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# A Survey on the Understanding and Viewpoints of Renewable Energy among South African School Students

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## Abstract
Renewable energy has become an essential component for the survival of human beings. This is because conventional energy supply is limited, nearing its limits, and or destroying our environment. The complete transition to renewable energy is a major approach to achieving sustainable and clean energy distribution progress in this ever-changing and demanding world. This research work investigates the knowledge of renewable energy among the youth and their understanding of sustainable energy prosperity towards meeting the future generation's energy needs. To achieve this, a set of questionnaires was developed to identify their knowledge of various renewable energy resources, energy aspects, applications, and the extent to which the current syllabus provides a well-developed background. They were administered to high school students in KwaZulu-Natal, Durban. The main findings of this investigation reveal that the students were most familiar with solar energy, which could be due to the increasing availability of solar panels across the nation. However, a lack of awareness and little understanding of geothermal energy was noted among the high school students. This indicates a poor future for its development. Furthermore, 86% of the students agreed that conventional energy sources would likely still be relied upon by a significant portion of the global population to meet daily energy needs. Therefore, the government must take swift action to address these issues, by promoting the deployment of renewable energy sources in schools.

**Keywords**: energy, knowledge, renewable energy, engineering education, South Africa

## 1. Introduction

The high dependence on burning fossil fuels in various sectors of the world's energy systems has led most researchers and experts in developed and developing countries to accept that the world's current energy systems are not sustainable (Ewim *et al.*, 2022). According to Zyadin *et al.* (2012), this is due to the high energy demand caused by improved living standards and urbanisation, especially in some developing countries and poor regions. In addition to this, pollution like

greenhouse gas emissions results in environmental degradation, which not only threatens the South African ecosystem but endangers the international ecosystem. As a result, clean energy which includes energy efficiency and renewable energy is becoming an increasingly important discuss through which better management and operations, highly efficient machinery and appliances achieve sustainable development (Egieya *et al.*, 2022; Jaber *et al.*, 2017; Ntuli *et al.*, 2022).

South Africa has approximately 54 GW of energy generation capacity. The South African energy mix is dominated by fossil fuels, as over 80% of the country's energy generation is dominated by coal (Akinbami *et al.*, 2021). Renewable with hydro contributes approximately 13.4%, nuclear energy accounts for 3.8%, while the power generation from diesel is 1.5% (Pierce & Roux, 2022). This consumption rate will continue to grow exponentially due to the ever-increasing population and industrialisation in South Africa, faced with a growth rate of 1.28% a year (Ateba *et al.*, 2019). These are expected to result in an increasing demand for electricity from the power grid, and if there is no drastic reduction or end to the coal burning, it means that the burning of more fossil fuels, an increase in the carbon footprint, and further environmental devastations have no end in sight. Renewable energy generates power through natural, replenishable resources as the primary component (light/water/biomass) (Owusu & Asumadu-Sarkodie, 2016). The country has made commitments to transition towards a more sustainable energy mix, with a focus on increasing the use of renewable energy sources (Ewim *et al.*). South Africa has great potential for solar renewable energy due to its geographic position, allowing for optimum absorption of light. This has led to the biggest solar farm in Africa – Jasper solar power project constructed in the Northern Cape, which generates 96 MW of power (Akinbami *et al.*, 2021). South Africa has 33 wind farms that develop an equivalent of 3.672 MW of power. These wind farms are being utilised in coastal areas due to immense wind speeds (Merem *et al.*, 2022; Mostafaeipour *et al.*, 2020; Rae & Erfort, 2020; Tshimbiluni & Tabakov, 2019). Biomass, such as plants, wood, and energy crops, contributes 9-14% of energy generation in South Africa (Benti *et al.*, 2021; Joan *et al.*, 2020). Aside from solar, wind and biomass, other renewable sources include hydropower – turbine spinning from the use of dams, and geothermal energy, which manipulates heat generated from the earth's core (Mutombo & Numbi, 2019).

In progressive times, electricity has proven to be a crucial component of our lives and daily needs. The lack of it resulting from energy inefficiency, inadequate maintenance and breakdowns of the power stations due to high demand is presently leading to the inability to store food, the loss of electronic and network communications, inefficient and incapable business operations, and an overall impact on the economy. This is generally referred to as load shedding, which is being experienced in various stages. This effect has largely reduced the full 24-hr supply of electricity. Thus, the ever-growing need to provide a platform for alternate power sources is imminent to mitigate nosediving of the economy as a result of the abysmal energy supply from fossil fuels.

