*European Journal of Sustainable Development* (2023), **12**, 4, 119-128 ISSN: 2239-5938
*Doi: 10.14207/ejsd.2023.v12n4p119*

# School for Sustainable Living: Assessing the Energy Related Topics Among Young People

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**Abstract**
We associate modern man with a sustainable way of life. The very concept of sustainability is closely linked to the energy we need for our lives. The amount of energy is limited by planet Earth itself and by technology for transformation/capturing energy. Man has always strived to have as much energy as possible, as it significantly affects the quality of life. With a population growth and slowly decreasing reserves of fossil fuels, it is increasingly important to make the most of a given energy and move to clean energy sources. The article conducted research on how well young people know the basic energy values for everyday needs and how familiar they are with current technologies that enable better use of energy. According to the results of the research, suggestions are made for improving general energy literacy among young people.

*Keywords: energy, sustainable competences, education, knowledge examination*

## 1. Introduction

Is it necessary for us to know anything about energy? What should we know? Let's ask another question: "Why do we educate ourselves?" The answer would probably be that we want to be successful in life, to get a job, and to earn money. But what do we need the money for? So that we can go to the store and buy food, clothes, a car, a house, fuel, go on a trip, and so on.
What is food? Chemical energy. What is clothing? Energy, in the form of materials, and some in the labour invested in making of the clothes. Travel is energy. We use some energy for transportation, some for the hotel, which required energy for its construction, some for the guide who will be able to buy some energy from the store and satisfy hunger, and so on.
Therefore, we can conclude that everything we do is somehow connected to energy. Energy is also the only true currency, as it is a rule that energy cannot be destroyed but only transforms from one form to another (Atkins 2010). Using monetary currency, we can consider something more valuable because it is rarer, not just its energy value. A good example of how we do not consider the actual invested energy in the use of monetary energy is, for example, artworks that can reach millions in value, even though not much energy was invested in them. Furthermore, the value of the artwork changes over time.
Year after year, the pressure increases due to the rising costs of energy. Therefore, there is a growing emphasis on the need to handle energy prudently. It is precisely because of the

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constant use of money that most people have lost their sense of energy or energy values (Tagliapietra 2020).
Of course, we can guide individuals in energy use through prices, but it would be even more effective if users had at least basic knowledge of energy values and the principles of key technologies that help in efficient energy use.

### 1.1 Literature review

For the purpose of this article, a study was conducted to determine if there are questionnaires available where individuals can test their knowledge in the field of energy and working with it. Questionnaires do exist (ProProfs. 2023), (The world's most engaging learning platform, 2023), (BBC 2023), but they are mostly at a very basic level, as increasing the complexity of the issue more specific knowledge is required. Therefore, a questionnaire was designed that attempts to cover key current knowledge in the field of energy use and sustainable living.

## 2. Research

The research was conducted among students aged 14 - 18. It was carried out in the form of an anonymous survey. The research sample included 344 students from three different secondary schools. One of the schools is a grammar school (112 students), another is a technical four-year school (118 students), and the third was a three-year vocational school (114 students). The survey was conducted in the form of a digital questionnaire The survey consisted of 10 questions. The following are individual questions from the survey, each accompanied by a brief explanation of why the question is important and its result.

**Question 1**
How much does the average consumed kilowatt-hour (kWh) of electricity cost in Slovenia (taking into account the grid fee, various charges, VAT, etc.)?
In Slovenia, according to the data (Eurostat 2023), the average cost of a kWh of electricity is currently € 0.20, while the average price in Europe is € 0.24. This question is important as Europe is strongly committed to phasing out the use of fossil fuels (M. & Hoppe 2023). This also includes an increasing use of electric vehicles. We can find many tips on how to save electricity (Scoot, 2022). It is good to know the basic unit and how much this unit actually costs in order to make informed decisions about energy usage and understand the financial implications.

Recently, the price of electricity has increased significantly, and there has been a lot of discussion about it on television, newspapers, and internet media (Eurostat 2023).


*Figure 1: Results for question 1*

Based on the results (Figure 1), we can conclude that students are not concerned about the price of electricity and probably do not pay attention to their consumption or seek ways to reduce it. There are no significant differences in the answers based on students' study programme, 44% of students form four-year technical school identified the price correctly.

**Question 2**

How much do we pay annually for electricity if we charge our mobile phone every two days? The phone has a 5000 mAh battery.

There is a significant emphasis on electricity consumption when it comes to the use of modern electronic devices such as mobile phones, computers, tablets, etc. It is often emphasized that these devices contribute significantly to the increasing electricity consumption. To estimate the cost of charging a mobile phone, we first need to calculate the annual consumption (Saveonenergy 2023). Annually, we need around 5 kWh of electricity. We can, therefore, conclude that we pay around € 1 annually for charging a mobile phone.

