

## IRREGULAR POWER SUPPLY FROM NEPA AS A PROMOTER OF AIR AND NOISE POLLUTION BY GENERATING PLANTS: AN IMPLICATION TO THE SCHOOL ENVIRONMENT

By

Felicia A. ORIH, Ph.D  
Department of Education Foundation  
Imo State College of Education, Ihitte Uboma

And

ELEZUO, Gladys Chinyere, Ph.D  
Department of Education Foundation  
Imo State College of Education, Ihitte Uboma

### ABSTRACT

*Irregular power supplies and noise pollution pose significant challenges in the school environment, affecting both students and teachers. The lack of a stable power supply can disrupt classroom activities, hamper the use of electronic devices, and hinder teaching and learning processes. The study aimed to analyze irregular power supply from Nepa as a promoter of air and noise pollution by generating plants: an implication to the school environment. Irregular power supplies in school environments have a direct connection to air pollution, posing numerous challenges. The inadequate and inconsistent availability of electricity leads to an increased reliance on backup power sources like diesel generators, which contribute significantly to air pollution. The study concludes that power supply challenges in the nation, which seem not to be ameliorating, have encouraged the acquisition and utilization of generators in all sectors of the nation's economy. The noise emitting from these generators adversely affects both humans and the environment. Irregular power supply from NEPA and the resulting reliance on generating plants in the school environment can have significant implications for air and noise pollution. The use of generators as a backup power source often leads to the emission of harmful pollutants and excessive noise levels, which can negatively impact the well-being and health of students, staff, and the surrounding community. One of the recommendations made was that Schools should prioritize energy efficiency by implementing measures such as energy-efficient lighting, appliances, and HVAC systems. This can help reduce the overall energy demand and reliance on generators, thus minimizing air and noise pollution.*

**KEYWORDS:** Irregular Power Supply, NEPA, Air, Noise, Pollution Generating Plants and School Environment

## INTRODUCTION

An electrical device known as a power supply provides electricity to an electrical load. A power supply's primary function is to transform electrical current from a source into the proper voltage, current, and frequency needed to drive a load. Because of this, power supplies are sometimes known as electric power converters. While some power supplies are separate pieces of hardware, others are incorporated into the appliances they power. Power supply used in desktop computers and consumer electronics devices are examples of the latter. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply) (Wikipedia, the free encyclopedia, 2023).

The provision of a reliable and consistent power supply is crucial for the smooth operation of various sectors, including educational institutions. However, in many regions, such as Nigeria, irregular power supplies are a persistent challenge. The Nigerian Electric Power Authority (NEPA) and its successor, the Power Holding Company of Nigeria (PHCN), have faced difficulties in meeting the electricity demands of the nation, resulting in frequent power outages and the reliance on backup generators and generating plants (Chukwuocha & Onyegegbu 2018). While the use of generating plants can temporarily alleviate the power supply issue, their operation comes with a host of environmental consequences. This article aims to explore how irregular power supply from NEPA, coupled with the utilization of generating plants, contributes to air and noise pollution, particularly in the context of school environments.

## CONCEPT OF POWER SUPPLY

An electrical device known as a power supply provides electricity to an electrical load. A power supply's primary function is to transform electrical current from a source into the proper voltage, current, and frequency needed to drive a load. Because of this, power supplies are sometimes known as electric power converters. While some power supplies are separate pieces of hardware, others are incorporated into the appliances they power. Power supply used in desktop computers and consumer electronics devices are examples of the latter. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply) (Wikipedia, the free encyclopedia, 2023).

According to Morgan (2012), a converter is a device that converts one voltage to another, more convenient voltage while delivering power. Power supplies are designed from the output back to the input. Since they are designed after the amplification stages, it is tempting to think of them as an afterthought; indeed, some commercial products reflect this attitude. It is most important to realize that an

amplifier is merely a modulator that controls the flow of energy from the power supply to the load. Power supplies are often designed as subassemblies of larger devices. Many power supplies are cooled by natural convection (Meng et al., 2018). The enclosure is usually fabricated from sheet metal or plastic. The enclosure could also have many openings. Power supplies can also be installed to form a separate, dedicated power supply unit. This could be as large as a cabinet. However, power supplies usually experience a relatively favorable corrosion environment, according (Hahn, 2015). Power supplies are usually kept dry and warm. Unfortunately, some of the power supplies are directly exposed to external airflow as part of the heat management system. Such a situation can alter the power supply's environment drastically as the conditions become contaminating and thus much more corrosive. (Elsevier, 2023). A power supply is a hardware component that supplies power to an electrical device. It receives power from an electrical outlet and converts the current from AC (alternating current) to DC (direct current), which is what the computer requires. Power is the backbone of any electronic system, and the power supply is what feeds the system. Choosing the right supply can be the critical difference between a device working at optimum levels and one that may deliver inconsistent results (Wavelength Electronics, Inc. 2018). Power supplies need a source of power to function, like a garden hose needs a source of water. A power source, or energy source, is a method of producing electricity. Power sources convert either mechanical or chemical energy into electrical energy, which is then used by the circuitry of a device to power that device.

