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ENERGY LITERACY SURVEY AT HIGH SCHOOLS IN NORTHERN CYPRUS[1]

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ABSTRACT
The main aim of the study is to collect data with a survey, evaluate the energy knowledge, behaviour and attitudes of students, and, at the end, interpret the resulting data. As it is known, the entire world is trying to prevent global warming, which is one of the major problems in the world. The easiest and effective solution to this problem is; using energy efficiently. Also, increasing the usage of renewable energy sources is another option. This study mainly depends on a survey carried out in two high schools in TRNC. This survey is used to evaluate the energy literacy, energy knowledge, awareness and behaviours. The objective of this study is to evaluate the energy awareness and knowledge level of the students about energy issues and also, propose some solutions to determined weaknesses. Therefore, a survey was done, which was used and validated in many scientific studies, and was applied in two high schools. A survey that has 61 questions and 4 main sections; personal information about energy, effectives, students' and also their families' behaviours on energy, and energy knowledge, was answered by 101 students. Results show that approximately 90% of the participants support the energy efficiency and also 68,30 % would like to save more energy. However, 45,50 % of the students are not sure if they can contribute to energy saving as an individual. In the knowledge section, only 27,70 % of the students was able to give correct answers to the energy efficiency related questions. This study reveals that the overall knowledge level of the students on energy issues is very low. Thus, an energy education program should be applied in Northern Cyprus as soon as possible.
Keywords: Energy literacy, energy education, survey, renewable energy, energy efficiency

1. INTRODUCTION

Nowadays, it is clearly seen that the global warming is one of the biggest problems for the world. The main reason of global warming is the emission of green house gasses such as carbon dioxide, by burning fossil fuels to produce electricity and for transportation. Carbon dioxide level is increasing as fossil fuels are combusted and also the temperature of earth is increasing too. However, the fossil fuel reserves are decreasing continuously. Therefore, it is important to decrease the burning of fossil fuels and there are some actions which can be done by consumers and also by the policy makers. Some solution advices are given; using energy efficiently, using renewable energy sources and resources, and also educating people about these energy issues, respectively. These solution advices are discussed in the following sections. Energy, energy education and energy efficiency gains importance in reducing global warming (DeWaters & Powers, 2010).

When it is looked all over the world; using renewable energy sources and improving techniques for this technology gain importance as well. For this reason, energy-related choices, energy efficiency, renewable energy resources must be learnt and the knowledge of these issues should be at high level. As the knowledge on clean energy technologies and energy usage increases, better choices about energy efficiency, and consumers' attention for their daily life habits about energy or their habits to improve energy usage will change (DeWaters & Powers, 2007).

Such studies are done by several researches and some of them are shown in this study as well. Brief information about these studies is given in this section and remaining information will be discussed in next sections. Some of these studies were done in the USA and according to the results energy-related knowledge level is quite low in the USA. A survey was done by the National Environmental Education & Training Foundation (NEETF) in 2001 through the phone and 1500 Americans answered

[1] This study consists of a part of the master's thesis research conducted by Tahsin OYKUN, who was supervised by Assoc. Dr. Serkan ABBASOGLU

this survey. The results show that, only 12% of these 1500 people have knowledge about energy issues. Whereas, these people described their selves as a well-informed persons about energy issues (DeWaters & Powers, 2006) .

Climate change caused by anthropogenic emissions of greenhouse gases, mainly from the use of fossil energy, needs to be tackled effectively and urgently. The Kyoto Protocol in the United Nations Framework Convention on climate change strengthens the international response to climate change. Developed countries committed themselves to reducing their collective emissions of six key greenhouse gases by at least 5% by the period 2008–2012. On March 2007, the European Council set up the energy and climate change-related objectives: reduction of greenhouse gas emissions by 20%, integration by 20% of renewable energy sources into the final energy mix in the EU and reduction by 20% of EU primary energy use by 2020. The transition to a low carbon economy will take decades to implement and concerns every sector of the economy. Improving energy efficiency is a priority for EU energy policy and demands not only efficient technologies but also energy saving through changes in consumer awareness and behavior (Zografakis, Menegaki & Tsagarakis, 2008).

In this context, a survey is done in the TRNC, at Haspolat Meslek Lisesi and Levent College. This survey is done to evaluate the basic energy knowledge, attitudes and behaviours of students and results are presented. With the survey, it is tried to find out students' daily life usage about energy, guide them to make better energy related choices and attract their and also their families' attention to energy awareness as well.

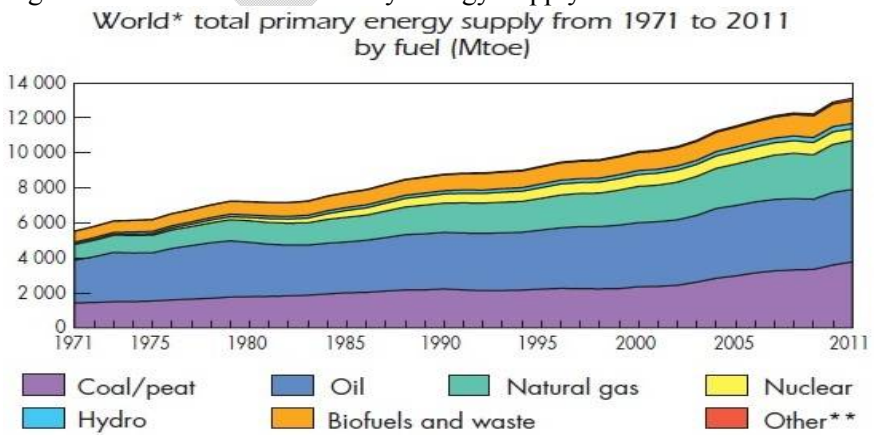
2. Energy and education:

People spend energy when walking, talking and even while breathing. Photosynthesis of plants, movement of the animals and etc., also needs energy too. There is an important fact that must not be forgotten; from the thermodynamics first law- which is also known as the law of conservation of energy- energy cannot be created nor destroyed. However, it is possible to convert energy from on form to another (Çetinkaya, S., 1999).

