European Journal of Engineering & Environmental Sciences

RESEARCH ARTICLE

Assessing the Impact of Fossil Fuel Emission on Quality of Life and Health of Individuals Living in Delta State Nigeria

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ABSTRACT

The study examined the impact of fossil fuel emissions on the quality of life and health of individuals in South-South Nigeria. The specific objectives sought to; Identify sources of fossil fuel emissions, analyze the cost-benefit implication of fossil fuel emissions, identify factors that are responsible for the frequent usage of fossil fuel, Identification of alternative energy sources, and Remediation of the impact of fossil fuel emissions in south-south Nigeria. A survey design was adopted for the study. A primary source of data was adopted for the study. A questionnaire and interview were used to collect data for the study. The Population is 4,112,445 people. The Sample sizes were determined using Yamane (1973) a standard statistical formula. The total sample size is 399. The data were analyzed using analysis of Variance (ANOVA). The result revealed that Fossil fuel emissions are bad and their impacts on the quality of human being lives are dangerous, also impact on the health of living organism are deadly. Fossil fuel emissions have an unhealthy impact on the environment, such as Air and Water pollution which causes acid rain, eutrophication (food nutrient oxygen deficiency that causes harms and genetic mutilations) which harms the ecosystem by covering oxygen levels and damage to crops, forest, and wildlife. We concluded that fossil fuel emission causes some harmful ailments like cancer and respiratory tract infections diseases. We recommended among others that government agencies should sensitize rural individuals to the dangers of fossil fuel emission.

Keywords: *Fossil Fue Emission, Air and Water Pollution; Life and Health of Individuals; South-South Nigeria*

Introduction

Fossil Fuel is a class of hydrocarbon-containing materials of biological origin which occur under the crust over many years under a very high temperature of over 6000oc. Water and Air pollution has increased the increase in the use of fossil fuels in the world, especially in the Niger Delta, Nigeria. The major problem with fossil fuel emissions is greenhouse gas (GHGs) emission that brings climate change through the Ozone layers. The GHGs—N2O, carbon dioxide (CO2) and methane (CH4) have increased by 20%, 40%, and 150% respectively above pre-industrial level. In the 1880s (during the industrial revolution), the atmospheric concentration of CO2 was about 280 parts per million (ppm). In 2015 and 2016, it was 399 and 403.9 ppm respectively, representing a 30% increase above the pre-industrial level. Emissions from the combustion of fossil fuels account for 65% of global atmospheric CO2 emissions. Two-thirds of global GHG emissions come from energy either in production or consumption. Between 1880 and 2012, the globe experienced an increase in temperature of about 0.85 ℃. Presently, there are increased variations in temperatures and severe weather (Climate change), resulting in hot days across most regions of the globe. Relative to industrial levels, a temperature increase of 1.5 ℃–4.8 ℃ is estimated to be experienced by the year 2100 (Deublein and Steinhauser 2008).

Streimikiene (2015} analyzes the scenario of the environment in a country is of high quality, human beings will live longer, and enjoy a life of improved quality, and hence sustainable development. Over the past couple of years, the quality of the environment in many countries of the world has been gradually receiving increasing attention on account of the awareness of the adverse implications of a degenerated environment that results from industrialization and energy sources of fossil fuels. Poor environmental quality results on account of various factors

Citation: Atilola, A. S. and Chime, T. (2023). Assessing the Impact of Fossil Fuel Emission on Quality of Life and Health of Individuals Living in Delta State Nigeria. *European Journal of Engineering and Environmental Sciences, 7(3), 1-11. DOI: https://doi.org/10.5281/zenodo.8229452*

such as fossil fuel emissions, carbon emissions from factories and vehicle exhausts, oil spills, deforestation, greenhouse gas emissions, Soil degradation, and so on. Blomquist, and Cave, (2008) talk about the adverse consequences of the fossil fuel emissions of private and public action of energy sources in society which contributes to a poor quality environment.