As today's youths are the future of tomorrow, their knowledge and understanding of available renewable energy resources would significantly contribute to capacity development, research and development, innovation, job creation, and large-scale deployment for local, provincial and national energy prosperity. Achieving these significantly relies on the education of the ethics, technology and economic know-how of clean energy resources. The students can only comprehend what they have been made aware of; without this information, they may be unable to create solutions to the existing energy problems. The understanding of renewable energy is crucial in ensuring that the generation can function. This education can thus be shared and diversified. Morals and rules following these sources ensure that the students are aware of the following energy systems and the contributing impact on the environment. The emission of sulphur dioxide, nitrogen oxides and greenhouse gas emissions from the burning of coal greatly motivate the change to alternate energy producing power sources such as renewable energy. This investigation examines the knowledge and awareness of renewable energy that high school students in Kwazulu-Natal, Durban hold. The study

proceeded to understand how the youth interpret renewable energy, the factors surrounding it, and the link with their curriculum content on renewable energy. The objective is to produce statistics on this information and data to articulate the level of knowledge and understanding senior high school students have surrounding renewable energy, which can be perceived by the public and give rise to greater awareness.

## 2. Methodology

### 2.1. Questionnaire

In this study, questionnaires were administered. The questionnaires incorporated relative aspects associated with high school students, as it was necessary to understand the magnitude of their knowledge and syllabus content that reflects their understanding of renewable energy. Schools are a good avenue for demonstrating the advantages and disadvantages of renewable energy. Students learn about real-world energy challenges, such as the need to lessen our reliance on fossil fuels while the school saves money on electricity. From the syllabus point of view, the concepts relating to renewable energy are briefly overviewed in Grade 9 in Natural Science. In grade 10, the students have the options to choose subjects such as geography and life science, which provide greater depth into renewable energy. Two hundred students were contacted. However, the total number of students that participated in this survey was one-hundred and forty-seven (147). Sixty-eight (68) of them were male, and seventy-nine (79) were female. The target age range was from 15-18 years old, which is the age range of students from grade 10 to grade 12. Students between the ages of 16 and 17 were found to be the most interactive (Table 1). Renewable energy systems installed in schools give pupils an on-site learning experience while also helping the school meet its energy requirements as well as a demonstration of the school's contribution to clean energy transition and sustainable development.

***Table 1: Demography of the students***

| Age | Gender | |
|---|---|---|
| | Male | Female |
| 15 | 25 | 19 |
| 16 | 16 | 30 |
| 17 | 21 | 26 |
| 18 | 6 | 4 |
| Total | 68 | 79 |

The questionnaire was developed using 3-time frames: The Past, The Present, and The Future. This interaction ensured the history students have with respect to renewable energy, as well as what they envision for the future of this concept. Most of the questions were shaped around the individual respondent's point of view, allowing the students a comfortable platform to display their knowledge and opinions freely. The questions were developed using multiple choice and dichotomous. To begin the questionnaire investigation, students had to first identify renewable energy sources. This was in the form of dichotomous questions for each renewable source. This provided a background of the individual's knowledge of what renewable sources they have come across, from highly common to rare resources. The five (5) renewable energy resources chosen were solar, wind, bioenergy, geothermal, and hydropower. Based on the introductory syllabus on renewable energy, students could completely identify solar energy, followed by wind energy. This was justified because the infrastructure of these two clean energy resources forms the basis of the syllabus, are easily and readily deployed in communities compared with the others.

Solar is the most familiar to the students for several reasons besides that it is a form of renewable energy and is on the school syllabus, mostly Geography or Natural sciences. Solar energy is installed in some homes around their communities, making it easy for students to be familiar with the installed solar photovoltaic (PV) infrastructure. Once the solar PVs are installed, there are few maintenance costs required. The service is usually dirt removal or wire replacement. It is never something major or expensive to the point of putting a dent in one's wallet (Nahar Myyas *et al.*, 2022; Patil *et al.*, 2017). Higher replacement costs will only be incurred when any of the major components in the system reaches its service life.

The students did not know much about geothermal as an energy source because the most significant drawback of geothermal energy is that it is site dependent. This is because geothermal facilities must be built where the energy is available, and some areas cannot benefit from this resource (Ciapała *et al.*, 2021; Salazar *et al.*, 2017; Uliasz-Misiak *et al.*, 2021). This is not a challenge if the end-users reside in an area where the geothermal energy is widely accessible, such as Iceland.

