Journal Visipena
Volume 16, Number 1, 2025 pp. 103-115
P-ISSN 2086-1397 E-ISSN: 2502-6860
Open Access: https://ejournal.bbg.ac.id/Visipena

STUDENTS CONCEPTIONS OF THE ENERGY CRISIS: A CROSS-SECTIONAL STUDY

Putri Sekar Melati*[1] , Nuryani Rustaman[2], Lilit Rusyati[3]
[1,2,3]*Department of Science Education, Universitas Pendidikan Indonesia (UPI)*

* Corresponding Author: putrisekarmelati1024@upi.edu

ARTICLE INFO

Article history:
Received : Feb 19, 2025
Revised : Apr 19, 2025
Accepted : Jun 29, 2025
Available online : Jun 30, 2025

Keywords:
cross-sectional, energy crisis, students' conceptions

ABSTRACT

This cross-sectional study looks at how junior high and elementary school students think about crisis energy. The tool is sent out through an open-ended online survey. There were 167 people who took part in the study. The number of sixth-grade elementary school students (14), seventh-grade students (51), eighth-grade students (6), and ninth-grade students (96) in Bandung City. The study's results showed that ninth-grade students came up with the most ideas, followed by eighth- and seventh-grade students. The ninth graders came up with the idea that "environmental crisis" was the most crucial concept; among eight pupils, "energy limitation" seemed to be the most critical concept; and among high school students, “energy" was the most crucial concept. These results suggest that higher levels of education can help people come up with bigger ideas about crisis energy. This is because they can learn through theory or practice. Ninth graders now know more about ideas related to the energy crisis. The research has implications for teachers because it lets them teach students more advanced ideas about crisis energy in addition to the basics.

INTRODUCTION

The energy crisis that the world faces today is a defining challenge of our times, impacting economic stability, environmental sustainability, and societal well-being. This concern is posed by increasing global energy demands, diminishing fossil fuel reserves, and environmentally detrimental effects when there is an over-reliance on non-renewable resources (Xu et al., 2022). This kind of problem affects future generations. Moreover, it is essential to address the need for sustainable energy systems as quickly as possible because climate change has intensified significantly in recent years due to the emission of greenhouse gases from traditional energy sources. In dealing with this crisis from all sides, education is critical for knowledgeable and proactive citizens who can contribute to sustainable approaches for sourcing power (Lu et al., 2022).

As future leaders, innovators, and policymakers, students are strategically positioned to address these energy challenges (Farghali et al., 2023). They learn about the issues surrounding this crisis, such as its causes, consequences, and possible solutions concerning their own educational experiences, levels of exposure to environmental problems, and cultural influences their societies have on them, as well as access reliable information concerning these issues(Majava et al., 2022). Nevertheless, many investigations indicate continuous misunderstandings regarding various energy aspects among students related to the environment or human society, especially during catastrophes (Xu et al., 2022) . These fallacies significantly influence attitudes, decisions, and sustainability practices(Li et al., 2022). For example, students may misunderstand the relationship between energy consumption and climate change or underestimate the potential of renewable energy technologies in mitigating environmental impacts (Hasan & Raza, 2022).

Educational institutions have a central role in fostering energy literacy by giving students the knowledge, critical thinking skills, and problem-solving abilities they need to tackle the energy crisis (Gajdzik et al., 2024). Despite the increasing focus on sustainability education, the existing curricula often fail to address comprehensively the intricacies of energy systems and their implications worldwide. Consequently, research is needed to understand students' conception of an energy crisis, as such insights will help design focused educative strategies targeting common misconceptions and promoting holistic comprehension of issues related to energy (Li et al., 2022).

