğitim Enstitüsü

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Literatüre yeni giren bir kavram olan enerji adaleti, tüm bireylerin herhangi bir ayrım gözetmeksizin, güvenli, düşük maliyetli ve sürdürülebilir enerjiye erişiminin olduğu adaletli ve eşitlikçi bir enerji sistemi oluşturmayı hedeflemektedir. Bu çalışma, enerji adaleti kavramı temelinde, sekiz farklı gösterge aracılığıyla çok boyutlu bir analiz kullanarak, seçilen ülkelerin enerji adaleti performansını ölçmek için bir endeks tasarlamayı amaçlamaktadır. Söz konusu göstergeler; "kişi başına düşen GSYİH", "elektriğe erişim", "karbon yoğunluğu", "kişi başına düşen karbon salınımı", "yemek pişirmek için temiz yakıtlara ve teknolojilere erişim", "kişi başına düşen enerji kullanımı", "enerji yoğunluğu ve yenilenebilir enerjinin toplam nihai enerji tüketimi içindeki payından" oluşmaktadır. Çalışma, 2006 ve 2016 yılları arasında 81 ülkenin Enerji Adalet Endeksi değerlerine ilişkin hesaplamaları ortaya koymaktadır. Sonuçlar iki farklı şekilde analiz edilmiştir. İlk olarak sınıflandırma yöntemine başvurulmuştur. Bazı ülkeler, yüksek enerji adaleti performansına sahip ülkeler olarak sınıflandırılırken, bazıları düşük enerji adaleti performansına sahip ülkeler olarak nitelendirilmiştir. Örneklem olarak alınan ülkelerin çoğunluğunun orta düzeyde enerji adaleti puanına sahip olduğu görülmüştür. Bu durum, çevresel sorunlara ve yenilenebilir enerji tüketimine daha fazla önem veren gelişmiş ülkelerin, halen karbon yoğun bir ekonomiye bağımlı olan azgelişmiş veya gelişmekte olan ülkelerden enerji adaleti performansı bakımından üstün geldiği önerisini kanıtlamaktadır.

Anahtar Kelimeler: Enerji Adaleti, Enerji Eşitliği, Enerji Adaleti Endeksi

To My Family

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CHAPTER 1

INTRODUCTION

The complex global energy system in which each country experiences differences regarding energy generation, energy consumption, access to energy resources and services as well as climate change and environmental problems-related outcomes creates serious justice concerns. These aspects are believed to have serious impacts on human happiness, social well-being and equity (Jones et al., 2015). Under these conditions, the energy system is regarded as unjust because of unequal distribution of benefits and illnesses (McCauley et al., 2019). This is proven by the fact that the costs and adverse impacts of climate change are mostly reflected on the least developed and poorest countries while the benefits and positive impacts are generally experienced by rich and powerful states (Matthew, 2007).

The burdens driven by injustice can be categorized in two different ways, including energy waste, over consumption and pollution on the one hand, and lack of access to energy resources and services as well as energy poverty on the other (Wilkinson et al., 2007). Both of these situations create risks to ensure justice in terms of the fact that over consumption of energy resources creates environmental challenges and unequal distribution of resources while under-consumption leaves billions of people without access to necessary forms of energy (Sovacool et al., 2016). In this perspective, as an attractive research area, energy justice framework tries to illuminate the underlying reasons behind the injustices in global energy system from an ethical point of view. Furthermore, it suggests principles to create a more equitable prospective energy system.

Currently, the energy justice literature tends to rapidly grow as the concept covers a broader range than environmental and climate justice movements that gave the birth to energy justice concept (Jenkins, 2018). However, it is observed that the energy justice literature has yet to be mature as the concept has been recently introduced. The recent studies mostly focus on the defining the energy justice concept and

extending the scope of its content and framework. The literature also provides several case studies to show how energy justice is conceptualized and to what extent it is possible to achieve a just energy system in these countries. However, it is seen that there exists a gap in the literature as there is not any systematic index to measure energy justice performance of different countries by utilizing specific indicators that are influential to assess energy justice.

This thesis tries to fill this gap by grounding its discussions on energy justice literature. In this sense, the fundamental purposes of this study are two-fold. Firstly, it has an aim to construct an index to measure energy justice. Secondly, it contributes to the literature by comparing the energy justice performance of the sample countries by utilizing the constructed Energy Justice Index. Accordingly, the study reveals the countries with high, medium and low energy justice performance. This helps to identify which countries are able to achieve energy justice and which are not.

Hence, this study aims to answer the following research questions:

i) How is energy justice defined?
ii) How does energy justice concept evolve from previous justice movements?
iii) What are the requirements and fundamental principles of energy justice framework?
iv) What are the key indicators to measure energy justice?
v) Is it possible to create an Energy Justice Index?
vi) Which sample countries have a better energy justice performance according to the recently introduced Energy Justice Index?
vii) How energy justice performance differs in different regions of the world?

This thesis consists of six chapters. **Chapter 1** introduces the topic and provides a background for the research by determining its aim. Furthermore, it formulates the research questions in detail.

Chapter 2 illustrates a comprehensive and state-of-the-art literature review. Firstly, it defines energy justice and shows how the concept of energy justice evolves from previous environmental and climate justice literatures. Secondly, it introduces the

three-legged framework used by multiple scholar in the analysis of energy justice and makes a discussion about the principles of energy justice decision-making.

The indicators used to design an innovative Energy Justice Index are presented in **Chapter 3.** The strength of these indicators to measure energy justice is also discussed in this chapter. Moreover, the relationship between energy justice indicators and energy justice framework is depicted. This chapter also designs how this research is conducted by visualizing the research framework.

Chapter 4 introduces the methodology to construct the Energy Justice Index. It also reveals the sample countries included in the Index. Furthermore, it provides the mathematical formulations to construct the equations and scale the indicator values. Finally, how each indicator affects energy justice performance is discussed.

The output of the thesis, Energy Justice Index (EJI), is presented in **Chapter 5**. Findings and analysis of the results are discussed by categorizing the sample countries under three different groups. Furthermore, a regional comparison is made regarding the energy justice scores and justice performances of the countries.

Chapter 6 is the concluding part of this thesis. It provides a final assessment on the Energy Justice Index and puts an end to the discussion by making recommendations for further research in energy justice literature.

CHAPTER 2

LITERATURE REVIEW

The first phase of the literature review conducted has focused on the fundamental sources identifying the concept of energy justice and its evolution. In this regard, definition of justice and energy justice, evolution of the energy justice concept, three-legged framework argued by multiple scholars, and eight principled decision-making framework on energy justice have been analysed and discussed.

The second phase of the literature review presents a discussion on the findings of the existing sources dealing with energy justice concept. In this section of the literature review, more than hundred articles have been scanned and analysed. Most of the sources used in the literature review were selected from studies listed under Sciencedirect, Ebscohost, Researchgate and Google Scholar, as well as European Commission's documents. Keywords used to delimit the research include: "energy justice", "energy equality", "energy affordability", "energy equity", "fuel poverty", "energy trilemma", "environmental justice", "three-legged framework", "distributional justice", "procedural justice", and "recognition justice".

The majority of the retrieved literature deals with low income regions of the world where the inequalities regarding the access to energy resources and facilities are mostly observed. The existing literature generally focuses on either the evolution of energy justice concept or case studies in order to evaluate the energy justice approach of multiple countries or regions. The analyses are mostly based on how decisions are taken regarding the establishment of renewable energy or nuclear facilities and coal-fired power plants.

2.1. Concept of Energy Justice and Definition

Energy, as an extremely crucial concept, constitutes the fundamental source of human and economic development. The concept of "energy justice" cannot be thoroughly understood without explaining the definition of "justice". Justice is

defined as ensuring and recognising basic equal rights to all human beings with a commitment to the "distribution of good and bad things" (Campbell, 2010). Accordingly, energy justice is defined as a set of principles seeking to protect people from any kind of environmental pollution by providing a clean and healthy environment, to ensure equal opportunities to have an access to energy resources, and to prevent the uneven share of costs and adverse impacts related to "building, operating and maintaining electric power generation, transmission and distribution system" (Joroff, 2017).

Energy justice has emerged as a new and prominent concept in energy literature with respect to decision-making regarding energy policies, energy production and consumption, energy distribution, energy security, and environmental concerns and climate change (Jenkins et al., 2016). According to McCauley et al. (2019), energy justice is regarded as a conceptual, analytical and decision-making framework in order to realize how the energy related-ethical questions emerge, whom will engage in the solutions of these problems, and what kinds of solutions are trailed for the sake of adopting a sustainable energy system through the principles of fairness and equity. In other words, energy justice seeks to detect the time and location of injustices, and find the most appropriate law and policy that will remove the injustices (Heffron and McCauley, 2014; McCauley et al., 2013; Sovacool and Dworkin, 2015). It is also defined as a decision-making tool that is related to moral considerations in terms of how decisions might influence individuals (Jenkins, 2018). Energy justice has an aim to provide all individuals, without any discrimination, "with safe, affordable and sustainable energy" (McCauley et al., 2013). Based on EU strategy of Energy 2020 called "A Strategy for Competitive, Sustainable and Secure Energy", the sustainable energy development of European Union Member States is of great importance as "the well-being of citizens, industry and economy depends on secure, safe, sustainable and affordable energy" (EC, 2010).

As a commonly referred concept in the academic literature, the transition to a low carbon energy system requires the consolidation of social justice concerns as well as "affordability and equity of new innovations" (McCauley and Heffron, 2018; Jenkins et al., 2018). At this point, there exist two arguments including to ensure a right to

the world population to have an access to affordable and clean energy resources, and to reduce the use of fossil fuels as a source of energy by considering the impacts of climate change (McCauley et al., 2019). These two arguments are also highlighted in Sustainable Development Goals, and they take the social justice into account within the framework of "fairness in access and allocation of resources and technologies" (UNDP, 2019). Therefore, the energy justice concept has been gradually gaining importance in academic environment in order to bring a new dimension to energy decision-making framework.

2.2. Evolution of Energy Justice Concept

The energy justice concept, as a policy-oriented term, was firstly used by McCauley et al. in 2013 in order to "refer justice-related concerns in energy systems, from production to consumption" (McCauley et al., 2013). However, before energy justice concept was introduced to the literature, justice-related concerns were mostly involved in environmental and climate justice literatures. Afterwards, energy justice is regarded as a "more manageable approach", also covering environmental and climate justice as a whole (Jenkins, 2018).

The intrinsic definition of environmental justice implies that the environmental hazards should be equally distributed and fair access to all natural resources should be ensured. In this regard, environmental justice also requires involvement in decision-making, fair treatment in access to benefits and equal protection from burdens (Jenkins, 2018; Sovacool and Dworkin, 2015; Schlosberg, 1999). "Unequal distribution of environmental ills", such as environmental pollution caused by waste facilities, led to the creation of environmental justice movement in 1970s North America (Davies, 2006; Williams, 1999). Accordingly, the environmental justice literature argues that particular groups such as socially deprived or ethnic minorities, especially poor black and minority ethnic groups in America, are exposed to the risks associated with environmental ills (Houstan, 2013). This situation is interpreted as environmental injustice as only a specific part of the society is negatively affected by environmental ills. As a response to the imbalanced distribution of environmental benefits, fair treatment without any discrimination such as race, ethnicity, or income

is tried to be ensured through "environmental laws, regulations and policies" (Bass, 1998).

Environmental justice is mostly conceptualized within the framework of two inter-related levels. Accordingly, it is firstly regarded as a local and activist level as a political opportunity to mobilize public, and secondly, it is conceptualized as a policy principle by governments to emphasize that no specific social group can be adversely affected by any public action (Agyeman and Evans, 2004). However, it is seen that this conceptualization is based on particular debates such as "toxic waste, air pollution and landfill sites" besides "ecological restoration, health, access to food, housing, and forest management" (Jenkins, 2018; Walker, 2009; Schlosberg, 2013; Sze and London, 2008). This proves that environmental justice literature does not intrinsically deal with energy-related issue, and the injustices caused by global supply chain are not addressed thoroughly (Hess and Ribeiro, 2016).

Environmental justice literature is also criticized by academia as it is lack of a pervasive impact except for its meaning and application as well as a lack of strong conceptual core (Jenkins, 2018). In this regard, it is argued that environmental justice is not sufficient to make a prominent impact on policy and decision-making (Bickerstaff and Agyeman, 2009). Another significant argument about the deficiency of environmental justice is that its arguments remain US-centric, probably because of the fact that the concept initially emerged in America (Reed and George, 2011). This is strongly restricting the concept to cover energy-related issues of other communities and countries. Furthermore, two specific problems regarding environmental justice are also identified as follows: Firstly, the definition of environmental justice concept is too broad and vague, and secondly, it is quite difficult to translate environmental justice into economics and policy formation because of its broad definition (Heffron et al., 2015). In accordance with these problems and weak points of environmental justice literature, its major motivation constitutes a concern for less affluent areas and people, and it remains insufficient for being overseas proliferation (Jenkins, 2018).

Similar to environmental justice, the concept of climate justice and its literature have a lack of strong basis to cover energy. It has several common characteristics with

environmental justice in terms of theory and methodology. Initially, the evolution of climate justice dates back to climate change activism by gaining speed in 1990s (Jenkins, 2018). When the climate justice concept started to attract attention, it was mostly dealing with assistance for communities negatively affected by climate change, mitigation and adaptation efforts for climate change, and carbon emission reduction (Lyster, 2015). It is also regarded as a mobilization tool in terms of climate policy. Contrary to environmental justice mostly dealing with local struggles and debates, climate justice predominantly tackles the debates on international level (Bulkeley et al., 2013; Lahn, 2017; Ciplet and Roberts, 2017).

One of the most significant difficulties encountered in climate justice is the fact that the concept does not enable successful implementation of climate change policy "in a local setting or on a smaller scale" since it covers the international arena as a whole (Jenkins, 2018). Furthermore, the largest CO_2 producers with a damaging trend in their climate change policy have led to a restricted success of climate justice movement. Accordingly, it is proved that climate justice is not successful enough to ensure the equity and justice. As a response to these arguments, it could be clearly stated that the content and scope of climate justice are not sufficient to provide a solution to climate change and to tackle larger climate challenges and risks (Jenkins, 2018).

As far as the evolution of energy justice concept is taken into account, it is seen that the energy justice literature dates back environmental and climate justice literatures emerged in 1970s and 1990s, respectively. However, energy justice literature differs from environmental and climate justice literatures in terms of three different aspects (Jenkins, 2018). Firstly, it is argued that energy justice is much more target-oriented with respect to its topic and concern as well as its high potential for policy-making. Accordingly, energy justice literature has a well-established content and scope covering energy, climate and environment as a whole. Secondly, it is seen that energy justice concept does not drive from any social movements unlike environmental and climate justice concepts. Last but not least, energy justice literature has a strong methodological basis applicable both in academia and policy-making.

2.3. Three-legged Framework on Energy Justice

Energy transitions are the fundamental focus of climate change policies, which require large-scale transitions based on energy generation from fossil fuels to renewable energy resources. However, the energy transition brings an unequal environment contrary to positive outcomes for environmental protection. This means energy transitions lead to unequal outcomes for different geographies, income groups, ethnic groups, genders, and generations (Sari et al., 2017). This situation creates multiple questions and multifaceted problems, including the utilization of fossil fuel technology, unequal distribution of generated energy and environmental benefits (Lohman, 2009). As a solution to these multifaceted problems, the following framework consisting of distributional, recognition and procedural justice, as depicted in Figure 1, is introduced in order to identify the place of injustices, and how justice can be ensured.

