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Inquiring the Meaning of the Energy Security Concept: Dimensions, Components, and Possible Need to Reframe it

Ali Berkul

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SUMMARY

This report aims to inquire into the meaning of the energy security concept. It is argued in the report that although the "multidimensional" and "polysemic" nature of the energy security concept makes it hard to define it uniformly, a framework can be formed to understand the very meaning of the term through analyzing the common dimensions and components and different components of various definitions. In this respect, the 4A's of APERC's energy security definition are used to provide a framework for combining different dimensions and components of the diverse definitions and to lay the groundwork for developing a framework to eliminate differences among various energy security definitions to some extent. That framework defines energy security more widely as "having energy autonomy from the absence of any threat" in the form of a better understanding of the concept. Nevertheless, it is also argued in the report that redefining the energy security concept would not be sufficient to inquire about its meaning since the concept remains incompatible with the international system and the anthropogenic energy system of the era.

For this reason, it is argued in the report that although energy security literature is rich enough, the necessity to reframe it reveals that the concept is approached and defined mainly through fossil fuels when the necessities of the 20th and 21st centuries are considered. In this regard, the provided framework is strengthened by reframing dimensions of energy security by including "renewable energy" as a fundamental element, securitizing "renewable energy," and initiating its integration with the trends of capitalism to understand the energy security concept fully. Finally, it is concluded in the report that the energy security concept should be reframed and de-fossilized to make it more relevant to the current era.

INQUIRING THE MEANING OF THE ENERGY SECURITY CONCEPT: DIMENSIONS, COMPONENTS, AND POSSIBLE NEED TO REFRAME IT

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Introduction

Energy is the "only currency" in the universe that "one of its many forms must be transformed to get anything done."[1] Likewise, energy is considered the source of "all-natural processes and human actions in the world" from the beginning.[2] In this regard, the history of humankind can also be understood and categorized by inquiring about humans' ability to move prime movers and create "anthropogenic energy systems." In other words, assessing prime movers and anthropogenic energy systems, "that is any arrangement whereby the humans use the Earth's resources to improve their chances of survival and to enhance their quality of life," together provide valuable ground to have a better insight about our history and to categorize it.[3]

The historical process can be categorized into three phases based on the era's prime movers that create the ability to control, manipulate, and direct the energy in line with the anthropogenic energy systems of the period.[4] According to Vaclav Smil, the first phase characterized human muscles as "the only prime movers," which were then

extended with the domestication of draft animals and the inclusion of renewable energy types (wind and water) in the second phase. Finally, in the third phase, the "long-lasting anthropogenic energy system" of the second phase expanded with engines emerging as "the mechanical prime mover of the era."[5]

In other words, assessing prime movers and anthropogenic energy systems, "that is any arrangement whereby the humans use the Earth's resources to improve their chances of survival and to enhance their quality of life," together provide valuable ground to have a better insight about our history and to categorize it.

Engines began a new era as they required fuel to function. As a result, fossil fuels started to gain significant importance, and limitations on the ability to produce work began to be overcome. Naturally, sectoral usage of fossil fuels has increased. They have become a vital input for countries to run the wheels of their economies, to deploy their militaries, to secure gainings in the socio-economic sphere, etc... Therefore, uninterrupted flow of energy resources is regarded as both a symbol of power and an indispensable part of national security for the countries, especially since the 20th century. Since then, the affordable and uninterrupted flow of energy resources has become a foreign policy and a security issue for both energy exporter and importer countries.[6]

The 1973 Arab-Israeli War, after which oil was weaponized to achieve foreign policy goals by some energy exporter countries against countries that supported Israel during the war, posed a significant threat to the affordable and uninterrupted flow of energy resources. After the war, the "linkage between energy, security, and foreign policy" became evident not only for the decision-makers but also for the ordinary citizens. Thus, the linkage made energy security the top issue to be addressed by the decision-makers at the domestic and international scales. The energy security concept emerged "as a study subject" in literature because of it, although it is "as old as fire," as Scott Victor Valentine said.[7] Since then, the scope of the energy security concept has widened in line with the needs of the era and developments on an international scale. The realities in this century, such as unprecedented demand for energy, expanding anthropogenic energy system, wars, climate change, and new security threats to energy supply, resemble the impact of the 1973 Arab-Israeli War that once it created on both domestic and international scale in respect to energy security. Given these factors, it is crucial to comprehend the energy security concept.