It's important to understand the energy crisis because knowing the facts will make people really care about the environment (Gitelman & Kozhevnikov, 2023). Cross-sectional data studies can help explain the idea of the energy crisis at different levels of education (Hasan & Raza, 2022). This study's main focus is on the school's point of view because the idea of an energy crisis is taught in science classes (Farghali et al., 2023). The participants who took part in the study and learned about energy and the energy crisis in science classes talked about the basic skills they learned in school. Researchers have looked into ideas about the idea of an energy crisis in the past (Mahbub et al., 2022). Having a basic understanding of the energy crisis is now the main reason why a country can grow and move forward. A framework that includes many different fields was made to help students connect with the real world. To show that the energy transition is interdisciplinary, scientific articles, analytical reports, and expert survey results were all put together (Park, 2022). When focusing only on certain energy sources or production

methods, this process requires taking into account a number of factors and risks. Around the world, fighting climate change and lowering greenhouse gas emissions have become top priorities (Huang et al., 2022).

The theoretical framework for the energy crisis is very important in many areas, such as business, manufacturing, health, education, agriculture, and many service industries (Leonard et al., 2022). Energy is necessary for life, has a big effect on economic growth, and is a driving force behind social progress. Energy is the ability to do work or make something happen (Prike et al., 2024). It can be in the form of kinetic, potential, thermal, or chemical energy, and it is a basic idea in physics and engineering (Malik et al., 2022). To understand natural events, you need to know about transformation and energy conservation. Energy is now necessary to control a country's economy (Farghali et al., 2023). Those that happen because of the drop in gas supply are very important and relevant (Xiuhui & Raza, 2022). The research conducted across sections, investigates how different educational levels perceive energy crises among students by examining patterns, misconceptions, and knowledge gaps within them. Concerning diverse student samples, this research aims to discover how age, academic background, and exposure to environmental education modify their perceptions of any aspects related to power developments.

The findings of this study will add to the existing literature on energy literacy and practically guide teachers and policymakers in developing more successful curricula. The study aims to make students responsible adults who can create a future with sustainable energy use as a solution for one of the world's most challenging problems (Ali et al., 2023). This study was innovative because the research novelty examined a cross-sectional study of four groups interested in crisis energy. Previous studies have found different factors that come from the perspectives of teachers and students. Also, earlier studies didn't look at the idea of an energy crisis in elementary and junior high school students, even though this student will go on to learn science and explain the idea of an energy crisis. This study also shows that a person's education level and the number of learning resources they have can affect their understanding of the concept of an energy crisis. So, the goal of this study is to find out what kinds and how many ideas about energy crises sixth, seventh, eighth, and ninth graders have.

RESEARCH METHODS

The researchers used convenience sampling to investigate students' conceptions of the energy crisis in SMP Bandung. Convenience sampling was used because it is practical and easy to conduct within a school setting (Creswell, 2018). The scholars chose students who were easily reachable during scheduled classes and extracurricular activities, thus ensuring that they represented different grade levels and backgrounds as constrained by their school's setting. This method ensured the research was done quickly with minimal resources while obtaining necessary information. Although convenience sampling expedited the research process, these findings might not be generalizable to all SMP students in Bandung. Nevertheless, these findings are essential for understanding how middle school pupils view energy matters and are crucial when providing interventions tailored for local audiences.

A cross-sectional study is a research design that calls for data collection at a single point in time to examine relationships among variables or describe the existing status of a phenomenon within a population. For example, this method is suitable for studying patterns, attitudes, and characteristics across different groups irrespective of age since it does not require long-term observation or follow-up. Researchers often use convenience sampling because it is easy to use and useful (Creswell, 2018). The method involves picking people to answer who are easy to reach and willing to do so without thinking too much about randomness or representation. The cross-sectional survey design was most feasible and suitable due to its low cost and simplicity and, as such, a convenience sample was employed for the study. This procedure enables the researcher to efficiently and inexpensively sample participants who are available, an important consideration when time or resources are limited, or a full sampling frame is not available (Strzelecki & Miklosik, 2024).

In real-life settings such as clinics, schools, or community centers, convenient sampling is often the only possible means to collect data in a short period of time. In addition, this method is inexpensive and easy to carry out, and hence is appropriate for exploratory studies or pilot type studies in which the goal is to obtain preliminary data or develop a hypothesis rather than to develop generalizable results (Prike et al., 2024). Despite the weaknesses of this sampling strategy, including potential sampling biases and decreased generalizability, convenience sampling is appropriate in cross-sectional survey studies--as long as more sophisticated sampling procedures are operationally unrealistic.

