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# Perceptions of Education Students on Philippines to Pursue a Renewable Energy Program

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**Abstract.** *This study attempts to investigate how college students studying science perceive renewable energy initiatives. The phenomenology approach was used to perform this qualitative investigation. The six participants in the in-depth one-on-one interview were chosen on purpose. To ensure the subjects' rights and privacy, the researchers sought their informed consent. With the participants' consent, the interview was audio recorded, and notes were taken during it for record-keeping purposes. The responses were collated, verbatim transcriptions of the data were made, and a thematic analysis was done on the responses. The perceptions, challenges, and insights of the science education college students are the nine themes that emerge from the data analysis. The government and energy company stakeholders are helped by the participants' shared accounts of their experiences in raising awareness of why there is a need to improve renewable energy programs and policies. Finally, implications were indicated about what measurements were needed to formulate in order to address the renewable energy policy concerns*

**Keywords:** *Renewable Energy Programs, Perceptions, Insights, Science Education Students.*

## 1. INTRODUCTION

The Philippines faces significant energy production issues due to its rising population as well as some of the most expensive electricity prices in Southeast Asia. Finding enough fuel has become challenging for several Asian nations due to the escalating cost of liquefied natural gas (LNG). As of October 2022, LNG prices in Asia were up by 300% compared to the previous year (Hashem, 2023). Millions of people's access to energy is at risk due to the



rising energy prices that are driving poorer nations off the market. A future energy problem is present in the Philippines pushing the country in the interest of using renewable energy. As the price of fuel goes up a big crisis arises as well; because of this, energy poverty is highly possible in every country.

According to Halkos & Gkampoura (2021), energy poverty is a problem that affects both emerging and industrialized nations, and its solution is crucial for societal wellbeing. Additionally, one of the factors that needs to be considered is the condition of our environment. The use of fossil fuels (coal, oil and natural gas) can be harmful both to nature and mankind. According to Denchak (2022), fossil fuel use has caused a devastating impact on both mankind and the environment, causing everything from air and water pollution to global warming. For these instances, the use of renewable energy became a single choice for most of the countries for innovation.

In the escalating rise of the use of renewable energy all over the world, concerns have arisen as well in this natural energy source. The efficiency of its use is undeniably a relief to all developing countries; however, the risks are undeniable too. According to Hossein Karami Lakeh (2022), renewable energy is not available round the clock. Natural forces known as renewable energy sources are highly influenced by the weather. Therefore, renewable energy sources like solar cells will be less useful in bad weather. Solar panels, for example, use sunlight as natural fuel for this technology to function and produce electricity. Climate change is one factor that contributes for the weather to change drastically, making these mediums for energy consumption less reliable.

Renewable energy works in the use of a technology that specifically functions as an energy conversion device. Unfortunately, the efficiency of such technology is lower compared to the traditional way that uses coal, fossil fuels, and natural gas. For this reason, it is likely a great challenge for a country that uses renewable energy whose development is not that progressive in terms of technological modernization. For instance, the market-available solar panels have an efficiency of 15% to 20%. However, older systems that rely on coal or natural gas can achieve efficiency levels of up to 40% and 60%, respectively (Lakeh, 2022). The low efficiency of those technologies is quite a big conflict.

Moreover, the cost of those technologies appear in a contrary manner as their initial cost is high and most of the time unaffordable. In fact, the production and installation of renewable energy equipment, such as PV (photovoltaic) panels, are relatively expensive operations according to Lakeh (2022). Additionally, the technology used in this program is usually built within a large mass of land. Renewable energy requires a lot of space. This concern arises as it usually affects the environment in constructing sites for this technology to be built on. Land—lots of land—will be required for further solar panels and onshore wind turbines. In comparison to coal- or gas-fired power facilities, utility-scale solar and wind farms need at least ten times as much area, including the land necessary to generate and transport fossil fuels, to produce one unit of energy (Christakou et. al, 2022). When numerous acres of land are used, the area may be cleared and graded, which may result in soil compaction, erosion,



and alterations to drainage channels. The negative effects of solar energy are linked to habitat loss, water pollution, land use, and the hazardous compounds used in solar panel production (Tajne, 2015).