In addition, poor access to clean water, sanitation, electricity, and a clean source of fuel are basic characteristics and causes of life degradation in rural areas. In 2012 premature deaths in Africa were attributable to exposure to ambient air pollution of PM2.5 from fossil fuels, mostly from power generation and road transport in Delta State Nigeria. Meagan and Ekundayo (2015) on combustion of fossil fuels emissions by power plants and vehicles release large quantities of nitrogen oxides (N2O), sulfur dioxide (SO2), and primary particles comprising organic aerosol (OA) and black carbon (BC). Vehicles were also a large source of non-methane volatile organic compounds (NMVOCs) (Orisakwe, 2019). The state of the environment per time has a significant impact on the biotic and of the environment, thus essential for health and human living. The World health report indicated that globally, 23 percent of adults and 26 percent of children deaths every year are due to environmental factors (Thurtle, et al.2014). Also, 85 out of 102 diseases and injuries are caused by environmental pollution (WHO,2020). According to the World Health Organization (WHO), the interactions between humans and the environment affect the quality of life, health, and life span. Making the environment healthier can prevent about 13 million deaths yearly and 13%–37% of the world's diseases. The high-quality environment prevents 40% of deaths from malaria, 41% of deaths from lower respiratory infections, and 94% of deaths from diarrheal disease (WHO, 2020).

Statement of the Problem

It has been estimated that about 70% of Delta State Nigerian households living uses fossil fuels (crude oil, kerosene, and Cooking Gas), and many of the factories use Crude oil, Diesel, and Gas.

Fossil fuel separations such as crude oil cracking by fractional distillations or illegal combustions generate natural gas (Methane -Propane) and petroleum products. These derivatives are for heating and cooking in the Delta State of Nigeria. The emissions include Carbon-dioxide Co_2, Methane CH_4, and Nitrous oxide N_2O. The impact of fossil fuel emissions on the environment when GhGs have been released into the atmosphere, contributes to the formation of smog and acid rain, for example, the release of nitrogen oxide into the air brings nitrogen-related compounds emitted into the air and water which is poisonous to human quality of life and health. Air pollution from burning fossil fuels can cause health issues, sicknesses, and diseases including asthma, heart disease, cancer, and premature death. Combusting the additives found in kerosene, gasoline such as benzene, toluene, ethylbenzene, and xylene causes cancer and ultrafine particles and aromatic hydrocarbon which is unhealthy and hazardous. Recently, there is evidence of black carbon soot in Delta State (Niger Delta area) Nigeria, arising from an illegal refinery at the creek because of incomplete combustions of fossil Oil, there is a need for cleaner energy to reduce Green House Gases for ozone layers improvement in the world.

Aims and Objectives

This study aims to assess the impact of fossil fuel emissions on the quality of life and health of individuals in South-South Nigeria.

This aim will be achieved through the following objectives set:

1. Identify sources of fossil fuel emissions in Delta State (Niger Delta area) Nigeria.
2. analyze the cost-benefit implication of fossil fuel emissions and use in Delta State Nigeria.
3. identify factors that are responsible for the frequent usage of fossil fuel in Delta State (Niger Delta area) Nigeria.
4. Identification of alternative energy sources and remediation of the impact of fossil fuel emissions in south-south Nigeria.

Research Questions

1. What are the sources of fossil fuel in Delta State (Niger Delta areas) Nigeria?
2. What is the cost-benefit implication of various fossil fuel sources and uses? In terms of availability, assessment, and cost for the people in Delta State.
3. Factors that encourage illegal fossil fuel sources in terms of cost of products in the study area.
4. What are the factors constraining the adoption of cleaner energy like natural gas in Delta State Nigeria?