Moreover, convenience sampling proves handy in exploratory works, pilot studies, or when there is limited time, funds, or contact with the participants. For example, researchers may incorporate members of just one classroom, working area, or society only because they are available and cooperative. Although this method offers several advantages, such as speed and cost-effectiveness, it has limitations that must be considered. The sample gathered may not reflect the larger target population, leading to selection bias and limiting the generality of findings acquired. Some shortcomings face this method, but it is pretty dominant across all disciplines, mainly if the primary aim is to get initial insights or test research instruments rather than make any definite/substantial population-wide conclusions about people's behaviors in general.

An educational research could employ the approach of comparing students from various grades to determine the differences between them. However, like any other type of study, cross-sectional studies are flawed in some ways, such as not establishing cause-effect relationships or allowing developmental changes over time (Chen, 2001). Nevertheless, within these constraints, cross-sectional designs remain invaluable descriptive and comparative tools, especially at the early stages of investigation. Because all the data is collected at the same time and mostly relates to the time of data collection, a cross-sectional study does not include a time dimension. This is an observational study in which each participant's exposure and outcome are ascertained simultaneously (Hakam et al., 2022). Cross-sectional studies are the easiest type of observational study to do at the individual level, and they are usually easy to do and not too expensive (Pandis, 2014). Depending on whether the result variable is evaluated for any correlations with exposures or risk factors, it can be categorized as either descriptive or analytical.

Data preparation, implementation, and analysis are all important parts of the study process (Eymur & Çetin, 2024). In the planning phase, an open-ended questionnaire was developed as the primary research instrument to explore participants' perspectives on the energy crisis. Open-ended questions were chosen to elicit in-depth responses, enabling participants to discuss not only immediate causes such as resource depletion, strained international relations, and technological failures, but also broader issues like economic dependence, environmental impacts, and social justice concerns. To ensure the validity of the instrument, the questions were reviewed by subject matter experts in energy policy and sustainability, who assessed whether the items accurately captured the complexities of the energy crisis (Hays & Reinders, 2020). Reliability was addressed by piloting the instrument with a small group of participants and refining the questions

based on their feedback to ensure clarity and consistency in responses. This approach encouraged participants to critically examine established narratives, propose alternative solutions, and consider the wider implications of policies related to renewable energy, policy reform, and sustainable development (Learners et al., 2011). Ultimately, employing a valid and reliable open-ended instrument enhanced the depth and quality of the data, providing a more comprehensive understanding of the energy crisis and empowering affected communities to engage with the issue more effectively (Farghali et al., 2023).

As part of the implementation stage, people who are taking part in the research are getting online surveys. The first page of the online questionnaire asked participants to write down their name and instructions to answer based on what they knew, not what they had read or seen online. This was done to make sure they were being honest when they answered the questions. The next step is to analyze the data, which means turning open-ended data into concept codes that show the percentages for each of the three groups of research participants. The study phases involved creating open-ended questions, submitting the application to transform it into an online survey, and then sending the link to the online survey to 167 research participants. The proportion included sixth-grade elementary, seventh-grade, eighth-grade, and ninth-grade students. There are three questions related to an energy crisis: (1) what do you know about the energy crisis? (2) How did you know about the energy crisis? (3) Why should we study the energy crisis?

Table 1 shows the percentage of Research subjects. There are 167 students involved, and the percentage comprises sixth-grade elementary students, seventh-grade students, eighth-grade students, and ninth-grade students. The students studied the energy crisis in a science lesson.