Bioenergy and hydropower as energy sources are on an average-common identification scale. After preceding the question of identifying energy sources, the students then had to use their knowledge to identify the processes of these renewable energy sources (Table 3). It was either they agree or disagree and also an option for neutral. Neutral is an option that suggests a student is aware of the statement but does not choose to answer for a particular reason. The rest of the questions followed the same criteria. Questions represented in Tables 5 and 6 allowed the participant not to select an option if they were undecided or chose not to answer out of uncertainty. To conclude the survey, a self-evaluation checklist is presented. This is not only for the purpose of the student evaluating himself/herself but also an indication to the student of the learning objectives and newly discovered information gathered from participating in the survey.

## 2.2.Data collection

To begin the survey procedure, the principal of a secondary school located in KwaZulu-Natal, South Africa, was contacted. This meeting consisted of the reasoning for the survey, the aims and outcomes of the survey, and how the data would be used and represented for research purposes. With their approval, the investigators were able to conduct a gathering with the grade 10–12 learners to discuss the research objectives. This assembly catered to the explanation and breakdown of the procedure and any questions students might have. The students gained access to the questionnaire through a link their respective teachers gave them. 200 links were sent, but only 147 surveys were completed, which were then analyzed and represented accordingly. In choosing respondents for this study, there were a few considerations made. For this questionnaire, the target group was high school students between the ages of 15 and 18 (Table 1). Due to COVID-19, there were protocols that had to be followed; these were preventive measures, including the use of face masks and social distancing, to minimize the risk of transmission of the virus. To replace physical survey forms, an online questionnaire was adopted. This ensured that COVID-19 protocols were maintained by removing the need for physical contact (from delivering, filling, and collecting documents). The online form was easily accessible through a link, and this web link directed the students to the readily available online survey form. This test was open to responses and feedback regarding the form and any other questions from the group.

## 3. Results

### 3.1. Identification of renewable energy source

Figure 1 shows the students' ability to identify the renewable energy resources specified in the questionnaire. A total of 147 students participated in this investigation. The renewable energy sources listed are solar, wind, geothermal, bioenergy, and hydropower. As shown in Figure 1, all the students identified solar energy (100%), indicating a strong familiarity with this clean energy source. For the wind energy system, 97% of the students identified this type of power source, whereas 3% could not. The results of this survey show that most students knew solar energy and wind energy as renewable sources, with only a minor percentage of students being unable to identify them. The geothermal energy source was only identified by 26 out of 147 (18.37%) students, which means most are not familiar with the geothermal energy source.