The energy security concept emerged "as a study subject" in literature because of it, although it is "as old as fire," as Scott Victor Valentine said.

In this regard, this report aims to inquire into the meaning of the energy security concept. Furthermore, the potential need to redefine the energy security concept, if there

is one, will also be explored in this report as well. To do so, different definitions of energy security made by various actors will be provided in the following section. Then, the common dimensions and components and different components of different energy security definitions will be examined. Lastly, the possible necessity to redefine energy security will be discussed.

Energy Security: Definitions and Dimensions

The "multidimensional" and "polysemic" nature of the energy security concept makes it hard to define it uniformly.[8] In other words, as it is a "complex concept with multilayered dimensions that interconnects different subject areas," there is no agreed definition of energy security.[9] In fact, according to Abdelrahman Azzuni and Christian Breyer, there are 66 definitions exist in literature.[10]

The "multidimensional" and "polysemic" nature of the energy security concept makes it hard to define it uniformly.

However, although many definitions of energy security make it complicated to comprehend, understanding it is crucial since it is a "concept rather than a policy."[11] This can be achieved, to some extent, by creating a framework that focuses on common dimensions and distinct components of some of the different definitions. Therefore, it is essential to mention some of the various definitions made by various actors, including international organizations with diverse founding purposes.

Abdelrahman Azzuni and Christian Breyer, there are 66 definitions exist in literature.

It is appropriate to start mentioning different energy security definitions with the definitions of the International Energy Agency (IEA) "which came into being in 1974" after the oil shock of 1973-74 to be prepared for the impacts of such shocks.[12] Having been founded by the energy importer countries shaped its perception and definition of energy security based on supply security. Accordingly, energy security was defined as "secure oil supplies on reason equitable terms" in 1974 by the IEA.[13] This definition is supported by the "common effective measures to meet oil supply emergencies" and the "emergency self-sufficiency" clause to cope with supply disruptions.[14] As one can deduce from this definition, the IEA's first definition mainly focused on oil supply security. Over time, the IEA recognized the need for a more inclusive definition, given the inclusion of other fuel types in the energy portfolios and developments in the energy sector. In 1985, The IEA defined energy security as an "adequate supply of energy at a reasonable cost," updated in 1995 to include "avoiding market distortions."[15] The nature of the concept led to further revisions to meet the necessities of the era. As a result, the IEA defines energy as the "uninterrupted availability of energy sources at an affordable price."

Additionally, it introduced short and long-term energy security, acknowledging that the energy security concept has many aspects. Hereof, short-term energy security "focuses on the ability of the energy system to react promptly to sudden changes in the

supply-demand balance." In contrast, long-term energy security "mainly deals with timely investments to supply energy in line with economic developments and environmental needs."[16] In short, IEA's definitions highlight the importance of the availability of energy sources and the affordable side of them while acknowledging the need to have a robust energy system and address environmental concerns.

Unlike the IEA's founding purpose, a collective defense organization, North Atlantic Treaty Organization (NATO) put energy security on its agenda in 2008 at the Bucharest Summit.[17] Most of its member states reliance on foreign energy supply and the possible negative impact of this on the military operational capacity of NATO in the case of supply disruptions paved the way for NATO to interpret the energy security concept. In line with its founding purpose and the necessities of member states, NATO based its energy security perception on 'supply security' and interpreted the concept from the perspective of 'security.' Thus, "sustaining the security of energy infrastructure," "surveilling maritime routes and choke points (…) to increase the security of commercial shipping lanes" that energy resources pass, and "ensuring resilience against attack or disruption," including "cyber and hybrid threats to infrastructure" remain in the scope of NATO's energy security perception.[18] In addition to those, "increasing military energy efficiency" concerning energy use to respond to the necessities of the era "while maintaining operational effectiveness" is also stressed by NATO.[19] Within the boundaries of the features mentioned earlier, NATO formed the framework for its energy security understanding. NATO's energy security framework is distinctive, not only because a collective defense organization forms it but also because it emphasizes hybrid and cyber threats to energy infrastructure, increasing military energy efficiency and securing both energy infrastructure and shipping lanes to access energy resources.