Review of Related Literature

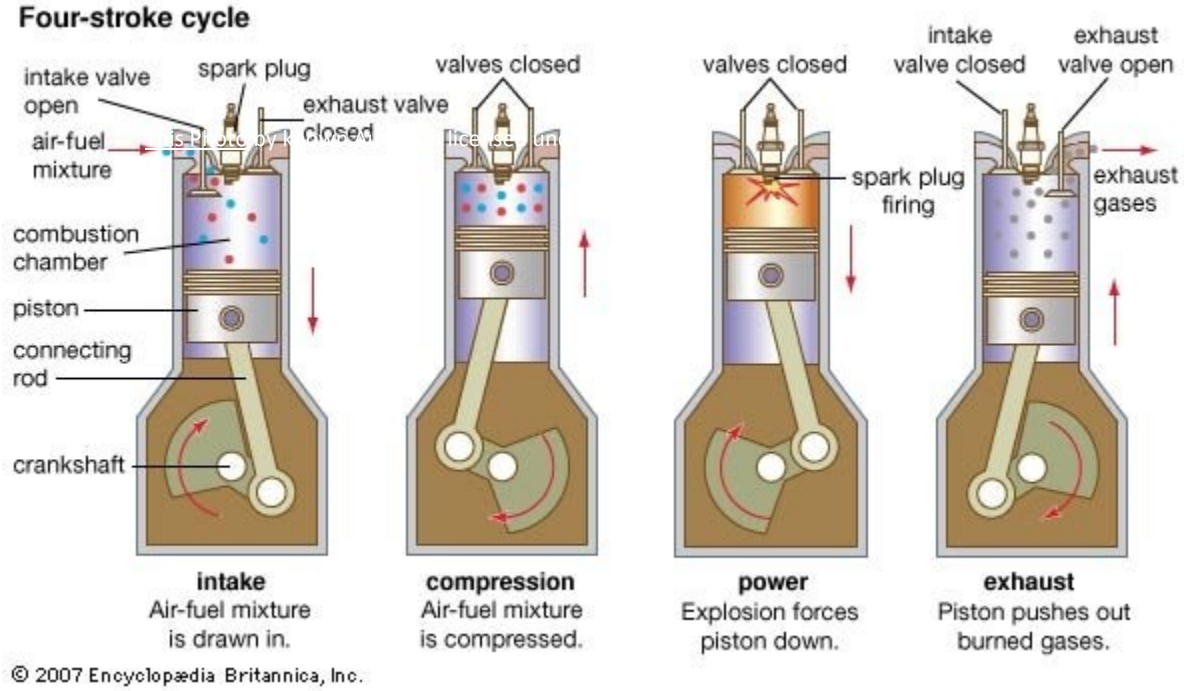
Conceptual Review

Fossil Fuels

Fossil fuels are made from the decomposition of plants and animals. These fuels are found in the earth's crust and contain carbon and hydrogen, which can be burned for energy in Industries and homes. Coals, Oil, Crude oil (petroleum) derivatives, and Natural gas are all examples of fossil fuels. Fossil fuel emissions are bad and their impacts on the quality of human being living are dangerous, also impact on the health of living organism are deadly. Fossil fuel emissions have an unhealthy impact on the environment, such as Air and Water pollution which causes acid rain, eutrophication (food nutrient oxygen deficiency that causes harm and genetic mutilations) which harms the ecosystem by covering oxygen levels and damage to crops, forest, and wildlife. The fossil fuel emissions solution in water which causes water pollution are mostly from industries and manufacturing Companies. The concepts to be considered in this study are Water and Air pollution by fossil fuel emissions hazardous impacts and environmental risks in Delta State Nigeria, Pipeline vandalization, and cost-benefit analysis of various fossil fuel sources in Delta State Nigeria**.**

The deterioration of the environment that led to poor quality of life and health standard degeneration in the Niger Delta area shall also be discussed. WHO identified some environmental factors affecting human health, arising from polluted air, poor sanitation, polluted water, and unhealthy domestic waste disposal which increase GHGs and eventually lead to global environmental change. This effect of fossil fuel emissions is identified with acute respiratory infections, diarrheal diseases, malaria, other vector-borne diseases, injuries and poisoning, mental health conditions, cardiovascular diseases, cancer, and other infections (WHO, 2003).

A Typical Fossil Fuel Product (PMS) Combustion



Fossil fuels emissions effects on ecosystem pollution as follows and potential defects on individual quality of life and health in Delta State Nigeria: Fossil fuels emissions effects on ecosystem pollution as follows and potential defects on individual quality of life and health in Delta State Nigeria:

Air Pollution

Air pollution is the discharge of any harmful substance into the air, which can cause health problems and eventually major health issues. Fossil fuel combustion and emissions cause particulates that bring pollution into the air and result in burning eyes and nose, itchy irritated throat, and breathing problems which result significantly in health problems such as chronic respiratory diseases or mortality (Cerbu, et al., 2019). Air pollution arising from domestic

fossil fuel emissions particulate causes the disintegration of the lithography of ozone layers and led to layer degradation and depletion. It is mainly categorized into two based on exposure: ambient pollution in outdoor exposure and indoor pollution. In Delta State Nigeria, air pollution impact is associated with different health risks such as cardiovascular diseases, respiratory infections, tuberculosis, lower respiratory infections, chronic obstructive pulmonary disease (COPD), chronic respiratory diseases, ischemic heart disease, stroke, communicable, maternal, neonatal, and nutritional diseases. Nigeria is ranked among the world's first five and the largest country in Africa, with the top-most level of premature death associated with air pollution (IHME 2020).