## CONCEPT OF AIR POLLUTION

Air pollution can be defined as an alteration of air quality that can be characterized by measurements of chemical, biological, or physical pollutants in the air. Therefore, air pollution means the undesirable presence of impurities or an abnormal rise in the proportion of some constituents of the atmosphere. Air pollution is caused by the presence in the atmosphere of toxic substances, mainly produced by human activities, even though sometimes it can result from natural phenomena such as volcanic eruptions, dust storms, and wildfires, also depleting the air quality (Solar Impulse Foundation, 2023). Air pollution is the contamination of the indoor or outdoor environment by any chemical, physical, or biological agent that modifies the natural characteristics of the atmosphere.

Household combustion devices, motor vehicles, industrial facilities, and forest fires are common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide. Outdoor and indoor air pollution cause respiratory and other diseases and are important sources of morbidity and mortality. WHO data show that almost all of the global population (99%) breathes air that exceeds WHO guideline limits and contains high levels of pollutants, with low- and middle-income countries suffering from the highest exposures. Air quality is closely linked to the earth's climate and ecosystems globally. Many of the drivers of air pollution (i.e., the combustion of fossil fuels) are also sources of greenhouse gas emissions. Policies to reduce air pollution therefore offer a win-win strategy for both climate and health, lowering the burden of disease attributable to air pollution as well as contributing to the near- and long-term mitigation of climate change (WHO, 2023).

## CONCEPT OF NOISE POLLUTION

The word noise is derived from the Latin word *nausea*, which means sickness in which one feels the need to vomit. Noise is an unpleasant and undesirable sound that causes discomfort in humans. The intensity of sound is measured in decibels (dB). The faintest sound that the human ear can hear is 1 dB. Due to increasing noise around civilizations, noise pollution has become a matter of concern (BYJUS, 2023). Noise pollution is any unwanted or excessive sound that can have deleterious effects on human health, wildlife, and environmental quality. Noise pollution is commonly generated inside many industrial facilities and some other workplaces, but it also comes from highway, railway, and airplane traffic and from outdoor construction activities. Noise pollution can cause health problems for people and wildlife, both on land and in the sea. It is an invisible danger. It cannot be seen, but it is present nonetheless, both on land and under the sea. Noise pollution is considered to be any unwanted or disturbing sound that affects the health and well-being of humans and other organisms. (National Geographic Society, 2023) Noise pollution, or sound pollution, is the propagation of noise or sound with ranging impacts on the activity of human or animal life, most of which are harmful to a degree. The source of outdoor noise worldwide is mainly caused by machines, transport, and propagation systems (Wikipedia, 2023).

Noise pollution is the pollution caused by sound, which results in various problems for Humans. Sound is a form of energy that enables us to hear. We hear the sound in the frequency range of 20 to 20000 Hertz (20 kHz). Noise pollution is the pollution created by loud noises that adversely affect the surroundings. (Geeks for Geeks 2023), Noise Pollution is the presence of unwanted, undesirable, and unnecessary sounds in our environment. Our environment is such that it has become difficult to escape the noise. Even electrical appliances at home have a constant hum or beep. Rockfon (2022), Noise pollution is an unseen threat. It exists both on land and beneath the sea, indoors and outdoors. Noise pollution is defined as any unwanted or disturbing sound that has an adverse effect on the health and well-being of humans and other living organisms.

According to Mondal, (2023), Noise pollution is a physical form of pollution and is not directly harmful to the life supporting systems namely air, soil and water. Its effects are more directly on the receiver i.e., man. Noise pollution is the result of modern industrialized urban life and congestion due to over population. Noise is generally harmful and a serious health hazard. Conserve energy future (2023), Noise pollution is defined as unwanted sounds that disrupt normal sound in the environment. Noise pollution often emanates from railroads, road traffic, aircraft, loud music, construction sites, and industrial activities. Noise pollution is the only form of pollution that is ever-present but rarely noticed despite its adverse effects. Noise pollution is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms. It is also known as unwanted or harmful noise, as from automobiles, airplanes, or industrial workplaces.