Human being need to heat, cool, illuminating places and etc., in which electrical energy is needed. Electrical energy is produced by burning of fossil fuels. When it is looked all over the world, since 1971, the world faces with a huge problem which is called global warming by scientists. Since the 20th century air and sea surface temperatures have increased 0.8^{o}C (National Academy of Sciences, 2008, T.C. Meteoroloji Genel Müdürlüğü, 2010).

Energy always has continued to be one of the primary needs. Figure 2.1 shows the total energy supply of the world by fuel shares between 1971 and 2011. It can be clearly seen from the figure that energy need increases continuously. Only share of different energy sources varies.

Figure 2.1 – World Total Primary Energy Supply



(International Energy Agency, 2013)

Renewable Energy Sources:

Energy can be grouped in two different categories;

1- Non-Renewable energy sources: Non-Renewable energy sources are energy sources that cannot be replenished by nature in short time. As an example; petroleum, coal (fossil fuels) are non-renewable energy sources.
2- Renewable Energy Sources; These type of energies can be replenished by nature in short time period and environmentally friendly. This type energy sources are clean and do not produce green house gasses.

There are 5 basic types of Renewable Energy Source and these are; Solar, Wind, Geothermal, Hydro and Biomass. Renewable sources of energy have been the driver of much of the growth in the global clean energy sector since the year 2000. In recent years installation of wind and solar photovoltaic (PV) technologies were increased. Other renewable technologies – including hydropower, geothermal and biomass – continued to grow from a strong established base, adding hundreds of GigaWatts (GW) of new capacity worldwide (NREL, 2001).

According to Table 2.2 below and from Figure 2.5 16,40 % is equal to 1000 GW installed power all over the world. As it is seen from the Table 2.2 wind power is at the second place figure 2.5, with 318 GW power and the percentage of wind power is 2,90 % as it is presented. Installed power of other 3 sources (Solar PV, Bio-power and Geothermal) are; 142 GW, 4 GW, 88 GW and 12 GW, respectively.

Table 2.2 - Installed Power of Renewable Energy

		START 2004	END 2012	END 2013
POWER				
Renewable power capacity (total, not including hydro)	GW	85	480	**560**
Renewable power capacity (total, including hydro)	GW	800	1,440	**1,560**
Hydropower capacity (total)[3]	GW	715	960	**1,000**
Bio-power capacity	GW	<36	83	**88**
Bio-power generation	TWh	227	350	**405**
Geothermal power capacity	GW	8.9	11.5	**12**
Solar PV capacity (total)	GW	2.6	100	**139**
Concentrating solar thermal power (total)	GW	0.4	2.5	**3.4**
Wind power capacity (total)	GW	48	283	**318**

(Renewables 2014 Global Status Report, 2014)

In the last century, to improve and to increase the effective use of renewable energy sources, governments have started different grant programs for people and companies as well. The cause of these programs is listed in the following way;

- Kyoto Protocol: was signed in 1997 and it is the only international protocol that aims to fight with climate changes and global warming. In this framework signatory countries have promised to reduce the emission of greenhouse gasses which are causing global warming. Kyoto Protocol has been signed by 181 countries. Although signed in 1997, this protocol came in use in 2005 (Wikipedia, 2007).

- Countries' Energy Policies: Another way to increasing the usage of renewable energy sources is related to countries' energy policies. According to this, renewable energy sources' usage should be increased by adhering to the energy policies and also Kyoto Protocol. As an example, considering the energy policy of Turkey;

The primary aim of Turkey is to realize its own energy security. So Turkey has four objectives in energy to;

- Diversify its energy supply routes and source countries,
- Increase the share of renewable sources and include the nuclear in its energy mix,
- Take significant steps to increase energy efficiency,
- Contribute to Europe's energy security (Republic of Turkey Ministry of Foreign Affairs, 2012).

2.1.1 Energy Efficiency:

Energy efficiency can be introduced as the use of technology that requires less energy to perform the same function, same comfort services and it has a major role to play in our nation's energy future. It can make immediate, significant contributions to mitigating emissions and reducing the impacts of climate change. Using energy efficiently can be explained as; using less energy to provide same comfort conditions as well. Or it can be explained with different way; closing one of two lamps which are on saves energy, changing incandescent lamps with compact fluorescent lamps provide same lightning and more energy efficiencies. Some applications are available around the world and one is given as an example; Austin's energy efficiency program.

Applications for energy efficiency are easy to apply. This is explained below with the Austin's program.

Austin's energy efficiency program is among the most comprehensive in the USA since 1982. Many of the suggestions are common sense that requires no tools or out of pocket expense and some suggestions about air conditioning (AC) units are given below;

- Clean or replace filters at least once a month

Dirty filters make the system work harder and run longer than necessary.

Also encourage the build-up of mold and mildew, make cleaning more difficult.