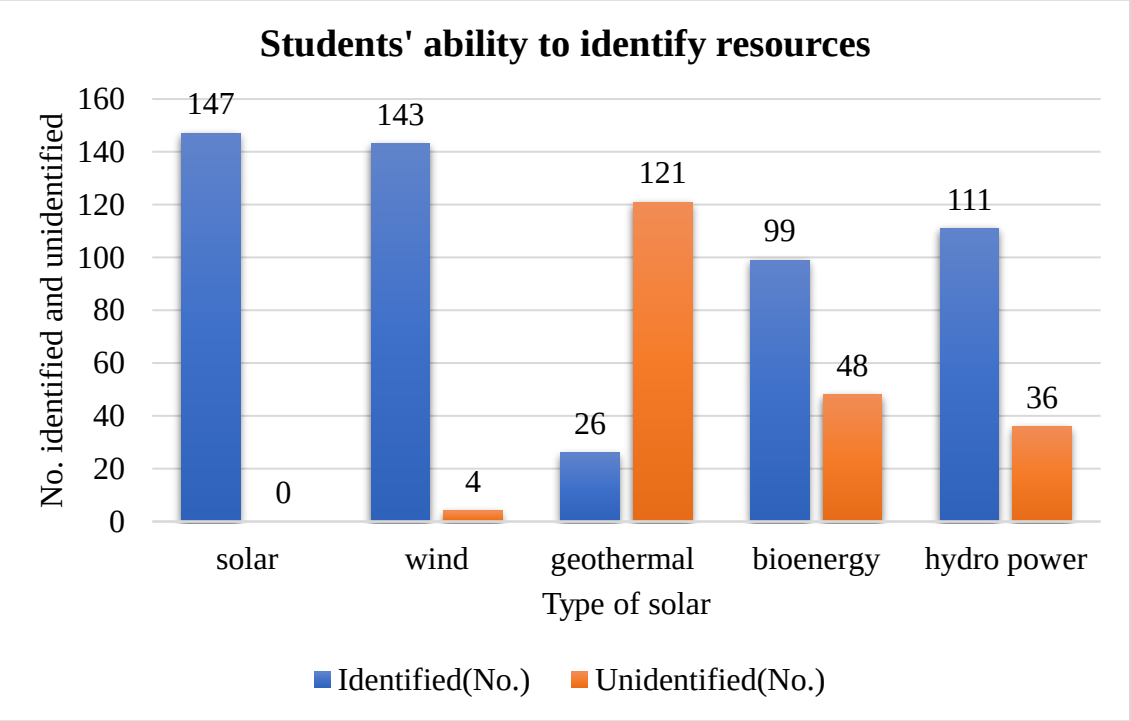


*Figure 1: Students' ability to identify renewable resources*

Bioenergy as a renewable energy source was recognised by 99 out of 147 students (67.35%). This is well known due to the common concept of burning organic substances for fuel through thermochemical processes (S. Ojolo *et al.*, 2012). Hydropower was recognised by 111 out of 147 (75.51%) students. The data revealed that the most prevalent renewable energy is well-know; however, there is still work to be done to improve people's awareness of renewable energy sources. This is due to limited exposure to specific renewable resources over others.

### 3.2. Knowledge of the renewable energy source

Table 2 shows the students' knowledge of renewable sources. When asked to agree, disagree, or be neutral on whether solar cells operate on the principle of sun irradiation to produce power, about 99% of the students agreed, while 1% were neutral. When the students were asked if the wind is used to generate power through wind turbines, about 73% agreed, 20% disagreed, and 7% were neutral. As to whether the geothermal incorporates the heat found within the earth, about 50% of

the respondents concurred, while 49% disagreed and 1% was neutral. When asked if bioenergy is based on the breakdown of organic matter, results showed that 72% agreed and 28% disagreed, and none were neutral. This means that students better understand this type of renewable source. 92% agreed that hydropower uses flowing water to generate electricity, 4% disagreed, and 4% were neutral. The results showed that many students know hydropower uses flowing water to produce power. Data from Table 2 shows that although some students are aware of various renewable resources, they do not understand the input procedure used to develop these systems. This can be due to inadequate explanations.

*Table 2: Students' knowledge on renewable energy*

| Renewable energy generation | Agree (%) | Disagree (%) | Neutral (%) |
|---|---|---|---|
| Solar cells work on the principles of sun irradiation to produce power | 99 | 0 | 1 |
| The wind is used to generate power through wind turbines | 73 | 20 | 7 |
| Geothermal incorporates the heat found within the earth | 50 | 49 | 1 |
| Bioenergy is based on the breakdown of organic matter | 72 | 28 | 0 |
| Hydro Power uses flowing water to generate electricity | 92 | 4 | 4 |

### 3.3. Choice of renewable energy source

Table 3 shows the students' best chosen power source and most affordable. The results show that about 79% of the students chose solar energy as their best power source. In comparison, 44% of the respondents picked solar energy sources as the most affordable.

*Table 3: Students best chosen power source*

| Type of Energy Sources | Best power source (%) | Most affordable source (%) |
|---|---|---|
| Solar energy (PV) | 78 | 44 |
| Wind turbines | 11 | 1 |
| Geothermal | 1 | 3 |
| Bioenergy | 1 | 47 |
| Hydropower | 9 | 5 |

Wind turbines are also an effective source but are expensive to build due to the cost of turbines and rotor blades. Geothermal is less effective due to a desired location and is a more expensive process. On the other hand, bioenergy is highly affordable, with a response percentage of 47% (Table 3). This is because the feedstock needed for the bioenergy is locally available. Hydropower is not cost-effective due to the cost of constructing a dam in the first place. These results were quite justified, suggesting that students are aware of the economics surrounding these renewable energy sources.

### 3.4. Environmental, social and economic effects of renewable energy resources

Figure 2 shows the student's responses to the effects of renewable sources on the environment, society, and the economy. When asked if renewable energy is useful to society, 61% of the respondents agreed, 30% disagreed, and 9% were neutral. Regarding whether renewable sources create more jobs and infrastructure, 64% of the students agreed, 28% disagreed, 7% were neutral, and 1% did not respond. As to whether renewable energy resources save the environment and slow climate change, the percentage was 70 % agreed, 24% disagreed, 3% neutral, and 3% had no response. When asked if the students felt safe using renewable energy sources, 65% agreed, 34% disagreed, and 1% had no answer. The results indicate that most students have a widespread positive impact associated with renewable energy. This can be due to their current experiences and interactions with such systems.

