



The concern about main crises such as the Covid-19 pandemic, the war in Ukraine, and climate change's impact on energy-saving behavior

Genovaitė Liobikienė^{a,*}, Yuliia Matiiuk^a, Ričardas Krikštolaitis^{b,c}

^a Department of Environmental Sciences, Vytautas Magnus University, Universiteto str. 10, Akademija, LT-53361, Kaunas Dist, Lithuania

^b Department of Mathematics and Statistics, Vytautas Magnus University, Universiteto str. 10, Akademija, LT, 53361, Kaunas Dist, Lithuania

^c Lithuanian Energy Institute, Breslaujos str. 3, LT-44403, Kaunas, Lithuania

ARTICLE INFO

Keywords:

Energy-saving behavior
Climate change
The Covid-19 pandemic
The war in Ukraine
Attitudes
Pro-environmental behavior

ABSTRACT

The number of crises experienced around the world forces people to reconsider and reassess various aspects of their lives. The energy crisis caused by the war in Ukraine and uncontrolled climate change revealed the importance of energy-saving behavior. Thus, the aim of this paper is to analyze the concerns about current crises such as the Covid-19 pandemic, the war in Ukraine, and climate change's impact on energy-saving behavior and changes in environmental concern. Referring to the survey conducted in Lithuania in 2022, where 1000 respondents participated, the results revealed that the war in Ukraine was the most concerning problem. The level of climate change concern was slightly lower. Meanwhile, the Covid-19 pandemic was the least important problem in Lithuania in 2022. Furthermore, respondents stated that the Covid-19 pandemic contributed to the changes in environmental concern and energy-saving actions more than the war in Ukraine did. Meanwhile, the Generalized Linear Model results revealed that only the war in Ukraine positively and significantly influenced energy-saving behavior. The Covid-19 pandemic concern negatively affected energy-saving behavior, while the climate change concern factor affected it indirectly, as the interaction of attitudes toward energy consumption. Thus, this study revealed the main aspect of and how to encourage energy-saving behavior in the context of the main current crises.

1. Introduction

In recent years, the world has faced more crises than ever before. The war in Ukraine caused big insecurity in all European Union countries, particularly in the Baltic countries. The energy crisis and increasing prices of this resource imbalance the EU countries' economies (Kuzemko et al., 2022; Zakeri et al., 2022). Lithuania is the country where the prices of energy increased the most among the EU countries. Thus, the promotion of renewable energy production and energy saving has become one of the most important tools to solve the energy crisis (Trypolska and Rosner, 2022; Creutzig, 2022). The encouragement of energy-saving behavior is the easiest tool which does not require a lot of investment. Thus, almost all of the EU policymakers encouraged people to save energy not only on the institutional level but in their households as well. The war in Ukraine is a potential opportunity to begin to change energy consumption behavior and mitigate not only the energy crisis but climate change as well. However, how the concern about the war in Ukraine has contributed to energy-saving behavior lacks scientific

research.

Another crisis which touched all of the world is the Covid-19 pandemic. The pandemic disrupted not only the health system but also the safety of economy and ecology around the world (Erokhin and Gao, 2020; Bouarar et al., 2020; Klenert et al., 2020). In literature, scientists analyzed not only how the Covid-19 pandemic is related to environmental pollution (Al Huraimel et al., 2020; Siddique et al., 2021; Maatoug et al., 2021), but also how the pandemic influenced resource-saving behavior (Pop et al., 2022; Mustapa et al., 2021; Ueno, 2022; Jiang et al., 2021). However, little attention has been paid to how this pandemic influenced people's behavior post-Covid-19 – when the virus still exists, but strict management tools such as quarantine are withdrawn (Ahmad et al., 2022). Authors declared that the pandemic can successfully change behavior in a short period of time (Zakeri et al., 2022; Mi et al., 2021; Lucarelli et al., 2020), but whether the behaviors are reverted after lockdown is also important to analyze.

Climate change is the last crisis which remains long-term (Boto-García and Buccioli, 2020). Throughout this century, the governments

* Corresponding author.

E-mail address: genovaite.liobikiene@vdu.lt (G. Liobikienė).