Another energy security definition is made by the Asia Pacific Energy Research Centre (APERC), founded to support activities of a regional economic cooperation forum, Asia-Pacific Economic Cooperation (APEC).[20] On the grounds of the needs of the APEC region and increasing energy demand, APERC also defined energy security from the supply security perspective. It defines energy security "as the ability of an economy to guarantee the availability of energy resource supply in a sustainable and timely manner with the energy price being at a level that will not adversely affect the economic performance of the economy."[21] Furthermore, three fundamental elements of energy security, "physical, economic, and environmental sustainability," are defined by APERC to correlate those with availability, accessibility, affordability, and acceptability dimensions of the concept.[22] Conversely, APERC's energy security definition reflects its founding purpose, which differs from NATO's and IEA's founding purposes. Thus, this definition provides four different dimensions and specific components under those dimensions that both enable understanding of the concept and make it distinguishable in the energy security literature.

In addition to the extensive definitions of energy security mentioned above, another definition is made by a supranational organization, the European Union (EU). Since domestic energy production of most

of the EU member states does not meet the energy demand, the EU bases energy security definition on supply security. According to *Green Paper*, which was presented by European Commission in 2000, the EU's long-term strategy for energy supply security is defined as follows:

> *"…. energy supply security must be geared to ensuring, for the well-being of its citizens and the proper functioning of the economy, the uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers (private and industrial) while respecting environmental concerns and looking towards sustainable development."*[23]

To grasp the EU's energy security understanding in general, this definition has to be comprehended together with its 2014 energy security strategy that highlights the significance of "a stable and abundant supply of energy" in order to sustain "prosperity and security."[24] In short, availability, affordability, and acceptability dimensions of the energy security concept are highlighted by the EU in their definitions. In addition, as defined by the EU, a long-term strategy for energy supply security sets the base for the inclusion of culture into the energy security concept by creating a bridge between its citizens and policies to tackle climate change.

Not all definitions of the energy security concept are based on supply security. There are some definitions of this concept made by various actors based on demand security as well. The energy security understanding of the Organization of Petroleum Exporting Countries (OPEC), founded in 1960 by five energy exporter countries, represents one of them. OPEC perceives energy security as a "two-way street" in which "security of demand is as important to producers as security of supply is to consumers." In other words, "energy security is reciprocal."

Moreover, a framework for energy security is provided by OPEC in line with some characteristics of the concept. Accordingly, energy security should be "universal," "focus on providing all consumers with modern energy services," "apply to the entire supply chain," "cover all foreseeable time horizons," and "allow for the development and deployment of new technologies in a sustainable, economical and environmentally-sound manner." Although OPEC does not define energy security clearly, it provides a common framework to grasp the concept that would be incomplete if not considered.[25]

Energy exporter countries also describe the energy security concept. For instance, Russia introduced an energy security definition based on demand security in its latest Doctrine of Energy Security in 2019. Accordingly, energy security is defined as "a state of protection of the national economy and population from the threats to national security in the energy sector, in which a compliance with the legislation of the Russian Federation for fuel and energy supply to consumers, as well as fulfillment of export contracts and international obligations of the Russian Federation, is ensured."[26] As in any other country that describes energy security as demand security, the importance of economic wealth generated from energy sales is stressed in this definition. Furthermore, referencing contracts and international obligations highlights the reliable energy exporter image.

Scholars have contributed to energy security literature. Among these scholars, Daniel Yergin's definition reflects the classical

understanding of the concept. According to Yergin, "The objective of energy security is to assure adequate, reliable supplies of energy at reasonable prices and in ways that do not jeopardize major national values and objectives."[27] By focusing on energy security from a supply security perspective, he highlights the concept's importance of availability and affordability. Douglas R. Bohi and Michael A. Toman approach the concept differently. It seems like the authors incorporated the concept with the state of energy insecurity. According to them, "energy security refers to the loss of economic welfare that may occur due to a change in the price or availability of energy."[28] Aleh Cherp and Jessica Jewel argued that the "4A's (Availability, Accessibility, Affordability, and Acceptability) of energy security (…) do not address security questions". To overcome that and to reach beyond the 4A's of the concept, the authors define "energy security as a low vulnerability of vital energy systems."[29] Abdelrahman Azzuni and Christian Breyer make a more comprehensive definition of energy security. They define energy security as "the feature (measure, situation, or a status) in which a related system functions optimally and sustainably in all its dimensions, freely from any threats."[30] Moreover, they put forward fifteen dimensions to define the energy security concept in full including demand side of it.[31]

Ten different definitions of energy security, based on either supply or demand security, are given to demonstrate the diverse interpretations of this concept. Although those definitions differ in terms of their dimensions, components, and the point of view in which they are addressed, they also share some commonalities. Therefore, focusing on the commonalities among diverse definitions and relating differences under common dimensions can provide a framework for understanding the energy security concept. The dimensions of APERC's energy security definition (4A's) may be a basis for forming such a framework. For this reason, the dimensions of APERC's definition need to be described and revised by incorporating the differences among definitions under these dimensions to create this framework.