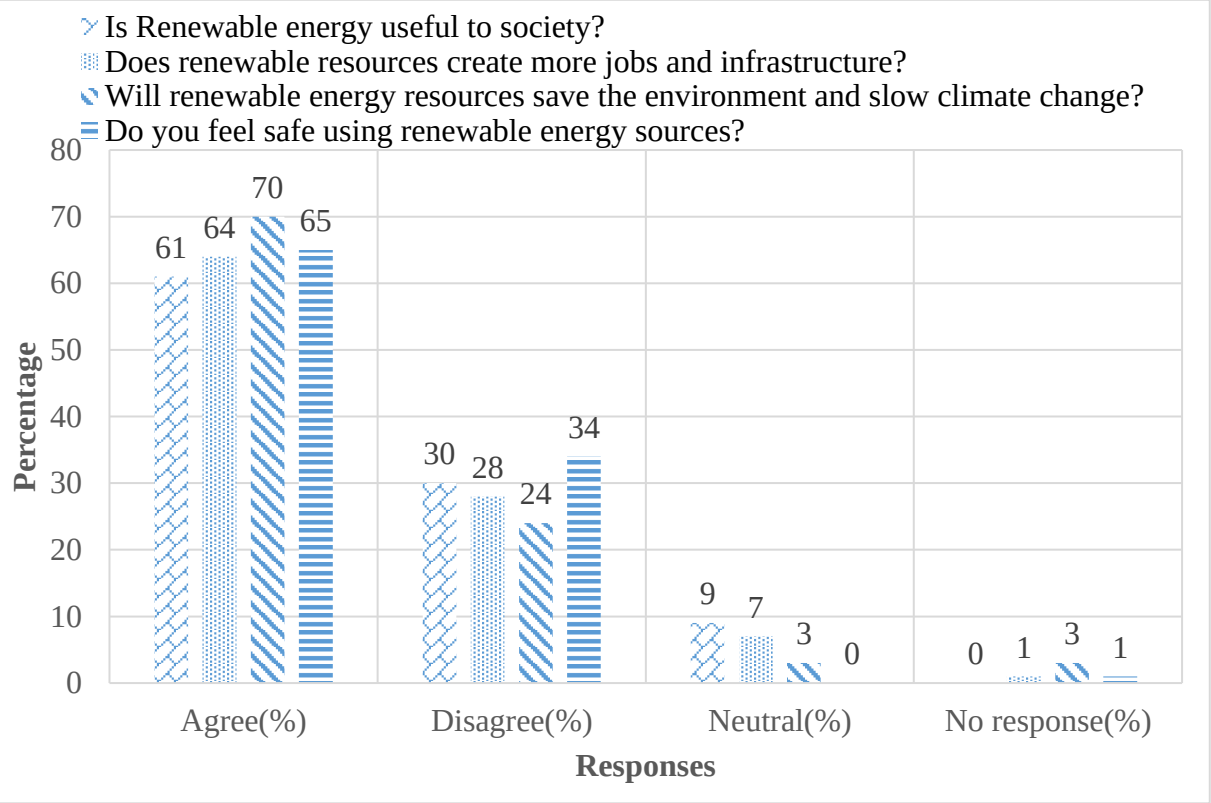


***Figure 2: The students' responses on the effects of renewable energy sources***

Figure 3 shows the students' responses to the future outcome of renewable energy. As fossil fuels may continue to be used as energy sources, 86% of the students agreed that a larger percentage of the global population might continue to depend on conventional energy sources to meet their daily energy needs. In terms of whether the amount of pollution will decrease as a result of reliance on renewable energy as a source of energy, 54% of students agreed, 39% disagreed, 6% were neutral, and 1% did not respond. With the implementation of renewable sources, air and land pollution will decrease because renewable sources emit less carbon dioxide at the point of use compared with fossil fuels. More so, renewable energy does not produce hazardous chemicals or waste that are disposed of unethically in landfills.