<https://doi.org/10.1016/j.enpol.2023.113678>

Received 24 March 2023; Received in revised form 1 June 2023; Accepted 11 June 2023

Available online 23 June 2023

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have been discussing and searching for tools to mitigate climate change. Energy consumption reduction is the main way we can reduce greenhouse gas emissions even also considering the household sector (Trotta, 2018; Huang et al., 2022). Thus, authors analyzed the main determinants of energy-saving behavior vastly (Park and Kwon, 2017; Carrus et al., 2021; Shrestha et al., 2021). The concern about climate change is one of the main drivers which influences energy-saving behavior (Bouman et al., 2020; Ohler and Billger, 2014; Nauges and Wheeler, 2017; Boto-García and Bucciol, 2020; Gregersen et al., 2021). However, to the best of our knowledge, none of the other authors analyzed how the climate change crisis impacts such behavior in context of other crises such as the war in Ukraine or the Covid-19 pandemic. Thus, the aim of this paper is to analyze how concerns about present crises, such as war in Ukraine, Covid-19 pandemic, and climate change impact the energy-saving behavior and environmental concern. Thus, the aim of this paper is to analyze the concerns about current crises (the war in Ukraine, the Covid-19 pandemic, and climate change) impact on energy-saving behavior. Considering that the encouragement of energy-saving behavior in recent years is escalated by media and policymakers, it is vital to reveal the main determinants of this behavior.

2. Literature review

2.1. Historical precedence of different crises

The current crises due to the globalization concerned all the world. However, the rather similar crises occurred in all centuries and different regions. For example, cholera pandemic (1961-ongoing) began in the Southeast Asian archipelago and rapidly spread around the rest of the globe (Islam et al., 1990; Kaper et al., 1995). Thus, served as a stark reminder for society to recognize the delicate nature of biodiversity and the intricate links between human health and climate change (Colwell and Huq, 1994). It is transmitted through untreated water and food, and occasionally from an infected individual to a healthy one (Clemens et al., 2017). The emergence of diseases can be attributed to a range of human activities, while various factors such as climatic, environmental, technological, social, economic, and political can influence the development of diseases and their progression into pandemics within populations (Colwell, 1997). Several studies have led scientists to believe that the cholera pandemic may be directly related to climate change-influenced variables (Craig, 2018). This, in turn, increases the risk of a cholera pandemic. Many authors also indicated that climatic factors, such as soil moisture, land surface, chlorophyll-a concentration, sea surface salinity, sea level, and rainfalls can have an effect on cholera pandemic outbreaks (Montilla et al., 1996; Lobitz et al., 2000; Lipp et al., 2002; Pascual et al., 2002; Chowdhury et al., 2017; Campbell et al., 2020). Koelle et al. (2005) revealed that El Tor variant of cholera takes advantage when monsoon rainfall becomes more extreme. Therefore, these findings suggest that *Vibrio cholerae* pandemic outbreaks can be linked to climate change.

As energy crisis we can compare with Oil Crisis (1973) had significant implications on the world economy and for the restructuring of energy policies (Ross, 2013). The precedent for this crisis was set when the United States and other Western countries backed Israel during the Yom Kippur War (Ross, 2013). However, it made Governments and policymakers of countries, affected by the embargo to re-access their energy strategies, which resulted in a concentration on minimizing the use of energy supplies, energy efficiency, and the development of new energy sources (green energy) (Council Resolution, 1974; Council Resolution, 1980).

2.2. The impact of war in Ukraine on energy-saving behavior

The outbreak of the Russian war against Ukraine left Europe and the rest of the world in a profound state of shock and exposed its dependence on Russian energy supplies. To counter Russian aggression, the

European Union and its allied countries implemented sanctions, which included the suspension of oil, coal, and gas imports (Kuzemko et al., 2022). While the energy crisis had its roots in the Covid-19 period, it was significantly exacerbated by the Russian war against Ukraine, leading to a substantial increase in energy costs in global markets and a worsening of the resource imbalance in the European Union's economy, which impacted consumers (Chomać-Pierzecka et al., 2022).

In response to the energy crisis and the rising energy costs for households, several EU countries have announced new policies on their local levels to help consumers. However, these measures only offer short-term relief (Kuzemko et al., 2022). Zakeri et al. (2022) suggested transforming energy demand and consumption towards responsible, sustainable, and sufficient ways. Trypolska and Rosner (2022) prioritized environmentally friendly appliances such as solar panels and water heaters to combat the energy shortage. Therefore, the crisis has accelerated the trend toward energy efficiency in Europe and led to a greater focus on reducing energy consumption and promoting sustainable energy sources. The encouragement of energy-saving behavior is the easiest tool to tackle the energy crisis. Policymakers also intensively highlighted this behavior as one of the alternatives to reduce the expenditure of energy resources. However, there is a lack of research on how the concern about the war in Ukraine contributed to energy-saving behavior, which mainly caused energy crisis.

2.3. The impact of the Covid-19 pandemic on energy-saving behavior

The Covid-19 pandemic has profoundly affected global energy consumption patterns, as widespread lockdowns and social distancing measures have resulted in a significant decrease in energy demand across multiple sectors. As a result of the pandemic, people started to spend more time at home, caused by social distancing rules or the simple fear of being infected, shortages of working places, and an increase in working from home. Movement regulations consequently led to reduced energy consumption in offices and commercial buildings but an increase in residential energy consumption. Ueno (2022) discovered increasing energy consumption in households caused by Covid-19 pandemic.

