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Perceived effects of coal-fired power plant operations on the living standards of the selected municipality in Quezon province

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Abstract

This study determined the perceived effects of the coal power plant on the living standards of the residents in Mauban, Quezon. The researchers used a quantitative method and gathered the data by asking and handing out questionnaires to the respondents, mainly in three barangays that are located near the power plant. The result of the study revealed that respondents perceived coal-fired power plant operations have “high effects” on human health, with an overall weighted mean of 3.17. Additionally, the environment had an overall weighted mean of 3.25, which means that the activities of power plant had a “high effect”. Lastly, socio-economic findings show a “very high effect” with overall weighted mean of 3.56. The Department of Health may thoroughly assess the effect of the coal-fired power plant's dust on the community's respiratory health and may conduct necessary interventions. Department of Environment and Natural Resources, through the Environmental Management Bureau (EMB), may assess and evaluate the promulgated rules and regulations following the Philippine Clean Air Act of 1999 or RA 8749 set forth for the said institution on the quality of air. Lastly, the Department of Environment and Natural Resources and the Department of Agriculture may consider entering into a joint task force to create a monitoring team that will test water pollution at the fishing areas and examines the condition of crop production. This monitoring team is responsible for reporting and takes immediate action in response to what they've observed.

Keywords: coal-fired, living standards, perceived effects, power plant

Perceived effects of coal-fired power plant operations on the living standards of the selected municipality in Quezon province

1. Introduction

A world without electricity is unimaginable, and as the demand to meet the energy needs of humans increases, power plants become the primary source of energy. For ages, coal has supported economies and been used to power and construct infrastructure in contemporary society, thus making it vital for creating and constructing modern life. Coal-fired power plants continue to play a significant role globally and are the main source of energy in the majority of the world's regions however, the emission of coal-fired power plants affects not only those residents who live near the operation of the said industry but it can be transported long distances, which may cause health effects for those who reside far from power plants. A study by Watanabe et al. (2017) found that individuals with pre-existing respiratory conditions, such as COPD or asthma, who lived near coal-fired power plants experienced worsening symptoms and reduced lung function. Moreover, the need for energy, particularly in emerging countries, is strongly associated with growth in the human population, the economy, and society. Utilizing coal has certain drawbacks, but it will be necessary to meet the electricity demand. According to the U.S. Environmental Protection Agency (2018), as cited by Amster et al. (2019), High-pressure coal combustion results in coal power plants releasing "hazardous pollutants". The hazardous pollutants impact the environment and can lead to diseases that threaten human life.

The Philippines is one of those countries that rely heavily on coal as a source of electricity. Many coal power plants are installed in some parts of the country, such as in Pagbilao, Mariveles, Bataan, Masinloc Zambales, and Mauban Quezon. However, the use of coal results in air pollution, which causes the biggest problems for the environment and human health in the Philippines. It is said that with 10 GW of installed coal-fired power capacity, the air pollution from coal is responsible for 630 GW of the air pollution related to death.

Objectives of the Study - The study aims to focus on the perceived effects of coal-fired power plants. This research was conducted to accomplish the following: to determine the demographic profile of the respondents in terms of age, gender, years of residency, and income; to determine the health problems of the residents in the community in terms of respiratory diseases, heart diseases, and skin diseases; to determine the perceived effects of coal power plant operations in terms of health, environment and socio-economic; to determine if there is significant difference between the level of perceived effects of coal-fired power plant and the demographic profile of respondents; and propose an Action Plan for the perceived effects of the coal-fired power plant.

Significance of the Study - This study aims to determine the perceived effects of Quezon power plant operation from the province of Mauban. The findings of the study are expected to benefit the following: (1) Department of Environment and Natural Resources. The department will benefit from the study's findings as they are in charge of assessing the possible environmental effects of large-scale projects, such as coal-fired power plants. This research will assist in identifying potential environmental concerns and mitigating them before they negatively affect the environment or public health. (2) Quezon Power Limited Co. The results of the study will help the QPL team improve their operations in the municipality. They can also have a collaborate with the local government officials for their improvement and to know the actions that will be taken to protect the community from the effects of their operations. (3) Local Government officials. The results of this study will assist local officials in determining the perceived effects of the coal power plant on the area. The information gathered can be used as a basis for them to implement proper rules and regulations from which their constituents may benefit. (4) Residents in Community. For the residents living close to the power plant, this study will provide greater knowledge. They can use this information to assess the potential effects of operating a coal power plant nearby. Additionally, it will identify the age group that might be most affected in this study. It can also be used as a resource for further research on projects they might establish in their area. (5) Public Administration Students. As

future professionals who will serve communities, through the study's findings, they can utilize their knowledge to establish proper action. (6) Future researchers. This study will serve as the basis for future research involving the impact of coal plant operations, which may strengthen the research's efficiency.

