



## DETERMINING THE ATTITUDES TOWARDS RENEWABLE ENERGY SOURCES OF TWELFTH GRADE STUDENTS ATTENDING DIFFERENT TYPES OF HIGH SCHOOLS

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### Abstract

The aim of this study was to determine the attitudes towards renewable energy sources of students from different schools in a province in Northern Turkey. To this end, a 37-item renewable energy attitude scale developed by Çelikler and Aksan (2016) was administered to a total of 257 twelfth grade students attending various high schools, including a Vocational and Technical Anatolian High School (n=59), an Anatolian Medical Vocational School (n=52), an Anatolian High School (n=74) and a Science High School (n=72). Study data were analyzed using the SPSS statistical package software. Based on the study results and an evaluation of the different types of high schools, it was determined that the attitudes towards renewable energy sources were significantly different and more positive among science high school students. The study results also indicated that although the participating students generally had a positive attitude towards renewable energy sources and the power plants that utilize them, their knowledge on renewable energy sources was lacking in various respects. This lack of knowledge, in turn, was found to cause various unfounded concerns among the students regarding these energy sources.

**Keywords:** Renewable energy source, attitude, high school student, science education.

### INTRODUCTION

The global demand for energy is gradually rising due to the rapid increase in world population and the improving living standards in developing countries. Nowadays, a significant proportion, roughly 65%, of the global energy demand is met through fossil fuels, owing to their accessibility and ease of use (Veziroğlu & Şahin, 2008). However, due to the fact that a significant proportion of the world energy production depends on fossil fuels, as well as the fact that fossil fuels are unsustainable, result in significant external dependence for energy, and engender various environmental problems, have lead to increase in the interest and demand for renewable energy sources (Güler, 2006). Renewable energy sources are environmentally-friendly sources that are renewed by nature's own cycles, and which do not result in environmental pollution. They include solar energy, wind energy, geothermal energy, hydraulic energy, hydrogen energy, sea-based energies, and biomass energy (Güneş, 1999; Oktit, 2000).

Preventing the deterioration of the environment at a global scale is only possible through changes in social and technological behaviors of individuals (McLaughlin, 2008). According to Agenda 21, it is through education that people acquire the environmental and ethical awareness, values, attitudes, skills and behaviors which are essential for sustainable development (UNCED, 1992). The World Conservation Union stated describes the need to change the behaviors of individuals regarding sustainable life-styles through education programs (IUCN, 1991). The United Nations, on the other hand, describes education as a prerequisite for achieving sustainable development, as well as a necessary instrument for promoting good management, judicious decision-making, and democracy (UN, 2005). Education enables the fostering of values, attitudes, decisions and skills that are essential for sustainable growth (Summers et al. 2000).

A review of the studies in the literature on renewable energy reveals that a number of studies have been conducted to determine the environmental knowledge and attitude of middle school teachers (Liarakou, 2009); the attitudes of university students (Karatepe et al., 2012); and teacher candidates' attitudes (Bilen, Özel & Sürücü, 2013) and level of awareness (Çelikler & Kara, 2012; Çelikler, 2013) regarding the environment. In addition to these studies, there are also studies on the perception, knowledge and attitudes of high school students (Zyadin et al., 2012); the thoughts of high school students (Kılınç, Stanisstreet & Boyes, 2009); and their opinions (Çelikler & Aksan, 2015).

In order to leave a more livable world for future generations, it is vitally important to raise knowledgeable and conscious individuals who are aware of the importance of renewable energy sources. In this context, the present study aimed to determine the attitudes regarding renewable energy sources of 12th grade students attending different high schools in a northern province of Turkey. We believe that this study attempting to determine the attitudes of high school students towards renewable energy sources is significant in that it will make an important contribution, and provide greater depth, to the literature on this age group, for which there is currently only a limited number of studies.

## METHODS

The study was conducted with 257 high school students in 12th grade attending four different high schools, including a Vocational and Technical Anatolian High School (N=59), an Anatolian Medical Vocational High School (N=52), an Anatolia High School (N=74), and a Science High School (N=72). The study was conducted using the cross-sectional study design, which involves the collection of data within a single and short period of time (Christensen, Johnson & Turner, 2015), and by utilising the scanning method, which is a preferred approach for determining the attitudes, actions, opinions and beliefs of individuals (Christensen, Johnson & Turner, 2015). Study data were collected using the 37-item renewable energy attitude scale developed by Çelikler and Aksan (2016). The renewable energy source attitude scale consists of seven dimensions, which are "Effects on the Environment" (eight items), "Effects on the Living Creatures" (three items), "Energy Sources and their Area of Use" (nine items), "Education" (six items), "Economy" (five items), "Security" (four items) and "Media" (two items). The internal consistency coefficient of the scale was determined as 0.753.