The pandemic increased not only the concern about health (Bae and Chang, 2021; Ahorsu et al., 2020; Schimmenti et al., 2020), but also concern about environmental problems. Gupta et al. (2021) and Lawler et al. (2021) link the Covid-19 pandemic to the climate change issue, leading individuals to re-evaluate their lifestyles. The research conducted by Lucarelli et al. (2020) revealed that individuals with a higher awareness of the interconnections between Covid-19 and climate change display increased intention and strengthened pro-environmental behaviors. According to Zebardast and Radaei (2022), the pandemic positively influenced pro-environmental attitudes and the relationship between pro-environmental intentions and pro-environmental actions. Mi et al. (2021) analyzed whether public knowledge of Covid-19 can predict pro-environmental behavior intentions. The results revealed that not only does Covid-19 serve as a mediator between emergency cognition and pro-environmental behavioral intentions, but positive environmental affective reactions also have a significant positive effect on the household sphere of pro-environmental behavioral intentions.

Considering the energy-saving behavior, Jiang et al. (2021) showed the substantial impact of this pandemic on energy consumption. Ahmad et al. (2022) investigated the impact of cognitive and emotional factors on intentions to save energy and the energy-saving behavior with perceived Covid-19 disruptiveness as a moderator. The results indicate that the perceived disruptiveness of Covid-19 positively moderates this relationship. According to the findings of Pop et al. (2022), it was observed that consumers exhibited heightened awareness regarding energy consumption during the Covid-19 pandemic, resulting in increased energy-saving practices. Meanwhile, Matiuk et al. (2023) revealed that tools assigned to stop the Covid-19 pandemic did not influence the resource-saving behavior. To the best of our knowledge, it was not analyzed how the pandemic contributes to energy-saving

behavior during the post-Covid-19 period.

2.4. The impact of climate change on energy-saving behavior

In recent years, increasing focus and concern have been directed toward climate change. More and more people are becoming aware of the importance of reducing emissions of greenhouse gases to mitigate climate change. Climate change concern is one of the main determinants of energy-saving behavior, which refers to the level of worry or anxiety that individuals or societies feel about the potential impacts of climate change on the environment, economy, and human well-being (Whitmarsh and Capstick, 2018; Lacroix and Gifford, 2018; Fierros-Gonzalez and Lopez-Feldman, 2021). Carrus et al. (2021) found that climate change beliefs have a positive to moderate association with energy conservation behaviors. The study of Whitmarsh and O'Neill (2010) discovered that importance of climate change is a significant factor of political actions and all energy/water conservation actions. Gregersen et al. (2021) and Matiuk et al. (2023) found concern about climate change was a strong predictor of people engaging in energy-saving behaviors. The results, obtained by Boto-García and Bucciol (2020) suggest that increases in climate change concern positively impact energy-saving behavior among European countries' citizens as well. However, according to Ohler and Billger (2014), environmental concern has little effect on annual electricity usage.

2.5. The impact of attitudes toward energy consumption impact on energy-saving behavior

The attitude toward energy consumption as an internal factor is also an important factor for energy saving (conservation) behavior Brounen et al. (2013), Chen et al. (2017) and Boomsma et al. (2019) found that this factor directly influenced pro-environmental behavior. However, Paço and Lavrador (2017), Vringer et al. (2007) and Huebner et al. (2015) revealed that attitudinal factor weakly influenced energy consumption. Meanwhile, Jakučionytė-Skodienė et al. (2020) found an insignificant relationship between electricity consumption and attitude towards energy consumption, when environmental awareness does not give a positive impact on pro-environmental behavior due to various barriers such as lack of knowledge, and social pressure. Moreover, other authors declared that attitudes such as catalytic effect can influence pro-environmental behaviors (Paço and Lavrador in 2017, Barber et al., 2009; Flamm, 2009; Polonsky et al., 2012; Liobikienė et al., 2016). Thus, in this paper, both affects (direct and indirect) were analyzed, which reveals whether this attitude (via climate change concern) influenced the energy-saving behavior.

3. Methodology

3.1. The characteristics of the participants of the survey

The data of the survey conducted in April 2022 was referred to evaluate how the concern about the main crises (the war in Ukraine, the Covid-19 pandemic, and climate change) contributed to attitudes and energy-saving behavior in Lithuania. The respondents were randomly selected considering the main societies' age, gender and living space proportion. The quota sampling method was applied. Respondents were questioned via telephone. 1000 respondents participated in this survey. According to the socio-demographic characteristics provided in Table 1, 45.5% of the respondents were men, while the remaining respondents were women. The average age of respondents was 44.5. Half of the respondents have higher education and live in old-built (50-20 years, blocked with central heating) non-renovated apartments. Notably, the share of income levels displayed a relatively equitable pattern.

