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EUROPEAN UNION ENERGY SECURITY: CONSTRUCTING A "SHELTER" FOR SMALL STATES' ENERGY SECURITY PRESERVATION[1]

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Abstract
Energy security has been one of the most important issues in the European Union over the past few years. Although the debate has focused primarily on the approach of the main EU powers, this research aims at studying the impact of small Member States' size on their energy security in the EU. Then it provides proposals to safeguard the energy security of EU small countries by providing a comprehensive interpretation of the term alliance in shelter theory. Applying the composed "smallness" index and the quantitative method, the results imply a direct relationship between the small states' size and energy security in the first step. The study shows that such a relationship cannot be proven in non-small States. Although the EU has tried to strengthen collective energy security in Member States, such differences show that complementary policies are needed to ensure energy security in small countries. Given an extensive interpretation of "alliance" in shelter theory, this research proposes deep integration of the small states' energy infrastructure in order to ensure their energy security. In the aftermath of the Russian invasion of Ukraine, where the EU's energy security, especially in the small states, is more fragile than ever, adopting such a policy seems more vital.

Keywords: *Energy security, Regional development, EU integration, Single energy market, Small states.*

INTRODUCTION

Energy is a vital element for the welfare and economic development of the European Union (EU). Given that people continued to aspire to energy-intensive life standards, demand for energy would be a continually rising in the future, and as a result, safeguarding the security of the energy supply

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would remain an essential need in the future (ESPON, 2017). The European Commission proposed the Energy Union structure to create a fully integrated European energy market in 2015, believing that establishing an integrated single energy market (SEM) could preserve the EU's energy security (Mišík, 2019). However, the harmonisation of Member States' energy policies, even within the Energy Union framework, has remained problematic, as Member States have different perceptions of the outlines of energy security (Talus, Aalto, 2017). Such an opinion gap is discernible between different groups of the Member States, for instance, between larger and smaller ones.

Although the EU's decision-making mechanisms are criticised for being significantly influenced by the interests of larger Member States (Wivel, 2010), it is believed that the role of small states will grow in the future, especially in the post-Brexit era (Thorhallsson, 2019). However, a few publications have discussed the energy security before. Most of these publications, as by Mišík (2019), have focused on the external threats to the energy security of small states. Some others, e.g. Juozas Augutis et al. (2020), Štreimikienė et al. (2016) and Zenga et al. (2017), followed a regional study approach, focusing on the Baltic States. Nevertheless, the domestic dimension of energy policymaking and its impact on the small states' energy security has remained almost untouched and needs scrutinising more than ever.

The purpose of this research is to study the impact of small Member states – small in their size - on their energy security in the EU. Nevertheless, the size factor does not negate or invalidate other factors as geography, climate, or indigenous resources. These elements show their influence, as the selected small states are located in different regions of the EU. In addition, this study does not seek to show the priority and relative importance of factors mentioned before and how they affect energy security of the EU member states, but will focus on assessing the "size" factor, specifically. It also aims to render suggestions for safeguarding EU small states' energy security in the end.

For the study's aims, the research question is "how does the EU Member States' size impact their energy security, particularly in those classified as "small" states?" Moreover, the study tries to define "what measures can small states adopt to enhance their energy security within the framework of the EU policymaking?" The main claim of this research is that there is a direct relationship between EU small states' energy security and their size. However, such a relationship is not discernible in non-small states. While this research offers a new method for defining small states in the EU, diversity was measured as an index to assess supply security. Therefore, relying on the shelter theory, entering an alliance is the recommended policy for smaller EU states. However, instead of entering some alliances with major EU powers, as shelter theory may suggest, this research takes position that such alliances should be formed with small- states neighbouring countries, resulting in regional energy integration.

The importance of energy security for small EU countries can be discussed from two perspectives. From a general viewpoint, the role of small states is growing in the international scene contrary to the Cold War era, with realism neglecting small states as a dominant paradigm of international relations. However, smaller states have become even more critical in the post-Cold War era, as they could pursue offensive foreign policy strategies without compromising their survival, especially in the EU (Thorhallsson, 2019). This makes the study of small states' behaviour a crucial issue for the time being. Viewed through the more specific lens of energy security, the 2004 EU enlargement resulted in the accession of small new states to the Union. Their energy security vulnerability was demonstrated in the 2000s when supplies of Russian gas were interrupted (Mišík, 2019). This resulted in recognising energy as a shared competence in the Treaty on the Functioning of the European Union (TFEU), where EU's energy security was aimed to be protected "in a spirit of solidarity between Member States" according to Articles 122 and 194. Given that the EU energy security, especially in the small states, has been exposed to unprecedented threats in the aftermath of the pandemic and the Russian invasion of Ukraine, the importance of this study becomes more accentuated.

In terms of structure, this article is delineated into four sections. The next part provides a literature review shedding light on the former relevant studies and the research gap. The second section discusses the applied method for measuring smallness and energy security. Then the Results and Discussion sections demonstrate correlation between small states' size and their energy security. Analytical framework enables solidifying small states' energy security with a special concern to their geographical classifications and based on the rendered extensive interpretation of the alliance concept in the shelter theory.

1 LITERATURE REVIEW

The small state concept has been widely discussed in the previous scholarly literature and in three different approaches; namely arbitrarily listed states, qualitative definitions and quantitative ones, as follows, respectively.

During the early years of the Cold War era, there was a tendency to use term of “weak state” instead of “small state”, especially regarding security studies. On some occasions, a weak state used to stand for any other state than the “Big Five” (i.e. the five Permanent Members of the United Nations Security Council), especially (Schmidl, 2001). This approach was then repeated afterwards in the EU context, denoting all Member States “small”, except the “EU big six” of France, Germany, Italy, Poland, Spain, and the UK (Baldacchino, 2009). Other researchers, as Blockmans (2017), avoid rendering any particular definition and provide alternative lists of small states within the EU territory. However, given that the big states were impacted by the 2006 Russia-Ukraine gas dispute differently, one can argue that they are not at the same level of vulnerability within the energy security considerations. Thus, such available designed lists of small states cannot work for the aims of our study.