Study data were analysed in terms of percentages (%) and frequency (f). The one-way analysis of variance (ANOVA) and Tukey HSD test were used to determined whether the students' attitude scores towards renewable energy sources differed depending on the school they attended.

## RESULTS

The percentage and frequency distribution of student responses to items belonging to the "Effects on the Environment" factor of the renewable energy source attitude scale are shown in Table 1.

Table 1: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Effects on the Environment” Factor of the Renewable Energy Source Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
Renewable energy sources are environmentally friendly.	VTAHS	0	0	5	8,5	10	16,9	26	44,1	18	30,5
	AMVHS	1	1,9	10	19,2	8	15,4	20	38,5	13	25,0
	AHS	0	0	3	4,1	11	14,9	21	28,4	39	52,7
	SHS	0	0	0	0	6	8,3	18	25,0	48	66,7
The use of renewable energy sources will reduce global warming.	VTAHS	0	0	1	1,7	23	39,0	21	35,6	14	23,7
	AMVHS	2	3,8	3	5,8	17	32,7	19	36,5	11	21,2
	AHS	0	0	7	9,5	9	12,2	42	56,8	16	21,6
	SHS	1	1,4	1	1,4	6	8,3	29	40,3	35	48,6
The use of renewable energy sources will not reduce environmental pollution.	VTAHS	13	22,0	19	32,2	10	16,9	7	11,9	10	16,9
	AMVHS	12	23,1	17	32,7	14	26,9	5	9,6	4	7,7
	AHS	27	36,5	22	29,7	9	12,2	10	13,5	6	8,1
	SHS	33	45,8	21	29,2	2	2,8	3	4,2	13	18,1
The use of renewable energy sources will not reduce the greenhouse effect.	VTAHS	9	15,3	19	32,2	7	11,9	12	20,3	12	20,3
	AMVHS	18	34,6	12	23,1	15	28,8	4	7,7	3	5,8
	AHS	28	37,8	22	29,7	5	6,8	6	8,1	13	17,6
	SHS	48	66,7	15	20,8	0	0	2	2,8	7	9,7
Power plants that use renewable energy sources have harmful effects on the environment.	VTAHS	22	37,3	21	35,6	9	15,3	6	10,2	1	1,7
	AMVHS	20	38,5	16	30,8	13	25,0	2	3,8	1	1,9
	AHS	42	56,8	14	18,9	8	10,8	4	5,4	6	8,1
	SHS	55	76,4	9	12,5	3	4,2	5	6,9	0	0
The use of renewable energy sources will not reduce air pollution.	VTAHS	21	35,6	22	37,3	4	6,8	6	10,2	6	10,2
	AMVHS	15	28,8	23	44,2	7	13,5	5	9,6	2	3,8

	AHS	34	45,9	17	23,0	4	5,4	8	10,8	11	14,9
	SHS	50	69,4	12	16,7	3	4,2	4	5,6	3	4,2
The use of renewable energy sources will reduce the depletion of the ozone layer.	VTAHS	16	27,1	19	32,2	16	27,1	6	10,2	2	3,4
	AMVHS	12	23,1	19	36,5	18	34,6	1	1,9	2	3,8
	AHS	34	45,9	22	29,7	11	14,9	2	2,7	5	6,8
	SHS	37	51,4	27	37,5	2	2,8	2	2,8	4	5,6
The use of renewable energy sources will not reduce the occurrence of acid rains.	VTAHS	14	23,7	16	27,1	15	25,4	6	10,2	8	13,6
	AMVHS	10	19,2	21	40,4	8	15,4	7	13,5	6	11,5
	AHS	39	52,7	10	13,5	10	13,5	9	12,2	6	8,1
	SHS	43	59,7	15	20,8	3	4,2	4	5,6	7	9,7

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

An evaluation of Table 1 reveals that all of the students had generally positive attitudes towards the view that renewable energy sources are environmentally-friendly, and that the use of renewable energy sources would help reduce environmental pollution, acid rains, air pollution, global warming and the greenhouse effect. On the other hand, students generally had a negative attitude towards the view that the use of renewable energy sources would reduce the thinning of the ozone layer. In addition, the students did not believe that power plants using renewable energy sources have harmful effects on the environment.