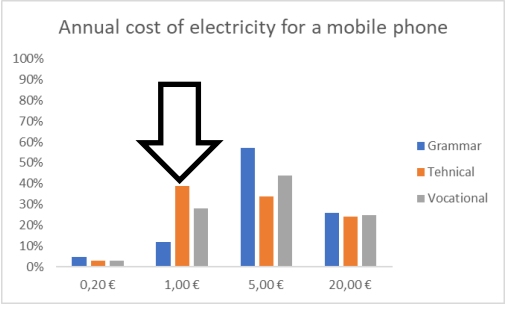


*Figure 2: Results for question 2*

Students are among the regular users of mobile phones. As seen in the previous answer they do not pay much attention to electricity consumption. However, they have probably heard that the use of modern electronic communication devices also increases electricity

consumption, that is why most students believe that the annual cost of charging a mobile phone is € 5 (Figure 2).

**Question 3**

How much primary energy does an average European (in kWh) require per day?

This question is quite challenging, as it requires knowledge of what primary energy is (Fanchi & Fanchi 2017). It is important to be aware that we need one form of energy for everything. Let us use as an example electrical energy obtained from the socket. When we consume 1 kWh of electrical energy, we needed at least 4 kWh in the form of coal. The same applies to food, clothing, and so on. Often, production-intensive countries like China and India are blamed for global pollution. Figure 1 shows how energy consumption has changed historically. In Europe, each resident requires around 100 kWh of primary energy per day, while the average global consumption is 50 kWh (Figure 2).

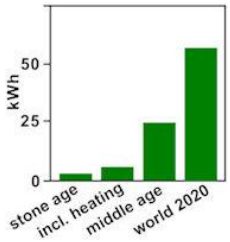


*Figure 3: The history of primary energy utilization**

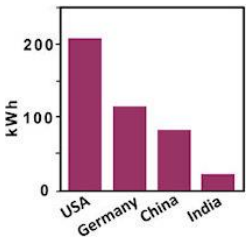


*Figure 4: Global primary energy consumption**

**Source: https://home.uni-leipzig.de/energy/energy-fundamentals/04.htm*

The answers clearly indicate that students tried to guess the correct answer, as all answers are equally represented (Figure 5). It is highly likely that students do not know what primary energy is or have no idea about energy itself.

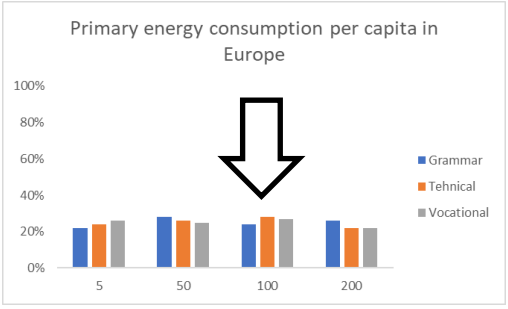


*Figure 5: Results for question 3*

**Question 4**

How many kWh of energy does 1 liter of gasoline contain?

This question is relevant as an increasing number of countries have set limitations on the sale of internal combustion engine cars. Currently, the only alternative are electric cars, and the biggest challenge with electric vehicles lies in the batteries. In reality, gasoline/diesel fuel are highly energy-dense, as 1 liter contains around 10 kWh of energy (World Scientific 2016).

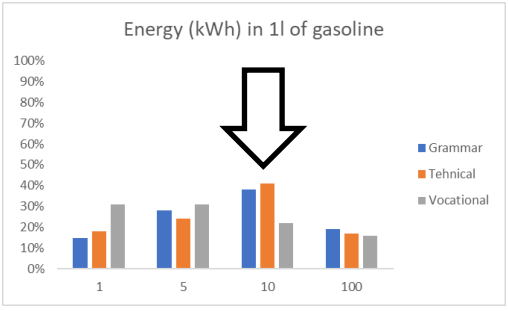


*Figure 6: Results for question 4*

Again, there are no significant differences in the answers to this question (Figure 6). However, slightly higher number of grammar school students and four-year technical school students answered the question correctly.

**Question 5**

What is the average consumption of an electric car per 100 km?

This question is related to the previous question. The fact is that we cannot directly compare conventional cars with electric cars since the latter have much better efficiency. An electric car consumes around 20 kWh of electrical energy per 100 km, while internal combustion engine cars consume around 60 kWh for the same distance (IEA 2022).