Table 1

Characteristics of respondents.

	Respondent characteristics N = 1000	Number	Percentage
Gender	Men	455	45.5
	Women	545	54.5
Age average	44.5		
Education (%)	Primary	3	0.3
	Lower Secondary	38	3.8
	Vocational	61	6.1
	Secondary	227	22.7
	Non-university higher	194	19.4
	Higher	477	47.7
Income per family member (EUR/month)	<300 EUR	61	6.17
	301-500 EUR	140	14.0
	501-700 EUR	203	20.3
	701-1000 EUR	215	21.5
	1001 > EUR	208	20.8
Type of house (%)	Difficult to say	173	17.3
	Old-built non-renovated apartments	476	47.6
	Old-built renovated apartments	139	13.9
	New-built apartments	51	5.1
	Detached house	294	29.4
	Cottage	40	4.0

3.2. The methods of scales' construction

In order to reveal how the concern about the main crises influenced energy-saving behavior the survey data was referred to. The impact of concern about climate change, the Covid-19 pandemic, and the war in Ukraine was analyzed. The concern levels of all these crises were measured referring to the Likert scale (1- "this problem is not serious" - 10- "this problem is extremely serious"). The same method was used in the Eurobarometer surveys when the concern level related to climate change was considered (Jakučionytė-Skodienė and Liobikienė, 2022).

The other scales were constructed using the statistical factor analysis. There were scales constructed as changes in environmental concern caused by the war in Ukraine and the Covid-19 pandemic, attitude towards energy consumption, and energy-saving behavior. In this factor analysis, the rotated components matrix was applied in order to guarantee that the constructs would be unrelated and uncorrelated. The value of Kaiser-Meyer-Olkin (KMO) indicator (0.959) showed that the used constructs are suitable for factor analysis (Chia et al., 2016; Field, 2013). The Bartlett's test result was statistically significant ($p < .001$) and confirmed the suitability of factor analysis as well (Kaiser, 1974). The factor loading coefficient, which exceeded the 0.5 boundary also revealed that factor analysis and construction of the scales were satisfactory (Table 2). The scales of changes in environmental concern caused by the war in Ukraine and the Covid-19 pandemic were constructed considering how individuals evaluated the changes in environmental concern due to the existing crises. The items for this construct were adopted using Lin and Syrgabayeve's (2016) scale. The scales of energy-saving behavior and attitudes toward energy consumption were prepared according to Paço and Lavrador (2017) study and adjusted taking into account the situation in Lithuania. All these scales were measured using a five-point Likert scale (from 1 "I strongly disagree" to 5 "I strongly agree"). Evaluating the reliability, the values of Cronbach's alpha coefficients were used and the values of 0.70–0.98 revealed highly reliable scales (DeVellis, 2003; Bland and Altman, 1997; Hair et al., 2010) (Table 2). Therefore, the constructs of analyzed variables were well-constructed and stable.

3.3. The statistical methods and the model used

In this paper, the differences between concern about climate change, the Covid-19 pandemic, and the war in Ukraine were assessed using the non-parametric Friedman test. Differences in changes in environmental

Table 2

Rotated component matrix of analyzed constructs, reliability statistics, and mean score.

		Loading coefficients	Variance Explanation (%)	Cronbach alpha	Mean	Standard deviation
Changes in environmental concern caused by war in Ukraine	War in Ukraine adds to my concern about the environment	0.850	52.024	0.979	2.42	1.127
	War in Ukraine adds to my concern about environmental problems	0.850			2.46	1.136
	War in Ukraine adds to my concern about climate change	0.851			2.40	1.140
	War in Ukraine adds to my concern about waste problems	0.852			2.39	1.136
	War in Ukraine adds to my concern about water pollution	0.864			2.41	1.135
	War in Ukraine adds to my concern about air pollution	0.850			2.42	1.136
	War in Ukraine adds to my concern about biodiversity loss	0.858			2.36	1.095
	Covid-19 adds to my concern about the environment	0.821			2.74	1.093
Changes in environmental concern caused by Covid-19 pandemic	Covid-19 adds to my concern about environmental problems	0.824	9.798	0.966	2.65	1.068
	Covid-19 adds to my concern about climate change	0.827			2.63	1.105
	Covid-19 adds to my concern about waste problems	0.825			2.64	1.090
	Covid-19 adds to my concern about water pollution	0.806			2.62	1.089
	Covid-19 adds to my concern about air pollution	0.831			2.65	1.085
	Covid-19 adds to my concern about biodiversity loss	0.791			2.59	1.051
	My energy consumption influences the general energy consumption level	0.764			3.20	1.041
	I can influence government actions related to solutions	0.724			2.37	1.040
Attitudes toward energy consumption	I can influence the actions of various companies related to energy issues	0.725	8.970	0.746	2.38	1.040
	My personal energy consumption contributes to climate change problems	0.720			3.30	0.986
	I turn off the light when I do not need it	0.751			4.44	0.832
	I use power saving bulbs (fluorescent lamps or light-emitting diodes (LEDs))	0.818			4.19	0.904
Energy saving behavior	I purchase and use energy efficiency class of the electrical appliances (A+, A++)	0.747	6.737	0.691	3.86	0.994