Given the fact that renewable energy reduces gas emissions that usually result in pollution, on the other hand the harm of this so-called pollution is still possible. Manufacturing the devices used for energy conversion and their disposal process usually emits pollution. For instance, solar cells eventually stop working properly, thus we must discard them. However, these devices might be harmful, so we need to come up with a method of recycling them (Lakeh, 2022). Our best hope to reverse the current trend and improve the quality of life on Earth is through the use of renewable energy sources. That is the reason why many countries today pursue this type of energy production despite some risks present on implementing it. In 2020, renewable energy will account for 29% of all electricity generated worldwide. When compared to a 27% share of electricity generation in 2019, this is a success. Furthermore, there are encouraging advantages to employing renewable technologies, despite the numerous challenges on the path to 100% renewable energy in a country (Lakeh, 2022).

Thus, the research objectives of this study include three questions: (1) What are the perceptions of science education students about the Philippines pursuing a renewable energy program? It is to know the individual perspective of every student in pursuing a renewable energy program in the country; (2) What are the challenges that the Philippines might encounter upon pursuing a renewable energy program in the country? It is to determine how renewable energy can overcome the difficulties they might encounter in the future; (3) What are the insights as a science education student in relation to pursuing a renewable energy program in the Philippines? It is to investigate if they still want to pursue the renewable energy program in the Philippines despite the difficulties they might encounter.

## **2. MATERIALS AND METHODS**

### **Participants**

The participants of this study were the science education students. By choosing six participants who are science education students at Davao del Norte State College (DNSC) and University of Mindanao Tagum College (UMTC). Informants undergo a one-on-one interview with different ages, sexes, and year level. Participants should have a renewable energy lesson or topic for at least one year that talks about science so that they can explain and interpret their perceptions as best as they can.

### **Materials/Instruments**

The researchers used a semi-structured interview guide questionnaire as an instrument for this research study to gather information from six science education students of Davao del Norte State College (DNSC) and University of Mindanao Tagum College (UMTC) in different majors. A semi-structured interview is a meeting in which the interviewer does not strictly follow a formalized list of questions (Doyle, 2020). Open-ended questions aim to better understand the participants' inner thoughts, emotions, and feelings concerning their



perspective on the Philippines pursuing a renewable energy program. The instrument covers three open-ended research questions that cover the experiences, challenges, and insights of significant education students. Three probing questions each supported it.

### **Design and Procedure**

This study employed qualitative research with a phenomenological approach. Tenny et al. (2022) stated that a sort of research called qualitative research looks at actual issues and offers more in-depth understandings. Qualitative research aids in the creation of hypotheses as well as the further exploration and comprehension of quantitative data. In qualitative research, participants' experiences, viewpoints, and actions are gathered. Instead of addressing how many or how much, it addresses the how's and why's (Bliss, 2016). A thorough exploration of what experiences mean to humans is phenomenological research. Its fundamental goal is to investigate commonplace human experiences in order to understand how people understand their world and how they interpret both their own and other people's experiences. In order to gather thorough details that serve as a foundation for reflective structural analysis, which eventually discloses the essence of the experience, a researcher conducting phenomenological research must concentrate on people's experiences of a phenomenon. For this research, after we get the approval from the research adviser to conduct the interview, we send consent and agreement to participants through a personal message on Messenger. Following participant confirmation, researchers set the interview date via Messenger in the participant's available time. Data was collected from the participants using in-depth interviews. The data collected was transcribed into English and subjected to thematic analysis. The list of data analysis is categorized based on the themes we defined, and only the relevant sentences from their response are included. Lastly, the researchers guarantee that the sensitive information in this document won't be used for any purpose other than evaluating or carrying out the inquiry without the participants' prior agreement.