In an alternative method, qualitative approaches have been applied to define small states. Most of the rendered definitions within this method focus on the limitations of small states in applying their (military and political) power. For instance, Krause and Singer (2001) justified minor powers as states “whose diplomatic and material resources are so limited that their leaders focus mainly on the protection of their territorial integrity rather than on the pursuit of more far-reaching global objectives”. Similarly, Small states are said to show limited involvement in international affairs, favour international governmental organisations and are less prone to the use of force, and, in general, have limited their foreign policy priorities, mostly those regional (Evans, et al., 1998). Tökölyová (2016) has taken the same approach classifying small states based on the specifications of the primary determinants of the foreign policy position of the state in the global political system, as well as on the understanding of the power potentials of enforcement and defence of own interests and goals. In addition to the difficulties of elaborating power dimensions, such qualitative approaches are criticised mainly as they fail to prove that the smallness - power correlation implies causation as well (Maass, 2009), and therefore, they appear less reliable for the aim of this study.

As an example of the quantitative style, Thorhallsson considered a combination of relevant indices to show smallness. This consists of the six variables of fixed size, sovereignty size, political size (including military and administrative capabilities), economic size (measured on the basis of

Gross Domestic Product (GDP), perceptual size and preference size, linking definition and theory by considering the size of states and influence within the EU (Thorhallsson, 2006). Although such quantitative methods seem holistic, two prerequisites must be met for them to be effective. First, the included components should be selected for each application and topic in which the behaviour of small states is studied. This means that there is more than one "small state" definition. Secondly, a cut-off value of selected criteria or the aggregated index must be chosen to distinguish the border between small and non-small states. This means that an appropriate index must be composed specifically for the aims of this research.

In addition to the small states' definition, discussing previous energy security measurement research is crucial. Although energy security is an issue of critical importance to many different stakeholders, particularly policy makers and scholars, there is no consensus about its definition and each definition highlights very different notions of energy security to justify actions and policies on energy security grounds (Ang, et al., 2015). Therefore, the selected energy security definition depends on the context of the study, as the current research will also follow (see Section 2.2).

Like the energy security definition, corresponding indicators assess one particular energy security dimension depending on the context. However, a significant number of studies have attributed energy security to the diversification of energy sources (Sovacool, 2011; Vivoda, 2009; Stirling, 2011; Cohen, et al., 2011), especially with respect to energy security of the EU member states. Chalvatzis and Ioannidis (2017a) have studied the diversity of fuel mix among the EU Member States and perceived an emerging paradigm shift from dependence to diversity throughout the EU. They interpreted that as an improvement in energy security. Another study applies diversity as an indicator to assess the EU Member States' energy security and argues that enhancing the diversification of energy sources through renewable energy deployment is a more coherent strategy than using them for dependency reduction (Lucas, et al., 2016).

Studies also applied energy security diversity indices for assessing one specific Member State's condition as the pre-Brexit UK (Grubb, et al., 2006) and Poland (Czech, 2017) or a group of the EU Member States as Southern Europe and Ireland (Chalvatzis, Ioannidis, 2017b), Visegrad countries (Brodny, Tutak, 2021) and small states as the Baltic States (Augutis, et al., 2020; Štreimikienė, et al., 2016; Zenga, et al., 2017). While most of the publications discussing small states' energy security, as by Mišík (2019), have focused on the external threats, the domestic dimension of energy policy-making and its impact on energy security has remained almost untouched and needs to be scrutinised.

Different strategies, including balancing or bandwagoning, strategic hedging or neutrality, and seeking shelter, have been proposed to address the security concerns (Vaicekauskaitė, 2017). While the school of realism introduces the first two strategies regardless of the size of the states, Thorhallsson (2011) has elaborated on "shelter" seeking exclusively for small state cases. However, he reasons for the obligation of small states to provide a shelter to prevent economic and political risks, and the demand for a shelter within energy security studies has not been addressed yet. Considering this fact and given the abovementioned research gap on the domestic dimension of energy security in the EU small states, the current research tries to develop ideas and recommendations for addressing small states' energy security vulnerability by developing shelter theory.

2 METHODOLOGY

2.1 Measurement of smallness

So not to get lost in the quagmire of definitions, a measurement tool to distinguish "smallness" must be introduced for the purpose of this research, considering that none of the above approaches introduced in Chapter 1. Here, the paper has discussed the smallness suitable for the energy security studies, as proved below. Therefore, the following paragraphs explore how to develop a definition that suits the energy arena by relying on a critical review of previously conceptualised formulas.

Considering previous relevant research, including those mentioned in Chapter 1, one can say that population, GDP and territory are repeatedly acknowledged as main factors for measuring the states' size. These factors are also relevant for energy studies, because:

- Although no consensus has emerged among various studies testing the causality between energy and economic growth among different sovereign states, general causality between aggregate energy consumption to GDP and GDP to energy consumption is prevalent in the OECD countries (Chontanawat, et al., 2006). Similarly, the population has a positive relationship with both primary and final energy consumption (Zaharia, et al., 2019). These justify considering GDP and population as a relevant factor for the aim of this study that focuses on the energy security of the EU member states.
- Although the amount of oil and gas reservoirs is similarly low in

the EU member states (except for the falling gas production in the Netherlands, there are no significant oil and gas fields), the relationship between the territory and the possibility of renewable energy utilisation in Europe has been discussed (Bagliani, et al., 2010). The importance of this issue increases when the climate priorities of the European Union are considered in replacing renewable resources instead of using the fossil resources. One can assume that territory that is more extensive can potentially facilitate an access to free lands for installing wind turbines and solar panels. This means that the territory considered by the previous studies as an indicator for identifying small states is also relevant within this study.