The answers confirm (Figure 7) the previously established fact that students possess very little understanding of energy and its consumption. It is important to note that today's secondary school students will be major users of electric vehicles in the future. In contrast it is common knowledge today how much fuel an average fossil car consumes.

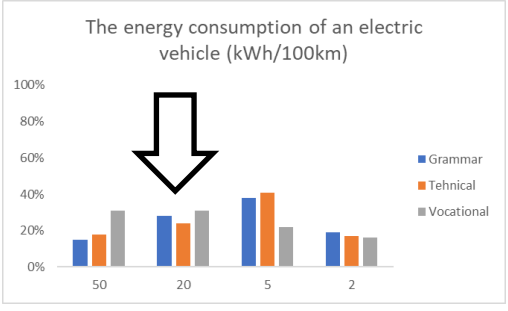


*Figure 7: Results for question 5*

**Question 6**

How much water is used in the production of a cotton t-shirt?

Drinking water is becoming increasingly scarce each year, and even in Europe, we have already faced shortages (Symons 2023). Unfortunately, the current trend is that products become outdated very quickly and are frequently replaced. Rapid replacement significantly impacts energy consumption (Eagan 2014). Growing cotton and processing it requires vast amounts of water. It is estimated that around 2,500 litres of water are needed for a single t-shirt (Taylor 2020).

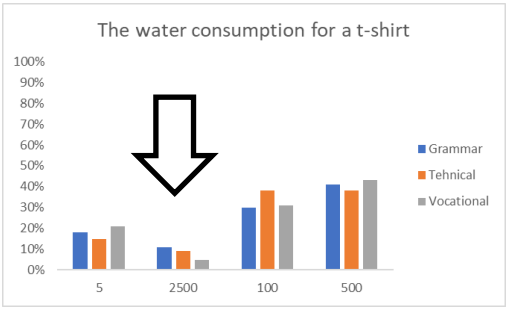


*Figure 8: Results for question 6*

Most students are unaware of how every- day products are manufactured. Among all the answers, students least often chose the correct answer (Figure 8), which is perhaps shocking and difficult to comprehend. With a better understanding of the manufacturing processes, fewer still usable things would be discarded and replaced with new ones.

**Question 7**

How does an air recuperator reduce energy consumption?

Since energy is valuable, we want to use it as efficiently as possible, which is referred to as energy efficiency. Air recuperators are practically essential in contemporary houses because they are airtight. The principle of operation is straightforward. We extract stale air from rooms such as the kitchen, bathroom, and toilet while supplying fresh outdoor air to bedrooms and living spaces, preheated with the previously extracted air. This eliminates the need to open windows and preserves a significant amount of the energy invested in heating the air. During summer, the process can be reversed to prevent the influx of hot air into the rooms (Turner 2023).

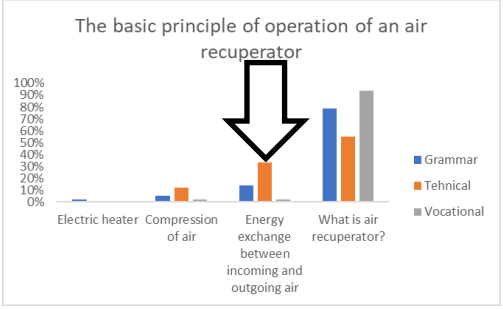


*Figure 9: Results for question 7*

One of the possible answers to this question was: "What is a heat recovery ventilator?" Students correctly circled this answer most frequently (Figure 9), acknowledging their lack of knowledge. Perhaps more people would consider installing heat recovery ventilators if they were familiar with this technology.

**Question 8**

How can a heat pump have an efficiency greater than 100%?

This question is related to energy efficiency. With a heat pump, one part of the energy is used to operate the compressor in the form of electricity, while the majority of the energy is obtained from the surroundings (Grassi 2018). As a result, we can obtain 4-5 kWh of heating/cooling energy for every kWh of electricity invested. Heat pumps are expected to replace conventional fossil fuel heating sources in the future.

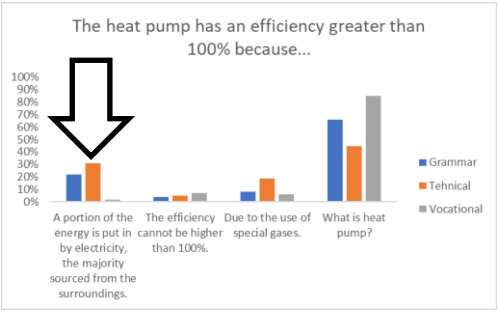


*Figure 10: Results for question 8*

Similar to the previous question, the students could choose the option of being unfamiliar with the mentioned technology (Figure 10). Heat pump technology is also used in refrigerators and air conditioners.