Research Paradigm

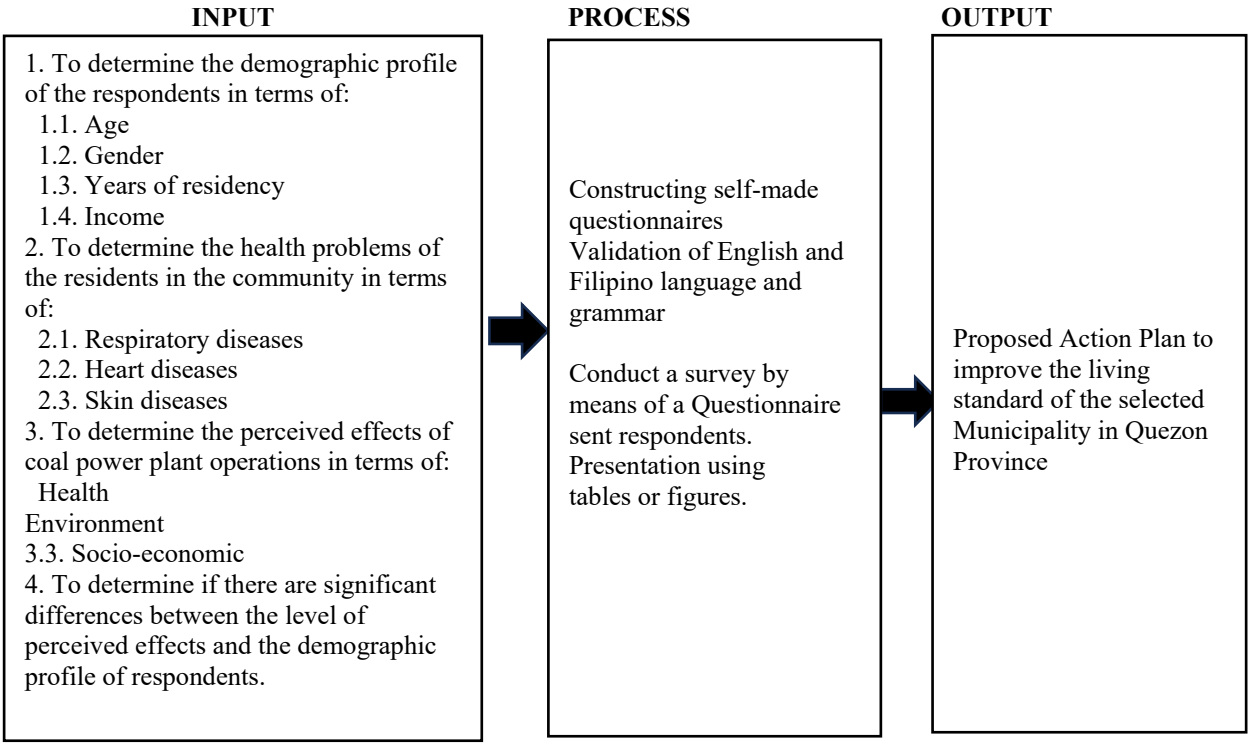

Fig 1- Input, Process, Output

Figure 1 shows the research paradigm of this study using the input, process, and output (IPO) process model. The input is the four main objectives of the study, such as the demographic profile of the respondents, their health encountered problems, perceived effects of coal-fired power plants in terms of health, environment, and socio-economics, and to determine the significant differences in the level of perceived effects and demographic profile. Meanwhile, the process is that researchers will construct self-made questionnaires and validate English and Filipino language and grammar. Afterward, conduct a survey using a questionnaire will be distributed to the selected respondents and present tables or figures the data collected. The output of this study is a proposed policy program.

Theoretical Framework - The theory is based on the Environmental Theory of Florence Nightingale. According to Nightingale, "Poor or challenging environments led to poor health and disease." She further believed that an individual's surroundings significantly impacted their health and defined disease as "dys-ease or the absence of comfort." This theory is relevant to the study since it focuses on environmental health awareness and health promotion initiatives that can improve or affect community members' quality of life. Health is influenced by the environment in which individuals live. Additionally, coal power plantss have hazardous substances that impact the environment, including fresh air, water, cleanliness, and sanitation. Based on the theory, it will help the researchers determine how hosting a coal power plant affects the environment and health of the residents residing nearby the operation.

2. Methods

Research Locale - This study was conducted in the municipality of Mauban. It belongs to a 1st class municipality in Quezon Province and consists of 40 barangays, and according to the 2020 Census of the Philippine

Statistics Authority (PSA), the municipality had a total population of 71,081. The barangays that the researchers chose were Barangay Cagsiay 1, Daungan, and San Lorenzo, with a combined total population of 13,403. The researchers chose the place of implementation since these are located nearby the coal-fired power plant, and the residents mostly felt the effects of the activities of the said power station in this area.