Availability

The availability dimension of the energy security concept has too many meanings. In a narrow sense, it refers to the total occurrence of energy resources on Earth.[32] Estimating the volumes of energy resources is the first component of this dimension.[33] The reason for that can be found in the countries' energy policy formulations. Both energy exporter and importer countries formulate short- and long-term energy policies based on these estimates, including the reserve-to-production ratio, which may differ regionally. In this respect, availability implies the "possibilities of energy supply geographically."[34]

These two definitions of availability enable establishing a relationship between availability and diversification, as diversification can only be achieved by utilizing available energy resources. Besides, to avoid being affected by the actions of "terrorist organizations, hostile states, market agents, etc.," which can cause disruptions in the supply of some available energy sources, diversification based on available resources is necessary. In that sense, diversification refers to "as a means

simultaneously to help prevent disruptions to energy supply and to mitigate their effects should they occur."[35] Achieving an "optimized level of diversification" "requires utilizing a mix of energy sources, fuel types, fuel cycles," purchasing energy resources from multiple sources rather than a single source country or region, and transferring them through different routes to the varying energy infrastructures[36] (For the forms of diversification, please check footnote number 37). Concerns regarding diversification are also relevant for energy exporter countries. However, their approach differs from that of energy-importing countries. Since their energy security perception is based on demand security, achieving an optimized level of diversification requires having diverse customers, routes, and fuel types.[37] In this context, diversification, accepted as another component of this dimension, strengthens energy security, and its importance can be seen in the case absence of it.

Relying on limited numbers of resources, energy infrastructures, suppliers, and routes cause a dependency that disruption in the flow of energy resources may result in economic losses and even put the sovereignty of a country at stake. In that circumstance, even the threat to cut energy flow puts countries' sovereignty at stake, which can also limit their foreign policy options. Armenia's dependence on Russia in its energy sector can be cited as an example. Russia's dominant position in Armenia's energy sector limits Armenia's foreign policy options so that she cannot pursue policies far from the foreign policy priorities of Russia. Because of this, Armenia could not even be involved in any energy project that would carry Iranian gas through Georgia to Europe.[38]

In short, without considering its components, the availability dimension can be narrowly defined as a "sufficient and uninterrupted supply"[39] of energy resources from the perspective of both energy exporter and importer states. Nevertheless, this definition reflects only one side, meaning the availability dimension should be understood as its components. Indeed, the volume of concurrent resources, the reserve-to-production ratio of existing resources, and the necessity of diversification to mitigate the negative consequences of disruption and dependency act harmoniously to grasp the essence of the availability dimension. However, just because energy resources are available in a particular location does not necessarily mean actors can reach and utilize them. Therefore, to fully understand the availability dimension as "the ability for consumers and users to secure the energy that they need," accessibility of these resources should be examined as a separate dimension.

Accessibility

The accessibility dimension of the energy security concept refers to the "absence of barriers that prevent energy consumers access to available energy resources" to meet the demand.[40] This dimension can be comprehended in two ways. The first one denotes reaching the energy resources proven to exist with geological data. However, given the "cost, political factors, workforce constraints," environmental restrictions, and technological shortcomings, some founded energy reserves are not considered suitable for extraction.[41] In this respect, stating only the extractable reserves remain in the concern of this dimension would not be wrong

since the energy demand can only be met through accessing available resources. This concern shapes the other meaning of the accessibility dimension that denotes transporting energy resources to the consumers.

As stated in the availability dimension, energy resources are much more abundant in some regions. In this case, some barriers might arise between energy exporters and importer countries due to their locations, long distances, lack of energy transportation infrastructure, etc.[42] Therefore, large volumes of energy resources must be transported by sea. That necessity has led to the increase in the capacity of the tanker fleet, which "has grown considerably by over 83 percent" between 1980 to 2020 in line with the increasing energy demand.[43] Parallel with the increasing capacity of the tanker fleet, "almost 1.9 billion metric tons of crude oil and 488 billion cubic meters of LNG were transported via waterways" globally in 2020 to meet the demand.[44] Naturally, as the seaborne energy trade volume grows, ensuring the safety and security of the sea routes and the narrow straits, which countries or non-state actors can target, has become an integral part of energy supply security. Although this is true for every country that ensures its energy flow by seaborne trade, it seems indispensable for countries whose significant percentage of imported energy passes through strategic sea lanes and narrow straits.[45] Bearing this in mind, from the energy importer states perspectives, geopolitical concerns, which can also be associated with the accessibility dimension, arise because of it.