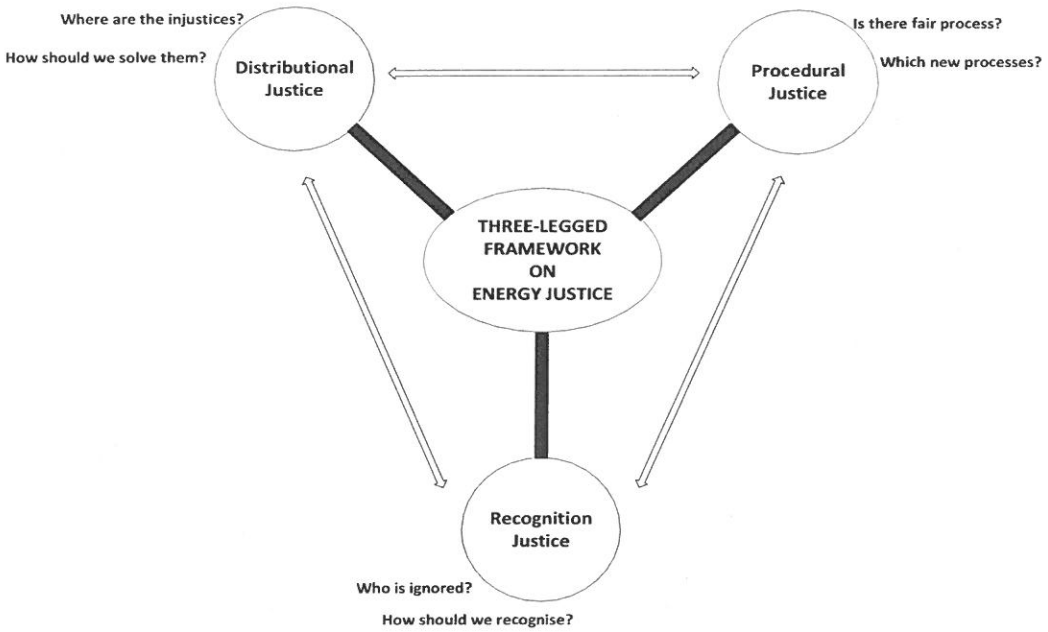

Figure 1.*Three-legged Framework on Energy Justice (Source: Jenkins et al., 2017)*

2.3.1. Distributional Justice

Multiple scholars believe that the energy system is intrinsically unequal in terms of the allocation of energy technologies and access to the energy generated as an output (Sovacool et al., 2016; McCauley, 2018). As far as consumption perspective is taken into account, it is clearly observed that physical and affordable "access to

heating and electricity" is the key element of distributional justice (Jenkins et al., 2016). Furthermore, distributional justice examines whether or not the environmental benefits and impacts are physically subject to equal allocation (McCauley et al., 2019). Namely, the environmental benefits are expected to evenly distributed regardless of income, race, or social status. Accordingly, it is argued that environmentally dangerous energy infrastructure is mostly located in specific regions where poverty is relatively higher and ethnic minority representation is lower (Taylor, 2000; Bullard, 2008). Distributional justice does not only take energy generation into account but also it covers dismantling of old fossil fuel infrastructures. Decommissioning of old oil and nuclear energy technologies besides the disposal of environmentally hazardous wastes might create inequality, which violates the principle of distributional justice.

It is commonly argued that an energy supplier that provides affordable energy services to the poor regions as a part of social responsibility creates a social value and contributes to ensuring of distributional justice (Karababa and Kjeldgaard, 2014). Accordingly, it is suggested that socially and environmentally conscious energy suppliers could encourage others to supply energy to every region without any discrimination, and they could potentially influence these kinds of social practices (Shove, 2003).

2.3.2. Recognition Justice

As the second pillar of three-legged framework on energy justice, recognition justice deals with lack of fair representation of specific parts of the society. Namely, recognition justice implies that "all individuals must be fairly represented and they must be free from physical threats" (Schlosberg, 2003). Moreover, they must be provided with political rights that are equal for everyone. At this point, the concept of "recognition" differs from "participation" with respect to the fact that "recognition" aims at "removing the process of disrespect, insult and degradation" which undervalue and misrepresent some parts of the society (Walker, 2009). The fundamental purpose of recognition justice is to identify where inequalities arise, who become the energy victims and when they suffer from distribution of inequalities (Jones et al., 2015). Recognition justice also considers groups of people

that are overlooked or not represented properly, and calls for greater recognition of these groups to reduce social inequality. For this reason, multiple scholars can define recognition justice as post distributional justice to some extent (Heffron and McCauley, 2017; McCauley et al., 2013). This stems from the fact that the distributional inequalities have always direct impacts on the specific neglected sections of the society (Bulkeley et al., 2014).

McCauley et al. (2019) make a reference to the misrecognition identified by Fraser (1999) within the framework of three main categories, including "cultural domination, non-recognition, and disrespect". In this regard, mostly indigenous groups and populations are exposed to inequalities and resources conflicts because of cultural domination (Acuna, 2015). It is also seen that disabled people in the society are in a disadvantageous position in terms of access to resources for affordable heating (Lalvani, 2013). Similar to indigenous groups, minorities and disabled people, male domination in energy sector also creates gender inequality with respect to insufficient women participation as professionals and women's lack of access to certain energy sources (Farhar et al., 2014; Reed and George, 2011). As a consequence, it is seen that there is less opportunity for women to work in the energy sector and take an active role in decision-making processes compared to men (Herring, 2009; Pearl-Martinez and Stephens, 2016).

2.3.3. Procedural Justice

The third pillar of the three-legged energy justice framework is procedural justice, which refers to "equitable procedures that engage all stakeholders in a non-discriminatory way" in decision-making process (Walker, 2009). This means all groups should have a right to have a voice in decision-making. "Participation, impartiality and information disclosure by government and industry" are the key issues in procedural justice (Davies, 2006). Accordingly, each participant in the energy sector should have the information about the incentive mechanisms and subsidies, and these participants should be accorded same rights in order to benefit from these mechanisms. This can only be achieved through a proper due process that will be relevant to local, provincial, national and global levels of energy decision-making (Heffron et al., 2015).

Procedural justice is regarded as a complementary pillar combining distributional and recognition justice with respect to the fact that it creates a requirement for the formal participation in decision-making process (Otsuki, 2016; Ottinger et al., 2014; Simcock, 2016; Yenneti and Day, 2015). It is not sufficient to determine and identify the reasons of injustices and detect the energy victims. Instead, it is necessary to provide just and equity-based policy solutions that will ensure full recognition of the society. In this regard, the right to fair process emerges as a key issue to achieve more equitable outcomes (McCauley et al., 2019).

2.4. Principles of Energy Justice

Energy systems and transitions are driven at different levels, including local, regional, national and international. In this regard, energy justice mechanism is also expected to operate in different manners in accordance with these different scales. Accordingly, a top-down or a bottom-up decision-making structure that will serve the requirements of the related scale is needed for the effective implementation of energy justice framework. Under these circumstances, eight principled decision-making framework is suggested for the better understanding of the principles of energy justice and an effective decision-making mechanism to formulate energy policy (Sari et al., 2017).

The decision-making framework for energy justice consists of eight principles, including "availability", "affordability", "due process", "good governance", "sustainability", "inter-generational equity", "intra-generational equity", and "responsibility" (Sari et al., 2017; Sovacool and Dworkin, 2015). Figure 2 illustrates these principles in detail. The framework argues that these principles constitute a guideline for decision-makers in order to formulate energy policy. As a consequence, more equitable and just energy policy outputs are expected to be achieved.

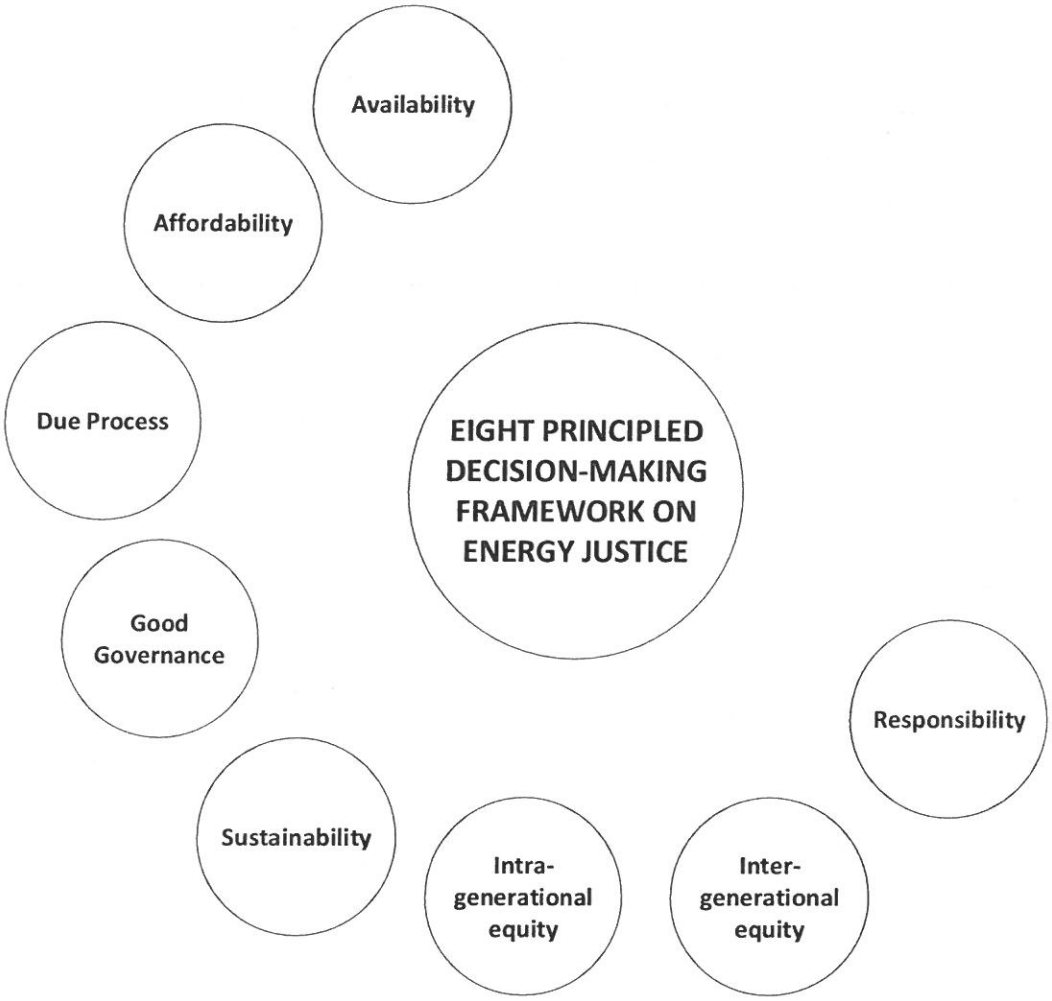

Figure 2. *Eight Principled Decision-Making Framework on Energy Justice*

2.4.1. Availability

As the fundamental principle of energy justice, availability refers to the "ability of an economy to ensure adequate energy resources" when needed (Sovacool and Dworkin, 2015). For this reason, the availability principle covers issues regarding "security of supply, sufficiency and reliability". The principle argues that all citizens without any discriminations have a right to access high quality resources. Moreover, the allocation of physical resources and technological solutions for producing, transporting, storing and distributing energy are involved in availability principle (Sovacool and Dworkin, 2015). Accordingly, the energy justice framework requires equal access of all citizens to the generated energy as an output within the scope of availability principle. Besides the availability of high quality resources, this principle also requires the necessary investment to be made for the functioning of the system

and improvement of the infrastructure to prevent accidental or intentional disruption (Elkind, 2010).

2.4.2. Affordability

From the energy policy perspective, affordability implies "all people, including the poor, should pay no more than 10 percent of their income for energy services" (Sovacool and Dworkin, 2015). In this regard, affordability principle matters when energy prices start to increase and consumers cannot have sufficient financial sources for heating or electricity besides lack of access to reliable energy services (Sovacool, 2015). Affordability requires not only decreasing energy prices so that people can afford heating services or electricity but also lowering energy bills to remove the overburden on consumers (Sovacool and Dworkin, 2015). Therefore, the major aim of affordability principle is to ensure equitable and stable energy prices with minimum volatility. This is expected to prevent households with lower income to disproportionately spend most of their income on energy services.

As far as affordability principle is taken into account, the concept of "fuel poverty" becomes prominent. Fuel poverty is identified as a situation experienced by households with high fuel expenditures (Liddell et al., 2012; Liddell, 2012). The contemporary definition of fuel poverty indicates that the households are regarded as fuel poor if they expend more than 10 percent of their income on fuel for heating their living area between 18 and 21 degrees (IOW Council, 2014). Accordingly, it is implied that the availability of energy fuels and services is worthless in case households don't have sufficient financial sources to have an access and use them and they experience fuel poverty (Sovacool and Dworkin, 2015).

2.4.3. Due process

As the third principle of energy justice decision-making framework, "due process" has an aim to ensure that the citizens' participation in policymaking is achieved with a commitment to protecting human rights in the pursuit of production and distribution of energy. According to the principle of due process, judicial and administrative remedies as a solution to the energy-related problems should be compatible with the interests of citizens (Hiteva and Sovacool, 2017). This principle requires the communities to take part in decision-making process of which projects will be

initiated and affect them in future. Furthermore, the communities are expected to give "fair and informed consent" for the future energy projects (Sovacool and Dworkin, 2015).

2.4.4. Good governance

In accordance with "good governance" principle of energy justice decision-making framework, access to high-quality information regarding energy and environment is regarded as the key element. The citizens' access to high-quality information is indispensable to reduce corruption and enhance accountability (Sovacool and Dworkin, 2015). In this regard, transparency and accountability constitute the subcategories of the principle of good governance (Sari et al., 2017). This principle aims to ensure a decision-making process that is democratic and transparent. It is accepted as an effective tool for reducing corruption as well as encouraging democracy and enhancing social stability (Wolfowitz, 2006). Namely, a fair and transparent energy decision-making can be achieved.

2.4.5. Sustainability

The concept of "sustainability" has emerged as a prominent aspect in different fields, particularly within the framework of "development". Brundtland Report published by World Commission on Environment and Development in 1987 made a definition of sustainability as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (UN, 1987). Accordingly, the sustainability principle puts great emphasis on satisfying the basic needs of world's poor population as well as considering the future environmental impacts of the current actions. As far as sustainability principle is construed within the scope of energy perspective, it implies ensuring the sustainable use of natural resources (Sovacool and Dworkin, 2015). This construction could be conceptualized in following ways: (1) It is a clear fact that states have a right to utilize their natural resources; however, rapid resource depletion is not a right provided to the states even though they possess the resource within their boundaries. (2) The states are committed to environmental protection and they do not have a right to pollute the environment. In this regard, the sustainability principle of energy justice claims that the natural resources should be utilized in the most effective way in order to ensure

a right for future generations to maintain their lives without any discrimination such as rich or poor, and minority or majority. Only in this way, the justice over sustainability can be achieved.

2.4.6. Intra-generational equity

As a significant component of justice concerns, equity refers to fairness by representing a belief that everyone should have, basic needs to be satisfied, sanctions and rewards to be equally allocated, and a policy to be designed within the framework of "impartiality, fairness and justice principles" (Falk et al., 1993). International law also guarantees the principle of equity. The Universal Declaration of Human Rights states that "*recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world*" (UN, 1948). In this respect, the principle of equity can operate across communities and nations within a single generation. This is defined as intra-generational equity, which seeks to ensure fairness and justice among the members of the same generation (Beder, 2000). Energy justice framework deals with intra-generational equity with respect to the fact that the members of the same generation should have a fair access to energy services.