The percentage and frequency distribution of student responses to items belonging to the "Effects on the Living Creatures" factor of the renewable energy source attitude scale are shown in Table 2.

Table 2: Percentage and Frequency distribution of Student Responses to Items Belonging to the "Effects on the Living Creatures" Factor of the Renewable Energy Source Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
I am concerned about the negative effects the use of renewable energy sources might have on the living creatures.	VTAHS	11	18,6	9	15,3	20	33,9	10	16,9	9	15,3
	AMVHS	5	9,6	5	9,6	16	30,8	21	40,4	5	9,6
	AHS	13	17,6	20	27,0	17	23,0	7	9,5	17	23,0
	SHS	17	23,6	20	27,8	16	22,2	12	16,7	7	9,7
I am not knowledge about the harmful effects that renewable energy sources might have on living creatures.	VTAHS	6	10,2	13	22,0	18	30,5	20	33,9	2	3,4
	AMVHS	4	7,7	11	21,2	19	36,5	11	21,2	7	13,5
	AHS	7	9,5	31	41,9	17	23,0	13	17,6	6	8,1
	SHS	4	5,6	35	48,6	22	30,6	9	12,5	2	2,8
Power plants that use renewable energy sources do not have harmful effects on living creatures.	VTAHS	2	3,4	5	8,5	15	25,4	20	33,9	17	28,8
	AMVHS	1	1,9	5	9,6	14	26,9	14	26,9	18	34,6
	AHS	9	12,2	8	10,8	13	17,6	14	18,9	30	40,5
	SHS	5	6,9	2	2,8	9	12,5	28	38,9	28	38,9

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

Table 2 indicates that most of the students from the Anatolian Medical Vocational High School were concerned about the harmful effects which renewable energy sources might have on living being, while students from the Vocational and Technical Anatolian High School, the Science High School and the Anatolian High School had no such concerns. The large majority of the students did not believe that power plants using renewable energy sources might have harmful effects on living beings. In addition, the majority of students in the Vocational and Technical High School did not believe that renewable energy sources might potentially harm living beings, while most students in the Science High School and Anatolian High School were of the opposite view. The majority of the students at the Anatolian Medical Vocational High School, on the other hand, were undecided on this subject.

The percentage and frequency distribution of student responses to items belonging to the “Energy Sources and their Area of Use” factor of the renewable energy source attitude scale are shown in Table 3.