Respondents of the Study - This study utilized in the selected barangays of Mauban, Quezon, specifically barangay Daungan, San Lorenzo and Cagsiay 1. The combined total population of the three barangays is 13,403. However, the researchers only chose those 18 years old and above, with a total population of 8 919, and using Slovin's formula with a 5% margin of error, they arrived at a total sample of 384 respondents.

Research Design - The study's main purpose is to determine the perceived effects of Quezon power plant's operation on living standards. The study's main purpose is to determine the perceived effects of the Quezon power plant's operation on living standards and use a quantitative method. A quantitative approach analyzes an idea by formulating specific hypotheses and using data collection to either confirm or refute the hypotheses. The data are evaluated using statistical techniques, and presumptions are verified. This type of research method helps the researchers compare the effect of the living standards through health, environment, and socio-economic factors to determine whether the independent variable, the coal power plant, will affect the outcome of the dependent variable.

Research Instrument - The researchers utilized the questionnaire method. It was used with a set of questions to collect information from the respondents. The researchers prepared a questionnaire that was divided into three parts. The first part of the questionnaire is the respondents' demographic profile, including age, gender, year of residency, and income. The second part of the questionnaire consists of questions about the health problems encountered by the respondents during their years of residency. On the other hand, the third part of the questionnaire consists of the perceived effects of coal power plants on their living standards. The statements were divided into the following living standards: health, environment, and socio-economic, with responses ranging from one (1) (Strongly Disagree) to four (4) (Strongly Agree). The respondent's score will be calculated after grading each subtest score separately. To ensure the accuracy and reliability of the questionnaires, researchers seek professional help from experts in the field for validation. During the validation process, the validators specifically told the researchers that the questionnaires should align with the objectives. The validator also suggested that the statement shouldn't contradict one another as it will give confusion to the respondents. All suggestions from the validators were considered and were included in the final questionnaire. Additionally, to assess the feasibility and effectiveness of the instrument before the full-scale implementation of the study, the researchers conducted their pilot testing in Pagbilao, Quezon, where another coal-fired power plant is located. The following summated scale points and adjectival interpretation were used for analysis.

Point scale	Range Interval	Verbal Interpretation	Quantitative Description
4	3.51-4.00	Strongly Agree	Very high
3	2.51-3.50	Agree	High
2	1.51-2.50	Disagree	Low
1	1.00-1.50	Strongly Disagree	Very Low

Data Gathering Procedures - To gather the necessary data for the study, the researchers first sent letters and waited for the approval of the research adviser. After the approval, the researchers coordinate with the Municipal Mayor of Mauban and Sanguniang Barangay to ask for permission to conduct the study with the selected barangay in Mauban Quezon. The researcher formulated questionnaires in each statement, and it has Filipino translation to ensure that it was appropriate for people of all ages and backgrounds and to collect accurate data. To make it more credible, they sought the advice of a Filipino subject teacher for counter-checking. The researchers formulated questionnaires that were validated and approved by the professionals. The data and analysis were used to draw a conclusion and make a recommendation.

Data Analysis - The researchers accumulated data and information, which is suited for analysis. The researcher collected, tabulated and analyzed the current study's gathered data using statistical methods and

procedures.

Weighted Mean. The weighted mean formula was also used to determine the perceived effects of Quezon power plant operation on the living standards of selected barangay, Mauban Quezon, with the formula:

$$\frac{WM= 4F + 3F + 2F + F}{N}$$

Where: WM = Weighted Mean ; F = Frequency; N = Total Number of Residents

Shapiro Wilk's test. It is a two-sample test that compares the sample data to a normal distribution.

$$W\frac{(\sum_{i=}^{n} a_{i}x_{(i)})^2)}{\sum_{i-}^{n}(X_{i-}X)}$$

Where: $\mathbf{x_i}$ = are the ordered random sample values $\mathbf{a_i}$ = are constants generated from the covariances, variances, and means of the sample (size) from a normally distributed sample.

Statistical Treatment - In gathering the data, the responses will be recorded and tabulated. The data results were tallied, analyzed, and interpreted, and then the data was subjected to statistical treatment. The following statistical procedures were used to interpret the data gathered from the study respondents.