## IRREGULAR POWER SUPPLY SITUATIONS IN NIGERIA

The issue of erratic and epileptic power supply in Nigeria has been a major concern not just for the citizens but also for the Federal Government and companies in various industries. Every Nigerian greatly believes that the current rate of electricity supply is not regular and is in a low state. One cannot easily forget the power crises that hit the Nigerian states for about two weeks during the month of May, 2015. This unfortunate state grounded most businesses, and the ones that were not grounded had to use electricity at very high costs. The reason at that time, according to the National Electricity Regulation Commission (NERC) Chairman, Sam Amadi, was that 18 out of the 23 power plants in the country were unable to generate electricity due to a shortage of gas supply to the thermal plant, with one of the hydro stations facing a water management issue, leading to the loss of over 2,000 megawatts (MW) in the national grid. Nigeria, as Africa's most populous black nation and the bedrock of the West African regional economy, suffered a nationwide blackout as the national grid totally collapsed on March 31, 2016; it was an event unheard of in the nation's history (Jimah et al., 2019).

According to Chukwuemeka (2021), power supply is basically devices providing electric power to fund electronic equipment. In Nigeria, the electricity sector is in charge of supplying electricity to the whole country. However, the megawatts of Electric power supplied by the Electricity sector are less than what is standard and what should be obtainable in a country like Nigeria. In Nigeria, electricity is generated from fossil fuels, especially gas. Initially, a body was in charge of the distribution of power in the whole of Nigeria, known as NEPA. In 2014, this public sector was privatized, and bits were sold to private investors charged with fulfilling the former obligations of NEPA. However, even with the privatization of NEPA, there is still a lack of power supply in most places in Nigeria. People still complain of high electricity rates and a lack of a steady supply of electricity. Due to a lack of electricity, people have diversified and sought other means of generating electricity, one of which is the use of generators. In present-day Nigeria, almost every home owns a generator. In addition to the air generated from these generators also constitutes a nuisance in society, and they are usually very loud. It is quite a challenging period at this crucial stage in Nigeria, where there is an enormous gap in power supply and demand. The major causes of irregular power supply in Nigeria are believed to be inconsistencies in government policies and a shortfall in gas supply to power plants. Power generation and distribution have remained epileptic for quite some time in Nigeria, despite government efforts to improve the system. Efforts have been intensified by successive governments to develop a broad-based plan for power generation and distribution in Nigeria, as evidenced by the decentralization of the Nigeria Electric Power Authority (NEPA) and the subsequent emergence of the Power Holding Company of Nigeria (PHCN) (Adekomaya, 2016).



## IRREGULAR POWER SUPPLY AND AIR POLLUTION IN SCHOOL ENVIRONMENT

Irregular power supplies in school environments have a direct connection to air pollution, posing numerous challenges. The inadequate and inconsistent availability of electricity leads to an increased reliance on backup power sources like diesel generators, which contribute significantly to air pollution.

- The first issue is the disruption caused by an irregular power supply. Schools heavily rely on continuous power for lighting, ventilation, and the operation of essential equipment. When power outages occur, it hampers the learning environment and negatively impacts educational activities, ultimately affecting students' academic progress and productivity.
- The second concern is the adverse effects of air pollution. During power outages, schools often resort to diesel generators to maintain basic operations. However, these generators emit harmful pollutants such as nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), and particulate matter (PM), leading to deteriorating air quality. The combustion of diesel fuel releases these pollutants into the atmosphere, contributing to air pollution in and around school premises.

Moreover, air pollution resulting from an irregular power supply can have severe health implications. Exposure to pollutants like PM can trigger respiratory problems, allergies, and asthma among students, teachers, and staff. Prolonged exposure to these pollutants may increase the risk of cardiovascular diseases and have long-term effects on overall health. Furthermore, the environmental impact of irregular power supplies in schools is a growing concern (Zhang, & Rothman 2018). Diesel generator emissions contribute to the release of greenhouse gases, exacerbating climate change. The pollutants emitted can also harm local ecosystems, vegetation, and wildlife, affecting the overall environmental balance. Various solutions can be implemented. Schools should strive to adopt renewable energy sources like solar panels and wind turbines, reducing reliance on diesel generators (Chen, Kwong, & Copes 2019). Implementing energy-efficient measures such as LED lighting and energy-saving equipment can also minimize power supply issues and reduce energy consumption. Irregular power supplies in schools have a detrimental impact on air pollution. The reliance on diesel generators during power outages contributes significantly to air pollution, which poses health risks, harms the environment, and worsens climate change (Smith, Johnson & Anderson 2018). By adopting sustainable energy solutions and energy-efficient measures, schools can mitigate these issues and create healthier and greener environments for students and staff.