- Shade outside air conditioning units

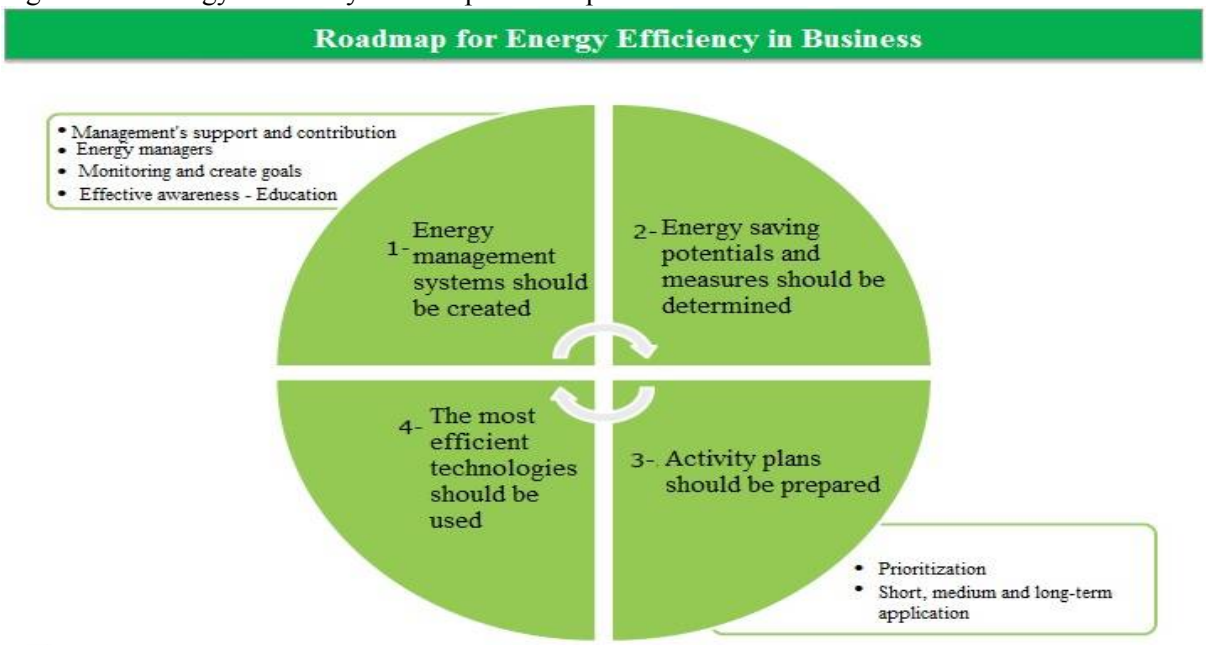
AC units shaded by trees or other mean work more efficiently and use up to 10% less electricity.

- Clean the AC's condenser/evaporator coils at the beginning of the season
- Keep debris and high grass away from the condenser
- Consider new high efficiency air conditioners and heat pumps (http://austinenergy.com).

When such suggestions are applied at homes, 20% of energy consumption will decrease.
As such suggestions can be applied at the homes, it should be applied at the workplaces.

Figure 2.6 shows the roadmap for energy efficiency in business.

Figure 2.6 - Energy Efficiency Roadmap for Companies



(Enve Enerji, Genel Bilgilendirme, 2011)

3. ENERGY LITERACY

Energy literacy can be explained as "an understanding of the nature and role of energy in the universe and in our lives. Energy literacy is also the ability to apply this understanding to answer questions and solve problems."

Followings are expected from an energy-literate person:

- Able to trace energy flows and think in terms of energy systems
- Able to know how much energy they use, for what purpose, and where the energy comes from
- Able to assess the credibility of information about energy
- Able to communicate about energy and energy use in meaningful ways
- Able to make informed energy use decisions based on an understanding of impacts and consequences (http://energy.gov).

Before understanding energy, a person should learn what energy is? This is possible with education.

3.1 Education

Education can be introduced as; a systematic process through which a child or an adult acquires knowledge, experience, skill and sound attitude (Kepçeoğlu, M. 1999). It can also be defined as; the process of bringing desirable change into the behaviour of human beings. The behavioural changes must be directed towards a desirable end.

3.1.1. Types of Education

3.1.1.1 **Formal Education:** The aim of this type education is to do education purposeful and planned. Generally, education can be given at schools by teachers or experts. In this type of education, it is expected to individual be educated to a good way always.

Formal education can be done at outside of schools to prepare persons for a profession at industry, agriculture and services. This type of education also can be done for professional development of persons'. Courses which are opened and given at the public education centres and training soldiers in the army can be given as examples for formal education.
The differences between the formal education which is given at schools and at outside are; be short-time, students are not grouped according to age, done when it's needed and is not limiting with the specific issues (Kepçeoğlu,1999).

3.1.1.2 **Informal Education:** This type of education is not planned and can be done at home, street and etc. There are two major ways to learn using the informal education; imitation and observation.

Cohabitation instinct guides people to learn, what society expects and wants from them. In very small and primitive societies, education is totally done with informal education. Children at the villages learn agricultural things with observation of their elders, imitate them and also learn by doing and experiencing.

In this type, education may not be always a good way. If it is explained with an example; when a child sees his father when he was smoking and child starts smoking too. When a child is learned smoking from his father, the meaning of this is education done but it's not to a good and expected way and it's called informal education (Kepçeoğlu, M. 1999).

4. MATERIALS AND METHODS

This study mainly depends on a survey carried out in two high schools. This survey is used to evaluate the energy literacy, energy knowledge, awareness and behaviours. The questionnaire developed by DeWaters and Powers is translated in Turkish and used during this study with the permission of related scientists. This questionnaire was developed according to established psychometric principles and methodologies, and fully described in DeWaters and Powers (2008). It has two different types, the one used in this study is for middle school students and other one is for high school students. However, the middle school questionnaire is applied to high schools in Northern Cyprus as the level of the original high school study is evaluated as too difficult by the authors for the existing high school students in Northern Cyprus. The numerical values are tried to find out for four main sections indicated above. Four questions at the first section are asked to evaluate the personal information about energy-related knowledge. Second section includes 17 questions which are asked to determine the effective of students, next 10 questions are related with the behaviours of students and also their families and the last section consists of 30 questions and these questions are asked to evaluate the cognitive aspects of students about energy. Affective and behavioural sections both are asked in a 5-part Likert-type and other sections are asked in 5-option multiple choice type. Cognitive subscales includes: saving energy, energy forms, conversions, units, home energy use, basic energy concepts, environmental impacts and energy-related issues.