Apart from the seaborne trade of energy resources, it can be transported by pipelines, land routes, and railways. Concerns about the security of maritime trade routes apply to pipelines as well. Indeed, those infrastructures can be sabotaged or targeted by non-state actors and conventional military elements.[46] This time, implications will be more comprehensive for energy exporter and importer countries since infrastructures like pipelines are linked. These attacks might undermine the ability of the importer states to access energy resources while threatening the demanding security of the exporter states. It should be noted that geopolitical concerns for pipelines arise from the possibility of this. On these grounds, the security of energy transportation infrastructures and strategic sea lanes of communications emerge as other components of this dimension.

The accessibility dimension, which broadly refers to the absence of barriers to reaching energy resources, should be understood with its components to inquire about energy security concepts. In this sense, it is essential to consider accessible reserves and the security of infrastructures and shipping lanes components to grasp the essence of this dimension. Because only by doing so, not only the accessibility dimension but also the availability dimension of the energy security concept can be fully understood. However, it should be noted that accessing energy services, which is associated with the accessibility dimension of the concept, is not included in this dimension on purpose since it is related to affordability to some extent. Therefore, it would be better to define the affordability dimension and see the scope of this dimension to understand why accessing energy services is not included in the accessibility dimension of the concept.

Affordability

The affordability dimension of the energy security concept reflects "the possibilities of energy supply economically."[47] In other words, it refers to accessing energy resources and services at the lowest cost with stable prices.[48] The reason for emphasizing low cost and stable prices can be found in the relatively unstable political environment of the 1970s for energy supply. The price of the primary energy resource of the era, oil, rose from $2.90 per barrel to $34 per barrel in the first half of 1980 after the oil shocks of 1973-74 and the Iranian Revolution.[49] Naturally, due to the high prices, energy consumption fell sharply. Hence, volatile and high oil prices, in other words, high production costs, negatively affected countries' economies in general, contributing to the realization of inflation.[50] However, what is experienced by energy importer countries can also be experienced by energy exporter countries, although higher energy prices might seem favorable for them in the short run. As energy consumption and demand decrease, the revenue generated from energy sales, which contributes to the economy of energy exporter countries, also decreases, affecting investments in other domestic services.[51] In that case, energy poverty can be seen, hindering equitable access to energy services for people. Therefore, it is essential to maintain stable and low energy prices that satisfy the needs of both the energy importer and exporter countries and to set conditions for equitable access to energy services. In this regard, low costs in terms of price to pay for energy resources and stable prices are regarded as components of this dimension.[52]

As Azzuni and Breyer argue, "the price to be paid for energy (…) is only one parameter" of this dimension, which they believe should be named the "cost dimension."[53] Besides the socio-economic impact of energy prices, it directly impacts the investment in exploration and reserve developments. If the energy prices are too low or volatile, energy companies can be reluctant to invest in developing new reserves.[54] In return, low energy prices increase energy consumption and create obscurity about the energy supply due to the profitability and possible imbalance between demand and supply. Thus, renewable energy investments may slow down if fossil fuel prices remain too cheap, and stockpiling cheap energy may become advantageous for countries in the short term. An example of that was when the price of oil fell to $15 worldwide due to the effects of Covid-19 that, resulted in a sudden decrease in demand.[55] For these reasons, affordable and stable energy prices are regarded as "a paramount condition and concern for security and economic welfare" for both energy exporter and importer countries.[56]

The affordability of energy resources can also be affected by developments in the places where energy exporter countries are located, the types of regimes of energy exporter state, and the time interval of the agreements. Although these components can be accepted as another dimension or parameters of other dimensions, they can also be regarded as components of affordability since they have a direct impact on energy prices. In this regard, regional dynamics can play a significant role in energy prices, as seen in the tense relations between Iran and Saudi Arabia. Tense relations ended up with the realization of a series of attacks on

each other's energy infrastructures and producing sites using non-state actors and cyber tools. In 2019, drones hit Saudi Aramco's facilities, resulting in an "unprecedented 50/50 halt" in energy production.[57] Iran is blamed for this attack because of its relations with the Houthis and their lack of capacity. As a result of it, oil prices rose above $70.[58] This event, on its own, proves the impact of regional dynamics on energy prices.