Globally, air pollution is estimated to cause about 29% of lung cancer deaths, 43% of COPD (chronic obstructive pulmonary disease) deaths, 25% of ischemic heart disease deaths, and 24% of stroke deaths (WHO 2018) particulate matter from fossil fuel polluting environmental air, reduces ozone layers and releases Co2, SO2, and NO2 directly into the atmosphere, this causes several respiratory problems, such as bronchitis, emphysema asthma, (Mabahwi Leh, Omar 2019) heart failure hospitalizations, and mortality (Shah, et al,2013). According to Ika and Bomadi LGA general hospital in 2005 death record cited 35 deaths out of 75 as respiratory infections diseases like tuberculosis, lower respiratory infections, and other related air pollution diseases. Marais, et al,2014 observed ambient particulate matter pollution with significant soot associated with Delta state. Outside air pollution, the study showed an increase in the environmental air pollution level in Delta State Nigeria (FEPA 2009) from illegal refining activities, industries, automobile exhaust, electrical generating plant exhaust at homes and business centers, exhausts from internal combustion engines, and particulates from milling activities, cement production, and quarrying sites. Nigeria in general is the mass importation of second-hand motor vehicles and automobiles, which FEPA cut to not be used for more than 10 years but Nigerians yet operating.

Automobiles and engines that exceed 30 years, old vehicles are still found on the road usually tagged 'smoking' vehicles due to the thick exhaust emissions visible. Second-hand used cars usually with high gaseous emissions due to incomplete combustion of oil and fuel impurities that could be hazardous to public health. Motorcycles and tricycles are also classified into these categories. (Akinlo,2009) Activities such as crude oil exploration, refining, and gas flaring are predominant in the Delta State of Nigeria. The use of petrol or diesel generators as a source of electricity for both residents and industries due to the lack of stable electric power has a large impact on environmental pollution. Clean dry air consists primarily of nitrogen and Oxygen- 78% and 21% by volume, the remaining 1% is a mixture of other gases mostly argon 0.9% with traces of methane, helium, and water.

$M\ (mixture) = x_i M_I + \ldots\ldots x_n M_n$ ---------- *(A)*
Where $x_{i\,=}$ *mole fraction of each gas* ---------- *(B)*
M_i *=molar mass of each gas* ---------- *(C)*

Household Air Pollution
More than 80% of air pollution is generated through fossil fuel burning in the Delta State area of Nigeria (Greig, *et al 2018)*. Studies have shown that 76% of the global particulate matter in air pollution are emissions from fossil fuels which often exceed 2000µg/m^3. For instance, in Nigeria, over 70% of the population uses fossil fuels (Cairncross,19920).

Water Pollution
Many times, GHGs and particulates are soluble in water sources such as rivers, wells, and underground waters. The sources of this pollution are always emissions of fossil fuels gases during burning and engine combustions. Unsafe water, pollution, poor sanitation, and hygiene led to the annual death of about 1.7 million people (WHO,2018). Over 70 thousand children under the age of 5 die due to water-borne diseases. Polluted water, poor sanitation, and hand washing have been associated with enteric infections like diarrheal diseases, water-communicable diseases, and neonatal, and nutritional diseases. Crude oil pipeline vandalization is another cause of water pollution in Delta State.

Fossil Fuel Composition
Fossil fuels are made from the decomposition of plants and animals. These fuels are found in the earth's crust and contain carbon and hydrogen, which can be burnt for energy in Industries and homes. Coals, Oil, Crude oil (petroleum) derivatives, and natural gas are all examples of fossil fuels. Fossil fuel emissions are bad and their impacts on the quality of human being living are dangerous, also impacts on the health of living organisms are deadly. The distillation process of fossil fuel (see Fig.2) clearly shows greenhouse gas emissions which are dangerous to the Atmosphere. The emissions have unhealthy impacts on the environment, such as Air and Water pollution which causes acid rain, eutrophication (food nutrient oxygen deficiency that causes harm and genetic mutilations)

which harms the ecosystem by covering oxygen levels (Climate change), and damages to crops, forest/ wildlife. GhGs emissions solution in water causes water pollution mostly from industries and manufacturing Companies.