As fair access to energy services is the key principle of intra-generational equity, this concept is mostly associated with distributional justice (Okereke, 2006). Accordingly, intra-generational equity tries to find an answer for which goods, including "wealth, power, respect, food, and clothing will be distributed", "among which entities the distribution will be made", and on which basis the distribution will be realized (Sovacool and Dworkin, 2015). In this regard, the members of the same generation are expected to utilize the minimum level of energy services that will be sufficient for them to maintain their minimum wellbeing.

2.4.7. Inter-generational equity

Similar to the principle of intra-generational equity of decision-making framework on energy justice, inter-generational equity highlights the importance of fair access to energy services. However, the major difference between intra-generational and inter-generational equity is the fact that inter-generational equity deals with distributional justice between present and future generations contrary to intra-

generational equity, which seeks to ensure justice between the communities of the same generation (Beder, 2000). According to inter-generational equity, the future communities hold the right to benefit from the natural resources and environmental benefits just like the present communities do. However, "undue damage to the environment" and rapid depletion of natural resources violate the "future communities' right to enjoy a good life" (Sovacool and Dworkin, 2015). In this regard, the principle of inter-generational equity requires present communities to adopt a moral responsibility in order to leave a global environment better than the one that our ancestors left. This principle also suggests that the present communities should take responsibility in order to combat with climate change and global warming within the framework of climate change adaptation and mitigation efforts (Unicef, 2019; Sovacool and Dworkin, 2015; Beder, 2000).

2.4.8. Responsibility

The final principle of energy decision-making on energy justice is "responsibility", which covers and harmonizes all the principles to some extent. In this direction, responsibility principle seeks to encourage countries to protect the environment, minimize their environmental costs, and consume natural resources in the most efficient way (Sovacool and Dworkin, 2015; Jenkins et al., 2017). Accordingly, governments, industrialized countries, current generations, and humans as a whole have different notions of responsibility. The governments are responsible for minimizing environmental pollution while the industrialized countries take the responsibility of the combat with climate change by paying to resolve the problem with respect to "polluter pays principle" (Sovacool and Dworkin, 2015; EC, 2012). On the other hand, the responsibility of current generations is to protect future generations by leaving a liveable environment. Finally, all human beings are responsible for recognizing the value of nonhuman species within the framework of environmental ethic.

In today's world where the level of carbon emission is extremely high, energy justice could be ensured by following a policy based on a "just transition to a low carbon economy" (McCauley and Heffron, 2018; Heffron and McCauley, 2017). Therefore, transition from a fossil fuel-based economy to carbon free economy is regarded as

the fundamental basis of energy justice. This transition inspired multiple empirical case studies to study how a just transition to renewable energy generation is achieved by ensuring energy justice. Table 1 illustrates the outstanding case studies conducted in 2017 and 2018 within the framework of energy justice literature by presenting the details of the case studies such as authors, publication year and content of the case study. However, there is a gap in the literature with respect to the fact that there is not any systematic index measuring energy justice performance of world countries as a whole. Furthermore, the analysis of energy justice performance of different countries is quite restricted with the below-mentioned case studies. The methodological framework used in the next chapters proves the strength of this thesis as this study provides a more comprehensive index and analysis over energy justice performance of multiple countries.

PAPER #	AUTHORS & YEAR	TITLE	SOURCE	CASE STUDY
1	Castan Broto et al., 2018	Energy justice and sustainability transitions in Mozambique	Applied Energy	Energy transition in a postcolonial context of Mozambique, a poor country of Global South
2	Bedi, 2018	'Our energy, our rights': National extraction legacies and contested energy justice futures in Bangladesh	Energy Research & Social Science	Energy projects in Bangladesh and the critiques of distributional energy justice activism
3	Evensen et al., 2018	The relationship between justice and acceptance of energy transition costs in the UK	Applied Energy	UK-based survey and focus groups to test whether the energy system exhibits distributive and procedural justice
4	Forman, 2017	Energy justice at the end of the wire: Enacting community energy and equity in Wales	Energy Policy	Energy justice assessment over small scale energy generation through a study of the community energy sector in Wales
5	Dolter and Boucher, 2018	Solar energy justice: A case-study analysis of Saskatchewan, Canada	Applied Energy	Solar energy justice in the province of Saskatchewan, Canada
6	Goddard and Farrelly, 2018	Just transition management: Balancing just outcomes with just processes in Australian renewable energy transitions	Applied Energy	How a transition to renewable energy generation is possible in a traditional energy production region, Gladstone in Australia by

				ensuring energy justice
7	Patridge et al., 2018	Urgency in energy justice: Contestation and time in prospective shale extraction in the United States and United Kingdom	Energy Research & Social Science	Relationship between energy justice and projected impacts of shale oil and gas extraction by hydraulic fracturing in US and UK
8	Rasch and Köhne, 2017	Practices and imaginations of energy justice in transition. A case study of the Noordoostpolder, the Netherlands	Energy Policy	How energy justice is 'made' by how people resist shale gas and engage in 'renewable energy practices in Netherlands
9	Sareen and Haarstad, 2018	Bridging socio-technical and justice aspects of sustainable energy transitions	Applied Energy	How justice considerations are involved in practices and politics of sustainable energy transitions in Portugal
10	Gillard et al., 2017	Advancing an energy justice perspective of fuel poverty: Household vulnerability and domestic retrofit policy in the United Kingdom	Energy Research & Social Science	Evaluation of energy justice perspective over fuel poverty and retrofitting inefficient housing stock in UK

11	Cardoso and Turhan, 2018	Examining new geographies of coal: Dissenting energyscapes in Colombia and Turkey	Applied Energy	Relationship between energyscapes and energy justice, environmental conflicts and social movements in new geographies of coal, Turkey and Colombia
12	Roddis et al., 2018	The role of community acceptance in planning outcomes for onshore wind and solar farms: An energy justice analysis	Applied Energy	The results of renewable energy projects, mostly onshore wind and solar farms, and the implications of community acceptance and energy justice in UK between 1990 and 2017
13	Heffron et al., 2018	Balancing the energy trilemma through the Energy Justice Metric	Applied Energy	Energy justice performance of US, UK, Germany, Denmark and Ireland through Energy Justice Metric (EJM)
14	Mundaca et al., 2018	'Successful' low-carbon energy transitions at the community level? An energy justice perspective	Applied Energy	Community perspectives and causal inferences about perceived energy (in)justice during the transition to a low-carbon local energy system in Denmark and Germany
15	Hurlbert and Rayner	Reconciling power, relations, and processes: The role of recognition in the achievement of energy justice for Aboriginal people	Applied Energy	The arguments of a Canadian Indigenous group on the pipeline approval case in Canada, and how the consideration of this group

				intersect with recognition, distributive and procedural justice
16	Jenkins et al., 2017	Attributing responsibility for energy justice: A case study of the Hinkley Point Nuclear Complex	Energy Policy	Energy justice concerns surrounding the Hinkley Point Nuclear Complex in Somerset, UK – 26 Semi-structured interviews with NGO and policy representatives
17	Sovacool, 2017	Contestation, contingency, and justice in the Nordic low-carbon energy transition	Energy Policy	Nordic energy transition and emphasis on empirical barriers, including political contestation, technological contingency, and social justice and recognition concerns.
18	Andreas et al., 2018	Overcoming energy injustice? Bulgaria's renewable energy transition in times of crisis	Energy Research & Social Science	Drivers and implications of Bulgaria's renewables expansion to test general expectations shaping renewable energy transitions by employing energy justice framework
19	Monyei et al., 2018	Energy (in)justice in off-grid rural electrification policy: South Africa in focus	Energy Research & Social Science	Analysis of mismatch in policy formulation, resource distribution and spatial distribution

				through energy justice framework
20	Bartiaux et al., 2018	Energy justice, unequal access to affordable warmth, and capability deprivation: A quantitative analysis for Belgium	Applied Energy	Examination of household access to energy and affordable warmth in Belgium

Table 1. *Case Studies in Energy Justice Literature*

CHAPTER 3

INDICATOR SELECTION AND RESEARCH DESIGN

While deciding the indicators to measure energy justice performance, the literature is systematically reviewed to construct an index for measuring the energy justice and compare the energy justice performance of multiple countries. In this process, around hundred sources were comprehensively identified. The main keywords for the identification of the indicators were: "energy justice performance", "energy poverty", "access to electricity", "carbon emission", "carbon intensity and energy justice", "energy intensity and justice", "renewable energy consumption and justice". Multiple scholars conducting studies regarding the literature on energy justice highlight that key pillars and indicators such as "GDP per capita", "access to electricity", "carbon intensity", "carbon emissions per capita", "access to clean fuels and technologies for cooking", "energy use per capita", "energy use per $1000 GDP", and "the share of renewable energy in total final energy consumption" determine whether the energy system is just or not (Martínez-Alier, 2012; Rao and Pachauri, 2017; Jenkins et al., 2016; Sovacool and Mukherjee, 2011; Goldthau and Sovacool, 2012; Sovacool and Dworkin, 2015; Sovacool et al., 2016; Davis et al., 2010; Sovacool et al., 2014; Finley-Brook and Holloman, 2016; Healy and Barry, 2017; Marshall et al., 2014; Lazarus et al., 2015; Wickramasinghe, 2011; Harrison, 2013; Hiteva, 2013; Banerjee et al., 2017; Gross, 2007). It is suggested that these indicators either violate the three-legged framework and principles of energy justice, or ensure energy justice. The studies in the literature proves that these indicators have a direct correlation with energy justice performance of different countries.

The first indicator GDP per capita is considered as a key indicator for energy justice as a higher level of GDP per capita is mostly associated with economic growth, resulting in more opportunities to have an access to goods and services (Martínez-Alier, 2012). There is a strong relationship between GDP per capita and living conditions such as health impact and clean cooking access (Rao and Pachauri, 2017).

This suggests that the countries with higher GDP per capita are tend to ensure a just energy system as more people have an opportunity to access affordable energy services.

As the second indicator, access to electricity is determined as an influential factor in measuring energy justice (Jenkins et al., 2016; Sovacool and Mukherjee, 2011). On the demand side, it is seen that global energy system is quite far from ensuring justice due to the fact that billions of people do not have any access to electricity (Goldthau and Sovacool, 2012; Sovacool and Dworkin, 2015). An estimated 1.1 billion people, which means 14% of world population, were lack of electricity in 2016 according to the data taken from Energy Access Outlook 2017 (IEA, 2017). Accordingly, nearly 84% of these were living in rural areas and more than 95% of these people experiencing lack of access to electricity were representing the residents in Sub-Saharan Africa and South Asia. For the first time in the history, 120 million people across the world gained access to electricity, and the total number of people that do not use electricity fell below 1 million in 2017 (IEA, 2018). In this regard, lack of access to electricity has severe negative impacts on socioeconomic conditions and implies to energy poverty which is regarded as a violating factor of distributive justice (Sovacool et al., 2016; Jenkins et al., 2016).

The third indicator, carbon intensity referring to the *carbon emission per unit of electricity generated* (UNESCO, 2018), has a significance to measure energy justice performance with respect to the fact that climate policy strategies can be achieved in a just manner by decreasing the carbon intensity of electricity generation by rising the share of renewable energy resources (UN, 2015). However, regarded as the major barrier to reduce carbon intensity, fossil fuel consumption poses a threat for low carbon energy transition (Sovacool et al., 2014; Day et al., 2016; Sovacool and Dworkin, 2015). Furthermore, carbon intensity mostly caused by a high level of fossil fuel consumption creates risks for resource availability, accessibility and sustainability, which are regarded as three of the fundamental principles of energy justice framework (Finley-Brook and Holloman, 2016). Besides, high carbon intensity level violates the global decarbonisation targets by decelerating the process of a just energy transition (Healy and Barry, 2017).

The fourth indicator, carbon emissions per capita, is mostly correlated with high fossil fuel consumption similar to carbon intensity. As a consequence of high fossil fuel consumption level, increasing carbon emission is regarded as a threat to ensure energy justice. The literature on energy and environmental justice highlights that high level of carbon emission results in air and water pollution (Marshall et al., 2014; Finley-Brook and Holloman, 2016). Related mostly with climate change, high carbon emission level leads to injustice with respect to the fact that costs and benefits of addressing climate change are not equally shared in all the countries in the world and the process of decision-making regarding low-carbon energy transition is not fair, respectively violating the distributive and procedural justice dimensions of three-legged framework (Bulkeley and Fuller, 2012). The data on carbon dioxide emissions in 2017 proves that less carbon emission levels in Nordic countries such as Norway, Finland and Denmark enable these economies to achieve low-carbon energy transition while higher emission levels in Asian or African countries constitute a barrier in this process, which implies that the costs or benefits of carbon emission are not equally distributed across the world (BP, 2018). Moreover, high levels of carbon emission per capita is believed to give permanent damages to human health, which create significant threats for intergenerational and intergenerational equity of justice principles (Lazarus et al., 2015).

As the fifth indicator, "access to clean fuels and technologies for cooking" is linked to fuel poverty concept. This means a high amount of people are lack of adequate fuels for cooking necessities. Around the world, 2.7 billion people are lack of access to clean cooking facilities in 2017 (IEA, 2018). This leads to multiple unfair outcomes caused by the existing global energy system (Hazrati, 2018). Use of polluting traditional fuels for cooking is directly linked to the unequal distribution of resources and environmental illnesses (Wickramasinghe, 2011). In this regard, achieving clean cooking is grounded on the deployment of LPG, natural gas and electricity in urban regions. On the other hand, rural areas are expected to be provided with more improved and cleaner technologies to ensure a just energy system (IEA, 2018).

The sixth indicator energy use per capita describes how much energy is used by each individual. However, this indicator does not provide any information about how this

consumed energy is helpful (Energy Education, 2018). In other words, energy use per capita is not an indicator to measure the efficiency of the energy consumed by individuals. The countries with more economic opportunities and higher levels of national income consume more energy per capita than the poor countries (Conference Board of Canada, 2018). Defined as a situation in which people do not have any opportunity to have an "adequate access to affordable and reliable energy services" (Day and Walker, 2013), energy poverty remains a significant threat for affordability and availability principles of energy justice (Walker et al., 2016). In this sense, higher energy use per capita removes the risk of energy poverty by proving that a large section of the society has an access to energy resources and services (Harrison, 2013; Hiteva, 2013). Based on this rationale, higher levels of energy use per capita are interpreted as "higher access to affordable and reliable energy" (Walker et al., 2016). Within this framework, it is observed that the countries that have high energy use per capita have a relatively better energy justice performance.

As the seventh indicator, energy intensity is defined as the ratio of total primary energy use to GDP (European Environment Agency, 2018). The data regarding energy use per $1000 GDP is observed to give a statistical information about the energy intensity level of the related countries (World Bank, 2019a). Energy intensity differs from energy use per capita with respect to the fact that energy intensity measures how efficiently an economy uses its resources (Energy Education, 2018). In case a country or an economy is not able to consume energy in an efficient way, it is likely to have an unjust energy system because of high energy intensity (Sovacool and Mukherjee, 2011). In this sense, when a country is able to reduce its wasted energy, it directly decreases its energy intensity and becomes more efficient. This means lower energy intensity is much better to achieve a high energy justice score.