Table 1. The proportion of research subject

Status	Gender		Total
	Male	Female	
6th	9	5	14
7th	27	24	51
8th	3	3	6
9th	42	54	96
Total	81	86	167

RESULT AND DISCUSSION

Rigor and transparency were pursued in this qualitative data analysis by way of using a systematic thematic analysis approach. From the 167 students (across four levels) that responded to three open-ended questions related to the energy crisis, the researchers

started by reading and re-reading all the responses, to gain familiarity with the data, and to record preliminary ideas and re- current concepts. Then began coding: for each bit of students' responses, generated a code that represented the main idea and which could also combine with a derived (and/or evolved) code, both deductive codes from the research question and inductive codes arising directly from the data. For example, such codes as "crisis", "energy", "source", "environmental crisis" and "climate change" were frequently referred to figure 1.

After all responses were coded, researchers aggregated the related codes into the more general or higher order categories, 2 and considered the relationships between the co des and the larger categories, and 3 patterns with regards to grade level. For one, codes such as "energy restrictions" and "exhaustion of resources" were aggregated under a higher level category labelled energy scarcity concerns. This led to several key themes, such as "basic understanding of energy crisis," "environmental concerns," and "sources of information," that were clarified by review iterations to reflect accurately the data and to remain conceptually unique from one another. The types of codes developed were indicative of the range and richness of students' understandings, evidenced by ninth-grade students generating the highest numbers and most complex themes, demonstrating a higher level of sophistication regarding the energy crisis (Li et al., 2022).

The coding and category process was used iteratively in order to develop themes and establishing that each theme was an important, repeated pattern in the data and there was enough data from student responses to support it. For instance, "environmental crisis" was the most salient theme for ninth graders, "energy limitation" was the most serious problem for eighth graders, and "crisis" was the primary theme for seventh and sixth graders. The connections among these themes showed an increasing level of complexity in students' understanding of the energy crisis across grade levels, where older students held more sophisticated interconnected conceptions(Farghali et al., 2023).

In summary, the process used was data familiarization, coding, theme development, and category creation which lead to a number of robust themes that represented students' varied views of the energy crisis. This rigor strengthened the trustworthiness of the results, and it generated insights that could be very useful for educators who wish to confront the misconceptions and foster a deeper understanding of the energy questions in the curriculum.

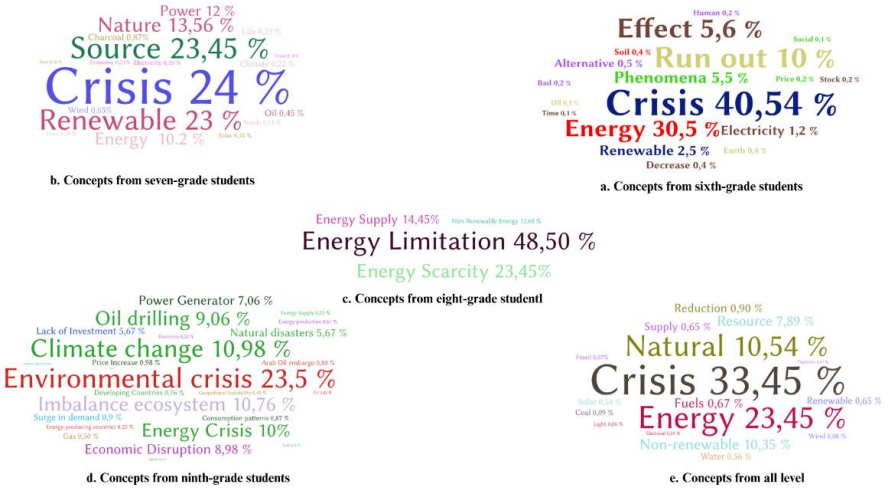

Figure 1. Conception of energy crisis based on the school's perspective

Research data shows that the concept of "Crisis" represents the "energy crisis" concept. Due to the global energy crisis, energy management has altered, with a greater focus on energy efficiency one of the emerging concepts is renewable energy. To optimize the current energy mix while also protecting the environment, renewable energy is a crucial part of the energy supply (Si, 2022). It has become imperative to develop renewable energy sources like solar, biomass, wind, and hydro to replace traditional energy sources due to the rise in the use of fossil fuels and the damage they do to the environment.

The second question is, how did you find out about the energy crisis? Figure 2 shows the results of the sources of the energy crisis idea. Sixth graders show where the idea of an energy crisis comes from tear "School" showed up in more than half of the five main ideas. Seventh-grade students show where the idea of an energy crisis comes from "Internet" and "News" appeared in more than 30% of 9 key concepts. Eight-grade students show that sources of energy crisis conception from "Social media" appeared in more than 30% of 4 key concepts. Ninth-grade students show sources of energy crisis conception from "Social media" appeared in more than 30% of 9 key concepts. The concepts of "Google" and "Science Lesson" appeared in more than 40 % of 9 key concepts from all levels of students when finding the sources of energy crisis conception.

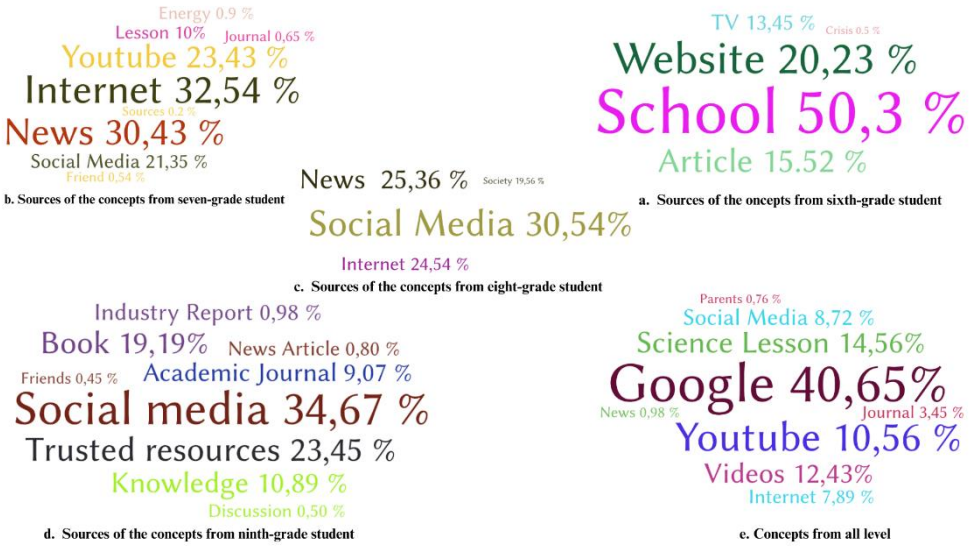

Figure 2. Sources of the conception of energy crisis based on the schools'perspective

Research data shows that the most significant source of concepts of "Google" represents the concept of "energy crisis" from students' conception. The Google search engine is used by billions of people daily and has become associated with searching. Another significant source is "social media". Since the early bloggers of the late 1990s, social media influencers have used sites like YouTube and Instagram to broaden their audience and vary the content they post. Social media influencers are people who have amassed a sizable following on social media and have the power to shape the opinions and actions of their audience (Han & Balabanis, 2024). The current study used a social media simulation to make an experimental poll that looked like a social media network (Prike et al., 2024). Social media has been the best and easiest way to get to know and talk to the user. The global energy crisis is one of the most important problems.

Table 2. Key Concepts for "Why Should We Study the Energy Crisis?" by Grade Level

Grade level	Most Frequent Key	% Appearance in	Total Key Concepts
Sixth Grade	Alternative Energy	>20%	13
Seventh Grade	Energy Crisis	>40%	8
Eighth Grade	Energy Crisis	>30%	4
Ninth Grade	Energy Crisis	>40%	16
All Levels	Energy Crisis	>35%	9