Simple Percentage. The demographic profile variables of the respondents were analyzed using the Simple Percentage with the formula: $\frac{P= fx100}{N}$=percentage; f = frequency; N = number of respondents

Slovin's Formula. The measurement of sample size of this research was calculated using Slovin's Formula with the formula: $n = \frac{N}{1+ Ne^2}$ ample size; N = population size; e = margin of error

3. Results and discussion

Table 1

Frequency and Percentage Distribution of Respondents according to Age

Age	Frequency	Percent
18-40 Yrs Old	136	35.4
41-60 Yrs Old	147	38.3
61 Yrs Old and Above	101	26.3
TOTAL	384	100

Table 1 shows that most of the respondents in nearby communities of coal-fired power plants in Mauban, Quezon are aged in their 40s to '60s, with the total percentage of 38.3%. Meanwhile, senior citizens were the least respondents in the survey, with a frequency of 101 or 26.3% of the total surveyed perception.

Table 2

Frequency and Percentage Distribution of Respondents According to Gender

Gender	Frequency	Percent
Male	198	51.6
Female	179	46.6
LGBTQIA+	7	1.8
TOTAL	384	100

Table 2 demonstrates the number of combined and separate male, female, and LGBTQ respondents. The majority of the respondents are male, with one hundred and ninety-eight (198) respondents or 51.6%, while females are 46.6% or one hundred and seventy-nine (179) respondents. LGBTQ were the least frequency of seven (7) respondents, or 1.8%.

Table 3 represents the years of residency of the respondents in the selected barangays. Most of the surveyed respondents have lived near coal-fired power plants for more than four decades. In contrast, the least respondents have been living near coal-power plants for one to five years (1-5).

Table 3

Frequency and Percentage Distribution of Respondents According to Years of residency

Years of Residency	Frequency	Percent
1-5 Years	7	1.8
6-10 Years	19	4.9
11-15 Years	23	6.0
16-20 Years	54	14.1
21-30 Years	26	6.8
31-40 Years	27	7.0
41-50 Years	114	29.7
51 Years & Above	114	29.7
TOTAL	384	100

Table 4 shows the household income of the respondents. The majority of the surveyed respondents are below the poverty threshold, earning an average of fewer than ten thousand pesos (₱ 10,000) per month. The Philippines Statistics Authority established in 2022 the poverty threshold at ₱12,030 per month for a family of five or ₱79 per day for food and non-food requirements. Hence, most of the family living nearby coal-fired power plants are among those whose income is not enough to meet even basic needs.

Table 4

Frequency and Percentage Distribution of Respondents According to Household Income

Income	Frequency	Percent
Less than P10,000	230	59.9
P10,000-19,999	125	32.6
P20,000-29,999	8	2.1
P30,000-39,999	3	.8
P50,000-59,999	2	.5
No response/cannot remember	16	4.2
TOTAL	384	100

Table 5 exhibits the respiratory diseases that the residents encountered during their years of residency. Cough and Cold are the most common respiratory diseases experienced by respondents living nearby coal-fired power plants, translating to 30.98% and 29.65%. Meanwhile, the lowest frequency falls under Bronchitis and others with one frequency (1).

Table 5

Frequency and Percentage Distribution According to Respiratory Disease

Respiratory Disease	Frequency	Percent
Cough	370	30.98
Sneezing	325	27.22
Cold	354	29.65
Pneumonia	57	4.77
Bronchitis	1	0.01
Asthma	80	6.70
Others	1	0.01
None of the above	6	0.50
TOTAL	1,194	100

Table 6 indicates the frequency and percentage distribution according to heart disease that the community may have experienced. The majority of the respondents were 46. 31% do not experience any kind of heart disease or with a frequency of two hundred and one (201), while 33.87% answered that they have high blood pressure.

Table 6

Frequency and Percentage distribution According to Heart Disease

Heart Disease	Frequency	Percent
High blood	147	33.87
Heart attack	2	0.46
Coronary Artery Disease	51	11.75
Others	33	7.60
None of the above	201	46.31
TOTAL	434	100

On the other hand, fifty-one (51) of the respondents experienced coronary artery disease. At the same time, 7.60% answered others. Lastly, the least frequency is a heart attack.

Table 7

Frequency and Percentage Distribution According to Skin Disease

Skin Disease	Frequency	Percent
Eczema	18	4.7
Psoriasis	3	.8
Dermatitis	3	.8
Tinea corporis (Buni)	18	4.7
Others	13	3.4
None of the above	329	85.7
TOTAL	384	100

Table 7 represents the skin diseases experienced by the respondents. The majority of them do not have any kind of skin disease, with a frequency of three hundred and twenty-nine (329) or 85.7%. On the other hand, eighteen (18), or 4.7%, answered that they had tinea corporis (buni) and eczema. Thirteen (13) of the respondents said that they have other skin diseases such as chicken fox and skin allergies.

Table 8

Mean Distribution of the perceived effects of coal-fired Power Plant in terms of Health.