Finally, renewable energy consumption is increasingly encouraged for their environmental and social benefits. Multiple studies in the literature deals with renewable energy consumption to prove the impact of renewable energy resources to ensure energy justice and equally allocate the environmental benefits (Banerjee et al., 2017; Gross, 2007; Brady and Monani, 2012; Hess and Ribeiro, 2016; Yenneti and Day, 2015). In a just energy transition process, renewable energy resources are

regarded as strugglers against greenhouse gas emissions, resource scarcity, pollution and increasing water stress (Banerjee et al., 2017). Furthermore, renewable energy resources eliminate intergenerational injustices by removing the risk of resource depletion (Hansen et al., 2013; Fischer et al., 2002). Another contribution of renewable energy resources to energy justice is based on the fact that renewable energy generation can be provided through distributed technologies, which enables community involvement in electricity generation process (Banerjee et al., 2017). This can also be thought as a facilitating factor to ensure a just energy system through procedural justice aiming to include all stakeholders in an energy system.

The systematically revived literature on energy justice indicators reveals that these eight dimensions consisting of "GDP per capita", "access to electricity", "carbon intensity", "carbon emissions per capita", "access to clean fuels and technologies for cooking", "energy use per capita", "energy use per $1000 GDP", and "the share of renewable energy in total final energy consumption" have a relationship with the three-legged framework on energy justice and the principles of energy justice framework. Accordingly, these indicators give an idea about the energy justice performance of countries, and they either facilitate ensuring energy justice or violate the energy justice framework. Table 2 illuminates the relationship between the mentioned indicators and energy justice framework.

Three-Legged Framework on Energy Justice	**Indicators**	**Principles of Energy Justice**
Distributional Justice	**GDP per capita**	Affordability
Distributional Justice Recognition Justice	**Access to electricity**	Affordability Availability Due process
Distributional Justice	**Carbon intensity**	Sustainability Inter-generational equity Intra-generational equity Responsibility
Distributional Justice	**Carbon emissions per capita**	Sustainability Inter-generational equity

		Intra-generational equity Responsibility
Distributional Justice Procedural Justice Recognition Justice	**Access to clean fuels and technologies for cooking**	Affordability Availability Sustainability Inter-generational equity Responsibility
Distributional Justice Procedural Justice Recognition Justice	**Energy use per capita**	Affordability Availability Intra-generational equity
Distributional Justice	**Energy use per $1000 GDP**	Due process Sustainability Inter-generational equity Intra-generational equity Responsibility
Distributional Justice Procedural Justice Recognition Justice	**Renewable energy consumption**	Availability Sustainability Inter-generational equity Intra-generational equity Responsibility Due process

Table 2. *Relationship between energy justice indicators and energy justice framework*

The innovative research designed on the basis of aforementioned critical indicators is regarded as unique in the realm of energy justice literature since the suggested Energy Justice Index constitutes the first quantitative study measuring energy justice performance of sample countries in academia. Figure 3 illustrates a representative framework for research design and depicts the steps to conduct this research and create the Energy Justice Index.

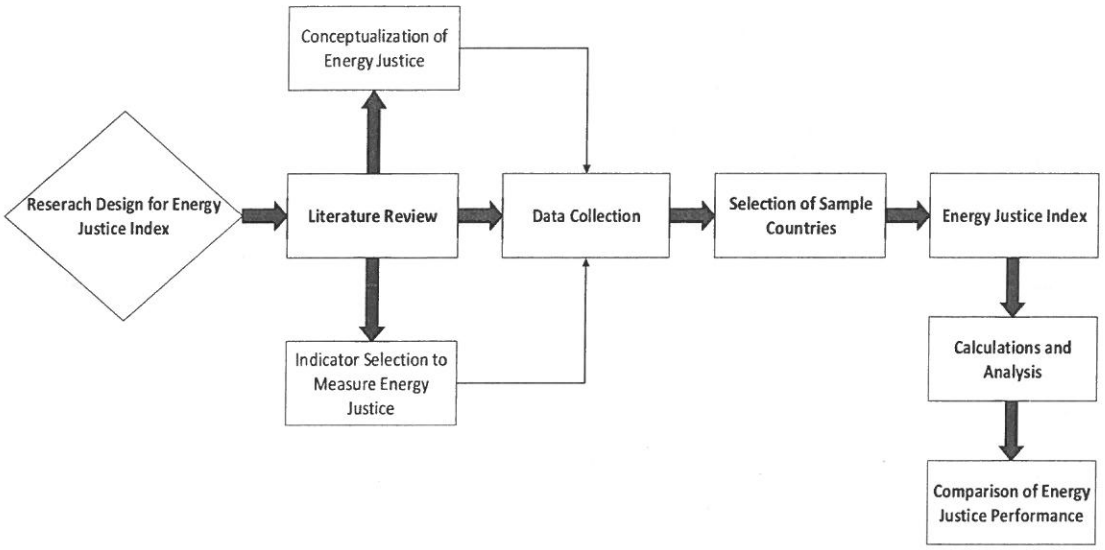

Figure 3. *Research Design*

The study is originated from a comprehensive literature review, and it is enhanced by a quantitative data collection method and relevant sample selection. Finally, the recently introduced Energy Justice Index provides a scientific basis to measure energy justice performance and categorize the sample countries according to their performances. Furthermore, it allows to make a regional comparison to see the differences in energy justice performance and to make predictions regarding the underlying reasons of such difference.

CHAPTER 4

METHODOLOGY

This study proposes a unique and innovative country-based composite index to measure energy justice performance, namely Energy Justice Index. This index utilized a quantitative approach to reveal to what extent the sample countries ensure energy justice and to assess their energy justice performance through a dataset based on "GDP per capita", "access to electricity", "carbon intensity", "carbon emissions per capita", "access to clean fuels and technologies for cooking", "energy use per capita", "energy use per $1000 GDP", and "the share of renewable energy in total final energy consumption". The methodology is originally inspired by Cabalu (2010). In this regard, Cabalu (2010) examines "the vulnerability to natural gas supply disruptions of gas importing countries" on the basis of several natural gas indicators. Cabalu's approach is based on creating "a composite gas supply security index". The method used in Cabalu's index is adopted from Gnansounou (2008), who makes an analysis on energy vulnerability through "a composite index of energy demand and supply weaknesses". The indicators used by Gnansounou (2008) are systematically reviewed from the literature by focusing on the structural problems regarding energy supply and demand balance. Gnansounou (2008) firstly scales the values of the related indicators, and then uses a root mean square to calculate the relative indicators and create the composite index. This approach also previously used in the publication of World Energy Council (WEC) regarding Europe's Vulnerability to Energy Crises (WEC, 2008). Accordingly, WEC's report argues that there was no appropriate methodology to assess and quantify energy vulnerability in a way that the proposed index would provide objective, unbiased and transparent information. This methodology fulfils the gap by utilizing multiple indicators in assessment because of its multi-dimensional nature. Furthermore, as a prominent study in resource curse literature, Biresselioglu et al. (2019) also inspired this research by adopting a similar methodology in calculating resource curse vulnerability. The study uses a resource curse vulnerability index with nine sub-indicators and provides resource curse vulnerability values and a

ranking between sample countries to show how vulnerable countries are to resource curse.

The methodology to calculate Energy Justice Index follows a similar path, and uses eight aforementioned indicators. These indicators were selected as a result of a comprehensive literature review. They are identified as quite strong to measure energy justice performance, and they are believed to have correlation between three-legged energy justice framework and eight-principled energy justice decision-making mechanism. The Energy Justice Index enables to categorize the sample countries according to their energy justice performance and to rank them as a response to their ability to ensure a just energy system.

In the analysis of energy justice performance, this study covers the period of 2006-2016 for different countries from various geographical regions. To build an objective, unbiased and concrete Energy Justice Index, the related datasets regarding the selected indicators on a yearly basis were taken from World Bank, which is regarded as a reliable source. The reason to choose the time period between 2006 and 2016 stems from the fact that the availability of the time period was different for each indicator. As the most extensive coverage for all sample countries and all indicators was for the period between 2006 and 2016, the Energy Justice Index was built on this time period. The sample country selection also followed similar steps. The countries that do not have any relevant statistical information in the selected dataset were eliminated. As a result, 81 countries from different geographical regions constitute the sample, including Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Canada, Chile, China, Colombia, Congo Republic, Costa Rica, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, Estonia, Finland, France, Gabon, Georgia, Germany, Greece, Guatemala, Honduras, Hungary, Iceland, India, Indonesia, Iran Islamic Republic, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea Republic, Latvia, Lithuania, Luxembourg, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Paraguay, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, Slovenia, South Africa, Spain, Sri Lanka,

Sweden, Switzerland, Thailand, Trinidad and Tobago, Turkmenistan, Ukraine, United Arab Emirates, United Kingdom, United States, and Uruguay.

During the data collection process, it is seen that different units for each selected indicator constitute a problem to combine all statistical information and obtain an energy justice score. For this reason, a scaling and normalization was performed to eliminate this problem. Accordingly, each indicator was scaled to make a cross comparison between multiple indicators (Cabalu and Alfonso, 2013; Cabalu, 2010; Gnansounou, 2008; Biresselioglu et al., 2019). As a consequence, this method requires to define a relative-indicator for every seperate indicator. These indicators are calculated by using scaling between 0 and 1. Within this framework, the country that has the best energy justice performance is appointed a score of 1 while the country that has the worst energy justice performance is appointed a score of 0. Other countries are appointed intermediate scores, according to their energy justice performances. Consequently, higher values of relative-indicators mean lower risks to experience injustice while lower values imply higher risks.

4.1. GDP per capita (I_1)

This data is collected from World Bank (2019b).

$$\varphi_{1C} = \frac{I_{1C} - MIN(I_1)}{MAX(I_1) - MIN(I_1)}$$

Higher values of φ_{1C} imply higher levels of use of energy supported by economic growth. In other words, higher GDP per capita is associated with more opportunities to have an access to energy resources (Martínez-Alier, 2012). In this regard, a direct proportion is observed between GDP per capita and energy justice, which is construed as energy justice tends to improve when GDP per capita rises.

4.2. Access to electricity (I_2)

This data regarding access to electricity (% of population) is taken from World Bank (2019c).

$$\varphi_{2C} = \frac{I_{2C} - MIN(I_2)}{MAX(I_2) - MIN(I_2)}$$

Lack of access to electricity is directly associated with energy poverty concept which violates distributional justice (Sovacool et al., 2016). On the demand-side, lack of access to electricity leads millions of people to face with energy poverty and it creates injustice in the global energy system (Goldthau and Sovacool, 2012). Accordingly, it is proved that there is a direct relationship between access to electricity and energy justice performance. In this sense, higher φ_{2C} values mean a better energy justice performance. Namely, it is suggested that the countries with higher access rate of electricity has a more improved energy system and better energy justice performance within the framework of "equity dimensions of energy production and use" (Sovacool et al., 2016).

4.3. Carbon intensity (I_3)

The carbon intensity data is collected from World Bank (2019d).

$$\varphi_{3C} = \frac{MAX(I_3) - I_{3C}}{MAX(I_3) - MIN(I_3)}$$

The distribution of benefits principle of energy justice framework implies that high carbon generation raises some equity concerns (Bickerstaff et al., 2013). In this regard, low carbon energy technologies are regarded as effective tools to achieve a just outcome (McLaren et al., 2013). When the carbon emissions of an economy increase, the level of carbon intensity tends to rise. This means higher carbon intensity prevents to ensure energy justice in terms of environmental concerns. Consequently, higher values of φ_{3C} indicate that the related country or economy has a relatively better energy justice performance by ensuring distributional fairness of generation.

4.4. Carbon emissions per capita (I_4)

The data regarding carbon emissions per capita is retrieved from World Bank (2019e).

$$\varphi_{4C} = \frac{MAX(I_4) - I_{4C}}{MAX(I_4) - MIN(I_4)}$$

Emissions caused by high level of greenhouse gases lead to significant changes of earth's climate, resulting in "a threat to basic human rights including right to live, health and subsistence" (Caney, 2009a). Energy justice framework requires the fair

distribution of carbon emissions among world countries (Caney, 2009b). In other words, all people in the world have "a right to emit an equal amount of carbon on a per capita basis" (Agarwal and Narain, 1991). In this regard, the countries with higher carbon emissions per capita are likely to violate the distributional justice. Consequently, the equation shown below implies that there exists an inverse proportion between carbon emissions per capita and energy justice, and higher φ_{4C} values mean an improved energy justice performance within the framework of the distribution of carbon emission per capita among world countries.

4.5. Access to clean fuels and technologies for cooking (I_5)

This data on access to clean fuels and technologies for cooking (% of population) is collected from World Bank (2019f).

$$\varphi_{5C} = \frac{I_{5C} - MIN(I_5)}{MAX(I_5) - MIN(I_5)}$$

Global energy system is regarded as unjust when billions of people are exposed to "extremely polluting traditional fuels for cooking" (Goldthau and Sovacool, 2012). The cooking facilities that are free from pollution are estimated to contribute poverty reduction, health and development process (Wickramasinghe, 2011). As a significant indicator of energy poverty, access to clean fuels and technologies for cooking has a positive relationship with energy justice. In this sense, according to this relative indicator, high values of φ_{5C} refer to more people with an access to clean cooking facilities by achieving a high energy justice performance.

4.6. Energy use per capita (I_6)

The data related to energy use per capita is retrieved from World Bank (2019g).

$$\varphi_{6C} = \frac{I_{6C} - MIN(I_6)}{MAX(I_6) - MIN(I_6)}$$

As a significant indicator of energy use, access to affordable energy becomes a fundamental dimension of energy justice as well as a key factor of social and economic well-being (Walker et al., 2016). Moreover, higher rate of energy use per capita removes the risk of energy or fuel poverty, and it contributes to affordability and availability principles of energy justice framework (Harrison, 2013; Hiteva, 2013).

Consequently, a positive relationship is observed between energy use per capita and energy justice performance. The relative indicator φ_{6C} scales I_6 between 0 and 1, and a higher value of φ_{6C} shows a higher access rate to affordable energy and a higher level of energy use, resulting in a just energy system.

4.7. Energy use per $1000 GDP ($I_7$)

The dataset showing energy use per $1000 GDP is taken from World Bank (2019h).

$$\varphi_{7C} = \frac{MAX(I_7) - I_{7C}}{MAX(I_7) - MIN(I_7)}$$

Defined as energy use per GDP, energy intensity becomes a measure of energy efficiency of an economy. Namely, higher levels of energy intensity imply harsh weather conditions requiring strong heating and cooling systems, use of fuel inefficient vehicles, lack of mass transportation tools and unproductive economy (Cornillie and Fankhauser, 2004). In this sense, a negative relationship is observed between energy intensity and energy justice performance. Accordingly, higher φ_{7C} values mean minimum energy intensity, which implies a higher energy justice performance.

4.8. Share of renewable energy in total final energy consumption (I_8)

This data is collected from World Bank (2019i).

$$\varphi_{8C} = \frac{I_{8C} - MIN(I_8)}{MAX(I_8) - MIN(I_8)}$$

The distribution of environmental benefits is regarded as one of the key aspects of energy justice framework. Concerns related to energy production and consumption are of great importance with respect to procedural and distributional justice (Sovacool and Dworkin, 2015). As a consequence of renewable energy consumption, decreasing carbon emissions besides reducing air and water pollution constitute a basis to achieve a higher energy justice performance. In this sense, there exists a positive relationship between the share of renewable energy in total final energy consumption and energy justice performance. Higher φ_{8C} values indicate a better energy justice performance of the sample countries.

CHAPTER 5

ENERGY JUSTICE INDEX

The composite energy justice index allows us to see energy justice scores of sample countries and evaluate their energy justice performances in the light of predetermined eight indicators that are believed to be highly influential to test the tendency to achieve energy justice. After a relative indicator score is obtained by scaling the values of each indicator between 0 and 1, an innovative and unique energy justice index is created through the calculation of the root mean square of all eight relative indicators. Accordingly, the equation for Energy Justice Index, abbreviated as EJI, is as follows:

$$EJI = \sqrt{\frac{\sum_{i=1}^{8} \varphi_{ic}^2}{8}}$$

In the results of the equation, the maximum score of 1 represents the highest energy justice score and the best energy justice performance among the sample countries. On the other hand, the minimum score of 0 refers to the lowest energy justice score and the worst energy justice performance. This means scores that are close to 1 are likely to represent a better energy justice performance.

The average energy justice score for all sample countries for the period of 2006-2016 is calculated as 0,66. Figure 4 depicts the average energy justice scores for all sample countries. The analysis based on the standard deviations of the energy justice indicators for each country presents that the results are coherent during the whole period. Consequently, the maximum standard deviation is seen as 0,019 while the minimum standard deviation is 0,002. Under these circumstances, the average standard deviation has a value of 0,011, implying that the index justifies the approach of using the values between the period of 2006 and 2016.

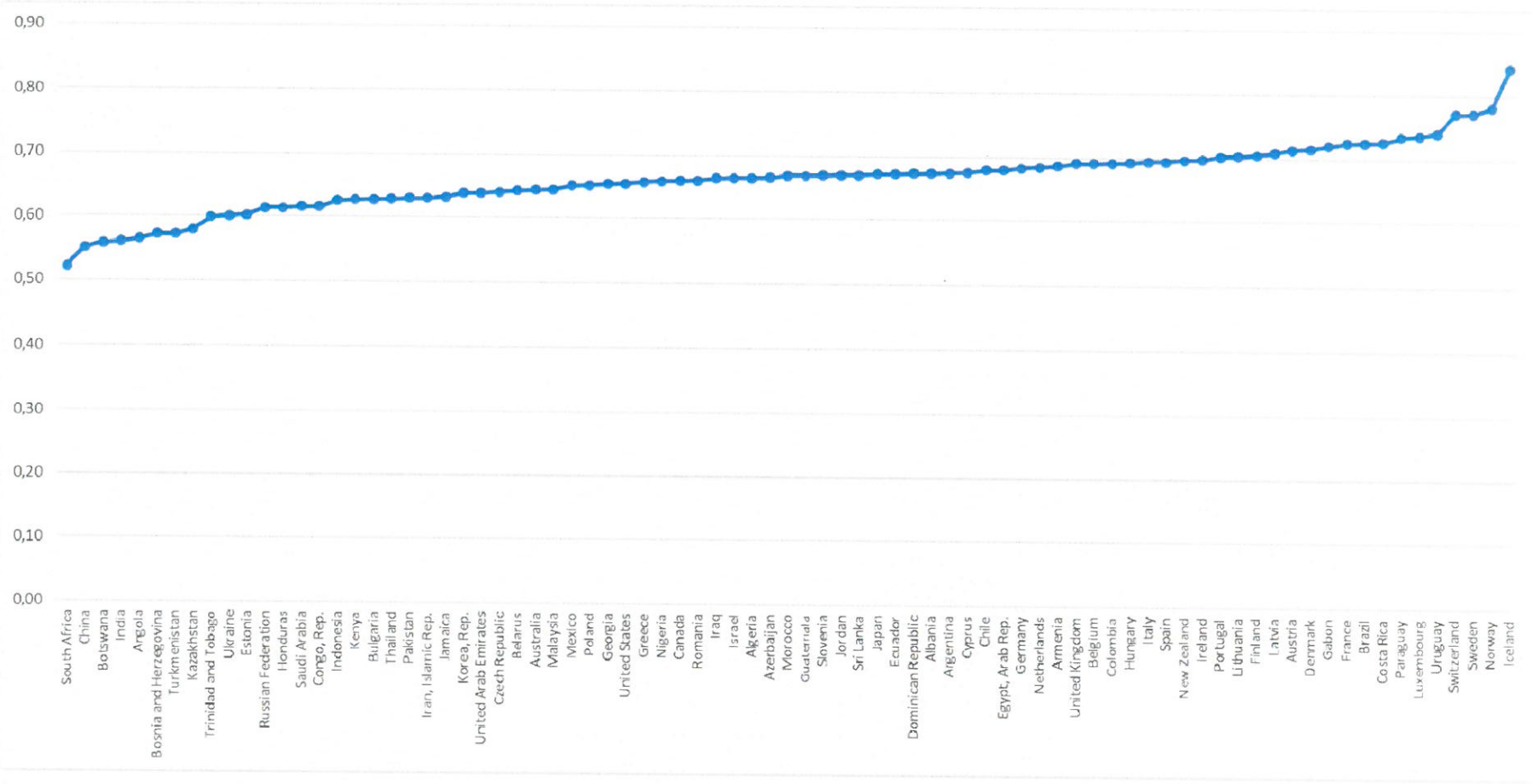

Figure 4. *Average Energy Justice Scores for the period of 2006-2016*

During the period between 2006 and 2016, on the basis of average scores, the countries with highest energy justice scores are determined as Iceland (0,84), Norway (0,78), Sweden (0,77) and Switzerland (0,77). On the other hand, countries with the lowest energy justice score are identified as South Africa (0,52), China (0,55), Botswana (0,56), India (0,56) and Angola (0,56). This picture also proves that developed countries perform better scores in terms of energy justice while underdeveloped or developing countries still experience challenges regarding equal allocation of energy resources, environmental benefits and energy poverty.

The constructed Energy Justice Index proves that the countries with highest and lowest energy justice scores remain the same throughout the period between 2006 and 2016. While Iceland is ranked as the first country with the average highest energy score of 0,84, South Africa is ranked as the last country that has the average lowest energy score which is 0,52. The fact that Iceland has the highest energy justice score stems from country's energy system based on 100% domestic and renewable resources for electricity production and house heating (Grímsson, 2013). This is further supported by the fact that 100% of the population have access to electricity and clean fuels and technologies for cooking (World Bank, 2019). Moreover, Iceland is observed as the country with the minimum carbon intensity level throughout the 11-year-period. Similarly, its energy use per capita is quite high, proving that Iceland is pretty successful to achieve energy justice. On the contrary, South Africa is not able to perform a high energy justice because of the fact that country has a low level of GDP per capita and relatively lower levels of access to electricity. It is revealed that the energy needs of the households cannot be thoroughly met because of "low power capacity of the system" (Azimoh et al., 2016). Furthermore, majority of the population relies on traditional biomass and charcoal for cooking necessities, implying that access to clean fuels and technologies for cooking is also low compared to other countries (Baurzhan and Jenkins, 2016; Monyei et al., 2018).

Table 3 illustrates the results of the Energy Justice Index for 81 sample countries for the period between 2006 and 2016.

Ranking/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	Iceland (0,83)	Iceland (0,85)	Iceland (0,84)	Iceland (0,83)	Iceland (0,83)	Iceland (0,84)	Iceland (0,84)	Iceland (0,84)	Iceland (0,84)	Iceland (0,84)	Iceland (0,85)
2	Norway (0,80)	Norway (0,79)	Norway (0,78)	Sweden (0,76)	Norway (0,77)	Norway (0,79)	Norway (0,79)	Norway (0,77)	Norway (0,77)	Switzerland (0,78)	Switzerland (0,78)
3	Sweden (0,78)	Sweden (0,77)	Sweden (0,76)	Norway (0,76)	Switzerland (0,77)	Switzerland (0,77)	Switzerland (0,77)	Sweden (0,77)	Switzerland (0,77)	Sweden (0,77)	Sweden (0,77)
4	Switzerland (0,76)	Switzerland (0,76)	Switzerland (0,75)	Switzerland (0,76)	Sweden (0,76)	Sweden (0,76)	Sweden (0,77)	Switzerland (0,76)	Sweden (0,77)	Norway (0,76)	Norway (0,76)
5	Luxembourg (0,75)	Luxembourg (0,74)	Luxembourg (0,73)	Brazil (0,73)	Uruguay (0,75)	Uruguay (0,73)	Uruguay (0,73)	Uruguay (0,74)	Uruguay (0,75)	Uruguay (0,75)	Uruguay (0,75)
6	Paraguay (0,74)	Paraguay (0,73)	Paraguay (0,73)	Luxembourg (0,73)	Luxembourg (0,73)	Paraguay (0,73)	Luxembourg (0,73)	Luxembourg (0,73)	Luxembourg (0,73)	Luxembourg (0,73)	Luxembourg (0,73)
7	Brazil (0,74)	Uruguay (0,73)	Brazil (0,72)	Paraguay (0,73)	Paraguay (0,73)	Luxembourg (0,73)	Paraguay (0,72)	Paraguay (0,73)	Paraguay (0,73)	Paraguay (0,73)	Paraguay (0,73)
8	Costa Rica (0,73)	Brazil (0,73)	France (0,72)	Uruguay (0,72)	Brazil (0,73)	Brazil (0,72)	Costa Rica (0,72)	Costa Rica (0,72)	Denmark (0,72)	Costa Rica (0,72)	Costa Rica (0,72)
9	France (0,73)	Gabon (0,72)	Uruguay (0,72)	Costa Rica (0,72)	Costa Rica (0,72)	Costa Rica (0,72)	Denmark (0,72)	France (0,72)	France (0,72)	Denmark (0,72)	Denmark (0,72)
10	Uruguay (0,73)	France (0,72)	Costa Rica (0,72)	France (0,72)	France (0,72)	France (0,72)	France (0,72)	Denmark (0,71)	Costa Rica (0,72)	France (0,72)	Gabon (0,72)
11	Gabon (0,72)	Costa Rica (0,72)	Gabon (0,72)	Gabon (0,71)	Gabon (0,72)	Denmark (0,71)	Brazil (0,72)	Brazil (0,71)	Gabon (0,72)	Gabon (0,72)	France (0,72)
12	Latvia (0,71)	Austria (0,71)	Austria (0,70)	Austria (0,71)	Austria (0,71)	Austria (0,71)	Austria (0,71)	Austria (0,71)	Austria (0,71)	Brazil (0,71)	Austria (0,71)
13	Austria (0,71)	Latvia (0,70)	Denmark (0,70)	Denmark (0,70)	Portugal (0,71)	Gabon (0,71)	Latvia (0,71)	Gabon (0,71)	Brazil (0,71)	Austria (0,71)	Brazil (0,71)
14	Lithuania (0,71)	Lithuania (0,70)	Latvia (0,70)	Latvia (0,70)	Denmark (0,70)	Portugal (0,70)	Finland (0,70)	Latvia (0,71)	Latvia (0,71)	Ireland (0,71)	Ireland (0,71)
15	Finland (0,70)	Denmark (0,70)	Finland (0,70)	Lithuania (0,70)	New Zealand (0,70)	Latvia (0,70)	Gabon (0,70)	Finland (0,70)	Finland (0,71)	Finland (0,71)	Latvia (0,71)
16	Denmark (0,70)	Finland (0,70)	Lithuania (0,70)	Finland (0,69)	Spain (0,70)	New Zealand (0,70)	Portugal (0,70)	Portugal (0,70)	Portugal (0,70)	Latvia (0,71)	Finland (0,71)
17	New Zealand (0,70)	New Zealand (0,69)	Portugal (0,69)	Portugal (0,69)	Lithuania (0,69)	Lithuania (0,69)	Lithuania (0,69)	Lithuania (0,70)	Lithuania (0,70)	Lithuania (0,70)	Lithuania (0,70)
18	Ireland (0,70)	Belgium (0,69)	Colombia (0,69)	Spain (0,69)	Latvia (0,69)	Finland (0,69)	New Zealand (0,69)	Spain (0,69)	Italy (0,69)	Portugal (0,70)	Portugal (0,70)
19	Portugal (0,70)	Portugal (0,69)	Ireland (0,69)	Italy (0,69)	Italy (0,69)	Spain (0,69)	Spain (0,69)	New Zealand (0,69)	Spain (0,69)	Spain (0,69)	Spain (0,69)
20	Belgium (0,70)	Ireland (0,69)	Belgium (0,68)	New Zealand (0,69)	Armenia (0,69)	Ireland (0,69)	Italy (0,69)	Italy (0,69)	Ireland (0,69)	New Zealand (0,69)	Italy (0,69)
21	Colombia (0,70)	Colombia (0,69)	Italy (0,68)	Ireland (0,68)	Finland (0,69)	Italy (0,69)	Ireland (0,69)	Hungary (0,69)	Hungary (0,69)	Italy (0,69)	New Zealand (0,69)
22	United Kingdom (0,69)	United Kingdom (0,69)	New Zealand (0,68)	Colombia (0,68)	Colombia (0,69)	Hungary (0,69)	Hungary (0,69)	Ireland (0,69)	New Zealand (0,69)	United Kingdom (0,69)	Hungary (0,69)