concern caused by the war in Ukraine and by the Covid-19 pandemic as well as differences of separate actions related to energy-saving caused by the war in Ukraine and the Covid-19 pandemic were assessed using the non-parametric Wilcoxon Signed Ranks Test. The p-value coefficients of these tests lower than 0.05 were considered to be significant.

The Generalized Linear Model (GML) was applied to evaluate the main determinants of energy-saving behavior. As independent factors, the attitudes toward energy consumption, climate change concern, the Covid-19 pandemic concern, the war in Ukraine concern, and the interaction between attitudes toward energy consumption and climate change concern were assessed (Fig. 1). The GML analysis reveals which variable influenced the energy saving behavior the most. The probability plots and variance inflation factor (VIF) analyzes were used to

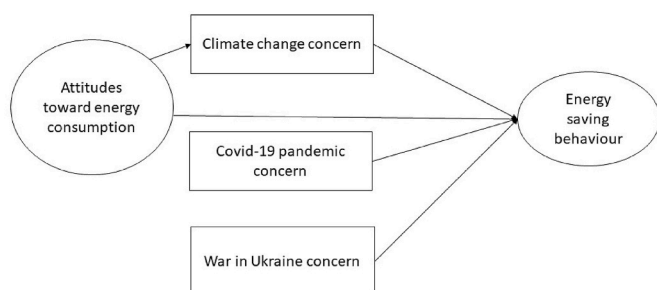
check the regression analysis assumptions such as normality of residuals and collinearity respectively. The Beta (B) coefficients, Wald chi-square indicators, and significance p-values were evaluated to reveal what factors determined the energy-saving behavior.

4. Results and discussions

4.1. Descriptive analysis

In Lithuania, individuals are demonstrating inclinations towards energy conservation within their own households. Considering individual actions, the majority of the respondents declared that they always turn off the light when they do not need it. Furthermore, people often used power-saving bulbs. Meanwhile, fewer individuals are linked to buying and using energy efficient appliances, which are more expensive (Table 2). According to data from the Lithuanian Department of Statistics, electricity consumption increased not only during the Covid-19 pandemic, when people spent more time at home, but also in the post-pandemic period. Two factors could be responsible for this. First, it may be due to the persistence of habits formed during the pandemic, when people used to spend a considerable amount of time at home. Second, it may be affected by the rebound effect, that usually occurs after installation of energy-efficient appliances and light bulbs, individuals tend to consume more energy overall.

In terms of the attitude toward energy consumption, half of the respondents agreed that their personal energy consumption affects overall energy consumption that contributes to climate change on a broader

**Fig. 1.** The principal scheme of the study.

scale. These tendencies are not very good, because it reveals that not all people understand their importance in terms of energy consumption, or people see themselves as only small parts of larger societies. Furthermore, respondents do not tend to think that they can influence the government and companies related to energy issues (Table 2). The first steps of liberalization of electricity suppliers show that Lithuanian people are not very active when it comes to choosing an electricity supplier. Only half of the Lithuanian citizens participate in this program, other people do not trust or do not want to change their habits and they trust the authorities and the universal electricity supplier. Thus, this passive participation in the market of electricity suppliers shows these tendencies. After living in a non-democratic system for a long period of time, it takes more than one generation to change the inactivity in society.

When analyzing the changes in environmental concern caused by the Covid-19 pandemic, the results presented in Table 2 showed that respondents do not tend to agree that the pandemic strengthens their concern about environmental problems. However, the most individuals agree that the pandemic increased their concern about the environment in general. Meanwhile, considering separate environmental problems people tend to not agree that the Covid-19 pandemic strengthens the concern about these problems. People declared that the pandemic increased their concern about biodiversity the least. For people it is very difficult to evaluate the changes in the importance of separate environmental problems. Moreover, the decrease in biodiversity was the least important environmental problem before the pandemic as well (Liobikiene et al., 2021). These results showed the lack of knowledge about the decline of biodiversity and how important it is to save it. Furthermore, the Covid-19 illness is dangerous not only to humans but also to other species. Thus, the decline of biodiversity has become a very serious problem.