It is foreseen that energy exporter countries governed by authoritarian regimes can influence energy trade through bilateral relations and determine energy supply and prices accordingly. Russia's energy diplomacy and pricing policy confirm this view. For instance, in 2014, there was a sudden increase in the price of natural gas sold to Ukraine from $268 to $485 per unit when the relations between the two countries deteriorated.[59] In addition, Russia has threatened to sell natural gas to European countries at more than 2000 Euros per unit after it attacked Ukraine lately.[60] As examples imply, authoritarian countries use bilateral relations to ensure energy sales and charge different prices based on their interests.

Furthermore, intentional increases in energy prices can be used by those states to bring their opponents into their foreign policy line while bringing new costs to energy importer countries. To overcome this, agreements play a crucial role in enhancing energy security by setting the price of energy for a certain period that secures both parties' interests.[61] Therefore, the time interval of agreements is also accepted as another component of this dimension.

In summary, the negative impact of high and volatile energy prices on global economic development concerns both energy importer and exporter countries. Therefore, stable and low energy prices are considered the paramount condition for countries since fluctuations in energy prices can affect many areas, including renewable energy investments, new reserve discoveries, and equitable access to energy services. Moreover, energy prices can also be influenced by regional developments, regime type of energy exporter states, and time interval of agreements. On the grounds of these, the price to be paid for energy resources represents only one side of this dimension. Considering all these components together, "affordable price" in the definitions of the energy security concept makes more sense. However, like energy resources, securing our gainings in the socio-economic sphere does not come at an accessible price. The cost is paid by damaging the climate of Earth and the environment in which we live. In this respect, it would be better to mention the acceptability dimension of the energy security concept.

Acceptability

Due to human activities, the concentration of greenhouse gases (GHGs) in the atmosphere has risen significantly for the last three hundred years.[62] Intensive burning of fossil fuels since the Industrial Revolution remains at the top among those activities. Although burning fossil fuels is not the only reason that disrupts the balance of GHGs in the atmosphere, the density of carbon dioxide, nitrous oxide, and methane gas in the atmosphere increased slightly. Since then, the concentration of carbon dioxide level in the atmosphere increased by %50. At the same time, methane gas "more than doubled," and nitrous oxide reached a "new

high of 331 parts per million (ppm)" when compared to the levels of the pre-Industrial Revolution period.[63] This disruption resulted in realizing climate change and its environmental impacts are being increasingly felt yearly. Energy resources, once the cause of war when their uninterrupted flow was threatened, have become a threat to the environment due to emissions released during their use. Thus, in addition to environmental effects, the multiplier effect of climate change poses a threat to many countries' infrastructures, including those related to energy. Therefore, the acceptability dimension takes place in different definitions of energy security to balance "ecology, economy, and energy."[64] In this respect, the acceptability dimension "reflects the impact of energy production and utilization on the economy and the environment."[65]

Starting from the balance between ecology and energy, energy extraction's impact must be addressed first. Although none of the forms of energy can be used or produced without causing environmental damage, the impact of energy production and usage on the environment can be minimized.[66] Effective water use during the extraction of energy resources and energy sources transfer to the end-use areas via environmentally sound infrastructures are concrete examples.[67] In this regard, technology is considered one of the components of this dimension. In addition to its necessity for utilizing energy for some purposes, efficient use of energy resources and environmentally sensitive tools for consuming them can be acquired through technological advancement. By improving the quality of equipment, more energy can be obtained by using fewer energy resources and decreasing the amount of greenhouse gases released into the atmosphere.

Another importance of technology is seen with the installments of renewable energy systems to decrease the release of GHGs into the atmosphere. Moreover, entropy can be mitigated by integrating renewable energy into the energy system, increasing energy efficiency. However, the balance between ecology and the environment should not be overlooked while installing renewable energy infrastructures. Installing wind tribunes and solar panels away from the migratory birds' routes can be given as an example. Finally, "renewable energy systems could reduce the risk of energy supply disruptions and the reliance on imported fuels" that, in return, enhance energy security.[68]

Lately, culture has emerged as a critical component of the energy security concept.[69] Indeed, the impact of culture on the decision-making process and shaping patterns should not be overlooked. In this sense, culture can influence attitudes, directly influencing consumption patterns. The EU is an example in which a culture has been created about green energy, energy saving, and energy efficiency in line with the necessities of the climate change era. Lastly, the EU's climate targets for 2030 and 2035[70] demonstrate the impact of this culture on its policies in general and its energy security understanding in particular.