### **3. RESULTS AND DISCUSSION**

This section presents the findings in a table, followed by discussions based on the research findings. The items in the table have been analyzed, categorized, and arranged according to different themes. Every piece of information gathered from informants was classified according to the various challenges to which they belonged. The researchers, adviser, data analyst, research coordinator, and validators carefully review and oversee the findings.

Table 1 Perceptions of Education Students about the Philippines pursuing a renewable energy program

<b>Themes</b>	<b>Core Ideas</b>
Benefits of Using Renewable Energy	Lower the electricity bills.
	Widen the knowledge about renewable energy.
	Nature friendly.
	Economic benefits.



Relevant Courses or Subjects for Renewable Energy	Science subjects.
	Science, Physics, Technology and Engineering.
	Environmental Science, Science and Technology, and Society subject.
Specialized Tracks for Renewable Energy Program	Science related.
	Science, Technology, Engineering, and Mathematics (STEM).

### **Benefits of Using Renewable Energy**

The first theme talks about the benefits of using renewable energy where students share their perspectives on how this type of energy source helps in a community. Moreover, the students found how helpful and how beneficial it can be upon using renewable energy.

It is supported by Student 1, who said that:

“Renewable energy is advantageous since it may expand access to electricity while lowering consumer electricity bills.” IDI\_S#001

It is also asserted by Student 2, who said that:

“Pursuing a renewable energy program will be helpful in terms of understanding natural energy sources.” IDI\_S#002

Another narrative is stated by Student 3, as follows:

“Pursuing renewable energies means reducing greenhouse gas emissions.” IDI\_S#003

Another one is from Student 6, stated that:

“The advantages are improved public health, lesser air pollution, improved way of living, higher gross of economy especially when relying more on domestic sources of energy rather than those imported fuels and a lot more.” IDI\_S#006

The fact that renewable energy does not produce any greenhouse gasses or other pollutants during the process is arguably its most important advantage. When compared to coal power plants, which produce about 2.2 pounds of CO<sub>2</sub> for every kilowatt-hour of electricity, solar and wind power sources produce zero CO<sub>2</sub>. Renewable energy sources are assisting in supplying us with emission-free energy, heat, cars, and even air transport as we rush to decarbonize our environment and adopt energy sources that do not contribute to global warming (Terrazas, 2020).

According to Foyster (2021), renewable energy is the most affordable energy source to develop, and consumers are increasingly benefiting from these cost savings. It is likely to be a budget-friendly source of energy for everyone who attempts to lessen their electricity bills.



### **Relevant Courses or Subjects for Renewable Energy**

The second theme that was analyzed from the perspectives of education students is the relevant courses or subjects for renewable energy. Students found science as the in-line course to pursue this renewable energy program.

It is supported by Student 1, who said that:

“It includes science related subjects.” IDI\_S#001

It is also stated by Student 2, stated that:

“I think courses that are related to science/physics, technology, and engineering.” IDI\_S#002

Another statement is as mentioned by Student 3:

“Typically, the environmental science subject, and the science, technology and the society subject.” IDI\_S#003

Newton (2022) states that engineers that specialize in renewable energy are essential for upgrading current energy systems and putting new renewable energy sources, such solar and wind power, into operation. It is impossible to produce sustainable energy without renewable energy engineers. Education in science, technology, engineering, and mathematics (STEM) has become more and more popular recently. Some believe that this is a passing academic fad, while others highlight its significance for the future of renewable energy. Teachers and educators can motivate kids to pursue STEM degrees and work in the renewable energy industry (Partida, 2021).

### **Specialized Tracks for Renewable Energy Program**

The third theme includes the specialized tracks for renewable energy programs. It tracks down and narrows whether there are specific concentrations within a renewable energy program.