Oil Exploration

Delta State, Nigeria rapidly turned to oil exploration and factories environments with fossil fuels as sources of residents' domestic energy sources. Also, Delta States' fast population growth has caused environmental-related problems that arise from domestics' fossil fuels cooking energy source. Note also rapid growth in population and progression forecasted by the National Population Commission and published by the Bureau Standard of Statistics quoted that Delta State has in 2012 – 4,112,445 human population and forecast of 5,663,362 human population by 2022.

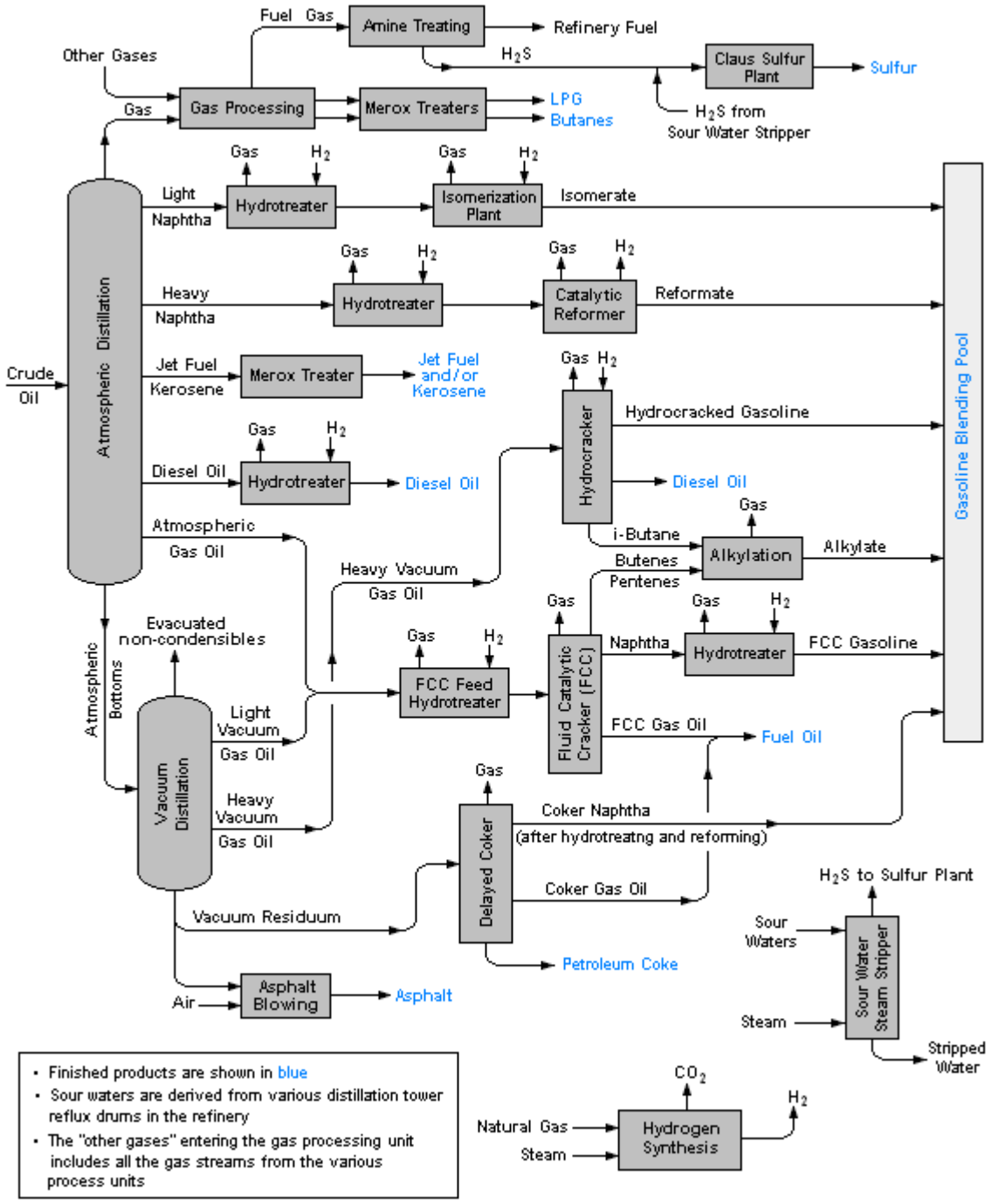
A Typical Crude Oil Emission in Burutu LGA, Delta State, Nigeria