**Question 9**

What percentage of energy does the average household use for lighting?

Lighting is often highlighted when it comes to raising energy consumption awareness. Not long ago, very inefficient lighting was commonly used. However, the "turn off the lights" rule will have to be upgraded to something more substantial if we want to make a significant contribution to energy consumption since lighting accounts for only around 1,5% of total household energy consumption or 9% when considering only electricity consumption (Majcen 2016).

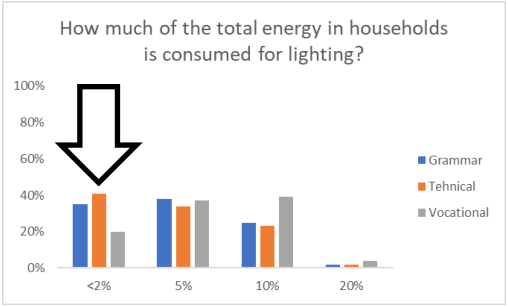


*Figure 11: Results for question 9*

The fact is that energy saving is strongly associated with turning off lights. For that reason, there has been a lot of promotion to use energy-efficient lighting. The answers clearly show that students believe that much more energy is consumed for lighting than there actually is (Figure 11). This thus poses a problem, as many people diligently turn off lights believing that they have done more to reduce the energy consumption than it is actually possible.

**Question 10**

How much $CO_2$ is generated due to energy consumption per 1 kg of beef?

Air, water, and food form the basis of our lives. For sustenance, we require chemical energy obtained from food. There is much discussion about the significant amount of food wasted. Energy is needed for food production (Wittwer 1995). Cattle farming is an energy-intensive industry. However, energy consumption is not the only issue; energy production also generates greenhouse gases. Water vapor, $CO_2$, and methane are the most problematic gases when it comes to global warming (Moran 2015).

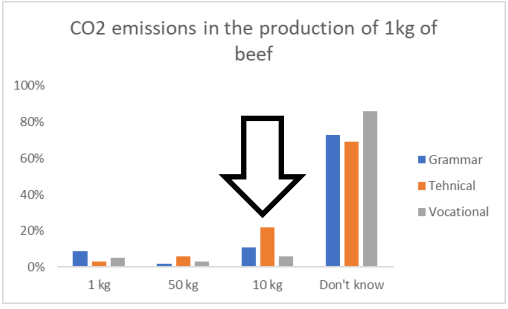


*Figure 12: Results for question 10*

Many greenhouse gases are associated with food production. Most students admit that they are not aware of the connection (Figure 12). With knowledge of the energy values in food energy, a lot could be done to reduce energy consumption and thereby reduce greenhouse gases.

## 3. Results of the survey

It is safe to say that the results are both expected and disconcerting.

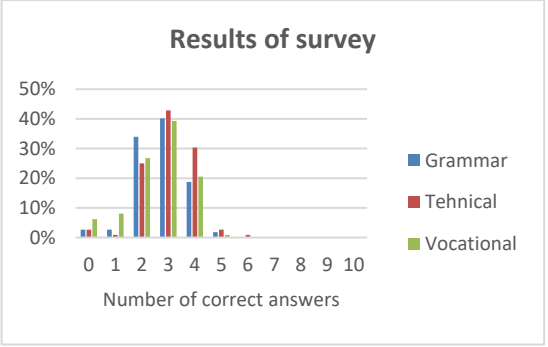


*Figure 13: Percent of correct answers by groups*

Figure 13 shows that there are no significant differences in results between examined groups. Out of ten questions, on average, three questions were answered correctly. Only one student answered six questions correctly.
More and more attention is paid to sustainable living and development. Sustainable development is directly linked to energy use. The results clearly show that young people do not have even basic knowledge in this field.

## 4. Conclusion

The knowledge of secondary school students about energy, energy values, and technologies directly related to energy is very limited. Only one student answered six questions correctly and six out of 344 students answered five questions correctly. The students' level of knowledge coincides with that of the educational system itself, since it does not provide focused education on environmental or energy issues. Although there are several online portals that help the user assess energy values and potential savings, very few people use them, except perhaps those who are interested in the issue due to their situation.
We can make a substantial impact to the energy future by being energy-conscious and self-sufficient. Moreover, by introducing energy-focused topics as a part of school curricula, we could contribute significantly to the faster development of a more sustainable society. To ensure an even/a homogeneous implementation across Europe, we could utilize international knowledge assessments i. e. the Programme for International Student Assessment (PISA 2000).

The world of energy is fascinating. Don't be afraid to meet it!

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