It is stated by Student 1, who said that:

“I think so, because every profession comes with learning before.” IDI\_S#001

It is also supported by Student 2, stated that:

“Yes. I think the Academic track (specifically STEM) is a good foundation for anyone who would wish to study a renewable energy program.” IDI\_S#002

STEM tracks, or Science, Technology, Engineering, and Mathematics tracks, refer to educational pathways that focus on these specific subjects (National Academies of Sciences, Engineering, and Medicine, 2021). STEM education aims to provide students with a strong foundation in these fields, as they are considered crucial for innovation, problem-solving, and technological advancements.



Table 2 Challenges that the Philippines might encounter upon pursuing a renewable energy program in the country

<b>Themes</b>	<b>Core Ideas</b>
Addressing Issues in Using Renewable Energy	Connecting other countries.
	Educate the young.
	Imprinting awareness to the public.
	Strengthening the core of National Renewable Energy Program (NREP).
Effects of Using Renewable Energy	Improves the economy.
	Adapt to the modernization.
	More job opportunities.
	Reduce costly investments.
Measuring the Risks in Using Renewable Energy	Habitat loss.
	Financial problem.

**Addressing Issues in Using Renewable Energy**

The first theme, analyzed out of the coping mechanisms of the use of renewable energy and how a country copes up on every present challenge that this energy source offers. To understand the coping mechanisms in challenges related to the use of renewable energy, it is important to consider the views of education students.

It is narrated by Student 1, who said that:

“The country should create strong networks with other countries.” IDI\_S#001

It is also supported by Student 2, who stated that:

“The renewable energy program must be endorsed to the public, most especially the younger ones who are bound to a higher level of education.” IDI\_S#002

Another statement by Student 3 who said that:

“By strengthening the many advocacies in support of this and also public awareness.” IDI\_S#003

Additionally, it is also mentioned by Student 4 which as follows:

“I think that the government should emphasize on strengthening and developing the Philippines' National Renewable Energy Program (NREP).” IDI\_S#004

Connecting to other countries for renewable energy consumption can bring several benefits, including diversifying energy sources, promoting renewable energy development, and enhancing energy security. International relations are of utmost importance in today’s interconnected world. According to Pfaltzgraff et al. (2023), the increasing popularization of international relations reinforced the idea that public control and oversight of foreign and military policies, international relations instruction should be included in general education, and this knowledge should be advanced. By reaching the goal of National Renewable Energy Program, which by 2030 generates 35% of renewable energy and by 2040 generates 50% of



renewable energy, the Philippine government seeks to employ cleaner energy sources to meet the country's expanding need for electricity, as well as to use hybrid technologies, more renewable energy sources, and lower carbon dioxide emissions overall (Masons, 2022).

### **Effects of Using Renewable Energy (RE)**

The second theme was from the analyzed idea of the science education students about the effects of using renewable energy specifically the positive side. Using renewable energy impacts the quality of life that people lived; it opens new opportunities, adapting to the current pattern of modern living, and it brings development in the country.

It is supported by Student 1, who said that:

“It helps to improve the trade balance by reducing the impact of fluctuating global fuel prices on energy production.” IDI\_S#001

Another statement by Student 2 said that:

“I think pursuing a renewable energy program would help our country to keep up with the modernization happening around the world.” IDI\_S#002

It is also asserted by Student 3 who said that:

“It can offer more jobs to the Filipinos and so with that, it can help the country withstand on its own.” IDI\_S#003

It is also added by Student 5, who stated:

“We can reduce the reliance of foreign resources and imported fossil fuels that really costs us.” IDI\_S#005

Renewable energy is the key to economic progress. In contrast to coal and other fossil fuel industries, renewables typically have a relatively high labor intensity, which means they spend more on hiring people. They also frequently produce higher-value, better-paying, cleaner, and healthier jobs than the fossil fuel industry does in the Philippines (Greenpeace, 2013). According to Alkhalili et al. (2023), renewable energy sources are regarded as a viable solution to the planet's alarming situation. A country who uses RE adapts to the modernization of the planet we live in and that country finds its resolve for the arising issues and crisis due to climate change and other environmental dangers.