Table 3: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Energy Sources and their Area of Use” Factor of the Renewable Energy Source Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
Energy should not be produced from waste.	VTAHS	15	25,4	18	30,5	14	23,7	6	10,2	6	10,2
	AMVHS	18	34,6	20	38,5	8	15,4	4	7,7	2	3,8
	AHS	30	40,5	23	31,1	10	13,5	6	8,1	5	6,8
	SHS	37	51,4	24	33,3	3	4,2	4	5,6	4	5,6
The use of renewable energy sources is increasing across the world.	VTAHS	10	16,9	20	33,9	14	23,7	14	23,7	1	1,7
	AMVHS	9	16,9	12	33,9	22	23,7	8	23,7	1	1,7
	AHS	15	20,3	29	39,2	22	29,7	6	8,1	2	2,7
	SHS	10	13,9	44	61,1	8	11,1	8	11,1	2	2,8
The use of renewable energy sources will help solve the world’s energy demand.	VTAHS	1	1,7	2	3,4	22	37,3	15	25,4	19	32,2
	AMVHS	1	1,9	4	7,7	9	17,3	24	46,2	14	26,9
	AHS	2	2,7	3	4,1	9	12,2	32	43,2	28	37,8
	SHS	0	0	3	4,2	6	8,3	22	30,6	41	56,9
The use of renewable energy sources should be promoted.	VTAHS	0	0	0	0	8	13,6	14	23,7	37	62,7
	AMVHS	0	0	0	0	4	7,7	20	38,5	28	53,8
	AHS	1	1,4	4	5,4	4	5,4	19	25,7	46	62,2
	SHS	0	0	0	0	1	1,4	13	18,1	58	80,6
Energy cannot be produced from energy resources such as the sun and water.	VTAHS	20	33,9	34	57,6	4	6,8	1	1,7	0	0
	AMVHS	25	48,1	23	44,2	4	7,7	0	0	0	0
	AHS	40	54,1	30	40,5	1	1,4	3	4,1	0	0
	SHS	48	66,7	24	33,3	0	0	0	0	0	0
Renewable energy sources are not being sufficiently utilized across the world.	VTAHS	1	1,7	4	6,8	21	35,6	27	45,8	6	10,2
	AMVHS	1	1,9	2	3,8	9	17,3	18	34,6	22	42,3
	AHS	2	2,7	5	6,8	8	10,8	34	45,9	25	33,8
	SHS	4	5,6	1	1,4	4	5,6	35	48,6	28	38,9
The energy produced by nuclear power plants is not a form of renewable energy.	VTAHS	0	0	0	0	35	59,3	14	23,7	10	16,9
	AMVHS	6	11,5	2	3,8	23	44,2	11	21,2	10	19,2
	AHS	4	5,4	6	8,1	4	5,4	18	24,3	42	56,8
	SHS	0	0	0	0	5	6,9	27	37,5	40	55,6
It is necessary to build power plants which use renewable energy sources.	VTAHS	1	1,7	3	5,1	23	39,0	14	23,7	18	30,5
	AMVHS	0	0	3	5,8	11	21,2	21	40,4	17	32,7
	AHS	12	16,2	2	2,7	17	23,0	15	20,3	28	37,8
	SHS	7	9,7	0	0	3	4,2	10	13,9	52	72,2
I support the use of hydrogen as a fuel in vehicles.	VTAHS	1	1,7	2	3,4	30	50,8	13	22,0	13	22,0
	AMVHS	1	1,9	5	9,6	27	51,9	13	25,0	6	11,5
	AHS	2	2,7	1	1,4	27	36,5	17	23,0	27	36,5
	SHS	4	5,6	3	4,2	12	16,7	24	33,3	29	40,3

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

Table 3 indicates that many students viewed the sun, water and waste as sources for energy production. The large majority of students at the Anatolian High School and Science High School supported the use of hydrogen

fuel in vehicles, while most students in the Vocational and Technical Anatolian High School and the Anatolian Medical Vocational High School were undecided concerning the use of hydrogen fuel. Students generally expressed the view that the global use of renewable energy sources is not increasing significantly, and that renewable energy sources are not being sufficient utilised. They also expressed the views that using renewable energy sources might help resolve the energy demand problems of the world; that there is a need to build more renewable energy power plants; and that the use of renewable energy sources should be encouraged. It was observed that the large majority of the students at the Vocational and Technical Anatolian High School and the Anatolian Medical Vocational High School were undecided as to whether energy from nuclear power plants constitute renewable energy.

The percentage and frequency distribution of student responses to items belonging to the “Education” factor of the renewable energy source renewable energy source attitude scale are shown in Table 4.