Considering the changes in environmental concern caused by the war in Ukraine, respondents do not agree much that it changed their concern. Individuals mostly stated that the war increased their concern about environmental problems in general. Meanwhile, according to the respondents' opinion, the concern about waste problems and biodiversity got strengthened the least due to the war in Ukraine (Table 2). In this case, as in previous results, the decline of biodiversity is not a very important problem. Furthermore, people do not relate war to increasing waste generation. Meanwhile, air and water pollution are the problems that were diffused. A lot of information was provided by the media not only about the course of the war but also about eco-crisis and air and water pollution. However, Lithuania is rather far from Ukraine, and it does not affect Lithuanians' concern related to these separate environmental problems.

4.2. The differences in concern about current crises, changes in environmental concern and actions related to energy-saving caused by the war in Ukraine and the Covid-19 pandemic

After evaluating the concerns about the main crises, we realized that people mostly cared about the war in Ukraine. Although Lithuania is not geographically adjacent to Ukraine and it seems that the ongoing war is quite far, it shares a border with Russia. In the mass media and on social networks this war is defined as Poland and Baltic States' war. Lithuania has a long history of being occupied by Russians, and in general Russia is perceived as a threat by Lithuanian citizens (Jakniūnaitė, 2015). Therefore, considering the trends of Lithuanian mass and social media, the opinion that if Russia will win the war against Ukraine, Lithuania and the other Baltic States will be next is quite popular. Thus, this concern of the Lithuanian people is very strong, especially because that this war is a new issue. The level of concern about climate change differed from the concern about the war in Ukraine. However, respondents declared that climate change is a very serious problem as well. The provision of a lot of information in media about extreme weather events in other countries increased this concern. Meanwhile,

extreme weather events were rather rare in Lithuania during the last year. Thus, globalization and increasing information flows contribute to concern about climate change. The Covid-19 pandemic was the least important to Lithuanian respondents (Fig. 2). Only a minor part of the respondents declared that they are very concerned about the pandemic. As per the findings of the study conducted by Matiuk et al. (2023), the concern about the Covid-19 pandemic decreased significantly when comparing pre- and post-Covid-19 periods. Thus, at the beginning of the pandemic people were very concerned about the illness, but later on the concern decreased due to successful vaccination, and other successfully implemented management tools, and the fact that people now know more about this illness.

Comparing how the Covid-19 pandemic and the war in Ukraine caused the changes in concern about environmental problems (Fig. 3) we see that the Covid-19 pandemic contributed to the concern more compared to the war in Ukraine, and that this difference is statistically significant ($Z = -9.897$, $p = .000$) (Fig. 3). It could be related to the fact that people understand that the environment and health issues are related. Meanwhile, the war in Ukraine is more of a political aspect and is mainly related to security and fear of war. Despite the large amount of information about ecocide, the genocide issue is more important to the society.

When analyzing the differences in actions related to energy saving caused by the Covid-19 pandemic and the war in Ukraine, we see in Fig. 4 that the pandemic encouraged energy-saving behavior more than the war in Ukraine ('I saved the environmental resource more' $Z = -6.017$, $p = .000$; 'I saved electricity more' $Z = -5.827$, $p = .000$; 'I purchased energy efficient appliances more' $Z = -8.348$, $p = .000$). In all cases, particularly considering electricity saving, people stated that the pandemic encourages them to do it more. It could be related to the fact that during the pandemic people spent a lot of time at home and their habits remain the same even in the post-Covid-19 period, thus citizens declared that they save electricity and other resources more because of the pandemic. Meanwhile, considering the war in Ukraine, this survey was conducted two months after Russian invasion of Ukraine. The energy crisis was not yet escalating, and the prices had increased negligibly. The purchase level of energy efficiency appliances was primarily driven by the pandemic of Covid-19, rather by war in Ukraine. These results could be related to the fact that during the Covid-19 pandemic citizens could not spend their money on holidays and trips, thus they can spend the saved-up money on energy efficient appliances, which are more expensive. Meanwhile, the war in Ukraine imbalanced the security level, and people began to save money for unforeseen situations.

4.3. The assumption and results of regression analysis

The correlation analysis was performed to reveal the tolerable level

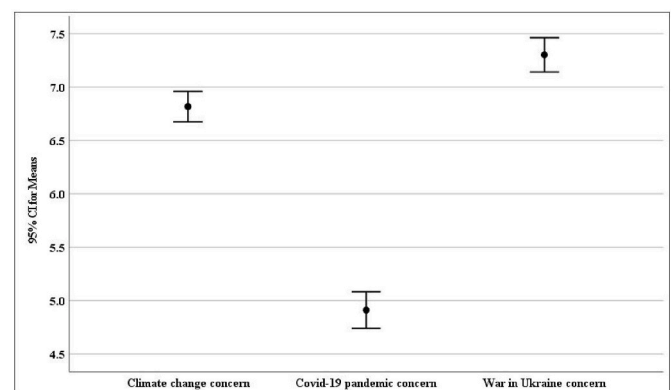


Fig. 2. The differences among concerns about climate change, the Covid-19 pandemic, and the war in Ukraine.