Some sources of fossil fuel include petroleum (34%), coal (27%), and natural gas (24%), amounting to 85% forming the primary source of energy in the world. Other includes energies are included Coal, Biomass, nuclear (4.4%), hydroelectric (6.8%), and renewable energy sources 4.0%, such as geothermal, solar, tidal, wind, wood, and waste (Wikipedia https/en.Wikipedia/fossil-fuel/cite-note5). However, there have been some environmental issues noted in the south–south region of Nigeria, such as Carbon black soothe in Air, Water, and environs currently, which can be traced to the indiscriminate usage of in the use of fossil fuel (Crude oil) as a domestic source of energy in this region, also activities such as illegal cooking/ separation of crude (Creek Diesel and kerosene). There are moves within government agencies (FEPA, DPR, and NOSDRA) and State Government to eliminate these illegal activities.

Wikipedia https/en.m.wikipedia.org.wki

A Typical Hydrocarbon Refinery, Saint Quantine, France

A Typical Green House Gases (Ghgs) Emission Activities By Fossil Fuel (Fig.2)



Economic of Fossil Fuel Organic Materials

Economic development of fossil fuel Petroleum products such as Kerosene, PMS, Diesel, Tar, Bitumen, and natural gas are:

I. Provisions of cleaner energy than coal and firewood.
II. Retail sales of kerosene improve financial income.
III. Tar and Bitumen for building materials production.
IV. Provisions of labor and employment.
V. Industrial and manufacturing companies development.

Sources of Energy in Delta State Nigeria

Sources of energy in Delta State vary. The sources can be classified into Natural (Charcoal, Firewood), Fossil (Petroleum), and Renewable (Hydro, Wind, Nuclear, Solar, Biomass) sources. This study shall be focused on Fossil/petroleum fuel emissions. Ali and Richard (2013) analyzed of usage of different fuel types among industries and households in Nigeria, and it was revealed that natural gas serves as modern energy for fuel than kerosene and Diesel. Similarly, solar energy is the least popular form of energy in Nigeria. Babanyara and Saleh (2010) have identified that kerosene constitutes the main source of fuel in Delta State and few people use LPG. This work shall be concluded on the identification of various Types of fuel (Energy source), Accessibility, Availability, and average income in Delta State. It is also noted during the cause of this study that firewood is still one of the prominent sources of cooking fuel in Delta State, Zaku et al (2013) examined that Firewood fuel is yet used in Nigeria's rural Areas. This is due to the high level of poverty, the cost of fossil fuel, and inadequate electricity supply.

Cost- Benefit of Fossil Fuel products over other available fuels in Delta State Nigeria

Fossil fuel production can only be achieved through crude oil distillation generally refers to as Refinery. The derivatives can be used for energy sources in homes and industries. Also, as by-products like methane in the fertilizer industry.

Benefits of Fossil Fuel Emissions over Firewood

A. Benefits for the Environment: -

I. Reduces emission of greenhouse gases (GHG).
II. Reduces nitrogen leaching into ground and surface waters.
III. Reduces odor by 80%.
IV. Reduces deforestation by providing a renewable alternative to wood fuel and charcoal.