Given the above facts, an aggregate index comprising the three indicators can provide a comprehensive measure that is applicable to the purpose of this study. However, composing an aggregate formula involves having elements of the same dimension. To equate the dimension of each indicator (e.g., population, territory, and GDP), the relative value of data in each case is derived by dividing each element by the average value (of the 27 EU Member States). This results in three dimensionless elements of $\frac{GDP_i}{GDP_{avg}}, \frac{Territory_i}{Territory_{avg}} and \frac{Population_i}{Population_{avg}}$ representing relative GDP, territory and population of the "i" Member State. While the first two factors influence a state's energy consumption, the third one represents the accessibility to energy resources, i.e. the supply. Thus, the dimensionless Small States' Index created for the i^{th} Member State, SSI_i, is defined by equation (1), accumulating the three elements.

$$\mathrm{SSI}_i = \frac{GDP_i}{GDP_{avg}} + \frac{Territory_i}{Territory_{avg}} + \frac{Population_i}{Population_{avg}} \qquad (1)$$

GDP, territory and population are measured in billion euros, square kilometres (km^2) and person, respectively. However, since the numerator and denominator of all the three fractions are of the same type, each element is dimensionless, and thus, the SSI_i. Moreover, SSI_i elements are given equal weighting since the relative importance of each component is presumed to be the same.

Using quantitative methods necessitates defining a threshold to distinguish the "small" versus "not small" states. While international organizations such as the World Bank or Commonwealth Secretariat introduced a list of small states by putting an "absolute" threshold on territory, population size, GDP, or military expenditure (Baldacchino, 2009), they do not necessarily indicate how these caps were defined. For our research purposes, since formula (1) has applied a normalisation method for each element, the desired thresholds can be derived and applied from the standard normal distribution graph (the so-called bell curve). This means that after sorting the SSI data by value, a threshold line is drawn to divide them somehow that the cumulative SSI value of the smaller part stands at almost 31.8 per cent of the whole. Those states below this threshold are distinguished as the small states in this investigation.

2.2 Energy Security Measurement

Since this research focuses on the energy security of small states in the EU, it applies the definition of energy security by the European Commission as "providing reliable energy at affordable cost and conditions" (Sovacool, 2010, p. 4). Such definition stands on two pillars - pillar of reliability and pillar of price. Reliability implies the geopolitical dimension of energy security accentuated more in the aftermath of the Russian invasion of Ukraine in 2022 to the extent that the EU intended to import more expensive LNG to replace Russian gas to improve the reliability of its energy supply. This can justify our choice to focus on reliability rather than the price in this research as the core of energy security in the European Union.

Among different methods and indicators for measuring reliability, diversity indicators have drawn attention in energy security studies (Jang, et al., 2014; Cherp, Jewell, 2011). Diversity is believed to enhance reliability in different ways. First, it helps the energy system responding more resiliently to external changes and physical supply interruptions. Furthermore, it reduces the vulnerability of a single energy source to supply shocks and the market power of various energy supply sources (Chuang, Ma, 2013). Although generally, the higher the diversity, the more solidified the reliability is, given the two gas cutting experiences by Russia in 2006 and 2009, it makes sense to consider reliability as a relevant indicator particularly for measuring the EU's energy security.

Although diversity can be directly assessed, one can suggest measuring "concentration" instead. Thus, two indices are available correspondingly: Herfindahl-Hirschman Index (HHI) and Shannon-Wiener Index (SWI) (Pavlovića, et al., 2018).

(2) $$\mathrm{HHI} = \sum_{i=1}^{n}(100\ x_i)^2$$

(3) $$\mathrm{SWI} = -\sum_{i=1}^{n} x_i \ln(x_i)$$

Wherein x_i is the market share of the "i^{th}" energy carrier (including coal, oil, gas, nuclear, renewable & biofuel and imported electricity). HHI is originally an indicator used in ecology and can be applied to energy security studies to assess the power of a monopoly supplier. The higher the HHI, the higher the concentration is, which means that the examined system is less diverse (Rubel, Chalvatzis, 2015). Therefore, if the number of suppliers is infinite ($n \to \infty$), HHI "approaches" zero. This represents a market with perfect competition, while HHI = 10000 indicates a total monopoly (n=1) due to the existence of a single supplier. Conversely, SWI focuses on dependency rather than concentration. Thus, a low SWI value indicates high-energy dependence. It means that if a country depends on a single import source, the SWI "equals" zero.

Researchers have various opinions about the pros and cons of HHI and SWI. While some scholars believe in the former (Stirling., 1998; Cohen, et al., 2011; Hickey, et al., 2010; Chalvatzis, Ioannidis, 2017a), some prefer the latter (Le-Coq, Paltseva, 2009) and a few others had mixed both indices (Grubb, et al., 2006). Generally, both indices have satisfactory consistency in their results. Since SWI includes the ln function, it reacts to the diversity changes considerably slower than the HHI. As a result, HHI works more sensitively, especially in our comparative study consisting of a few cases where differences are desired to be visualised more vividly.

2.3 Evaluation of the SSI-HHI Relations and Recommendations

Once the SSI of the EU member states is calculated, the small states are distinguished according to the method described in 2.1. To examine the impact of states' size on the energy security trend, the existence of meaningful relations between SSI and HHI indices should be evaluated. Therefore, SSI versus HHI graph is plotted. Using MS Excel, the trend line is drawn, and the correlation coefficient is then calculated. Finally, comparing the derived coefficient with the correlation, a look-up table (two-tailed) can imply the significance level of their relationship. When the relation is proved, the small states are classified on their geographical position. This gives the ground to us to evaluate how the alliance concept within the framework of the shelter theory can be interpreted and applied extensively for proposing some corresponding recommendations for consolidating the energy security of each small states cluster based on their existing infrastructures.