HEALTH	Mean	Interpretation
1. The pollutants from the coal-fired power plant cause a range of harmful health effects especially to the vulnerable groups like elderly, children and pregnant women, and those with pre-existing health conditions	3.24	Agree
2. The coal dust exposure has been linked to decreased life expectancy.	3.17	Agree
3. The air pollutants pose a significant health risk, resulting in increased hospitalizations, and disability.	3.16	Agree
4. The air pollutants from coal-fired power plant can have significant adverse effects on health such as respiratory diseases, e.g., lung cancer, asthma, pneumonia, bronchitis.	3.09	Agree
5. The air pollutants from coal-fired power plant causes cardiovascular diseases, e.g., heart attack, stroke, high blood pressure, low blood pressure.	3.10	Agree
6. There are changes in breathing patterns due to the polluted air from coal-fired power plants, e.g., difficulty breathing.	3.19	Agree
7. The exposure from Coal pollution leads to community health issues like cough and cold	3.27	Strongly Agree
8. The air pollutants that comes from the chemical of the coal-fired power plant causes skin diseases, e.g., eczema, psoriasis, dermatitis, tinea corporis	3.17	Agree
AWM	3.17	Agree

Table 8, as shown on the succeeding page, shows the mean distribution of the perceived effects of coal-fired power plants in terms of health. The overall weighted mean is 3.17, as respondents perceived that power plant activities have a “high effect” on their health. Among the eight statements, the higher mean is 3.27, which means that respondents strongly agree that exposure to coal-fired power plants leads to community health issues like cough and cold. The lowest mean is 3.09, which states that pollutants from coal-fired power plants have significant adverse effects on health, such as respiratory diseases, heart diseases, and skin diseases.

To support this data, a study by Watanabe et al. (2017) found that individuals with pre-existing respiratory conditions, such as COPD or asthma, who lived near coal-fired power plants experienced worsening symptoms

and reduced lung function. Another study entitled "The Impact of Coal-Powered Electrical Plants and Coal Ash Impoundments on the Health of Residential Communities" by Kravchenko et. al.,(2018) revealed that those who lived close to coal-fired plants had greater rates of all-cause and premature death, elevated risks for lung cancer and cardiovascular disease.

Table 9

Mean Distribution of the Perceived effects of Coal-Fired Power Plants in terms of Environment

ENVIRONMENT	Mean	Interpretation
Coal-fired power plant.....		
1. affects the source of air, water, and soil pollution.	3.41	Agree
2. produces carbon dioxide that increases heat temperature in the community.	3.33	Agree
3. releases toxic chemicals that affect animals in the community.	3.15	Agree
4. releases coal combustion that contributes to acid rain and smog.	3.14	Agree
5. contaminates waterways which could harm the local water supply.	3.10	Agree
6. contaminates fishing areas.	3.26	Agree
7. affects the plants and crops production	3.26	Agree
8. releases burning emissions that lead to large quantity of coal ash.	3.36	Agree
AWM	3.25	Agree

Table 9 represents the mean distribution of the perceived effect of coal power plants on the environment. The overall weighted mean is 3.25, as the respondents perceived power plant activities have a *"high effect"* on the environment. Among the eight statements, the highest mean is 3.41, which means that the respondents agree that coal-fired power plants affect the source of air, water, and soil pollution. In contrast, the lowest mean is 3.10, which stated that respondents agree that coal-fired power plants contaminate the waterways and could harm the local water supply. It is revealed that coal combustion pollutes the air and has an impact on the global climate system, altering the environment and having an immediate impact on nearby inhabitants. A study titled Mercury pollution in vegetables, grains, and soils from areas surrounding coal-fired power plants, found that the coal power plant produces mercury that can be absorbed by water, soil, and air, which may kill the crops and plants located near the power plant (Li et al., 2017). The primary source of coal ash, also known as coal combustion residuals, is coal burning in coal-fired power plants.

Table 10

Mean Distribution of the perceived effects of coal-fired Power plants in terms of socio-economic

SOCIO-ECONOMIC	Mean	Interpretation
The coal-fired power plant.....		
1. does not just produce electricity but also employment for residents.	3.79	Strongly Agree
2. decreases social problems such as poverty and unemployment.	3.77	Strongly Agree
3. offers scholarships and other livelihood programs in the community.	3.87	Strongly Agree
4. can generate revenue that support education, employment and health care services.	3.83	Strongly Agree
provides a secure base of low-cost generation for all of the consumers in the community.	1.87	Disagree
6. conducts medical missions in the community.	3.90	Strongly Agree
7. produces high employment that increases living standards for people	3.91	Strongly Agree
AWM	3.56	Strongly Agree

Table 10 shows the mean distribution of the perceived effects of coal-fired power plants in terms of socio-economic. The overall weighted mean is 3.56, as the respondents perceived that power plant activities are *"very high"* to socioeconomic. Particularly, respondents strongly agree that coal-fired power plants produce high employment, which increases the living standards of the people, with a mean of 3.91. At the same time, the lowest mean is 1.87, which stated that respondents agree that the power plant does not provide a secure base of low-cost generation for all consumers in the community.