Table 4: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Education” Factor of the Renewable Energy Source Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
It is important to provide education in schools regarding renewable energy sources.	VTAHS	0	0	3	5,1	13	22,0	20	33,9	23	39,0
	AMVHS	2	3,8	0	0	5	9,6	30	57,7	15	28,8
	AHS	3	4,1	4	5,4	6	8,1	28	37,8	33	44,6
	SHS	5	6,9	0	0	2	2,8	22	30,6	43	59,7
I am not sufficiently knowledgeable about renewable energy sources.	VTAHS	3	5,1	6	10,2	19	32,2	21	35,6	10	16,9
	AMVHS	5	9,6	13	25,0	16	30,8	16	30,8	2	3,8
	AHS	10	13,5	17	23,0	12	16,2	22	29,7	13	17,6
	SHS	10	13,9	35	48,6	13	18,1	11	15,3	3	4,2
Society’s level of awareness regarding renewable energy sources should be increased.	VTAHS	1	1,7	2	3,4	12	20,3	37	62,7	7	11,9
	AMVHS	0	0	4	7,7	15	28,8	27	51,9	6	11,5
	AHS	0	0	2	2,7	7	9,5	54	73,0	11	14,9
	SHS	0	0	0	0	0	0	59	81,9	13	18,1
In general, people are not sufficiently knowledgeable about renewable energy sources.	VTAHS	1	1,7	1	1,7	26	44,1	23	39,0	8	13,6
	AMVHS	2	3,8	17	32,7	16	30,8	8	15,4	9	17,3
	AHS	8	10,8	4	5,4	17	23,0	34	45,9	11	14,9
	SHS	0	0	3	4,2	13	18,1	36	50,0	20	27,8
In classes, more emphasis must be placed on the subject of renewable energy sources.	VTAHS	8	13,6	4	6,8	13	22,0	19	32,2	15	25,4
	AMVHS	0	0	2	3,8	12	23,1	27	51,9	11	21,2
	AHS	3	4,1	4	5,4	13	17,6	35	47,3	19	25,7
	SHS	1	1,4	2	2,8	13	18,1	24	33,3	32	44,4
I believe it is necessary to organize various educational programs in schools regarding the importance of renewable energy sources.	VTAHS	0	0	3	5,1	14	23,7	17	28,8	25	42,4
	AMVHS	2	3,8	0	0	12	23,1	20	38,5	18	34,6
	AHS	3	4,1	4	5,4	6	8,1	28	37,8	33	44,6
	SHS	5	6,9	0	0	2	2,8	22	30,6	43	59,7

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

An evaluation of Table 4 reveals that most students were of the view that providing education of renewable energy sources in schools is important; that there is a need to organise various educational projects in schools; and that the subject of renewable energy sources should be covered to a greater extent in classes. The large majority of the students in the Vocational and Technical Anatolian High School, the Anatolian Medical Vocational High School and the Anatolian High School described that they lacked adequate knowledge on renewable energy sources, while most students in the Science High School considered themselves as being sufficiently knowledgeable on this subject. The majority of the students attending the Vocational and Technical Anatolian High School, the Science High School and the Anatolian High School described that people in society generally lack adequate knowledge on renewable energy sources, while most students in the Anatolian Medical Vocational High School were of the opposite view, believing that most people are knowledgeable on this subject. Some of the students in the Vocational and Technical High School and the Anatolian Medical Vocational High School were undecided on whether people are, in general, sufficiently informed about renewable energy sources. In addition, the large majority of the students expressed the view that people need to be informed about renewable energy sources, in order to raise their awareness on this subject.

The percentage and frequency distribution of student responses to items belonging to the “Economy” factor of the renewable energy source attitude scale are shown in Table 5.

Table 5: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Economy” Factor of the Renewable Energy Sources Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
The use of renewable energy sources will contribute to the country's economy.	VTAHS	0	0	3	5,1	15	25,4	17	28,8	24	40,7
	AMVHS	1	1,9	1	1,9	10	19,2	24	46,2	16	30,8
	AHS	1	1,4	2	2,7	10	13,5	27	36,5	34	45,9
	SHS	2	2,8	0	0	9	12,5	24	33,3	37	51,4
Energy produced from renewable energy sources is not cheap.	VTAHS	6	10,2	6	10,2	28	47,5	13	22,0	6	10,2
	AMVHS	4	7,7	9	17,3	24	46,2	8	15,4	7	13,5
	AHS	7	9,5	18	24,3	28	37,8	7	9,5	14	18,9
	SHS	7	9,7	19	26,4	21	29,2	11	15,3	14	19,4
It is important for energy produced from renewable energy sources to be cheap.	VTAHS	4	6,8	2	3,4	16	27,1	14	23,7	23	39,0
	AMVHS	5	9,6	2	3,8	13	25,0	19	36,5	13	25,0
	AHS	2	2,7	12	16,2	14	18,9	21	28,4	25	33,8
	SHS	14	19,4	6	8,3	14	19,4	12	16,7	26	36,1
The construction of power plants using renewable energy sources is not less costly than the construction of other types of power plants.	VTAHS	5	8,5	13	22,0	27	45,8	11	18,6	3	5,1
	AMVHS	4	7,7	9	17,3	19	36,5	15	28,8	5	9,6
	AHS	15	20,3	11	14,9	20	27,0	16	21,6	12	16,2
	SHS	13	18,1	6	8,3	14	19,4	16	22,2	23	31,9
The investments currently being made for promoting the use of renewable energy sources are not sufficient.	VTAHS	24	40,7	15	25,4	15	25,4	4	6,8	1	1,7
	AMVHS	17	32,7	28	53,8	7	13,5	0	0	0	0
	AHS	35	47,3	26	35,1	6	8,1	6	8,1	1	1,4
	SHS	33	45,8	24	33,3	4	5,6	4	5,6	7	9,7