B. Benefits to the economy:

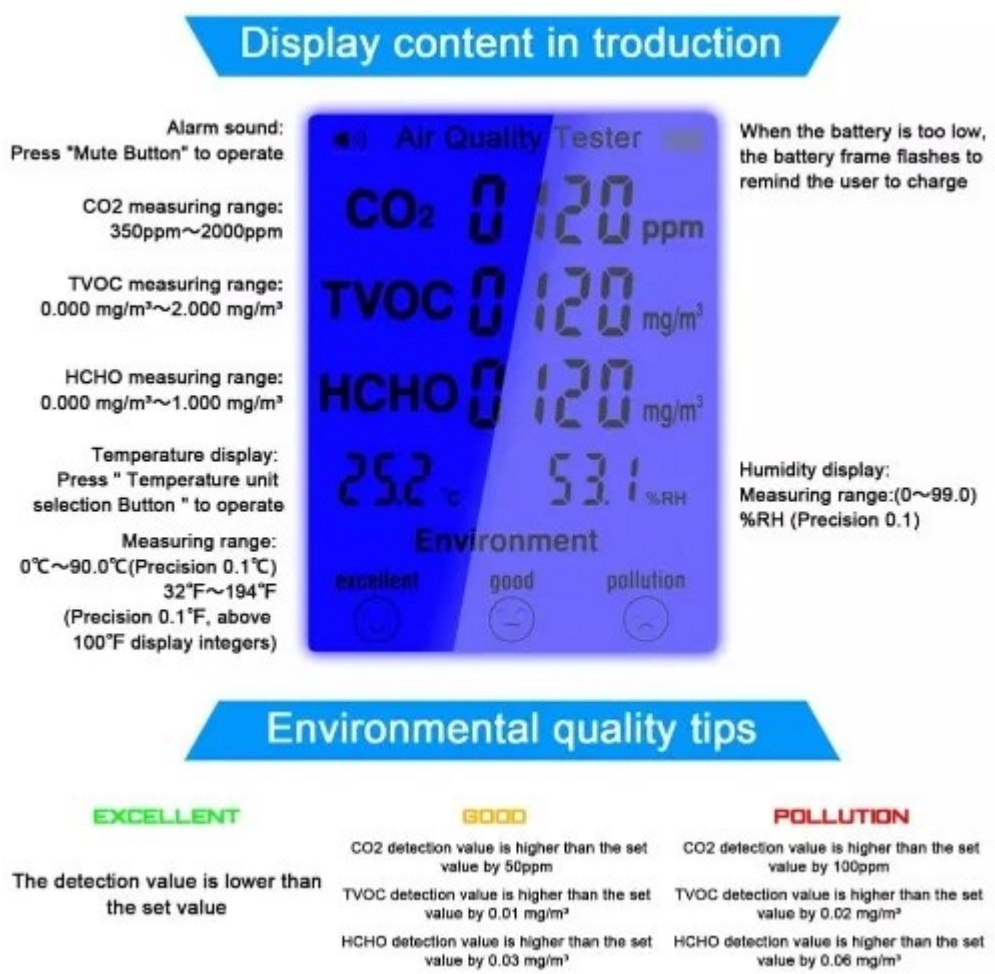
I. Provides cheaper energy and fertilizer.
II. Provides additional income to farmers.
III. Creates job opportunities.
IV. Decentralizes energy generation and environmental protection.
V. The tonnage of human excreta generated was calculated using 1.093 × 10-3 tons/ind

Materia and Methods

A survey design was adopted for the study. The Study Design was based on primary data gathering through a questionnaire survey, interview, and checklist by selecting homes in Ten (10) Local government Areas, in Delta State Nigeria. In-person contact and presence in the Areas of study, that is the 10 LGAs selected out of a total of 19 LGAs in Delta State Nigeria-Bomadi, Ethiope East, Ika North, Ika South, Burutu, Sapele, Ugheli, Oshimili North, Okpe and Udu, this Areas in Delta State Nigeria is in Mangrove Vegetation. Delta State is one of the South-South geopolitical zones of Nigeria, it was formed from the former Bendel State on August 27, 1991. Bordered on the north by Edo State, East by Anambra State and River State, South by Bayelsa State, and west by the coastline Bight of Benin, with Asaba as State Capital with a Landmass f 17,698km^2, estimated population of 5,828,163 people it by it the end of 2022, the economic value of Delta State ranges from Crude oil and gas production and agricultural occupation such as fishing, palm oil, and Yam production. Purposive and systematic random sampling will be used in the selection of households to administer the questionnaire. A purposive sample is useful in selecting a sample for a peculiar reason. Firstly, the purposive sample will be used to select ten (10) local Government areas (Ika North, Ika South, Ethiope East, Ugheli, boma, Okpe Oshimilli, Udu, Sapele, and Burutu). The selections of these L.G. As were based on the predominance of Petroleum, natural gas, coal, and fuel natural gas use in these local government areas than others. Secondly, a systematic sampling technique will be employed to select samples of households from the ten L.G.As. A systematic sampling technique gives equal opportunity to any household within the selected L.G.As. Three house intervals will be used to select households to administer the questionnaire.

Instrument of Data Collection (Explosimeter and Environmental Chromatography)

Air Quality Analyzer



Air Quality Interpreter

Note:

Methods/ Techniques employed for data collection in this research include a questionnaire survey, observation, interview, photo camera, and sound recorder.