This survey is done in Haspolat Meslek Lisesi and Levent College. Survey is answered almost in one and half hour by 101 students in two different schools. Female/male ratio is 1/3 according to results and percentages are given respectively; 24,80 % and 75,20 %.

Answers were transferred to Microsoft Excel software in order to evaluate. Items and options used in scaling were converted to numerical scores. All options are numbered between 1 and 5 and each section is examined separately. Each score and total scores were converted to percentages in first three sections of the survey and last part is analyzed analytically and exact percentages are found. Statistical analyses were performed with Statistical Package for Social Sciences (SPSS) Statistics Version 21.0 and tables and figures are created by the author according to these results.

5. RESULTS AND DISCUSSIONS

This section is prepared for; showing and interpreting data obtained from the survey results. Figures and tables in this section are created by the author according to the results.

5.1 Findings

First part of the survey is related with personal knowledge of the students about the energy issues and results are presented in Table 4.1, Figure 4.1 and Figure 4.2.

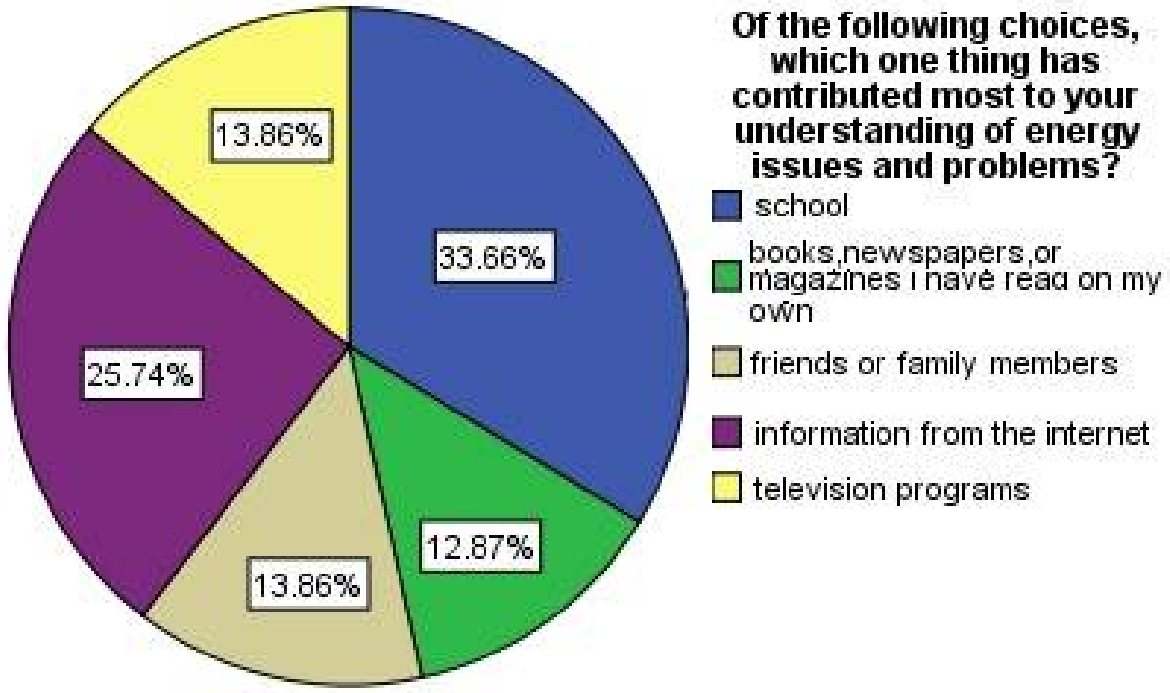
Table 4.1 – Personal Knowledge

Questions	Answers				
How much do you feel you know about energy?	Expert- A lot	Quite a bit - Informed	A medium amount- Somewhat informed	Not much- Novice	Nothing- Not in the running
	5,90	18,80	58,50	15,80	1,00
When it comes to energy use, how would you describe yourself?	High energy user	Moderately high energy user	Medium energy user	I try to save energy sometimes	I almost always try to save energy
	10,90	25,70	31,70	22,80	8,90

According to the first question in Table 4.1, nearly 25 % of students described themselves as well informed on energy. Also, 58,40 percent indicated that they know about energy "A medium amount". Second question is seen in the table 4.1, "When it comes to energy use, how would you describe yourself?" 10,90 and 25,70 percent of the students marked themselves as; "High energy user" and "moderately high energy user", respectively and 31,70 % selected the "medium energy user" option. When two questions are evaluated together, it is clearly seen that there is a contradiction with the answers. According to the first questions' answers, 83,10 % of the students think that they have knowledge about energy but only 31,70 % of them try to save energy.

