UNIVERSITY OF LJUBLJANA
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MASTER'S THESIS

ENERGY ACCESS AND ENERGY POVERTY IN THE EUROPEAN UNION AND BOSNIA AND HERZEGOVINA

Ljubljana, July 2021

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The undersigned Nea-Adrianna Bukić, a student at the University of Ljubljana, School of Economics and Business, (hereinafter: SEB LU), author of this written final work of studies with the title Energy Access and energy poverty in the European Union and Bosnia and Herzegovina, prepared under supervision of phD Nevenka Hrovatin

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LIST OF ABBREVIATIONS

ALTENER – New and renewable resources

APE – Alliance Against Energy Poverty

BiH – Bosnia and Herzegovina

BHAS - Agency for Statistics of Bosnia and Herzegovina

℃ - Degrees Celsius

COVID-19 – Coronavirus

EPBiH – Elektoprivreda of BiH

EPRS – Elektroprivreda Republike Srpske

EU – European Union

EUROSTAT – European Statistical Office

FBiH – Federation of Bosnia and Herzegovina

GHG – Greenhouse gases

IEA – International Energy Agency

IRENA – International Renewable Energy Agency

kg – kilograms

kWh – kilowatt hours

LIHC – Low Income High Cost

LPG – Liquefied petroleum gas

MEPI – Multidimensional Energy Poverty Index

MJ – Megajoule

NGOs – Non-governmental organisations

OBA – Output-based aid

OECD – Organisation for Economic Cooperation and Development

OPEC – Organisation of the Petroleum Exporting Countries

PV – Photovoltaic

RMB – Renminbi

RS – Republic of Srpska

SAVE – Specific Actions for Vigorous Energy Efficiency

SDG7 – Sustainable Development Goal 7

SEE – South East Europe

SHS – Solar Home Systems

SILC – Statistics on Income and Living Conditions

STEER – Energy in transport

TOE – Tonnes of oil equivalent

TV – Television

UK – United Kingdom

UN – United Nations

UNEP – United Nations Environment Programme

UNFCCC – United Nations Framework Convention on Climate Change

UNSD – United Nations Statistics Division

UNDP – United Nations Development Programme

WHD – Warm Home Discount

WHO – World Health Organization

INTRODUCTION

Today, one of the most serious problems for the significant number of people around the world is the fact that billions of people still do not have access to energy services, yet alone to modern energy services, especially when modern energy services such as heating, cooking, lighting, and cooling are considered to be a crucial precondition to a proper quality of living. The lack of energy access is influencing not only the economic development of a country but also has great influence, either direct or indirect, on health, education, surroundings and even influences gender equality (Bazilian, Nakhooda & Van de Graaf, 2014).

Energy poverty and energy access are closely related, and the basis of energy poverty lies in understanding the problem of energy access. One of the preconditions for energy poverty elimination is the development and energy access relationship. Even though there are lots of definitions explaining the existence of energy poverty, none of them give the solution to the problem itself. The problems arise in the fact that different countries use different energy poverty definitions, which is causing the inability to use the conclusions of other countries' cases and compare the data. Energy poverty is certainly a huge problem that influences the lives of many people around the European Union (hereinafter: EU) and Bosnia and Herzegovina (hereinafter: BiH). The problem itself is not investigated enough and insufficient amounts of interest have been given to address this issue by states.

Energy poverty and lack of energy access are serious problems also for BiH because a large number of households in BiH face difficulties in meeting the costs of energy and energy services. Energy poor households often lack sufficient resources or knowledge to meet basic energy needs, and are socially isolated, and have no one to ask for help. As expected, no matter what part of BiH is the word about, the Federation of Bosnia and Herzegovina (hereinafter: FBiH), the Republic of Srpska (hereinafter: RS) or Brčko District, there are no programs to assist households that have problems paying for electricity and heat bills or procuring heating energy. It is important to mention that there are major losses in the cycle of production, distribution, and consumption of energy in BiH. With the same amount of energy consumed, it produces four times less gross national product than in the EU average and twice as much pollution.

The purpose of this thesis is to clarify the problem of energy poverty and energy access through understanding their causes and consequences, with an analysis of global trends concerning the EU and BiH. In general, the main purpose of the thesis is an attempt to find out how severe energy poverty is and which measures are used to tackle it through investigating and analysing this problem in a few selected countries, with special emphasis on BiH and the EU as a whole.

This master's thesis analyses the presence of energy poverty in countries of the EU, countries of South East Europe (hereinafter: SEE) where some are not members of the EU, but strive to be as their final goal, and BiH, while presenting new insights and results of recent research. The analysis will provide a platform to propose suitable measures to deal with the lack of energy access and with energy poverty in BiH. Therefore, the following research questions will help to achieve the purpose of this master's thesis:

- What are the causes and consequences of the problem of energy access and energy poverty in the EU and BiH?
- How serious is the problem of energy access and energy poverty in the countries of interest?
- What are the possible solutions to resolving the problem of energy access and mitigating energy poverty?
- What are the driving forces and obstacles of potential solutions for the widespread energy poverty problems?

When talking about the objectives of this master's thesis, the first one would be to describe the problem of energy access and energy poverty, as well as its causes and consequences in the cases of the EU and BiH, while focusing on the wide scope of challenges that are present in addressing these issues. Furthermore, another important objective is to examine the conditions of the countries of interest in terms of energy access and energy poverty, while comparing the data gathered in these countries. What also needs to be addressed is exploring the possible solutions to resolving the problems of energy poverty, with an emphasis on different approaches that have the potential to improve the lives of those who are energy poor and to prevent those who are at risk of becoming energy poor by mitigating the increasing trends of energy poverty. Nevertheless, it is important to evaluate and define driving forces and obstacles of potential solutions for the widespread energy poverty problems and to analyse the capacities of governments and other institutions that are responsible for addressing the problems related to the energy sector in general. Finally, possible measures are to be proposed specifically for BiH based on best practices and the country's modalities.

This master's thesis will mainly use the literature review for the purpose of creating a wider scope of data and formulating areas for further research on this topic. Secondary data, in terms of different types of literature such as books, scientific articles, statistical research and data, country studies, and other relevant information from the Internet and other printed sources, will be used and will contribute to a deeper understanding of the problem described in this master's thesis. Through literature review, the information gathered will identify the gaps present in existing knowledge by presenting limitations of current approaches to solving the problems of energy access and energy poverty. In addition to this, a critical review will question information presented in this master's thesis and evaluate the conditions in selected countries in terms of vulnerable consumers, causes, and consequences of the problem of energy poverty. Other relevant subjects will be critically reviewed through

examination of policies and patterns of energy poverty. The qualitative research will be conducted to explain definitions, models, and descriptions of problems and possible solutions. Using the data, understanding of energy poverty and the energy access phenomenon will be clarified. Furthermore, current solutions and measures for helping vulnerable consumers, implemented through regulations of public institutions such as public power utilities in BiH and other public utilities and institutions in the EU, will be presented and analysed.

This master's thesis contains four main chapters. The first chapter explains definitions of energy access, as well as different alternatives for access to energy sources. Energy access and sustainable development, and the addition of the review of electrification experience will also be examined in the first chapter. The next chapter will explain energy poverty in general, by tackling different issues and trends in relation to it. The perspectives of institutions on various levels will also be introduced with an important insight on causes, signs and consequences of energy poverty. The third chapter analyses the state of energy access and energy poverty in the EU, with special emphasis on the identification of vulnerable consumers in the EU and models of support for socially disadvantaged groups in terms of energy. In order to understand the problem more, this chapter presents driving forces, patterns and numerous policies of energy poverty. The end of this chapter will give a review of selected EU projects, with a special focus on the state of energy poverty in the countries of SEE. The final chapter will explain the condition of energy access and energy poverty in BiH and provide information regarding energy consumption in BiH, as well as the (non)existence of measures for vulnerable consumers in the country itself. This chapter also recommends possible solutions to the problem of energy poverty that are feasible in BiH.

1 ENERGY ACCESS

1.1 Definition of energy access

There is no universal definition of the term *energy access*. There are many of them in the numerous literatures, but each of them has its strengths and weaknesses. For example, International Energy Agency (hereinafter: IEA, 2017, p. 21) defines energy access as "a household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional average". This definition assumes that the acceptable minimum need is equal to the regional average of consumption, which can potentially impose encouragement of wasteful consumption and maintain an unsustainable lifestyle.

A basic bundle of energy services includes, at a minimum, a few lightbulbs, task lighting (e.g., flashlight), a radio and phone charging. Furthermore, access to clean cooking facilities

is related to the access to modern fuels and technologies and their primary use, including liquefied petroleum gas (hereinafter: LPG), natural gas, biogas and electricity, or improved biomass cookstoves that are the opposite of the basic biomass cookstoves and three-stone fires used in transition countries (IEA, 2017).

It is extremely hard to reach a consensus on this topic. Bhattacharyya (2012) explains that the problem is in comparing energy access to energy poverty, where energy poverty is mainly caused by the inability to satisfy the essential needs due to the inadequate levels of income and consumption. From that point of view, energy access can be explained as having in disposition a minimum quantity of energy to fulfil the basic needs of a population. That being said, a question arises: "*What are the essential needs?*". Determining essential needs is being done with unavoidable subjectivity, whether engineering estimates or normative values are used.

According to Pachauri & Spreng (2011), a consensus on the definition of energy access can be reached by making agreements on three elements:

- consensus on services defining the basket of basic needs;
- a clear definition of the thresholds defining basic needs;
- assessing the household expenditure on energy by different income classes.

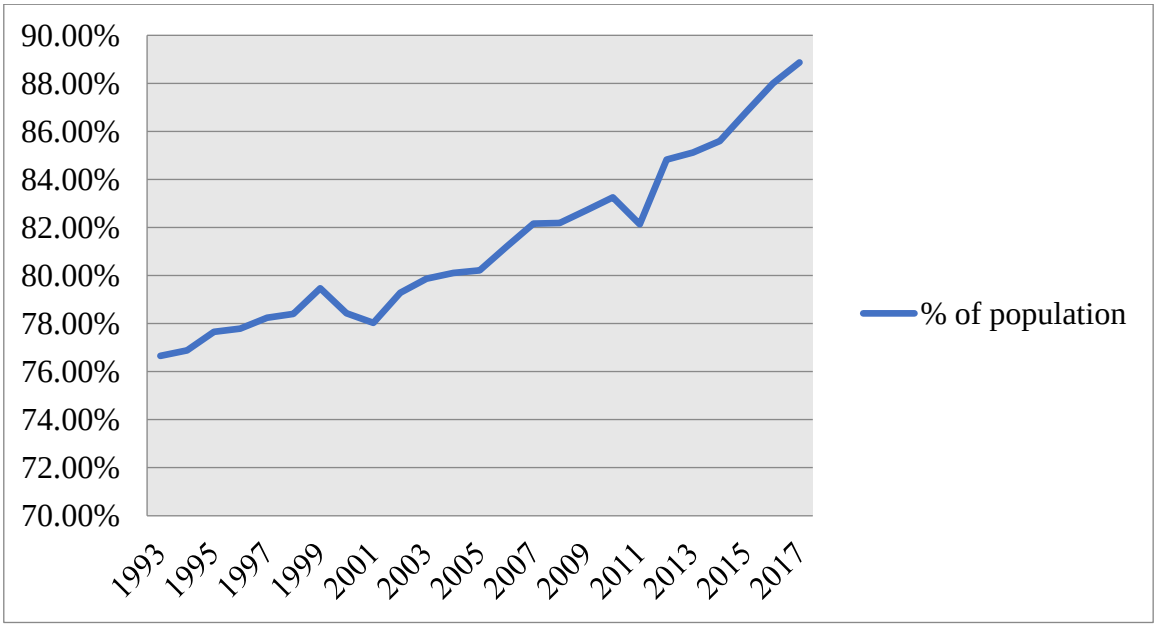
1.2 Access to energy sources

It is evident that access to energy sources represents one of the most serious problems for a significant amount of people around the world. Access to energy sources, especially access to modern energy sources, such as heating, cooking, lighting and cooling is still not available to everyone, even though it is considered to be a crucial precondition to a proper quality of living, and can even be viewed as one of the basic human rights (Bazilian, Nakhooda & Van de Graaf, 2014). In the early, as well as in the late 1980s, many authors based their research on the quantification of basic energy needs. The result varied from 500 watts of primary energy per person to 250 watts of primary energy per person or even 30 watts of useful energy per person. So, even with the later on encountered problems with measurement of energy services, it is clear that life without the minimum of access to energy sources is considered to be a breach of human rights. For many years the problem of lack of access to energy sources has been greatly overlooked. However, in recent years, more attention was given to increasing access to energy sources for those still without it (Pachauri & Spreng, 2004).

IEA (2018) underlines that in 2017 number of people without access to electricity fell below 1 billion. Positive effects in the domain of access to electricity have been visible since 2014, especially in the regions such as sub-Saharan Africa, which was estimated to have one of the greatest problems with the lack of access to energy sources and electricity as well. It is estimated that the efforts in 2014 for the improvement of access to electricity in sub-Saharan

Africa have been greater than the growth of population. In 2016, approximately 1.1 billion people were without access to electricity, whereas in 2000, the number of people without access to electricity was much higher, and has affected 2.3 billion people (IEA, 2017). Even though progress has clearly been made, around 14% of the total population still lacks access to electricity, which is shown in the review through the years in Figure 1. However, out of these numbers, approximately 84% of the total population in 2017 lives in rural areas (IEA, 2018). According to IEA (2017), in 2016 the percentage of people living without access to electricity in rural areas was also 84%. When comparing the data to 2009, approximately 85% of the rural population lived without access to electricity (Bhattacharyya, 2012). This shows that from 2009 to 2016 the decline in the number of people living in rural areas which do not have access to electricity was as low as 1%.

Figure 1: Access to electricity worldwide (% of the population)



Source: World Bank (2020).

According to Sustainable Energy for All (2017), the objectives of universal access to electricity by 2030 could be met if the electrification process advances as much as four times faster. More specifically, the percentage of 0.19% of the global electricity access rate from the period of 2012 to 2014 needs to be increased to 0.92% from 2015 to 2030 globally per year. However, the problem is the fact that the last percentages of the population without access to electricity are extremely hard to reach. This is because they usually live in highly remote locations or can also live in overloaded cities. Based on these numbers, assumptions are that universal access to electricity will probably not be reached by 2030, as the population of approximately 650 million will still have to live without access to electricity. 90% of people living without access to electricity will be in sub-Saharan Africa (IEA, IRENA, UNSD, WB & WHO, 2019).

Access to clean cooking services is also one of the problems in the domain of energy access, or lack of it. According to IEA (2018), in 2017, approximately 37% of the total population around the world did not have access to clean cooking services, or even to any cooking services at all. According to IEA (2017), the predictions of reaching universal access to clean cooking services by 2030 are that the world is not close to achieving universal access to clean cooking services. Some scenarios, such as the New Policies Scenario, predict that approximately 2.3 billion people will still lack access to clean cooking services. For the purposes of comparison, 38% of the total population in 2016 that did not have access to clean cooking services amounts to approximately 2.7 billion people, which, compared to the prediction of 2.3 billion people in 2030 that will remain without access to clean cooking services, shows that the progress in this field needs to be intensified significantly. Even in 2000, the number of people without access to clean cooking services was approximately 2.8 billion, which shows that not much was done to improve and solve the problem that is quite grave. According to Sustainable Energy for All (2019), the progress of ensuring access to clean cooking services is one of the most disappointing and is considered to be a failure as it has predominantly been flat. According to IEA, IRENA, UNSD, WB & WHO (2019), the percentage of the population lacking access to clean cooking services is also higher in rural areas, where approximately 34% of the population has access. However, the pace of progress in the domain of access to clean cooking services has significantly slowed down after 2008, even though from 2010 to 2017 the growth rate of 0.5% has been registered. In order to reach 2030 objective of universal access to clean cooking services, the progress of ensuring clean cooking services needs to increase from registered 0.5% to at least 3%.

According to Bhattacharyya (2012), when discussing the aspect of the idea of reaching the universal access to energy sources, the problem of the quantification of the term arises. It is a subject of debate because it has not been clarified if the development is promoted and measured only when most basic needs for energy services are satisfied and if it is promoted whether the adopted strategies for the improvement of energy access are actually sustainable.

When talking about lack of access to electricity and lack of access to clean cooking services, or when talking about lack of energy access in general, it is evident that the majority of the population living in these conditions is living in rural areas. The problem with rural areas is that they mostly lack needed infrastructure for the provision of even the most basic energy services. This means that even when presented with the same up-front costs of providing energy access, rural poor are in a worse position compared to urban poor because they are presented with the additional costs of building the infrastructure. After being presented with the initial costs for building the needed infrastructure, the fee for connecting to the electricity grid in developing and transition countries can range up to USD 1,000.00. Low incomes of those living in rural areas make this digit even higher for them (Saghir, 2005). However, the physical access to energy sources is considered to be a precondition for having access to energy sources, but another problem that arises is that physical access to energy sources does not ensure that the person having the physical infrastructure built will actually benefit from

it and have access to energy sources. The complicated thing is the fact that, next to the problem of physical access, the problem of real access arises too. The real access to energy services is ensured by the capability of a certain household to actually purchase energy services, which means that the access to energy services can also be limited by the purchasing power of the household (Pachauri & Spreng, 2004). It is evident that there are many problems connected with the problem of energy access. For some, even if they could afford the provision of access to energy sources, the problem lies in the fact that there are no possibilities for connection to needed energy sources. This is the problem that impacts not just rural households, but urban households as well. Also, the problem of profitability for energy providers can be one of the reasons why a certain area of the population does not have access to energy sources. This often happens in remote places with a low density of population living there. It is clear that the level of access to energy sources varies not only between urban and rural areas but also by different geographical regions. It is more common for low-income countries to have a lower rate of energy access when compared to middle-income countries (Komives, Foster, Halper & Wodon, 2005). However, this does not mean that the population in high-income countries does not suffer from the problems associated with the lack of energy access.

The absence of energy access has many consequences for the population living in the conditions without it, and it does not just focus on the lack of services that are considered to be basic human rights, such as cooking, heating, or access to electricity. Therefore, González-Eguino (2015) underlines that the lack of access to energy sources directly or indirectly influences human development, as even education, health, connection to information or even connection to political involvement is being influenced by the lack of access to energy sources. Lack of access to energy sources can be especially problematic in times when the world is faced with a crisis such as a recent pandemic of Coronavirus (hereinafter: COVID-19). Ogunbiyi (2020) argues that these types of crises affect developing countries, and underlines the fact that the lack of energy access contributes to the creation of additional challenges for these countries. For example, the spread of the virus in most countries is controlled by using measures of social distancing. However, for the majority of the population that does not have access to energy sources, this is not possible. The case of countries of sub-Saharan Africa where approximately 840 million still live without access to electricity or any other energy sources and where additional millions still live with unreliable access to energy sources contributes to the severity of the situation. Many hospitals are also affected by the lack of reliable access to energy sources, and this complicates the ability of doctors to treat patients. Unfortunately, less than 30% of health facilities in the countries of sub-Saharan Africa have access to electricity. It is apparent that the provision of energy access can also save the lives of millions of people when being confronted with such a serious threat as the world is being confronted right now.

On the other hand, energy is undoubtedly one of the most important drivers of not only social but also economic development and has a significant impact on the reduction of poverty,

especially in developing countries. Its effects contribute to the increase of economic security, improvement of public health and public education, and ultimately contribute to the generation of income. This is why IEAs goal of *"ensuring access for affordable, reliable and modern energy for all by 2030*" (IEA, 2018) is a challenge, even though a demanding one, that should be reached.

Sustainable development depends significantly on the provision of modern energy services and is very important in the everyday lives of people. Quality databases are required as a basis of effective policies for modern energy access expansion (Nussbaumer, Bazilian & Modi, 2012).

Different energy types and their affordability for household usage depend on the factors such as prices of the market, efficiencies and costs of appliances needed for employing energy sources as well as energy sources themselves. In some instances, while there may not be any financial worth or cost related to certain non-commercial fuels, for example, wood or manure, there is an open-door cost regarding the estimation of the time spent in gathering the fuelwood. On the contrary, where fuelwood is accessible it is the more favoured fuel source among the low-income households since it doesn't have a financial value appended to it and can be gathered from close, by forests, public grounds, or private terrains independently. Moreover, the capital expense of the stoves for the wood-burning is practically insignificant, particularly for the less complex (and furthermore generally wasteful) crude three-stone stoves. In any case, there is frequently a market cost for fuelwood in urban living regions (Pachauri & Spreng, 2004).

When it comes to rural regions, according to Saghir (2005), the factors of distance and low-density are important. These factors raise the expenses of electrification to almost restrictive levels. The primary strategy to handle this issue is to have arrangements for financing capital expenses for this kind of regions' electrification grid. Another possible solution is to create arrangements for the peri-urban regions' off-grid charge. In both cases, it is required to have a cautious strategical plan with a capable execution. These policies are intended to decrease the costs of service expansion for the people living in rural areas as well as for the urban poor.

Effective policies for the resolving of the issue of metropolitan regions stretching out power admittance to the poor depend on precise strategies that will ensure it. The companies that will invest in these policies already have the needed framework to make minimal new capital ventures. This investment in suburban grid access is much less compared to new rural area energy supply expenditure. However, poor individuals will still have difficulties with managing the costs even with the lower capital expenses and higher livelihoods in metropolitan regions. To handle this issue efficiently, the energy companies must take into consideration the administration development which will support the poor individuals.

Energy sectors need public policies and strategies that will effectively sustain and promote commitment. To ensure this the business side of the energy sector requires subsidies and finances which will make energy supply open to poor people yet abstain from any disruption of the energy market in terms of preference of one fuel over the others. Additionally, through this, the markets will not have counterproductive prices and subsidy arrangements.

For the poor, the cost of having energy service of usage of fuels such as wood and kerosene oil is less productive than utilising fuels that are modern. Another correlated issue that increases the costs of the poor is that they have to buy smaller more frequent amounts of fuelwood and charcoal. Another example of an expensive energy service for the poor is the energy used for cooking since the costs of efficiency and transaction show that for poor individuals this amounts to great expenses (Saghir, 2005).

According to the gathered data, nearly 91% of the world's metropolitan populace has access to energy power. Certain places of the world have almost the whole metropolitan populace with full access to electrical power: in North Africa, East Asia (including China), the Middle East, and Latin America, the offer is in any event 98%. So, the issue of having access to electrical power is fundamentally an issue for rural areas. Access to electrical power will continue to be in short supply in provincial areas. Moreover, in the future, the issue will be troublesome for metropolitan areas as well (Saghir, 2005).

Sustainable Development Goal 7 (hereinafter: SDG7) introduced by the United Nations (hereinafter: UN), involves high and deliberate monetary responsibility. To achieve the goal and secure access to reasonable, dependable, feasible, and present modern energy for all by 2030, billions of dollars need to quickly begin streaming towards electric power and clean cooking arrangements every year. The measure of funds required is not of large proportions considering the measure of capital flowing the globe every day. On the other hand, the general access to electricity is falling with a pattern indicating that year by year, there is a lack of capital dedicated to providing sustainable and efficient universal access (Sustainable Energy for All, 2017).

According to the World Health Organization (hereinafter: WHO, 2016), there is a correlation between the disproportional burden on women and girls in matters of health, work efficiency, and employment with a lack of energy access and fuel assortment in the modern world. Roughly 3.8 million individuals around the world, especially women and girls, die every year due to biomass consumed inside households and closed areas. This major issue of access for everyone to clean energy sources has concerning health consequences (Sustainable Energy for All, 2017).

Energy access has been classified according to the stability by the Advisory Group on Energy and Climate Change, an intergovernmental body made out of delegates from organisations, the United Nations, and examination establishments (United Nations, 2010). The first category is that essential human needs are met with both electrical power

consumption of 50-100 kilowatt hours (hereinafter: kWh) per person for each year and 50-100 kilograms (hereinafter: kg) of oil equivalent or modern fuel per person every year (or the possession of improved cookstove). Second is the utilisation of profit, which includes admittance to mechanical energy for agribusiness or irrigation, business energy, or fluid-vehicle fuels. The consumption ascents to 500-1,000 kWh every year in addition to the equivalence of 150 kg of oil. The third aspect is the present-day needs, which incorporate the utilisation of household machines, cold and hot water, and private transportation in total outcomes in the consumption of around 2,000 kWh per year and 250-450 kg of oil equivalent (Sovacool, 2012). Table 1 outlines this order precisely.

Table 1: Energy services and access levels

Level	**Electricity use**	**kWh per person per year**	**Solid fuel use**	**Transport**	**Kilograms of oil equivalent per person per year**
Basic human needs	Lighting, health, education, and communication	50 to 100	Cooking and heating	Walking or bicycling	50 to 100
Productive uses	Agriculture, water pumping for irrigation, fertiliser, mechanised tilling, processing	500 to 1,000	Minimal	Mass transit, motorcycle, or scooter	150
Modern society needs	Domestic appliances, cooling, heating	2,000	Minimal	Private transportation	250 to 450

Source: Sovacool (2012).

Since the 1950s the primary goal is to improve access to electrical power and modern energy as a way to have economic stability. The improved financial status of the population living in provincial regions by expanding human profitability and government assistance is a method proposed by the UN that focuses on accomplishing "development first" for the issue of energy access (Sovacool, 2012).

Social and economic developments are connected to energy supply and usage. Sustainable financial development in both industrialized nations and rising economies have shown to be dependent on access to moderate energy and effective administrations that regulate it. Access to modern energy sources is a large contributor to poverty eradication, food securement, clean water preservation and access, general human well-being improvement, education, and salary increase (United Nations, 2014).

The process of networks forming and extending with regards to technological innovations is the key for the electricity access efficient expansion. This is achieved with the help of corresponding frameworks of capital and administration, foundations, and accurate data.

Advancement in any of the above-mentioned dimensions can prompt development but each is dependent on the remaining network support (Alstone, Gershenson & Kammen, 2015).

The goal by 2030 is to proceed with the growing framework extension with a scope of projected grid network-based access. Alstone, Gershenson & Kammen (2015) emphasise that the IEA estimates that in the future more than 900 million individuals in provincial areas will stay without power by 2030, as opposed to just around 100 million in metropolitan areas, with by far most in sub-Saharan Africa. Sustainable Energy for All, utilising information from the IEA, expects that arriving at universal access will require grid extension for all new metropolitan connections and 30% of provincial areas. The rest 70% of rural area living individuals will be getting access through decentralized arrangements (65% through mini-grids, 35% through Solar Home Systems (hereinafter: SHS) and intra-household or 'pico-solar' items).

The grid expansion is limited by complex geography, long transmission separations, and diffuse populaces. This problem is present in numerous suburban regions of low economy countries as a result of the high marginal expense of connection in comparison with anticipated usage. Low energy utilisation, issues to pay connection charges, and difficulties in getting household wiring and appliances represent the financial restrictions that the provincial poor are facing with connection to the grid network. Indeed, numerous family units and businesses in the, so-called, electrified regions need access, even if this means that they will connect straightforwardly underneath power lines. Political power and support for the centralized grid expansion are needed for achieving the desired outcomes, but for some of the provincial and metropolitan populace with the opposition, marginalised, or diffuse cultural and political affiliations can be a drawback (Alstone, Gershenson & Kammen, 2015).

Another region where there is an especially significant linkage with energy access is human well-being. Family unit air quality and well-being can be improved by admittance to clean cooking. As IEA (2017) highlights, the utilisation of candles, kerosene, and other polluting fuels for lighting has genuine effects on human well-being, as well as dependence on biomass and coal for cooking, usually in a closed space without appropriate ventilation. All these reasons together are accountable for approximately 2.8 million unexpected life losses every year, all around the world. There are many difficulties in ensuring access to clean cooking, but also advantages. Clean cooking gives direct medical advantages, including a decrease in the number of unexpected losses. It likewise can help convey different Sustainable Development Goals by decreasing ozone harming substance emanations. There are critical collaborations between approaches to address energy access, air contamination on a local level, well-being, and environmental change. Together they underline the significance of incorporating arrangements and nearby activities to decrease obstacles of improving admittance to clean cooking.

Energy access and health have different collaborations that link them. Medical care offices rely upon energy to work and offer fundamental types of assistance. Almost 60% of well-being offices in sub-Saharan Africa have no power. Moreover, data shows that only 34% of clinics and 28% of health institutions in this region have stable power access (IEA, 2017). Around 60% of fridges utilised in health facilities in Africa have untrustworthy power, bringing a loss of practically 50% of vaccines. Clinical staff frequently needs to work with spotlights or lamp oil lights due to the absence of electrical power. Also, the energy needs of the well-being areas in low and middle-income nations are relied upon to rise (Porcaro et al., 2017).

For industry and administration progress, the population moves towards more modern and technological financial frameworks that utilise more energy and a bigger portion of complete energy is given to profitable future utilisation. All things considered, the provision of energy for beneficial utilisation can't kick off an economy or an area as a single strategy. Different issues, for example, the improvement of financial and technical knowledge, infrastructure, working business sectors, and access to credit and financing are also of vital importance to ensure progress within the nation (IEA, 2017).

1.3 Energy access programs and sustainable development

Today the poor members of the society in most developing countries have no say in the creation of inventive approaches to convey modern energy. There are great institutional and administrative boundaries, and energy strategies generally disregard the poor in these matters. Clean energy fuels that are more environmentally friendly and efficient can be hard for poor individuals to access due to taxes and policies that restrict them from usage. Also, energy changes planned and actualized without the contribution of the local community can wind up harming rather than helping poor people. It is at least one of these issues that represent the greatest issues for poor people being able to have access to modern energy (Saghir, 2005).

Improved efficiency of the entire energy sector with all existing and future obstacles can be managed by energy policies that will help both rich and poor and both provincial and metropolitan customers. For certain energy problems, the best energy policy for the metropolitan poor may be in contrast with the best policy for the provincial poor individuals. Also, the extent of the change that public approach must achieve contrasts significantly among provincial and metropolitan regions. Administrative approaches should permit rival technological advancements to be chosen based on their financial benefits. Moreover, the administrative or market boundaries should not oppress any technological advances. The plan and conveyance of energy service have to take into consideration the interest of the local community, financial contributors, and overall users. Decentralised methodologies, including the efficient building of local capacity, should be essential for ensuring all interested parties are satisfied (Saghir, 2005).

The number of individuals living around the world without access to electrical power and modern clean cooking is still high, despite ongoing advancements in some countries. Electrical power is essential for the improvement of living standards that 840 million individuals presently need, while very nearly 3 billion individuals need admittance to clean fuels and technological advancements for cooking (Sustainable Energy for All, 2017). In 2018, the IEA assessed that accomplishing global energy access by 2030 requires an extra USD 51 billion every year of investing and USD 4.4 billion every year for admittance to modern clean cooking arrangements (IEA, 2018). According to Bhattacharyya (2012), various methodologies have typically been utilised by countries in improving energy access, yet little consideration has been given to see if these endeavours are reasonable arrangements.

1.4 Review of electrification experience

There are numerous conventions of supporting provincial electrical programs both by worldwide associations and public governments. Cook (2011) demonstrates, that the pattern relied upon political thinking about the given time. The rush of state-driven infrastructure improvement for provincial territories of the 1960s was accountable for starting endeavours in many nations. The liberalisation arrangements of the 1980s and 1990s diminished state uphold for private branch activities. Non-market issues identified with changes were dealt with by explicit funds, accordingly, making a straightforward administrative system for supporting social and public merchandise measurement. Provincial electric power hindered as the private branch premiums were not frequently viable with rural economic situations. The arrival of state involvement to address the failure of the market issue became noticeable universally as the emphasis on power access has increased.

1.4.1 Grid extension as the favoured choice

According to Bhattacharyya (2012), electrification in numerous nations has gained impressive development. The achievement isn't confined to a district either. In terms of electrification, for example, the metropolitan regions of Latin America have generally performed well. However, East Asia, especially China, has set a phenomenal case of accomplishing widespread electrification despite its billion or more populace and huge provincial populace. High electrification rates and even moderately less fortunate economies of South East Asian nations have additionally been effective. Vietnam and the Philippines are also fantastic achievement models of this progress. South Africa, then again, is an effective case in the African continent. Simultaneously, numerous nations such as Indonesia, Botswana, Kenya, and Nigeria have not performed well in terms of progress.

In every advanced case, electrification was the favoured method of grid expansion. However, the off-grid method has been utilised either as a temporary option (a pre-electrification choice) or as a secondary arrangement. Even though off-grid choices have gained the favour

and backing of worldwide associations and beneficiaries for funds, for example, the renewable energy systems such as SHS have developed as pioneers in this section, there has been quite a restricted infiltration of this choice internationally. Significant expenses, restricted application, and lack of performance of technological advancements as well as the picture of the "second rate or impermanent" nature of such choices have lowered the development rate (Bhattacharyya, 2012).

1.4.2 Restricted advancement with off-grid charge

Bhattacharyya (2012) states that the advancement in off-grid electrification then again is harder to follow because of little scope activity and nonattendance of any orderly regulatory reporting requirement for such tasks. These arrangements have been advanced where the grid has not been deployed or is probably not going to be deployed soon. Two methods of activity are predominant: independent frameworks and grid frameworks on a local level. Diesel generators or hydropower are usually factors that are needed for the network frameworks on a local level. It was indicated that compact 5-10 kW diesel generators are generally utilised. Notwithstanding, weighty dependence on diesel for little-scope power generation forces high costs on the utilities (all the more significantly on oil importers). The value variances in the global market influence the general production cost and the business viability.

According to Magradze, Miller & Simpson (2007), the grid system on a local level has additionally evolved in hydro-rich zones. For instance, in China, it was revealed that more than 27,000 hydropower stations are working in rural China with around 14 GW of total installed capacity. Numerous hydropower plants were at first evolved using a grid system on a local level and afterward linked to the main grid. Speaking of independent frameworks, the sun-powered photovoltaic (hereinafter: PV) systems (in the local network or battery charging frameworks) and the SHS have developed as the favoured rural off-grid technology. One should note that SHS in developing nations have given power admittance to somewhere in the range of 0.5 and 1 million family units. Through different projects upheld by the World Bank (hereinafter: WB) and the International Finance Corporation group (hereinafter: IFC), more than 1.3 million sun-oriented PV systems have been introduced around the world. The difference between the two figures might be because of retirement, estimation mistakes and abandonment. Regardless of such a great development, SHS are powering one portion of the non-electrification populace (only a million families as against 300 million families without power access), which raises worries about its prospects in the future. Off-grid arrangements seem to have power limited necessities of the customers for lighting, radio and television (hereinafter: TV) entertainment, because of the expenses, overemphasis on lighting-only solutions and the complexity of the system.

1.4.3 State financing and subsidy

A related component of grid expansion programs is that the state has commonly financed the electrification progress to reach effectiveness. As Bhattacharyya (2012) emphasises, the assets for electrification in rural areas came from different levels of government. For example, in China and South Africa, the state accepted its accountability for financing it under the Integrated National Electrification Program. In Brazil, the PRODEEM program was subsidised by the fundraising organisations and the national government, while Light in the Countryside and Lights for All programs are mainly financed by the national government, although lower governmental levels can contribute to financing it as well. Through the Rajiv Gandhi Village Electrification Program in India, the central government gives 90% of the investments to rural electric power. A few nations, like Kenya and Tanzania, have made a fund for electric energy, and general power consumers are levied an additional charge to increase fund revenues. Notwithstanding, these assets have not yet ended up being effective in enhancing the development of infrastructure in these states. The assets may not be adequate and the administrative limit in contributing the assets may be an obstacle for the electrical power access arrangement to further development and efficiency.

According to Bhattacharyya (2012), for minimum usage of electrical power by the customer, additional help is needed no matter of existing subsidies that uphold network expansion. Free of charge 20-ampere connection is given in South Africa to poor people and a 50 kWh free amount of power per month. Numerous different nations charge poorer purchasers a lifeline rate, such as India. India permits the lowest consumption level either at a fixed regularly scheduled instalment or at a subsidy rate. However, various issues emerge because of subsidies, inducing power leakage due to usage which is unmetered or potentially robbery, rise in the number of purchasers which thusly builds the subsidy burden, poor generation of revenues for the utilities that decreases their long-term interest, and so on. According to IRENA (2020), intentional interventions by governments, non-planned turnouts of policy decisions, as well as market failures can result in the creation of subsidies. Even though there are some issues connected to the implementation of subsidies, it is important to emphasise that subsidies are not necessarily bad. What is important is to create goals that cooperate with other policy priorities.

Some of the policy goals that should be achieved through energy subsidies include (IRENA, 2020, p. 14):

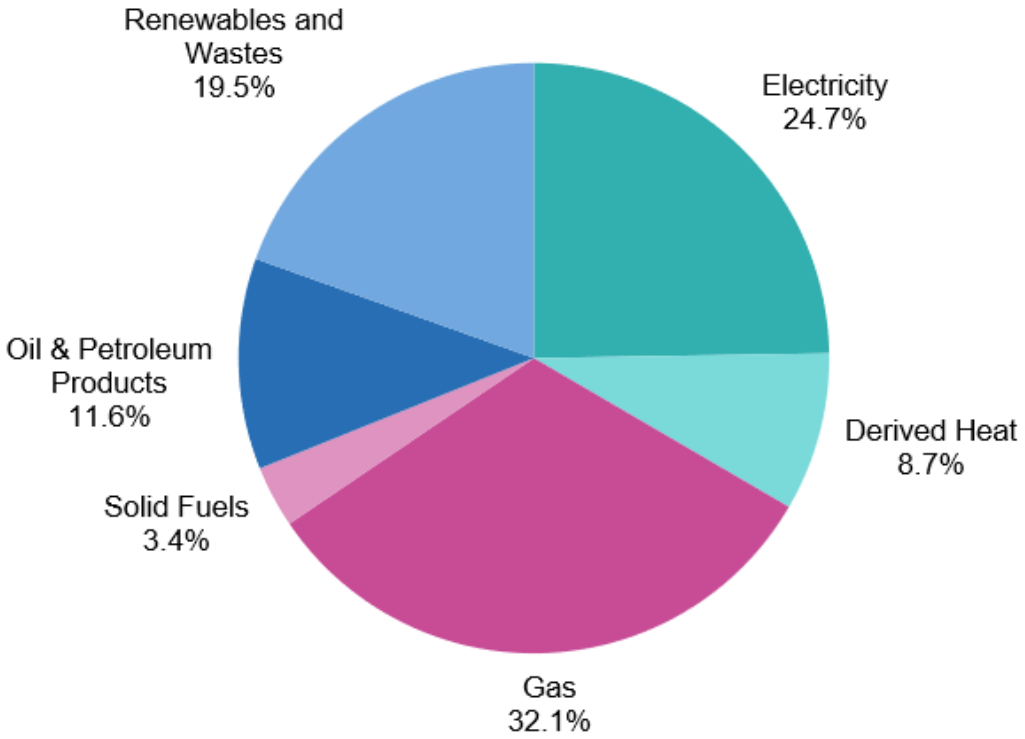
- affordable energy for vulnerable consumers;
- correct markets for unpriced externalities;
- lower the costs of new technologies and encourage the development of technology;
- reduce dependence on import and improve energy security;
- create new economic activity and jobs.

The goal by 2050, according to IRENA (2020), emphasises that the development of sustainable energy should redirect subsidies of the energy sector to subsidies that are environmentally friendly from those that are environmentally harmful. In the previous period, many existing energy subsidies focused on fossil fuels. Global subsidies to individual fuels have not been the focus of analysis of many institutions. Furthermore, the methodology used by these institutions, as well as subsidy definitions were different which led to difficulties in comparing data. This was the reason why key stakeholders were confused and not attracted to invest their resources in the reforms of policy.

1.4.4 Energy systems for electricity access

As Nussbaumer, Bazilian & Modi (2012) state, almost all services, for example, entertainment businesses, educational institutions, and communication technologies depend upon access to electrical power. Electricity, as one of the energy sources, is taking the biggest part in the composition of energy consumption in almost all parts of the world. Figure 2 presents the share of energy consumption in EU-27 countries in 2018.

Figure 2: Final energy consumption in the residential sector by fuel, EU-27 in 2018



Source: EUROSTAT (2020).

Natural gas and electricity are used the most in the EU 27 countries when talking about final energy consumption. Renewables and wastes are following with the smaller share in the final energy consumption in the residential sector. Finally, petroleum products, derived heat and solid fuels are used the least in the countries. The main energy source in the nine Member states is electricity when the word is about households' consumption. Furthermore, eight Member states mostly use renewable energy sources and seven Member states rely on natural gas (EUROSTAT, 2020).

1.4.4.1 Subsidising capital costs for rural grid electrification

The first issue that should be resolved regarding the provision of grid electricity in provincial areas is the minimisation of high capital expenses for supplying. Subsidies are the proposed solution to this problem. They include some downsides, yet they can provide the poor provincial areas with modern energy access. Poorly framed subsidies can send wrong signals to the consumers by supporting one fuel over another and create business discouragements for solutions to energy supply. Another downside is the top-down approach policy where consumers are not deciding which energy services are supplied to them. The challenge is to have subsidies that will be more effective and show results (Saghir, 2005).

Having subsidies introduced as a method is mainly focused on territories where more work is required. All things considered, it is turning out to be progressively evident that operating expenses should not be subsidised as an approach to stimulate provincial grid electrification. Global experts are proposing that subsidies for capital expenses are more beneficial and maintainable than those for operating expenses. Output-based aid (hereinafter: OBA) is a methodology being utilised to advance the use of public funds for the infrastructure services delivery, which turns to be very effective. Under this methodology, governments delegate service conveyance to an outsider under agreements that attach dispensing of public financing to the outputs or services conveyed to focused groups. Such methods are utilised by governments based on strategical subsidies in the sense of monitoring the financial state of certain clients to afford energy access, to legitimise public subsidising to supplement or supplant client expenses. The proposed guideline is to have grant subsidies accessible to energy service organisations for infrastructure access investing and, as important, some type of cross-subsidy of wealthier energy users to reduce the costs of the weakest population (Saghir, 2005).

1.4.4.2 Developing off-grid solutions

Most provincial area programs have the goal of connecting provincial territories to public or local networks. Having this grid providing electricity is not always the cheapest alternative, and different possibilities have to be considered before the implementation of the solution.

For individuals living in distant or difficult to reach zones where network supplies are not practical for costs, specialised, or institutional reasons, their use of energy for lighting is through LPG, kerosine, dry cell, and vehicle batteries, and, sometimes, little diesel or gas generators. Likewise, PV frameworks are ending up being progressively serious competitors by cost and service quality rules with these traditional fuel sources. Other promising ways to give power to new provincial clients apart from the use of the grid are starting to be introduced. Among recent off-grid power programs, a large portion of the new ideas has included a reserve for giving advances and subsidies to provincial communities, private businesses, or non-governmental associations that build up a feasible marketing strategy for giving rural power access. With given subsidies in electricity service, the business must exhibit that it can keep up budgetary reasonability while proceeding to serve the rural populace (Saghir, 2005).

Finance is critical to accomplishing SDG7, which intends to guarantee access to reasonable, dependable, maintainable, and modern energy for all. Nonetheless, less than a quarter of the required investment for ensuring universal electricity access is provided in the world. The circumstance of lack of funds for clean cooking is considerably additionally concerning (Sustainable Energy for All, 2017).

According to the United States Agency for International Development (2003), three methodologies for addressing adequately the needs of vulnerable households were inspected in the examinations at the Conference on "Energy Reform and Social Safety Net Approaches" held in Sofia, Bulgaria on October 2003. They are social assistance payments, tariff approaches and energy efficiency. The first one, social help payments, is the most frequent as all nations have used a lot of different social government assistance programs through history with various degrees of achievement in old system reforms. The second methodology refers to altering tariffs for low-pay family units or other intentions. This is utilised by few nations, however social tariffs change in their adequacy and alternative solutions are commonly suggested where conceivable. The third, energy efficiency measures that diminish energy use and expenses to families, merit to get larger recognition due to its documented successful experience. There is a significant space for energy efficiency initiatives pursuit to reduce excessive household consumption of the poor.

1.4.4.3 Social Assistance Payments

In accordance with United States Agency for International Development (2003), generally, the social well-being net in the transition countries was not based on needs and was vigorously impacted by political preferences. Because of this, recipient types were included as rewards for military, political, or other services that made noteworthy requests on accessible resources and occupied assets from those that have no income. To have a social government payment framework established on need has been a difficult endeavour. Moreover, it is politically troublesome because of the need to dispose of the enormous

classifications of beneficiaries. Ongoing budgetary restrictions have compelled the process of reform and truly limited all levels of government to address the necessities of the poor. Help for the poor and the improvement of a viable authoritative system to convey these strategies has been a persistent issue of practically meeting the needs of families that have no access to energy or resources. This is a huge ongoing shortcoming of the social payment system experiencing the reform.

Certain transition countries, such as Bulgaria and Romania in 2019, used financial assistance as a main social assistance program dedicated to helping those in need, such as income support, heating aid, or one-time grants. Income support in general is meant for the low-income households determined by a certain threshold. Heating aid is used during winter periods in a way of covering the heating costs of vulnerable consumers. And finally, one-time grants are being provided in exceptional conditions when extra costs are induced. For example, these extra costs include an increase in heating expenditures in winter or replacements of faulty or broken heating appliances (EU Energy Poverty Observatory, 2020).

1.4.4.4 Tax Approaches

According to United States Agency for International Development (2003), in the history of the transition countries, one of the biggest issues of the process of energy reform is that tax had no relationship to costs and was a significant social and political apparatus used by the past governments. Free or intensely limited power was given to judges, veterinarians, and so on, with no relationship to the cost of conveyance of electrical power or the need of the beneficiary. Tax change was by many administrations noted as one of the most troublesome political choices. Governments are occasionally hesitant to change taxes because financial levies mean higher energy bills for the administration itself. Additionally, government budgetary associations are usually poor payers. While most nations in transition have made huge progress with tax reform, further increments are required. Some nations, for example, Hungary, adopted a strategy that electrical power taxes are a monetary system to reflect costs, markets, and guarantee funds and quality. Also, addressing social issues through the tariff system is hard without degrading the economic goal of a cost-effective power system.

However, a few nations have endeavoured to utilise the tax framework to address the necessities of poor families. Still some issues regarding the points of interest, for example, simplicity of organisation, remain. Targeting is to some extent still an issue in terms of monetary decision-making and can have a negative effect on energy productivity. An extra danger would be pressure on the controllers to stretch out tariff subsidies to accomplish different purposes, e.g., uphold regional development, keep an inefficient industrial plants group working, and so forth. Most such methodologies are not efficient and bring numerous "free riders" (those that do not need help) and are an expensive method of giving help to the poor.

1.4.4.5 Energy Efficiency

The inefficient clients of energy are usually housing squares and social establishments like schools, orphanages, and hospitals that serve the poor populace. The beginning of transition was focused on the progress of energy supply framework reforms, and partially on the "demand" side, e.g., housing squares. The housing block similarity in construction and design across the region assists the exchange of successful experiences between nations. Despite the focus on the "supply-side", there are some effective energy productivity encounters. They exhibit that energy waste and expenses to families, including low-pay family units, can be decreased fundamentally. Recognition of energy efficiency measures to diminish household utilisation of either heat or power will profit wages and facilitate the effect of tax reforms. What is novel about the energy effectiveness approach is that there are one-time project expenses to execute and the advantages of decreased energy use and cost to families go on for a long time. The benefits of this methodology are clear, as opposed to the social assistance payments mechanism which requires annual payments.

1.4.5 Petroleum fuels

Many researchers have analysed what influences the selection of fuels utilised by a specific family unit. The conventional view on fuel changing in the family units in developing nations has been that families steadily climb the energy ladder. There is a straightforward movement from generally wasteful fuels and energy end-use gear to more productive energy power and equipment, with an increase in salary levels and urbanisation. However, recent findings show that household energy use in developing nations change from wasteful to more productive fuels and equipment is not a direct or unidirectional method as demonstrated by the basic energy ladder idea. Because of the need to build the security of supply now, family units sometimes, decide to utilise more than one fuel, and sometimes, the decision is subject to social, cultural, or taste inclinations (Pachauri & Spreng, 2004).

As Saghir (2005) highlights, enormous issues remain in modern fuel access, for example, kerosene and LPG. Almost 2.4 billion individuals in transition nations depend on wood, rural deposits, and dung for cooking and warming. Projections show that without more prominent endeavours to address this issue, the number will raise to 2.6 billion by 2030. According to Sovacool (2012), every one of these individuals must face the weaknesses of utilising traditional fuels. As noted, cooking with fuels, for example, biomass, which requires hours of gathering biomass fuels by women and children, is not as efficient as cooking with modern fuels, for example, LPG or kerosene. For instance, kerosene is 3 to 5 times more effective than wood for cooking, and LPG is 5 to 10 times more effective than crop remains and dung. Also, biofuels consumed in inadequately ventilated houses and inefficient stoves cause unsafe indoor contamination, with great danger for human well-being.

Bhattacharyya (2012) states that the promotion of liquid or gaseous hydrocarbons in the form of kerosene and LPG was the usual approach to shift from solid fuels used for cooking

purposes. In comparison to solid fuels, petroleum fuels produce less pollution at the point of use due to better efficiency of conversion. There is a competition between modern and traditional fuels, collected by the consumers, where modern fuels cannot incur any monetary expenses. Because of this, the main policy intervention was the subsidisation of modern fuel supply which was intended to change customer's consumption behaviour in favour of modern fuel. However, the use of kerosene requires some initial investment, compared to LPG, and the subsidy represents a significant incentive for unintentional product use (diesel smuggling and adulteration). Furthermore, Rao (2012) contends that the subsidy for kerosene acts regressively and that is more beneficial to the urban population, in comparison to the provincial poor that use it for lighting.

When it comes to the countries that depend on imports, supply subsidies can easily turn into a monetary issue. This refers to the price increase in the international market, where governments are working under different financial limitations, confronted with issues in keeping up such endowments in the long run. These subsidies become almost impossible to eliminate over time. Further, this issue of supply chain did not get sufficient consideration, suggesting that in any event, when purchasers chose to utilise the modern fuel, its consistent accessibility was not guaranteed. The issue emerged because of restricted demand of such fuels from poor families, suppliers under the state control had a weak organisation for rural supply and monetary sustainability because of high exchange costs.

However, technology developments have occurred also, as reduced sizes of bottles for LPG which made transportation simpler and reduced the initial costs, just as the periodic costs. Furthermore, there were involved coloured products for various markets for adulteration prevention as well as the funding for the initial investment in equipment acquisition and connections.

It was estimated that to guarantee cooking, energy access for all will build the oil demand by just 0.9 million barrels per day (against 87.4 million barrels per day worldwide demand in 2011). The long-term manageability of this methodology is uncertain because of price instability in the global market, expanding foreign trade and subsidy prerequisites. One should note, though, that, while LPG can still be useful, it is probably not going to rise as a worldwide solution for all rural areas (Bhattacharyya, 2012).

1.4.6 Biogas

As per IEA's (2017) projections, LPG and biogas arrangements can give clean cooking access to 1 billion individuals by 2030, generally in metropolitan regions. Biogas choice promotion has been recognised especially from oil-importing nations. The monetary rationale is on the basis that the utilisation of local assets can spare foreign trades, limit introduction to variances in worldwide market prices, while simultaneously gives clean energy. According to Bhattacharyya (2012), China is the number one in the world in biogas production and about 26.5 million biogas plants were utilised in the country in 2012.

According to Global Innovation Path (2018), China is still one of the biggest producers and consumers of biogas energy, with 50 million households in rural areas powered by biogas. As IEA (2020) states China is producing almost one-third of the world's total biogas and is planning to increase the production from 7 million tonnes of oil equivalent (hereinafter: TOE) to nearly 17 million TOE. States in South Asia, such as India, Sri Lanka, and Nepal likewise use biogas in smaller amounts. For instance, around 4 million biogas plants are working in India. The utilisation of biogas is additionally expanding in some more countries, such as Vietnam, Brazil, and Tanzania (Bhattacharyya, 2012).

The advancement of biogas is certainly not a rapid solution. It took over 40 years for China to arrive at its status as a leader. Even though biogas was advanced during the 1970s, its quick improvement began during the 1980s. During this time, a move was made towards an incorporated energy methodology and provincial energy management. A management plan detailed system was created to execute the strategy. It included innovative work, development, pilot studies, preparing and setting up a framework for manufacturing, adjusting and sale of the plants. Investing in the know-how of talented specialists and task staff and the presentation improvement through feedback circles were basic variables as well. The presence of a huge manufacturing base has additionally permitted the state to exploit the innovation. Continuous demand growth and scale and scope economies exploitation, as a consequence, have brought lower supply costs, making it more reasonable. The monetary help from the government likewise made a difference. According to Bhattacharyya (2012), the Central Treasury in China, measured in Chinese currency, contributed 61 billion Renminbi (hereinafter: RMB) in the period between 2003 and 2010 for this reason. Somewhere in the range of RMB 800 and RMB 1,200 per family is given as a subsidy towards biogas plants. It was demonstrated that about half of the biogas plants on the planet are not in function because of the weak maintenance of existing facilities. Consequently, future technology projects depend on sufficient networks for servicing development. They likewise contend for adaptable plans to decrease reliance on livestock manure, cost decreases, and upgraded usefulness with an accentuation on indoor contamination decrease to improve the appearance of biogas plants later.

2 ENERGY POVERTY

2.1 Definition of energy poverty

According to Bazilian, Nakhooda & Van de Graaf (2014), energy poverty is almost always discussed by primarily understanding the problem of lack of energy access. Some others even emphasize the relationship between energy access and development, as preconditions for the reduction or elimination of energy poverty. Energy poverty is a problem more widespread among the world's population than the previously elaborated lack of energy access and that energy poverty is considered to be one of the most widespread problems, in

general, affecting a high proportion of the world's population today. One can view energy itself as a central precondition to resolving many challenges that affect development, such as poverty in general, health, education, and even climate change (Nussbaumer, Bazilian & Modi, 2012). The term energy poverty is, however, not new, and can often be viewed as a synonym for the term fuel poverty, which is a common term used in earlier literature. However, fuel poverty is usually used in connection with electricity pricing and social equity, where the inability to pay the electricity bill is considered to be a symptom of poverty and inequality more generally.

Defining energy poverty is not as easy as it may look like, as countries have been given the choice to choose the definition that best describes the problem that they themselves face. Many definitions tackling energy poverty exist, and the problem with these definitions lies in the fact that they are very different, making the problem of measuring and comparing energy poverty, which will be explained later in detail, very serious. According to Robić (2016), the inability of the household to secure adequate amounts of energy in their living space, in addition to having an access to necessary energy services so that everyday requirements can be met can be defined as energy poverty in its general terms. However, here the main problem that arises is defining and measuring what the adequate amount of energy is, as it varies among different cultures and different geographical locations. The universally accepted definition for adequate heating, for instance, is 21 degrees Celsius (hereinafter: °C) in the living room, whereas in other rooms the temperature should be set to 18°C. It is important to emphasise that energy poverty does not refer only to heating (even though the focus has been given to the problem of inadequate heating), but to all uses and types of energy in the household.

Other commonly used definitions of energy poverty include the United Nations Development Programme (hereinafter: UNDP) definition where energy poverty is viewed as an inability of cooking and using modern cooking fuels with the absence of a minimum of electricity that should be used for reading or other activities that are produced after the sunset (Sovacool, 2012). According to Masud, Sharan & Lohani (2007, p. 47), energy poverty can be defined with taking a broader approach, and is "the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development". Boardman's (2009) definition is one of the most well-known and commonly used definitions of energy poverty in the world and is often called the *Ten-Percent-Rule*. One should be aware that this definition defines energy poverty in terms of fuel poverty and states that the household is energy poor if it needs to spend more than 10% of its revenues for energy costs, in order to keep the warmth in the home on the adequate level. The definition, even though problematic nowadays, is still used. The problems of Boardman's definition lie in the fact that the estimates of energy poverty grounded on the assumptions of 10% of the revenues are problematic (Agić, Agić & Kunto, 2017). The United Kingdom (hereinafter: the UK), as one of the leaders in the solutions for energy poverty, used Boardman's definition of energy

poverty until 2013, when the new Law on energy was passed and adopted. This law is important because, later, the new definition for energy poverty was adopted. The definition called Low Income High Cost (hereinafter: LIHC) defines a household as energy-poor when it has energy (fuel) costs which are above the national average and if the revenue, that is left after spending the revenues on the energy costs, is under the official poverty line. It is important to emphasise that, when comparing the LIHC and Boardman's definition, the LIHC definition is less problematic, and the main differences lie in the fact that the LIHC definition compares the state average of costs and revenues taking into consideration the number of households that have both high energy costs and low revenues, as well as the depth of energy poverty in those households (Agić, Rizvić & Agić, 2016).

Even from the used definitions, it is evident that these definitions, even though they have certain similarities also have a lot of differences and can be interpreted differently. According to Pachauri & Spreng (2011), no matter the definition used to describe the problem of energy poverty, true progress cannot be made until not only the problem of energy poverty is mitigated, but also the problem of sustainability of solutions to the problems is solved. Many authors, including Robić (2016), emphasise that energy poverty is such a complex problem that involves many factors that can determine if a household is energy poor or not. Therefore, it is evident that the first step, in order to eradicate energy poverty is to form a universal definition that should include all the factors connected with energy poverty.

Unfortunately, current actions to decrease and solve the problem of energy poverty, in general, are not so successful, not in terms of the scale of resolving the problem, nor in terms of the pace. It is almost certain that more people will be without access to modern energy services in 2030 than today, which almost certainly means that more people will be energy poor. In order to change this, it is evident that broader commitment from communities around the globe is required. One should note that policy priorities and economic conditions are some of the factors that condition the challenges of energy poverty and create specific problems, that need to be solved using a diversity of solutions. For many, as it has already been said, energy poverty can be observed as one of the aspects of general poverty (Nussbaumer, Bazilian & Modi, 2012, Kaygusuz, 2011).

2.2 Measuring energy poverty

In accordance with the fact that many definitions of energy poverty exist, it is inevitable that many different ways of measuring energy poverty exist. In accordance with this, Bouzarovski (2014) emphasises that the difficulties connected with the problem of energy poverty definitions are much more easily solved in comparison to the difficulties with its measuring. The problem of measuring and properly determining the levels of energy poverty is, actually, not a new problem, as it is considered to be a private problem for most of the

energy poor. Also, it is different for different geographical areas and changes and varies over time and is sensitive when looking at it culturally.

Nussbaumer, Bazilian & Modi (2012) argue that number of efforts to measure energy poverty both qualitatively and quantitatively exist because they depend on a broad set of factors that can be taken into account while trying to find a proper measure of energy poverty. Such factors may depend on the culture and associated practices, climate, levels of energy that is being consumed, types of energy sources that are both reachable and used, and many others. It is quite clear that the issues connected with the determination of proper measurement of energy poverty are connected with the issue of data availability, assumptions for the created models and methodology used.

Bouzarovski (2014) argues that three main approaches in the context of measuring energy poverty exist and are being used. The first approach examines the level of energy services used in households such as heating, cooling, lighting, by measuring those services directly and then comparing the values attained through the measurements to the standard that is already given. This approach is, however, not used in the EU, as many authors, including Bouzarovski, connect it to certain ethical matters and technical problems connected to the implementation of the said approach. Also, it should be noted that this approach can be problematic when defining the adequate level of energy services, as this is different between different cultures, countries and geographical areas. However, national statistical agencies do collect the expenditure data, especially in the EU through the European Statistical Office's (hereinafter: EUROSTAT) Statistics on Income and Living Conditions (hereinafter: SILC) survey. The second approach analyses the patterns of household energy expenditures visible while examining the total population and how they vary when comparing the absolute and relative data. The third approach is based on people's subjective opinions and impressions. What is measured and examined by the third approach are the opinions of households regarding the levels of energy services used in their home.

González-Eguino (2015) also emphasises the use of three different approaches which are, in the opinion of the author, complementary to each other, but can also be used as alternatives. The approaches being used focus on energy poverty by focusing on energy access in relation to three different thresholds: physical, economic and technological threshold. The first approach, physical threshold, is based on estimations and calculations of the minimum of energy that one should consume in order to have basic requirements, which is similar to the approach explained by Robić (2016) and the WB, where anyone under a certain threshold is classified as an energy-poor individual. However, the problem with this approach is also connected with the problem of determining what a basic requirement is. The approach of measuring energy poverty through the determination of economic threshold is the approach where the maximum percentage of income that one should spend for energy is measured and defined. This approach is actually connected with the Boardman's definition of energy poverty and is, to this day, still the most commonly used measurement, especially in the developing countries that are facing the problem of energy poverty in higher gravity than the

developed countries are. The problem with the measurement of this kind is that it is not comparable among different countries, as different countries are in different economic situations. Finally, the third approach, the approach of measuring energy poverty through the determination of technological threshold is an approach mostly connected with the problem of energy access. In other words, energy poverty can be and is measured by the determination of the exact number of people who have no access to modern and clean energy services. However, one should still remember that this approach only takes into account electricity and other energy sources except biomass used for home heating and cooking. The disadvantage of this approach lies in the fact that it does not provide any information regarding the level of energy consumption in total.

Pachauri & Spreng (2011) use the solution where a couple of basic methods to measuring energy poverty are used. These basic methods estimate the number of energy-poor. The first approach to the estimation of the number of energy-poor relies on presenting an energy poverty line by determination of conventional income or by determination of the measure of expenditure poverty. What this approach does is that it uses the calculation of the average energy use level that is in correspondence with the amount of conventional income or with the amount of expenditure. Here, energy use is being viewed as a function of either expenditure or income. One can argue that this approach is simple for use and that this is its greatest merit, while its greatest flaw is it only shows a single energy poverty line, which is not enough to provide important data or to bring new perception on the overall problem of energy poverty and ways how to possibly resolve it. The second approach to the estimation of the number of energy-poor is derived from engineering and the way direct energy that is required for basic needs satisfaction is determined. This approach is most popular with the authors who view the energy poverty problem mainly as a problem of energy access. This is because efforts to properly measure energy poverty are, in most cases, very connected with the absence of access to energy sources.

What Nussbaumer, Bazilian & Modi (2012) underline is the importance of the provision of a direct measurement that should segregate important aspects of energy poverty. They provide several suggestions which emphasise the importance of creating a methodology that should investigate the problem of energy poverty by investigating the energy services used in households for meeting the energy needs, one of which being the Multidimensional Energy Poverty Index (hereinafter: the MEPI), which focuses on quantifying the energy deprivation and not focusing on the energy access. The thing that distinguishes the MEPI metric from other metrics is that it gives focus to the energy services and bases its methodology on the energy deprivation data through the five dimensions of most basic energy services and six indicators. In addition to this, the MEPI metrics cover both the number of those who are energy poor and the intensity of their energy poverty. One could, in fact, conclude that this could be viewed as one of the most important advantages of the MEPI metrics. What is important to remember is that the emphasis on the problem with the already used measures of energy poverty is because they are usually focused only on the

supply-side data and elements, whereas demand-side data and elements are overlooked and not taken into consideration. Also, the problem lies in the algorithm of the measurement which should be constructed in a manner to include both qualitative and quantitative measurement.

When looking at the problem of measurement of energy poverty at an international scale, not much has been done to develop an internationally comparable set of measures of energy poverty. IEA, WHO and UNDP are some of the organisations that have recognised the need for the development of an internationally comparable set of energy poverty measures. Hence, in order for the problem of energy poverty to be solved or even mitigated, one should be aware that much more needs to be done, especially in the field of creating comparable and useful energy poverty indicators as highly aggregated indicators alone are usually not very helpful (Pachauri & Spreng, 2011).

2.3 Energy governance and poverty: institutional standpoint

In order to understand the gravity of the widespread problem of energy poverty, one should understand that the solution to the problem can only be found through the involvement of different institutions, such as government agencies, non-governmental organisations (hereinafter: NGOs), development organisations, political institutions, as well as other actors. These institutions need to be involved in series of programs, aiming at creating opportunities for energy-poor in terms of creating clean and modern access to energy services and eradicating energy poverty in general. When talking about energy governance from an institutional standpoint, Johnson (2013) implements the so-called "ecosystem" approach which can best be explained as a network that needs to be connected between different organisations, institutions, processes and people in order to incorporate solutions for energy poverty mitigation and to efficaciously overcome all barriers and problems that may arise.

In accordance with this, Bazilian, Nakhooda & Van de Graaf (2014) argue that a minimum of three requirements from the institutions of energy governance in terms of eradicating energy poverty are needed. These requirements refer to the quality of services provided, its affordability, and the possibility for access to said services, however, not necessarily in this order. First, access to clean and modern energy services in a physical sense needs to be ensured in order to meet the needs of the poor. Johnson (2013) emphasises that availability of the energy actually represents one of the dimensions of energy supply. The physical aspect of the availability of energy through energy access can be viewed by observing if one has a connection to electricity or is connected to the grid. However, in order to understand energy access as one of the requirements, one should, also, remember that there is much more to it than a simple physical connection, or physical availability. Other dimensions of access to energy supply include affordability, quantity and quality of services provided, as well as the sustainability of energy supply. According to Bazilian, Nakhooda & Van de Graaf (2014),

the second requirement is actually related to the dimension of affordability and represents the second "step", whereas the third requirement is related to the dimension of quality which also includes the rest of the dimensions.

The contemporary understanding of energy governance and institutional standpoint as actors of change and development in terms of energy poverty eradication is similar to the mentioned Johnson's "ecosystem". It is important to understand that the contemporary governance range needs to be observed as a model with a diverse range of actors with a diverse range of mechanisms that could be implemented, acting as a collective. This is a crucial change in the contemporary world, as the traditional understanding of energy governance included only the work of institutions inside the country, through the so-called, interstate relations. In accordance with this, many authors, such as Bazilian, Nakhooda & Van de Graaf (2014) identify institutions whose work is connected with the problem of energy poverty. Even though the list of institutions can be much wider, in accordance with Bazilian, Nakhooda & Van de Graaf (2014, p. 4), few institutions will be mentioned, and those are:

- global institutions;
- regional institutions;
- national institutions and
- cross-cutting and local institutions.

The roles of these institutions will be elaborated in the next sections, where the importance of global, regional, national, and cross-cutting and local institutions will be explained in more detail.

2.3.1 Global institutions

Global institutions are particularly interesting when analysing energy poverty and the role of the global institutions, as they are different when looking at their main activities. Some do specialise their work in the problem of energy poverty, whereas for others energy poverty is just a consequence of another activity that can be viewed as a core activity for them. One thing that is common for these institutions is the fact that they act, as their name already says, globally, meaning that they cover both developed and developing countries all over the world. This means that the global institutions have a wider picture of the problem itself, which can be used as an important advantage as the problem of energy poverty is a global problem itself.

Energy poverty is usually more covered by international agencies specialised in working with the widespread energy poverty problem. Most of these agencies are closely connected with the problem of energy poverty itself, as their core activities include energy in general, as well as certain energy technologies and these activities cannot be separated from the problem of energy poverty itself. Some of these institutions include the United Nations

Environment Programme (hereinafter: UNEP), International Renewable Energy Agency, Sustainable Energy for All, or the most well-known UNDP. All of these international institutions are currently dealing or have dealt with the matters and problems connected with energy poverty (Bazilian, Nakhooda & Van de Graaf, 2014). Out of these institutions, International Renewable Energy Agency is perhaps the institution with the most work dedicated to finding the solution for the rising problem of energy poverty. The vision and mission of the International Renewable Energy Agency is the adoption of different forms of renewable energy in order to promote universal energy access, sustainable development and mitigation of energy poverty. What is important to mention in the context of renewable energy is the importance International Renewable Energy Agency gives to it in the perspective of resolving and mitigating energy poverty. It is the belief of the International Renewable Energy Agency that renewables are crucial to ending energy poverty in the world.

Next to these institutions which deal with the problem of energy poverty, either directly or indirectly through their activities, different financial institutions are also one of the drivers of finding the solutions to the problem. One of them is the WB, which has, in the past decade, given a lot of attention to the financing problem of energy poverty, which is, also, considered to be one of the most challenging problems and one of the reasons why a lot of players that could resolve the problem faster are choosing to ignore it. One should probably remember that institutions such as the Organisation of the Petroleum Exporting Countries (hereinafter: OPEC) are also one of the global institutions which are supporting energy poverty projects. What is interesting to mention is that OPEC, even though it is the institution whose main activities are connected with fuels and the supply of fuels, both supports and funds projects for mitigation of energy poverty in the developing countries (Bazilian, Nakhooda & Van de Graaf, 2014). For example, the OPEC Fund was created in order to support energy access and help mitigate energy poverty worldwide. One should remember that in 2019 approximately USD 515 million was implemented in different operations in the energy sector through commitments to the public sector, private sector and grants. Some of the latest projects funded by the OPEC fund include the energy access projects in Madagascar and Rwanda which were approved on December 16th, 2020, and are still ongoing. These projects in particular indirectly contribute to the mitigation of energy poverty, through the enhancements in the field of energy access (OPEC Fund for International Development, 2021).

When talking about the global institutions' certain clubs, partnership institutions, as well as different international policy processes exist and all these institutions play a crucial role in the investigation and resolving the problem of energy poverty (Bazilian, Nakhooda & Van de Graaf, 2014). The role of these institutions is extremely important, especially now when everything is globalised, and in order for the problem of energy poverty to be mitigated, or in order for universal energy access to be ensured, these institutions need to be even more involved than they are today.

2.3.2 Regional institutions

When describing regional institutions dealing with the problem of energy poverty, one usually describes certain development banks acting in certain regions, as well as regional groups and trading blocks and bilateral agreements, usually made between countries in the same regions. What separates these institutions from global institutions is the fact that they are able to engage only in certain regions and not globally.

Development banks acting in certain regions are extremely important and are similar to explained global financial institutions. One should remember that regional development banks have just recently recognised the problem and the need to resolve it and participate through its both finance and technical assistance, and all for the purpose of resolving energy poverty and helping the vulnerable consumers in the regions where they are active. On the other hand, regional groups can be viewed as equally important when talking about the impact they have on mitigating the problem and finding possible solutions. The main importance and distinction of these groups is the fact that they refer to certain regional political organisations, as the energy governance itself is closely connected with the political standpoint. For example, the Association of South East Asian Nations is one of the best examples of regional groups and regional cooperation where secure and sustainable energy is one of the key goals to be met by 2040. What is especially important for the countries of South East Asia is their diversity, which makes this regional group even more important, and it is important to mention that all the countries in this region have taken some steps in order for the goal of secure and sustainable energy to be met. When talking about the energy projects one of the most important projects implemented in this region refers to the idea of a regional power grid (Bazilian, Nakhooda & Van de Graaf, 2014).

It is clear, that for every country and every region, political incentives are of great importance. Hence, even for energy poverty, regional groups such as political institutions can be drivers of success or failure of energy poverty programs. Regional bilateral agreements can also be one of the products of the existence of regional groups and, in this context, refer to certain agreements between countries that govern all questions related to energy. These questions usually refer to energy supply. Therefore, energy poverty issues are a product of these questions and, hence, bilateral agreements need to be understood better than they are today so that they could be structured in a way that will address the energy poverty issues (Bazilian, Nakhooda & Van de Graaf, 2014). Even today, most bilateral programs are only focused on the fixed capital assets, as well as providing experimental technologies to those who later on have no use from these technologies, as they are not constructed in a way to fulfil their need in the long-term, as they are mostly not constructed to be self-sufficient and self-sustainable, making the effort ultimately untenable (Sovacool, 2012).

2.3.3 National Institutions

Institutions such as governments, public enterprises, national banks, or energy regulators are especially important for the issue of energy poverty, in addition to the issue of energy access. This is especially true for most developing countries, as these countries have, or could have, most benefits from national institutions such as these. One should keep in mind that in the majority of developing countries national institutions can have a greater impact on resolving the problem of energy poverty, as they represent key players in most of the sectors, especially in the energy sector. Hence, one should be aware of the importance of national institutions when talking about energy in general, or energy poverty as a globally widespread problem.

National governments and public enterprises in developing countries have a central and crucial role regarding the energy itself, as they are, even today, involved in the governance of energy-connected institutions or providers. Their involvement is crucial as they are the major shareholders in energy companies and utilities in developing countries, as most of the developing countries are in the beginning stage of energy sector reforms, such as liberalisation of the energy market itself and privatisation of energy companies and utilities. For many national governments in developing countries energy poverty, as an effect of energy governance, is a political priority. However, the situation in practice is quite different as national governmental bodies and political actors are not doing approximately enough to address the problem or try to find the solution for the problem of energy poverty. Energy regulators, as one of the most important institutions and also one of the most important fruits of energy poverty reforms, represent mediators with independent insight and opinions regarding the work of national governments and public enterprises. This is significant because energy regulators can have a crucial role when ensuring that these national bodies are addressing the problem of energy poverty by harmonizing what should be done in theory and what is being done in practice. In other words, energy regulators regulate the work of national governments and public enterprises by managing and setting up standards for the quality of provided energy services as well as monitoring the situation in practice. In addition to national governments, public enterprises and energy regulators, another important national institution which has a significant role regarding the problem of energy poverty are national banks and other national financial institutions whose role is mostly connected with financing energy poverty programs. Through financing these programs, national banks and other financial institutions enable investments towards the energy sector in general which as a direct, or indirect effect has an improvement in energy access and mitigation of energy poverty. In addition to this, they can provide very much needed finance for energy vulnerable consumers (Bazilian, Nakhooda & Van de Graaf, 2014).

2.3.4 Cross-cutting and local institutions

The cross-cutting and local institutions have yet another important role in the society regarding the problem of energy poverty, varying from the global to the national level.

According to Bazilian, Nakhooda & Van de Graaf (2014), civil society, actors from the private sector, as well as other local institutions can be classified as cross-cutting institutions. Civil society, as one of the actors representing cross-cutting institutions, is an important actor as the great share of the stakeholders can be engaged in cooperation on a wider area covering poverty alleviation, including the energy poverty and energy poverty-related issues such as the problems women and children are facing as a direct result of energy poverty, or the energy poverty connected climate issues. Civil society can especially be important in energy-poor societies as those that can help, such as government or political parties, can be engaged through the active work of the civil society. Civil society as a concept can be understood as a new approach that represents the middle between public and private actors. Private sector participants represent another cross-cutting institution influencing the energy sector and as such can have substantial consequences on vulnerable consumers and alleviate the problems these consumers are dealing with. On the other hand, the situation in practice, according to Sovacool (2012), is that majority of private sector actors are only concerned with profits and, hence, are not taking into consideration long-term opportunities which can arise after alleviating the problem of energy poverty. One should note that the private sector actors often do not even attempt to invest in areas with most vulnerable consumers, as these groups are often characterised by the lack of collaterals, as well as lack of access to commercial loans.

When talking about energy poverty mitigation, one should not forget local institutions, as there are numerous formal and informal local institutions connected with the energy in general, and acting as actors connected with the establishment of energy services for those who are most vulnerable and affected by energy poverty. Unfortunately, as the case was with other institutions, getting local institutions to properly function in favour of energy poor is not an easy task and, in order to alleviate energy poverty as a societal problem, more should be done to engage local institutions into performing functions needed for the problem to be solved.

2.4 Global trends in energy poverty

It is clear that energy poverty is an extremely complex problem, which is triggered by a number of different and complex factors. All the countries in the world, whether talking about developed or developing countries, are currently facing this problem. One should remember, though, that the problem of energy poverty among vulnerable households is especially present in the developing countries which are currently (or have been recently) going through changes in the field of energy reforms, such as liberalisation and restructuring of the market. This is especially hard for those households who are already facing all the difficulties that come along with their low income. For example, liberalisation and opening of the energy market, as well as the involvement of foreign capital will as a direct consequence have the real cost of energy for certain categories of energy consumers, which, for most of the developing countries, was certainly not the case. When looking at the problem

globally, one should take note that the energy poverty problem has just recently been recognised as one of the gravest problems affecting the population worldwide. However, the topic itself is, in most countries, viewed as "unattractive" and is, hence, neglected in almost every aspect. According to Sovacool et al. (2012), the discussion on energy poverty is largely ignored in most cases during energy meetings, especially in an Organisation for Economic Cooperation and Development (hereinafter: OECD) context. This is because the technologies connected with the problem of energy poverty include cookstoves, cooling and heating solutions, biogas units, and are considered to be "unattractive" and quite ordinary even though the use of these technologies, or the lack of it, affects everyday life for substantial number of people around the world.

Only recently, specific governmental and non-governmental organisations have given their attention to the problem of energy poverty through their involvement in programs for the enhancement of energy services for the poor, with the ultimate goal of eradicating energy poverty globally. However, there has been slight progress done in this field, as monetary funds and help needed to tackle the problem are not sufficient, especially in developing countries. Most of the funds are being directed to the commercial segment of energy provision. As the problem of energy poverty is predominantly a rural problem, even though each year more urban households are reported to be energy poor as well, efforts for reducing the problems which are associated with the use of traditional fuels are not sufficient. It is quite worrying that a significant percentage of people in developing countries (56% in 2011) rely exclusively on traditional sources, such as coal for cooking (Sovacool, 2012). Frankhauser & Tepic (2007) argue that the last two decades have been marked by an increase in those affected by the problem of energy poverty. One could conclude that the situation nowadays is not much better as the efforts being made are not enough. It is most likely that the affordability problems, highly linked with the problem of energy poverty, will get much worse even before they can get any better. Efforts that are being made, such as promotion and access to modern energy technologies in households, are itself not enough to resolve the problem completely, as the attention for resolving the problem on a higher scale has not been given (Sagar, 2005). In other words, despite the provision of modern energy technologies that can improve the lives of a significant amount of people around the world, what is needed is successful cooperation from every level, including a series of political and economic efforts that need to be implemented, which is extremely difficult as it implies cooperation between the private and public sector, as well as because it does not imply direct profit for either participant (Sovacool, 2012).

It is evident that significant effort needs to be done, in order for the problem of energy poverty to be decreased and, consequently, mitigated. Unfortunately, projections are that by 2030 more people, especially in the poorest parts of the world, such as Africa and Asia, will be energy poor, despite any progress in the field of provision of energy access. In order for the problem to be mitigated it is extremely important to bring the focus to those households

struggling the most, by identifying them and creating specific solutions for each situation and with the help of different organisations, both private and public.

2.5 The relationship between energy poverty and climate

Alstone, Gershenson & Kammen (2015) mark that the fast-growing problem of energy combined with the negative climate changes are two important challenges for the contemporary society of the twenty-first century. These problems have become so intertwined that it is almost impossible to talk about one without mentioning the other, and vice versa. At the end of 2015, as the Paris Agreement within the United Nations Framework Convention on Climate Change (hereinafter: UNFCCC) was held, all countries have commonly agreed to have a responsibility to decrease the emissions of greenhouse gases (hereinafter: GHG), in order to stop the warming of the world by more than 1.5 ℃. This responsibility affects the entire population, regardless of its income. The relationship between energy poverty and climate lies in the fact that the solutions for mitigating energy poverty, by helping those affected by it, are also solutions that can decrease the emissions of GHG, consequently decreasing the negative effects on the climate. Even though this may look like an absolutely ideal situation, it can be achieved by increasing the energy bills, as sources of clean energy are not common and come with greater costs. For those affected by energy poverty, these solutions may not look as good, even though they have positive impacts in the long run (Robić, 2016).

According to Smith, Zhang, Uma, Kishore & Joshi (2000), used biomass fuels in the homes of energy-poor, commonly produce grave products of incomplete combustion, that are considered to be GHGs, which means that even though biomass energy sources have been considered to be harmless and "eco-friendly" their use in energy-poor households influences the climate change in a negative manner. While making an analysis for energy-poor in households in India, it was estimated that every Megajoule (hereinafter: MJ) of the heat that is delivered emits two-thirds, in the carbon-equivalent, of GHG when compared to kerosene stoves. These results are estimated even when the households used "renewably" harvested wood because the wood was used on a mix of stoves that are being used in India. In accordance with this, when the household uses "non-renewable" wood or other "non-renewable" energy materials, the emission of GHGs is even higher. Sagar (2005) argues that the traditional belief that the use of biomass is "climate-friendly", which has traditionally been regarded as carbon-neutral, led to the lack of motivations for change and investment in solutions. One should note, though, that some rural renewable energy programs have been put in place, as some organisations have recognised that the implementation of renewable energy programs could help solve the problem of energy poverty and mitigate the negative climate changes.

Unfortunately, energy-poor people are entombed in a cycle where they are both starters and victims of environmental damage, influenced by climate change, meaning that they are the

ones that contribute more to the climate change damage, but also the ones that suffer from the consequences the most. The process that usually contributes to consequences of climate change usually begins with a simple wood or fuel gathering, that leads to degradation of the land, even deforestation, which is a grave problem in certain countries, then incomplete combustion of biomass and indoor air pollution, combustion of dirty fuels and outdoor air pollution, which ultimately, through GHGs, leads to global warming (Saghir, 2005). However, another important fact connected with this problem is that, even though access to the energy services is an important driver for the development, growth and overall high-value life of those without it, the emissions resulting from the networks and sources that are being delivered to those who are vulnerable are actually one of the principal drivers of negative climate change in the world. Hence, it is not just important to connect vulnerable consumers to the grids, but also to connect them and provide them with high-value and clean energy services (Alstone, Gershenson & Kammen, 2015).

It is apparent that, in order to fight the negative consequences of climate change, such as global warming, energy efficiency programs are one of the solutions that are necessary. The consequences of the implementation of energy efficiency programs are dual, as they influence both the problem of energy poverty and the problem of global warming (Schuessler, 2014). In other words, the energy sector has a crucial role in reducing the harmful effects of climate change by presenting renewable and clean energy sources, modern fuels for cooking, clean fuels, and, thus, increasing energy efficiency (Saghir, 2005). However, one should also remember that, because of the fact that these problems are most present with the rural poor, authors, such as Sagar (2005), believe that it is not so likely that the institutions and developers will dedicate much attention, time or money to solve the problems of rising GHG emissions in those areas as the transaction and related costs are just too high for them. However, this is the approach that focuses only on current, short-term financial consequences. Casillas & Kammen (2010) strongly argue that every dollar of support that is spent on the change to clean energy systems and sources results in even greater potential for the development and even savings for both those most vulnerable and those providing the energy.

2.6 Causes, signs and consequences of energy poverty

Poor households are mainly also energy-poor because they are not able to invest in home maintenance, repairments and insulation, which means that their houses and apartments require more to, for instance, be adequately heated. As the problem itself has become more recognised in countries around the world, the causes of energy poverty have been found in energy inefficient households who pay high prices of energy and are earning significantly less (Robić, 2016). In other words, this means that, usually, three main causes of energy poverty are (Rizvić & Agić, 2018, p. 8):

- low household income;

- high energy prices and
- low-quality accommodation and low levels of energy efficiency.

The signs that can be viewed as the signs of energy poverty in a household are (Rizvić & Agić, 2018, p. 8):

- low income (one or more members of the household receiving pensions or social help);
- inability to adequately heat the home;
- older houses and buildings which imply worse energy efficiency;
- late or no payment of utility energy bills;
- damp walls and floors;
- rotten or damaged window frames;
- absence of central heating;
- high energy costs in comparison to income and
- living in low-quality accommodations.

There are a lot of consequences of energy poverty, and each consequence is of great severity in some way. Saghir (2005) underlines the severity of energy poverty, as well as its broad impact on human lives, from its influence on poverty, income, health, education, environment, gender equality, and social and economic development. For example, when talking about consequences of energy poverty, and according to Rizvić & Agić (2018), financial difficulties are the first direct consequence of energy poverty as energy-poor households use social help as well as other means for financing living, such as debts or loans, and use the funds to pay energy bills. The funds used for energy bills would usually be used for living, food, education, and for other things. Another financial aspect connected with energy poverty is a more contemporary situation where the energy-poor spend significant amounts of both money and time for mobile phone recharging. As the use of mobile phones is significantly growing in numbers each year, one should remember that both lighting and telecommunications can now be considered to be basic necessities and, hence, people, including energy-poor, are willing to pay more for the provision of these services (Alstone, Gershenson & Kammen, 2015). González-Eguino (2015) argues that the impact of energy poverty on the economy is severe, as it has an effect on all production sectors, and it is known that the production sector is one of the most important drivers of economic development. For example, in energy poorer countries the agriculture sector mainly consists of human and animal labour, whereas in energy richer societies the agricultural sector mainly consists of machines which directly use energy and are able to yield more crop. On the other hand, energy poorer societies struggle to advance and develop because of the lack of energy and, consequently, cannot use the much-needed help. Educational effects of energy poverty are not uncommon and relate to the time that is spent out of school due to the inability to fund materials needed for it, as well as increased absence due to energy poverty-related diseases (Sovacool, 2012). One should be aware that the educational effects of energy poverty are connected with the economic consequences of energy poverty in a society. This is because

education is one of the crucial preconditions for the creation of businesses, which, consequently, help the economy to grow and the society to develop (González-Eguino, 2015).

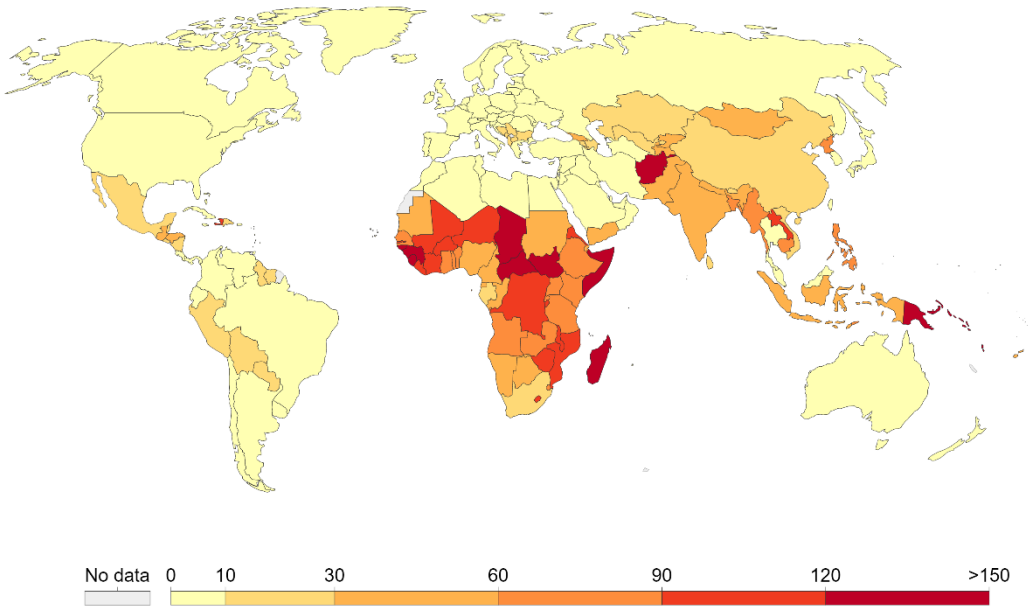
Rizvić & Agić (2018) argue that bad living conditions which usually include unheated or unventilated rooms that are usually damp and unhealthy, lead to many health consequences. Cold, which is widespread especially during winter, is not a factor of the disease itself, but has, however, several negative consequences for health. For example, in order to keep an adequate body temperature, a person needs to work more, which leads to additional stress. Coughing or sore throat also lead to the transfer of pathogenic viruses. All this can lead to different types of diseases such as respiratory diseases, arthritis, or cardiovascular diseases. Robić (2016) argues that the consequences of energy poverty that include a series of health and mental issues have a series of resulting problems, like children not going to or missing school or premature deaths of elderly caused by these consequences. The mental issues perspective of energy poverty is largely overlooked, and one can conclude that this health aspect of energy poverty needs more attention. However, the provision of modern energy services influences human mental health in a way that it promotes overall life satisfaction, optimism, vitality, social engagement, self-esteem as well as other psycho-social aspects of human life (Thomson & Bouzarovski, 2018).

Health consequences associated with energy poverty can be viewed as one of the most important impacts energy poverty has on humans. According to the WHO (2019), harmful microscopic particles in the air can damage the lungs, heart and brain and it was estimated that more people die from indoor pollution caused by burning biomass than by malaria or tuberculosis and slightly less than from HIV/AIDS (González-Eguino, 2015).

Indoor air pollution is considered to be one of the most direct and one of the most severe consequences of energy poverty, as it can best be explained as living with a “massive smoking cigarette”. One should emphasise that indoor air pollution is a complex problem, as it has many direct and indirect influences. Through ineffective burning of fuels in traditional or primitive stoves usually used in energy-poor households, dangerous and hazardous gases are created and spread indoors, usually in small rooms. This creates the level of hazardous gases as high as sixty times more than it is acceptable outdoor for huge cities in Europe or in North America (Sovacool, 2012). Indoor air pollution is an especially serious problem that affects women and children the most, as they are the ones traditionally spending more time inside the homes (Sagar, 2005), and it is projected that by 2030 as many as 10 million women and children living in the poorest parts of sub-Saharan Africa will suffer from premature death as a result of indoor air pollutions (Sovacool, 2012). In 2016, approximately 3.8 million people died from illnesses caused by indoor pollution which represents 7.7% of the population worldwide (World Health Organization, 2019). Indoor air pollution causes a wide spectre of associated illnesses such as acute infections of the respiratory system, lung cancer, asthma, tuberculosis, cardiovascular diseases, eye diseases, as well as problems in child birth and during pregnancy (Sovacool, 2012). The severity of

the indoor air pollution and the mortality worldwide in 2017 is visible from Figure 3, where countries coloured in dark red represent those countries where most people (per population of 100,000) die because of the health problems caused by the air pollution problem, and those coloured in lighter colours represent countries where least people (per population of 100,000) die because of the health problems caused by the air pollution problem.

Figure 3: Mortality from indoor air pollution in 2017 worldwide (per 100,000 citizens)



Source: Ritchie (2020).

Masud, Sharan & Lohani (2007) emphasise that even though diseases connected with indoor air pollution represent one of the most serious consequences of energy poverty, there are a number of other health consequences which are also influenced by energy poverty. Common injuries connected with energy poverty include foot damage, injuries, cuts, or even sexual assault of women and children in some parts of the world. It is important to emphasise that the provision of modern energy can resolve these problems both directly and indirectly. For example, Saghir (2005) underlines that the provision of electricity can enable health institutions to have operating "refrigerators" needed for vaccines, medical equipment that is operative and can provide treatments no matter the time of the day. This is important because the provision of operating medical tools and tools of mass communication are crucial in order to tackle the problems of HIV/AIDS or other preventable diseases, such as the outbreak of coronavirus.

Another grave consequence of energy poverty, which consequently has an influence on the climate changes and global warming, is deforestation and degradation of land. As energy-poor usually rely on biomass and wood, the demand for it, especially the demand for wood becomes higher than the ability to replace and grow new trees. This results in deforestation,

land degradation, and, in some parts, desertification. Even when the entire trees are not collected and used for energy needs, energy poor usually collect residue dungs, branches, and other materials that have nutrients much needed for the soil itself, damaging it in most cases beyond repair (Sovacool, 2012). According to Velumail (2011), the problem of agricultural production as a consequence of energy poverty refers to the fact that, in cases where the supply of wood is scarce, people use alternative energy sources, such as crops, which decrease the supply of food. In addition to this, the burning of crops also influences deforestation and land degradation as the land remains infertile.

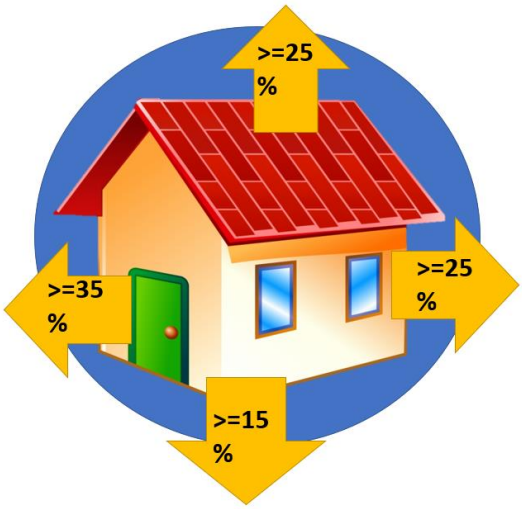
3 ANALYSIS OF ENERGY ACCESS AND ENERGY POVERTY IN THE EUROPEAN UNION

3.1 Definition of energy access and energy poverty in the European Union

In the EU, according to the assessment of the European Commission currently between 50 and 125 million energy-poor citizens exist, which can be viewed as a grave problem in the EU, considering that this means that every seventh citizen suffers from some sort of energy poverty (Agić, Rizvić & Agić, 2016). The state of energy poverty and lack of energy access in the EU was, until recently, considered not to be an issue at all, with the exception of former EU Member state, the UK, where the concept of energy poverty was recognised through the wider problem of fuel poverty (Bouzarovski, Petrova & Sarlamanov, 2012). Even though energy poverty has almost always been present in developing countries, what is important to mention is that the problem of energy poverty is not limited only to poor or middle-income Member states, but is prevalent even in the richest and most developed EU Member states (Schuessler, 2014). What is important to underline when talking about the problem of energy poverty and energy access among the EU Member states is that, for most EU Member states, there is almost no difference when observing urban and rural areas, as this is usually the case in other parts of the world (Ruggeri Laderchi, Olivier & Trimble 2013). Also, energy poverty issues are more present in the Mediterranean countries of the EU, such as Greece, Portugal and Spain, where one would expect this to be the case in the northern countries, which means that this situation can be partly observed as a paradox. The situation in the southern Mediterranean countries of the EU regarding the problem of energy poverty is more present and more severe compared to the northern countries because the southern Mediterranean countries traditionally lack adequate heating systems and have older buildings built with low-quality materials, and often with bad thermal isolation. For example, one study showed that nearly 25% of households in Portugal stated that they live in dwellings with old and rotten window frames, where approximately 33% of households stated that they were having areas of condensation on the indoor walls in their dwellings. Other problems that were mentioned were connected with the bad state of the roofs for which they reported leakages during the rain or for which they reported that they did not have any roof insulation. All these examples are usually considered as important indicators of energy poverty

(Bouzarovski, 2014). It was even calculated that the proper isolation of the home can save up to GBP 800 (EUR 897.06), as the heat cannot be maintained in dwellings with bad isolation. Figure 4. shows how the percentage of heat loss within a dwelling is spread (Liverpool City Council, n.d.).

Figure 4: Percentage of heat loss through the roof, walls, floors and windows and floors



Adapted from Liverpool City Council (n.d.).

However, when talking about the concepts of energy and fuel poverty, one should note that the term and the concept of fuel poverty has not been a preferred term among the other EU Member States, as over 70% of the EU Member states prefer the term energy poverty (Pye et al., 2015). One should keep in mind, though, that the terms are often used with the same meaning, even though these terms are not synonyms. Throughout this master's thesis, the term energy poverty will be used. Only recently, in the last decade, has more attention been given to the problem of energy poverty and energy access in the EU, with special emphasis on the energy-poor coming from Central, Eastern and Southern Member states, with the most attention on the energy poverty in Eastern EU Member states, whereas certain Western EU Member states, such as Germany, refuse to acknowledge the gravity of energy poverty in the country (Schuessler, 2014).

According to Agić, Agić & Kunto (2017), the concept of energy poverty in the EU has entered the EU legislation after the Third energy package, within the directive concerning electricity and natural gas markets with the help of a number of international organisations and other academics dealing and recognising the problem itself. After that, the Vulnerable Consumer Working Group was established by the European Commission, as the problem of energy poverty is becoming more pronounced. This group was established with the goal of determining the qualitative and quantitative review of the different aspects connected with vulnerability in the energy sector. This group is more connected to the specific problem of vulnerable consumers. However, as vulnerable consumers are a constituent and inevitable

part of energy poverty one should remember that it has an important role in the possible solutions of the problem.

The problem of energy poverty has been recognised recently only partly because of the recognition of different actors. Another determining factor was the fact that the prices of energy services grew, as a part of energy market liberalisation in the EU, which led to an increase in energy poverty and an increase in people being aware that they cannot pay for certain living preconditions, such as energy costs anymore (Robić, 2016). According to this, it is evident that much more needs to be done in order for EU Member states to first adopt and then use the definition, with the combination of measures to resolve the problem of energy poverty and energy access in their respective countries. As those who suffer from energy poverty or lack access to even the most basic energy services most often as a consequence suffer from negative health effects, it is most urgent that all EU Member states address the problem and adopt clear definitions and strategies so that those who suffer from energy poverty related consequences can establish the quality of living (Pye et al., 2015). This proves that energy poverty is a crucial societal problem and represents a challenge that should be addressed by the EU Member States with great urgency.

In accordance with the fact that energy access, and energy poverty as a more widespread problem in the EU, is a complex and wide concept, no universal EU definition of the problem exists. The EU legislation has given liberty to EU Member states to choose a definition these states view as the best for the problem itself. According to the ACER/CEER (2019) last issued Report on Consumer Protection and Empowerment Volume emphasises that in 2018 seven National Regulatory Authorities reported the presence of an official definition of energy poverty, which is one more than in 2017. Energy poverty definitions exist in Cyprus, Spain, France, Great Britain, Ireland and Romania, as well as Belgium which joined in 2018 with an official definition of energy poverty. Hence, there is a number of definitions being in use concerning energy poverty, such as those observing energy poverty through the lens of lack of access to modern energy sources or the definitions observing the problem by observing it as a function of the inability to heat homes properly, or definitions observing the inability to pay bills (Robić, 2016). Certain indicators have usually been connected to the problem of energy poverty in the EU and were considered for the empirical research across the EU and according to certain researchers should be included in the definition of energy poverty. These indicators can be classified in subjective qualitative assessments of those who are vulnerable, subjective qualitative assessments of other persons connected to those who are most vulnerable, objective indicators not based on expenses and indicators based on them. However, one of the most common and most used definitions of energy poverty is the *Ten-Percent-Rule.* This definition is characteristic and used in a high share of EU Member states because of its simplicity and intelligibility for the public. However, this definition is proven to be one of the most problematic definitions, as it does not determine the appropriateness of real energy used nor the nature of energy services used. Another problem with this definition is that it can show a larger percent of energy poverty in places

where this is not the case, such as in Germany, where, according to this definition, high levels of energy poverty are present (Schuessler, 2014). The problem of defining energy poverty leads to uneven use of terminology and the inability to measure the problem properly among different EU Member states. Hence, the problem of measurement is another problem arising from the uneven distribution of definitions used among different EU Member states.

Because of this, certain governmental actors and EU institutions such as EUROSTAT use few general indicators that have helped to measure the existence and gravity of energy poverty in the EU. The concept of those at risk of poverty has been measured through the data collected by the EUROSTAT whereas the definition for those who will soon suffer from energy poverty can be viewed as those households whose income is 60% of the median national income. This helped with understanding the overall energy poverty status in the EU Member states. Most important indicators are also created by EUROSTAT's SILC, which provided an important base for the comparison of the situation among the different EU Member States. Even though this is not a completely accurate way of measuring energy poverty and has certain limitations and weaknesses, it is still one of the best ways for energy poverty determination among different EU Member states. There are several SILC indicators used by EUROSTAT and those include the *Inability to keep home adequately warm*, the *Inability to keep home adequately cool, Living in homes with damp walls and leakages*, as well as having *Arrears on energy bills* (Pye et al., 2015). These indicators represent an important approach as energy poverty is not a one-dimensional concept and it is, hence, believed that it cannot be measured by using only one indicator, but a set of indicators instead. This is explained through the changes and different pieces of knowledge each of the indicators brings when researching the prevalence and measuring energy poverty. One should keep in mind that these indicators are, even though all important, not equal to one another. Hence, the division into the categories of primary and secondary indicators.

Inability to keep home adequately warm, Arrears on energy bills (utility bills), High share of energy expenditure in income, and *Hidden energy poverty* are categorised as primary indicators, as they capture and refer to different aspects of energy poverty, and are most commonly used in various researches. On the other hand, secondary indicators include prices of fuel, biomass, electricity, gas, or the research on the equipment of the dwelling during the summer or winter, presence of damp and leaks, and similar indicators are classified as such because either they are considered not to be as quality as primary indicators or they do not represent directly the problem of energy poverty and are only an indirect indicator of the problem (Thomson & Bouzarovski, 2018). When talking about energy poverty in the EU, it is important to note that, according to EUROSTAT's (2021a) SILC Survey, energy poverty in the EU is determined by four indicators marked as primary indicators and those being *Inability to keep home adequately warm, Arrears on utility bills, High share of energy expenditure in income (2M) and Hidden energy poverty*, as well as two secondary indicators which are being used with reference to cooling in the summer and those are *Summertime energy poverty* and *Space cooling difficulties*.

According to the EUROSTAT's (2021a) EU-SILC Survey, for the period 2010-2019, the occurrence of energy poverty, measured by the *Inability to keep home adequately warm*, for the many EU Member States, as well as EU average has remained relatively unchanged. *Inability to keep home adequately warm* is one of the most used energy poverty indicators in the EU, and is within the EUROSTAT's EU-SILC Survey covered through the question of *"Can your household afford to keep its home adequately warm?".* In other words, this is a primary indicator focusing on the subjective issues of thermal discomfort (Thomson & Bouzarovski, 2018). According to the EUROSTAT (2021a), in the observed period 2010-2019, the largest decrease in the energy poverty happened in Bulgaria, with a reduction of 36.4 percentage points, from 66.5% in 2010 to 30.1% in 2019, as seen in Table 2. However, the latest data from 2019, still represent the highest rate of energy poverty in the EU. When observing this period, it is visible that Lithuania has the second-highest rate of energy poverty, measured by the *Inability to keep home adequately warm*. In the period of 2010-2019, an increase of 1.5 percentage points is visible from 25.2% in 2010 to 26.7% in 2019. One should be aware that the decreasing trend is visible when observing energy poverty in Lithuania in the period 2015-2019. Greece is another EU Member State with a high rate of energy poverty of 17.9% in 2019, which represents a decrease when observing the period 2012-2019. However, when observing the period 2010-2019, it is visible that the increase of energy poverty in the amount of 2.5 percentage points is still significant considering that in 2010 energy poverty measured by the *Inability to keep home adequately warm* amounted to 15.4%. The decrease of energy poverty in 2019 visible in Greece is important because it represents progress, as another EU Member State notes its energy poverty levels higher than Greece. Cyprus in 2019 counted the level of energy poverty in the percentage of 21.0%, which is higher than the amount of energy poverty measured in Greece for the same period. When looking at the households in the EU, in 2019, overall, 7.0% stated that they are *unable to keep home adequately warm,* which is approximately 30,150,324 people and represents a decrease of 0.3 percentage points in comparison to 2018. When looking at the countries with the data for 2019 it is visible that most of them had a decrease in energy poverty measured by the *Inability to keep home adequately warm*. However, one should still note that certain countries such as France, the Czech Republic, Estonia, Malta, the Netherlands, Austria, Slovakia and Finland count a slight increase of energy poverty measured by this indicator.

Table 2: Inability to keep home adequately warm indicator 2010-2019 for the EU and selected EU Member states (share in %)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
EU (28 countries)	9.5	9.8	10.8	10.7	10.3	9.4	8.7	7.8	7.3	7.0(e) [1]

(table continues)

[1] (e) – estimated

(continued)

Table 2: Inability to keep home adequately warm indicator 2010-2019 for the EU and selected EU Member states (share in %)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Bulgaria	66.5	46.3	46.5	44.9	40.5(b)[2]	39.2	39.2(b)	36.5	33.7	30.1
Lithuania	25.2	36.2	34.1	29.2	26.5	31.1	29.3	28.9	27.9	26.7
Greece	15.4	18.6	26.1	29.5	32.9	29.2	29.1	25.7	22.7	17.9
Cyprus	27.3	26.6	30.7	30.5	27.5	28.3	24.3	22.9	21.9	21.0
France	5.7	6.0	6.0	6.6	5.9	5.5	5.0	4.9	5.0	6.2
Czech Republic	5.2	6.4	6.7	6.2	6.1	5.0	3.8	3.1	2.7	2.8
Estonia	3.1	3.0	4.2	2.9	1.7(b)	2.0	2.7	2.9	2.3	2.5
Malta	14.3	17.6	22.1	23.9	22.3	14.1	6.6	6.3	7.6	7.8
Netherlands	2.3	1.6	2.2	2.9	2.6	2.9	2.6(b)	2.4	2.2	3.0
Austria	3.8	2.7	3.2	2.7	3.2	2.6	2.7	2.4	1.6	1.8
Slovakia	4.4	4.3	5.5	5.4	6.1	5.8	5.1	4.3	4.8	7.8
Finland	1.4	1.8	1.5	1.2	1.5	1.7	1.7	2.0	1.7	1.8

Adapted from EUROSTAT (2021a).

The occurrence of energy poverty, measured by the indicator of *Arrears on utility bills* is another important and primary indicator helping researchers to identify energy poverty, especially in the EU. According to Thomson & Bouzarovski (2018), the *Arrears on energy bills (utility bills)* is covered through the question of *"In the last twelve months, has the household been in arrears, i.e., has been unable to pay on time due to financial difficulties for utility bills for the main dwelling?"*. Table 3 provides the data for the indicator of *Arrears on utility bills*, in the period 2010-2019. In the observed period 2010-2019, according to the EUROSTAT's (2021a) EU-SILC Survey, the occurrence of energy poverty, measured by this indicator, recorded a slight decrease. In 2019, Greece had the highest rate of presence of arrears on utility bills with the rate of 32.5% and in the observed period 2010-2019, this represents an increase of approximately 13.7 percentage points from 18.8% in 2010. According to Thomson & Bouzarovski (2018), Greece's rate more than doubled from 2010 to 2016 and was almost certainly an indicator of other economic issues. According to EUROSTAT's (2021a) EU-SILC Survey, one of the EU Member States where the changes of *Arrears on utility bills* were not significant was Bulgaria which, for the period 2010-2019, measured a slight decrease of 4 percentage points from 31.6% in 2010 to 27.6% in 2019, with the rate that places Bulgaria second next to Greece. Croatia is another EU Member State, whose energy poverty levels, measured by the indicator of *Arrears on utility bills*, are high and amounted to 14.8% in 2019. However, the situation for Croatia is different when comparing it to Bulgaria and Greece, as Croatia reported a decrease in energy poverty by 13.2 percentage points from 28.0% in 2010 to 14.8% in 2019. It is important to note that, out of selected EU countries, the Netherlands and the Czech Republic measured the lowest

[2] (b) – break in time series

rate of energy poverty of 1.5% and 1.8%, respectively in 2019. Also, as shown in Table 3, energy poverty in these countries decreased, in comparison to 2010, when the rates were 2.1% for the Netherlands and 4.2% for the Czech Republic. Overall, in 2019, 6.1% of households comprising approximately 31,219,800 residents in the EU stated that they are having arrears on utility bills and represents a decrease of 0.5 percentage points in comparison to 2018.

Table 3: Arrears on utility bills in the EU and selected EU Member states (share in %) in the period 2010-2019

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
EU (28 countries)	9.1	9.0	9.9	10.2	9.9	9.1	8.1	7.0	6.6	6.1(e)
Bulgaria	31.6	28.6	28.4	34.0	32.9(b)	31.4	31.7(b)	31.1	30.1	27.6
Lithuania	10.9	11.8	12.6	13.2	10.4	8.4	9.7	7.9	9.2	7.5
Greece	18.8	23.3	31.8	35.2	37.3	42.0	42.2	38.5	35.6	32.5
Cyprus	16.3	16.9	18.4	21.9	20.5	20.1	15.4	13.7	12.2	10.4
France	7.1	7.1	6.7	6.2	6.3	5.9	6.1	6.1	6.4	5.6
Czech Republic	4.2	4.3	4.1	4.0	4.7	3.0	3.0	2.1	2.1	1.8
Estonia	11.0	11.8	10.9	10.4	10.0(b)	7.9	7.9	6.3	6.5	7.2
Malta	6.8	8.6	10.1	11.6	14.6	10.2	9.5	5.6	6.9	6.5
Netherlands	2.1	2.4	2.3	2.4	3.0	2.7	2.0(b)	2.1	1.5	1.5
Austria	4.4	4.0	3.8	4.6	3.5	3.5	4.2	3.6	2.4	2.4
Slovakia	9.6	6.4	5.8	5.9	6.1	5.7	5.7	5.5	7.9	8.4
Finland	6.9	7.8	7.9	8.4	7.9	7.5	7.7	7.8	7.7	7.8
Croatia	28.0	27.5	28.9	30.4	29.1	28.7	25.3	21.0	17.5	14.8

Adapted from EUROSTAT (2021a).

According to the latest available data from 2015 presented by the European Commission (2020), the occurrence of energy poverty, that is measured by the *High share of energy expenditure in income (2M)*, is the highest in Sweden, with 28.7% of the population spending more on energy. Finland is another country which, according to this measure, has a *High share of energy expenditure in income*, and in the amount of 22.3%. When compared to the EU 27 average of poverty occurrence with the rate of 15.5% of EU household having a significantly high share of energy expenditure in income, the rates of Sweden and Finland are significantly higher, and almost double the rate of 15.5%. For this indicator, the EU average is much higher when compared to the EU average measured by the indicator *Arrears on utility bills* and the EU average measured by the *Inability to keep home adequately warm*. The problem with this indicator is that the latest data is from 2015. Before this data was published, data from 2010 was used for measuring energy poverty in EU Member states. Table 4 provides the data for the indicator of the *High share of energy expenditure in income (2M)*, for the period 2010 and 2015. According to Thomson & Bouzarovski (2018), in 2010, the highest share of energy expenditure in income was also found in Sweden with the rate of 17.7%, which means that from the period 2010-2015, the rate has increased by 11.0

percentage points. Another EU Member state that had the *High share of energy expenditure in income (2M)* in 2010 is Lithuania, with the rate of 21.4%. However, the rate of energy poverty measured by this indicator for Lithuania in the period 2010-2015 has decreased by 7.5 percentage points from 13.9% in 2015, which can be viewed as a significant decrease. In 2010 Finland's average poverty rate of 14.8%, measured by *High share of energy expenditure in income (2M)*, was close to the EU average. For the period 2010-2015, the rate of energy poverty measured this way has increased by 7.5 percentage points (European Commission, 2020). The main problem of this indicator is the fact that the databases across the EU Member States are not harmonised and that some countries carry sampling every year and other countries carry sampling every five years. Hence, the problem of publishing data occurs. What is important to remember when looking at the data presented through the *High share of energy expenditure in income (2M)* indicator is that higher shares will be visible in places where income distributions are more equal, as this variance in energy expenditure leads to higher shares of energy expenditure in income (Thomson & Bouzarovski, 2018).

Table 4: High share of energy expenditure in income (2M) (in %) for 2010 and 2015

	2010	**2015**
EU average	16.3	15.5
Sweden	17.7	28.7
Finland	14.8	22.3
Lithuania	21.4	13.9

Adapted from Thomson & Bouzarovski (2018) and European Commission (2020).

Besides the share of energy expenditure in income, *Hidden energy poverty* indicators should also be considered to see how widespread the energy poverty is (Table 5). According to Thomson & Bouzarovski (2018), in 2010 *Hidden energy poverty* indicators are measured to be highest in Sweden (31.0%), France (23.7%) and Finland (22.3%), as these countries had the most population whose expenditures regarding energy services were abnormally low. For the purpose of comparison, the EU average of energy poverty measured by the *Hidden energy poverty* in 2010 was 15.1%, which means that Sweden had twice the EU rate. Thomson & Bouzarovski (2018) emphasise that the *Hidden energy poverty indicator* is the highest in northern and western EU Member States. The explanation for this can be found in the fact that these countries are traditionally extremely energy efficient and are under-consuming energy. Energy poverty measured through this indicator was the lowest in the Czech Republic and Slovakia with 8.4% and 9.2%, respectively in 2010.

Table 5: Hidden energy poverty indicators in 2010 (in %)

	2010
EU average	15.1
Bulgaria	15.9

(table continues)

(continued)

Table 5: Hidden energy poverty indicators in 2010 (in %)

	2010
Lithuania	21.2
Greece	10.3
Cyprus	13.2
Sweden	31.0
France	23.7
Czech Republic	8.4
Estonia	16.5
Malta	15.6
Austria	12.5
Slovakia	9.2
Finland	22.3

Adapted from Thomson & Bouzarovski (2018).

According to EUROSTAT (2021a), a similar indicator is the indicator of *Poverty risk*, which shows the percentage of the population at risk of poverty or social exclusion. This indicator, reported in Table 6, is also important because of the fact that energy poverty is closely related to the problem of poverty in general. According to the newest data for 2019 available on EUROSTAT (2021a) EU-SILC Survey, the highest share of the population at risk of poverty is also visible in Bulgaria with the share of 32.5%, which represents the decrease when observing 2016 in the amount of 7.9 percentage points. When observing the period 2010-2019 the decrease is even more visible and amounts to 16.7 percentage points (2010: 49.2%). In 2019, Romania also noted a high share of the population at risk of poverty in the percentage of 31.2%, which represents the decrease when observing 2016 in the amount of 7.6 percentage points. For the observation of the longer period of 2010-2019, the trend of decreasing is visible for Romania in the amount of 10.3 percentage points from 41.5% in 2010. In 2019 Greece also had a high share of the population at risk of poverty in the amount of 30.0% which also shows a decrease in comparison to 2016 in the amount of 5.6 percentage points. However, for the period 2010-2019 increasing trend has been visible when looking at the indicator of the share of the population at risk of poverty, with the decrease visible in the period 2015-2019, as seen in Table 6. For the selected EU countries, the lowest energy poverty rates were recorded in Czech Republic (12.5%) and Finland (15.6%), measured by the indicator *Poverty risk*. Overall, in 2019, 21.4% of households in the EU are in danger of becoming energy-poor, which represents a decrease of 0.4 percentage points in comparison to 2018.

Table 6: Indicator of Poverty risk 2010-2019 (share in %)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
EU[(e)]	23.8	24.3	24.8	24.6	24.4	23.8	23.5	22.4	21.8	21.4

(table continues)

(continued)

Table 6: Indicator of Poverty risk 2010-2019 (share in %)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Bulgaria	49.2	49.1	49.3	48.0	40.1(b)	41.3	40.4(b)	38.9	32.8	32.5
Lithuania	34.0	33.1	32.5	30.8	27.3	29.3	30.1	29.6	28.3	26.3
Greece	27.7	31.0	34.6	35.7	36.0	35.7	35.6	34.8	31.8	30.0
Cyprus	24.6	24.6	27.1	27.8	27.4	28.9	27.7	25.2	23.9	22.3
France	19.2	19.3	19.1	18.1	18.5	17.7	18.2	17.0	17.4	17.9
Czech Republic	14.4	15.3	15.4	14.6	14.8	14.0	13.3	12.2	12.2	12.5
Estonia	21.7	23.1	23.4	23.5	26.0(b)	24.2	24.4	23.4	24.4	24.3
Malta	21.2	22.1	23.1	24.6	23.9	23.0	20.3	19.3	19.0	20.1
Netherlands	15.1	15.7	15.0	15.9	16.5	16.4	16.7(b)	17.0	16.7	16.5
Austria	18.9	19.2	18.5	18.8	19.2	18.3	18.0	18.1	17.5	16.9
Slovakia	20.6	20.6	20.5	19.8	18.4	18.4	18.1	16.3	16.3	16.4
Finland	16.9	17.9	17.2	16.0	17.3	16.8	16.6	15.7	16.5	15.6
Romania	41.5	40.9	43.2	41.9	40.3	37.4	38.8	35.7	32.5	31.2

Adapted from EUROSTAT (2021a).

For the majority of people when talking about energy poverty the only thing one usually associates energy poverty with is winter and winter conditions. However, another important and often forgotten aspect of energy poverty are summertime issues. Summertime issues in the context of problems of energy poverty and energy aspects refer to two secondary indicators, *Summertime energy poverty* and *Space cooling difficulties*. Summertime issues have also been a topic over which researchers argue, however, still this part of the energy poverty topic remains relatively unexplored. According to Thomson & Bouzarovski (2018), several EU Member states, such as Hungary have experienced extremely high temperatures in the summer measured inside of homes of those that did not equip their homes with the technology for cooling. Extremely high temperatures in the long run are also one of the major reasons that lead to the development of health problems with household members living in such dwellings. The main indicators showing summertime issues were shaped with the help of the EU-SILC survey where two main indicators that show summertime issues were formed. These indicators were formed in the form of the following questions: *Is the dwelling comfortably cool during summertime?* and *Is the dwelling equipped with air conditioning facilities?* The problem of summertime cooling is especially widespread in eastern, central and southern EU Member States, and in 2012 it was calculated that approximately 19.2% of households in the different EU Member States were not *comfortably cool during the summertime.* One should remember that this problem is not uncommon for states such as the United Kingdom (even though the United Kingdom today is not classified as EU Member state due to Brexit) where in 2012 it was measured that 7.8% of the population was not comfortably cool during the summertime. As the cooling of living space and dwellings is

directly influenced by the air conditioning equipment, the indicator showing the rate of equipment with air conditioning units shows that southern EU Member states have the highest rates of equipment with such units. This is connected with the fact that summers are hotter and more extreme in these countries and, consequently, the population living in southern EU Member states has the need to equip its homes with air conditioning units. According to the data from Thomson & Bouzarovski (2018), reported in Table 7, in 2007 southern EU Member states such as Cyprus, Greece and Spain had the highest rate of equipment with air conditioning units. The rates were as high as 77.1% for Cyprus, 52.8% for Greece and 38.2% for Spain. On the other hand, households in Bulgaria reported 49.5% dwellings being extremely hot during summer in 2012, where only a small share of households in 2007 had air conditioning units. For the purposes of comparison, the EU average in the terms of the rate of equipment with air conditioning units was only 10.8% in 2007, whereas the EU average in the terms of the number of households stating that their dwellings are extremely hot during summer was 25.8%.

The data collected through EUROSTAT (2021a), referring to *Summertime energy poverty* and *Space cooling difficulties*, is only available for 2012 in the case of *Summertime energy poverty* and for 2007 in the case of *Space cooling difficulties*. This is also one of the main problems which are connected to summertime issues and its indicators, as the data is scarce even though the problem of energy poverty visible through these issues is not resolved. The situation here is that the data referring to equipment with air conditioning units has stopped being collected through the EU-wide EUROSTAT SILC survey after 2007 and the data collected for the purposes of measuring the *Summertime energy poverty* has stopped being collected after 2012, and after 2020 the indicators showing *Summertime energy poverty* and the data regarding the comfortably cool indicator are no longer collected and there will be no data showing the state of energy poverty through the lens of summertime issues. This is also one of the reasons why this indicator is not classified as a primary indicator, even though certain organisations such as Energy Poverty Observatory see the *Inability to keep adequately cool* as a rather primary indicator (Thomson & Bouzarovski, 2018).

Table 7: Summertime energy poverty and Space cooling difficulties for 2007 and 2012 (share in %)

	Dwelling equipped with air conditioning units	**Dwelling not comfortably cool during summer time**	
	2007	**2007**	**2012**
EU	10.8	25.8	19.2
United Kingdom	1.9	10.8	3.3
Cyprus	77.1	40.9	29.6
Greece	52.8	29.4	34.0
Spain	38.2	25.9	25.6
Bulgaria	8.4	-	49.5

Adapted from Thomson & Bouzarovski (2018).

According to Thomson, Simcock, Bouzarovski & Petrova (2019), many things still remain unknown regarding the summertime issues, in order to solve the related problems of energy poverty. Although there will no longer be EU-wide available data presented by the EUROSTAT, the European Commission did recognise the problem and in 2016 launched the Heating and Cooling Strategy. This represents a major step forward as the problem of summertime cooling was largely overlooked in the EU society in comparison to heating. The Heating and Cooling strategy recognises the problem of summertime cooling as one of the most important aspects connected to the energy poverty problems in warmer climates of the EU. Another step forward when talking about summertime cooling is a proposal made by the European Commission that all Member states reduce their energy consumption and energy emissions connected with cooling. The survey conducted in 2015 in several neighbourhoods of Prague, Gdansk, Skopje and Budapest conducted by Thomson, Simcock, Bouzarovski & Petrova (2019) showed that approximately 40% or more of the citizens living in high-rise blocks of apartments in Budapest and Prague experienced the excessive heat and troubles during summer. This is connected with the low equipement with air conditioning units in these areas.

Even though EUROSTAT's EU-SILC survey and the primary and secondary indicators presented through the data are still the single best resources for energy poverty and energy access researchers, one should be aware that the data presented may not show the real state of the problem. This is because of the problem of comparability of the data that is also present here largely because different EU Member states use different methods of data collection and even process them in a different manner. This is important to emphasise as this data may influence the results researchers get and may potentially influence their conclusions, which are oftentimes mapped to new policies. Still, EUROSTAT is working on improving solutions for the solving of this problem regarding the EU-SILC survey and the problem of comparability of the data collected mostly through the solutions including detailed metadata. This metadata is crucial as it is planned for it to include a detailed description of the components that were aggregated and collected in order for the data to be presented, specifically in the field of income variables (Zardo Trindade, & Goedemé, 2020).

3.2 Vulnerable consumers

In accordance with the research on the number of energy-poor citizens in the EU and with the fact that every seventh citizen in the EU suffers from some sort of energy poverty the need for defining vulnerable consumers in this field has arisen. Given that detection of vulnerable consumers is a complicated process it is possible that even more people living in the EU can be classified as vulnerable consumers. One of the largest paradoxes in the energy sector is the fact that vulnerable consumers are one of the most important drivers of energy poverty and the energy sector in general, however, they are, at the same time, one of the hardest sectors of society to reach. As the problem of energy poverty itself (and even energy access in some places) is becoming more pronounced it is important to mention that there is

still no clear frame for its resolving. Similar to the problem of defining energy poverty as a concept generally, the Vulnerable Consumer Working Group concluded that it is not possible to have a unique definition of the concept of vulnerable consumers that is applicable to the EU as a whole and to its Member states. However, four major trigger groups were determined, and those are (Agić, Agić & Kunto, 2017, p. 7):

- conditions of the market;
- individual circumstances;
- life organisation and
- natural or social environment.

In general, the simplest way of determining who the vulnerable consumers are is to understand that those who can be viewed as vulnerable are those who according to socio-demographic, and both economic and energy indicators have a greater probability of becoming energy poor. These are usually users of social protection, single parents, pensioners, or persons with disabilities. Robić (2016) argues that the reason pensioners are more likely to be poor, compared to those still working, is because they spend more time in their homes and because of their age, immune system and similar things that come with old age, they need more heat than those who are still employed. Pensioners are also those most affected by the phenomenon of excess deaths during winter. Agić, Agić & Kunto (2017) in the groups of vulnerable consumers include households with a larger number of children. However, even if one "belongs" to a certain group that can be viewed as vulnerable it does not mean that this person of household is vulnerable. Still, one thing is clear and that is that EU Member states and the EU in general needs a comprehensive definition that will take into account all these indicators and problems which are usually associated with vulnerable consumers and energy poverty in general. This should also be treated as one of the most important problems which could lead to resolving and mitigating the widespread problem of energy poverty and lack of energy access.

3.2.1 Defining vulnerable consumers

As many definitions of energy poverty in the EU exist, it is not unexpected that many definitions of the concept of vulnerable consumers among EU Member states also exist. This leads to the problem of identification of further approaches on the EU level and, at the same time, leads to confusion and inability to create EU-wide policies that could be helpful in terms of energy poverty and energy access problems. Pye et al. (2015) state that this situation can be viewed partly as positive because each EU Member state can define vulnerable consumers in accordance with its specific situation. Henceforth, it is understandable that they could perhaps implement better solutions to resolving their specific situations. Vlahinić Lenz & Grgurev (2017) emphasise that from 2016 (or end of 2015) the definition of vulnerable consumers became a legal obligation for each EU Member state, as well as the obligation of the states to ensure that vulnerable consumers (however they are defined) have

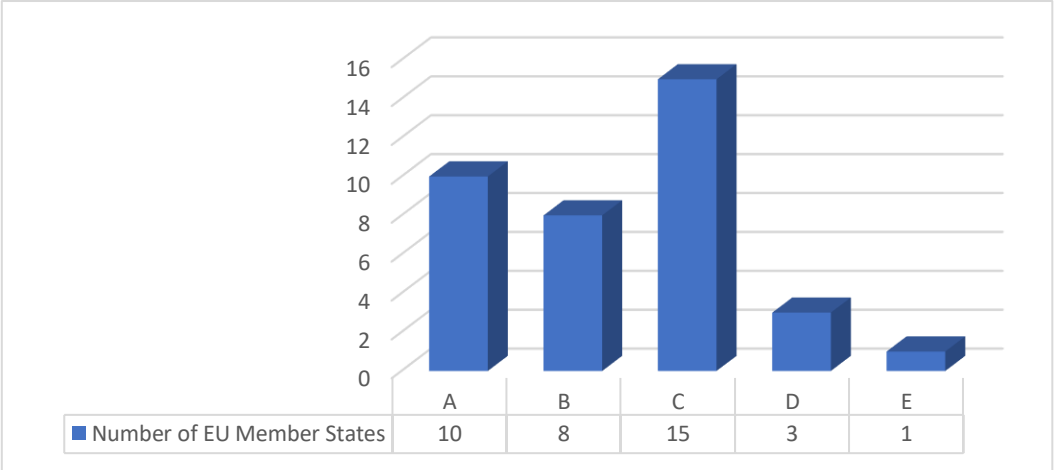
a needed supply to energy sources. The EU Member states are obligated to define vulnerable concepts through the concepts of energy poverty in general or the lack of connection to electricity and gas in certain moments. In addition to this, as Pye et al. (2015) emphasise and underline, the Third Energy Package not only stated that the definitions of vulnerable consumers identifications are needed, it also underlines that certain measures directed towards vulnerable consumers and energy poverty eradication need to be put in place. It is important to emphasise that after the Third Energy Package, the Winter package was adopted in 2019 with the improvement on the measures, and with the instructions to all Member states to further develop their national plans to eradicate the problem of energy poverty.

As it is clear that many definitions exist, each definition is useful in a different manner and targets a different part of energy in general. For example, EU directives that refer to rules for internal markets in electricity, such as *Common rules for the internal market for electricity* (Directive 2019/944) and EU directive for natural gas, such as *Common rules for the internal market in natural gas* (Directive 2019/692) are the ones providing the outline for vulnerable consumers identification and their defining. As these Directives provide the measures of protection of vulnerable consumers it is important to mention that they are also the ones prescribing that each Member state defines the concept of vulnerable consumers, ensuring that, in the process, no vulnerable consumer is disconnected during its critical times.

Pye et al. (2015) define vulnerable customers in the concept of the electricity sector as consumers using energy for supply of its permanent dwelling, not exceeding the maximum consumption of electricity per person (which for a family of four means up to 200 kW per month), belonging to the category of those having lowest income or having its consumption of electricity supplied via the single-phase meter. The definition of vulnerable consumers in the natural gas sector is almost the same, except one of the indicators of a vulnerable consumer is that it does not exceed the maximum consumption of natural gas per person of up to 70 cubic meters per month. Pye et al. (2015) state that another definition of vulnerable consumers is oriented towards the problem of energy affordability, meaning that vulnerable consumers are defined as those having problems paying energy bills, which is a definition that is closely connected with one of the EU-SILC survey's indicators – arrears on utility bills. However, in order to define vulnerable consumers in this way, EU Member states have included several additional indicators such as characteristics of consumers, the share of income needed to meet fuel requirements and income threshold. In accordance with this, Pye et al. (2015) underline several categories of vulnerable consumers' definitions. These definitions were classified as A, B, C, D, and E definitions where A are those where vulnerable consumers are defined based on their personal characteristics, B are those where vulnerable consumers are defined in accordance with their non-personal circumstances or unfavourable situations in which they found themselves, C are those where consumers are defined as vulnerable if they are only recognised by the energy law and/or social security system in the state. D and E are somewhat different, as for example, D of vulnerable

consumers refer to the situation where there are no definitions in the country and E are all definitions of vulnerable consumers where they cannot be classified in any other category. Figure 5 shows the prevalence of A, B, C, D, and E definitions in 28 observed EU Member states.

Figure 5: Number of EU Member states with A to E definition of vulnerable customers



Adapted from Pye et al. (2015).

Even though definitions of 28 EU Member states were classified in the A, B, C, D, and E classifications (with the exception of the Czech Republic, whose term protected customer referred only to people who are sick in hospitals or are on life-support and hence cannot be classified), this does not mean that every definition of the same category is the same. This is not the case, as every EU Member state adjusts its definitions of vulnerable consumers to its specific situation.

In conclusion, when composing the definition, one of the hardest things to overcome is the fact that the definition needs to relate to each and every EU Member state, and each and every specific situation regarding vulnerable consumers and energy poverty in general. This is also one of the reasons why further research is much needed in the field of energy poverty, as through research it will be possible to understand the problem better and, ultimately, help those who are most vulnerable.

However, according to the latest findings from ACER/CEER (2020) in the countries where definitions of vulnerable consumers do exist, most Member states tend to use explicit definitions. The term explicit definitions refers to those definitions which are constituted in the legislation. Implicit definitions are, however, as important as explicit definitions as they refer to the problem of vulnerable consumers by making the problem of vulnerable consumers an integral part of a country's legislation without defining it through specific definitions. According to ACER/CEER (2019, p.18), several additional criteria were introduced in order to define the concept of vulnerable consumers in the EU, such as income levels, the share of energy expenditure in disposable income, the energy efficiency of homes,

critical dependence on electrical equipment for health reasons, age or other criteria. As shown in Table 8, most Member states, 19 for electricity and 14 for gas , use income level as a criterion for defining the concept of vulnerable consumers. However, this criterion is often used in combination with other criteria such as critical dependency on electricity-powered equipment for health reasons, age, or other criteria chosen by each Member state. It is important to mention that, in addition to these criteria, Great Britain defined vulnerable consumers using the share of energy expenditure of disposable income and energy efficiency of homes. According to ACER/CEER (2020), other criteria include other specific determinants such as mental or physical disorders, larger families, unemployment, or remote location.

Table 8: Criteria used for defining the concept of vulnerable consumers in the EU in 2018

Member state	Income level	Critical dependency on electricity powered equipment for health reasons	Age	Other	None of the above
Austria	●			●	
Belgium	●		●	●	
Bulgaria					●
Cyprus	●	●	●	●	
Czech Republic	●				
Germany	●				
Denmark					●
Estonia					●
Spain	●	●	●	●	
Finland	●			●	
France	●				
Greece	●	●	●		
Croatia	●			●	
Hungary	●	●	●	●	
Ireland		●	●		
Italy	●	●		●	
Lithuania	●				
Luxembourg	●				
Latvia	●			●	
Malta					●
Netherlands		●			
Poland	●				
Portugal	●				
Romania	●	●	●	●	
Sweden	●				
Slovenia	●	●		●	
Slovakia				●	

Adapted from ACER/CEER (2019).

3.2.2 Models of support for vulnerable consumers

Even though the problem of vulnerable consumers definitions in the EU exists and even though some countries such as Luxembourg or Finland, did not even recognise the term *vulnerable consumers* as such, as Pye et al. (2015) emphasise, it is important to remember that the concerns and the problems which come with the vulnerability in the energy sector are at least being recognised. In accordance with this, a number of EU Member states started to develop much-needed solution for the resolving of the problem and started to create models of support intended for vulnerable consumers hit by the problem of energy poverty and lack of energy access. What is important to understand when talking about models of support is that a number of institutions such as governments, both local and regional authorities, institutions dealing with energy both directly or indirectly, non-governmental organisations as well as other relevant institutions need to be and are in practice involved into creation of programs and models of support to vulnerable households.

The involvement of different governmental and non-governmental institutions is important and needed because only by acting together, measures of models of support for vulnerable consumers can be established. This is because, in order for successful models of support to be created and implemented, a significant financial resource is needed, as well as good knowledge of the consumers as well as their habits regarding energy in general, such as their energy consumption. So, it is evident that certain criteria need to be satisfied in order for models of support for vulnerable consumers to be created.

One of the most crucial criteria that should be implemented when creating these solutions are those referring to all vulnerable consumers (Javno preduzeće Elektroprivreda Bosne i Hercegovine, 2009). However, governmental inclusion and inclusion of other organisations whether governmental or non-governmental is crucial for another aspect and that is vulnerable consumer protection measures. In accordance with this, governments and other institutions need to make sure that models of support for vulnerable consumers do not disadvantage those who need the help the most, establishing certain rules and ways of conduct, as well as properly identifying vulnerable consumers (Pye et al., 2015).

According to OFGEM (2018), this part is important because these models need to be directed only to those who really need them, and this is why identification of vulnerable consumers is of great significance. For example, it is prescribed that both energy suppliers and organisations with energy distribution networks in the UK must keep the register of those who are a priority (i.e. vulnerable consumers) and provide them certain free services of support. The UK managed to create some sort of vulnerable consumers identification program by prescribing this through the revised Standards of Conduct for both electricity and natural gas markets. So, the suppliers are those who are obligated to monitor, collect and use data in order to identify vulnerable consumers in the appropriate manner. This has resulted in the creation of the, so-called, Warm Home Discount (hereinafter: the WHD) in the UK where the government created a model of support for vulnerable consumers and for

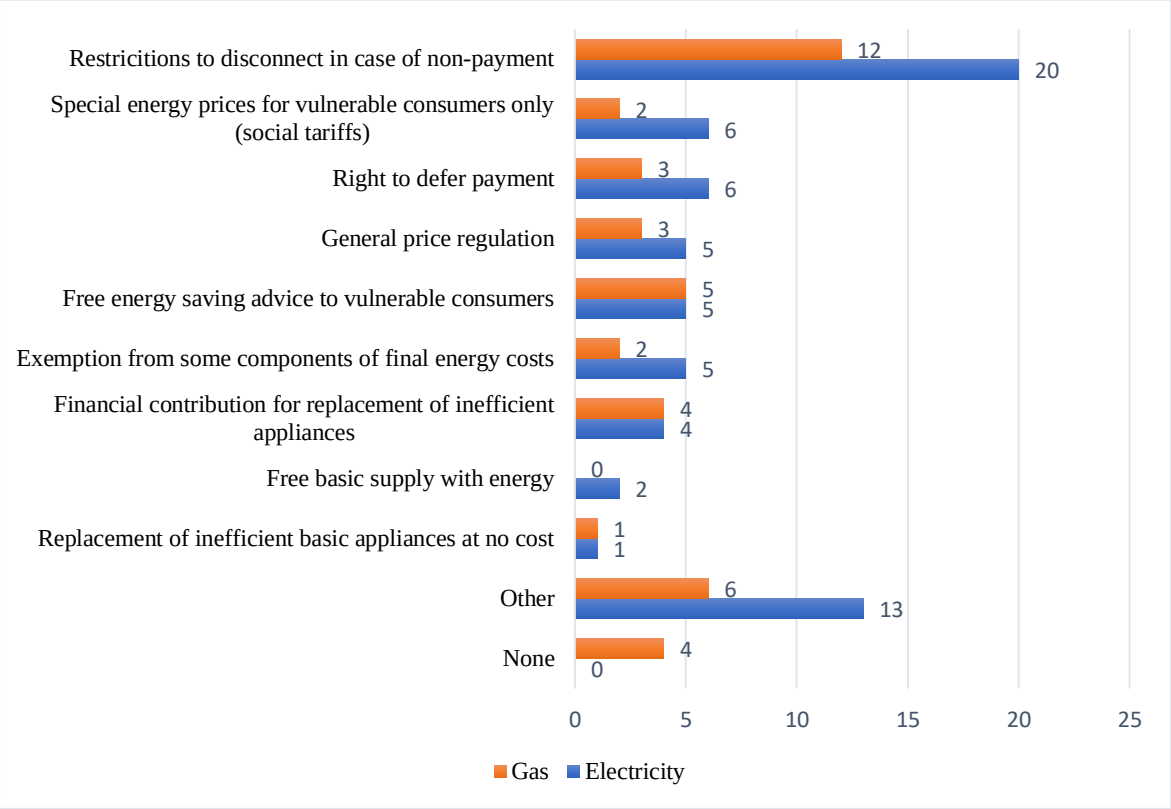
finding the solutions for energy poverty eradication. Under the WHD, energy suppliers are those who support those who are considered to be energy vulnerable, whether they are currently facing the problem of energy poverty (or to be more precise fuel poverty as we are talking about the UK), or they are at risk of becoming energy poor. What this model is designed to do is to provide help through the allocation of benefits to those who are classified as being vulnerable, and those categories can save up to GBP 140 when paying their electricity bills. WHD initiative has proven to be extremely helpful for vulnerable consumers living in the UK, as currently 2.2 million vulnerable consumers use it.

According to Assist2gether (n.d.), many EU Member states, such as Finland, Spain and Greece have implemented social protection schemes for vulnerable consumers during winters, where the problem of disconnection is extremely serious, where those who were disconnected must be reconnected to the grid. This is extremely important because the risk of excess mortality during the winter is significantly higher than during the summer. In certain EU Member states, such as Spain this model of support for those who suffer from the problem of energy poverty is not available only during winter periods, but also during the whole year. One should remember, though, that, in the example of Spain, these measures only refer to those who live in situations of extreme poverty. In Belgium, on the other hand, to disconnect someone from the grid, there are a lot of steps that need to be made, which means that those who are the most vulnerable will be more protected. According to ACER/CEER (2019), the Directives 2009/72/EC and 2009/73/EC for internal markets of electricity and gas did not oblige the Member states to define specific sets of measures or models of support in order to protect vulnerable consumers. Instead, each Member state was given a right to decide which measures and models of support are needed and which to implement.

According to ACER/CEER (2020), there are several groups of measures that were used in order to protect vulnerable consumers in the EU. The most used models of support were restrictions to disconnection in case of non-payment which were used by 20 Member states in the electricity market and 12 Member states in the gas market. This measure of protection is implemented differently in different Member states. It is used to warn consumers to pay their energy bills on time, in order not to be disconnected. These warnings usually consist of two reminders, the first and the final reminder. This is where most differences among Member states are visible as Member states have different time frames between reminders. For example, Hungary sends the final reminder in less than one week after the first reminder, whereas Luxembourg has a time frame of nine weeks. In Denmark, a first reminder is sent to consumers seven weeks before disconnection and the final warning is sent three weeks before disconnection. However, several Member states have introduced rules on the prohibition of taking any action on disconnection on specific days or specific situations. For instance, these rules apply on weekends, winters or in situations where consumers are dependent on life-supporting appliances. Other models of support are, however, starting to gain popularity and many Member states are starting to use models of support that include

types of grants for replacing the old energy appliances with new and more efficient ones, as shown in Figure 6.

Figure 6: Measures for the protection of vulnerable consumers in EU in 2019



Source: ACER/CEER (2020).

Another important criterion is the economic criteria that should be implemented when creating models of support for vulnerable consumers in the field of energy poverty refer to cost-effectiveness, with minimisation of cost coming from the governments or other organisations and minimisation of cost of subsidies. However, here the problem arises because certain models of support that have proven to be successful according to one of these criteria were not successful according to other criteria (Javno preduzeće Elektroprivreda Bosne i Hercegovine, 2009).

Many researchers and organisations dealing with different aspects of energy, and hence the problems of energy poverty and vulnerable consumers, argue that models of support for vulnerable consumers are usually classified into three general categories and those being models of support through the direct help via revenues, models of support through different tariffs, which is considered to be the indirect way of help, and measures of energy efficiency directed towards those who are most vulnerable. These measures are used in the field of electricity, as well as in other energy-related fields (Javno preduzeće Elektroprivreda Bosne i Hercegovine, 2009).

Models of support through revenues are usually directed towards individual possibilities of consumers to meet energy-related needs. In the example of electricity, these measures include cash transfers intended directly to energy-poor and energy vulnerable consumers, compensation of costs for electricity up to a certain extent, certain subsidies formed based on vulnerable consumers' individual characteristics, and certain more favourable ways of bills repayment. The advantage of this kind of model of support for vulnerable consumers is reflected in the fact that these models are exclusively directed towards revenues of the energy vulnerable households and do not reflect the price. It is also emphasised that costs that come with these models are significantly lower than costs that come with models that use different solutions and methods of help. These types of measures are considered to be a crucial way of resolving the problems associated with energy poverty in the terms of helping and assisting vulnerable consumers (Javno preduzeće Elektroprivreda Bosne i Hercegovine, 2009). Hungary was one of the EU Member states whose answer to the sharp rise in prices of gas and electricity in the amount of 50% (in the period before Hungary was an EU Member state) was the creation of a social fund in the period of a year and a half so that this fund can provide revenues needed to level the increase of prices of gas and electricity for households. This social fund was funded partly from the budgets of energy companies and partly from the private sector and represented help for those who were the most vulnerable in this period. The funds were distributed through the distribution of cash to energy-poor if the monthly total costs of energy were above 35% of the monthly income of the household and the fund would pay up to 40% of the amount of the energy bill. Another way of fund distribution was by distributing funds directly to energy companies, as well as direct delivery of an estimated amount of coal and wood for the energy-poor (Agić, Agić & Kunto, 2017). However, these models are usually extremely helpful only in the short run and are also usually used to identify those who need the help the most. The fact that these models can be used to identify vulnerable consumers has proven to be another advantage when talking about models of support for vulnerable consumers through revenues because these types of targeting have improved the process of collecting data and avoided the usually complex administrative process of vulnerable consumers identification (Pye et. al, 2015).

Models of support through different tariffs such as, so-called, block or lifeline tariffs are another commonly used solution for helping vulnerable consumers. Actors that are directly included in the procedure of creating and implementing tariffs as a model of support for vulnerable consumers are governmental institutions or, for example, power companies in the example of tariffs that are implemented in the electricity sector. In the example of the electricity sector these measures are implemented through the decrease of electricity bills for those having lower income and problems with paying their electricity bills. These types of models are characteristic because they involve several measures through which these organisations can achieve their goals. There are three different ways that are commonly used to achieve the goals of helping vulnerable consumers pay their bills without difficulties they would usually face, and those subsidies are created specifically for keeping the price of electricity above the total costs, tariff systems that include block or lifeline tariffs which are

extremely important as they work on the basis of, so-called, cost "spill-over" among different consumer groups, which enables vulnerable consumers to pay their bills and, finally, social tariffs that are implemented for special categories of vulnerable consumers. Block or lifeline tariffs are the single most commonly used tariffs, at least when speaking about electricity, in transition countries which enable the decrease of costs for consumed energy (or electricity in this particular example). According to Čavrak, Gelo & Pripužić (2008), there are two categories of block tariffs; the first being a double block tariff, and the second being a triple block tariff. The difference between double and triple block tariffs are simple and refer to the number of tariffs used for the energy consumed. In other words, a double block tariffs consist of a lower tariff for energy consumption which is limited by a special form of limit. Here, the limit usually shows the minimum or necessary amount of energy that needs to be consumed, hence, the limit is usually very low. Unlike double block tariffs, triple block tariffs have another higher tariff for energy consumption which is set above the limit. The purpose of this additional tariff is to lower the high consumption, which is usually a sign of energy inefficiency. One should remember that this is especially important in cases where electricity is also used for heating, but the consumer has a replacement fuel such as natural gas available.

Social tariffs play a crucial role when talking about the models of support for vulnerable consumers. The situation in the electricity sector regarding the understanding of social tariffs and their implementation can be mapped to other energy sectors. The main assumption on which this type of tariff is created is that households that earn less income consequently consume less energy and their needs are met in the first tariff block. In accordance with this, those households whose members earn more consume more and their bills will, accordingly, be higher. It is precisely that these bills compensate for the costs that will be incurred for the energy in the first tariff block (Filipović & Tanić, 2008). Many EU Member states and countries in general use block tariffs' models of support for vulnerable consumers. For example, Belgium, France, Greece, Italy and Latvia are EU Member states which have decided to use social tariffs as models of support for households that are classified as vulnerable. However, Belgium is the first EU Member state out of these that has implemented social tariffs for both electricity and natural gas (Čavrak, Gelo & Pripužić, 2008). According to EU Energy Poverty Observatory (n.d.), as a result of social tariffs implementation in Belgium approximately 8.5% of households received help automatically. This measure was implemented in 2004, for both electricity and natural gas, and targeted the disabled population, households which rely on social benefits and vulnerable households. One should remember that block tariffs all function in the same way in these countries. However, the difference is visible in the way countries define the first block tariff. The difference is so significant that it varies between 50 kWh per month and 200 kWh per month when talking about energy consumption (or electricity consumption to be more precise). Of course, there are a lot of advantages of these models, such as the fact that energy is cheaper. However, the main disadvantage when talking about block tariffs comes from the fact that

usually those households who can be classified as middle or higher income benefit the most from them (Filipović & Tanić, 2008).

As Komives, Foster, Halper & Wodon (2005) emphasise the reason why these models of support (block or lifeline tariffs) favour those not needing it instead of energy-poor is because they are regressive in their distribution and also because they can be manipulated by actors whose job is to design these types of models of support. For the possible solution to this problem some researchers propose that connection subsidies be used, as block or lifeline tariffs are consumption subsidies. However, one should remember that connection subsidies are not a definitive substitute for consumption subsidies. For example, connection subsidies are characteristic for situations when the coverage of energy supply is low, and have proven in these situations to be a better solution than the implementation of consumption subsidies. One of the largest disadvantages of connection subsidies is that they can only be useful if they persuade households to connect to the needed energy system, because they are models of support used only to those households who are not connected to the systems, whereas consumption subsidies are models of support that can only be used for those who already are connected to energy systems.

Energy efficiency measures are probably one of the most popular measures to be used. This is because many advantages of energy efficiency measures and models of support for vulnerable consumers based on these measures not only refer to the vulnerable but also protect the environment from the negative influence from energy sources. One should note that energy efficiency measures can be observed as the long-term solutions for energy-poor because not only do these measures help energy-poor directly and indirectly, they also help the economy, by decreasing the expenditures and direct money transfers that are directed towards vulnerable consumers (Čavrak, Gelo & Pripužić, 2008). According to Ciucci (2020), energy efficiency measures in the EU have an increasing trend of implementation as they are linked to sustainable energy supply, positive impact on the environment, as well as promotion of competitiveness of the EU. Energy efficiency goals are set as one of the strategic goals for the EU with the target of decreasing energy consumption by at least 32.5% by 2030.

In most EU Member states, the problem of energy poverty is directly linked with the concept of energy efficiency, and especially, the state of dwellings in which those who are most vulnerable live. Those households with lower incomes consequently live in dwellings that are usually cheaper, older and are considered to be low-quality dwellings. The usual condition of these dwellings does not allow the energy to be used efficiently, which means that, for example, the energy bills are higher than they should be for those using energy efficiently. This issue does not only occur in transition countries and traditionally “poorer” countries in the EU, but also in the majority of EU Member states, including those states who are most developed and most wealthy. It is important to mention that, in order for the problem to be resolved, many EU Member states have, in recent years, created and implemented different programs and models of support that tackle the problem through

different energy efficiency programs. Many EU Member states such, as Slovenia, Croatia, Greece, France have presented a grant that is used for the reconstruction of old buildings and dwellings and installing units of energy efficiency. Some EU Member states, such as Denmark have introduced a program of change of old oil boilers for boilers working on natural gas or heat pumps. However, even though these programs were successful, for countries that implemented the programs of reconstruction of old buildings, vulnerable consumers were not the reason, as these measures were introduced primarily because of the carbon savings not only for vulnerable consumers but for all consumers. It should be emphasised that even though these measures were not implemented specifically to target vulnerable consumers they do target them and have proven to be extremely helpful for them. On the other hand, for EU Member states such as Denmark, the program of help was cancelled because of the financial difficulties connected with it (Assist2gether, n.d.). When talking about the programs of change of old inefficient energy appliances, it should be emphasised that there is a measure implemented towards vulnerable consumers where the replacement of the inefficient energy appliances for new ones is done free of charge. (ACER/CEER, 2020). Only the UK implemented this measure in 2019, while it was still a member of the EU. Free Boiler Grants is a measure that grants free energy-efficient boilers for low-income households, put in place in order to reduce the costs of energy. These grants are not repayable, i.e., the money does not have to be paid back at any time (Boiler Grants, n.d.).

As it is becoming evident that energy efficiency represents an important concept in the energy sector, the EU has continued to provide incentives for energy efficiency programs around the EU to be implemented. One should remember that one of the most important models of support for vulnerable consumers in the energy sector was implemented in 2003 by the name Intelligent Energy Europe and was a program realised in order to provide support for the realisation of energy strategies around the EU. Intelligent Energy Europe integrated energy programs that were implemented in the EU by 2003, and those were the Specific Actions for Vigorous Energy Efficiency (hereinafter: the SAVE) program, the New and renewable resources (hereinafter: the ALTENER) program, the Energy in transport (hereinafter: the STEER) program and the COOPEN program (Čavrak, Gelo & Pripužić, 2008). The SAVE program was a program implemented in order to fund programs of energy efficiency in the industry, whereas the ALTENER program was implemented in the energy sector so that the funding can be available for the assistance in the renewable energy sources sector and their production for cooling, heating and electricity. The STEER program is linked with the solutions in the field of transport, meaning that new and energy efficient solutions in the transport sector were the focus of the STEER program, and, finally the COOPEN program was implemented as help for transition countries. The Intelligent Energy Europe program was considered to be one of the most important programs in the EU because it was a pioneer in the field of implementations of programs in the energy sectors, as well as the creation of models of support for vulnerable consumers (European Commission, 2019).

Models of support for vulnerable consumers are one of the most important social and economic models of welfare in the energy sector and in society as well. What is important to mention is that there is no universal solution that can be implemented and that works for each and every country, as what works for one country does not necessarily work for another. In order for the model of support for vulnerable consumers to be successful, it needs to be adjusted to specific characteristics of the country such as their geographic location, economic situation, the concrete situation in the field of energy poverty, as well as other crucial characteristics. One should also remember that there is currently no model of support that has no disadvantages, even when specifically implemented for the specific situation of a certain country.

3.3 Driving forces of energy poverty

Driving forces of energy poverty in the EU can be classified using different terminology, but all these concepts ultimately lead to the same conclusions. These conclusions state that three key driving forces of energy poverty exist and that these drivers can occur as individual drivers or in the combination with each other, and those are low incomes, inefficient dwellings lacking thermal insulation and high costs of energy services provided in the households. From these key drivers, energy poverty can be observed through sub-factors such as the rate of the price of the energy compared to the growth/decrease of income, the ability of the household to access more affordable energy services that are essentially cheaper, the real needs of energy in a household ultimately connected with the energy efficiency and policy interventions (Pye et al., 2015).

Schuessler (2014) underlines that driving forces of energy poverty that are considered to be based on the expenditures are based precisely on the concepts of energy efficiency, energy prices and the income of the household. Energy (in)efficiency is one of the concepts for which many researchers on the problem of energy poverty state that it is a key to make a distinction between those who are poor in general and those who can be considered energy poor. Energy inefficiency is also observed through the type of residential dwellings because the type of the dwelling can influence the demand for energy in it, as those dwellings that are energy inefficient are those who clearly show signs of energy poverty. Energy prices as one of the concepts of energy poverty, and at the same time of the driving forces of energy poverty are an important indicator. However, one should remember that a number of factors influencing energy prices exist. Some of them include the tax levels, costs of energy supply, or the situation if the energy prices in a certain country are regulated or competitive. As for the connection between energy prices and energy vulnerability, the change of energy prices over time is an important indicator that should be constantly monitored, because in dynamic markets it is not unusual for energy prices to move rapidly (Pye et al., 2015). Changes in energy prices are one of the most direct drivers of energy poverty, as energy consumers react and are affected the most by these changes as the increase in energy prices can lead to increased energy vulnerability.

Income of the household as a driver of energy poverty in OECD countries is usually an indicator not only of energy poverty but of poverty in general as well. Households with lower incomes have trouble paying the energy bills, however, another situation that arises is when households with higher incomes spend too much of their income on energy services because their homes are not energy efficient (Schuessler, 2014). Pye et al (2015) argue that household income can be observed as one of the most important driving forces of energy poverty, because, based on the household income, it is possible to assess the number of those who are at risk of energy poverty, that is of those who are at risk of becoming a vulnerable consumer.

When talking about driving forces of energy poverty it is crucial to mention driving forces of consumer vulnerability, as energy vulnerable consumers represent perhaps the most important social group connected with the energy sector. In the EU in 2016 five groups of driving forces for energy vulnerability were identified (Assist2gether, n.d., p. 19-20):

- the inability to properly choose and then access energy services because of the problems connected with technical difficulties which arise before contracting services, such as not understanding the contract conditions or simply not being able to access these conditions, as well as the fact that most are uninformed when it comes to different possibilities that come with choosing proper energy services;
- age can be a driver of energy vulnerability, as often young and old population suffers from problems that arise from energy poverty, as well as those who are not educated, do not speak the language of the country they are living in, or those living in regions without many habitants;
- consumers with lower incomes, as well as those who suffer from different types of disabilities or have long-term sicknesses;
- those who do not use the Internet or other media to search for relevant information in the field of energy and energy services;
- consumers whose personal characteristics classify them into groups of those who are impulsive, those who have higher aversion to risk or trust people less.

3.4 Energy poverty policies

Energy poverty policies in the EU represent the foundation needed in order for the solutions and different approaches to be created so that the problem of energy poverty is eradicated, with further creation of successful and sustainable projects and programs. Back in 2010, as the problem of energy poverty was getting more recognised in the EU, it was noted by the European Commission that, even though the list of, at the time, existing and new energy poverty policies was created, no EU-wide consensus on the important elements (including the creation of the universal energy poverty definition) of energy poverty was made. Important energy poverty policies that paved the way for new understandings and helped understand the importance and the gravity of the problem of energy poverty included the following decisions, publications and events: Gas and electricity liberalisation directives,

European Economic and Social Committee opinion on energy liberalisation and the works of European Commission. Gas and electricity liberalisation directives from 2009 helped with energy poverty measures identification, whereas the Clean energy package legislation from 2019 improved the understanding of energy poverty itself, with new guidelines for its resolving. European Economic and Social Committee's opinion on energy liberalisation from 2010 was an important energy poverty policy as the conclusions that were drawn up included the understanding of the EU-wide statistics that would refer to data needed to understand and resolve the energy poverty problem, and forming of the EU-wide organisation with the job of monitoring energy poverty around the EU. And finally, the European Commission played a crucial role in 2010 because EU Member states were encouraged to explore and adopt long-term instead of short-term policy solutions for energy poverty eradication and suggested the creation of quantitative indicators that could show the percentage of households having arrears on their utility bills. However, even with the existence of such important energy poverty policies, the energy poverty problem was usually only viewed through the indicators of households with low income, high prices of energy and low-quality dwellings. Other important indicators, such as the lack of institutional help, emphasising the problem of energy poverty, were overlooked and it became clear that much needed to be changed in the following years in order for progress to be made (Bouzarovski, Petrova & Sarlamanov, 2012).

Since then, and starting in the last couple of years, the problem of energy poverty was recognised as one of the growing social problems in the EU. This was the driver for the creation and implementation of the EU's program named Clean Energy for all Europeans, which is extremely important for tackling the problems of energy poverty in the EU because it contains a number of energy poverty policies that were designed to address the problem itself. The importance of the Clean Energy for all Europeans program is reflected in the fact that as many as eight legislative acts targeting different problems related to energy poverty were its component, meaning that it has enabled the problem of energy poverty to enter the EU legislature. In other words, the importance of energy poverty has been emphasised by creating a commitment to EU Member states through these legislative acts, which is a step forward to finding a solution or sets of solutions for the problem of energy poverty in the EU. In accordance with this, one should remember that the Clean Energy for all Europeans program consists of a set of obligatory directives for EU Member states, where EU Member states are obliged to recognise officially the presence of energy poverty in their countries through their National Energy and Climate plans (Pye et al., 2015). National and Climate plans are often considered starting points when talking about the plans for energy poverty eradication. An important step forward when talking about the energy poverty policies refers to the European Parliament's Resolution which underlines the importance and occurrence of energy poverty in the EU. At this point, the Resolution makes a strong recommendation for all EU Member states to include the number of energy-poor households into their National Energy and Climate plans, as well as to use all actions needed for the energy poverty alleviation (Bouzarovski, Thomson, Cornelis, Varo & Guyet, 2020).

In order for energy poverty policies to be classified, and for the purpose of their comparison, all policies in the field of energy poverty battle implemented among different EU Member states can be classified as either social policies or strictly energy policies. The difference between these policies lies in the fact that the energy policies are strictly focusing on energy poverty through the lens of pure energy, whereas the social policies tend to focus on fighting energy poverty through social provisions (Pye et al., 2015). Not all EU Member states officially recognise the problem, as, in their beliefs, the energy poverty problem cannot be classified as the component of energy policies, which is why no energy poverty mitigation policies were created, nor has there been a strategy for its resolving. Countries such as Germany, Malta, Finland, Sweden and the Netherlands view the problem only as a form of general poverty, which means that the strategies implemented in these countries are general social strategies for general poverty mitigation (Bouzarovski & Thomson, 2019). According to ACER/CEER (2020), direct energy poverty policies are implemented through engagement at the national level in twelve EU Member states, whereas Estonia has implemented direct energy poverty policies at the smaller engagement.

In order to implement successful energy poverty policies, there are several factors that should be implemented into them. For instance, in order for certain energy poverty policy to be efficient and successful, it needs to be based on the specific context and needs to combine different approaches for energy poverty mitigation and prevention. What is important to mention is that these approaches should be done in a way that they should address the problem both in the short-term and in the long term. One should remember that the most important component of an efficient energy poverty policy is the people. In other words, in order for the policy to be successful, it should consist of the needs and problems of those who are suffering from energy poverty, with the solutions for their help. Energy poverty policies are extremely important and in order for them to be successful, they also need to contain three crucial steps. The first step is to analyse, expose and address the problem and the drivers of the problem of energy poverty itself, as many of the drivers that, eventually, influence energy poverty can be found in other policies. The second step is to correct these policies and create policies that do not undermine the process of energy poverty mitigation through its solutions. Finally, the third key step that should be taken refers to the design of new policies where policy-makers need to pay great attention to involve the key stakeholders in the development of energy poverty policy itself (Thomson & Bouzarovski, 2018).

3.5 Summary of selected EU's projects

As it is already clear that the problem of energy poverty has become more recognised across the EU, it is becoming inevitable for EU Member states to create projects in order for the problem of energy poverty to be eradicated. However, as for many EU Member states the recognition of this problem is still new and fresh, not many projects exist. Nevertheless, several EU Member states have implemented successful and innovative projects that could be seen as examples of good initiatives and could incite the rest of the Member states to

create projects targeted for their specific problems in the field of energy poverty and lack of energy access in certain locations. Usually, northern and western EU Member states are those who are targeting their social policies and creating projects in order to decrease the number of the energy poor, and create a sustainable and better future, not only for those who suffer from energy poverty, but for all citizens (Thomson & Bouzarovski, 2018). Some of the extremely successful projects in the EU include the "Mehr als Wohnen" project in Switzerland, the "Liverpool Healthy Homes Programme" in the United Kingdom, "The Alliance Against Energy Poverty in Catalonia" project in Spain. Thomson & Bouzarovski (2018) emphasise the importance of these projects as they are the main drivers for change regarding the energy poverty problems and treat the problem as the problem of the social kind, not just energy.

For example, Switzerland's (concretely Zurich's) project "Mehr als Wohnen" was implemented in 2007 and is best understood as a housing community created for the purpose of creating sustainable and future-oriented living spaces. What is characteristic for this project is the fact that it is created not only for those suffering from energy poverty but for all citizens. So, in this way, by making a housing community for all, not only is social diversity promoted, the step for energy poverty eradication was also made. The "Mehr als Wohnen" project is a good example of a long-term project that keeps developing and the best example is the fact that the Strategy 2018-2020 exists where four strategic points exist. These strategic points are oriented towards (Mehr als wohnen, 2018):

- strengthening of the social cohesion and participation, with the goals of creation of welcoming culture and motivation for further engagement, possibilities for good cohabitation, possibilities for inclusion in the project as well as the possibilities for citizens to share the responsibilities among them;
- further development of the Hunziker Areal, which is the name of the architectural buildings constructed under the "Mehr als Wohnen" project, with the goals of development of the structures, with the adjustments of houses and environment in the terms of knowledge and needs, as well as with the goals of the development of services and increase the outward bandwidth of the area itself;
- continuance in the field of innovative growth and sustainability, with the continuing contribution to the quantitative growth which can be achieved through new projects, that often include either the purchase of new construction of non-profit residential buildings and with the development of innovative ideas for new projects;
- continuance in the field of innovations and learning platforms created for the public housing construction, with the active transfer and strengthening of knowledge, support for the industry, as well as with the inclusion of new issues and questions important for the industry itself.

According to Thomson & Bouzarovski (2018), the "Liverpool Healthy Homes Programme" is, next to Switzerland's "Mehr als Wohnen" project, another project which focuses on social inclusiveness through creating solutions for the problems that energy-poor face because of

the low-quality dwellings they live in. Energy poverty was addressed by as many as 16 different partners which cooperated with the sole purpose of the transformation in the field of energy poverty solutions. United Kingdom's "Liverpool Healthy Homes Programme" is considered to be one of the most successful projects in the country and has been implemented in other cities across the United Kingdom, and has also been recognised through several awards it has been given. This project is extremely important as it focuses on two extremely important dimensions of energy poverty. The first dimension that is usually ignored refers to free help and advice for all energy-poor who have troubles or are struggling to pay their energy bills. The dimension of advice is usually disregarded and ignored when talking about the problem of energy poverty but has a crucial position when talking about energy poverty eradication. Energy poor often have troubles understanding the concept of energy poverty and, hence, the guidance provided by the "Healthy Homes" team is a step closer to resolving the energy poverty problem. What the team does is pays energy-poor a free home visit where subjects, such as how to use less energy and understand why energy bills are so high, then the support and advice on the appropriate energy tariffs which lead to the best specific solution regarding the energy or general help with various topics related to energy and energy poverty, are covered. The second dimension of energy poverty that is covered through this project is related to measures of energy efficiency, such as the insulation and heating, replacements of energy units, such as boilers, radiators, and even lighting (Liverpool City Council, n.d.). Thomson & Bouzarovski (2018) emphasise that energy efficiency measures are important because they provide energy-poor households with the possibility for the energy transition to safe and reliable energy sources, which, ultimately, improve the living situation for them, and create a better and sustainable future for them.

And finally, for the purpose of this master's thesis, Spain's "The Alliance Against Poverty in Catalonia" (hereinafter: the APE) will be presented, as another successful project in the EU. Thomson & Bouzarovski (2018) emphasise that this project is important as it started as the citizens' initiative, which was ultimately adopted in 2015. One should remember that the citizens then initiated change by securing more than 140,000 signatures because, at that time, five main energy companies that operated in Spain created the situation where thousands of people were left without a connection to electricity. This was the main driver for the initiative and fight to introduce a commitment to universal access to basic energy services. After the initiative was adopted and implemented by the Parliament of Catalonia, the law which protects customers from energy (and water) disconnections was implemented as well. The APE is extremely important as the get-togethers that are being organised every two weeks are led by those who are most affected by the problem of energy poverty, rather than by experts or politicians, as it is usually the case. Guiteras (2018) emphasises that the APE in Catalonia is of great importance because, even in 2016, after the law, a great number of households suffered from problems associated with energy poverty. For example, 11% of the population in Spain could not keep their homes adequately warm during the winter and 21% of the population lived in situations of energy poverty.

In conclusion, these projects have shown that progress in the field of energy poverty is possible and that, in order for energy poverty to be decreased, and, ultimately, eliminated, EU Member states need to implement significantly more projects. Energy poverty projects are not only helping the energy poor, but are also creating a sustainable future for all citizens, which means that, in the end, not only energy-poor benefit, but all.

3.6 Energy poverty in South East Europe

SEE represents a geographical region in Europe, which, for the most part, refers to countries located in the Balkans. Hence, SEE represents a wider region with many countries included in it. However, for the purpose of this paper, only a few SEE countries are going to be mentioned, where some are already members of the EU, and the rest of the countries have the ultimate goal of becoming members of the EU. Croatia is among the SEE countries EU Member states that are going to be presented, and Albania, Serbia, Northern Macedonia, Kosovo and Montenegro are non-EU SEE countries that are going to be presented and explained in the context of energy poverty.

Before presenting the state of energy poverty in selected SEE countries one needs to be aware that according to Bouzarovski, Petrova & Sarlamanov (2012), one of the most prominent attributes of selected SEE countries, with the exemption of coastal area of Croatia and Montenegro, are its harsh and cold winters, even though these countries are located in the south. Another important fact that influences many happenings and many conditions in SEE countries are its histories and the fact that all these countries were once communist countries, where its centrally planned economies supplied its citizens with energy coming from polluting energy sources, with the characteristic of inefficiently built dwellings and its heating systems, and the fact that the state was the owner of energy companies. What is important to mention is that the communist era influenced all these countries in a way that its central planning was present and that, in most cases, social support measures are those which are used as political instruments (Bouzarovski, Petrova & Sarlamanov, 2012). Another important aspect that needs to be taken into consideration when talking about energy poverty and the energy sector in general in the SEE is the fact that about 13 million people across the 17 countries still use solid fuels as a source of heating and cooking energy, which are not considered to be efficient energy sources. In accordance with this, the equipment used for processing of these types of energy sources is also inefficient, where heating stoves usually have a 20% or less of a conversion efficiency, combined with poor construction materials and poor insulation which is a common occurrence in SEE countries. One of the factors that could have the biggest impact on energy poverty and related energy access problems is the access and efficient use of non-solid fuels (United Nations Economic Commission for Europe, 2015). When comparing energy use per capita in SEE countries with energy use per capita in the EU as a whole, SEE countries use approximately half that of the EU. For example, in 2018, final energy consumption in households measured in thousand tonnes of oil equivalent (hereinafter: TOE) per capita in the EU amounted to an

average of 0,64 TOE per capita. Final energy consumption in households measured in TOE per capita for Croatia in 2018 was 0,56, in Montenegro 0,40, North Macedonia 0,23, Albania 0,18, Serbia 0,32 and Kosovo 0,30 (EUROSTAT, 2021b). However, in comparison with the EU, because of the previous history in these countries, buildings, and heating systems and appliances are inefficient and require much more energy to be used to reach the same comfort level as in the EU (Robić, 2016).

Hence, it is evident that the SEE countries are facing many problems in the energy sector. Even though a part of the reasons for the hard situation in these countries can be attributed to their turbulent history, which left the countries with enormous infrastructural damage and the decline or stagnation of their national economies, other reasons can be found in the recent energy sector liberalisation, which had brought major changes to the energy sector in SEE countries. Those that were already considered vulnerable in the terms of energy poverty became even poorer, as the energy sector liberalisation implied higher energy prices. It is important to mention that liberalisation of the energy sector was harder on the citizens in SEE countries than in the rest of the EU, as for these countries energy prices were kept at unnaturally low levels thanks to the historically long periods of regulation and subsidisation of energy prices. The region of SEE is characteristic when talking about energy poverty because often those who are energy poor are forced to choose between basic energy services and food, and, instead of efficient energy sources use alternative fuels which are not only more expensive when looking at them long-term, but are also dangerous because of the number of health consequences related to them. Another important challenge for the countries of SEE is the growing problem of deforestation that arose as a consequence of people's inability to use modern, reliable, sustainable and efficient energy sources (Robić, 2016).

Energy and the problem of energy poverty in SEE countries is one of the most complex issues that need to be resolved when talking about the well-being of the citizens of these countries, as well as when talking about their economies. The complexity of the problem is reflected in the fact that the region of SEE represents a massive location with approximately 25 million citizens. Out of the approximately 25 million citizens living in SEE countries, it was estimated that more than 30% of households living in these areas can be classified as energy poor. According to Robić, Živčić & Tkalec (2016), even though the definition stating that the "household that would need to spend more than 10% of its annual income on having adequate energy services is in energy poverty" is commonly used in almost all SEE countries, one needs to be aware that this definition is not acceptable for the countries of SEE. The reason for the inadmissibility of this definition lies in the fact that for most of the SEE countries, this would mean that approximately the whole population would be energy poor. On the other hand, those who live in SEE countries and are not classified as energy-poor face another problem, which is that they cannot ensure permanent access to energy services. The problem of energy poverty in SEE countries is not "attractive" for politicians in the region.

As Robić (2016) states that the lack of definition and recognition, as well as monitoring of energy poverty is common for almost all SEE countries. For example, for the problem of energy poverty in Albania, no specific policies designed to resolve it are in place, even though Albania has recognised the concept of vulnerability in the energy sector. What is especially characteristic for Albania is the problem of energy access, where approximately 40% of households have appropriate access to appliances needed for everyday needs for clean, sustainable and reliable energy. Kosovo, Serbia, North Macedonia and Montenegro have similar situations regarding energy poverty in their countries. For example, for Kosovo, which is one of the poorest countries in Europe and in the SEE, the situation with energy poverty is extremely serious, as approximately 80% of the population was measured to be below the line of poverty. Kosovo is one of the SEE countries whose energy poverty situation got worse also as a result of constant change and increase of the price of energy. For example, in 2012 it was estimated that the electricity bills increased as much as by 8.9%. This is extremely important as the majority of citizens living in Kosovo use either electricity or wood for heating, and each energy source in Kosovo is provided with unreliable and inefficient supply.

According to Robić (2016), for Serbia, the problem of energy poverty consists in the fact that the majority of residential buildings (59%) were built before 1962, which means that they are at least 58 years old. Combining the age of the buildings with the fact that these buildings, and even those built from this period until 1991, are provided with inefficient and unsustainable appliances, with little or no investments in their insulation, one should be aware that energy poverty related issues are inevitable in these situations. However, when talking about Serbia, one needs to remember that, even though the problem of energy poverty in Serbia is significant, where households on average spend approximately 11% of their income on energy bills, the legislation recognising and attempting to create vulnerable consumers was aligned with the EU policies. In a similar way as Serbia, North Macedonia recognised the problem of energy poverty through its energy legislation. This is an exception when talking about the situation regarding the recognition of the problem in the SEE countries, even though there is no official definition of energy poverty in place in North Macedonia.

The situation with energy poverty in Montenegro is similar to these countries, primarily because, similarly to other countries, the energy prices increased and the residential dwellings are not insulated, old, and are equipped with bad and inefficient appliances. For example, it was estimated that approximately 74% of all households in Montenegro still use stoves that use solid fuels, even though approximately 98% of households in Montenegro have electric stoves. Montenegro's efforts in fighting energy poverty are included in the country's energy sector development, where the need for the protection of vulnerable consumers in the field of energy is recognised (Robić, 2016).

Vlahinić Lenz & Grgurev (2017) emphasise that Croatia, as one of the EU Member states and SEE countries, defined the problem of energy poverty also by defining and recognising

vulnerable consumers through its energy act, the law regarding the electricity and gas markets. The latest addition for definition and status of Croatian vulnerable consumers was adopted in 2015 when the Croatian Government adopted the decision where vulnerable consumers are those who are either a beneficiary of the minimum guaranteed social or disability allowance. For Croatia, another important aspect that is connected with energy poverty refers to the gap between those who are really energy poor or energy vulnerable and those who are beneficiaries of help. It was estimated that the percentage of those receiving help in terms of energy poverty was approximately 3%, whereas the percentage of those who were determined to be energy poor goes up to 10%.

What is common for all these countries is that all SEE countries have problems associated with unemployment and the energy poverty problems are graver and harder to solve as they cannot only be resolved by using the solutions that can be applied only for the energy sector. Deeper reform is needed in all these countries as not only are they fighting energy poverty, they are fighting problems that could be associated with the much graver causes, such as poverty in general, high unemployment rates or the fact that there are almost no incentives, policies and projects created for the resolving of these problems. The situation in SEE countries in terms of energy poverty has been recognised as extremely serious and, even though the EU is working on finding the solution to the constantly growing energy poverty problem in the region, to this day little has been done.

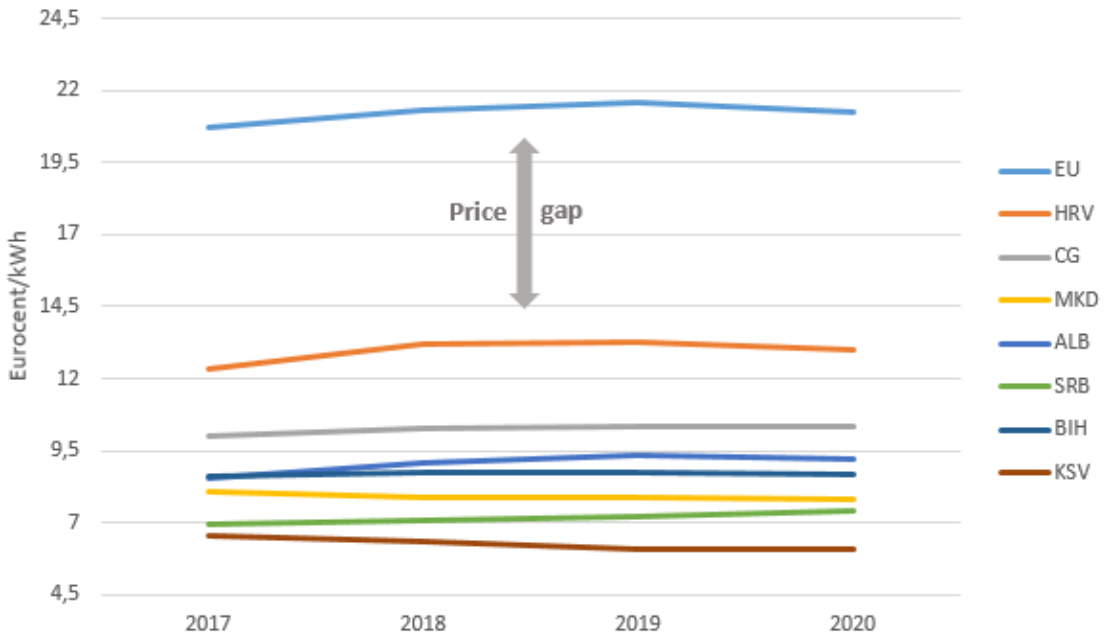
4 ANALYSIS OF ENERGY ACCESS AND ENERGY POVERTY IN BOSNIA AND HERZEGOVINA

4.1 The condition of energy access and energy poverty in Bosnia and Herzegovina

BiH and the surrounding countries face many difficulties in the energy sector, as a result of historical heritage and transition, resulting in infrastructural damage and stagnation or collapse of national economies. It is therefore logical to assume that energy poverty has the same characteristics across the region, regardless of cultural, climatic, or political circumstances (Agić, Agić & Kunto, 2017).

Even though no direct indicators of energy poverty in BiH exist, the severity of situation is visible and presented through unenviable level of liberalisation as BiH is still in the beginning stage of the process, energy sources usually used by households which are traditionally inefficient and polluting, condition of dwellings and household appliances, as well as other indirect indicators. The situation of energy poverty in BiH has just recently led the country on a path towards decarbonisation and green economy. Therefore, BiH is one of the first countries in Western Balkans who adopted “Nationally Determined Contributions” with the plan to decrease GHG emissions for 33.2% by 2030 and almost 66% by 2050 compared to 1990 levels. This climate pledge will help with economic restructuring and transition from fossil fuels to renewables (United Nations Development Programme, 2021).

Figure 7: Electricity prices for household consumers (2017-2020)



Source: EUROSTAT (2021c).

Although electricity prices in BiH and the surrounding countries are still significantly lower than in the EU (as shown in Figure 7), the abolition of state regulation and the liberalisation of the energy market lead to rising prices and can create significant problems in covering basic energy needs. The market liberalisation process is not a problem in itself, however, it must be carried out with adequate safeguards in order to allow a smooth transition (Agić, Agić & Kunto, 2017).

The largest single consumers of energy are the residential buildings and those are the main source of greenhouse gas emissions. Current housing construction principles are falling behind EU levels. The house which is old stock is becoming wasteful and decayed. According to Robić (2016)[3], over 83% of the populace lives in family units with an average of 3.1 relatives. Most family units (93%) have a washer, but they are generally (65%) more than 6 years old, with 27% being for over 10 years in function. The circumstance is surprisingly more dreadful with coolers which are regularly more than 10 years old (42.5%) and refrigerators, 32.3% are used for more than 10 years. Household appliances which are old and wasteful and warming systems with the focus group coming from provincial territories depend on individual stoves usually warming only one room. In BiH, the administrative organisation has embraced a few endeavours in aiding the poor. Because of the complex authoritative constitution combined with financial troubles which have caused

[3] The last research conducted by the Agency for statistics of BiH (Survey on household energy consumption in BiH) was done in 2015. To this date there is no new data as the research is being conducted every 5 years and the research from 2020 is still not finished.

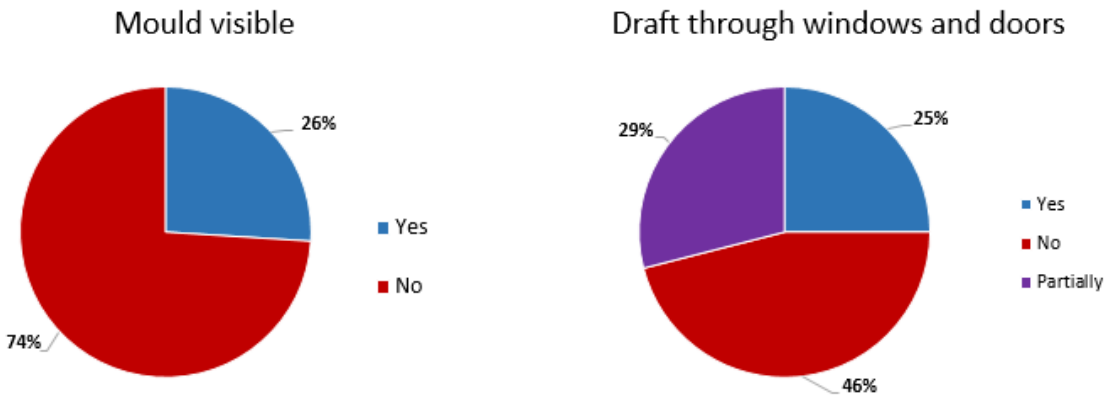
a weak adaptation of several aspects of national legislation, this aid is delayed. In any case, some advancement has been made concerning the assurance of poor energy clients.

Following a similar pattern as different nations from the SEE region, that are the Energy Community parties, the primary necessity to ensure poor energy customers was made within the Social Action Plan (SAP, OG 79/2010). One of the main activities under SAP is the advancement of a program for helping socially weak families. By knowing the poor members of the society within the energy consumers the essential proposed measure is to have social government assistance, given a material registration of government assistance clients and their salary. The individuals who are characterised as vulnerable energy customers should be qualified to get discounts on already determined amounts of used power. The social care communities should convey arrangements of qualified clients to the power providers who at that point demand assets for discounts from the Ministry of Finance (Robić, 2016).

According to Robić (2016), transposing of the consumer protection provisions of Directives by the electricity laws in the FBiH and RS is not very successful. The legal framework of the Brčko District implements consumer protection within the general public service. The regulatory acts, for example, general conditions for power usage and the standards for the supply of qualified clients, in all three levels of jurisdiction advance client insurance regarding the conditions for disconnection, complaints, and data rights. The current legislation of the Federation characterises protected clients and gives requirements to the supplier of tariff customers (in spite of the fact that tariff customers should have stopped existing by January, 1st 2015) as a way of client insurance, yet permits discrimination between clients through price regulation, which makes interpretation of directives generally stay fragmented and unbalanced. It is important to underline that the current situation in BiH is still the same regarding consumer protection and that no new measures were implemented. One should also note that the latest Law on consumer protection in BiH was published in 2015.

According to Robić (2016), a survey was conducted in Tuzla on a sample of 97 households, on a social status basis. The participants were members of different associations, such as women's associations, pensioners' associations, local communities, etc., mostly with low income. Because of the incapability to meet the expenses of adequate heating, numerous families are compelled to reduce the size of their living space. Furthermore, the greater part of the visited families lives in more than 36 years old homes, with single glazing windows and very weak insulation. Coal and wood are the main sources of heating for 73% of the respondents, mostly used for the individual heating types like stoves. High energy losses, as well as the bad health impact, have been demonstrated by survey participants as the constant presence of cold wind flowing through windows and entryways, while mould was not reported by most respondents in BiH.

Figure 8: Occurrence of drought and mould in visited households in BiH in 2015



Source: Robić (2016).

The fact that most of the households use home appliances, such as wash machines and freezers, that are more than 10 years old is also indicator of the inefficient energy and high energy expenses. The overviewed family units use 3,975 kWh of power on average every year, while the country average is 4,568 kWh, on which 9% of the total income of the household is spent, where the average income of the respondents is EUR 321 per month. Appliances that can be viewed as a luxury in BiH, for example, dishwashers, tumble dryers and air condition systems, are commonly not acquired by families who participated in the research (Robić, 2016).

As expected, regardless of the part of BiH, FBiH, RS or Brčko District, there are no assistance programs for households that have problems paying electricity and heat bills or buying energy for heating (Agić, Agić & Kunto, 2017).

4.2 Energy consumption in BiH

In the cycle of production, distribution and consumption of energy in BiH, large losses are realised. With the same amount of energy consumed, it generates four times less gross national product than in the average EU country and twice as much pollution. Disproportionate coal exploitation causes a high degree of pollution and achieves economic loss, the distribution of heating energy records an additional loss and finally, the use of energy in households and the public sector is extremely inefficient. This whole cycle of losses in the energy sector is ultimately paid for by the citizens themselves.

BiH faced a key development dilemma: to continue the practice as before and guarantee poverty to future generations or to change the policy of energy sector management, gradually turning towards rationalisation of production and distribution, renewable energy sources and investment in energy efficiency, i.e. making strides in development.

The administration of BiH has made some attempts to protect the vulnerable group of beneficiaries, however, the complex administration along with economic difficulties has led to the slow adoption of state legislation in many segments, and lags far behind the other countries. However, little progress has been made on protecting vulnerable energy consumers (Agić, Agić & Kunto, 2017).

Traditionally, Governments of the Entities set the prices and kept them falsely low, particularly for the family units for social reasons. Presently, this methodology is going through some changes. Private residencies are the biggest single energy consumers and a significant source of ozone-harming substances (Robić, 2016).

Hidden costs are found in the allocation of funds for subsidies to power plants, covering the costs incurred by heating plants and poor living conditions in a large number of households during the winter months. When society pays all these costs, less money is left for food, clothing, education, health, infrastructure and investments to improve energy efficiency. The low consumer price of electricity demotivates private investment in renewable energy sources, and the country is thus lagging behind in technological development. Poor management of the energy sector also has a negative impact on agriculture, the environment, tourism and other sectors of the economy (Agić, Rizvić & Agić, 2016).

4.2.1 Heating

Biomass and other forms of solid fuels have been traditionally used in many parts of Europe and still are a main source of heat in parts of Central and Eastern Europe as in BiH where the majority of households rely on fuelwood and subsidised coal for heating sources (Robić, 2016). A strategy to make domestic heating more affordable, these practices entail various health risks related to indoor and outdoor air pollution and house fires and fire-related accidents, as reported by local environmental organisations in BiH.

As shown in Table 9, 72.9% of households in BiH have room heating which includes heating with individual stoves and split systems, 19% have their own central heating, while only 7.9% have central heating from a local heating plant. A small part of households does not have any heating systems and sums to 0.2% (Agency for Statistics of BiH, 2015).

Table 9: Households by types of heating in BiH in 2015 (share in %)

	Not heated	**Rooms heating**	**Own central heating**	**Central heating from the heating plant**
Bosnia and Herzegovina	0.2	72.9	19.0	7.9

(table continues)

(continued)

Table 9: Households by types of heating in BiH in 2015 (share in %)

	Not heated	Rooms heating	Own central heating	Central heating from the heating plant
Federation of BiH	0.1	69.8	20.4	9.6
Republic of Srpska	0.4	78.2	16.3	5.2
District Brčko	0.7	78.2	21.1	-

Source: Agency for Statistics of Bosnia and Herzegovina (2015).

Table 10 shows that wood occupies the biggest share of energy sources in predominately own central heating of households in BiH, with the amount of 54.5%. Coal takes second place with 31.4% and natural gas takes third place with 9.1%. 3.4% goes to electricity and 1.6% goes to fuel oil and other petroleum derivatives. When it comes to the solid fuels consumption in the Federation of Bosnia and Herzegovina and Brčko District, the usage of coal is predominant. In the RS electricity is mainly used for central heating and in a very small share in the Federation in BiH (Agency for Statistics of BiH, 2015).

Table 10: Households by the energy fuels which are mainly used for central heating in BiH in 2015 (share in %)

	Electricity	Natural gas	Fuel oil	Coal	Wood
Bosnia and Herzegovina	3.4	9.1	1.6	31.4	54.5
Federation of BiH	1.2	13.4	1.4	38.8	45.1
Republic of Srpska	8.1	0.0	1.9	13.3	76.7
District Brčko	7.0	0.0	1.9	45.7	45.5

Source: Agency for Statistics of Bosnia and Herzegovina (2015).

When it comes to room heating of households in BiH, 88.3% of households use wood. Electricity and coal take second place with a share of around 5% and the use of other energy fuels comes to an insignificant number (Table 11). The average usage of wood for room heating in all metropolitan regions is 31.9%, and provincial and suburban zones 68.1%. The proportion of wood in metropolitan/provincial territories in the two entities of BiH is similar. (Agency for Statistics of BiH, 2015).

Table 11: The energy fuels which are mainly used for room heating in 2015 (share in %)

	Electricity	Natural gas	Fuel oil	Coal	Wood
Bosnia and Herzegovina	5.2	0.8	0.1	5.5	88.3
Federation of BiH	5.9	1.4	0.1	8.6	84.0
Republic of Srpska	4.0	-	0.1	0.7	95.2
District Brčko	7.6	-	-	1.6	90.7

Source: Agency for Statistics of Bosnia and Herzegovina (2015).

Among the nations of previous Yugoslavia, BiH is the greatest and only exporter of power. It can potentially stay in this position and is arranged to grow further and develop in terms of renewable sources. In 2004, the Council of Ministers of BiH adopted the medium-term goals as follows (Energy Charter Secretariat, 2012):

- attract domestic and foreign investments;
- ensure reliable energy supply, according to defined standards and the lowest prices possible;
- integrate with international markets by developing consolidated markets for electricity and gas, and by introducing competition and transparency;
- protect the interests of consumers;
- ensure environmental protection, according to domestic and international standards;
- enhance rational and efficient use of energy resources;
- fulfil the commitments of the Energy Charter Treaty, as well as other international agreements and conventions;
- increase the use of renewable energy.

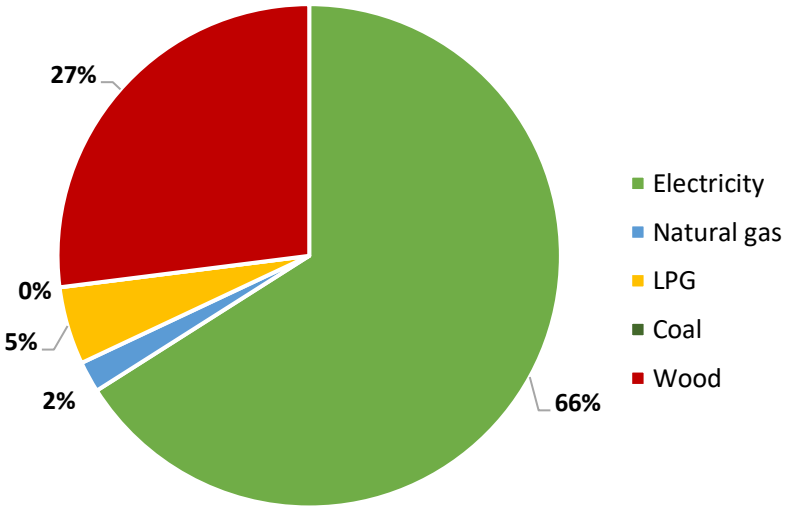
4.2.2 Cooking and hot water

64.5% of households in BiH mostly use two or more fuels for cooking and the remaining 35.5% of households use only one energy fuel. In all metropolitan communities, more than 20% of households utilise just a single fuel for cooking, contrasted with provincial and semi-metropolitan territories. In BiH provincial and suburban regions, more than 70% utilise at least two energy fuels for cooking, contrasted with metropolitan area usage (Agency for Statistics of BiH, 2015).

As shown in Figure 9, the most utilised fuel for cooking is electrical power which amounts to 65.8%. The high portion has wood with 27.2%, while LPG has 4.5%, natural gas has 2.4% and coal amounts just to 0.1%. Coal covers lignite, brown coal, coal briquettes, and charcoal. Wood covers fuelwood, wood pellets, wood briquettes, wood chips, and agricultural waste.

Electricity is prevailing in the structure of energy used for hot water, close to 90%. Other fuels participate in this structure with 7.8% (Agency for Statistics of BiH, 2015).

Figure 9: Share of energy fuels in households that used only one fuel for cooking



Source: Agency for Statistics of BiH (2015).

4.2.3 Annual energy consumption

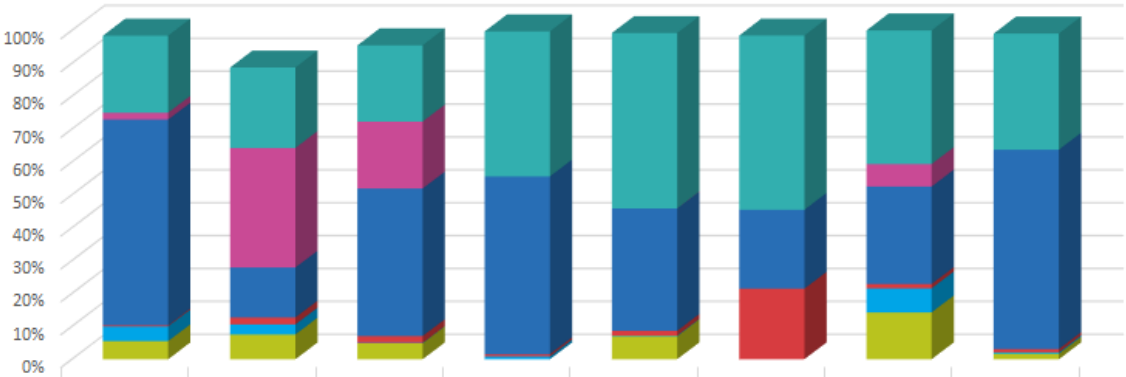
As shown in Figure 10, the annual consumption of electricity in BiH is 23.43% of the final energy consumption, whereas in the EU-28 electricity amounts to 24.49% of the final energy consumption. When talking about analysed SEE countries the share of electricity in total energy consumption in Serbia is 40.64%, while in Croatia it amounts to 23.20%. North Macedonia and Albania use electricity the most when looking at its share in the final energy consumption. The share of electricity in total energy consumption in these countries is 53.32% and 53.01%, respectively.

Wood is the most commonly used fuel type in BiH with 62.60% of the final energy consumption, followed by Croatia with 44.91% of the final energy consumption. Albania uses wood the least with 23.97% of the final energy consumption. It is important to mention that out of selected SEE countries, Kosovo has the highest share of wood, with 60.63% of the final energy consumption.

Figure 10 shows that out of selected SEE countries, BiH and Kosovo use LPG the least, with 0.30% and 1.01% of the final energy consumption, respectively. In BiH, natural gas is the second least used fuel type with 2.09% of the final energy consumption, while, for instance, Kosovo has even smaller share in the final energy consumption.

EU-28 countries mostly use natural gas with 36.34% of the final energy consumption. LPG is used the least with 2.13% of the final energy consumption (EUROSTAT, 2021b).

Figure 10: Energy fuels in final energy consumption in households in 2018 (share in %)



	BIH	EU-28	Croatia	Montenegro	North Macedonia	Albania	Serbia	Kosovo
Electricity	23.43%	24.49%	23.20%	44.10%	53.32%	53.01%	40.64%	35.32%
Natural gas	2.09%	36.34%	20.32%	0.00%	0.04%	0.00%	6.84%	0.00%
Wood	62.60%	15.20%	44.91%	54.08%	37.20%	23.97%	29.63%	60.63%
LPG	0.30%	2.13%	2.07%	0.68%	1.48%	21.47%	1.33%	1.01%
Coal	4.46%	3.03%	0.11%	0.85%	0.16%	0.00%	7.31%	0.44%
Heat	5.51%	7.54%	4.85%	0.00%	7.00%	0.00%	14.25%	1.67%

Source: *EUROSTAT (2021b).*

4.3 Vulnerable consumers

Exposure to the risks of poverty of individuals also depends on the households they live in. Data on the risk of poverty by type of household indicate that the following types of households are most vulnerable (Rizvić & Agić, 2018):

- single-member households (especially pensioners) are exposed to higher risks than persons living in multi-member households;
- people over 65 years old;
- households of single parents with one or more dependent children;
- households that are income-related to pensions and social assistance;
- households with more children.

The first compulsory document on the country level overseeing vulnerable energy purchasers was the Electricity Act (OG 66/13) which highlights that energy methodology has to design a program for the vulnerable energy customers protection (Article 5), and that this program should be designed to shield vulnerable customers from disconnections and ensure remote regions (Article 13). In June 2015, the Commission for the development of a Program for the Protection of Vulnerable Household Electricity Buyers was formed (OG 51/15), as per the Electricity Act requirement set. The task of the Commission is to define practices that can be executed with the purpose of vulnerable customers protection from

disconnecting from the grid, to provide protection in far off regions and to discover social protection instruments for the times of energy sector reforms where there is a possibility of redundant employees (Robić, 2016).

The Transmission of Electric Power Law, the Regulator and Electricity Market was drafted in 2014. Article 16 required security of vulnerable clients to the extent of ensuring that customers have benefits through the electricity market efficient operating, supporting healthy competition and transparency of the terms and conditions of contracts, general information, dispute resolution instruments, and simple change of supplier (Robić, 2016).

According to Robić (2016), the Government of RS reached an agreement in 2007 on the program that systematically provided protection to the vulnerable consumer. This Program for the protection of Socially Vulnerable Categories of Electricity was applied in 2008, 2009 and 2010, and it subsidised 150 kWh of electricity on the monthly basis. There were in the range of 28,000 and 35,000 qualified purchasers. In 2011 and 2012 there were no subsidies given to the electricity consumers. The government of RS was requested by the National Assembly to ensure assets for further assistance, within a half year of analyses and propose a mechanism for using the electricity profit for vulnerable customers' subsidies. The final result was a fund of BAM 8.6 million (EUR 4.3 million). In 2012, 120 kWh per user were subsidised monthly, which increased to 167 kWh in the last three months of 2012. RS has also agreed on the Strategy for the Development of the Energy Sector until 2030 (01-794/09) with the main goal to provide enough quantity and ensure a sustainable supply for all necessary energy services, with consideration of the vulnerable customers' protection. The second key goal is to increase energy efficiency in all segments of the energy sector, with special emphasis on buildings.

Just like general social protection in BiH, energy-related social protection is diffuse and not regular. There are some subsidy arrangements provided by some Canton authorities, as well as by some municipalities. Two of three electricity companies have formal agreements with local institutions for local protection to provide subsidies to socially vulnerable customers.

The Cantons of FBiH are responsible for social funds payments to the customers who are not able to pay their electricity bills, where a Canton achieves an agreement with the electricity company to cover a particular part of the bill. Elektoprivreda of BiH (hereinafter: EPBiH) has this kind of agreement with Zenica and Tuzla Cantons. The subsidies provided to the EPBiH are intended to help refugees and displaced persons meet their electricity bills. A different situation is in Canton Sarajevo, where socially disadvantaged households are offered BAM 200 (approximately EUR 100) during winter periods to cover costs for natural gas, solid fuel and central heating. The following people are eligible: Residential consumers whose total income does not exceed BAM 70 per family member per month; pensioners with only one family member whose total income does not exceed BAM 150 per month; pensioners with two family member whose total income does not exceed BAM 200 per month; households within which there are one or more beneficiaries of the financial

contribution for assistance and care or a person who is 95-100% deaf whose total income per family member does not exceed BAM 120. “Elektroprivreda Hrvatske Zajednice Herceg Bosne” does not have any precise agreements with authorities of Cantons.

RS charged all customers, which included households, commercial and industrial, a 10% of extra fee to all bills, with the intention to subsidise the expenses of the most vulnerable customers. Each municipality was informed by the Elektroprivreda Republike Srpske (hereinafter: EPRS) of the total amount of collected money every month. The municipality specified which consumers are qualified for a subsidy, estimated the amount of subsidy for every customer, and informed the EPRS. EPRS then reduced the electricity bills of the eligible customer based on the amount of the subsidy in the following month (European Bank for Reconstruction and Development, 2003). The Government of RS transposed the directive for vulnerable customers in the new Law on electricity in the RS (Official Gazette of the RS, number 68/2020), which implies the possibility of subsidising socially endangered households. This new measure should be at the expense of the budget of RS, or local communities, because social policy is in the exclusive jurisdiction of these levels of government, and not at the expense of public companies.

4.4 Possible solutions to resolving energy poverty in BiH

It is obvious that energy poverty is a burning problem in BiH, although much data and methodologies for defining vulnerability criteria are still lacking. Another important issue is the methodology and financial mechanisms through which assistance would be provided to vulnerable consumers (Agić, Agić & Kunto, 2017).

One possible answer is to analyse the various indicators that can be attributed to energy poverty (income, expenditure, energy consumption, facility condition, health and social criteria), which should be conducted at the state level. Because it is a long-term process, long-term, medium-term, and short-term approaches are possible. The first key step is to establish cross-sectoral energy and social group, including representatives of civil society and research institutions, to lead the process of harmonising national legislation, and to monitor progress in the field of various initiatives such as REACH project, thus ensuring central data collection (Agić, Agić & Kunto, 2017).

Competent institutions at all levels of government should recognise the existence of the problem of energy poverty and put it in the focus of their activities. Addressing it requires adjusting policies and measures at all levels of government (Rizvić & Agić, 2018).

Based on available data and conducted analyses, possible measures are (Rizvić & Agić, 2018):

- first of all, increase the share of the state budget to solve these problems;
- develop a model for identifying energy-poor households;

- develop priority lists to reduce energy-poor households;
- introduce regular visits and energy counselling of vulnerable households;
- design co-financing programs: energy renovation of buildings of poor households (installation of thermal insulation facades, replacement of carpentry, replacement of the inefficient heating system, etc.), procurement of energy efficient household appliances and efficient lighting;
- adopt energy renovation of all state-owned social housing;
- when building new social housing, strictly take into account the energy efficiency of buildings;
- introduce "energy literacy" campaigns for vulnerable groups of citizens.

Key step for BiH would be an alignment of EU acquis with BiH legislation regarding the protection of energy customers. This implies energy customers' mechanisms provision in both the electricity and gas sector, highlighting improvements in energy efficiency. The next step would include defining and observing energy poverty on the national level (Robić, 2016).

When it comes to potential instruments for reducing energy poverty, energy efficiency measures should be a priority. There are many proved advantages of energy efficiency, which is why this step is inevitable. Improvements in energy efficiency of households and appliances have positive impacts on overall life quality, health, energy bills expenses. It should be emphasized that data sharing on rational energy consumption advantages and education are an integral part of energy efficiency. Monetary support should not be the first choice of cost-effective energy efficiency measures, as it does not stimulate energy efficiency and does not provide a contribution to the general enhancement of life quality. After the realisation of all cost-effective energy efficiency alternatives, some kind of monetary help, for example, energy bills deduction, should be implemented as a measure (Robić, Živčić & Tkalec, 2016).

The state should include energy poverty in energy efficiency programs on the national level. Implementation mechanisms should be created in a way to increase energy efficiency for the socially vulnerable customers and should be offered by energy poverty programs on the national level. The focus of the measures for the energy poverty solving, provided through implementations of energy efficiency measures should be on (Robić, Živčić & Tkalec, 2016, United Nations Development Programme, 2021):

- low-cost energy efficiency and energy-saving measures (efficient indoor lighting, draft proofing of doors and windows, reflective foils for radiators, thermometers, etc.);
- replacement of household appliances ("old for new");
- use of renewable energy sources when possible;
- different levels of retrofitting building envelope:
    - window and door replacement;
    - insulation of roofs, walls and floors;

- deep renovation of the buildings whose occupants are vulnerable should be promoted and, if impossible due to deteriorated state of the building, replacement homes should be ensured;
- subsidies, which are suitable and useful for energy-poor households (e.g., high financing rates), should be shaped, especially for deep renovation of dwellings;
- support in filling out paperwork, as well as minimising bureaucracy;
- demand for low energy consumption for all new social housing;
- loans with no interest should be supported, mainly for deep renovation;
- decrease GHG for 33.2% by 2030 with the focus on key country sectors: power, district heating, buildings, forestry and transport;
- decarbonisation of the economy, especially in the power sector with investments estimated at approximately USD 10.18 billion until 2030.

Another important thing is that socially vulnerable customers should have all the necessary information to understand their energy bills and habits. Energy efficiency programs need to pay attention to improving "energy literacy" programs (Robić, Živčić & Tkalec, 2016).

Recommendations for solutions to the problem of energy poverty that are feasible in BiH are (Agić, Agić & Kunto, 2017, Robić, Živčić & Tkalec, 2016):

- development of a program to combat energy poverty, which must define steps and procedures to address this problem, and which includes a set of measures, ranging from the simplest and cheapest such as energy consulting to large investment projects implementing energy efficiency measures (installation of thermal insulation facades, replacement of carpentry, etc.);
- if possible, provide grants from the pre-accession funds of the EU in the first place, i.e., funds with minimum interest for "heating" of housing facilities whose beneficiaries are persons in a state of energy poverty;
- ensure the abolition of taxes and other taxes for energy delivered to persons in energy poverty, fees paid by energy suppliers to the local community on the basis of harmful effects on the environment must be redirected to take care of the most vulnerable categories of the population;
- privileged energy price, i.e., a certain amount of energy that people in a state of energy poverty can use for their needs, without compensation to the energy supplier (various types of subsidies, etc.);
- a partnership between the NGOs sector and government in defining sustainable solutions in energy poverty.

Current trends in the EU in terms of investment in renewable energy sources are actually complementary to sustainable development, and investing in energy efficiency in BiH would produce multiple benefits given the current situation, and provide a large return on investment in a relatively short time. The key to success lies in changing the way public

goods are managed. Without structural reform, where public funds are invested transparently and responsibly, it is not possible to design and implement energy sector policy for the benefit of citizens. EU guidelines and EU Member states' best practices on this issue represent a kind of roadmap for BiH and are crucial for improving the standards of the population (Agić, Rizvić & Agić, 2016).

CONCLUSION

It is clear that energy access and energy poverty are a huge global problem since a large number of people face difficulties with meeting basic living needs, such as heating, cooking, lighting and other important energy necessities. It is extremely hard to reach a consensus on this topic, due to the problem of comparing energy access to energy poverty, where energy poverty is mainly caused by inadequate levels of income and consumption. Historically, the problem of energy poverty and a low level of access to energy sources has not received much attention. Only recently more time was invested in resolving these problems. Evidently, energy poverty is also viewed as one of the main social issues, and not just energy issues, that need to be solved in the shortest period of time. Not having the appropriate energy access can cause significant damages to the well-being, as well as the mental health of individuals. One of the most serious consequences for health is related to the consequences of the burning of wood and waste, which lead to indoor air pollution. Indoor air pollution is especially dangerous, as it leads to different diseases and often premature deaths.

Rural areas are especially affected by energy access and energy poverty problems, due to the factors of distance and low density of population. For instance, the expenses of electrification in these areas are extremely high, which makes it hard to handle this issue. It is essential to have monetary support on the national level for financing capital expenses or to introduce some types of subsidies. Nevertheless, it should not be neglected that urban and suburban areas also struggle with the problems arising from energy poverty and lack of energy access.

When talking about the EU, it is important to mention that energy poverty and lack of energy access were not presented as the problems at all, except in, until recently the EU Member state, the UK, where the concept of energy poverty was introduced through the term fuel poverty. In the EU, even in the most developed Member states, there is a presence of these problems, i.e., it is not restricted only to the developing, poor or middle-income states. All EU Member states are supposed to have a definition of the concept of energy poverty and identify vulnerable customers in order to make progress, which is not the case. Official energy poverty definitions exist in seven EU Member states, Cyprus, Spain, France, Ireland, Romania and Belgium, as well as Great Britain as a former Member state. There is no universal EU definition of energy poverty, but there are numerous definitions put in place in different EU Member states, which are adjusted to national modalities. Definitions of vulnerable consumers in the EU include explicit and implicit definitions. Explicit definitions

are those constituted in the legislation, whereas implicit definitions refer to the problem of vulnerable consumers without defining the term itself.

Vulnerable consumers in the EU are protected by several measures used in the electricity and gas markets. One of the most frequently used measures of protection are restrictions to disconnections in cases when the bills could not be paid in time. Twenty EU Member states use this measure in the electricity market, whereas twelve Member states use this measure in the gas market. Other measures include social tariffs, right to defer payment, general price regulation, free energy-saving advice, exemption from some components of final energy costs, a financial contribution for replacement of inefficient appliances, free basic supply with energy, replacement of inefficient basic appliances at no cost, as well as other measures applied on national levels. Many advantages of energy efficiency measures make them also one of the most popular measures used in the EU. The positive side of these measures is reflected mostly in the long term, as they help the economy as well as the most vulnerable population. Even though there are many different programs being used, a lot of effort and work needs to be put into tackling these issues.

In regards to the situation in SEE countries, it is important to conclude that almost all SEE countries are missing the definition, as well as recognition and monitoring of energy poverty. Furthermore, there are also problems with a low rate of employment which makes energy poverty harder to eradicate. There are almost no policies, incentives and projects implemented in solving these problems, as the politicians in the region do not pay much attention to this problem. Due to the past events and the turbulent history that occurred in SEE countries, the problems arise with the appliances and heating systems which are dated and poorly efficient, as well as in the enormous infrastructural damage and poor insulation of buildings, which is why they use more energy than in the EU. Another growing problem for SEE countries is deforestation which is a consequence of the inability of using reliable, sustainable, modern and energy-efficient energy sources. One should note that the region of SEE has recently become the focus of EU's initiatives, as the situation was assessed as extremely severe. To this day, these countries still struggle with energy poverty and energy poverty associated problems, as only a little progress has been made.

BiH, as well as the neighbouring countries, are far behind the other European countries due to the historical events and transition, which caused huge destruction of infrastructure and stagnation of national economic development. Cultural, political or climatic circumstances do not make any differences in energy poverty characteristics when talking about BiH and the countries in the region. One of the main problems in BiH are the large losses made in the processes of production, distribution and consumption. Specifically, four times more gross national product is generated in the EU than in BiH, and twice as less pollution, with the same amount of consumed energy. Ultimately, these losses cause large burdens on citizens, as they are the ones that make up for them.

For BiH, it is hard to make any progress and to develop much-needed programs and measures for support of socially vulnerable groups, due to the complex structure of the country and the political, economic and cultural division of individual parts of the country. Likewise, general social protection in BiH, social protection in terms of energy is also diffuse. There is a certain number of subsidy programs implemented by authorities of the Cantons in FBiH and by some municipalities meaning there are no universal programs for BiH.

Generally speaking, little is known and done about energy poverty in BiH. The existence of the energy poverty problem needs to be recognised by adequate institutions at all levels of government and put in the focus of their activities. Policies and measures that are conducted on different levels of the state should be adjusted. Considering conducted analyses, increasing the share of the state budget for the purposes of tackling the energy poverty problems is inevitable. Furthermore, tackling the problem of energy-poor households could be done through developing models for identifying them in the first place and prioritising the ones that are the most vulnerable. Public awareness must not be left out due to its importance in improving the life quality of vulnerable population by introducing "energy literacy" campaigns. Special attention should be given to energy efficiency, as one of the instruments for energy poverty reduction, due to the many advantages of energy efficiency to health, overall life quality and reduction of energy bills costs. Financial mechanisms for vulnerable customers' support and tackling the energy access problems should be implemented also at the national level.

Finally, the BiH legislation in terms of energy customers' protection should be in line with the EU acquis. There is an indication that now is the right time to change the paradigm in the energy sector. First, the policy of subsidies and investments in obsolete forms of production has reached the level of economic unsustainability. Secondly, the process of European integration and internationally signed agreements represent a chance for BiH to join the trends prevailing in the EU and thus seize the chance for reforms that will guarantee sustainable development.

REFERENCE LIST

1. ACER/CEER. (2019). Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas markets in 2018. *Consumer Empowerment Volume*.
2. ACER/CEER. (2020). Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2019. *Energy Retail and Consumer Protection Volume*.
3. Agency for Statistics of Bosnia and Herzegovina. (2015). *Anketa o potrošnji energije u domaćinstvima u BiH*. [Survey on household energy consumption in BiH]. Sarajevo: Agency for Statistics of Bosnia and Herzegovina.

4. Agić, S., Agić, Dž. & Kunto, A. (2017). *Energetsko siromaštvo u Bosni i Hercegovini* [Energy poverty in BiH]. Tuzla: Centar za ekologiju i energiju.
5. Agić, Dž., Rizvić, V. & Agić, S. (2016). *Pregled nacionalne situacije u pogledu energetskog siromaštva u Bosni i Hercegovini* [Overview of the national situation regarding energy poverty in BiH]. Tuzla: Centar za ekologiju i energiju.
6. Alstone, P., Gershenson, D. & Kammen, D. M. (2015). Decentralized energy systems for clean electricity access. *Nature Climate Change*, *5*(4), 305-314.
7. Assist2gether. (n.d.) *Report on national and European measures addressing vulnerable consumers and energy poverty*. Retrieved 2 November 2020 from report_on_national_and_european_measures_addressing_vulnerable_consumers_and_energy_poverty
8. Bazilian, M., Nakhooda, S. & Van de Graaf, T. (2014). Energy governance and poverty. *Energy Research & Social Science*, *1*, 217-225.
9. Bhattacharyya, S. C. (2012). Energy access programmes and sustainable development: A critical review and analysis. *Energy for sustainable development*, *16*(3), 260-271.
10. Boardman, B. (2009), *Fixing Fuel Poverty*. London: Earthscan.
11. Boardman, B. (2013). *Fixing fuel poverty: challenges and solutions* (1st ed.). London: Routledge.
12. Boiler Grants. (n.d.). *Free Boiler Grants.* Retrieved 20 March 2021 from https://www.boilergrants.org.uk/
13. Bouzarovski, S., Petrova, S. & Sarlamanov, R. (2012). Energy poverty policies in the EU: A critical perspective. *Energy Policy*, *49*, 76-82.
14. Bouzarovski, S. (2014). Energy poverty in the EU: landscapes of vulnerability. *Wiley Interdisciplinary Reviews: Energy and Environment*, *3*(3), 276-289.
15. Bouzarovski, S., & Thomson, H. (2019). Transforming energy poverty policies in the EU: Second Annual Report of the EU Energy Poverty Observatory.
16. Bouzarovski, S., Thomson, H., Cornelis, M., Varo, A. & Guyet, R. (2020). *Towards an inclusive energy transition in the European Union: Confronting energy poverty amidst a global crisis.* Luxembourg: Publications Office of the European Union.
17. Casillas, C. E. & Kammen, D. M. (2010). The Energy-Poverty-Climate Nexus. *Science*, *330*(6008), 1181-1182.
18. Centre for Policy and Governance. (2011). *Upravljanje energetskim sektorom i siromaštvo u Bosni i Hercegovini* [Managing energy sector and poverty in BiH]. Sarajevo: Centre for Policy and Governance.
19. Ciucci, M. (2020). Energy efficiency. *European Parliament.* Retrieved 20 March 2021 from https://www.europarl.europa.eu/factsheets/en/sheet/69/energy-efficiency
20. Cook, P. (2011). Infrastructure, rural electrification and development. *Energy for Sustainable Development*, *15*(3), 304-313.
21. Čavrak, V., Gelo, T., & Pripužić, D. (2008). Modeli potpore socijalno ugroženim kućanstvima na primjeru potrošnje energije u Europskoj uniji. (Support models for socially disadvantaged households in the example of energy consumption in the EU). *Zbornik Ekonomskog fakulteta u Zagrebu*, *6*(1), 315-338.

22. Directive 2019/692. *Common rules for the internal market in natural gas.* European Parliament, Council of the European Union. https://eur-lex.europa.eu/eli/dir/2019/692/oj
23. Directive 2019/944. *Common rules for the internal market for electricity.* European Parliament, Council of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0944
24. Energy Charter Secretariat. (2012). *In-Depth Review of Energy Efficiency Policies and Programmes: Bosnia and Herzegovina*. Brussels: Energy Charter Secretariat.
25. European Bank for Reconstruction and Development. (2003). *Can the Poor Pay for Power? The Affordability of Electricity in South East Europe.*
26. European Commission. (2018). *Launch of the EU Energy Poverty Observatory (EPOV)*. Retrieved 1 November 2019 from https://ec.europa.eu/energy/en/events/launch-eu-energy-poverty-observatory-epov
27. European Commission. (2019). *Intelligent Energy Europe*. Retrieved 16 August 2020 from https://ec.europa.eu/easme/en/section/energy/intelligent-energy-europe
28. European Commission. (2020). *Horizon Europe*. Retrieved 16 August 2020 from https://ec.europa.eu/info/sites/info/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_factsheet-horizon-europe_2019.pdf
29. European Commission. (n.d.). *Secure, Clean and Efficient Energy*. Retrieved 16 August 2020 from https://ec.europa.eu/programmes/horizon2020/en/h2020-section/secure-clean-and-efficient-energy
30. EUROSTAT. (2020). *Energy consumption in households*. Retrieved 20 February 2021 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_consumption_in_households#Energy_consumption_in_households_by_type_of_end-use
31. EUROSTAT. (2021a). *EU-SILC Survey*. Retrieved 1 February 2021 from https://ec.europa.eu/eurostat/search?p_auth=K4fAybuS&p_p_id=estatsearchportlet_WAR_estatsearchportlet&p_p_lifecycle=1&p_p_state=maximized&p_p_mode=view&_estatsearchportlet_WAR_estatsearchportlet_theme=empty&_estatsearchportlet_WAR_estatsearchportlet_action=search&_estatsearchportlet_WAR_estatsearchportlet_collection=empty&text=eu+silc
32. EUROSTAT. (2021b). *Final energy consumption in households by type of fuel*. Retrieved 18 February 2021 from https://ec.europa.eu/eurostat/databrowser/view/ten00125/default/table?lang=en
33. EUROSTAT. (2021c). *Electricity prices for household consumers.* Retrieved 13 February 2021 from https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_204/default/table?lang=en
34. EU Energy Poverty Observatory. (n.d.). *Social tariff for natural gas and electricity.* Retrieved 20 March 2021 from https://www.energypoverty.eu/measure-policy/social-tariff-natural-gas-and-electricity
35. EU Energy Poverty Observatory. (2020). *Member State Reports on Energy Poverty 2019*. Luxembourg: Publications Office of the European Union.

36. Fankhauser, S., & Tepic, S. (2007). Can poor consumers pay for energy and water? An affordability analysis for transition countries. *Energy Policy*, *35*(2), 1038-1049.
37. Filipović, S., & Tanić, G. (2008). The policy of consumer protection in the electricity market. *Economic Annals, 53*(178-179), 157-182.
38. Global Innovation Path. (2018). *From Waste to Energy, Biogas Powering China.* Retrieved 11 March 2021 from https://globalinnovationpath.com/en/biogas-powering-china/
39. González-Eguino, M. (2015). Energy poverty: An overview. *Renewable and Sustainable Energy Reviews, 47*, 377-385.
40. Guiteras, M. (2018). Alliance against Energy Poverty, Cataluña. *Energy Democracy*. Retrieved 29 August 2020 from https://www.tni.org/en/article/alliance-against-energy-poverty-cataluna
41. IEA. (2017). *Energy access outlook 2017: from poverty to prosperity*. Paris: IEA.
42. IEA. (2018). *Population without access to electricity falls below 1 billion*. Retrieved 12 November 2019 from https://www.iea.org/commentaries/population-without-access-to-electricity-falls-below-1-billion
43. IEA. (2020). Outlook for biogas and biomethane. *World Energy Outlook Special Report.*
44. IEA, IRENA, UNSD, WB & WHO. (2019). *Tracking SDG 7: The Energy Progress Report 2019*. Washington DC.
45. Javno preduzeće Elektroprivreda Bosne i Hercegovine. (2009). *Primjena blok tarifa kao mjera zaštite socijalno ugroženih kupaca elektročne energije.* (The application of block tariffs as a measure of protection of socially disadvantages electricity customers). Sarajevo: Javno preduzeće Elektroprivreda Bosne i Hercegovine.
46. Johnson, O. (2013*). Universal energy access: moving from technological fix to poverty reduction*. Bonn: Deutsches Institut für Entwicklungspolitik.
47. Kaygusuz, K. (2011). Energy services and energy poverty for sustainable rural development. *Renewable and sustainable energy reviews*, *15*(2), 936-947.
48. Komives, K., Foster, V., Halpern, J. & Wodon, Q. (2005). *Water, electricity, and the poor: Who benefits from utility subsidies?.* Washington DC: The World Bank.
49. Liverpool City Council. (n.d.). *Fuel poverty and energy efficiency*. Retrieved 29 August 2020 from https://liverpool.gov.uk/healthyhomesprogramme/
50. Magradze, N., Miller, A., & Simpson, H. (2007). *Selling Solar: Lessons from More than a Decade of IFC's Experience*. International Finance Corporation, World Bank Group.
51. Masud, J., Shara, D & Lohani, B. N. (2007). *Energy for all: addressing the energy, environment, and poverty nexus in Asia.* Manila: Asian Development Bank.
52. Mehr als wohnen. (2018). *Die 4 strategischen Stossrichtungen von mehr als wohnen*. [Four strategic points from Mehr als wohnen]. Retrieved 29 August 2020 from https://www.mehralswohnen.ch/dokumente/
53. Nussbaumer, P., Bazilian, M. & Modi, V. (2012). Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Reviews*, *16*(1), 231-243.

54. OFGEM. (2018). *Vulnerable consumers in the energy market: 2018.* Retrieved 16 August 2020 from https://www.ofgem.gov.uk/publications-and-updates/vulnerable-consumers-energy-market-2018
55. Ogunbiyi, D. (2020). Power in a pandemic - why energy access matters during coronavirus. *Thomson Reuters Foundation News.* Retrieved 14 April 2020 from https://news.trust.org/item/20200331134807-w6a0h/
56. OPEC Fund for International Development. (2021). *Energy.* Retrieved 9 February 2021 from https://opecfund.org/focus-areas/energy
57. Pachauri, S., & Spreng, D. (2004). Energy use and energy access in relation to poverty. *Economic and Political weekly*, 271-278.
58. Pachauri, S. & Spreng, D. (2011). Measuring and monitoring energy poverty. *Energy policy, 39*(12), 7497-7504.
59. Porcaro, J., Mehta, S., Shupler, M., Kissel, S., Pfeiffer, M., Dora, C. F. C., & Adair-Rohani, H. (2017). *Modern Energy Access and Health*. World Bank.
60. Pye, S., Dobbins, A., Baffert, C., Brajković, J., Grgurev, I., Miglio, R. D. & Deane, P. (2015). Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures. *Insight_e Policy Report*, (2).
61. Rao, N. D. (2012). Kerosene subsidies in India: When energy policy fails as social policy. *Energy for sustainable development, 16*(1), 35-43.
62. Ritchie, H. (2020). Indoor Air Pollution. Retrieved 10 September 2020 from https://ourworldindata.org/indoor-air-pollution
63. Rizvić, V. & Agić, Dž. (2018). *Pregled situacije u pogledu energetskog siromaštva u Zeničko-Dobojskom Kantonu*. [Overview of the situation regarding the energy poverty in Zeničko-Dobojski Canton]. Tuzla: Centar za ekologiju i energiju.
64. Robić, S. (2016). *Energy Poverty in SEE: Surviving the Cold.* s.l.: SEE Sustainable Energy Policy Programme.
65. Robić, S., Živčić, L. & Tkalec, T. (2016). *Energy poverty in South-East Europe: challenges and possible solutions.* s.l.: Reduce Energy use and Change Habits Programme.
66. Ruggeri Laderchi, C., Olivier, A. & Trimble, C. (2013). *Balancing act: Cutting energy subsidies while protecting affordability*. Washington DC: The World Bank.
67. Sagar, A. D. (2005). Alleviating energy poverty for the world's poor. *Energy Policy, 33*(11), 1367-1372.
68. Saghir, J. (2005). Energy and poverty: myths, links, and policy issues. *Energy Working Notes, Energy and Mining Sector Board*, 4.
69. Schuessler, R. (2014). Energy Poverty Indicators: Conceptual Issues – Part I: The Ten-Percent-Rule and Double Median/Mean Indicators. *ZEW-Centre for European Economic Research Discussion paper*.
70. Smith, K.R., Zhang, J., Uma, R., Kishore, V.V.N., Joshi, V. & Khalil, M.A.K. (2000). Greenhouse implications of household fuels: an analysis for India. *Annual Review of Energy and the Environment, 25*, 741-763.

71. Sovacool, B. K. (2012). The political economy of energy poverty: A review of key challenges. *Energy for Sustainable Development, 16*(3), 272-282.
72. Sovacool, B. K., Cooper, C., Bazilian, M., Johnson, K., Zoppo, D., Clarke, S., Eidsness, J., Crafton, M., Velumail, T. & Raza, H. A. (2012). What moves and works: Broadening the consideration of energy poverty. *Energy Policy, 42*, 715-719.
73. Sustainable Energy for All. (2017). Electrification. Retrieved 10 September 2020 from https://www.seforall.org/data-stories/electrification
74. Sustainable Energy for All. (2019). *Energizing finance: Understanding the Landscape 2019.* Washington DC: Sustainable Energy for All.
75. Thomson, H. & Bouzarovski, S. (2018). *Addressing Energy Poverty in the EU: State of Play and Action*. Manchester: EU Energy Poverty Observatory.
76. Thomson, H., Sareen, S., Mattioli, G., Kyprianou, I., Gouveia, J.P., Mazurkiewicz, J., Brito, M., Katsoulakos, N., Lis, P. & Robić, S. (2018). *European Energy Poverty: Agenda Co-Creation and Knowledge Innovation.* Manchester: University of Manchester.
77. Thomson, H., Simcock, N., Bouzarovski, S. & Petrova, S. (2019). Energy poverty and indoor cooling: An overlooked issue in Europe. *Energy & Buildings, 196*, 21-29.
78. United Nations. (2010). *Energy for a sustainable future: the secretary general's advisory group on energy and climate change summary report and recommendations*. New York: United Nations.
79. United Nations. (2014). *A Survey of International Activities in Rural Energy Access and Electrification.* New York: United Nations.
80. United Nations Development Progamme. (2021). Bosnia and Herzegovina releases new climate pledge under Paris Agreement. Retrieved 05 July 2021 from https://www.ba.undp.org/content/bosnia_and_herzegovina/en/home/presscenter/articles/2021/NDCBiH.html?
81. United Nations Economic Commission for Europe. (2015). *UNECE Renewable Energy Status Report*. Geneva: United Nations Economic Commission for Europe.
82. United States Agency for International Development. (2003). *Energy reform and social safety net approaches*. Washington DC: United States Agency for International Development.
83. Velumail, T. (2011). Regional context for improving access to energy: energy for creating and sustaining livelihoods. *Presentation to the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and International Fund for Agricultural Development (IFAD) Inception Workshop on "Leveraging Pro-Poor Public-Private-partnerships (5Ps) for Rural Development*. Bangkok: United Nations Convention Center.
84. Vlahinić Lenz, N. & Grgurev, I. (2017). Assessment of energy poverty in new EU member states: The case of Bulgaria, Croatia and Romania. *International Journal of Energy Economics and Policy, 7*(2), 1-8.
85. World Bank. (2020). Access to electricity. Retrieved 17 September 2020 from https://data.worldbank.org/indicator/eg.elc.accs.zs?end=2017&start=1990&view=chart

86. World Health Organization. (2016). Household air pollution and health. Retrieved 22 November 2019 from https://www.who.int/en/news-room/fact-sheets/detail/household-air-pollution-and-health
87. World Health Organization. (2019). Household air pollution. Retrieved 22 November 2019 from https://www.who.int/gho/phe/indoor_air_pollution/en/
88. Zardo Trindade, L., & Goedemé, T. (2020). The comparability of the EU-SILC income variables: review and recommendations. *Statistical Working Paper Series*, 2020 Edition, Eurostat, Luxembourg: Publication Office of the EU.

APPENDICES

Appendix 1: Povzetek (Summary in Slovene language)

Ena najresnejših težav na svetu, ki je bila prepoznana pred kratkim, je problem energetske revščine in pomanjkanja dostopa do energije. Veliko ljudi po vsem svetu se zaradi neustrezne ravni porabe in dohodka sooča s težavami pri izpolnjevanju osnovnih energetskih potreb. Posledice teh težav vplivajo na zdravje, kakovost človeškega življenja, okolje, izobraževanje, družbeni in gospodarski razvoj, podnebne spremembe ali splošno finančno stanje.

Tako podeželska kot urbana območja se spopadajo s težavami pri dostopu do energije in energetski revščini zaradi svojih geografskih lokacij, ločenih prenosov in razpršenega prebivalstva. To pomeni, da na podeželju zagotavljanje energetskih storitev stane več in je težko doseči prebivalstvo, ki živi na teh območjih, zato ponudnikom energije pogosto ni donosno vlagati v infrastrukturo.

EU prizadeneta tudi energetska revščina in težave z dostopom do energije. Čeprav se vsem članicam EU priporoča, da imajo uradno definicijo koncepta energetske revščine in prepoznajo ranljive odjemalce, to pa ne drži. V državah EU je veliko definicij, ki so prilagojene vsaki državi, vendar univerzalne definicije energetske revščine v EU ni. Ne glede na to, da se v EU uporablja veliko programov in politik, je za reševanje teh težav treba vložiti veliko več truda.

Tako kot v EU tudi države Jugovzhodne Evrope pogrešajo uradne opredelitve energetske revščine. To je pomembno, saj se države Jugovzhodne Evrope soočajo s številnimi težavami, povezanimi s tem problemom, zaradi pomanjkanja politik in projektov za odpravo teh težav. Že tako ranljivi odjemalci v državah Jugovzhodne Evrope so se po liberalizaciji energetskega sektorja soočali z večjimi težavami, kar je imelo za posledico višje cene energije. V primerjavi z EU je imel ta proces negativne posledice za državljane držav Jugovzhodne Evrope zaradi dejstva, da so te države ohranjale cene energije na neobičajno nizki ravni. V državah Jugovzhodne Evrope je nujno potrebna poglobljena reforma energetskega sektorja za reševanje zadevnih težav.

BiH glede na okoliščine in zapleteno strukturo države nima učinkovitih programov za pomoč ranljivim odjemalcem, ki se soočajo s problemi energetske revščine. Za BiH, pa tudi za države jugovzhodne Evrope, je značilno, da morajo energetsko revni pogosto izbirati med hrano in osnovnimi energetskimi storitvami ter izbrati alternativna goriva, ki so dražja, pa tudi nevarna za zdravje in okolje v Evropi. dolgoročno. Resnost težav, povezanih z energetsko revščino v BiH, ne bo rešena, če se javna sredstva za strukturno reformo ne bodo vlagala odgovorno in pregledno. Prav tako je treba prepoznati ranljive odjemalce in prednostno obravnavati tiste, ki so najbolj ranljivi. Izvajati bi bilo treba tudi druge politične ukrepe, kot je povečanje državnega proračuna. Vendar bi bilo treba te ukrepe prilagoditi in izvajati na nacionalni ravni, da bi zmanjšali težave z energetsko revščino v BiH.