

# Conversion of Noise Pollution into Electrical Energy

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**ABSTRACT:-**Noise is often defined as unwanted sound, but technically noise is the perception of a series of compressions and rarefactions of the air above and below normal atmospheric pressure. It generates the vibration of air particles. Vibration refers to the oscillating movement of any object.

Noise is the form of pollution which is not restricted till industries only, sources of noise includes vehicle fleets, housing colonies, loud music in marriages/celebrations, loudspeakers used in political rallies, industrial appliances, generators, loud speakers at spiritual places, airport and railway tracks etc. Continuous exposure to high noise has been observed to affect the human health. Various control methodologies are used to minimize the human exposure to high level of sound.

This is based on the oscillation created by the sound wave which can be further converted to electricity by the use of magnetic field. We will use loudspeaker (transducer) to work opposite as its normal working, instead of converting electrical signal into sound it converts sound wave into electrical energy.

A number of other ways are also available for such conversion such as Piezometers and piezoelectric devices, but the efficiency of these processes have not been found satisfactory. Therefore, through this project we aim to devise a device which can convert noise from loudspeaker into electricity. Noise pollution is waste and no one want it and if this waste form of sound could be converted and used, then it will be very beneficial for mankind.

We all consider noise as a form of sound pollution but with technological advancement and great research work going on, it is possible now to convert this universally distributed pollution into useful form energy such as thermal energy and electrical energy.

**Key word:** noise pollution, electrical energy, piezoelectric material.

## I. INTRODUCTION

In our daily life there is greater need of electricity, without the electricity many of our work will shut down and stuck at the same point. There is a greater need and huge amount of electricity is required so various methods are adopted for the production of electricity. But use of electricity at high rate and devastation also, thus requires the alternate a source of energy that not only produce the electricity but become a

convenient way to produce high electric energy advantageous. New and creative method are used produce electricity is something different and valuable. It has disclosed the new dimensions in the field of electricity. We always eager to find out and also how noise pollution can be used to convert into electricity.

The “law of conservation of energy” states that energy cannot be created nor be destroyed. Under the consideration of this law the technological giants have discovered numerous sources to extract energy from them and use it as a source of power for conventional use.

There are various so called eco-friendly sources of energy that we have discovered till the present artificial era. Some of them are implemented to great extent under the suitable circumstances to overcome the short run of the energy due to technological boom that has led the energy needs to its apex. Solar energy is one in the list that came up with the wide range of applications such as solar heaters; solar cookers and it gained success due to its easy implementation. There are various other sources of renewable energy which includes harnessing energy from wind, Biomass, water etc.

But the efficiency of the energy sources discussed above is the major issue over which the scientists are working since long. The efficiency of the solar cell is 20% only under the practical conditions. This is not the only problem with present sources it further extends to high cost involved in production process. Thus the researchers now are feeling the need of other kinds of sources to harness energy for our conventional uses.

To add to the list there is an emerging scenario which leads us to a new renewable energy source known to us since long and that is the sound. The sound or noise in other terms is present all around us. So why not use it to satisfy our needs of energy. In our basic applications we see sound be converted in the electrical signals to travel over the media for communication purposes. For example the sound energy is converted into electrical signals using diaphragm present in the microphone and these signals then reach to the speakers and then converted back to sound. The electrical current generated by a microphone is very small and referred to as MIC-level; this signal is typically measured in mill volts. Before it can be used for any-thing serious the signal needs to be amplified, usually to line level (typically 0.5 -2V). Application of sound energy as the source of electricity can be much beneficial for the human existence as compared to other sources. This is because the sound is present in the environment as a noise which forms an essential part of the environmental pollution. The

concentration of noise to use it for power generation can lead to discovery of another hidden source of energy which can act as a boon to non-renewable sources such as coal, crude oil etc. which are on line of extinction.

Sound that is perceptible by humans has frequencies from about 20 Hz to 20,000 Hz. In air at standard temperature and pressure, the corresponding wavelengths of sound waves range from 17 m to 17 mm.

But have we ever imagined sound as source of electricity? No, is the answer. This is because it was stone which was left unturned by the researchers up till now but this hidden source is now emerging as the a new era in the world of renewable sources of energy. This could be easily understood by the “law of thermodynamics” which states that the mechanical energy can be converted to electrical energy.

#### A. Nature of sound and its effects

Sound energy is a mechanical energy which travel in the form of wave, mechanical wave that is an oscillation of pressure which need medium to travel i.e. it could not travel through vacuum. In medium like liquid and gas sound is transmitted as longitudinal wave whereas through solid it could be transmitted as both longitudinal wave and transverse. Sound could be converted into electricity as mechanical energy could be converted into electricity by the law of thermodynamics.