### **Measuring the Risks in Using Renewable Energy (RE)**

The third theme is about the risks in using renewable energy, where science education students find the opposing factor against renewable energy. Knowing the risks of RE allows the student to come up with a corresponding response appropriately in the given scenario. They pointed out two different aspects and argue those risks that can harm the country and the well being living there.

It is supported by Student 1, who said that:





“The effect on the utilization of land and habitat loss is one of the primary environmental dangers associated with renewable energy.” IDI\_S#001

It is also said by Student 2 that:

“Financial aspects like how much this program costs.” IDI\_S#002

Building infrastructure for renewable energy devices requires a great mass of land. This will cause many problems for RE sites. A great source of renewable energy is the sun. However, the negative effects of solar energy are linked to habitat loss, water pollution, land use, and the hazardous compounds used in solar panel production (Tajne, 2015). Moreover, Gretz (2018) stated that the U.S. economy continues to see a rise in the use of renewable energy, which is aided by a favorable lending environment. Energy poverty might end up in economic poverty when countries insist on the use of renewable energy despite limitations in privilege on acquiring their source of energy consumption.

Table 3 Insights as a science education student in relation to pursuing a renewable energy program in the Philippines

<b>Themes</b>	<b>Core Ideas</b>
Renewable Energy Awareness	Understands through research.
	Easy to comprehend.
Reasons of Pursuing Renewable Energy Program	Common good.
	Awakening potentials.
	Improves life.
Personal View About the Use of Renewable Energy	Addresses significant issues.
	Constant practice of educating.
	Very relevant.

### **Renewable Energy Awareness**

The first theme encompasses the overall awareness of the science education students about renewable energy. Renewable energy awareness is crucial in addressing the pressing challenge of climate change. The student’s essential knowledge accelerates in the transition of a sustainable energy future. As the students understand the benefits and potential of renewable energy, they can now make informed decisions, support renewable policies, and contribute to a cleaner and more sustainable planet.

It is supported by Student 3, who said that:

“There were times I got confused, but through delving deeper, researching, I managed to understand things better and made myself conscious of the public concern about the state of our environment.” IDI\_S#003

It is also supported by Student 5, who stated:

“Not likely, as it is just about making use of our natural resources whilst considering its duration for future use.” IDI\_S#005



Research is of utmost importance in various aspects of life, it is essential for progress and development in all areas. It enables us to gain knowledge, solve problems, innovate, make informed decisions, improve quality of life, and drive economic growth. Research is a systematic and objective investigation conducted to discover new knowledge, expand existing knowledge, or validate existing knowledge. According to Creswell & Creswell (2017), research involves the collection, analysis, and interpretation of data to answer a research question or test a hypothesis. That is why through research we can gain new knowledge or information about various ideas and concepts.

### **Reasons of Pursuing Renewable Energy Program**

The second theme includes the science education students' insights about the reasons why a country pursues the transitional use from traditional to renewable energy sources. The students perceive the potential of RE for improved life and beneficial results for the majority of consumers.

It is supported by Student 3, who said that:

“Yes. It is because it is also us, the citizens that will be benefiting from it.” IDI\_S#003

It is also supported by Student 5, who stated:

“Yes. Having a renewable energy program would help them nurture their talents. We’ll never know, they might invent new energy resources someday.” IDI\_S#005

Another statement by Student 6 said that:

“of course. If we have a healthy environment, then we can have an improved public health and improved way of life.” IDI\_S#006

Transitioning to renewable energy in a community brings environmental, economic, and social benefits. It contributes to sustainability, reduces energy costs, enhances energy independence, creates jobs, improves public health, and drives technological innovation. Renewable energy sources, such as solar, wind, hydro, and geothermal power, produce little to no greenhouse gas emissions during operation. This helps reduce carbon dioxide and other pollutants, mitigating climate change and improving air quality. Thus, it helps the community for a safe living. Additionally, RE sources produce minimal air and water pollution compared to fossil fuel-based energy sources. By reducing pollutants, communities can improve air quality, reduce respiratory and cardiovascular diseases, and improve overall public health (The International Renewable Energy Agency (IRENA), 2019).