2.4 Data Preparation

The statistics required for the means of the research were obtained from primary and secondary sources. Energy mix information of the Member States required calculating the HHI, which was extracted from the EU energy figures in the 2020 Statistical Pocketbook (European Commission, 2020b). Data are cross-checked and completed by the International Energy Agency (IEA, 2020), the US Energy Information Administration (EIA) brief country reports and statistics, and the European Spatial Planning Observation Network (ESPON) database and statistical reports from BP companies (2020). For data homogeneity, territory and population data were taken from Eurostat (2021). It stands to reason that since the COVID-19 outbreak influenced the EU's economy, this research has used the last available GDP values before the pandemic, i.e. 2019.

3 RESULTS

Table 1 demonstrates the data acquired to calculate the SSI of each of the member states. Applying these data in equation (1) results in the corresponding SSI for each Member States, as visible in the first right column of Table 1. Applying this method described in section 2.1 for classifying the small states, nine member states were distinguished as small ones, including Malta, Cyprus, Luxembourg, Slovenia, Estonia, Latvia, Lithuania, Croatia, and Slovakia. These states are indicated in Table 1.

Table 1: *The SSI value calculated for EU-27*

Member states	Population (in 2019)	Area (km^2)	GDP in 2019 (billion euros)	SSI
Malta (MT)	493,559	316	13.20	5.75
Cyprus (CY)	875,899	9,251	21.90	15.46
Luxembourg (LU)	613,894	2,586	63.50	17.68
Slovenia (SL)	2,080,908	20,273	48.00	34.85
Estonia (EE)	1,324,820	45,227	28.00	42.35
Latvia (LV)	1,919,968	64,589	30.50	58.81

Lithuania (LT)	2,794,184	65,200	48.30	67.94
Croatia (HR)	4,076,246	56,594	53.90	71.28
Slovakia (SK)	5,450,421	49,035	94.20	82.58
Denmark (DK)	5,806,081	43,075	310.60	122.90
Bulgaria (BG)	7,000,039	110,994	60.70	125.05
Ireland (IE)	4,904,240	70,273	347.20	141.93
Hungary (HU)	9,772,756	93,030	143.80	146.46
Czechia (CZ)	10,649,800	78,866	219.90	157.47
Portugal (PT)	10,276,617	92,212	212.30	162.27
Belgium (BE)	11,455,519	30,528	473.60	180.66
Austria (AT)	8,858,775	83,855	398.50	184.47
Greece (EL)	10,724,599	131,990	187.50	185.59
Netherlands (NL)	17,282,163	41,543	810.70	288.34
Finland (FI)	5,517,919	338,424	240.90	296.40
Romania (RO)	19,414,458	238,391	222.10	312.86
Sweden (SE)	10,230,185	449,964	474.70	441.54
Poland (PL)	37,972,812	312,685	527.00	531.73
Spain (ES)	46,937,060	504,030	1,244.80	847.48
Italy (IT)	59,816,673	301,338	1,787.70	901.15
France (FR)	67,177,636	632,833	2,419.00	1,280.00
Germany (DE)	83,019,213	357,386	3,435.80	1,397.00
Average	16,535,053.48	156,462.53	515.49	--

Source: Author's calculation, data from the European Commission, 2020b and Eurostat, 2021.

Table 2 shows the data required for calculating the HHI index and the derived HHI by applying these data in equation (2) in the far right column.

Table 2: *Energy mix of small EU states and the HHI index.*

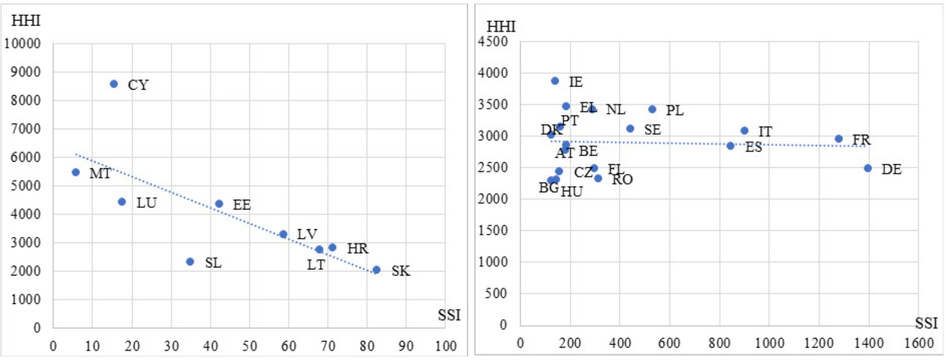
No	**State**	Market share of each energy carrier (x_i) in the energy sector Member States' energy mix (2019) to be applied in equation 2						The HHI calculated using equation 2
		Coal	**Oil**	**Gas**	**Nuclear**	**Renewable & Biofuel**	**Imported Electricity**	
1	Malta (MT)	0.000	0.625	0.375	0.000	0.125	0.000	5,468

2	Cyprus (CY)	0.000	0.923	0.000	0.000	0.077	0.000	8,579
3	Luxembourg (LU)	0.000	0.644	0.156	0.000	0.067	0.111	4,440
4	Slovenia (SL)	0.159	0.362	0.101	0.203	0.159	0.014	2,335
5	Estonia (EE)	0.008	0.512	0.160	0.000	0.384	0.000	4,352
6	Latvia (LV)	0.000	0.333	0.250	0.000	0.396	0.021	3,302
7	Lithuania (LT)	0.027	0.413	0.240	0.000	0.213	0.107	2,747
8	Croatia (HR)	0.045	0.386	0.261	0.000	0.250	0.057	2,821
9	Slovakia (SK)	0.193	0.222	0.240	0.222	0.105	0.018	2,045

Data source: European Commission, 2020b, calculation by the author.