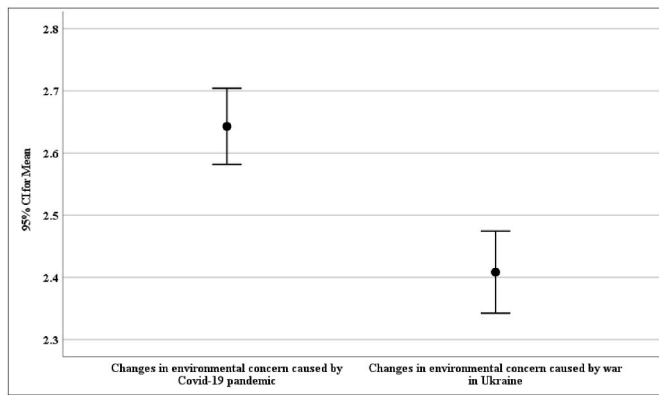


Fig. 3. The differences in changes in environmental concern caused by the Covid-19 pandemic and the war in Ukraine.

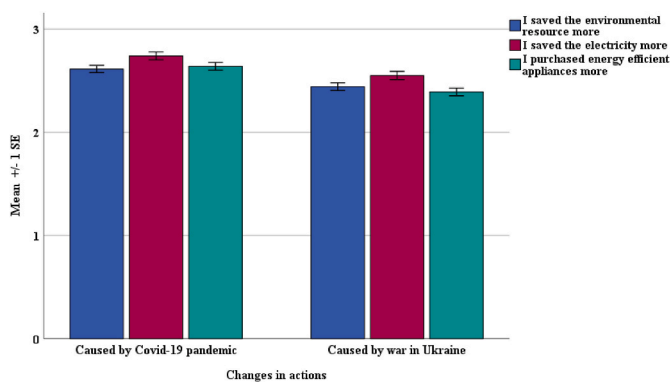


Fig. 4. The differences in actions related to energy-saving behavior caused by the Covid-19 pandemic and the war in Ukraine.

of discriminant validity and multicollinearity assumptions. The correlation matrix presented in Table 3 shows that all independent variables' values were below 0.5. Thus, the discriminant validity and multicollinearity assumptions were satisfied (Bryman and Cramer, 2001). All determinants included in the model (attitudes towards energy consumption, climate change, the Covid-19 pandemic, and the war in Ukraine concerns) were dissimilar. To confirm the multicollinearity assumption, tolerance and VIF statistic values were assessed and the values greater than 0.6 for tolerance and lower than 2 for VIF (Table 4) showed that there is no problem with multicollinearity (Hair et al., 1998).

The results of GLM analyzes were presented in Table 5 and they showed that considering all crises only the concern about the war in Ukraine significantly and positively influenced energy-saving behavior. Consequently, a stronger level of care regarding the war in Ukraine was associated with a higher likelihood of individuals declaring their

Table 3
Correlation matrix.

	Attitudes towards energy consumption	Climate change concern	Covid-19 pandemic concern
Climate change concern	0.369*		
Covid-19 pandemic concern	0.228*	0.362*	
War in Ukraine concern	0.251*	0.475*	0.390*

*p < .01.

Table 4
Test of multicollinearity.

	Tolerance	VIF
Attitude towards energy consumption	0.850	1.177
Climate change concern	0.683	1.465
Covid-19 pandemic concern	0.801	1.249
War in Ukraine concern	0.717	1.395

Table 5
Regression results of energy-saving behavior.

Coefficients	Estimate	Std. error	Wald Chi-Square	p.
(Intercept)	4.372	0.2024	466.616	<0.001
Attitudes toward energy consumption	−0.385	0.0801	23.162	<0.001
Climate change concern	−0.026	0.0303	0.720	0.396
Covid-19 pandemic concern	−0.029	0.0087	11.570	0.001
War in Ukraine concern	0.044	0.0098	20.344	<0.001
Attitudes toward energy consumption * Climate change concern	0.044	0.0109	16.320	<0.001

$R^2 = 0.118$ Dependent variable energy-saving behavior.

engagement in energy-saving practices within their households. There could be several reasons. Firstly, increased insecurity could cause this behavior. Second, the war in Ukraine triggered the energy crisis, which began in the first days of the war and continued until this winter. The increasing prices of energy resources, particularly gases motivate people to save energy at home. The fact that Russian attacks on critical Ukrainian infrastructure frequently result in blackouts of heat and power may also contribute to the widespread support and solidarity with Ukrainians (60 Minutes of Darkness), that could lead to energy-saving behaviors.