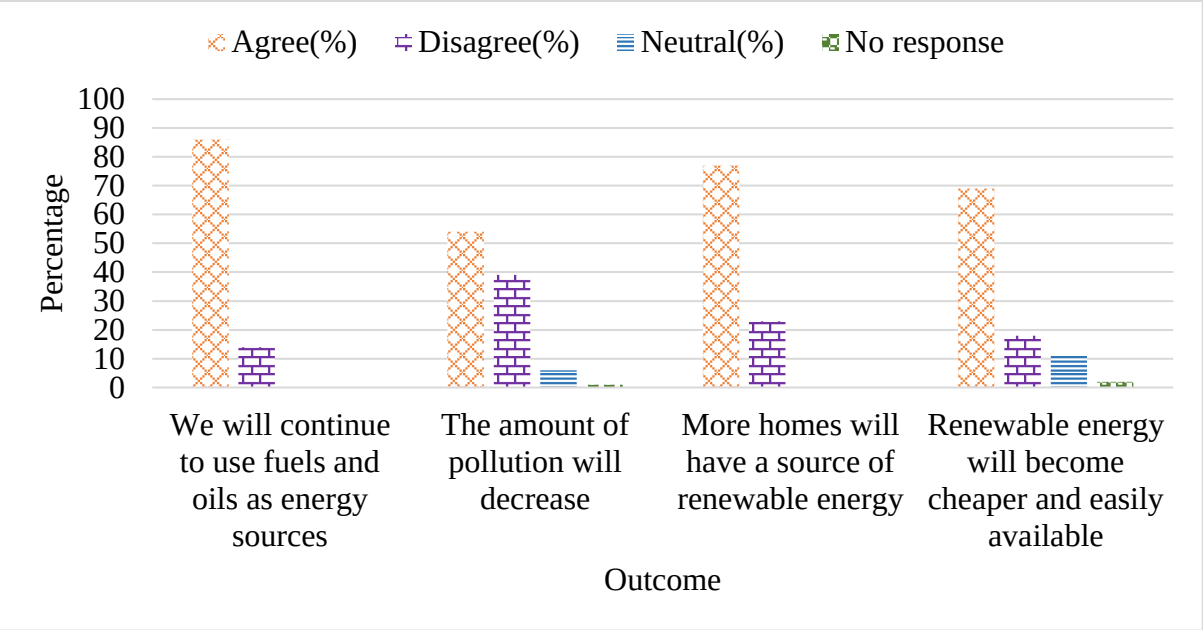


*Figure 3: The future outcome of renewable energy*

When asked if more homes will have a renewable energy source, 77% of the students agreed, while 23% disagreed. Suppose people are introduced to these types of energy-efficient homes. In that case, more homes will transition to clean energy technologies because renewable energy sources reduce pollution and mitigate climate change. Regarding whether renewable energy will become more affordable and accessible, the percentage of respondents who agreed is 69%, students who disagreed account for 18%, the neutrality of 11%, and no response of 2%. Renewable sources can be easily accessible depending on the type of renewable resource. The data indicate that students have answered the questions with reference to created-real scenarios.

### 3.5. Students' self-evaluation

From the evaluation, it can be noted from Table 4 that the students have an evaluation average of 95.5% after completing the survey. Looking at significant findings and areas to improve the data, the significant primary finding was the lack of familiarity with less common renewable energy sources. However, from the self-evaluation, 100% of students indicated they could now define renewable energy. The more people are aware of the various types of renewable energy, the more they are interested in the concept.

***Table 4: Students' self-evaluation of their understanding***

| | Yes (%) | No (%) |
|---|---|---|
| I can define renewable energy | 100 | 0 |
| I can identify renewable resources | 95 | 5 |
| I can display examples | 95 | 5 |
| I can incorporate renewable energy into my everyday life | 92 | 8 |