When sound wave travel through a medium in that medium is periodically displaced and thus oscillates with sound wave. The sound wave displace back and forth because of the potential energy compression and the kinetic energy of the oscillation. Sound energy could be easily converted into heat energy and then converted into electricity but it is not highly efficient as the loss in conversion will be more whereas the other method is converting sound energy to electricity by piezo electric material, piezoelectric materials are the crystal which converts mechanical strain to electric energy by such method. So we could see that sound is a form of mechanical energy and according to third law of thermodynamics mechanical energy could be converted into electric energy Countries like Israel, India, America and china etc. are try to give the advanced, effective and economical approaches and to produce electricity at vast scale. So it is necessary to increase the supply of electric power for that it is very essential for us to find other alternative methods to produce electric energy. Today world need electricity at every second so numerous approaches are using to produce unstoppable at high rate. Countries like ISRAEL using creative minds and producing new ideas in conference was held in December 2016.

#### B. Method for conversion of noise pollution into electrical energy

Piezoelectric material used for the conversion of noise pollution to green energy and into electric energy. Piezoelectric crystals are the crystals which converts mechanical strain to electric energy. The strain applied to piezoelectric material by sound energy could be converted into electricity.

- *Practical Approaches*

The term piezoelectricity define as electric charges that accumulates in certain solid materials (such as crystals, certain ceramics and biological matter such as bone, DNA etc.) in response to applied mechanical stress. The Piezoelectric effect is the liner electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry.

Piezoelectric materials are the crystal which converts mechanical strain to electric energy. Piezoelectric materials are transducers its crystals could convert mechanical strain to electricity, the crystals are formed naturally e.g. quartz and artificially ZnO, Niobaet Lead etc. The sound energy could be converted into electricity using piezoelectric material. Piezo electric materials are transducers its crystals could convert mechanical strain to electricity, the crystals are formed naturally e.g. quartz, bone, DNA whereas artificially ZnO, lithium niobatet Lead Metaniobate the sound energy could be converted into electricity using piezo electric material. Certain single crystal materials exhibit the following phenomenon: when the crystal is mechanically strained, (here sound energy) or when the crystal is deformed by the application of an external stress, electric charges appear on the crystal surfaces; and when the direction of the strain reverses, the polarity of the electric charge is reversed. This is called the direct piezo electric effect, and the crystals that exhibit it are classed as piezoelectric crystal.

Converting sound energy to electricity by piezo electric material device could be made which will collect the sound wave that are travelling near it and that sound wave will be used to cause a strain due to pressure created by its oscillation in the piezo crystal and that will create the disturbance in its atoms resulting in the flow of electric charge on the surface of the crystal thus sound energy could be converted. And thus this sound energy could be used to perform various tasks by converting it into useful electric energy.

- *Piezo Electric Material and Their Properties*

When a piezoelectric crystal is placed in an electric field, or when charges are applied by external means to its faces, the crystal exhibits strain, i.e. the dimensions of the crystal Changes.

When the direction of the applied electric field is reversed, the direction of the resulting strain is reversed. This is called the inverse piezo electric effect. So it could be seen that when the

sound energy is applied to the piezoelectric material it create strain in the crystal then it reverse it and the strain is converted into electric energy. This direct piezo electric effect property of piezoelectric material could be used for making the device to convert sound energy to electric energy.

Piezo converter a device could be made using piezo electric material which will collect the sound wave which are travelling near it and that sound wave will be used to cause a strain due to pressure created by its oscillation in the piezo crystal and that will create the disturbance in its atoms resulting in the flow of electric charge on the surface of the crystal thus sound energy could be converted into electricity as the piezo electric material convert mechanical strain to electric energy. And thus this sound energy could be used to perform various tasks by converting it into useful electric energy.

## II. ADVANTAGES

- Due to conversion from the sound to the electric energy it is the possible to use energy in abundant.
- The electric energy is the cleanest energy.
- With an effective conversion we can use this energy to lighten the street lights and can use effective signal marks of lights sensors that can prevent accidents.
- The noise pollution in runway could be used to produce electricity.
- In civil engineering, the noise from cars can be converted to electrical energy production.
- This method is very effective and therefore the scope of this smart approach never ends.

## III. DISADVANTAGES

- Its efficiency is not so good so improvement is being required.
- It could not be give it's result if used in the places where decibel of sound is very low.
- It is entirely based on sound of critical value.
- