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### COVID-19 impacts on Energy Poverty: Lithuanian case study

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#### ABSTRACT

*The analyses the impact of COVID-19 pandemics on energy poverty. Comparative assessment of Lithuanian trends with EU-27 and other Baltic States was applied to identify the main differences in these trends and to provide policy implications. Three main indicators from EU-SILC database were selected to measure energy poverty: Population unable to keep home adequately warm, Arrears on utility bills and Population living in a dwelling with a leakages. Energy prices as the main indicator driving energy poverty during COVID-19 pandemic was also addressed in order to fully grasp the negative impact of pandemics on energy vulnerability and energy poverty in Lithuania. The paper also provides policy recommendations to mitigate negative impact of COVID-19 on energy poverty in Lithuania.*

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#### INTRODUCTION

The COVID-19 pandemic is manifesting its devastating effects in multiple directions and demonstrating multiply effects on energy sector, including the increasing the level of energy poverty in many EU Member States (Karpinska and Smiech, 2020; Nagaj and Korpysa, 2020; Carfora et al., 2021; Primc and Slabke-Erker, 2020; Bienvenido-Huertas, 2021).

Therefore, there is no doubts that COVID- 19 crisis had big impact on energy sector. First of all, this impact is linked to decrease of mobility and reduced energy demand in transport and also due to various restrictions putting on various industries and services having impact on energy price decrease. At the same time energy consumption has drastically increased in residential sector. The recent increase energy prices provides a lot of problems for households, especially vulnerable groups of population. The decrease of energy consumption had positive impact on environmental pollution reduction however there are many doubts about energy use efficiency and fast penetration of renewables (Pilotta and Sedera-viciute-Paciauskiene, 2021, Peng et al., 2021). The main areas of energy sector effected by COVID-19 pandemic are: energy demand changes, recent increase in energy prices having impact on low-income

vulnerable population. Though there are several studies dealing with COVID-19 impacts on specific energy sector areas however energy vulnerability and poverty issues are not well addressed (Abu-Rayah and Dincer, 2020; Bamanyar et al, 2020; Fell et al., 2020; Hosseini, 2020; Sovacool et al., 2020; Haxsimusa and Liebensteiner, 2021, Halkos, Gkampoura, 2021; Hoang et al., 2021), though few authors (Brosemer et al., 2020, Mastopietro et al, 2020) have identified terrifying consequences of COVID-19 on population like inequity, poverty and health.

The paper aims to overcome this gap and provides indicators framework to monitor COVID-19 impacts on energy poverty. The developed framework was tested and applied for case study in Lithuania. The main problematic issues were addressed and policy recommendations to overcome the main negative effects on energy poverty were developed.

The rest of the paper is structured in the following way: section 1 presents the background of the study based on literature review, section 2 introduces methods and data; section 3 provides case study results; section 4 concludes and provides future research guidelines.

## 1. LITERATURE REVIEW AND STUDY BACKGROUND

Energy poverty, is defined as the situation in which individuals or households are not able to adequately heat their homes or meet other required energy services at affordable cost, and this the major problem present in many Member States, especially during COVID-19 pandemics (Bouzarovski and Petrova, 2015). It is difficult to grasp multiple drivers of energy poverty, different consequences of it and households' responses. Especially it is important to develop policies and measures to overcome negative impact of COVID-19 on energy poverty. In order to measure the extent and severity of the problem, a variety of energy poverty indicators exist and are applied in European Union. This paper aims to compare energy poverty indicators trends in Lithuania by applying comparative assessment approach to grasp the differences between countries in dealing with the negative consequences of COVID-19 on most vulnerable population and increasing energy poverty.

The main measures to alleviate energy poverty can be grouped into four clusters: a) energy access b) energy inputs, c) outcomes of energy use, and d) the quality of energy delivered (Nussbaumer et al., 2012). There are many indicators developed to address energy poverty over the world (Siksnytytė-Butkienė et al., 2021). Energy poverty measurements were addressed in several important studies by Bouzarovski and Tirado Herrero, 2017; Fzaine and Kahouli, 2019).

EU applies several indicators to monitor energy poverty as energy poverty is a multi-dimensional concept that is not easily captured by a single indicator. EU Energy Poverty Observatory (EPOV) project was established with the aim to set of consensual and expenditure-based indicators to measure energy poverty. Four different primary indicators for energy poverty are identified, of which two are based on self-reported experiences of limited access to energy services (based on EU-SILC data) and the other two are calculated using household income and/or energy expenditure data (based on HBS data). Additionally, a set of 19 secondary indicators are extracted from different data sources, mainly the Eurostat (ESTAT) website, SILC and the Building Stock Observatory (BSO). Each indicator used in EPOV captures a different aspect of the phenomenon (Streimikiene et al., 2021).

There are 3 main indicators provided by EU-SILC database: Population unable to keep home adequately warm, %; Arrears on utility bills, %; population living in a dwelling with a leakage, Indicators calculated using household income and/or energy expenditure data (based on HBS data) are: expenditure-based indicators: M/2: Absolute (equalised) energy expenditure below half the national median and 2M: Share of (equalised) energy expenditure (compared to equalized disposable income) above twice the national median (Streimikiene et al., 2021).

The indicators provided by EU-SILC database are used in all EU Member States and are the most popular as most EU Member States have no official definition for the "energy poverty" or benchmark to assess it. So very often, the energy poverty situation is defined as the "inability to keep homes adequately warm". In many countries, like France or Lithuania this approach has been officially adopted. The inability to keep homes adequately warm is monitored by EUROSTAT and in EU Statistics on income and

living conditions (EU-SILC) and indicates the percentage of persons from the total population who are in the state of enforced inability to keep their home adequately warm (European Commission, 2020).

Arrears on utility bills, is very important indicator of energy poverty as it provides information on high energy costs and/or low household income that force people affected by energy poverty to fall behind on the payments of their utility bills. The indicator "arrears on utility bills" is also monitored by Eurostat and EU-SILC annually and shows the percentage of persons from the total population who are in the state of arrears on utility bills, expressing the enforced inability to pay their utility bills on time due to financial difficulties (European Commission, 2020).

The indicator of population living in a dwelling with a leakage measures the share of the population experiencing at least one of the following basic deficits in their housing condition: a leaking roof, damp walls, floors or foundation, or rot in window frames or floor. Together with the indicator on "Housing cost overburden", this indicator addresses severe housing deprivation and complements the established multidimensional poverty indicator. This indicator can be considered as similar to global SDG indicator "Proportion of urban population living in slums, informal settlements or inadequate housing" (European Commission, 2020).

Another important issue to be addressed is linked to households energy prices which are the main drivers of energy poverty (Jai et al., 2021). Therefore, the authors recommend to analyse various energy indicators including their drivers.

## 2. DATA AND METHODOLOGY

The main approach applied in this paper – comparative assessment of dynamics of the main energy poverty indicators during COVID-19 pandemics in Lithuania. The EUROSTAT, EU-SILC and Energy Poverty Observatory data was applied for comparative assessment of results energy poverty .

In Table 1 the main energy poverty indicators are provided.

**Table 1.** Indicators of energy poverty of households

EU-SILC indicators for energy poverty measurement	1. Population unable to keep home adequately warm, % 2. Arrears on utility bills, % 3. Population living in a dwelling with a leakage, %	Eurostat (2021), EU-SILC, Energy Poverty Observatory
Electricity prices for household consumers	Electricity prices for household consumers with all taxes and levies, EUR	Eurostat (2021)

Further these indicators will be collected for Lithuania, EU-27 and other Baltic States (Estonia and Latvia) during 2016-2020 period to define the main trends and the differences in these trends. The reasons for differences will be further discussed and policy implications will be provided for Lithuania.

## 3. RESULTS

In Table 2 the main energy poverty indicators from EU-SILC database for Lithuania during 2017-2020 are given and compared with EU-27 average and other Baltic States – Latvia and Estonia.

**Table 2.** Dynamics of energy poverty indicators from EU-SILC database in Lithuania, EU-27 and other countries during COVID-19 pandemic

	2016	2017	2018	2019	2020
<i>1. Population unable to keep home adequately warm, %</i>					
European Union - 27 countries (from 2020)	9,0	8,1	7,6	6,9	8,2
Estonia	2,7	2,9	2,3	2,5	2,7
Latvia	10,6	9,7	7,5	8,0	6,0
Lithuania	29,3	28,9	27,9	26,7	23,1
<i>2. Arrears on utility bills, %</i>					
European Union - 27 countries (from 2020)	8.4	7.3	6.8	6.2	6.0
Estonia	7.9	6.3	6.5	7.2	5.0
Latvia	13.2	11.9	11.6	8.7	8.3
Lithuania	9.7	7.9	9.2	7.5	6.3
<i>3. Population living in a dwelling with a leakage, %</i>					
European Union - 27 countries (from 2020)	15.2	13.1	13.6	12.7	13.9
Estonia	13.9	13.9	13.1	13.8	10.2
Latvia	21.9	22.8	23.5	19.3	17.5
Lithuania	18.2	15.7	14.8	14.0	10.9

Source: (EUROSTAT, 2021)

As one can see from information provided in Table 2, Estonia distinguishes with the lowest indicators of energy poverty between Baltic States. According to indicator of population unable to keep home adequately warm, Lithuania shows positive trends during pandemics, however this indicator is very high showing almost 10 times higher energy poverty rates in comparison with Estonia. In Estonia indicator of population unable to keep home adequately warm in 2020 was 3 times lower than EU-27 average. This indicator has declined in Estonia in 2018, however since 2019 it is started to increase and reached year 2016 level by 2020. In Lithuania this indicator has declined since 2016 almost 20% however comparing with other EU member states it seems ab normally high. This is linked with low availability to regulate heat in multi-flat buildings which are not renovated and cold, i.e., residents can't regulate temperature and increase they comfort in flats. This is not issue of high prices but mainly issue of not efficient energy consumption in Lithuanian multi-flat buildings.

According indicator of arrears on utility bills, Lithuanian situation was very similar to EU-27 in 2020 and almost all investigated period. The tendencies of this indicator's dynamics were also positive in all Baltic States and EU-27 average during 2016-2020. Latvia distinguishes with the highest share of arrears on utility bills during all investigated period and Estonia again shows the lowest level of arrears on utility bills. In Lithuania indicator of arrears on utility bills has decreased from 2016 by 35%. The similar trends were in other investigated countries.

According to indicator of population living in a dwelling with a leakage the positive trends of energy poverty decline can be noticed in Baltic States and EU-27 average. Estonia distinguishes with the lowest share of population living in a dwelling with a leakage and Latvia with the highest one in 2020 and all investigated period. In Lithuania the share of population living in a dwelling with a leakage was even lower than EU-27 average during all investigated period.

Though all energy poverty indicators provided in EU-SILC database show positive trends of decline during 2016-2020, the trends of energy price increase in households show alarming trends in all EU-28

since 2020 second half of year and especially in the end of 2021 situation become unstable and terrifying due to political situation. The surge in demand for energy as we come out of the restrictions imposed by the pandemic, combined with a reduced supply of gas on the global market, made very negative impact on increase of energy prices in EU.

In Table 3 dynamics of bi-annual energy prices for households during 2016-2021 is provided in order to analyse the main drivers of energy poverty – households energy price dynamics during COVID-19 pandemics.

Table 3. Dynamics of households energy prices in Lithuania, EU-27 and other countries during COVID-19 pandemic

	2016 2nd	2017 1st	2017 2nd	2018 1st	2018 2nd	2019 1st	2019 2nd	2020 1st	2020 2nd	2021 1st
Households electricity price, prices including all taxes, levies and VAT, EUR/kWh										
EU - 27	0,1276	0,1271	0,1270	0,1286	0,1327	0,1282	0,1283	0,1270	0,1282	0,1329
Estonia	0,0960	0,0926	0,0950	0,0989	0,1048	0,0982	0,1027	0,0882	0,0953	0,0980
Latvia	0,1074	0,1043	0,1039	0,1035	0,1041	0,1136	0,1144	0,0996	0,1005	0,1024
Lithuania	0,0818	0,0783	0,0777	0,0771	0,0771	0,0947	0,0947	0,1111	0,0972	0,1003
Natural gas prices for households, including all taxes, levies and VAT, EUR/kWh										
EU - 27	0,0470	0,0430	0,0472	0,0434	0,0494	0,0457	0,0497	0,0431	0,0476	0,0410
Estonia	0,0243	0,0310	0,0306	0,0287	0,0306	0,0322	0,0311	0,0307	0,0305	0,0325
Latvia	0,0318	0,0296	0,0307	0,0301	0,0355	0,0351	0,0273	0,0243	0,0214	0,0229
Lithuania	0,0320	0,0302	0,0290	0,0285	0,0297	0,0321	0,0287	0,0272	0,0218	0,0201

Source: (EUROSTAT, 2021)

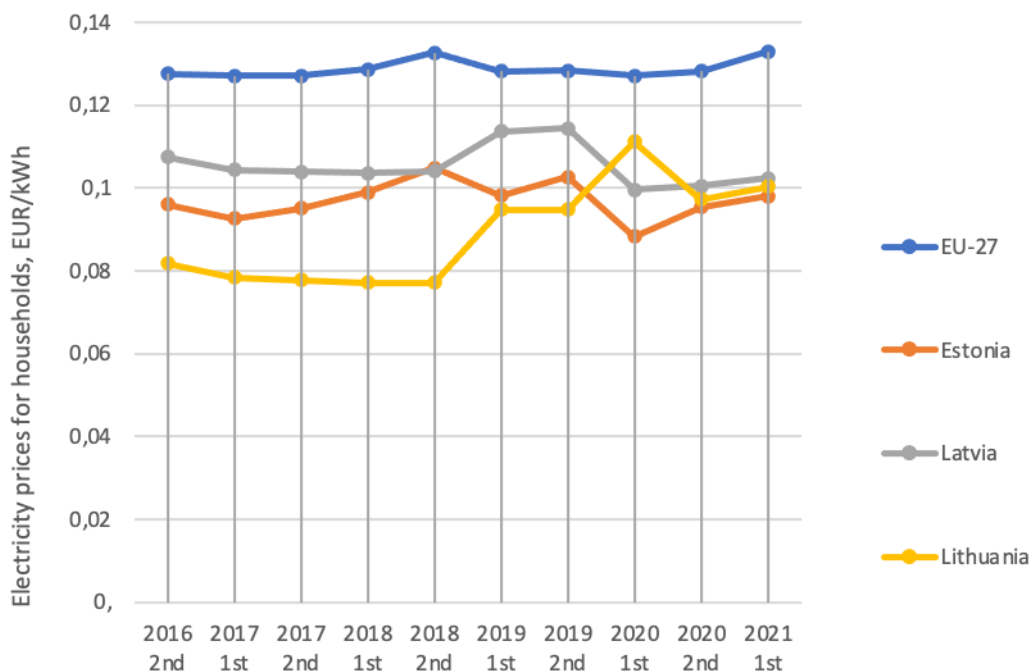
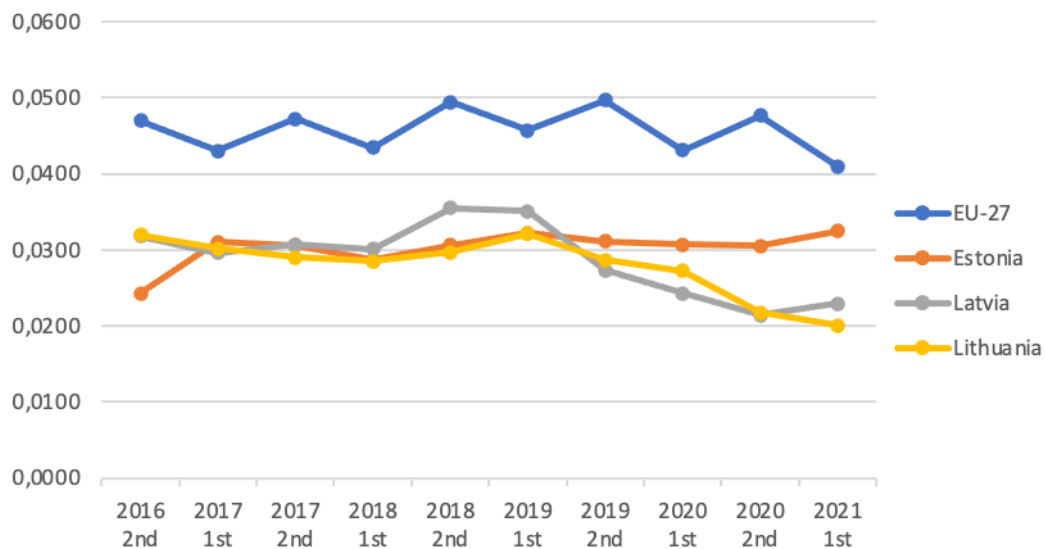


Figure 1. Dynamics of households electricity prices in Lithuania, EU-27 and other Baltic States

Source: (EUROSTAT, 2021)

Results of comparative analysis show that the lowest electricity prices for households during investigated period since 2016 were in Lithuania before 2020 first half of the year, as electricity prices have drastically increase for Lithuanian households but since second half of 2020 the prices have decreased and now they are at similar level in Baltic States. In EU-27 during investigated period electricity prices for households were more than twice higher indicating that full electricity market opening and synchronization with EU electricity supply grid by 2025 would have impact on increase of electricity prices in Lithuania. Litgrid, the Lithuanian electricity transmission system operator, has successfully completed the expansion of LitPol Link, the interconnection between Lithuania and Poland. This is one of the most crucial of the four synchronisation projects already implemented so far, as the upgraded LitPol Link station near Alytus is now capable of operating in the synchronous mode with the Continental European Synchronous Area. Therefore, the increase of electricity prices is forecasted in Lithuania and the impact on increase of energy poverty can be significant in Lithuania, though current EU-SILC database energy indicators shows positive trends of energy poverty decrease during COVID-19 pandemic.



**Figure 2.** Dynamics of households natural gas prices in Lithuania, EU-27 and other Baltic States

Source: (EUROSTAT, 2021)

As one can see from the dynamics natural gas prices for households provided in Figure 2, natural gas prices were decreasing in Lithuania, Latvia and EU until 2<sup>nd</sup> half of 2020 however, new tendencies of sharp increase can be noticed in all analysed countries since 1<sup>st</sup> half of 2021. The current trends in 2<sup>ns</sup> half of 2021 shows even more negative trends in Lithuania as well in other Baltic States. During investigated period the natural gas prices for households were lowest in Lithuania. Comparing natural gas prices for households in Baltic States and EU-27 one can notice that they are more than twice higher in EU-27.

#### 4. DISCUSSIONS AND POLICY IMPLICATIONS

Conducted analysis of energy poverty indicators development during 2016-2020, indicated positive trends in reduction of energy poverty in Lithuania, however the increase of natural gas and electricity prices in households since the second half of 2020 provides significant risks for vulnerable population. In addition, the energy price increase is expected due to foreseen synchronisation of electricity supply system with EU.

Another important issue is that some indicators of energy poverty in Lithuania, like indicator of population unable to keep home adequately warm shows very alarming situation in Lithuania. As the share of population of population unable to keep home adequately warm is almost 10 times higher than in neigh-

bouring country – Estonia having the similar economic development and price level. Therefore, policies to deal with this issue should be priority in Lithuania. Also it might be possible that such high rates of population that is unable to keep home adequately warm is linked with poor insulation of multi-flat buildings in Lithuania as other energy poverty indicators like the share of population having arrears on utility bills, in Lithuania are similar to other Baltic States and EU-27 average showing that not low income is the major problem for keeping their homes adequately warm, therefore the main policy implications of conducted study for Lithuania is promotion of renovation of multi-flat buildings and creating heat comfort and providing ability for households to control temperature in their apartments.

There is no specific strategy for addressing energy poverty in Lithuania. Energy poverty in the country is as part of overall social policies and measures. Reduced the VAT for district heating and hot water to 9% is applied in Lithuania since independence. There are no national indicators or benchmarks developed to address energy poverty in the country. The main instrument for dealing with energy poverty in Lithuania is a heating compensation, providing financial support to households who cannot afford sufficient heating services due to low income, however conducted research shows that not low income is the major problem and driver of energy poverty in Lithuania but poorly isolated in-efficient multi-flat building stock inherited from soviet past and low rates of mass renovation. Though, the households that receive heating compensation and live in multi-flat building are entitled to support towards the cost of a loan taken out to finance the renovation of the multi-building, the progress in this field is very low. This is linked with institutional, organizational and behavior barriers as low income population is lacking knowledge and know-how for initiation of energy renovation in their apartments. Especially big problem is to find consensus and to agree by all owners of flats on the renovation of multi-flat buildings and to initiate renovation project. Between 2009 and 2018 just 47,000 apartments were renovated in Lithuania. The most promising measure for Lithuania is requirement set for energy suppliers to establish an agreement with the national government and perform education and advising of households on various energy efficiency measures.

## CONCLUSIONS

Analysis and comparative assessment of energy poverty indicators development during 2016-2020 in Lithuania, indicated overall positive trends in reduction of energy poverty in Lithuania, the analysis of the main drivers of energy poverty (natural gas and electricity prices in households) show alarming trends as since the second half of 2020 electricity and natural gas prices for households started to increase in all EU Member states due to reduced natural gas supply by Russia on international markets and increased energy demand and economic recovery from COVID-19 pandemics all over the world.

Lithuania distinguishes with very high share of population unable to keep home adequately warm, almost 10 times higher than in Estonia and 3 times higher than in EU-27. The other indicators of energy poverty, like the share of population with arrears on utility bills show that not low income is the major problem for Lithuanian inhabitants encountering energy poverty but low insulation of multi-flat buildings and low possibilities to regulate temperature in the apartments as these old multi-flat buildings do not provide such possibilities.

As, such high rates of population that is unable to keep home adequately warm is linked with poor insulation of multi-flat buildings in Lithuania as other energy poverty indicators in Lithuania are similar to other Baltic States and EU-27 average showing that not low income is the major problem for keeping their homes adequately warm, therefore the main policy implications of conducted study for Lithuania is promotion of renovation of multi-flat buildings and creating heat comfort and providing ability for households to control temperature in their apartments.

Therefore, the main policy recommendations for Lithuania is to promote renovation of old energy in-efficient multi-flat buildings. For this purpose it is necessary to switch from such environmentally harmful and und just social support policies like reduced VAT for district heating where the richer people are more supported by government though the poorest one as in general richer people have bigger apartments and consume more heat to policies promoting education and advise of households on various energy efficiency measures including organizational support of renovation projects of multi-flat buildings.

The biggest problem is lack of knowledge and organizational and behavioral barriers of flat owners and inability to find consensus and to agreement by all owners of flats on the renovation of multi-flat buildings and to initiate renovation project.

The study has limitations as just period 2016-2020 data was used to analyse trends of energy poverty in Lithuania due to COVID-19 pandemics. Also, limited number of energy poverty indicators was analysed and compared between Lithuania and Baltic States and EU-27. This is due to limited availability of other energy poverty indicators available for COVID-19 pandemic period. The future research is necessary to address these issues by using new data on energy poverty indicators and providing comparative assessment of all EU Member States. The policy analysis and more in depth policy discussion will be provided for better understanding of differences between groups of EU Member States representing different economic development and energy poverty levels.

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