23	Armenia (0,69)	Netherlands (0,69)	Netherlands (0,68)	Belgium (0,68)	Ireland (0,69)	Colombia (0,69)	Belgium (0,69)	Belgium (0,68)	United Kingdom (0,69)	Hungary (0,69)	United Kingdom (0,69)
24	Netherlands (0,69)	Italy (0,68)	Spain (0,68)	Hungary (0,68)	Hungary (0,69)	United Kingdom (0,68)	Colombia (0,68)	United Kingdom (0,68)	Colombia (0,68)	Belgium (0,68)	Colombia (0,69)
25	Italy (0,69)	Armenia (0,68)	Hungary (0,68)	Armenia (0,68)	United Kingdom (0,68)	Belgium (0,68)	United Kingdom (0,68)	Colombia (0,68)	Belgium (0,68)	Colombia (0,68)	Belgium (0,68)
26	Chile (0,69)	Hungary (0,68)	United Kingdom (0,68)	Netherlands (0,68)	Belgium (0,68)	Armenia (0,68)	Guatemala (0,68)	Armenia (0,68)	Armenia (0,68)	Armenia (0,68)	Armenia (0,68)
27	Hungary (0,69)	Germany (0,68)	Armenia (0,68)	United Kingdom (0,68)	Netherlands (0,68)	Germany (0,68)	Netherlands (0,68)	Cyprus (0,67)	Egypt, Arab Rep. (0,68)	Morocco (0,68)	Morocco (0,68)
28	Spain (0,69)	Iraq (0,68)	Germany (0,68)	Germany (0,68)	Guatemala (0,68)	Netherlands (0,68)	Germany (0,68)	Egypt, Arab Rep. (0,67)	Germany (0,68)	Egypt, Arab Rep. (0,68)	Dominican Republic (0,68)
29	Germany (0,69)	Spain (0,68)	Egypt, Arab Rep. (0,67)	Chile (0,68)	Germany (0,68)	Guatemala (0,67)	Chile (0,67)	Albania (0,67)	Dominican Republic (0,67)	Germany (0,68)	Egypt, Arab Rep. (0,68)
30	Japan (0,68)	Chile (0,67)	Chile (0,67)	Japan (0,67)	Egypt, Arab Rep. (0,68)	Egypt, Arab Rep. (0,67)	Armenia (0,67)	Germany (0,67)	Netherlands (0,67)	Netherlands (0,67)	Germany (0,68)
31	Morocco (0,68)	Egypt, Arab Rep. (0,67)	Ecuador (0,67)	Egypt, Arab Rep. (0,67)	Japan (0,68)	Argentina (0,67)	Egypt, Arab Rep. (0,67)	Netherlands (0,67)	Cyprus (0,67)	Cyprus (0,67)	Netherlands (0,67)
32	Egypt, Arab Rep. (0,68)	Argentina (0,67)	Japan (0,67)	Albania (0,67)	Chile (0,67)	Chile (0,67)	Cyprus (0,67)	Argentina (0,67)	Slovenia (0,67)	Dominican Republic (0,67)	Cyprus (0,67)
33	Canada (0,68)	Japan (0,67)	Argentina (0,67)	Dominican Republic (0,67)	Sri Lanka (0,67)	Dominican Republic (0,67)	Albania (0,67)	Chile (0,67)	Chile (0,67)	Albania (0,67)	Albania (0,67)
34	Argentina (0,67)	Cyprus (0,67)	Dominican Republic (0,67)	Argentina (0,67)	Argentina (0,67)	Cyprus (0,67)	Argentina (0,67)	Guatemala (0,67)	Romania (0,67)	Chile (0,67)	Slovenia (0,67)
35	Ecuador (0,67)	Ecuador (0,67)	Jordan (0,66)	Cyprus (0,66)	Dominican Republic (0,67)	Jordan (0,67)	Sri Lanka (0,67)	Morocco (0,67)	Ecuador (0,67)	Slovenia (0,67)	Chile (0,67)
36	Albania (0,67)	Albania (0,66)	Algeria (0,66)	Sri Lanka (0,66)	Azerbaijan (0,67)	Japan (0,67)	Dominican Republic (0,67)	Dominican Republic (0,67)	Albania (0,67)	Argentina (0,67)	Ecuador (0,67)
37	United Arab Emirates (0,67)	Algeria (0,66)	Albania (0,66)	Jordan (0,66)	Jordan (0,67)	Azerbaijan (0,67)	Ecuador (0,67)	Sri Lanka (0,67)	Argentina (0,67)	Ecuador (0,67)	Romania (0,67)
38	Sri Lanka (0,67)	Canada (0,66)	Sri Lanka (0,66)	Azerbaijan (0,66)	Albania (0,67)	Sri Lanka (0,66)	Japan (0,67)	Ecuador (0,67)	Israel (0,66)	Romania (0,67)	Argentina (0,67)
39	Algeria (0,67)	Dominican Republic (0,66)	Cyprus (0,66)	Ecuador (0,66)	Cyprus (0,67)	Ecuador (0,66)	Morocco (0,66)	Jordan (0,67)	Azerbaijan (0,66)	Azerbaijan (0,66)	Israel (0,67)
40	Cyprus (0,67)	Slovenia (0,66)	Iraq (0,66)	Nigeria (0,66)	Ecuador (0,67)	Albania (0,66)	Jordan (0,66)	Azerbaijan (0,67)	Jordan (0,66)	Israel (0,66)	Sri Lanka (0,67)
41	United States (0,67)	Jordan (0,66)	Georgia (0,66)	Slovenia (0,66)	Slovenia (0,67)	Slovenia (0,66)	Azerbaijan (0,66)	Romania (0,66)	Sri Lanka (0,66)	Guatemala (0,66)	Azerbaijan (0,66)
42	Slovenia (0,67)	Sri Lanka (0,66)	Guatemala (0,66)	Iraq (0,66)	Algeria (0,66)	Morocco (0,66)	Slovenia (0,66)	Slovenia (0,66)	Nigeria (0,66)	Jordan (0,66)	Jordan (0,66)
43	Jordan (0,67)	Israel (0,66)	Slovenia (0,65)	Algeria (0,66)	Iraq (0,66)	Algeria (0,66)	Algeria (0,66)	Israel (0,66)	Morocco (0,66)	Sri Lanka (0,66)	Japan (0,66)
44	Guatemala (0,67)	Azerbaijan (0,66)	Israel (0,65)	Guatemala (0,66)	Morocco (0,66)	Israel (0,66)	Canada (0,66)	Japan (0,66)	Japan (0,66)	Japan (0,66)	Guatemala (0,66)

45	Israel (0,66)	Nigeria (0,66)	Azerbaijan (0,65)	Israel (0,66)	Romania (0,66)	Nigeria (0,65)	Romania (0,65)	Algeria (0,65)	Greece (0,65)	United States (0,66)	United States (0,66)
46	Iraq (0,66)	United States (0,65)	Greece (0,65)	Morocco (0,65)	Israel (0,66)	Iraq (0,65)	Iraq (0,65)	Canada (0,65)	Iraq (0,65)	Iraq (0,65)	Iraq (0,66)
47	Congo, Rep. (0,66)	United Arab Emirates (0,65)	Canada (0,65)	Romania (0,65)	Georgia (0,66)	Greece (0,65)	Israel (0,65)	Greece (0,65)	Algeria (0,65)	Greece (0,65)	Greece (0,65)
48	Malaysia (0,66)	Greece (0,65)	Morocco (0,65)	Greece (0,65)	Greece (0,66)	Romania (0,65)	Nigeria (0,65)	Nigeria (0,65)	Poland (0,65)	Algeria (0,65)	Nigeria (0,65)
49	Nigeria (0,66)	Guatemala (0,65)	Nigeria (0,65)	Georgia (0,65)	Nigeria (0,66)	Canada (0,65)	Australia (0,65)	Iraq (0,65)	Canada (0,65)	Canada (0,65)	Algeria (0,65)
50	Korea, Rep. (0,66)	Georgia (0,65)	Romania (0,64)	Poland (0,64)	Canada (0,66)	Mexico (0,65)	United States (0,65)	Georgia (0,65)	Mexico (0,65)	Poland (0,65)	Poland (0,65)
51	Dominican Republic (0,66)	Morocco (0,65)	Poland (0,64)	Canada (0,64)	Mexico (0,65)	Poland (0,65)	Poland (0,65)	Australia (0,65)	Georgia (0,64)	Georgia (0,65)	Canada (0,65)
52	Greece (0,65)	Malaysia (0,65)	Mexico (0,64)	United States (0,64)	United States (0,65)	United States (0,64)	Greece (0,65)	Poland (0,65)	United States (0,64)	Nigeria (0,65)	Georgia (0,65)
53	Mexico (0,65)	Poland (0,65)	United States (0,64)	Mexico (0,64)	Poland (0,65)	Georgia (0,64)	Mexico (0,64)	Mexico (0,64)	Australia (0,64)	Mexico (0,65)	Mexico (0,65)
54	Georgia (0,65)	Korea, Rep. (0,65)	United Arab Emirates (0,64)	Malaysia (0,64)	Belarus (0,64)	Belarus (0,64)	Malaysia (0,64)	United States (0,64)	Guatemala (0,64)	Australia (0,65)	Jamaica (0,65)
55	Kenya (0,65)	Kenya (0,64)	Malaysia (0,64)	Belarus (0,63)	Malaysia (0,64)	Australia (0,64)	Georgia (0,64)	Czech Republic (0,64)	Jamaica (0,64)	Czech Republic (0,64)	Pakistan (0,64)
56	Poland (0,64)	Mexico (0,64)	Korea, Rep. (0,64)	Korea, Rep. (0,63)	Australia (0,64)	Malaysia (0,64)	Belarus (0,64)	Belarus (0,64)	Czech Republic (0,64)	Jamaica (0,64)	Czech Republic (0,64)
57	Belarus (0,64)	Belarus (0,64)	Belarus (0,64)	Czech Republic (0,63)	Jamaica (0,63)	Czech Republic (0,63)	Czech Republic (0,64)	Malaysia (0,63)	Belarus (0,64)	Belarus (0,64)	Australia (0,64)
58	Romania (0,64)	Romania (0,64)	Kenya (0,63)	Iran, Islamic Rep. (0,62)	Czech Republic (0,63)	United Arab Emirates (0,63)	Jamaica (0,63)	United Arab Emirates (0,63)	Indonesia (0,64)	Indonesia (0,63)	Indonesia (0,64)
59	Australia (0,64)	Iran, Islamic Rep. (0,64)	Czech Republic (0,63)	Jamaica (0,62)	Korea, Rep. (0,63)	Iran, Islamic Rep. (0,63)	United Arab Emirates (0,63)	Bulgaria (0,63)	Pakistan (0,64)	Malaysia (0,63)	Belarus (0,64)
60	Iran, Islamic Rep. (0,64)	Australia (0,63)	Australia (0,63)	Australia (0,62)	United Arab Emirates (0,63)	Korea, Rep. (0,63)	Korea, Rep. (0,63)	Jamaica (0,63)	Malaysia (0,64)	Bulgaria (0,63)	Malaysia (0,63)
61	Thailand (0,64)	Czech Republic (0,63)	Iran, Islamic Rep. (0,63)	Bulgaria (0,62)	Iran, Islamic Rep. (0,63)	Thailand (0,62)	Pakistan (0,63)	Pakistan (0,63)	Korea, Rep. (0,63)	Korea, Rep. (0,63)	Korea, Rep. (0,63)
62	Azerbaijan (0,64)	Saudi Arabia (0,63)	Thailand (0,62)	Thailand (0,62)	Thailand (0,63)	Jamaica (0,62)	Bulgaria (0,62)	Indonesia (0,63)	Bulgaria (0,63)	Pakistan (0,63)	Bulgaria (0,63)
63	Czech Republic (0,63)	Congo, Rep. (0,63)	Saudi Arabia (0,62)	United Arab Emirates (0,62)	Bulgaria (0,63)	Pakistan (0,62)	Thailand (0,62)	Korea, Rep. (0,62)	Honduras (0,62)	United Arab Emirates (0,62)	Thailand (0,62)
64	Trinidad and Tobago (0,62)	Thailand (0,62)	Congo, Rep. (0,62)	Pakistan (0,62)	Indonesia (0,62)	Kenya (0,62)	Kenya (0,62)	Thailand (0,62)	Thailand (0,62)	Thailand (0,62)	United Arab Emirates (0,62)
65	Indonesia (0,62)	Russian Federation (0,62)	Bulgaria (0,61)	Kenya (0,61)	Pakistan (0,62)	Bulgaria (0,62)	Iran, Islamic Rep. (0,62)	Iran, Islamic Rep. (0,62)	Iran, Islamic Rep. (0,62)	Honduras (0,62)	Iran, Islamic Rep. (0,62)

66	Saudi Arabia (0,62)	Pakistan (0,62)	Pakistan (0,61)	Indonesia (0,61)	Honduras (0,62)	Congo, Rep. (0,61)	Indonesia (0,61)	Kenya (0,62)	United Arab Emirates (0,62)	Iran, Islamic Rep. (0,62)	Honduras (0,62)
67	Pakistan (0,62)	Trinidad and Tobago (0,62)	Russian Federation (0,61)	Russian Federation (0,61)	Kenya (0,62)	Saudi Arabia (0,61)	Honduras (0,60)	Honduras (0,61)	Kenya (0,61)	Kenya (0,61)	Kenya (0,62)
68	Russian Federation (0,62)	Jamaica (0,61)	Indonesia (0,61)	Saudi Arabia (0,61)	Russian Federation (0,61)	Honduras (0,61)	Saudi Arabia (0,60)	Saudi Arabia (0,61)	Russian Federation (0,61)	Russian Federation (0,61)	Russian Federation (0,61)
69	Bulgaria (0,62)	Bulgaria (0,61)	Jamaica (0,61)	Estonia (0,60)	Saudi Arabia (0,61)	Russian Federation (0,60)	Russian Federation (0,60)	Russian Federation (0,60)	Ukraine (0,61)	Saudi Arabia (0,60)	Ukraine (0,60)
70	Estonia (0,61)	Indonesia (0,61)	Estonia (0,60)	Honduras (0,60)	Congo, Rep. (0,61)	Indonesia (0,60)	Congo, Rep. (0,60)	Ukraine (0,59)	Saudi Arabia (0,60)	Ukraine (0,60)	Saudi Arabia (0,60)
71	Honduras (0,61)	Estonia (0,60)	Honduras (0,59)	Congo, Rep. (0,60)	Trinidad and Tobago (0,60)	Estonia (0,59)	Estonia (0,60)	Congo, Rep. (0,59)	Congo, Rep. (0,60)	Congo, Rep. (0,60)	Congo, Rep. (0,60)
72	Jamaica (0,60)	Ukraine (0,60)	Trinidad and Tobago (0,59)	Ukraine (0,59)	Estonia (0,59)	Ukraine (0,59)	Ukraine (0,59)	Estonia (0,59)	Estonia (0,59)	Estonia (0,60)	Estonia (0,60)
73	Ukraine (0,60)	Honduras (0,59)	Ukraine (0,59)	Trinidad and Tobago (0,59)	Ukraine (0,59)	Trinidad and Tobago (0,58)	Trinidad and Tobago (0,59)	Trinidad and Tobago (0,58)	Trinidad and Tobago (0,58)	Trinidad and Tobago (0,59)	Trinidad and Tobago (0,58)
74	Angola (0,59)	Bosnia and Herzegovina (0,58)	Angola (0,57)	Kazakhstan (0,57)	Kazakhstan (0,57)	Kazakhstan (0,57)	Kazakhstan (0,57)	Kazakhstan (0,57)	Kazakhstan (0,58)	Bosnia and Herzegovina (0,58)	Kazakhstan (0,58)
75	Kazakhstan (0,58)	Kazakhstan (0,58)	Kazakhstan (0,57)	Turkmenistan (0,57)	Turkmenistan (0,57)	Botswana (0,57)	Botswana (0,57)	Turkmenistan (0,56)	Bosnia and Herzegovina (0,57)	Kazakhstan (0,58)	Bosnia and Herzegovina (0,58)
76	Bosnia and Herzegovina (0,58)	Angola (0,57)	Bosnia and Herzegovina (0,56)	Botswana (0,56)	Angola (0,56)	Turkmenistan (0,56)	Turkmenistan (0,56)	Bosnia and Herzegovina (0,56)	Turkmenistan (0,57)	Turkmenistan (0,57)	Turkmenistan (0,57)
77	Turkmenistan (0,58)	Turkmenistan (0,57)	Turkmenistan (0,56)	Angola (0,56)	Bosnia and Herzegovina (0,56)	Angola (0,56)	Bosnia and Herzegovina (0,55)	Botswana (0,55)	India (0,55)	India (0,57)	India (0,56)
78	India (0,57)	India (0,56)	India (0,55)	Bosnia and Herzegovina (0,56)	India (0,56)	Bosnia and Herzegovina (0,55)	India (0,55)	India (0,55)	Angola (0,55)	China (0,55)	China (0,55)
79	Botswana (0,56)	China (0,55)	Botswana (0,55)	India (0,55)	Botswana (0,56)	China (0,54)	Angola (0,55)	Angola (0,55)	China (0,55)	Angola (0,55)	Angola (0,55)
80	China (0,55)	Botswana (0,55)	China (0,55)	China (0,54)	China (0,55)	India (0,53)	China (0,54)	China (0,54)	Botswana (0,54)	Botswana (0,54)	Botswana (0,54)
81	South Africa (0,51)	South Africa (0,51)	South Africa (0,50)	South Africa (0,50)	South Africa (0,52)	South Africa (0,52)	South Africa (0,52)	South Africa (0,53)	South Africa (0,53)	South Africa (0,52)	South Africa (0,52)

Table 3. *Results of Energy Justice Index*

5.1. Analysis of the Results

The analysis of the results of Energy Justice Index consists of two main parts. The first part of the analysis categorizes the sample countries according to their energy justice performances. The second part of the analysis is conducted through a regional comparison between sample countries. Accordingly, the energy justice performances of European, American, African and Asian countries are discussed, and the underlying motives behind their high or low energy justice scores are justified.