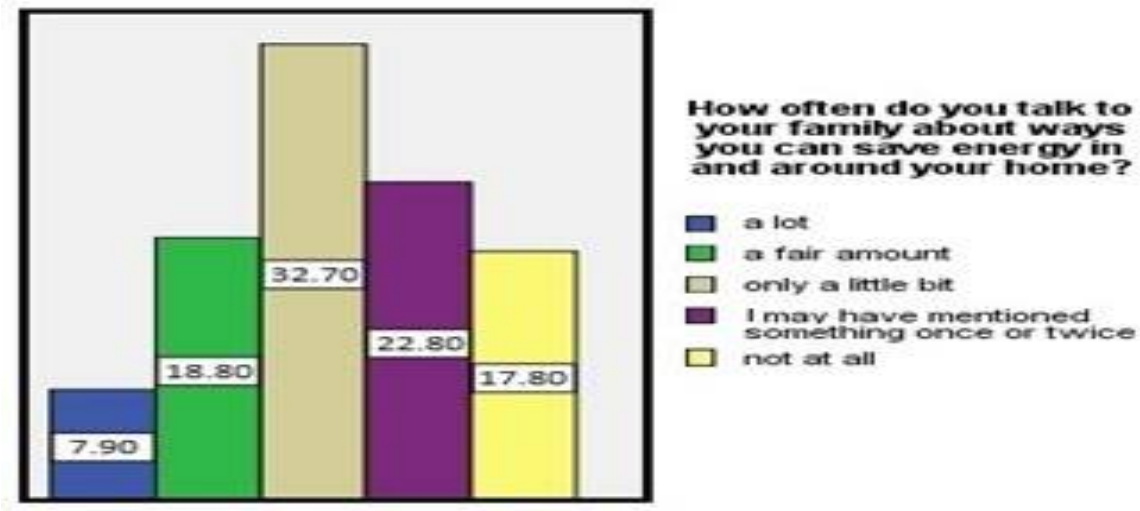
Generally, these results show that students have an idea about energy but do not use it efficiently. When "How do you learn energy issues" asked to students, results indicate that students believe the importance of school education on energy issues with 33,66 % and with 25,74 %, internet took the second place in the chart as shown in Figure 4.1

Figure 4.1 – Contribution to Understanding of Energy



"Friends or family members" and "Television programs" are both selected by 14 students which is equal to 13,86 % and books, newspapers etc., has took the last place with 12,87 %.
Figure 4.2 shows the result of Question 4 and the question is; "How often do you talk to your family about ways you can save energy in and around your home?" (As an example; shutting off the lights when they are not in use, turning down the heat, closing doors and windows and etc.)".

Figure 4.2 – Talk to Family about Saving Energy



Nearly 27 % of the students mentioned that they are talking sufficiently with their families about saving energy. However, almost 40 % of students prefer not to talk about this and rest 33 % marked only a bit or a few words occasionally.

Second part of this survey is designed to evaluate the energy-related effectives of students and the Table 4.2 was created by the data according to the results.

Table 4.2 – Energy-Related Effectives of Students

Energy-Related Effectives of Students
Energy Education (Q.5-6-7)
• Energy education should be an important part of every school's curriculum • I would do more to save energy if I knew how. • Saving energy is important.
Energy Efficiency-Behaviours (Q.8-9-10)
• The way I personally use energy does not really make a difference to the energy problems that face our nation. • I don't need to worry about turning the lights or computers off in the classroom, because the school pays for the electricity. • Citizens of TRNC should conserve more energy.
Energy Efficiency- Technology (Q.11-12-13)
• We don't have to worry about conserving energy, because new technologies will be developed to solve the energy problems for future generations. • All electrical appliances should have a label that shows the resources used in making them, their requirements, and operating costs. • The government should have stronger restrictions about the gas mileage of new cars.
Renewable Energy Sources(Q.14-15-16)
• We should make more of our electricity from renewable sources. • TRNC should develop more ways of using renewable energy, even if it means that energy will cost more. • Efforts to develop renewable energy technologies are more important than efforts to find and develop new sources of fossil fuels.
Environment(Q.17-18-19)
• Law protecting the natural environment should be made less strict in order to allow more energy to be produced. • More wind farms should be built to generate electricity, even if the wind farms are located in scenic valleys, farmlands, and wildlife areas. • More oil fields should be developed as they are discovered, even if they are located in areas protected by environmental laws.
Personal Contribution to Energy Issues (Q.20-21)
• I believe that I can contribute to solving the energy problems by making appropriate energy-related choices and actions. • I believe that I can contribute to solving energy problems by working with others.

Energy Education;

First three questions of this part are about energy education. According to findings, 63,40 % of the students believe that energy education should be an important part of every school's curricula and also, 68,30 % of the students mentioned that if they know how, they would do more to save energy. When these findings are evaluated together with Table 4.1, where 83,20 % of the students think that they know energy issues, there is a contradiction with the finding that shows that 68,30 % do not know how to save energy. Another interesting point is that, even though they do not know how to save energy, 87,20 % of the students marked strongly and moderately agree options to "saving energy is important" question and defending it according to Table 4.2 above.

Energy Efficiency-Behaviours;

Next three questions are asked to find out the students' personal attitudes on energy efficiency. According to Table 4.2, 45,50 % of the students don't think themselves as an actor of national energy problems, even if they use energy inefficiently.

In previous section (Question 7), 87,20 % know that saving energy is important and they supported it, and also 68,30 % would like to save more energy in Question 6 but here it is clarified that 45,50 % of the students are not sure if they can contribute to this personally.

Also, 48,50 % of the students mentioned that they are responsible from turning off the lights or computers even if school pays the electricity bill. However, nearly 35 % thinks opposite and agrees that they do not need to think about closing lights or computers, because the school pays for the electricity.

Question 10 is about TRNC citizens and asked students to answer if they should conserve more energy. 41,60 % of students marked "strongly agree" and "agree moderately" options. However, 35,70 % thinks in the opposite way and marked "disagree moderately" and "strongly disagree" options. Therefore, it is clear that the students believe in the importance of energy efficiency but they are not that much determined to contribute conservation of energy.

Energy Efficiency- Technology;

Questions in this section are prepared to evaluate the response of students on energy efficiency technologies. Question 11 asks students their comments on depending on energy efficiency technologies without giving any effort on saving energy individually is adequate. The findings show that 37,60 % of the students are disagree, but 33,60 % is agree and rest has no idea. Probably, this distribution shows the lack of knowledge on conserving energy and also energy efficiency technologies.

According to question 12, 60,40 % of the students thinks that "All electrical appliances should have a label that shows the resources used in making them, their energy requirements, and operating costs" and marked "strongly agree" and "agree moderately" options. This issue is well-known because of TV spots and advertisement so such a high percentage is acceptable.