## 4. Discussion and conclusions

The main objective of this study was to investigate the knowledge and perceptions of South African school students regarding renewable energy. The total number of students that responded was 147, with 46% male and 54% female. This consisted of an age range from 15 years to 18 years old. Figure 1 provided great insight into students' ability to identify resources. The following types of renewable sources were considered; solar, wind, geothermal, bioenergy, and hydropower. Each student was asked based on these sources. The number of students identified for each renewable energy source was considered. The unidentified number was taken into account so as to draw a conclusion on how the participants responded to each source provided. The number of responses for solar energy was at its peak because all students responded to it. Wind energy was second, with a deficit of four unidentified students. Amongst these renewable energy sources, hydropower was the third most popular, accounting for 36 unidentified students. This could be strongly justified due to the increasing availability of solar panels. Many residential houses have visible solar panels on their roofs, thus creating exposure. Looking at significant findings and areas to improve the data, the first significant finding was the lack of familiarity with less common renewable energy sources. The more people know about the different types of renewable energy and their interest in them, the more governments and businesses will have to develop the technologies to harness these sources. While wind, solar and hydro energy are the most common and most applicable to nearly all places around the world, in some places, these types of sources are either not an option due to various reasons or not enough current output to meet the demand with our current technology. Using these lesser common forms of renewable energy, the gap created before can be filled using the less common types of renewable energy to help lessen the demand from other sources if they are the sources of energy abundantly available in such locations/places. While these fewer common forms of renewable energy are not likely to be the main source of energy in the future, with what is currently understood, it would be amiss not to develop technology to harness energy from different sources. All these contribute to the progress of South Africa in becoming carbon neutral and protecting the environment.

The understanding of the functioning of various forms of renewable energy, as shown in Table 2, can be deemed satisfactory, with an average proficiency of 77.2%. It should be noted that only 50% of students in this survey could identify the generation of geothermal energy, which currently indicates a poor future for its development. Although geothermal energy is a less popular form of renewable energy, it should be actively developed. It also suggested that some students know how these sources work practically, not theoretically, and vice versa. The PV cells on a solar panel capture the energy from the sun as it shines on it. This energy forces electrical charges to move in reaction to a cell's internal electric field, which allows electricity to flow. The wind is used in turbines to produce electricity. The propeller-like blades of a turbine are turned by the wind around a rotor, which spins a generator that generates energy. Geothermal energy is heat that is present in the crust of the earth. The Greek words geo (earth) and theme (heat) are the source of the word geothermal. Geothermal energy is a renewable energy source since heat is constantly created inside the earth. Geothermal heat may be used to generate power, heat homes, and heat water for bathing. This means people need to be educated about this type of renewable energy. Bioenergy refers to energy that is produced from biological sources, such as plant matter, agricultural waste, and organic waste. Bioenergy can be produced through various processes, including combustion, anaerobic digestion, and fermentation. Moving water's energy can be used to generate electricity in various ways. A hydroelectric dam, for example, absorbs energy from a river's flow. Dam operators manage the water flow and electricity generated. According to the results, many students know that hydropower uses flowing water to produce power. The results indicate that all the listed renewable

energy sources utilise the type of energy source associated with the need for increased awareness to improve public understanding and usage of locally available renewable energy.

It was noted in Table 3 that the students identified the solar energy as the best renewable energy source at 78% was not surprising. Many students are already exposed to households with systems such as solar panels for lighting and solar geysers. Bioenergy (47%) beating solar energy (44%) by 3% to be the most affordable renewable energy source was not expected, but it is not without its reasons. The use of wood as fuel justifies this reasoning. Wood not contributing to deforestation or waste from processed wood such as sawdust is much cheaper than installing solar panels. In current times with how much waste is produced from processed woods at sawmills, a portion of that waste can be converted to energy for people to use (S. J. Ojolo *et al.*, 2012). In the pursuit to become carbon neutral as a society, bioenergy a viable option in the short term to help convert the waste being generated to useful energy. It also has long-term uses, allowing us to harness energy from as many places as possible such as our homes, take us closer and closer to being able to live entirely independently from society. Analysing Figure 2, renewable energy sources' environmental/social/economic effects were considered. Several questions about these factors were generated. Each student was asked whether he or she agreed with the question (by answering Yes, No, Neutral, or No Response). The outcome of the survey was generally good, with an average of 65% in agreement with the question. This first set of questions allowed the students not to submit a response. From the results, it is evident that students used this option.