Table 2 presents the rationales for studying the energy crisis that students articulated in response to the open-ended survey item. Out of the 13 key concepts identified at that level, on average the top concept, "alternative energy" was mentioned in over 20%. by the twelfth graders in the responses to the concept "energy crisis" as a

whole, whereas both that of the appearance rate among the key concepts and the percentage was lower, with more than 40% of the key concept for the seventh and ninth graders and more than 30% for the eighth. Across all grade levels, "energy crisis" was the most heavily represented concept, occurring in over 35% of the nine key concepts. These findings suggest a conceptual shift, with younger learners focusing on the relevance of alternative energy as a solution to the energy crisis and older learners moving towards attention to the energy crisis as a topic of concern in itself. This trend indicates that students graduate towards a more sophisticated understanding of the relevance of studying the energy crisis focusing on social and environmental issues of the crisis as they progress through grade levels describe in the Figure 3

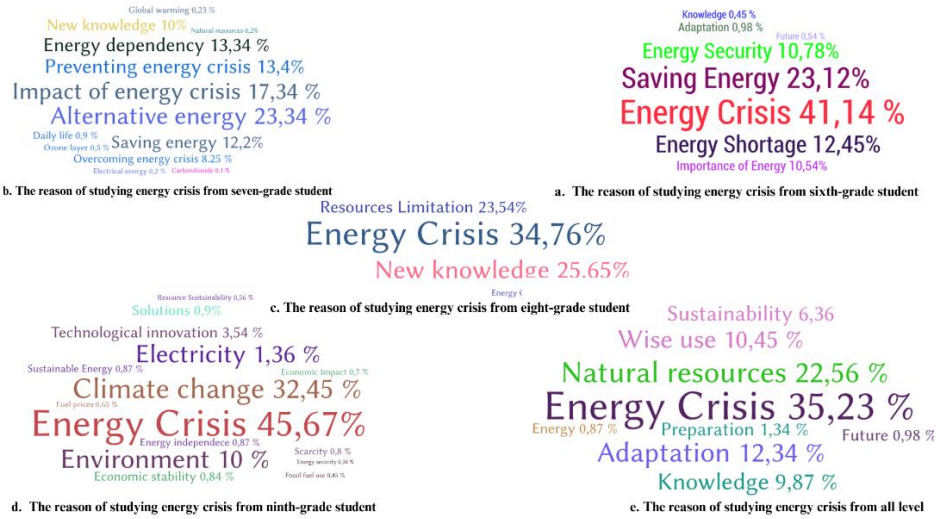

Figure 3. The reason for studying energy crisis is based on the school's perspective

From figure 3 the presentation of the results of the research in the research exhibits some students' specific improvement in the perception at the energy crisis along their educational trajectory. More complex issues are discussed in more advanced levels (for example, ninth grade) such as environmental crisis and climate change, and basics in lower levels such as crisis and energy(Farghali et al., 2023). These results show that students develop a broader and more sophisticated thinking about energy issues as they advance in school, which implies a greater consideration of real world challenges of energy sector such as energy poverty, security of energy and climate change. This relationship is observable in the students' environmental and climate change concepts at higher grades. On the other hand, the concepts of energy poverty and energy security continue to be hardly evoked by lower secondary students, which confirms the necessity to improve these topics in the curricula regarding young children. It emphasizes the

necessity of integrating such issue of energy in gradual and complete approach in order to achieve environmental dimension, social, and economic dimension of this crisis of the energy(Farghali et al., 2023).

The implication of these observations for school science curricula is that complexor even real-worldcontextual energy ideas should be introduced into science learning, especially at the early school levels(Barbar et al., 2022). Teachers should be encouraged and supported to create cross-cutting domain and contextual materials to facilitate exploration by students of their understanding of energy and of global challenges they will confront(Rusyati et al., 2021). A relevant and flexible curriculum will shape the energy literate GDE learners, who will have the necessary knowledge and skills to respond to energy-related challenges in the future(Prike et al., 2024).