To sum up, energy security from the acceptability dimension has emerged in response to the needs of our era to create a balance between ecology, economy, and energy. Furthermore, the components of this dimension, such as technology, renewable energy, and culture, create a nexus that allows us to fully understand the relations between human beings, ecology, economy, and energy. Lastly, concluding all components of

the acceptability dimension of the concept sets a base for understanding "environmental concerns" and "sustainable development" of different energy security definitions.

In short, though each definition of energy security reflects a particular perspective, their arguments can be understood by focusing on their dimensions and components. The dimensions of APERC's energy security concept provide a framework combining different dimensions and components of the diverse definitions. They lay the groundwork for developing a framework to eliminate differences among diverse energy security definitions to some extent. Defining energy security more widely as "having energy autonomy from the absence of any threat" and utilizing the framework provided in this section is a good starting point for understanding the concept to a great extent. However, to fully understand the energy security concept, there is much to be done since the concept's current meaning and fundamental elements are not in line with today's anthropogenic energy system, and the current trends of the economic system are not fully integrated into the concept.

Defining energy security more widely as "having energy autonomy from the absence of any threat" and utilizing the framework provided in this section is a good starting point for understanding the concept to a great extent.

Analyzing the Possibility of Reframing the Energy Security Concept

As previously mentioned, there is no uniform definition of the energy security concept, nor can there be due to its multidimensional and astatic nature. Moreover, numerous "conceptual and operational" differing definitions exist in energy security literature that provides a framework for understanding it.[71] However, it is unsurprising that most of the energy security definition in literature is approached and defined mainly through fossil fuels when the necessities of the 20th and 21st centuries are considered. Even if these energy security definitions are still valuable for providing a framework for understanding it, the dominant position of fossil fuels in these definitions can obscure the impact of today's anthropogenic energy system and international economic system. This, in return, hinders a thorough understanding of the ongoing trends' effect on the concept. For this reason, although energy security literature is rich enough, the necessity to reframe it reveals the grounds of current trends in anthropogenic energy systems and international economic systems.

However, it is unsurprising that most of the energy security definition in literature is approached and defined mainly through fossil fuels when the necessities of the 20th and 21st centuries are considered.

In this regard, it would be helpful to briefly mention anthropogenic energy systems of previous eras on the emergence of the energy security concept. As previously stated, human muscles were the only prime movers in the first phase until the domestication of draft animals in the second phase.[72] Moreover, renewable energy types are included in this phase's anthropogenic energy system, producing more energy for "dealing with exhausting work." The increasing efficiency of water mills, windmills, domesticated draft animals, and human muscles through new tools perfected the prime movers of this phase and, therefore, a long-lasting anthropogenic energy system over a wide period.[73] With the integration of engines in the production stage and other sectors of life, in the third phase, fossil fuels found their place in the anthropogenic energy system of the era. Since then, they have become a key source to sustain the needs of modern societies in all aspects of life, including electricity production. Thus, as of this phase, "the shift of the power source from pre-dominantly local energy sources to imported ones" was realized, and energy security became an issue.[74]

For this reason, although energy security literature is rich enough, the necessity to reframe it reveals the grounds of current trends in anthropogenic energy systems and international economic systems.

However, it became an issue when the anthropogenic energy system of the third phase began to expand throughout the industrialized world, and the volume of imported fossil fuels by them started to increase. In this context, the impact of the Industrial Revolution on energy consumption, sectoral enlargement of energy use, the impetus behind the industrial powers to control regions where energy resources are abundant, wars, diversification, the importance of energy prices, desire to access energy resources, the geopolitics of energy, and many other factors contribute to emergence and evolution of energy security concept. Nevertheless, climate change, among many factors that contribute to the evolution of energy security, and its impact on the anthropogenic energy system of the third phase, particularly with renewable energy, has not been fully acknowledged in the dimensions of its definitions. For instance, climate change and renewable energy are treated as complementary elements rather than fundamental or primary components. As a result, only some dimensions of the energy security concept, such as acceptability and components like diversification, are associated with renewable energy when the current scopes of dimensions are considered. Moreover, accessibility is not even related to renewable energy. This situation, namely considering renewable energy as a complementary element or a component, created a disconnection between the concept and today's anthropogenic energy system, making it incomplete and hard to understand.