Using the calculated SSI (listed in table 1) and the HHI (presented in table 2), Graph 1 (on the left) is plotted, indicating the HHI vs SSI for the small states. The same can be repeated for the other Member States, as indicated in the graph on the right.

Graph 1: *The HHI-SSI Correlation in the EU "Small" States (left) and "Not Small" States (right)*



Source: author's contribution.

The correlation coefficient for both graphs can be derived using the Microsoft Excel CORREL function to evaluate the strength of the HHI-SSI relation. The results show that, for the small states, the correlation coefficient is -0.735. Looking up in the "correlation look-up table (two-tailed)" as indicated in Table 3 and crossing the number of data in the N column and the significance of correlation in the top row (α), it is apparent that the correlation between the HHI and SSI is significant at the 95% level, implying on a strong meaningful relation.

Table 3: *Critical Values for Pearson's Correlation Coefficient*

N \ ∝	0.2	0.1	0.05	0.02	0.01	0.001
5	0.8000	0.9000	0.9500	0.9800	0.9900	0.9990
6	0.6870	0.8054	0.8783	0.9343	0.9587	0.9911
7	0.6084	0.7293	0.8114	0.8822	0.9172	0.9741
8	0.5509	0.6694	0.7545	0.8329	0.8745	0.9509
9	0.5067	0.6215	0.7067	0.7887	0.8343	0.9249
10	0.4716	0.5822	0.6664	0.7498	0.7977	0.8983

Source: (Verma, 2012, p. 462). Highlights added.

This proves the strong negative correlation between size and concentration of the energy mix, or the solid direct relationship between energy security and size in small states; the larger the small state, the greater the energy security. On the contrary, the right-hand graph shows that applying the same logic for not-small EU states results in a correlation coefficient of r = -0.064, which does not show any meaningful relationship between the HHI and SSI among "not small" states. Therefore, one can claim such a relationship is discernible exclusively in small states in response to the first research question.

One logical explanation for this relationship is considering the elements of the small state definition rendered in equation (1), as it encompasses aspects of population, economy, and territory. When it comes to policy-making, small states must sacrifice some issues. This is not necessarily due to limited resources but is due to other considerations as the economy of scale (Thorhallsson, Steinsson, 2017). For energy policy-making, due to the small size of the economy (indicated by GDP in equation (1)) and the small population, the size of the energy market is not significant. For example, statistics show that nine of the EU small states consumed 4.02% of total EU energy consumption in 2018, less than one-fifth of Germany's consumption as the largest EU Member State (European Commission, 2020b). Therefore, even if different energy sources were available, the government preferred to rely on a few less expensive sources instead of diversifying its energy mix. Such an intention is reinforced by the size of the small territory, as a small state is less likely to possess and gain access to different energy resources across its territory. These factors result in higher concentrations in the energy mix of small states.

4 DISCUSSION AND POLICY RECOMMENDATION

In general, the lack of diversity in economic relationships of small states makes them vulnerable to fluctuations in market prices (Thorhallsson, 2019). Similarly, the low diversity of a small state's energy portfolio makes its energy security more vulnerable to external threats. Thus, one may suggest interconnecting a small state's energy market with another small state somehow to create an enlarged integrated market. Such regional energy market integration complies with the SEM rationale, i.e. allowing energy to flow through (under constructed) interconnectors without technical or regulatory barriers between the states (European Commission, 2021).

The abovementioned small-states deep integration also brings them benefits. Generally, states accept surrendering part of their autonomy when entering alliances so that their security is not further threatened by a third party (Wagner, et al., 1998). In the same way, the small states' deep integration means beneficiaries consider their mutual interests, limitations and concerns thoroughly in their energy policy-making. Additionally, since these states are of the same size and are grouped in the same geographical locations (as shown later), they share common concerns about energy security. Therefore, these small states partially relinquish their energy policy-making independence to acquire higher energy security collectively. Moreover, it makes their voice possible to be heard at the EU level without being under the shadow of major powers' domination.

One can justify such integration by relying on the context of Shelter theory. "Shelter is an *alliance* relationship in which small states alleviate their political, economic, and social vulnerabilities by allying with large states and joining international or regional organisations" (Thorhallsson, Steinsson, 2017). Small states seek shelter to prevent probable upcoming crises and manage impacts of shocks that may occur, or recover from past catastrophes (Thorhallsson, 2019). The alliance concept is addressed in shelter theory more effectively, contrary to other theories, especially neorealism. This approach is crucial for two reasons. First, unlike neorealism, shelter theory assumes that small states have some significant capabilities, given their importance in the post-Cold War era, and it is more consistent with the purpose of this research. In addition, shelter theory assumes forming alliances is a response to internal weaknesses (e.g. infrastructure deficiencies) and external threats, while neorealism perceives only external ones (Mearsheimer, 2001, p. 146; Thorhallsson, 2019). The importance of this approach lies in the fact that disruption to the energy security of a highly concentrated energy mix can occur due to either external threats or internal weaknesses.

However, this research applies a broader meaning of alliance when the shelter theory is used since the theory focuses primarily on alliances with large states. This is because building an energy alliance in the EU is highly curtailed by geographical factors and the availability of regional infrastructures, especially interconnections and available cross-border network capacity. For instance, the transmission capacity inside the Baltics (Lithuania, Latvia, and Estonia) and also in the Iberian Peninsula (Spain and Portugal) and France is not well-developed yet (Pollitt, 2019). Under such circumstances, the foundation of an energy alliance between a small state as Estonia and a large one such as France seems meaningless. Furthermore, even though a small-large energy alliance may result in higher energy security for both, it is dangerous to turn any small state into a follower, especially in energy policy-making of the EU legislative bodies. Thus, contrary to the shelter theory, an alliance created between two or more small states may even look preferential if the geographical factor permits. Considering these facts, the discussion will continue to elaborate on the already defined regional integration concept by relying on the geographical location of small EU states (depicted in Table 4).