However, when results of question 13, which is related to gas mileage of new cars, is evaluated and only 37,70 % of students thinks that the government should have stronger restrictions about the gas mileage of new cars. 28,80 % are disagree and rest of the students have no idea about it.

Renewable Energy Sources;

Three questions are asked related to renewable energy sources. The first question is "We should make more of our electricity from renewable sources" and nearly 70 % of the students do agree with this.
Question 15 asks students' comments about "TRNC should develop more ways of using renewable energy, even if it means that energy will cost more" and again 62,40 % students are positive about renewables.

Last question of the renewable energy section is related to "Efforts to develop renewable energy technologies are more important than efforts to find and develop new sources of fossil fuels" and 57,40 % of the students agreed with this idea.

When findings on three questions about renewable energy sources are evaluated, it is clear that high amount of the students support the usage of renewable energy sources. It is also witnesses that as the technical details in the questions increases, the positive responses decreases.

Environment;

Next three questions are asked to evaluate the thoughts of students about environmental impact of energy systems. Results show that nearly 35 % of the students agreed that energy should be produced even if these systems have a negative impact on environment. Also, nearly similar percentages are seen to disagree and no idea options. This results show that students are not well informed and conscious about energy-environment relationship.

Personal Contribution to Energy Issues;

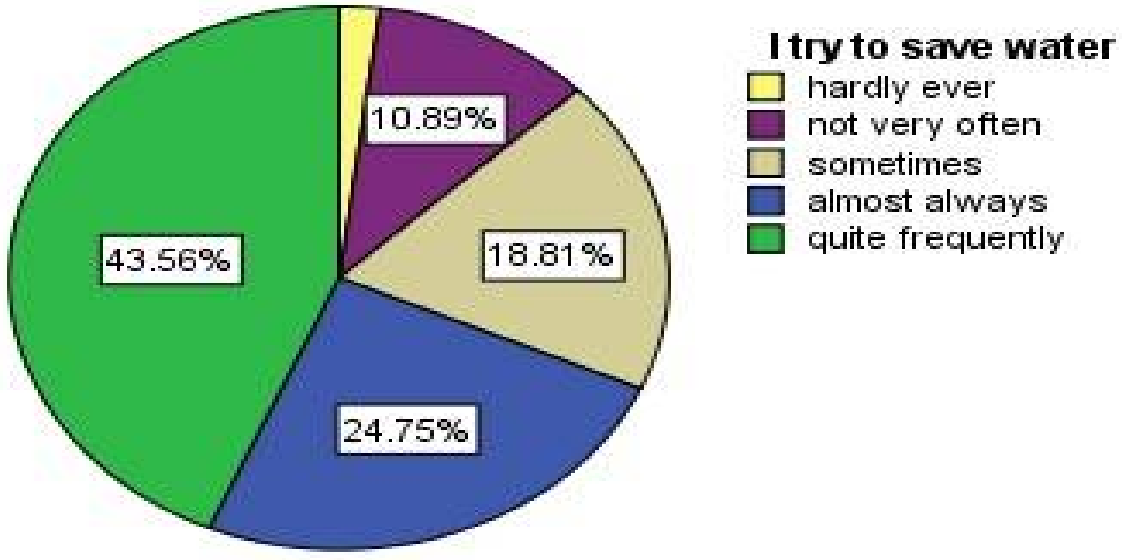
Last section of this part of the survey is about the personal contribution about energy issues and includes two questions. First question is; "I believe that I can contribute to solving the energy problems by making appropriate energy-related choices and actions". This question analyses confidence of the students to solve energy problems. Nearly 60 % of the students are confident to solve energy related problems.

The last question of this part of the survey is; "I believe that I can contribute to solving energy problems by working with others" and 49,50 % believes that they can contribute to solve energy problems by working with others.

The results of these two questions are parallel with the findings presented in Table 4.1 that shows the results of question 1 which asks energy knowledge of students according to themselves.

The next part of the survey consists from 10 questions which is asked for evaluate the students' behaviours. The first question of this part is about saving water and results of this question are given below;

Figure 4.3 – Try to Save Water



According to Figure 4.3, nearly 70 % of the students try to save water. This results show that students are aware of the importance of water.

Table 4.3 shows the results that obtained from questions from 23 to 31.

Table 4.3 – Behaviours of Students and Families

Number of Question	Always	Quite frequently	Sometimes	Not very often	Never
Walk or bike to short distance instead of riding a car (Q-23)	24,80	28,70	22,70	10,90	12,90
Turn off the lights before leave the room (Q-24)	50,50	20,80	18,80	6,90	3,00
Turn off the computer when it's not being used (Q-25)	44,60	14,90	13,90	10,90	15,70
Daily decisions affected by thoughts on energy use (Q-26)	9,90	17,80	31,70	19,80	20,80
Family turns heater down when they are not at home (Q-27)	35,60	29,70	17,80	10,90	6,00
Willing family to turn heater down when they are not at home (Q-28)	35,60	21,80	32,70	5,90	4,00
Family buys energy efficient light bulbs (Q-29)	29,70	25,70	24,80	8,90	10,90
Willing to encourage family to buy energy efficient light bulbs. (Q-30)	45,50	27,70	17,80	5,90	3,10
Willing to buy fewer things to save energy (Q-31)	14,90	18,80	30,70	18,80	16,80

First three questions of Table 4.3 are related to the behaviours of the students to reduce energy consumption and results show that nearly 70 % of the students try to do this.