CONCLUSION

In this cross-sectional study, the idea of an energy crisis owned by sixth-grade elementary students (14), seventh-grade students (51), eighth-grade students (6), and ninth-grade students (96) is to be examined. An online survey, an open-ended inquiry, is used to distribute the instrument. Ninth-grade students proposed the idea that "environmental crisis" and "climate change" were the highest notion; in eighth-grade students, the idea of "energy limitation" seemed to be the highest, and in seventh and sixth-grade students, the idea of "crisis" was the highest. These findings suggest that more significant ideas regarding conceptualizing energy crises can be brought up at higher educational levels. The implications of the findings give educators the chance to teach students more complex concepts connected to the energy crisis and the fundamentals.

REFERENCES

Ali, M. I., Abduh, A., Mahmud, R., & Dunakhir, S. (2023). Raising Students' Awareness on Environmental Education Issues. *Indonesian Journal Of Educational Research and Review*, *6*(1), 1–8. https://doi.org/10.23887/ijerr.v6i1.59146

Barbar, M., Mallapragada, D. S., & Stoner, R. (2022). Decision making under uncertainty for deploying battery storage as a non-wire alternative in distribution networks. *Energy Strategy Reviews*, *41*(May), 100862. https://doi.org/10.1016/j.esr.2022.100862

Chen, X. Da. (2001). The dual near-field effect in radio frequency simulation. In *Xitong Fangzhen Xuebao/Acta Simulata Systematica Sinica* (Vol. 13, Issue 1).

Creswell, J. (2018). *Key Point Chapter Summaries for John Creswell's Research Design Textbook on Qualitative, Quantitative, & Mixed Methods Approach*. 1–40.

Eymur, G., & Çetin, P. S. (2024). Investigating the role of an inquiry-based science lab on students' scientific literacy. *Instructional Science*, 743–760. https://doi.org/10.1007/s11251-024-09672-w

Farghali, M., Osman, A. I., Mohamed, I. M. A., Chen, Z., Chen, L., Ihara, I., Yap, P. S., & Rooney, D. W. (2023). Strategies to save energy in the context of the energy crisis: a review. In *Environmental Chemistry Letters* (Vol. 21, Issue 4). Springer International Publishing. https://doi.org/10.1007/s10311-023-01591-5

Gajdzik, B., Wolniak, R., Nagaj, R., Žuromskaitė-Nagaj, B., & Grebski, W. W. (2024). The Influence of the Global Energy Crisis on Energy Efficiency: A Comprehensive Analysis. *Energies*, *17*(4), 1–49. https://doi.org/10.3390/en17040947

Gitelman, L. D., & Kozhevnikov, M. V. (2023). New Approaches to the Concept of Energy Transition in the Times of Energy Crisis. *Sustainability (Switzerland)*, *15*(6). https://doi.org/10.3390/su15065167

Hakam, D. F., Nugraha, H., Wicaksono, A., Rahadi, R. A., & Kanugrahan, S. P. (2022). Mega conversion from LPG to induction stove to achieve Indonesia's clean energy transition. *Energy Strategy Reviews*, *41*(May), 100856. https://doi.org/10.1016/j.esr.2022.100856

Han, J., & Balabanis, G. (2024). Meta-analysis of social media influencer impact: Key antecedents and theoretical foundations. *Psychology and Marketing*, *41*(2), 394–426. https://doi.org/10.1002/mar.21927

Hasan, M. M., & Raza, M. Y. (2022). Nexus of natural gas consumption and economic growth: Does the 2041 Bangladesh development goal realistic within its limited resource? *Energy Strategy Reviews*, *41*(May), 100863. https://doi.org/10.1016/j.esr.2022.100863

Hays, J., & Reinders, H. (2020). Sustainable learning and education: A curriculum for the future. *International Review of Education*, *66*(1), 29–52. https://doi.org/10.1007/s11159-020-09820-7

Huang, Z., Ming, X., & Duan, H. (2022). Heterogeneous effects of energy poverty convergence in Europe. *Energy Strategy Reviews*, *41*(March), 100822. https://doi.org/10.1016/j.esr.2022.100822