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

Table 5 indicates that most students were of the view that using renewable energy sources will contribute to the national economy. With the exception of the students attending the Science High School, students were generally undecided on whether energy from renewable energy sources is inexpensive. In addition, the students were generally of the opinion that energy from renewable energy sources should be affordable, and that the level of investments for the use of renewable energy sources are currently insufficient. Anatolian High School and Science High School students described that the establishment of power plants using renewable energy sources is less costly than other types of plants, while students from the Vocational and Technical Anatolian High School and the Anatolian Medical Vocational High Schools were undecided on this subject. The percentage and frequency distribution of student responses to items belonging to the “Safety” factor of the renewable energy sources attitude scale are shown in Table 6.

Table 6: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Safety” Factor of the Renewable Energy Sources Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
I would not like to see a power plant using renewable energy sources built in the location where I live.	VTAHS	20	33,9	21	35,6	9	15,3	2	3,4	7	11,9
	AMVHS	23	44,2	14	26,9	7	13,5	2	3,8	6	11,5
	AHS	34	45,9	16	21,6	9	12,2	10	13,5	5	6,8
	SHS	29	40,3	11	15,3	13	18,1	17	23,6	2	2,8
Power plants using renewable energy sources are safer than other types of power plants.	VTAHS	0	0	3	5,1	9	15,3	19	32,2	28	47,5
	AMVHS	0	0	0	0	11	21,2	19	36,5	22	42,3
	AHS	2	2,7	0	0	14	18,9	20	27,0	38	51,4
	SHS	1	1,4	0	0	9	12,5	31	43,1	31	43,1
Power plants using renewable energy sources are less dangerous than other types of power plants.	VTAHS	3	5,1	3	5,1	3	5,1	9	15,3	41	69,5
	AMVHS	1	1,9	1	1,9	1	1,9	20	38,5	29	55,8
	AHS	4	5,4	2	2,7	6	8,1	14	18,9	48	64,9
	SHS	5	6,9	0	0	0	0	20	27,8	47	65,3
I believe that renewable energy power plants will not lead to problems that endanger the world.	VTAHS	28	47,5	12	20,3	14	23,7	2	3,4	3	5,1
	AMVHS	13	25,0	19	36,5	13	25,0	2	3,8	5	9,6
	AHS	26	35,1	21	28,4	13	17,6	12	16,2	2	2,7
	SHS	32	44,4	25	34,7	7	9,7	6	8,3	2	2,8

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

An evaluation of Table 6 indicates that, in general, students do not want to see power plant using renewable energy sources built in the vicinity of where they live. The students also considered power plants using renewable energy sources as being safer than other power plants, and that these renewable energy source-using power plants posed less of a threat to the environment than other types of power plants. In addition, students expressed the view that power plants using renewable energy sources are unlikely to cause problems that would threaten the world.

The percentage and frequency distribution of student responses to items belonging to the “Media” factor of the renewable energy source attitude scale are shown in Table 7.

Table 7: Percentage and Frequency Distribution of Student Responses to Items Belonging to the “Media” Factor of the Renewable Energy Source Attitude Scale

Items	Type of High School	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		f	%	f	%	f	%	f	%	f	%
It is important for the media to broadcast news and programs regarding renewable energy sources.	VTAHS	3	5,1	0	0	10	16,9	18	30,5	28	47,5
	AMVHS	1	1,9	0	0	5	9,6	21	40,4	25	48,1
	AHS	1	1,4	3	4,1	5	6,8	30	40,5	35	47,3
	SHS	0	0	1	1,4	1	1,4	32	44,4	38	52,8
There are not sufficient news and programs on the media regarding renewable energy sources.	VTAHS	0	0	1	1,7	12	20,3	24	40,7	22	37,3
	AMVHS	0	0	2	3,8	7	13,5	30	57,7	13	25,0
	AHS	0	0	4	5,4	6	8,1	38	51,4	26	35,1
	SHS	2	2,8	1	1,4	3	4,2	28	38,9	38	52,8

*Vocational and Technical Anatolia High School (VTAHS), Anatolia Medical Vocational High School (AMVHS), Anatolia High School (AHS) and Science High School (SHS)*

Table 7 indicates that the students generally considered that the broadcasting/publishing of new and programs on renewable energy sources is important, and that the number of news and programs currently in the media on this subject is insufficient.