The power plant contributes to increased employment and reduced poverty through increased economic growth and electricity access. As stated by Brunet et. al.,(2022), employment in the energy industry can be essential for reducing poverty as energy makes possible investments, innovations, and new industries that are the engines for jobs, inclusive growth, and shared prosperity for entire economies. The power plant provides jobs

and makes purchases that stimulate the local economy directly and indirectly. The benefits to the area come through jobs, taxes, economic output, labor income, and contributions to the local community, such as offering scholarships to students, conducting medical missions, and improving health care services.

Table 11
Significant differences in the level of perceived effects and respondents' Age

Perceived Effects of Coal-fired power plant	ANOVA/T- test	P-value	Interpretation
Health	15.175	.001	Significant
Environment	16.351	.001	Significant
Socio-economic	.433	.649	Not Significant

Table 11 exhibits the statistical results of the significant difference in the level of perceived effects on the age demographic of the respondents. Socio-economic variables do not have significant differences, with a p-value of .649. Hence, the decision to accept the null hypothesis means that age does not affect the respondent's perception of the effects of Coal-fired activities. On the other hand, the health and environment variables show significant differences, with a p-value of .001. Hence, the null hypothesis is rejected, which means that the age of the respondents affect their perception of Coal-fired activities.

Researchers inferred that the significant difference in the respondents' perception of the effects of the activities of coal-fired power plants lies in their age gap. Those respondents aged 18-40 manifested lower mean in the perceived impact in terms of health compared to those 61 and above. It could be inferred that this age group are their prime of health and does not seem to feel any impact on the activities of coal-fired power plants. As people age, their immune systems may weaken, making them more susceptible to the health effects. Conversely, regarding the perceived effects of the environment, age groups 61 and above manifested the highest agreement on the effects of coal-fired activities on the environment. This could be due to the fact that they have been exposed to environmental pollutants for a longer period compared to younger age groups. Cumulative exposure to pollutants can have a more significant impact on health outcomes over time.

Table 12
Significant differences in the level of perceived effects and respondents' Gender

Perceived Effects of Coal-fired power plant	ANOVA/T- test	P-value	Interpretation
Health	2.920	.055	Not Significant
Environment	3.466	.032	Significant
Socio-economic	2.794	.062	Not Significant

Table 12 shows the significant differences in the level of perceived effects and respondents' gender. Environment variable indicates that there are significant differences in the perception of gender relative to coal-fired power plant activities with a p-value of .032. Thus, rejecting the null hypothesis suggests that gender plays a significant role in shaping respondents' perceptions of the environmental aspects associated with coal-fired power plant activities. Moreover, there are no significant differences in the level of perceived effects of health and socio-economic variables based on respondents' gender, with a p-value of .005 and .062. Hence, the decision to accept the null hypothesis implies that there is no difference between gender and the two variables in terms of how they are affected by coal-fired power plant activities.

This can be attributed to the significant difference in the respondents' perception of the effects of the activities of coal-fired power plants, which lies in their gap in gender. Those male respondents were said to have felt the perceived effects of coal-fired power plants in terms of the environment. When the researchers conducted this research, they interviewed fishermen, farmers, construction workers, and tricycle drivers, and some were used to be workers of the power plant because they were available and outside their homes at that time. On the contrary, female respondents are said to have felt less about the perceived effects of the power plant as they stayed more often inside their homes to do their chores.

Table 13
Significant differences in the level of perceived effects and respondents' Years of residency

Perceived Effects of Coal-fired power plant	ANOVA/T- test	P-value	Interpretation
Health	9.695	.001	Significant
Environment	11.042	.001	Significant
Socio-economic	3.276	.062	Not Significant

Table 13, shown on the succeeding page, shows the significant differences in the level of perceived effects and years of residency. Variables of health and environment show significant differences with a p-value of .001; hence, the decision to reject the null hypothesis means that years of residency affect the perception of the respondents in terms of coal-fired activities.

On the other hand, socio-economic variables are not significant; thus, accepting the hypothesis means that years of residency do not affect the respondents' perceptions the coal-fired activities. This implies that the significant difference in respondents' perceptions of the effects of the activities of coal-fired power plants lies in their years of residency. Those respondents residing for 1–5 years do not feel the impact yet, while those respondents residing 50 and above are more aware of the effects of the coal power plant because they were there even before the power plant was constructed in the area.According to Kravchenko et. al.,(2018), burning coal produces coal ash, which is dumped in landfills and slurry ponds, many of which are close to residential areas. This indicates a high danger of environmental pollution and rising health concerns. He reported that those who have lived close to coal-fired plants for more than 30 years are more likely to have health issues because they are subjected to more harmful substances from the operation every time coal is burned, which produces coal ash.