To achieve the first part of the analysis, three major categories including high, medium and low energy justice performance are created. The method to categorize the sample countries is based on frequency distribution that enables to observe how frequencies are distributed over values. Accordingly, the following equation is referred to calculate frequency distribution of countries' justice performances.

$$i = \frac{(MAX - MIN) + 0{,}01}{3}$$

The outputs of the index reveal that highest average EJI score is 0,84 while the lowest EJI score is 0,52. The result of the equation suggests that frequency for categorization is 0,11. In this sense, countries with an average EJI values of 0,77 or higher are classified as the ones with a highest energy justice performance, whereas countries with an average EJI values of 0,63 or less are regarded as the ones with the lowest energy justice performance. The remaining countries that have EJI scores between 0,64 and 0,74 are categorized as medium energy justice performance countries.

5.1.1. High Energy Justice Performance Countries

The frequency distribution conducted to analyse the results of the index shows that four countries are identified as high energy justice performance countries. In this sense, the highest energy justice score belongs to Iceland followed by Norway, Sweden and Switzerland. Table 4 demonstrates high energy justice performance countries along with the 11-year average. This situation is also evidenced by the fact that these countries have strict climate and energy policies as well as their efforts to become leaders in renewable energy and energy efficiency (Sovacool, 2017). Moreover, their commitments to be fossil free by 2050 further supports this outcome.

Country	Average EJI Score
Iceland	0,84
Norway	0,78
Sweden	0,77
Switzerland	0,77

Table 4. *High Energy Justice Performance Countries*

The accuracy of the index results is firstly justified by the fact that Sweden and Norway aim 100% renewable energy deployment while Iceland committed to 50-75% renewable energy penetration mostly through its geothermal potential (International Energy Agency and Nordic Energy Research, 2016). Secondly, high level of awareness and education imply that the citizens in these countries tend to consume energy more efficiently, which directly reduces level of energy intensity by contributing to a just energy system. Moreover, their developed economies enable these countries to equally allocate their economic and energy resources among their citizens. A high energy justice score is achieved in these four countries as they have a high GDP per capita, high level of access to electricity and clean fuels for cooking, high level of renewable energy consumption as well as low levels of carbon emissions. This can be interpreted as these countries well perform the requirements of energy justice.

5.1.2. Medium Energy Justice Performance Countries

The medium energy justice performance countries have average values for justice score between 0,74 and 0,64. Table 5 depicts the countries with medium energy justice performance. The interesting outcomes of the analysis suggest that Uruguay (0,74), Paraguay (0,73), Brazil (0,73), Costa Rica (0,73), Gabon (0,72), United States (0,65) and United Kingdom (0,69) are identified as medium energy justice performance countries. Accordingly, Uruguay stands out for its high income per capita and low level of poverty as well as the opportunities it provides in terms of access to basic services including running water, electricity and sanitation. The country has been experiencing a transition from imported oil dependent energy sector to a renewable energy-based economy in which 94% of country's electricity mix and 55% of its energy mix are supplied from renewable energy resources. Such transition has increased its population's energy access and enabled to decrease carbon emissions per capita and carbon intensity of the economy by further

improving its energy justice (Angel, 2016). Similarly, Costa Rica, where renewable energy resources have 79% share in energy mix and 99% share in electricity generation mix, performs a medium energy justice performance. Furthermore, it is seen that nearly 100% of the population has an access to electricity, which is regarded as at universal level (World Bank, 2019). This shows these two countries tend to enhance their potential to ensure energy justice.

Country	Average EJI Score	Country	Average EJI Score	Country	Average EJI Score
Uruguay	0,74	Belgium	0,69	Algeria	0,66
Luxembourg	0,74	United Kingdom	0,69	Israel	0,66
Paraguay	0,73	Armenia	0,69	Iraq	0,66
Costa Rica	0,73	Netherlands	0,68	Romania	0,66
Brazil	0,73	Germany	0,68	Canada	0,66
France	0,72	Egypt, Arab Rep.	0,68	Nigeria	0,66
Gabon	0,72	Chile	0,68	Greece	0,66
Denmark	0,72	Cyprus	0,67	United States	0,65
Austria	0,71	Argentina	0,67	Georgia	0,65
Latvia	0,71	Albania	0,67	Poland	0,65
Finland	0,71	Dominican Republic	0,67	Mexico	0,65
Lithuania	0,70	Ecuador	0,67	Malaysia	0,64
Portugal	0,70	Japan	0,67	Australia	0,64
Ireland	0,70	Sri Lanka	0,67	Belarus	0,64
New Zealand	0,70	Jordan	0,67	Czech Republic	0,64
Spain	0,69	Slovenia	0,67	United Arab Emirates	0,64
Italy	0,69	Guatemala	0,67	Korea, Rep.	0,64
Hungary	0,69	Morocco	0,67		
Colombia	0,69	Azerbaijan	0,67		

Table 5. *Medium Energy Justice Performance Countries*

Surprisingly, Paraguay has a relatively higher score of energy justice compared to other countries. This probably stems from country's faster economic growth than regional neighbours. Such economic growth is also supported by poverty reduction, which enable more citizens to have access to energy resources and services. However, poverty reduction is still not at the expected level, and this situation prevents Paraguay to achieve a higher energy justice score (World Bank, 2019). As far

as Brazil's energy justice score is considered, it is seen that the country has a relatively better energy justice performance than other medium justice performance countries. The reason behind this situation is based on the fact that Brazil has ambitious efforts to increase the level of access to electricity and the share of renewables in total final energy consumption. In this regard, it is observed that the rural and urban areas of the country have nearly 100% access to electricity despite its large territory that is likely to create challenges for the transmission of the electricity (World Bank, 2019). Besides, nearly 45% of energy demand is met by renewable energy resources, implying that Brazil is one of the leading countries in the world with the least carbon intensive economy (IEA, 2019). Although its low GDP per capita and slow recovery in economic activities, Brazil is still ranked with a relatively higher energy justice score due to its better performance in terms of other indicators.

The fact that Gabon is ranked as a country with medium energy justice performance is quite interesting. The index reveals that Gabon has a higher energy justice score than other medium justice performance countries such as Belgium, United Kingdom and United States. As an upper-middle-income country, Gabon faces several challenges regarding energy poverty (World Bank, 2019). Nevertheless, the high energy justice performance can be explained as poverty is equally allocated among the population. On the other hand, medium energy justice performances of United States and United Kingdom can be construed as these countries pave the way for a just energy system by focusing on more renewable energy consumption and combat with climate change. However, the ambitious and strong economic activities prevent these countries to achieve a higher energy justice score because of high levels of carbon intensity and energy intensity.

5.1.3. Low Energy Justice Performance Countries

The average energy justice scores for low energy justice performance countries are ranging from 0,63 to 0,52. Table 6 present the countries with the lowest energy justice scores. These countries are lack of efficient government policies to ensure a stable energy system that will look after the interests of the citizens. Specifically, it is observed that South Africa (0,52), China (0,55), Botswana (0,56), India (0,56) and Angola (0,56) has the lowest energy justice scores among sample countries. It is

evident by the fact that South Africa cannot make a prospective progress in GDP per capita and still faces with energy poverty. Besides, the rate of inequality is extremely high by only enabling the richest part of the society to hold nearly 71% of net wealth (World Bank, 2019). This means allocation of economic resources is not equal among the citizens, which directly violates the "distributional, procedural and recognition justice dimensions of energy justice framework" (Jenkins et al., 2106). Furthermore, high carbon emissions per capita and low share of renewable energy resources in total final energy consumption strengthen the possibility to rank South Africa as the last country in terms of energy justice performance. Similarly, India and China have a low justice score probably because of high population, low GDP per capita, and high levels of carbon intensity and carbon emissions per capita caused by fossil fuel dependency.

Country	Average EJI Score	Country	Average EJI Score
Jamaica	0,63	Estonia	0,60
Iran, Islamic Rep.	0,63	Ukraine	0,60
Pakistan	0,63	Trinidad & Tobago	0,60
Thailand	0,63	Kazakhstan	0,58
Bulgaria	0,63	Turkmenistan	0,57
Kenya	0,63	Bosnia and Herzegovina	0,57
Indonesia	0,63	Angola	0,56
Congo, Rep.	0,62	India	0,56
Saudi Arabia	0,61	Botswana	0,56
Honduras	0,61	China	0,55
Russian Federation	0,61	South Africa	0,52

Table 6. *Low Energy Justice Performance Countries*

An interesting result is observed for Russian Federation that has a lower energy justice score than its regional comparators with a score of 0,61. This situation stems from the fact that the country faces with a threat of poverty. Despite its ambitious targets to halve the poverty by 2024, Russian Federation probably cannot achieve this target because of slow pace of GDP growth rate. Besides, high levels of carbon intensity and relatively high levels of carbon emission per capita as well as low levels of energy use per capita caused by poverty further deteriorate the conditions to achieve a just energy system. Moreover, low share of renewables in total final energy consumption will lead Russian Federation to combat with climate change related

concerns in the future, implying that the country should take more ambitious steps to achieve a just energy system. The similar results are also observed for Pakistan that has a low energy justice score of 0,63. The same picture also applies to Pakistan as the country is under a serious risk of poverty, which prevents the citizens to have an equal access to energy resources and services.

5.1.4. Regional Comparison of Energy Justice Performance

The constructed Energy Justice Index enables to make a regional comparison based on sample countries' energy justice scores and performances. In this sense, sample countries are divided into four groups according to their geographical locations. Consequently, the regional distribution is as follows: (1) European countries, (2) African countries, (3) Asian, Eurasian and Caucasian countries, (4) North American, Latin American and Oceanian countries.

It is seen that there is generally an even distribution of energy justice performance among European countries. Figure 5 illustrates that most of European countries have an average energy justice score between 0,63 and 0,73. This means majority of European countries is regarded as medium energy justice performance countries according to the frequency distribution calculated on the basis of Index results. Moreover, the energy justice performance of these countries tend to be stable and does not fluctuate too much.

When European countries are classified in itself according to their energy justice performances, it is seen that Bosnia and Herzegovina emerges as the European country that has the lowest energy justice score compared to other countries. This is evident by the fact that Bosnia and Herzegovina has a relatively less share in renewable energy consumption despite a prominent increase in recent years. Additionally, extremely low levels of energy use per capita and lack of access to clean fuels and technologies for cooking prove this low energy justice score. It is seen that only 63% of the population has an access to clean fuels and technologies for cooking in 2016, which is correlated with energy poverty.

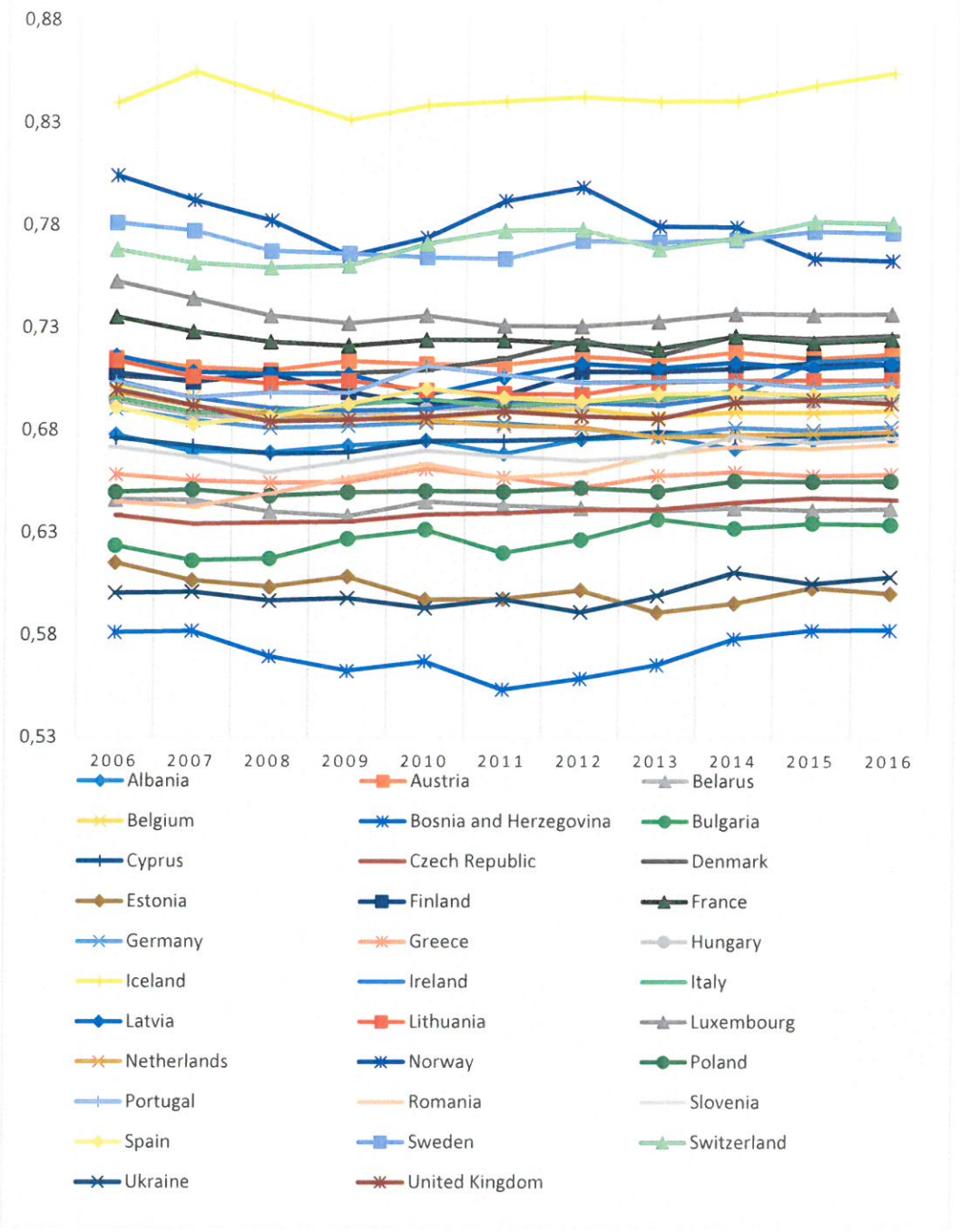

Figure 5. *Energy Justice Performance of European Countries for the Period of 2006-2016*

When African countries are considered, it is seen that their energy justice performances are quite fluctuating according to different time periods. Figure 6 presents a comparative illustration for the energy justice performance of African countries for the time period between 2006 and 2016. In this sense, South Africa is

seen as the lowest energy justice performance country among others. South Africa is followed by Botswana and Angola.