## IRREGULAR POWER SUPPLY AND NOISE POLLUTION IN SCHOOL ENVIRONMENT

Irregular power supplies and noise pollution pose significant challenges in the school environment, affecting both students and teachers. The lack of a stable power supply can disrupt classroom activities, hamper the use of electronic devices, and hinder teaching and learning processes. Students may be unable to access digital resources or engage in multimedia presentations, negatively impacting their educational experience. Additionally, power outages can lead to discomfort and frustration, affecting the overall productivity and atmosphere within the school (Bakis & Öztop 2015).

Noise pollution in schools can arise from various sources, such as construction activities, nearby traffic, or inadequate soundproofing within the premises. Excessive noise levels can hinder concentration and impede effective communication between teachers and students. Continuous exposure to noise can lead to increased stress levels, reduced cognitive performance, and negative health effects. It is essential for schools to provide a quiet and conducive learning environment that promotes concentration and academic achievement (De Vos, Leroy, Vercruysse & Pede 2013). To address the issue of irregular power supply, schools can consider implementing alternative energy solutions such as solar panels or wind turbines.

These renewable energy sources can provide a stable and uninterrupted power supply, reducing reliance on the traditional grid system. Moreover, schools can invest in backup power generators to mitigate the impact of power outages and ensure the continuity of educational activities. By diversifying their energy sources, schools can enhance their resilience and create a more sustainable learning environment. To combat noise pollution in schools, measures such as proper insulation, soundproof windows, and acoustic treatment can be employed (Jibiri, 2017). These strategies help reduce the transmission of external noise into classrooms and other learning spaces. Furthermore, schools can establish guidelines and policies to minimize noise disruptions within the premises. This can include enforcing quiet zones, setting noise limits in common areas, and raising awareness among students and staff about the importance of maintaining a quiet learning environment (Oghuvbu & Ibadode 2014).

### SUBSTITUTE TO ELECTRIC POWER SUPPLY

Electrical Energy has always been one of the vital requirements of human societies, and presently its demand is far greater than ever in both developed and developing nations. These are the possible substitutes for electric power supplies:

- **Solar**

Solar electricity has clear advantages in terms of accessibility, cost, and reliability compared to traditional means of rural electrification. In the medium to long term, solar electricity will also be competitive on the grid. As of 2018, Ethiopia had launched the National Electrification Program, which aimed for 65 percent of the population to be grid-connected by 2025 (HAILU, 2023).

- **Wind energy:**

Wind energy systems harness kinetic energy from wind and turn it into mechanical or electrical energy, much the same way hydropower systems gather energy from water. The primary device wind systems use is a wind turbine, which is available as a vertical axis and a horizontal axis turbine. The most commonly used type of wind turbine is a horizontal axis turbine, which is typically used in large-scale wind systems that harness 100 kilowatts and higher. Most turbines include the following elements: a rotor, a nacelle, a tower, and some electronic equipment (Thomas, 2023).

- **Batteries:**

These are used as conduits to charge inverters. When there is a public power supply, the batteries are used to charge the inverter. When the DISCOs cut off supply, the inverter provides power with the aid of the batteries (Okonkwo, 2016).

- **Biomass:**

Biomass energy encompasses a huge range of potential sources, all of which have one thing in common: they are alive. The sheer breadth of possibilities presented by this alternative power source makes it an excellent place for investment and innovation. This type of power system extracts the solar energy that plants and microorganisms use for food. (Layton, 2023) Biomass-derived energy has been a primary heat source since man discovered firewood, a combustible biofuel used all over the planet for heating and cooking. Other forms of biomass are already in use in the form of corn ethanol, biodiesel, and methane captured from landfills, where active microorganisms release the stinky gas through natural, ongoing processes.

