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Understanding the impact of COVID-19 lockdown on energy consumption and digital engagement in Polish households

Abstract

This paper aims to analyze energy consumption trends in Polish households during the COVID-19 pandemic and assess the pandemic's influence on household behavior. The study divides the topics into three thematic blocks: the government's pandemic policies, the pandemic's impact on household energy consumption through qualitative and literature-based analysis, and the consequences of the pandemic on households and their energy-related activities. Original research findings from a study conducted in 2021 are utilized in the analytical section. The study reveals an increase in energy demand among households during the lockdown period, driven by remote work, education, and lifestyle shifts. Changes in energy-saving habits and motivations for energy conservation are explored and the potential implications of these shifts for energy suppliers are discussed. Additionally, the study employed methods of literature analysis, qualitative information analysis from secondary sources, as well as synthesis and inference. The paper concludes that lockdown-driven changes in energy consumption patterns demonstrate the adaptability of households and the potential for new forms of collaboration between consumers and energy suppliers.

Key words: energy security, COVID-19 lockdowns, energy consumption, households

Introduction

In the wake of the unprecedented COVID-19 pandemic, understanding its multifaceted impact on various aspects of society has become imperative. One such facet is the effect of the pandemic on energy con-

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sumption patterns within households. This article endeavors to delve into the nuanced dynamics of energy consumption trends in Polish households during the COVID-19 pandemic while evaluating the extent to which the pandemic has influenced household situations. Building upon the groundwork laid by the initial article on this topic (Czech 2022), we focus on variables such as energy consumption, energy-saving behaviors, the ability to manage energy bills, and the willingness to embrace energy-efficient practices.

These focal points are presented within three thematic sections: the evolution of government policies throughout different pandemic stages, a qualitative and literature-based analysis of the pandemic's impact on household energy consumption, and the ramifications of the pandemic on households and their energy-related activities. The study employs various research methods, including literature analysis, qualitative data analysis from secondary sources, synthesis and inference. Additionally, this study includes original research from our investigation titled "The Impact of the COVID-19 Pandemic on the Energy Situation of Households Led by Individuals Aged 25–45," conducted between October and November 2021, spanning the entirety of Poland.

Literature review

The COVID-19 lockdown constituted a unique period in terms of households' fulfillment of their regular duties. The necessity to stay at home, limiting work and social activities to the place of residence, led to changes in energy consumption patterns across all user groups. This issue has been examined in numerous articles and reports dedicated to the impact of the COVID-19 pandemic on energy consumption from a global (International Energy Agency IEA 2020; International Energy Agency IEA 2020a; Mofijur et al. 2021; Aktar et al. 2021), as well as national and regional perspective (Akrofi et al. 2020; Gebreslassie 2020).

In response to COVID-19, a group of European countries such as Spain, Italy, the United Kingdom, Belgium, the Netherlands, and Sweden have demonstrated the influence of various containment measures on their patterns of electricity consumption (Bahmanyar et al. 2020). China has also developed a model to analyze the impact of COVID-19 on electricity and oil demand (Norouzi et al. 2020). In India the effects of the pandemic on energy consumption were explored, investigating whether the lockdown had a positive impact on energy use (Abu-Rayash et al. 2020). Similar studies have been conducted in Brazil and Sweden (Car-

valho et al. 2021; Zhang et al. 2020), while in Italy researchers analyzed the impact of COVID-19 on electricity consumption and energy prices (Narajewski et al. 2020).

Within the existing literature, there are precious few instances exist of analyses examining the impact of lockdowns on electricity consumption within specific groups of end consumers, particularly households. The latter represent a significant consumer group, likely to alter their energy demands during the exceptional events, like the pandemic, due to lifestyle changes. Among the available studies, one can find a survey-based research project conducted on 500 households in China, assessing the influence of the COVID-19 pandemic on household energy consumption (Cheshmehzangi 2020). Additionally, studies have explored electricity consumption during lockdowns among domestic users in Australia (Snow et al. 2020) and Spain (Santiago et al. 2021).

Government policy stringency during different stages of the pandemic

The lockdown imposed during the COVID-19 pandemic resulted in changes in energy demand, decreasing energy consumption in public and commercial buildings while increasing energy use in households. Data from 2020 indicate that the most stringent pandemic-related restrictions lasted for 5 weeks from March 16th to April 18th (*Kalendarium*… 2020).

Among the key events in combating the first wave of the COVID-19 pandemic in Poland was the introduction on March 8, 2020, of a special law by the Polish government. This law, passed on March 2, 2020, comprised specific measures related to preventing, countering, and combating COVID-19, along with other infectious diseases and the crises they triggered (Ministry of Health Regulation of March 13, 2020). Additionally, mass indoor events were cancelled by the Chief Sanitary Inspector. Subsequently, on March 11, 2020, all forms of teaching were suspended in most public universities, and on March 12, 2020, the Prime Minister and the ministers for health, education, and science decided to close all educational institutions. Following the government's recommendations, remote work was gradually implemented in home offices on March 16, 2020, distancing employees from company buildings and institutions. Moreover, the operation of shopping centers exceeding 2,000 m^2 was limited or prohibited, and commercial activities by restaurants, bars, cafes, and gastronomic venues were fully banned. Further restrictions

were introduced on March 25, 2020, which included a ban on movement except for essential work activities and satisfying daily life necessities. Gathering in groups of more than two people was prohibited, and restrictions were imposed on public transportation and participation in religious ceremonies.