Question 26 is; "Many of my everyday decisions are affected by my thoughts on energy use" and this question is important to evaluate the behaviours of students. As a result, it is clearly seen from the table above, 59,40 % mentioned that their everyday decisions are affected by their thoughts on energy and this proves that many of the students pay attention and are open-minded about energy issues.
Next five questions are about current behaviours of students, their families about energy efficiency and also student willingness to convince their families to apply energy saving measures. It is found that nearly 80 % of their families try to save energy and also, about 90% of students are willing to motivate their families to apply energy efficiency. But according to Figure 4.2, almost 60 % of the students are talking with their families a bit about saving energy and this shows, there is a 30 % deviation between results. And, also nearly 65 % of the students are willing to give up their desires in order to decrease energy consumption, according to question 31.

The last part of survey consists from 4 main topics as shown in Table 4.4 below and given, respectively;

Basic energy concepts, energy sources, environmental/societal impacts and energy efficiency. The aim of this section is to measure Energy knowledge of the students. There are nine questions under the basic energy concepts, 11 questions under the energy sources topic, five questions under the environmental/societal impacts and five questions under the energy efficiency topics.

Table 4.4 – Overall Success of Energy Knowledge

Topic	Number of Questions	% Correct
Basic Energy Concepts	*(32-33-34-35-37-38-39-41-55)*	33,00
Energy Sources	*(36-40-42-43-44-45-46-47-48-56-57)*	28,80
Environmental/Societal Impacts	*(53-58-59-60-61)*	27,70
Energy Efficiency	*(49-50-51-52-54)*	24,50
Total Success:		**28,50**

The results in Table 4.4 clearly show the low knowledge level of students on these four different topics. Mean values of the results is 28,50 % which is very low. The highest knowledge level is seen for the basic energy concepts with 33% correct answer percentage. The positive answers on energy sources, environmental/societal impacts and energy efficiency amount to an average 28,80 %, 27,70 % and 24,50 %, respectively.

According to Table 4.2 (Q-14-15-16), almost 63 % of the students mentioned the importance of the renewable energy and support the renewable energy sources. However, at the Table 4.4, this value decreases to almost 29 % and the difference between two values is high. This proves that, even if students do not know what exactly renewable energy is and support it.

When it comes to environmental related questions at the Table 4.2, nearly 35 % of the students disagreed that energy should be produced even if these systems have a negative impact on environment. According to Table 4.4, it is clearly seen that with the 28 % mean value of about environment impacts, students are aware some of the risks and almost all of them disagree the bad ideas at the environmental related questions.

Via the data at Table 4.4, 24,50 % is the mean value for energy efficiency. When it is compared with the previous section (Q-8-9-10-11-12-13), almost 42,50 % of the students marked strongly agree or moderately agree options about Energy efficiency-behaviours and energy efficiency-technology for both. This result is similar with environmental impacts part of the survey. 42,50 % of students support energy efficiency but when it comes to knowledge, the rate decreases to 24,50 %.

CONCLUSION AND RECOMMENDATIONS

3.1. Overall survey results

Students who were considered ‘‘energy literate’’ and participated in the instrument validation studies achieved an average cognitive subscale score of 75% (DeWaters and Powers, 2008).

HS students scored significantly better than MS students on the cognitive subscale (p ¼ 0.001), although their scores are still unacceptably low (mean ¼ 44%). The trend is reversed on the behavior subscale, where HS students scored significantly lower than MS students (p ¼ 0.001). Differences between the performance of the two age groups on the affective subscale were less, but still significant (p ¼ 0.030), with HS students scoring higher than MS students and both groups scoring quite high relative to the other two subscales. Self-efficacy scores did not differ between the two groups. In general, the overall student perfor- mance on each subscale, as well as the observed trends – with students consistently scoring lowest on the cognitive and highest on the affective subscales, – are consistent with earlier findings from the pilot study (DeWaters & Powers, 2008).

3.2. Energy knowledge

Roughly half of the students (50% MS; 48% HS) reported that they learn most about energy at school, emphasizing the importance of effective formal energy education programs. Although more conclusive findings could be drawn if the same students were assessed longitudinally, as they pass through various grade levels, the two independent samples used in this study do provide us the opportunity to use the observed MS/HS performance differences to examine the extent to which various energy topics are included in the school curriculum, keeping in mind that the conclusions are drawn by conjecture (DeWaters & Powers, 2008).

Zografakis, N. et al. (2008), worked on the study which is named as "Effective education for energy efficiency". This study includes results of an energy-thrift information and education project in different levels of education in Greece and 321 students' and their parents' daily energy-related behaviours. Results prove that this behaviour changes to a more energy efficient way, after the dissemination of relevant information and the participation into the energy projects. The energy-efficient behaviours increased after project participation while the ones indicating an energy-squandering behaviour decreased.

The objective of this study is to determine the knowledge level and behaviour of the students on energy issues. Therefore, the data collected by survey is evaluated to find out the education level on energy. The survey was conducted in two different schools and 101 students answered 61 questions in the questionnaire. The survey includes 4 main sections listed below;

- Students' personal information (feelings) about energy,
- Students' effectives about energy,
- Students' and also their families' behaviour,
- Energy knowledge.

24,80 % of the attended students to the survey were female and the rest, 75,20 %, were male. According to the results, 83,20 % of the students described themselves as aware of energy issues. In the fourth section, however, the energy knowledge level was examined and was found that students' knowledge (even on the basic energy concept) is only 33 %. Similar situation was observed for energy efficiency; 87,20 % of the students know and acknowledge that "energy saving is important" and, 68,30 % would like to save more energy, but only 24,50 % of the students are aware of the basics of energy efficiency. This is an unfortunate situation since the students' think that they are well informed about energy and that there is no need to be educated. However, in needs to be noted that about 65 % of the students mentioned that if they knew how, they would do more to save energy. This shows that students are aware of their unawareness but they do not want to refer themselves as uneducated.

Another important issue is that nearly 60 % of the students talk with their families about energy issues and about 90 % of the students are willing to motivate their families to apply energy efficiency procedures. The results indicated that 30 % of the students cannot communicate with their families even if they wanted so. The communication is important because education of 3rd group is dependent on the knowledge level of the 2nd group.