The results of the descriptive statistical analysis and one-way analysis of variance, performed in order to determine whether the attitude scores towards renewable energy sources differed depending on the type of high school the students attended, are shown in Table 8 and 9.

Table 8: Descriptive Statistical Analysis of the Attitude Scores According to the Type of High School the Students Attended

Type of High School	N	X	ss
Vocational and Technical Anatolia High School (VTAHS)	59	123,5763	7,81070
Anatolia Medical Vocational High School (AMVHS)	52	125,5000	7,74976
Anatolia High School (AHS)	74	128,1486	10,46414
Science High School (SHS)	72	136,9167	11,13395

Table 9: One-Way Analysis of Variance of the Attitude Scores According to the Type of High School the Students Attended

Source of Variance	Sum of Squares	SD	Mean Square	F	p
Inter-Group	6938.631	3	2312.877	25.011	0.000
Intra-Group	23396.272	253	92.475		
Total	30334.903	256			

*p*<.001



Table 8 and 9 indicates that student attitudes towards renewable energy sources differed significantly depending on the type of high school they attended [ $F_{(3, 253)} = 25.011$ ;  $p < .001$ ]. The results of the Tukey HSD test performed to determine the groups between which these differences existed is shown in Table 10.

Table 10: Tukey HSD Test Results According to the Type of High School the Students Attended

Groups	Mean Difference	Standard Error	p
VTAHS - AMVHS	-1,92373	1,82914	,719
VTAHS - AHS	-4,57238	1,67841	,035*
VTAHS - SHS	-13,34040	1,68872	,000*
AMVHS - AHS	-2,64865	1,74013	,426
SHS- AMVHS	-11,41667	1,75007	,000*
SHS-AHS	-8,76802	1,59187	,000*

$p < .001$

An evaluation of Table 10 indicates that the significant difference between the student groups attending different schools with regards to their attitude scores towards renewable energy sources was largely in favor of the Science High School students. In addition, a significant difference was identified between the Vocational and Technical Anatolian High School and the Anatolian High School groups in favor of the Anatolian High School.

## CONCLUSION AND RECOMMENDATIONS

The study results demonstrated that the high school students have a generally positive attitude towards renewable energy sources and power plants that use renewable energy sources. However, it was also observed that the students still have some concerns about renewable energy sources, which we believe stems from a lack of knowledge.

The study results indicated that most of the high school students were of the view that renewable energy sources are environmentally-friendly, and that they will help reduce environmental problems such as acid rain, air pollution, and the greenhouse effect. In addition, the students also expressed the view that power plants using renewable energy sources are safer and less hazardous than other types of power plants, and that these power plants will contribute to the national economy. It was noteworthy, however, that many of the students also expressed the view that they would not want to see a renewable energy source-using power plant in the vicinity of where they live. The students were aware that water, the sun and wastes are sources of renewable energy. However, the students were undecided as to whether nuclear energy and hydrogen energy are renewable, even though the former is clearly not renewable, while the latter is a renewable form of energy. In addition, it was also observed that the students have a generally positive attitude towards power plants using renewable energy sources. According to the study results, most students were of the view that providing education of renewable energy sources in schools is important; that renewable energy sources should be covered to a greater extent in classes; that there is a need to organize various educational projects in schools on this subject; and that there should be efforts towards raising people's awareness on renewable energy sources. Furthermore, the students generally considered that the broadcasting/publishing of new and programs on renewable energy sources is important, and that the number of news and programs currently in the media on this subject is insufficient. These results demonstrate that high school students are aware of the importance of the media in raising social awareness.

The study also showed that student attitudes towards renewable energy sources differed significantly depending on the type of high school they attended [ $F_{(3, 253)} = 25,011$ ;  $p < .001$ ]. This difference was generally in favor of Science High School students; in other words, attitudes towards renewable energy sources were more positive among students attending the Science High School. In addition, a significant difference was identified between the Vocational and Technical Anatolian High School and the Anatolian High School groups in favor of the Anatolian High School.