Learners, M. G., Expectations, M. H., Gerrold, D., Committee on Highly Successful Schools or Programs in K-12 STEM, & Education; National Research Council. (2011). Successful K-12 STEM Education: Identifying Effective Approaches in Science, Technology, Engineering, and Mathematics Committee on Highly Successful Schools or Programs in K-12 STEM Education; National Research Council. In *Mathematics Education in the Middle Grades*. https://www.ltrr.arizona.edu/~sheppard/TUSD/NRC2011.pdf

Leonard, A., Ahsan, A., Charbonnier, F., & Hirmer, S. (2022). The resource curse in renewable energy: A framework for risk assessment. *Energy Strategy Reviews*, *41*(March). https://doi.org/10.1016/j.esr.2022.100841

Li, Y., Alharthi, M., Ahmad, I., Hanif, I., & Ul Hassan, M. (2022). Nexus between renewable energy, natural resources and carbon emissions under the shadow of transboundary trade relationship from South East Asian economies. *Energy Strategy Reviews*, *41*(May), 100855. https://doi.org/10.1016/j.esr.2022.100855

Lu, J., Chen, H., & Cai, X. (2022). From global to national scenarios: Exploring carbon emissions to 2050. *Energy Strategy Reviews*, *41*(May), 100860. https://doi.org/10.1016/j.esr.2022.100860

Mahbub, T., Ahammad, M. F., Tarba, S. Y., & Mallick, S. M. Y. (2022). Factors encouraging foreign direct investment (FDI) in the wind and solar energy sector in an emerging country. *Energy Strategy Reviews*, *41*(May), 100865. https://doi.org/10.1016/j.esr.2022.100865

Majava, A., Vadén, T., Toivanen, T., Järvensivu, P., Lähde, V., & Eronen, J. T. (2022). Sectoral low-carbon roadmaps and the role of forest biomass in Finland's carbon neutrality 2035 target. *Energy Strategy Reviews*, *41*(March).

https://doi.org/10.1016/j.esr.2022.100836

Malik, H., Yadav, A. K., Márquez, F. P. G., & Pinar-Pérez, J. M. (2022). Novel application of Relief Algorithm in cascaded artificial neural network to predict wind speed for wind power resource assessment in India. *Energy Strategy Reviews*, *41*(May). https://doi.org/10.1016/j.esr.2022.100864

Park, Y. E. (2022). Research evidence for reshaping global energy strategy based on trend-based approach of big data analytics in the corona era. *Energy Strategy Reviews*, *41*(March), 100835. https://doi.org/10.1016/j.esr.2022.100835

Prike, T., Butler, L. H., & Ecker, U. K. H. (2024). Source-credibility information and social norms improve truth discernment and reduce engagement with misinformation online. *Scientific Reports*, *14*(1), 1–11. https://doi.org/10.1038/s41598-024-57560-7

Rusyati, L., Rustaman, N. Y., Widodo, A., & Ha, M. (2021). the Conception of Soils: a Cross-Sectional Study Based on the School'S Perspective. *Journal of Engineering Science and Technology*, *16*, 34–41.

Si, Y. (2022). Co-authorship in energy justice studies: Assessing research collaboration through social network analysis and topic modeling. *Energy Strategy Reviews*, *41*(May), 100859. https://doi.org/10.1016/j.esr.2022.100859

Strzelecki, A., & Miklosik, A. (2024). Device-dependent click-through rate estimation in Google organic search results based on clicks and impressions data. *Aslib Journal of Information Management*. https://doi.org/10.1108/AJIM-04-2023-0107

Xiuhui, J., & Raza, M. Y. (2022). Delving into Pakistan's industrial economy and carbon mitigation: An effort toward sustainable development goals. *Energy Strategy Reviews*, *41*(March), 100839. https://doi.org/10.1016/j.esr.2022.100839

Xu, J., Akhtar, M., Haris, M., Muhammad, S., Abban, O. J., & Taghizadeh-Hesary, F. (2022). Energy crisis, firm profitability, and productivity: An emerging economy perspective. *Energy Strategy Reviews*, *41*(January), 100849. https://doi.org/10.1016/j.esr.2022.100849