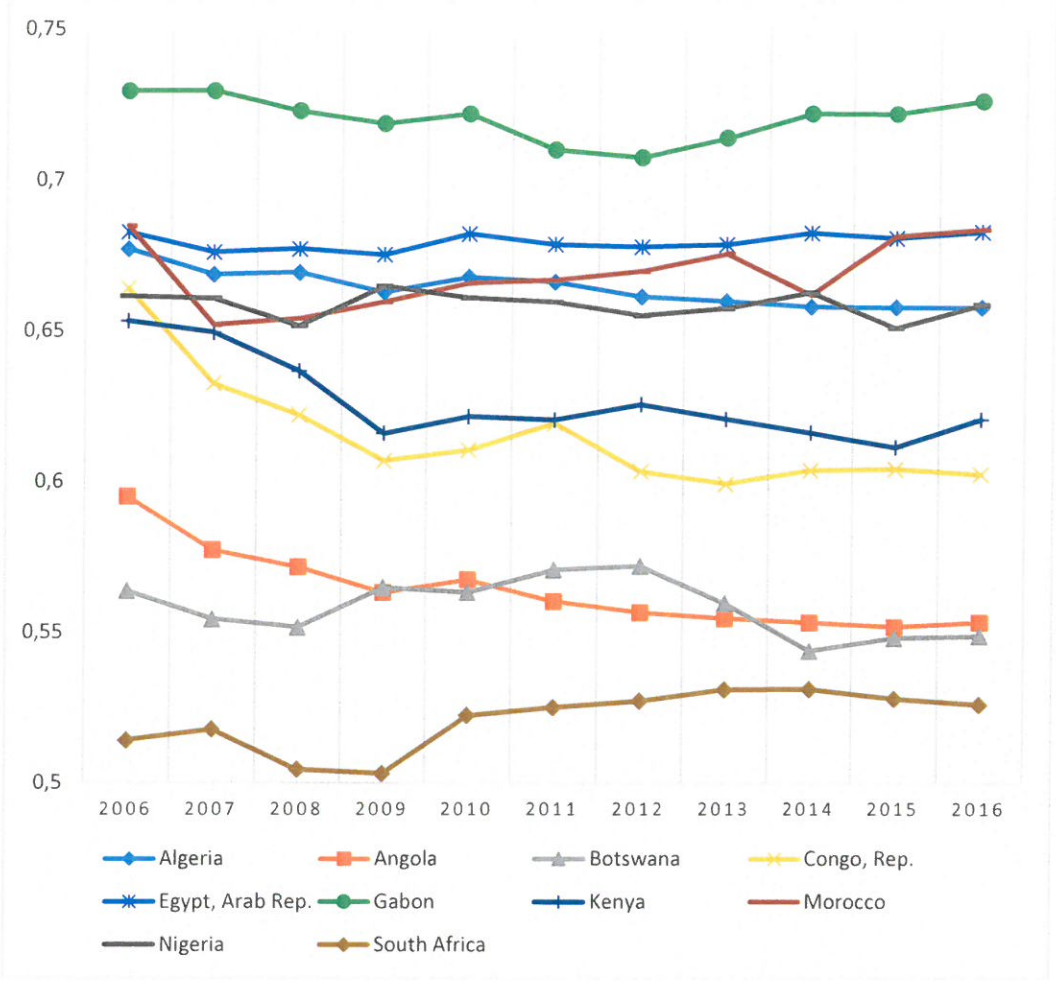

Figure 6. *Energy Justice Performance of African Countries for the Period of 2006-2016*

An interesting picture is observed when the energy justice performances of Asian, Eurasian and Caucasian countries are taken into consideration. Figure 7 shows that there is a breaking point at 0,58 which belongs to Kazakhstan in 2016. The energy justice performances of other countries in this groups are distinguished from the justice performances China, India, Turkmenistan and Kazakhstan. It is seen that China has the lowest energy justice score for the whole period except for 2011. Instead, India struck the bottom in 2011 with a score of 0,53. This is probably caused by the fact the country faces with severe energy poverty, extremely high carbon emissions

per capita and carbon intensity besides lack of access to clean fuels and technologies for cooking.

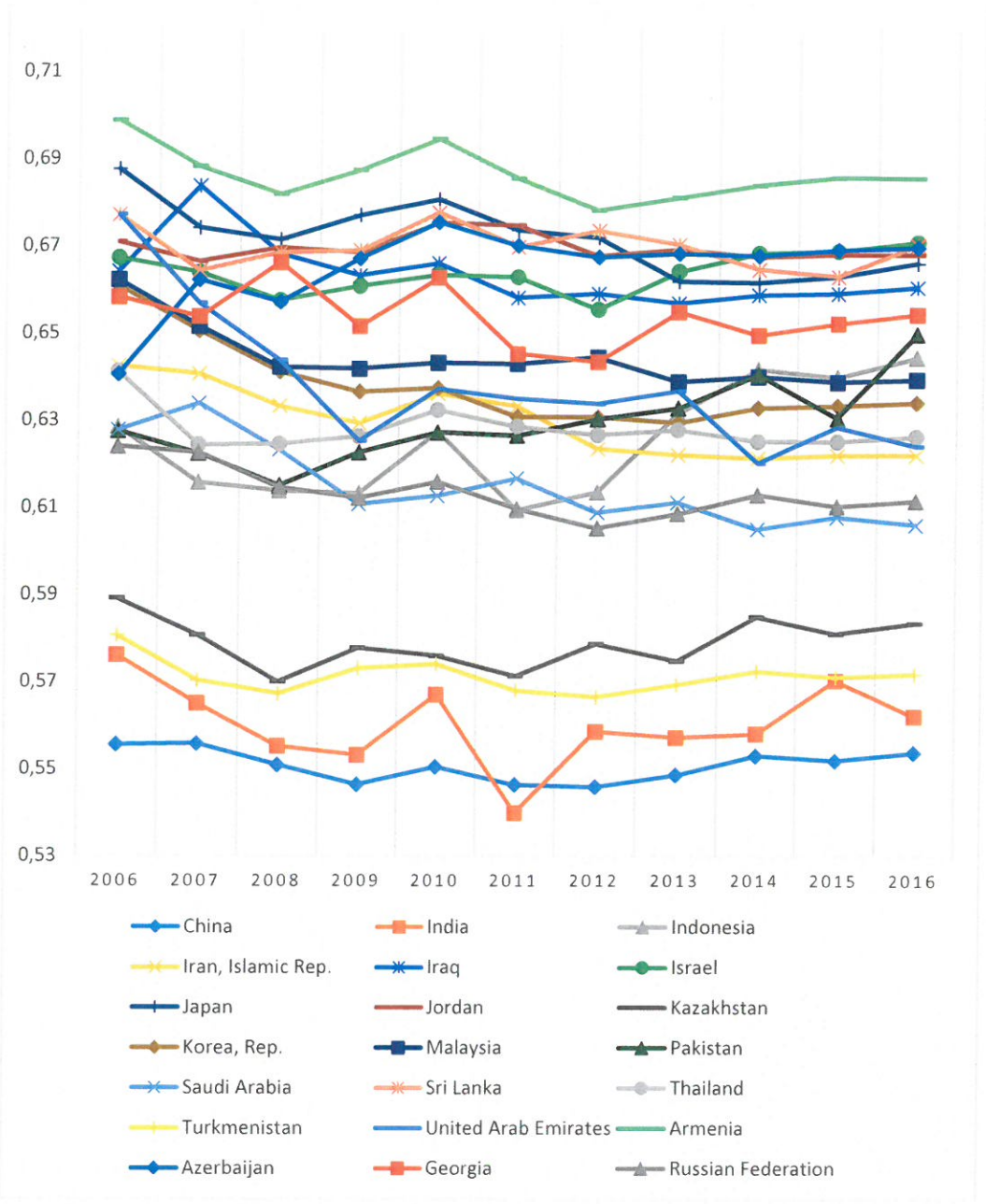

Figure 7. *Energy Justice Performance of Asian, Eurasian and Caucasian Countries for the Period of 2006-2016*

On the other hand, as an interesting outcome, Iraq has a fluctuating energy justice performance, which can be explained as the political turmoil have negative impacts on Iraqi energy system. Similarly, the significant shift in the energy justice score of United Arab Emirates during the whole period implies that sanctions and embargos

on the country directly affects its economy, resulting in deteriorations in the energy system.

Finally, the energy justice performances of North American, Latin American and Oceanian countries reveal that developing countries such as Honduras and Jamaica have relatively lower justice scores compared to other Latin and North American countries. Figure 8 represents the details regarding these countries.

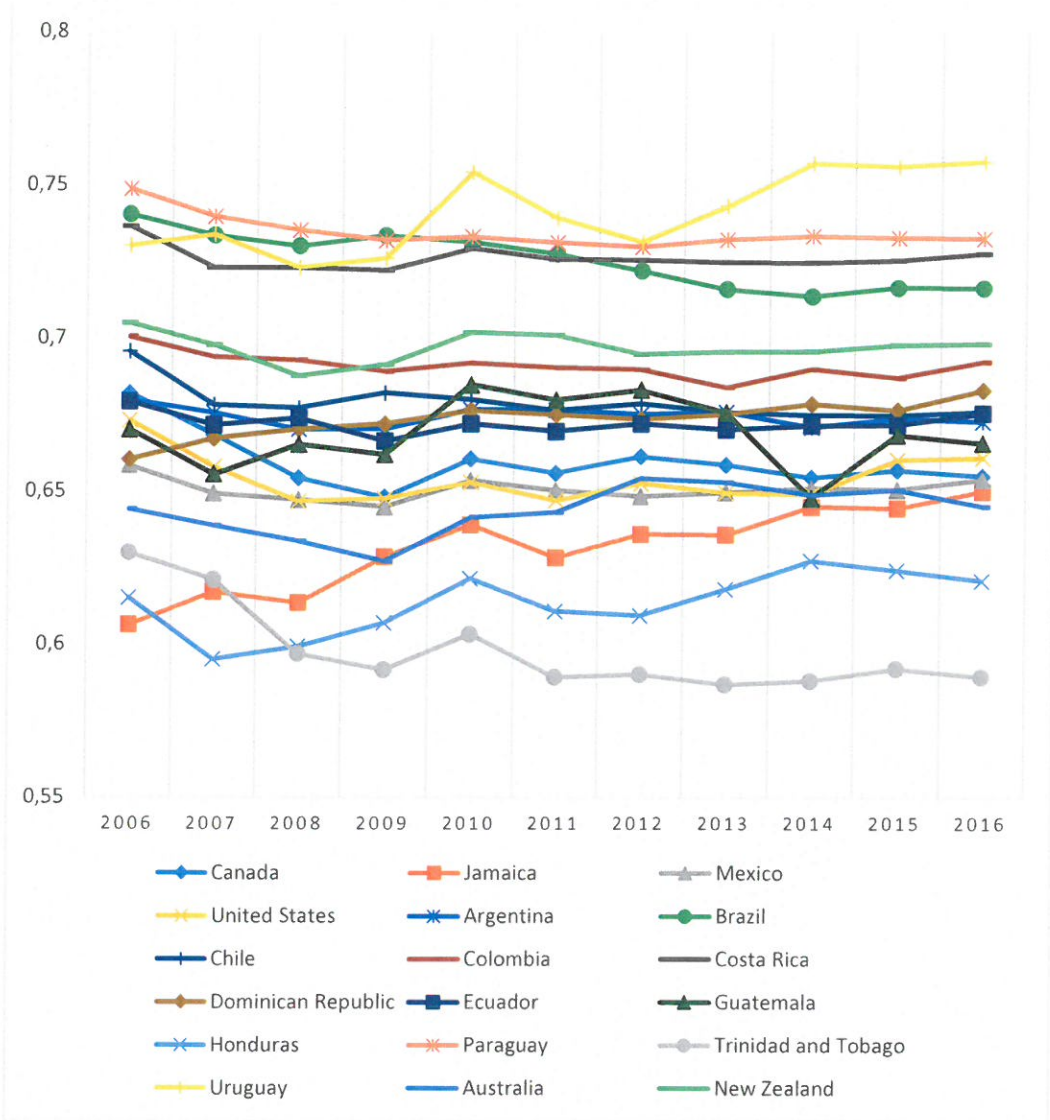

Figure 8. *Energy Justice Performance of North American, Latin American and Oceanian Countries for the Period of 2006-2016*

On the contrary, it is not surprising to see Uruguay at the top of the diagram with its highest energy justice score. This can be justified by the fact that Uruguay is the third most developed Latin American country according to Human Development Index. A

similar case also applies to Costa Rica, one of the most developed nations of Latin America.

CHAPTER 6

CONCLUSION

Defined as an ethical framework aiming to provide all individuals, without any discrimination, with "safe, affordable and sustainable energy", the concept of energy justice has attracted a great attention from the first moment that it has been introduced to the literature. Multiple scholars try to define the concept and suggest principles to ensure a just energy system. Accordingly, a three-legged framework consisting of distributional, procedural and recognition justice aspects is created and eight different principles including "availability", "affordability", "due process", "good governance", "sustainability", "inter-generational equity", "intra-generational equity", and "responsibility" are introduced to formulate just energy policies. Grounded on social justice and fairness in terms of access and allocation of energy resources and technologies, energy justice seeks to encourage clean energy policies by reducing the consumption of fossil fuels and alleviating the impact of climate change. Namely, energy justice framework adopts policies to protect people from environmental pollution and degradation. Furthermore, it is regarded as a tool to combat with energy poverty.

The fundamental rationale behind achieving energy justice is based on a just transition to a low carbon economy. In this regard, the energy justice literature mostly deals with case studies to show how energy justice is tried to be ensured in different countries. However, lack of a systematic index that will measure energy justice performance of countries is observed and the gap is tried to be filled by designing a composite Energy Justice Index. The index is regarded as an innovative and unique study as it is the first statistical index study in energy justice literature. This perspective justifies the strength of this study via filling the gap in the literature. Constructed upon eight energy-related indicators, namely "GDP per capita", "access to electricity", "carbon intensity", "carbon emissions per capita", "access to clean fuels and technologies for cooking", "energy use per capita", "energy use per $1000

GDP", and "the share of renewable energy in total final energy consumption", the Energy Justice Index tries to analyse the energy justice performance of 81 sample countries during the period of 2006 and 2016 and reveal which countries have a better energy justice performance by categorize them according to their justice scores.

The results of the Energy Justice Index illustrate that Nordic countries have a better energy justice performance than the rest of the world. This is further proven by the fact that these countries are by far the most developed countries in the world according to Human Development Index. Moreover, higher GDP per capita, high energy use per capita, low carbon emissions per capita and carbon intensity as well as energy intensity, and high share of renewable energy resources in total final energy consumption are observed to have an impact on higher energy justice scores of these Nordic countries. In general sense, the index also shows that the justice performance of developed countries has higher scores than developing or underdeveloped countries. This can be construed as developed countries that pay more attention to environmental concerns and renewable energy consumption prevail developing or underdeveloped countries that are still dependent on a carbon intensive economy.

On the side of lowest energy justice performance, South Africa, China and India are seen as the countries with the lowest energy justice scores because of high carbon intensity and carbon emissions per capita, low GDP per capita level, lack of access to clean fuels and technologies for cooking and low share of renewables in total energy consumption. This implies that these countries are likely to experience energy poverty and environmental problems compared to other countries.

In conclusion, the categorization of sample countries according to their energy justice performances demonstrate that Iceland, Norway, Sweden and Switzerland are ranked as the high energy justice performance countries, whereas 22 out of 81 countries (e.g. South Africa, China, Botswana, India and Angola) are regarded as the low energy justice performance countries. The remaining 55 countries are ranked as medium energy justice performance countries. The second part of the analysis focusing on a regional comparison of energy justice performance puts forward that

European countries have a more stable justice performance during the 11-year-period compared to other countries. As a consequence of the analysis, it is seen that Latin American countries still experience problems regarding energy access, which leads to energy poverty.

As the energy justice literature has yet to be mature, there are still several gaps to be filled. As a further research, eight principled-decision making framework on energy justice could be enlarged and improved by including new dimensions such as gender justice as a part of recognition justice. Moreover, procedural justice tenet could be elaborated through regulatory justice, retributive justice and restorative justice concepts that will analyse whether or not the regulations in the energy market look after the interests of all parts of the society without any discrimination, how the injustices are punished, and how the inequalities are removed or restored.

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