The raising of conscious and knowledgeable individuals who are aware of the importance of environmentally-friendly renewable energy sources is closely associated with the quality of the education on the environment that is provided in schools. For this reason, it is possible to state that there is a need for greater inclusion of renewable energy source-related subjects in educational programs at all levels, starting from pre-school, and up to undergraduate programs. To ensure that such knowledge becomes lasting, environmental education should be provided using student-centered methods and techniques, within the frame of the relevant classes. However, education is a process that continues outside of schools, while the internet and media have a significant impact on society. For this reason, we also believe that it is important to raise social awareness on renewable energy sources through public service announcements, advertisements, and programs.

## REFERENCES

- Bilen, K., Özel, M. & Sürücü, A. (2013). Fen bilgisi öğretmen adaylarının yenilenebilir enerjiye yönelik tutumları. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, 36, 101-112.
- Christensen, L.B., Johnson, R.B., & Turner, L.A. (2015). *Araştırma Yöntemleri Desen ve Analiz (Research Methods Design and Analysis)*. (Çeviri Editorü: Ahmet Alpay). Ankara: Anı.
- Çelikler, D., & Kara, F. (2011). İlköğretim matematik ve sosyal bilgiler öğretmen adaylarının yenilenebilir enerji konusundaki farkındalıkları. *2nd International Conference on New Trends in Education and Their Implications*. 27-29 April 2011.
- Çelikler, D. (2013). Awareness about renewable energy of pre-service science teachers in Turkey. *Renewable Energy*, 60, 343-348.
- Çelikler, D., & Aksan, Z. (2015). The opinions of secondary school students in Turkey regarding renewable energy. *Renewable Energy*, 75, 649-653.
- Çelikler, D., & Aksan, Z. (2016). The development of an attitude scale to assess the attitudes of high school students towards renewable energy sources. *Renewable and Sustainable Energy Reviews*, 54, 1092-1098.
- Güler, Ö. (2006). Türkiye’de rüzgar enerjisinin durumu ve geleceği. *Dünya Enerji Konseyi Türk Milli Komitesi Türkiye 10. Enerji Kongresi*, s.143-151.
- Güneş, M. (1999). Fotovoltaik sistemin sağladığı elektrik enerjisi ile çalışan bir uygulama sisteminin tasarımı, Yüksek Lisans Tezi, Elazığ.
- Karatepe, Y., Varbak, N., Keçebas, A., & Yumurtacı, M. (2012) The Levels of awareness about the renewable energy sources of university students in Turkey. *Renewable Energy*, 44, 174–179.
- Kılinc, A., Stanisstreet, M., & Boyes, E. (2009). Incentives and disincentives for using renewable energy: Turkish students’ ideas. *Renewable and Sustainable Energy Reviews*, 13, 1089–1095.
- Liarakou, G., Gavrilakis, C. & Flouri, E. (2008). Secondary school teachers’ knowledge and attitudes towards renewable energy sources. *Journal of Science Education and Technology*, 18(2):120e9.
- McLaughlin, C. (2008). Career connections: Environmental occupations. *Technology and Children*, 13(1), 14-15.
- Oktit, Ş. (2000). *Fotovoltaik güneş pilleri ve güç sistemleri dünü, bugünü, yarını*. Türkiye’de 8. Enerji Kongresi, Yeni ve Yenilenebilir Enerji Kaynaklarının Gelişimi, Cilt II, Ankara, 47-62.
- United Nations Commission on Environment Development. The global partnership for environment and development: A guide to Agenda 21. Geneva: UNCED, 1992.



UN (United Nations) (2005). "Strategy for education for sustainable development", CEP/AC.13/2005/3/Rev.1.  
The World Conservation Union. Caring for the earth: a strategy for sustainable living. Geneva, Switzerland:  
IUCN, 1991.

Veziroğlu, T.N., & Şahin S., (2008). 21st Century's Energy: Hydrogen energy system. *Energy Conversion and Management*, 49, 1820–1831.

World Wild Fund for Nature. The energy Report 100 % renewable energy by 2050. Gland, Switzerland, WWF, 2011.

Zyadin, A., Puhakka, A., Ahponen, P., Cronberg, T., & Pelkonen P. (2012). School students' knowledge, perceptions, and attitudes toward renewable energy in Jordan. *Renewable Energy*, 45, 78-85.