The Polish government faced a challenging decision between implementing a wide range of economic and societal restrictions to counteract or mitigate the pandemic's effects, or adopting the so-called Swedish liberal strategy for combating COVID-19, which relied on citizens voluntarily adhering to Public Health Agency recommendations. The former approach was chosen, negatively impacting the functioning of the state, society, and economy. Subsequently, on April 1, 2020, a ban on minors being in public spaces without adult guardians was introduced, hair salons and cosmetic studios were suspended, very strict limitations on the number of people allowed in stores and service points were imposed, and access to parks, promenades, forests, and beaches was prohibited. Restrictions in Poland were gradually eased on April 20, 2020, involving an increase in the limit of people in stores and permitting recreational mobility. The government's stringent policy led to changes in households, resulting in increased energy consumption due to continuous residence at home during the lockdown.

The Impact of the COVID-19 Pandemic on Household Energy Consumption – Literature and Survey Findings

This section of the study aims to analyze the influence of the pandemic on household energy consumption during the 2020 lockdown, compared to the same period in 2018. The analysis encompasses both a review of relevant literature and findings from our own survey research.

Changes in household energy consumption occurred due to the implementation of restrictions, where a significant portion of office work and the educational sector was relocated to residential areas. During the lockdown period, there was a noticeable increase in active energy consumption by households during daytime hours compared to the analogous period in 2018. According to research conducted on 7,000 households, the average active energy consumption per household throughout the lockdown period was 180 kWh with a standard deviation of 261 kWh, whereas in 2018, the average was 155 kWh with a standard deviation of 246 kWh. The average active energy consumption per household

in the analyzed group during the lockdown period increased by almost 16% compared to the 2018 period. For 65% of the hours within the analyzed period, the average active energy consumption during the lockdown exceeded that of the same hours in the analogous 2018 period (Bielecki et al. 2021). Energy demand reflects the intensity of activities performed by individuals, thus during the lockdown period, due to the necessity of staying at residential locations, household energy consumption saw an increase. Also, in comparison to the analogous pre-pandemic period, electricity consumption in households increased. This resulted from the growth in energy consumption during daytime hours and weekends (Bielecki et al. 2021).

The subject literature lacks sufficient research on energy consumption in households during lockdowns based on measurement analyses. Nevertheless, research on electricity consumption in Spain during the 2020 lockdown can be considered a representation of household situations during quarantine (Santiago et al. 2021), and the analysis of electricity consumption in a sample of Australian households from February 1st to March 19th, 2020, provides insight into the situation before the imposition of restrictions, revealing a significant impact of the lockdown on energy consumption (Snow et al. 2020). The conclusions presented in the mentioned articles align with the findings presented in this article. It can thus be stated that changes in the quantitative energy demand of households during lockdowns result from local activities and the lifestyle of individual residents, which are tied to local customs and the average economic situation. Therefore, differences that may arise stem from factors such as climatic conditions and the average standard of living, which influence the way households utilize energy in different countries.

This section of the article presents the findings of the study, which employed the method of direct research through a questionnaire survey. The questions included in the survey were qualitative in nature. Some of the questions were open-ended, allowing for a deeper understanding of household behaviors during the pandemic. The research was conducted using the CAWI method – Computer Assisted Web Interview – which has become one of the few viable options for understanding respondent situations in the current context. This method enables the participation of a significant group of survey participants while maintaining anonymity. The study was conducted with a sample of 533 respondents during the period of October to November 2021, covering the entire territory of Poland.

Several significant trends emerge from this research regarding the analysis of energy consumption in households during the COVID-19

pandemic. The implementation of government restrictions had a notable impact on respondents' energy habits, with 45% of them experiencing an increase in energy bills due to remote work or online education. Consequently, 30% of the participants decided to focus on energy conservation during the pandemic. However, heightened energy consumption was associated with financial difficulties for a certain group of respondents, with 16.5% struggling to cover electricity bills and 14% choosing to allocate resources to cover energy costs at the expense of essential items like medicine and food.

Certain changes in energy-saving habits persisted after the pandemic-related restrictions ended – 34% of respondents continued to make efforts to reduce energy consumption. The study reveals that these shifts in energy behaviors correlate with household activities, economic conditions, and customs. Unfortunately, respondents' assessment of energy policy is not favorable. A significant 73% of participants were critical of the energy policy in Poland, perceiving its actions to be misdirected. Increasing energy prices and the efficiency of the energy system are cited as the main reasons for this dissatisfaction. Moreover, 13% of the surveyed individuals believe that energy policy is detrimental to the environment and climate goals.