### **Personal View about the Use of Renewable Energy**

The third theme commemorates the personal view of the students about the use of renewable energy in the country. They suggested that using RE is a great idea and very relevant for innovation and adaptation. Also, the students opened up some opinions on how to preserve the idea of using renewable energy as a primary source of energy for the country.

It is said by Student 1 that:



“In my own understanding, implementing this project addresses a number of issues the nation is currently facing, and investing in renewable energy should be one of the nation's top objectives.” IDI\_S#001

It is supported by Student 3, who stated:

“Sectors that are supporting this must continue their venture to also wake the minds of many individuals.” IDI\_S#003

Another statement by Student 5, who said that:

“Studying this program makes sense and is relevant to all of us since it connects to the environment.” IDI\_S#005

Renewable energy is highly relevant today due to several reasons as it addresses pressing global challenges such as climate change, energy security, economic development, unemployment and public health. Its growth and adoption contribute to a sustainable and resilient energy future. Lakeh (2022), states that renewable energy sources do not quickly run out of resources; and as natural methods of energy production, RE sources can be regarded as clean. Renewable energy technologies have proven to be a significant source of job creation. The sector offers diverse employment opportunities, ranging from manufacturing and installation to research and development. Understanding renewable energy is crucial for several reasons. According to Seven Square Learning (2021), as a global civilization, we are not simply dealing with environmental difficulties. Understanding social, political, and economic issues is equally crucial. The significance of the situation must be made clear to the students. They should be able to understand the crisis that the majority of the people are in. Then and only will they be inspired to act and solve these issues.

#### **4. CONCLUSIONS**

Based on the result of the study, education students perceive the value of the use of renewable energy. They are well-aware of both the advantages and disadvantages of renewable energy. On the other hand, they are also able to suggest some adjustments to ease the risks. Science related courses are more likely chosen by the students to take upon pursuing the renewable energy program. They find it easy to comprehend how renewable plays a significant role in our modern day in advancing some technological development. A great impression of the renewable energy program marked all of the students. Regardless of the positive appearance of renewable energy, education students notify themselves about the risk it can contribute to our environment and economy. Specifically referring to damage it can be done on building the infrastructure, a mass land consumption, and lowering the financial status of the country on purchasing those devices needed for this program. More so, the Philippines pursuing a renewable energy program marks its potential as one solution for the country's crises and issues about the arising effects of climate change throughout the years. Embracing this energy source boosts the confidence of every Filipino to enjoy the privileges it offers.

### **Implications**

This study shows that pursuing a renewable energy program in the Philippines is a big challenge for us, as a Filipino. Since, many people assume that renewable energy is not good for our country. Yet, it can satisfy the need of individual through the help of the natural resources. This implies that proper orientation and strategic ways are needed in order to understand the usefulness of the renewable energy resources within the country. The researchers recommend the following:

First, develop educational campaigns and programs to raise awareness about renewable energy among different target audiences, including schools, universities, community centers, and professional organizations.

Second, engage with local communities through outreach programs, town hall meetings, and public consultations. Involve community members in decision-making processes related to renewable energy projects.

Third, launch public awareness campaigns through various media channels, including television, radio, print, and social media. These campaigns can highlight success stories, case studies, and real-life examples of renewable energy projects. They can also emphasize the environmental, economic, and social benefits of renewable energy adoption.

Fourth, provide education and skills development opportunities to enhance the workforce's knowledge and expertise in renewable energy technologies, installation, operation, and maintenance.

Finally, collaborate with media outlets to promote renewable energy awareness through news articles, features, interviews, and documentaries.

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