Another important result can be stated as follows; nearly 65 % of the students believe that energy education should be an important part of every school's curriculum. However, according to data in the first section, only around 35 % of the students mentioned that they have learnt energy issues at school. Some of the teachers give information about energy in their lessons and this shows the curiosity of teachers on energy issues. Therefore, the students are aware of the importance of school education on energy issues, however, they believe that the school curricula are not adequate to educate them on energy.

Almost 65 % of the students support renewable energy and improving the techniques for renewable energy sources. Almost 35 % of the students mention that, systems should be produced even if these systems have a negative impact on environment. At this stage, it should be noted that, according to the last section of the survey, only 27,70 % of the students are aware of environmental impacts.
According to the results, almost 50 % of the students do not consider themselves as an actor of national energy problems and other half believe that they can contribute to solve energy problems as individuals. This is a sign of lack of knowledge and thus, students should be educated to acknowledge the importance of energy problems and to offer solutions.

An important amount of data is collected in the 3rd section of the survey in which almost 70 % of the students mentioned that, they support the reduction in energy consumption and almost 65 % of the students are willing to give up their desires in order to decrease energy consumption. However, according to the results obtained from the 2nd question of the survey, only 32 % of the students try to save energy.

Almost 85 % of the students are willing to motivate their families to save energy and almost the same values of these students' families try to save energy. However, as it's noted in section one, only 60 % of the students are talking with their families about saving energy. This shows that, there is a 25 % deviation between the motivation and talking related questions' results. According to this, 25 % of the students just think about the motivating part but do not talk with their families to try saving energy.
Last section of the survey is about knowledge and includes 4 main topics; basic energy concepts, energy sources, environmental/societal impacts and energy efficiency. Mean value of the results of knowledge section is 28,50 % which is a very low and unexpected result. According to our findings, it is clear that energy knowledge level at High Schools in Northern Cyprus is very low. Moreover, students are aware of the importance of energy education, but, they are not aware of their energy knowledge level. Therefore, it is a must to apply an energy education program at schools (elementary, secondary and high schools i.e.,) to increase awareness and the knowledge level on energy issues.
And a comparison has been made between the results of this study and "Energy literacy of secondary students in New York State (USA): A measure of knowledge, affect and behaviour" study which is done by DeWaters in 2010.

According to data; basic energy knowledge of the students in TRNC is around 33%, however, it is 42 % in the USA. This shows that, knowledge about basic energy concepts is 9% higher than in USA. According to results from this study, mean of the 11 questions' results which are related with energy sources were almost 29 %. The value of this part is quite similar with USA and the percentage is 32 % in USA. But, the mean value of the environmental/societal impacts in USA is almost 17 % higher than it is in TRNC. The value for environmental/societal impacts in TRNC is nearly 28 %. The changes we face with respect to energy resources and energy consumption are unavoidable. Our successful shift into a stable future will rely not only on qualified technical, scientific, and professional expertise, but also on the ability of the average citizen to make appropriate energy choices that range from mode of transportation to consumer purchases, voting habits, and acceptance of policies that include changes to the way we harness and consume energy. Energy literacy, which includes broad content knowledge as well as affective and behavioral aspects, will empower individuals to make informed energy-related choices and actions as they go about their daily life (DeWaters & Powers, 2011).

Students should be aware of the importance of energy education, but, they are not aware of their energy knowledge level. Therefore it is a must to apply an energy education program at schools (elementary, secondary and high schools i.e.,) to increase awareness and the knowledge level on energy issues.

REFERENCES

DeWaters, J. and Powers, S. (2008). *Energy Literacy Among Middle and High School Youth.* Clarkson University – Session T1A –Session T2F

DeWaters, J. and Powers, S. (2010). *Energy Literacy of Secondary Students in New York States (USA): A measure of knowledge, affect, and behaviour*. Clarkson University - Energy Policy 39 (2011) 1699-1710

Energy Efficiency Watch Project. (2012). *SURVEY REPORT: Progress in energy efficiency policies in the EU Member States – the experts perspective.* Energy Efficiency Watch- Intelligent Energy, Europe

Enve Enerji (2011). *Enerji Verimliliği Genel Bilgilendirme.* www.enve.com.tr

EUROPEAN COMMISSION (2006). *EDUCATON ON ENERGY, Teaching tomorrow's energy consumers*. European Communities

International Energy Agency (2013). *Key World Energy STATISTICS 2013* – The International Energy Agency, p: 6-7

Kepçeoğlu, M. (1999). *Psikolojik Danışmanlık ve Rehberlik*. Alkın Yayınevi, İstanbul.

National Renewable Energy Laboratory (2001). *Renewable Energy: An Overview.* DOE/GO-102001-1102 FS175 March 2001

Renewable Energy Policy Network for the 21th Century (2014). *Renewables 2014-Global Status Report.* REN21

URL-1 < https://en.wikipedia.org/wiki/Kyoto_Protocol

URL-2 < 2013, *Renewable Energy,* http://www.iea.org/topics/renewables/ - International Energy Agency

URL-3 < 2009, *KKTC Elektrik Kurumu*, http://www.kibtek.com/Santrallar/SantTarihce.htm

URL-4 < 20 February 2012. *Enerji.* http://www.enerji.gov.tr/index.php?sf=webpages&b=enerji T.C. Enerji ve Tabii Kaynaklar Bakanlığı

Vassileva, I., Campillo, J. (2013). *Increasing energy efficiency in low-income households through targeting awareness and behavioural change.* Renewable Energy 67 (2014) 59-63

World Energy Council, (2013). *World Energy Resources.* World Energy Council

Zografakis, N., Manegaki, A., and Tsagarakis, K. (2008). *Effective education for energy efficiency*. Energy Policy 36 (2008) 3226-3232