Table 14
Significant differences in the level of perceived effects and respondents' Household income

Perceived Effects of Coal-fired power plant	ANOVA/T- test	P-value	Interpretation
Health	2.535	.058	Not Significant
Environment	3.096	.059	Not Significant
Socio-economic	8.005	.001	Significant

Table 14, as shown on the succeeding page is the significant differences in the level of perceived effects and respondents' household income. Socio-economic variables differ significantly, with a p-value of .001. Hence, the decision to reject the null hypothesis means that household income affects respondents' perception of coal-fired activities. Researchers presumed that the significant difference in the respondents' perception of the effects of the activities of coal-fired power plants lies in their household income. Those respondents with an income of less than 10,000 a month have felt the perceived effects of coal-fired power plants in terms of socio-economic as those people are said to have a boost and increase in their living standards. The respondents that the researchers interviewed who have less than 10,000 a month are mostly sari-sari store vendors, and according to them, they benefit from the power plant as employees or workers. According to them, they benefit from the power plant as the employees or workers often buy from their stores. On the contrary, there are differences in the respondents' perception who have a monthly income of 50,000 - 59,999 that don't benefit from the activities of the power plants. Some have a family member who works abroad and has their own business to help them support their daily needs. On the contrary, health and environment variables with a p-value of.058 and.059 resulted in not significance in household income. Thus, the decision to accept the null hypothesis implies that household income does not affect the perception of the respondents associated with coal-fired activities Income and energy consumption are tightly correlated on every continent and across every period, as coal-fired power plants are a vital source of jobs that create positive ripple effects throughout society and our economy.

Proposed Action Plan to Improve the Living Standard in a Selected Municipality in Quezon Province

General Objectives: to act upon the perceived effects of a Coal-fired Power Plant when it comes to the living standards of those residents living near the operation. It is to properly address and have a movement on how to properly manage the effects of the Coal-fired Power Plant.

Component 1: Public Education and Awareness: Develop educational materials and workshops to inform the public about the effects of coal-fired power plants on air and water pollution. And Organize community events and town hall meetings to raise awareness about the health effects of pollution.

Component 2: Health Impact Assessment: Conduct a comprehensive health impact assessment to identify potential health risks associated with coal-fired power plant emissions. Identify vulnerable populations, such as children, the elderly, and those with pre-existing medical conditions. Develop strategies for mitigating health effects, such as air quality alerts and public health advisories.

Component 3: Community Engagement and Participation Establish a community advisory board to engage local residents in decision-making processes related to the power plant's operations, health, and environmental effects. And Conduct public meetings and surveys to gather feedback on health and environmental concerns and suggestions for improvement.

Table 15
Proposed Action Plan to Improve the Living Standard in a Selected Municipality in Quezon Province

Issues and Concerns	Objectives	Activities	Persons Involved
Public Education and Awareness	To educate the public about the potential health and environmental risks associated with the coal-fired power plant, including air pollution, water pollution, and climate change.	Community Events: Organize community events, such as town hall meetings, health fairs, or environmental festivals, to educate the public about the risks associated with coal-fired power plants.	Rural Health Unit: Evaluate the potential health effects of pollutants released by the power plant. Local Government Officials: Work with community health experts to develop strategies for mitigating the health effects of the power plant.
	To encourage active participation from local residents, community leaders, and stakeholders in decision-making processes related to the plant's operations and environmental effects	Conduct meetings, seminars, or webinars: This can lead to a more comprehensive understanding of the issues and potential solutions. Meetings and webinars can facilitate public engagement with the topic of coal-fired power plants. This encourages individuals to participate in decision-making processes and advocate for their concerns.	Quezon Power Plant: Responsible for operating the power plant, maintaining equipment, and ensuring compliance with regulations. Local Government Officials: Work with community health experts to develop strategies for mitigating the health effects of the power plant.
Health Impact Assessment	To assess the potential health risks associated with air pollution from the coal-fired power plant, including respiratory problems and cardiovascular diseases.	Population-Based Analysis: Estimate the number of people affected by the perceived effects of the power plant, including respiratory, cardiovascular disease, and other health outcomes.	Rural Health Unit: Local health organizations, such as hospitals and community clinics, provide medical care to residents affected.
	To identify vulnerable populations, such as children, older adults, and individuals with pre-existing medical conditions, who may be disproportionately affected by	Community Outreach: Engage with community groups, schools, and healthcare providers to raise awareness about health impacts and promote mitigation measures.	Rural Health Unit: Local health organizations, such as hospitals and community clinics, provide medical care to residents affected

	the plant's emissions.		
Community Engagement and Participation	To collaborate with government agencies to develop and implement effective regulatory frameworks that ensure sustainable operations of the coal-fired power plant.	Public Meetings and Open Houses: Hold regular public meetings and open houses to provide information about the power plant's operations, emissions, and environmental impact.	Local Residents: Ensures that local residents have a say in the decisions that affect their community, leading to more effective and relevant community development initiatives.
	To conspire with local healthcare providers and community organizations to promote healthy living practices and support initiatives that address environmental health concerns.	Joint Community Outreach: Establish a community outreach program to ensure that information is shared regularly with the public about the power plant's activities and any changes or updates.	Local Government Officials: Organizing community events and activities to raise awareness about the perceived effects of the power plant.