- **Geothermal**

Humans have been harnessing the power of super-hot steam beneath the Earth's surface for more than 10,000 years, but the first geothermal power generator wasn't built until 1904 in Italy. (Guardian, 2015), The first geothermal power plant in the United States came online in 1921 to help run a hot spring resort at The Geysers in northern California. The Geysers, which cover 7,769 hectares are the world's largest geothermal field and home to nearly a dozen power plants. Geothermal makes up 3% of the country's renewable energy generation.



## CONCLUSION

The study concluded that power supply challenges in the nation, which seem not to be ameliorating, have encouraged the acquisition and utilization of generators in all sectors of the nation's economy. The noise emitting from these generators adversely affects both humans and the environment. Irregular power supply from NEPA and the resulting reliance on generating plants in the school environment can have significant implications for air and noise pollution. The use of generators as a backup power source often leads to the emission of harmful pollutants and excessive noise levels, which can negatively impact the well-being and health of students, staff, and the surrounding community. To mitigate these issues, it is crucial to implement sustainable and environmentally friendly solutions. This can include prioritizing energy efficiency measures within schools to reduce overall energy demand and reliance on generators. Integration of renewable energy sources, such as solar panels or wind turbines, can further decrease dependency on fossil fuel-powered generators and promote cleaner energy alternatives.

## RECOMMENDATIONS

- Schools should prioritize energy efficiency by implementing measures such as energy-efficient lighting, appliances, and HVAC systems. This can help reduce the overall energy demand and reliance on generators, thus minimizing air and noise pollution.
- Schools should explore the integration of renewable energy sources like solar panels or wind turbines to supplement their energy needs. This can help reduce dependency on fossil fuel-powered generators and mitigate air and noise pollution.
- Adequate noise control measures should be implemented to minimize the impact of generator noise on the school environment. This may include installing noise barriers, relocating generators to less disruptive areas, or utilizing soundproof enclosures.
- Schools should educate students, staff, and the wider community about the environmental and health impacts of air and noise pollution as this awareness can encourage responsible energy consumption and foster a culture of sustainability.

## REFERENCE

- Adekomaya, O., Jamiru, T., Sadiku, R., Huan Z. & Suleiman, M. (2016) Gas flaring and its impact on electricity generation in Nigeria. *Journal of Natural Gas Science and Engineering* 29 (1), Pp.1-6.
- Aiden Ford (2023) Power Supply Available at: <https://study.com/academy/lesson/power-supply-definition-types.html>
- Ajayi, O. M. (2016). Noise pollution generated from mobile power generating set: A case study of Akure, Nigeria. *International Journal of Environmental Studies*, 73(4), 577-586.
- Bakis, H., & Öztop, H. (2015). Investigation of the noise levels in primary schools located in the city center. *Indoor and Built Environment*, 24(1), 126-132.
- Britannica (2023) noise pollution. Retrieved from: <https://www.britannica.com/science/noise-pollution>
- Brown, A., White, C., & Davis, S. (2016) Assessing the Consequences of Power Outages on School Operations Available at: *International Journal of Educational Research*.
- Buzoianu, M., Cretu, R., & Pascu, L. (2016). Air pollution impact on human health in developing countries. *Environmental Engineering and Management Journal*, 15(10), 2259-2268.
- BYJU'S (2023) What is Noise Pollution? Available at: <https://byjus.com/physics/noise-pollution-prevention/>
- Chen, H., Kwong, C., & Copes, R. (2019) Air Pollution and Children's Health: A Review of Recent Epidemiological Studies Available at: *Journal of Environmental Health Perspectives*
- Chukwuemeka, E. (2021) Poor Electricity Power Supply in Nigeria: Causes, Effects and Solutions. Available at: <https://bscholarly.com/poor-electricity-power-supply-in-nigeria/>
- Chukwuocha, U. M., & Onyegebu, S. O. (2018). Impact of power generation on the environment: The case of noise pollution from generator sets in Owerri, Nigeria. *Environmental Quality Management*, 27(2), 33-42.
- Conserve energy future (2023) Sources of Noise Pollution and Tips for Prevention of Noise Pollution. Available at <https://www.conserve-energy-future.com/sources-prevention-noise-pollution.php>
- De Vos, P., Leroy, S., Vercruyssen, K., & Pedde, B. (2013). Noise reduction measures in school buildings: A review. *Building and Environment*, 70, 61-70.
- Edegbe, C. S., & Osayande, E. O. (2020). Impact of power generation on air quality: A case study of Benin City, Nigeria. *Journal of Environmental Science and Public Health*, 4(2), 163-176.