Table 4: *Location of the EU Small States*

Region	Baltic[3]	Balkans	CEE	Other
State	Estonia, Latvia, Lithuania	Slovenia & Croatia	Slovakia	Cyprus, Malta, Luxembourg

Source: author's classification

4.1 Baltic States

The Baltic States have long been known as the "energy island" within the EU, due to the lack of solid infrastructure connecting their energy network to the rest of Europe (Švedas, 2017). Although Lithuania sought to come up

[3] For the aim of this research, Baltic States, Baltics and Baltic region indicate these three states unless specified differently.

with solutions during the time of its EU presidency in 2013, and the Baltic Energy Market Interconnection Plan (BEMIP) has been proposed as part of the SEM idea (European Commission, 2020a), isolation is still a challenge for the region. Although great efforts have been made, to build or strengthen gas and electricity interconnectors between the Baltic and neighbouring states, at the same time it is crucial to enhance the integration of the Baltic States.

Each Baltic state is distinguished by its exclusive energy strengths (and weaknesses). For instance, while Estonia has a low dependency on external energy imports thanks to its shale oil resources, it also has a higher carbon intensity (Zenga, et al., 2017). Although Lithuania has the only Liquefied Natural Gas (LNG) and oil refinery among Baltic States (Matsumoto, et al., 2018), it has a higher rate of import dependency rate (Streimikiene, 2020) and the highest energy poverty (Jääskeläinen, et al., 2019). Furthermore, Latvia has the privilege of having the only underground gas storage facility (UGS) in the region, as backup for its gas distribution system (Augutis, et al., 2020). Thus, in line with the shelter concept and deep intra-Baltic integration of energy systems, the energy alliance provides equal access for all Baltic States to each other's energy facilities. This is also beneficial for the economic performance of these energy installations (i.e. refinery, LNG terminal, and UGS) and, at the same time, for the EU's trans-Baltic energy plans, such as BEMIP or even the European Union Strategy for the Baltic Sea Region (EUSBSR). Table 5 shows the distribution of these facilities across the Baltic States.

Table 5: *Baltic States' Energy Facilities*

LNG Terminal	**UGS**	**Electricity & gas interconnector**[4]	**Hydropower**	**Major domestic fossil resource**	**Oil refinery**	**Nuclear power plant**
Lithuania	Latvia	Lithuania, Estonia	Lithuania, Latvia	Estonia	Lithuania	None (Estonia planned)

Source: Augutis, et al., 2020; Matsumoto, et al., 2018; Amber Grid, 2021.

[4] Interconnector with non-Baltic EU Member States

The future energy plans may also act as the driving force of this integration. Studies show that the integrity of the Baltic power grid is essential to cope with the side effects of leaving the electrical ring of Belarus, Russia, Estonia, Latvia and Lithuania (BRELL), as Baltic States declared their intent to do this in 2015 (Bompard, et al., 2017; Bahşi, et al., 2018). Additionally, Estonia is determined to end the use of its pollutant oil shale, in accordance with the EU climate targets (European Commission, 2018b). However, this could have implications for the security of supplies. A similar experience in the past showed that Lithuania adopted appropriate policies to compensate for the adverse effects of shutting down the Ignalina Nuclear Power plant, such as building an underwater power cable to Sweden, called NordBalt (Augutis, et al., 2012). Therefore, taking a similar approach to strengthening the interconnections infrastructure and commissioning alternative energy generation systems, such as renewable and nuclear, Estonia can manage the phasing out of shale.

We suppose that the intra-Baltic connectors are strengthened enough to allow energy to flow freely across the region and facilitate free access to the energy installations for all three states. In optimal case, the HHI level for all three Baltic States will then approach a single value. Assuming that the total energy consumption remains the same, the planned Estonian 300MW nuclear power plant becomes operational (Fermi Energia, 2020), and the Lithuanian LNG terminal works at full capacity, the hypothetical HHI will reach 2906. This shows a significant improvement compared to the current values depicted in Table 2. Additionally, this intra-Baltic initiative will pave the way for establishing the Baltic Sea Region Energy Supergrid that includes all the littoral states of the Baltic Sea, as already proposed by ESPON. The supergrid seeks to found a fully integrated network that interconnects power plants and brings higher energy independence to the Region (ESPON, 2019b). Furthermore, an integrated Baltic gas market can ensure economic competitiveness compatible with low-carbon solutions, as planned in accordance with the goals of the EU Green Deal (Belyi, Piebalgs, 2020).

4.2 Small Balkan states of Slovenia and Croatia

The HHI index of Slovenia and Croatia in Table 2 seems satisfactory. However, complementary measures must be adopted to maintain the diversity level of the energy mix in Balkan countries, if energy and climate policies should be implemented (Sekulić, et al., 2019). Thus, energy shelter seems a reasonable solution for small Balkan States, as they are essentially more vulnerable to drastic changes. Slovenia's energy network strengthening has been enshrined within the framework of projects of common interest (PCI) as part of the SEM Plan (Crnčec, et al., 2021; European Commission, 2018a). Therefore, in addition to the Croatia-Slovenia bond, one can discuss establishing an energy alliance with larger neighbours (e.g. Italy and Austria) or even non-EU states such as Serbia. However, the Slovenia – Croatia alliance is sufficiently supported by solid reasons, contrary to other options.