On the contrary, The Covid-19 pandemic significantly but negatively determined energy-saving behavior (Table 5). However, when examining people's opinions about how the war in Ukraine and the Covid-19 pandemic affected their behavior and environmental concerns, the results portrayed a different situation. It could be due to the gap between peoples' attitude and real behavior. Our results revealed that the more people are concerned about the Covid-19 pandemic, the less they declare that they exhibit energy-saving behavior. Thus, the pandemic influenced the behavior only short-term as was revealed by other authors (Zakeri et al., 2022; Mi et al., 2021; Lucarelli et al., 2020). However, taking into account the long-term situation, the concern about the pandemic did not motivate citizens to save energy. People return to their usual daily routine and the concern about the Covid-19 pandemic even increases this behavior. Thus, energy-saving behavior is not as important as health issues.

The climate change concern negatively but insignificantly influenced energy-saving behavior. Thus, this crisis directly had no effect on energy-saving behavior. However, this factor indirectly influenced the demonstration of this behavior as the interaction of concern about climate change and attitude toward energy consumption (Table 5). Therefore, respondents who were concerned about climate change and had positive attitudes about the importance of energy consumption were motivated to save energy in households. Fang et al. (2021), also indicated that concern for energy and environmental problems are important variables narrowing the gap between actions and statements of individuals.

The attitudes toward energy consumption significantly but negatively influenced energy-saving behavior (Table 5). Despite that people declared that they understand their contribution to general energy consumption and climate change and that they can influence industry and government, however, they did not link to saving energy in households. This result contradicts Brounen et al. (2013), Chen et al. (2017) and Boomsma et al. (2019) findings. However, referring to

Jakučionytė-Skodienė et al. (2020) results, environmental awareness does not give a positive impact on pro-environmental behavior due to various barriers such as lack of knowledge and social pressure. Furthermore, this factor as a catalyst via climate change concern positively and statistically significantly influenced this behavior (Paço and Lavrador, 2017; Barber et al., 2009; Flamm, 2009; Polonsky et al., 2012; Liobikienė et al., 2016).

5. Conclusions and policy implication

The War in Ukraine, the Covid-19 pandemic and climate change are the main crises in recent years concerning the world. Like never before, the policymakers highlight the importance of energy-saving which is required not only to control the energy crisis caused by the war in Ukraine but also is essential to mitigate climate change. Thus, the aim of this paper is to analyze the concerns about current crises – the war in Ukraine, the Covid-19 pandemic, and climate change's impact on energy-saving behavior and changes in environmental concern.

The war in Ukraine was the most serious problem in Lithuania. The level of climate change concern was a little bit lower compared to concern about war but was not very high. Thus, the education and environmental information provision about climate change, its consequences, and the drivers are particularly important. The problem could be that climate change is a long-term issue and that only severe and extreme weather events remind people of it. However, the long-term perspective of climate change often fails to receive the attention it deserves. Thus, the concern about climate change should increase and contribute to behavioral change as well. The Covid-19 pandemic was the least important problem, which shows that by implementing successful management tools, the pandemic can be tackled.

According to the respondents' opinion, the Covid-19 pandemic contributed to the changes in environmental concern and energy-saving actions more than the war in Ukraine. However, the level of contribution was not very high. Despite that the war in Ukraine and the Covid-19 pandemic are not directly and visibly related to environmental issues, however, the impact of these crises on the environment is undoubted. Thus, providing information about the pandemic and war, it is also important to highlight the connections to the environmental impact. The better quality of the environment can contribute to better health. Moreover, by supporting Ukraine financially we can not only help stop the war but also in turn relieve the environment from the extra pressure caused by the war.

Referring to the regression results, only the war in Ukraine positively and significantly influenced energy-saving behavior. Considering that this problem was rather new in the Lithuania, it could influenced this strong relationship. However, in order to check the impact of war on energy-saving behavior long-term analyses are needed. The concern about the Covid-19 pandemic negatively and the climate change concern factor indirectly as the interaction of attitudes toward energy consumption affected this behavior. Therefore, the policymakers should continue (even after the energy crises) to highlight the importance of energy-saving behavior, which is also vital to climate change mitigation. The exploitation of current crises could help change pro-environmental behavior. However, taking into account the long-term situation, the concern about the pandemic did not motivate citizens to save energy. Therefore, it is important to educate people that energy-saving behavior not only is important to mitigate climate change, but also can contribute to a better quality of the environment, which is also important for our health.

CRediT authorship contribution statement

Genovaitė Liobikienė: Conceptualization, Investigation, Writing – original draft, preparation, Writing – review & editing. **Yuliia Matiuk:** Formal analysis, Writing – original draft, preparation. **Ričardas Krikštolaitis:** Data curation, Methodology, Software, Validation, All

authors have read and agreed to the published version of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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