Manufacturing, installation, and other businesses are generating economic growth and jobs by diversifying energy sources and reducing dependency on foreign fuels. There is evidence that the use of renewable energy promotes job growth. For example, energy generated by solar photovoltaic cells, landfill gas, or biomass facilities creates more jobs per unit of energy produced than energy generated from conventional sources (Fragkos & Paroussos, 2018; Garrett-Peltier, 2017; Mu *et al.*, 2018). Using renewable resources can save the environment and reduce climate change because people will use renewable sources that produce less carbon emissions and destroy the ozone layer, leading to climate change. More of the environmental protection can be accelerated when energy efficiency is first implemented and integrated with the deployment of renewable energy sources (Abolarin *et al.*, 2013; Ahmed Ali *et al.*, 2020; Moeletsi & Tongwane, 2020). There is no way to safeguard the environment without drastically altering how electricity is produced and consumed; power plants that burn fossil fuels account for approximately 40% of $CO_2$ emissions in the United States (Goldstein *et al.*, 2020; Hickel, 2020), while South Africa emits the largest greenhouse gases in Africa(Ayompe *et al.*, 2020; Oladunni *et al.*, 2022). However, this could be reduced since renewable energy diminishes carbon pollution and has a lesser environmental impact at the point of use. The renewable energy sector has risks; however, it is far safer than the fossil fuel industry. While renewable energy continues to gain traction, it is critical to combine risk knowledge with action to keep people as safe as possible. Practical examples must be given to improve these results when discussing the future of renewable energy. While the current outlook on the effects on students is positive, students must be regularly surveyed with better questions each time to improve how students are taught continuously. Technology advances at an unpredictable rate, and as such, it is essential to ensure that everyone is as close to the cutting-edge as possible, including the learning methods.

The general future outcome for renewable energy is positive, with an average of 70.75% in agreement. With only 54% agreeing that renewable energy will reduce the amount of pollution, this is the central area of improvement that should be focused on. If these problems are not addressed, pollution will continue to be a hazard in our world. The problem of pollution cannot be rectified with a fast method; it must start by ensuring that the current amount of pollution is reduced. Most of the students understand that using renewable energy will save the climate and is affordable compared to using fossil fuels, leading to various factors that are not good for the earth. Coal, natural

gas, and other fossil fuels are not only unaffordable, and yet also dangerous. Fossil fuels are created over time from the remains of live species. They provide most of our energy demands in the United States, including about two-thirds of our generating power. Generally, hydroelectric, wind and solar technology contribute the least to contamination. Compared to burning fossil fuels, renewable energy sources emit far less pollution, although they do not exhale waste gases during the energy generation operation. Renewable sources can be easily accessible depending on the type of renewable resource. According to a recent study, renewable energy was still the world's cheapest energy source in 2020 (Bogdanov *et al.*, 2021; Holechek *et al.*, 2022). When students are being taught renewable energy, the aspect of the potential future of our society must be thoroughly taught, as well as all the steps that need to be taken to achieve a greener future. These bricks will be the foundation on which future generations will continue to build.

An average of 95.25% of students agreed that they understood the concept of renewable energy from Table 4. While this is a good thing, we must not become complacent and let the knowledge of our future generations become stagnant. Only by ensuring that students genuinely understand renewable energy can we ensure that we advance the field of renewable energy. Surveys like this one allow us to formulate plans to follow through on our goals as a society. While perfection may not be attainable, constantly striving to be the best we can be, is just as good. A contributing factor might be that urban households commonly have better earnings and, therefore, better-educated parents, who can also be greater environmentally conscious. The better dwelling standards and municipal services of urban regions, mainly wealthy districts, tend to have greater exposure to renewable resources and greater technological developments. The rural area, however, does not have such exposure to renewable advancements.

## 5. Conclusion and recommendations

This study did not only investigate the knowledge and perceptions of South African school students regarding renewable energy but also led to an increased understanding of renewable energy for the students. The study revealed that the students have adequate coverage of renewable resources, which can be further expanded. It is accepted that the guarantee of sustainable power has become a reality. Sun-powered photovoltaics and wind energy turbines are encountering quick deals in development. In light of these advancements, market opportunities now exist to enhance and make the most of developing business sectors. Improvements and utilization of these sources can boost R&D, capacity, innovation, and upgrade a variety of energy supply markets. It contributes to long-haul economic energy supplies and worldwide barometric discharges. It gives economically alluring choices to meet explicit needs for energy benefits, especially in agricultural nations and provincial regions, and makes new businesses open their doors. More importantly, renewable energy helps mitigate the impact of climate change, improve energy security, and reduce the negative impact on the environment.

The study recommends that syllabi covering aspects such as hydropower and geothermal power be included in the existing standards, as these are unknown to most students. This would allow students to adapt to and become familiar with renewable resources that are best suited to their needs rather than what is readily available or most popular. Schools should implement field trips to renewable energy sites. In addition, they should invite experts involved in renewable energy projects to give talks to educate students on the changing world and its environmental impact. This would further provide students with the most recent developments in renewable energy and its contributions to the economy and society.

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