Firstly, the renewable options available to Croatia and Slovenia are limited, as the development of hydropower plants in both countries has been hampered by high costs and adverse impacts on ecology and tourism (Young, Brans, 2020; Crnčec, et al., 2021). Thus, they will need to focus on other energy options, which make their energy policy-making contexts more similar to each other. Second, Slovenia and Croatia still have the privilege of connected energy infrastructures, as parts of the former integrated state of Yugoslavia. For instance, the only nuclear power plant in Slovenia, named Krško, is still co-owned by Croatia and was built in 1981 when the countries were both part of Yugoslavia (Pumaneratkul, 2018). This integration can act as a driving force for the energy alliance. Third, the joint implementation of energy infrastructure development plans can improve the economic performance, for example, for Croatia's 1.9 million ton liquefied natural gas (LNG) project (IGU, 2021) is now under construction. The utilisation factor of Croatia's LNG terminal can be enhanced if it supplies a larger market, such as a wider Croatian and Slovenian market.

This benefits Slovenia's carbon abatement plans because in contrast to Croatia, which ceased to extract indigenous coal in the 2000's (Young, 2021), gradual phasing out of coal was not implemented in Slovenia. Closure of the only Slovenian thermal unit would severely affect the security of the electricity supply unless alternative solutions guarantee its supply security. Nevertheless, replacing gas with coal for electricity generation could be a short-term solution to reduce carbon emissions in Slovenia. Additionally, as it currently receives gas from Russia and the Baumgarten Hub (Crnčec, et al., 2021), LNG enhances Slovenia's energy security by diversifying its gas supply routes and energy mix.

4.3 Slovakia

Slovakia is distinguished as the "largest state" in this research. Thus, it is not surprising that its HHI ranks lowest among others, and the urgency to establish an energy alliance is much less pressing than for others. Additionally, Slovakia has developed its oil refinery, UGS facility and nuclear power plants thanks to the size of its energy demand. This justifies the Slovakian perception of energy security that emphasises the self-sufficiency paradigm (Kratochvíl, Mišík, 2020). As a result, it was not unexpected for analysis of this research on Slovakia's HHI not to indicate any fall since 2000. However, Slovakia had to shut down the Bohunice V1 Nuclear Power Plant before acceding to the EU in 2004. In the same way, while Slovakia has followed the fundamental energy policies and has shown a great desire to integrate into the EU, it did not give up its national energy dreams. This is particularly discernible in its nuclear energy development policy, despite Austrian and German criticism (Mišík, 2019, p. 123; Mišík, 2015).

Slovakia has had a strategic place in the transiting of Soviet (and then following this, Russian) gas from Ukraine to Central and Western Europe, particularly Austria and the Czech Republic (ENTOSG, 2020). In the beginning, Slovakia stood alongside the other seven EU leaders who objected to Nord Stream II (NS II) in March 2016, because its transition role was jeopardised by the threat of Ukrainian route closure under the influence of NS II operationalisation (Sziklai, et al., 2020). However, as the Czech Republic and, conversely to Poland, Slovakia has gradually moderated its approach toward a market-oriented attitude on NS II and became less strongly opposed (Jirušek, 2020). Such "heterogeneity" among V4 states is also visible in other aspects of their external energy policy, even in EU legislative bodies (Zapletalová, Komínková, 2020). Therefore, one can conclude that neither internal nor external factors force Slovakia to seek shelter to preserve its energy security. It is worth mentioning that this conclusion does not repeal the integration of Slovakia in the EU energy policymaking structure of the EU or active collaboration with other V4 states on energy grounds either.

4.4 Luxembourg, Malta and Cyprus

The situation for Luxembourg and Malta are similar with respect to the diversity of energy mix. Both states rely heavily on the energy infrastructures. Although Luxembourg managed to partially use renewable energy, Malta did not succeed significantly, although it was the state that introduced the Clean Energy for Islands initiative during the time of its EU Presidency (ESPON, 2019a). Thus, Malta's energy mix depended on oil and a little on electricity imports, until it launched its first floating storage regasification unit (FSRU) in 2017, that provides Malta's power plant fuel (IGU, 2021). Luxembourg imports 95 % of its energy needs, and its renewable development perspective highly vary, region by region. Thanks to Luxembourg's role as one of the founders of the European Coal and Steel Community, as the predecessor of the EU, it has participated in different regional energy networks, including the North Seas Energy Cooperation. However, Luxembourg is a *follower* of its neighbours' decisions for its energy pricing and policies (ESPON, 2020). The dependency on neighbours in these two small states is not limited to energy. Luxembourg relies heavily on Belgium for its foreign service, as sometimes Belgium even represents it at the EU meetings (Thorhallsson, 2006). These two cases may be fully-fledged examples of the shelter concept in energy policy because their energy security depends on their larger neighbours (namely Italy, Germany, Belgium, and France). Since large EU states carefully guard and protect their energy security, the dependence of small states on larger ones is not perceived as a threat. In contrast, it may even safeguard security of supply.

The situation is different for Cyprus, which according to the EU definitions (ESPON, 2019a) is the only "island state" without any significant energy interconnector to the mainland. Although Cyprus has a 17.404 MWh/capita photovoltaic economic potential (at 8 c/KWh), which is considerable compared to its total energy consumption of 35.44 MWh/capita/year, solar power has not yet found a significant footing in Cyprus. The situation is not likely to change soon (ESPON, 2021). In 2018, more than 92% of Cyprus' energy was supplied by oil. Insularity results in greater autonomy in the formulation and implementation, which means reduced opportunities for the EU energy policies to act as a driving force (ESPON, 2018). One can realise the exemption of Cyprus from implementing market liberalisation laws in the Third Electricity Directive as a testimony to this (Papsch, 2021, p. 584), and expect Cyprus to lag behind in renewable energy production soon.