In fact, this situation does not only cause the disconnection between renewable energy and the concept but also between renewable energy, the international economic system, and the concept. Even though the energy security concept is a product of capitalism, the impact of capitalism on the

concept can be deduced from some of the factors that are previously mentioned, ongoing trends under the brands of "Green New Deal," "Green Economy," and "Circular Economy" to reshape powering futures production phase are not fully realized in the dimensions of the concept. Considering the ongoing trends of capitalism and the impact of renewables on anthropogenic energy systems, energy security can be reframed comprehensively to fill the missing part in the literature. Scholars such as Valentine aim to bridge the gap between climate change, renewables, and fossil fuels by creating symbiosis to fill the emptiness in literature. However, his work falls short mainly because he does not securitize this symbiosis or initiate this bridge with capitalism.

To overcome this disconnection, dimensions of the concept must be reframed in line with today's anthropogenic energy system, namely by including "renewable energy" as a fundamental element, securitizing "renewable energy," and initiating it with ongoing trends with capitalism. In this regard, the very essence of the availability dimension of the concept should be based on "occurrent resources" (Please check footnote number 32). This will include renewable energy types in the "available resources" part of this dimension. As a result, this will pave the way for the de-fossilization of the availability dimension of the concept as it only deals with scientifically proven 'reserves.' Thus, in return, renewable energy will not only be related to the diversification component of this dimension but also strengthen the meaning of the geographically differing existence of energy resources. However, the renewable energy potential of a specific place cannot be harnessed without relevant technologies. Renewable energy technologies and infrastructures are needed to harness diverse types of it. In that sense, the accessibility dimension of the concept and renewable energy technologies will be related to each other as this dimension mainly refers to the absence of barriers to acquiring energy. Therefore, accessing "renewable energy," other than fossil fuels, can be another component of this dimension. Accessing renewable energy technology will be another challenge since renewable energy technologies may not be affordable for every country. In that sense, "renewable energy" will also be related to the affordability dimension of the concept concerning the price to be paid for acquiring energy. Thus, not every country can produce renewable energy technologies, and this reality can lead the way to securitize "renewable energy." On the grounds of that, countries that can produce renewable energy technologies may use them to achieve their foreign policy goals, similar to energy exporter countries. This creates a risk for the importing country's energy security, as they may have to rely on imported parts to fix malfunctioning infrastructure from the source country. Using renewable energy technologies to achieve foreign policy goals only represents one side of the equation, as "renewable energy" opens a profitable sector for capitalism to invest in while also setting the base to reshape powering futures production phase and providing its continuity under "Green" economy formulations.

In short, including "renewable energy" as a fundamental element already existing in today's anthropogenic energy system, securitizing "renewable energy" and initiating it with ongoing trends with capitalism strengthen the framework to inquire

about the meaning of energy security concept. The potential that renewable energy presents for reframing dimensions of the energy security concept should be explored more as it promises to fill the emptiness in literature and leads to a meaningful understanding of the concept. Furthermore, such a framework makes the energy security concept de-fossilized and more relevant to the current era of climate change as it is formed in line with today's anthropogenic energy system and the needs of capitalism. However, since the purpose of this report does not include detailing this, reframed energy security concept and its advantages in analyzing energy security policies will be covered in the next issue.

Conclusion

The impact of energy on the history of humankind has paved the way for introducing the energy security concept. The increasing dependence on energy resources in every sector, especially since the Industrial Revolution, led to the emergence of energy security as a "study subject" after the oil shocks of the 1970s. Since then, it has been evolving with the latest developments that took place internationally and the necessities of the era. In parallel with its evolution, the number of energy security definitions in the literature has also increased. For that reason, APERC's classification of the dimensions of energy security has been utilized in this report to form a framework, which is based on commonalities and differences in various definitions, for understanding the concept. In line with that, a framework to understand the energy security concept, defined as "having energy autonomy from the absence of any threat" in this report, is formed based on availability, affordability, accessibility, and acceptability with their respective components.

Nevertheless, this framework does not provide a complete understanding of energy security since the concept is not associated with today's anthropogenic energy system and international economic system. In this regard, the provided framework is strengthened by reframing dimensions of energy security by including "renewable energy" as a fundamental element, securitizing "renewable energy," and initiating its integration with the trends of capitalism to understand it fully. In conclusion, this report concludes that the energy security concept should be reframed and de-fossilized to make it more relevant to the current era. However, as mentioned previously, this will be further explored in the following issue in detail.

Endnotes

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