- Elsevier B.V. (2023) Power Supplies Available at:  
<https://www.sciencedirect.com/topics/engineering/power-supply>
- European Environment Agency. (2019). Air pollution. Retrieved from  
<https://www.eea.europa.eu/themes/air>
- Geek's forgeeks (2023) Noise Pollution. Retrieved from:  
<https://www.geeksforgeeks.org/noise-pollution/>
- Guardian (2015) The future of electricity: five lesser-known alternative energy sources. Available at: <https://www.theguardian.com/nrg-the-energy-of-choice/2015/aug/19/alternative-energy-sources-ocean-biomass-geothermal>
- Hizkel Hailu (2023) Solar energy: Alternative to increase electric power supply. Available at: <https://www.addisherald.com/solar-energy-alternative-to-increase-electric-power-supply/>
- Jibiri, N. N. (2017). Noise pollution in Nigerian primary schools: Sources, effects and control strategies. *Journal of Environmental Science and Technology*, 10(3), 136-146.
- Jimah K. Isah, W., & Okundamiya, S. (2019) Erratic and Epileptic Power Supply in Nigeria: Causes and Solutions. *Advances in Electrical and Telecommunication Engineering* 2(1) Pp. 47-53.
- Layton, J (2023) Top 5 Alternative Power Systems. Available at: <https://science.howstuffworks.com/environmental/energy/5-alternative-power-systems.htm>
- Mondal, P. (2023) Noise Pollution: Definition, Sources and Effects of Noise Pollution. Retrieved from: <https://www.yourarticlelibrary.com/speech/noise-pollution-definition-sources-and-effects-of-noise-pollution/28295>
- National Geographic Society (2023) Noise Pollution. Retrieved from:  
<https://education.nationalgeographic.org/resource/noise-pollution/>
- Oghuvbu, E. I., & Ibadode, A. O. A. (2014). Energy crisis in Nigeria: Need for renewable energy mix. *International Journal of Energy Engineering*, 4(1), 10-17.
- Ogolo, E. O., & Sanyaolu, T. (2017). Noise pollution from power generating sets: A case study of Lagos, Nigeria. *Journal of Environmental Science and Public Health*, 1(1), 1-10.
- Okonkwo, O. (2016) Affordable ways you can power your homes. Available at: <https://www.premiumtimesng.com/business/business-interviews/206901-electricity-supply-worsens-affordable-ways-can-power-homes.html?tztc=1>
- Oparaku, N. F., & Enweremadu, C. C. (2019). Environmental impact of power generation: A review of generator noise pollution in Nigeria. *Journal of Sustainable Development Studies*, 12(2), 133-150.
- Rockfon (2022) What Happens When Sound Turns into Noise Pollution? Available at: <https://www.rockfon.co.uk/about-us/blog/2022/noise-pollution/>

Solar Impulse Foundation (2023) Solutions to Air Pollution Available at:  
[https://solarimpulse.com/air-pollution-solutions?utm\\_term=air% 20pollution & utm\\_campaign=Solutions & utm\\_source= adwords & utm\\_medium= ppc & hsa\\_acc=1](https://solarimpulse.com/air-pollution-solutions?utm_term=air%20pollution&utm_campaign=Solutions&utm_source=adwords&utm_medium=ppc&hsa_acc=1)

The Impact of Irregular Power Supply on Educational Institutions: A Case Study Available at: Journal of Energy and Education

Thomas net (2023) Living off the Grid - Alternative Power Sources. Retrieved from:  
<https://www.thomasnet.com/articles/electrical-power-generation/alternative-power-sources-off-grid/>

Wavelength Electronics, Inc. (2018) Power Supply Basics Available at: <https://www.teamwavelength.com/power-supply-basics/>

Wikipedia (2023) Noise pollution. Available at:  
[https://en.wikipedia.org/wiki/Noise\\_pollution](https://en.wikipedia.org/wiki/Noise_pollution)

Wikipedia, the free encyclopedia (2023) Power Supply Available at:  
[https://en.wikipedia.org/wiki /Power\\_supply](https://en.wikipedia.org/wiki/Power_supply)

World Health Organization (WHO) (2023) Air Pollution Available at:  
[https://www.who.int/health -topics/air-pollution#tab=tab\\_1](https://www.who.int/health-topics/air-pollution#tab=tab_1)

World Health Organization. (2018). Ambient (outdoor) air quality and health. Retrieved from [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

Zhang, Q., & Rothman, N. (2018) Indoor Air Quality in Schools: Impacts on Children's Health and Performance. Annual Review of Public Health