Data Presentation

Homes Sample sizes were determined by Yamane (1973) a standard statistical formula**:**

$$S = \frac{N}{1+N(ME)^2}$$ where S = sample size N = population ME = margin of error allowed (0.05).

We shall be considering Delta State which has a Population of 4,112,445 people.

N= 4,112,445

Going by Yamane standard statistical formulae = $4,112,445/1+4,112,445(0.05)^2$

= 4,114,445/1+4,112,445(0.0025)

=399.142 ≈ 399

Therefore, a total of 399 homes as samples were selected from the Delta States. The questionnaire was distributed across 10 LGA of Delta States based on their population size and the willingness of the Residents to answer the questions.

Data collection summary

Table 1: Questionnaire Administration for sample size field survey, Mar-June 2022

S/	*Selected LGA*	*Population Size (Homes)*	*No. Questionnaires Administered*	*Sample Responded from Homes*	*%Sample Responded (Home)*	*Kerosene*	*Gas*	*Coal*	*Firewood*
1	Ika south	116	20	29	94	15	2	7	5
2	Burutu	145	22	21	96	16	2	2	1
3	Sapele	567	30	30	100	24	2	3	1
4	Ugheli	889	56	49	88	32	5	7	5
5	Oshimilli North	895	52	47	90	36	4	5	2
6	Okpe	234	40	38	95	28	4	4	2
7	Udu	890	50	45	90	37	3	3	2
8	Bomadi	678	59	46	78	32	6	5	3
9	Ethiope	102	20	20	100	13	2	3	2
10	Ika North	122	30	29	97	17	3	6	3
Total				354		250	33	45	26

Data Analysis

The data collected was analyzed based on the objectives as follows:

I. Sources of cooking energy were presented in frequency as collected from the survey. Analysis of Variance (ANOVA) was used to determine their significance and the difference in the mean distribution was presented, this is the most used cooking energy source in Delta State (Kerosene).

II. analyze the cost-benefit implication of the source of fuel which necessitates the most frequent use of fuel.

III. Source of frequently used fuels as in Table 1, denotes the reason for constant carbon emissions of fossil fuel and dangers attributed to environmental, social-cultural, and economic in the rural areas among the ten selected Local Government Areas of Delta State, Nigeria. In conclusion, ten LGAs in Delta State use various fuels in their homes, survey depicted 250 out of 354 homes use Kerosene, 33 out of 354 homes use Gas, 45 out of 354 use Coal, 26 out of 354 homes use firewood according to Table 1 questionnaires feedback.

The percentage of sources of various fuels summarized kerosene as the most used source of fuel for domestic energy sources.

Domestic energy source from Table 1:

70.62% Kerosene**,** 9.32% Gas, 12.72% Coal, and 7.35% Firewood.

Above depicted that kerosene is one of the fossil fuel derivatives contributes the highest emissions that affects the quality of life and health of individuals in Delta state.

Conclusion

Fossil fuel emissions are generated from industrial air pollution, smoke, emission of carbon IV oxide, oil spillage, burning of plastic materials, Nitrogenous gas, and other hydrocarbon products. This emission could result in or cause some harmful ailments like cancer and respiratory tract infections diseases. Meanwhile, there is a need for government to improve the living standard of individuals by providing alternative cooking energy such as steady electricity and Natural gas in rural areas which would go a long way to mitigate the effect of fossil fuel emissions in rural areas. Incessant deforestation and indiscriminate burning of plastic products and other aromatic hydrocarbon materials should be discouraged. Impact of Fossil fuel emissions mitigation is needed to cut off health dangers, discouraging the use of fossil fuel may affect the social and economic development of some hydrocarbon developing nations, but the impact of the emissions on the quality of life and health is dangerous.

Recommendation

Based on the research findings, the following recommendation were made.

i. The relevant government agency should sensitize rural individuals to the dangers of fossil fuel emission

ii. There is a need to reduce the burning of plastic materials which generate bad smoke in the environment.

iii. State Environmental Protection Agency should enforce laws that could hinder the indiscriminate throwing of waste in areas that are not proper.

iv. Environmental degradation, environmental pollution, and deforestation should be discouraged by the relevant authorities Also there is a need for a regular health check on the individual for rapid treatment in case of ailment development because of fossil fuel, emissions.

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