In general, barriers between regions increase the desire for energy independence to guarantee their supply security (Kruyt, et al., 2011, p. 292). In the case of Cyprus, these restrictions exclude the possibility of implementing the shelter concept. This means that the diversification strategy (including increasing resilience to physical interruptions caused by internal factors) should be implemented within the framework of the energy independence paradigm. Energy independence for Cyprus, especially when renewable development prospects are not clear, implies optimising decentralised energy production (ESPON, 2019a) and diversification of supply relying on natural gas utilisation. This strategy is compatible with the EU climate goals and can be achieved by relying on Eastern Mediterranean gas resources or even by constructing LNG import terminals (Tilliros, 2017).

CONCLUSION

The importance of small states in international relations has increased since the end of the Cold War era and, remarkably, within the European Union and after the 2004 EU enlargement, when new small states joined the EU. However, small states must compromise with their interests due to lower bargaining power at the international level. Therefore, it is not always easy for them to pursue and fully obtain their national interests in the EU policy and decision-making, contrary to bigger states. Since the Lisbon Treaty recognised energy as a shared competence, concerns about sacrificing energy security interests of small states under the influence of the larger EU states has become a serious matter.

This study aimed to investigate the relationship between the size of states and their energy security in the EU, and whether proper measures are applicable to improve small-states energy security levels. Since there is still none single definition for the small state, and the definitions rendered describe the smallness based on their aim, e.g. mainly political aspects, this research sought to introduce an index compatible with its context for energy security. The aggregated index that encompasses population, GDP, and territory distinguished nine small states in the EU. Furthermore, the Herfindahl–Hirschman diversity index (HHI), which can represent the resilience of a state to supply disruptions, was applied to measure the energy security. Accordingly, the survey results show a solid and direct relationship between energy security and state size in small EU states; the smaller the state, the lower the diversity and energy security. The results do not prove the existence of any similar relationship in small EU states. This could mean that energy diversification is a vital requirement for the EU small states by adopting appropriate policies. One can justify such a relation considering the smallness and lower population, as considered in the definition of small states in this paper. This results into a smaller market size than the critical mass needed to develop all energy carriers' infrastructure, including coal mines, oil refineries, LNG terminals, UGS facilities, electricity networks, nuclear power plants, and concentrated renewable power plants. In the lack of massive oil and gas domestic resources in the EU, which can potentially enhance their energy security, small states must allocate their resources to develop some energy choices. This undermines their energy mix diversity and, as a result, reliability and energy security according to the acquired definition.

While the construction of interconnectors between the EU Member States was previously discussed as a solution to increase resilience, especially against external supply threats, this research specifically focused on the idea of enhancing small states' energy security by creating/joining an alliance. According to the shelter theory, such an alliance alleviates small states' internal vulnerabilities during times of crisis, by leading them to join regional organisations. Additionally, small states establish an alliance if they find it beneficial for the majority of their society and the state's security. Furthermore, considering the HHI diversity index, the alliance is expected to diversify the small states' energy mix.

Since establishing an energy alliance is highly dependent on geography, one can divide small states into the four categories of Baltic States, the Balkans, the CEE, and very small surrounded and encircled states (including Luxembourg, Malta, and Cyprus). The results show that the definition of alliance in shelter theory applies perfectly for Luxembourg and Malta. These states can form an alliance with their bigger neighbours (as the alliance is defined in shelter theory) in order to preserve their energy security. Cyprus, however, is unable to implement such a strategy due to the remoteness and isolation of its energy system and its geographical location. This could suggest that energy diversification within the self-dependency paradigm is a suitable policy for this island state. This paradigm is the logical policy prescribed for the largest small state, Slovakia, but with a different rationale. This is mainly due to the development of energy facilities and infrastructure in Slovakia, as it benefits from a refinery, underground gas storage, and nuclear power plants. These possessions have enabled Slovakia to adopt an independent approach to external energy policy comparing to its V4 neighbours in various cases.

Shelter theory can be applied to render policy recommendations for improving the energy security of small Baltic and Balkan States if a broader definition of an alliance is intended. This could suggest alliances with other small neighbouring states instead of large states and establishing a regional institution rather than joining an already existing organisation. Formation of a regional alliance means further integration of the energy infrastructure within the Baltic States or between Croatia and Slovenia. This will provide partners with free access to existing energy facilities or facilities under construction of their counterparts (whether LNG, refineries, nuclear power plants or UGS). It enhances the economic performance of energy facilities for owners, increases diversity and, therefore, the energy security of all beneficiaries at the same time. Therefore, intra-Baltic and intra-Balkan connectors are as crucial as trans-regional interconnections planned within the EU single energy market. Additionally, formation of such regional energy alliances prevents small states, interests, concerns and considerations ignored by the major powers in energy policy-making at an EU level.

Overall, we may say that the policy of small states in establishing alliances to protect their energy security is mainly limited by geographical factors. The policy then requires a cost-benefit analysis that compares the achievements in exchange for a partial loss of autonomy. This means that having a well-developed energy infrastructure may raise the tendency for self-dependence rather than for an alliance. Therefore, while security concerns dominate the motivation as very small states of Luxembourg and Malta to seek shelter, the Balkans and the Baltic states can pursue their economic and security interests in a positive-balance game of energy alliance with smaller neighbours. Finally, since small EU states try to support the Commission in general, their proposed solutions must align with the general orientations to create a synergy. This is compatible with the main idea, since it reinforced Baltic and the Balkan energy markets and integration of infrastructures. It can act as defined within the framework of the projects of common interest (PCI) as they aim to strengthen interconnections. Moreover, they can also be considered in line with the Commission-backed plans as Three Seas Initiative, the European Union Strategy for the Baltic Sea Region (EUSBSR) and also for the EU single energy market in a broader perspective.

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