4. Conclusion and recommendation

Based on the findings in the demographic profile, most of the respondents are male, ages 41–60, and have been residents of the area for more than 40 years. In contrast, the majority of respondents have household incomes of less than ten thousand, as their work is mainly for farmers, fishermen, construction workers, tricycle drivers, and street vendors who only earn below the minimum wage. In terms of the health problems of the respondents, it was revealed that most of them experienced respiratory diseases such as cough, cold, and sneezing. With regard to heart disease, the majority of the respondents specified that they experienced high blood pressure. On the other hand, in skin disease, most respondents do not experience any of the listed skin diseases. In addition, in the perceived effects of coal-fired power plants activities on health and the environment are considered to have a high effect. Meanwhile, the perceived effects of coal-fired power plants on socioeconomic variables resulted to have a very high effect. Furthermore, in the level of perceived effects of coal-fired power plant activities as to respondents' age have dissimilar perception in terms of health and environment variables, while there is commonality in socio-economic variable. Moreover, it was identified that there is significant difference between perceived effects of coal-fired power plant and respondents' gender in terms of environment, implying that respondents' perceptions vary. Conversely, no significant difference found in the level of perceived effects and respondents' gender as to health and socio-economic which means that respondents have the same perception. Iit was also highlighted that there is significant difference in respondents' years of residency in terms of health and environment, implying that respondents' perception differ. Meanwhile, there is no significant difference in socio-economic status in terms of years of residency, revealing that respondents have similar insights. Lastly, it was shown that there are no significant differences between perceived effects of coal-fired power plant and household income, indicating, that respondents have the same perception. While there is significant difference in socio-economic in terms of household income, implying variations in respondents perception.

Based on the overall findings and conclusion of the Study, the following recommendations are hereby endorsed by the researchers: The Department of Health may thoroughly assess the effect of the coal-fired power plant's dust on the community's respiratory health and may conduct necessary interventions. The Department of Environment and Natural Resources, through the Environmental Management Bureau (EMB), may assess and evaluate the promulgated rules and regulations following the Philippine Clean Air Act of 1999 set forth for the said institution on the quality of air to help enforce protection of public health from the adverse effects of air pollution, such as respiratory diseases and other health issues associated with pollutants emitted by coal-fired power plants. The Department of Environment and Natural Resources and the Department of Agriculture may create a joint task force to create a monitoring team that will test water pollution at the fishing areas and examines the condition of crop production.

5. References

Amster, E., & Levy, C. L. (2019b). Impact of Coal-fired Power Plant Emissions on Children's Health: A Systematic Review of the Epidemiological Literature. *International Journal of Environmental Research and Public Health, 16(11).* https://doi.org/10.3390/ijerph16112008

Brunet, C., Savadogo, O., Baptiste, P., Bouchard, M. A., Cholez, C., Rosei, F., Gendron, C., Sinclair-Desgagné, B., & Merveille, N. (2022b). Does solar energy reduce poverty or increase energy security? A comparative analysis of sustainability impacts of on-grid power plants in Burkina Faso, Madagascar, Morocco, Rwanda, Senegal and South Africa. Energy Research & Social Science, 87, 102212. https://doi.org/10.1016/j.erss.2021.102212

Kravchenko, J., & Lyerly, H. K. (2018b). The Impact of Coal-Powered Electrical Plants and Coal Ash Impoundments on the Health of Residential Communities. *North Carolina Medical Journal, 79(5), 289–300.* https://doi.org/10.18043/ncm.79.5.289

Li, R., Wu, H., Ding, J., Fu, W., Gan, L., & Li, Y. (2017). Mercury pollution in vegetables, grains and soils from areas surrounding coal-fired power plants. Scientific Reports, 7(1). https://doi.org/10.1038/srep46545

U.S. Environmental Protection Agency. 2018. National Emission Inventory (NEI) report 2014.

Watanabe et al. (2017). Worsening of respiratory symptoms and lung function in asthmatic patients living near a coal-fired power plant: A longitudinal study. *Journal of Occupational and Environmental Medicine, 59(9), 913-919.*