Among the motivating factors for energy conservation, the desire to reduce bills (56% of respondents), concern for the environment (40%), and the aspiration to align with the eco/green trend (10%) stand out. It is noteworthy that despite increased presence and activities at home during the pandemic, 40% of respondents aimed to maintain their energy consumption at a similar level, while 13% admitted to using more energy than before the pandemic, often monitoring their meters. The study reveals the complexity of households' responses to changing conditions and the need to balance energy savings with daily necessities.

The Consequences of Lockdown on Energy Consumption and Digital Engagement

The COVID-19 pandemic led to the implementation of restrictions by the Polish government, providing an opportunity to observe energy demand by users, including households, in extreme situations. The lockdown influenced the development of digital skills among households and their correlation with electricity consumption. There is no doubt that the lockdown enforced changes in household behaviors, stemming from the necessity of engaging in new and existing energy-related activities.

Among the new energy-related activities, one can mention remote forms of work such as remote employment and education, home entertainment, online business and personal meetings, as well as existing activities like utilizing digital tools for payments and transactions, encompassing all internet-based services and actions, including handling official matters.

The lockdown demonstrated that certain professional tasks can be performed at home with comparable efficiency. This paves the way for businesses to potentially increase remote employment in the future through remote work. Furthermore, home-based learning, office work, recreational activities, and social interactions during the COVID-19 pandemic became commonplace, consequently impacting energy consumption (Ozimek 2020). In the longer perspective, the widespread adoption of remote work would require the implementation of new solutions in management, organization, and even psychological aspects (Ro 2020). Additionally, the execution of remote activities leads to changes in the amount of energy consumed by households and necessitates an interest in new forms of transactions and services delivered through digital communication means (Ozili 2018).

Analyzing energy consumption by end-users during the COVID-19 pandemic provides insights into the potential for using electrical energy in extreme conditions, such as continuous stay-at-home situations and the utilization of devices for work and education. The observed scenario indicated that there was an increase in energy demand by households during the lockdown period, and electricity was used to meet the growing needs stemming from staying at home, fulfilling remote work obligations, as well as engaging in remote schooling, and leisure activities, all of which also involved the use of electronic and electrical equipment.

Conclusions

In this article, based on both original research and existing literature, we explore how the energy consumption of households changed during the lockdown period caused by the COVID-19 pandemic, as compared to the analogous period in the preceding year. Our research has revealed an increase in electricity demand among domestic users during extreme conditions like the lockdown. The insights obtained from qualitative analysis and literature review during the lockdown period can be extrapolated to the post-pandemic phase. This is because they provide insights into the potential utilization of energy in extreme circumstances, which

may potentially arise in pandemic-free times. Moreover, the lockdown has highlighted that some new and existing activities can effectively be carried out within households.

The consequences of the lockdown can also be seen as a change in the household profile, involving a partial relocation of electricity consumption due to the necessity of remote work and remote learning (Barrero et al. 2021). This entails the shifting of electricity consumption from office buildings and schools to households. Another aspect is to what extent such changes can be sustained and which of these changes will be beneficial for households. The situation brought about by the COVID-19 pandemic and the ensuing government restrictions not only led to the need for remote work and education but also resulted in an increase in digital competencies within households. In the context of energy operations, this could contribute to a heightened interest in new forms of collaboration between end-users, including households, and their energy suppliers and distributors.

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Wpływ pandemii COVID-19 na zużycie energii i cyfryzację pracy w gospodarstwach domowych w Polsce

Streszczenie

Celem artykułu jest analiza trendów dotyczących zużycia energii w polskich gospodarstwach domowych podczas pandemii COVID-19 oraz ocena wpływu pandemii na zachowania gospodarstw domowych. Praca skoncentrowana jest wokół trzech bloków tematycznych: polityki władz podczas pandemii, wpływu pandemii na zużycie energii w gospodarstwach domowych oraz konsekwencji pandemii dla gospodarstw domowych

i ich działań związanych z konsumpcją energii. W artykule wykorzystano wyniki badania przeprowadzonego w 2021 r., które ujawniło wzrost zapotrzebowania na energię w gospodarstwach domowych w okresie lockdownu wynikający z pracy zdalnej, edukacji na odległość i zmiany stylu życia. Omówiono także zmiany w nawykach oszczędzania energii i motywacjach do oszczędzania energii, a także potencjalne konsekwencje tych zmian dla dostawców energii. Ponadto w badaniu zastosowano metodę analizy literatury, analizy informacji jakościowych ze źródeł wtórnych, a także syntetyzację i wnioskowanie. Głównym wnioskiem z artykułu jest obserwacja, że zmiany wzorców zużycia energii spowodowane lockdownem pokazują zdolność gospodarstw domowych do adaptacji oraz potencjał nowych form współpracy między konsumentami a dostawcami energii.

Słowa kluczowe: bezpieczeństwo energetyczne, pandemia COVID-19, zużycie energii, gospodarstwa domowe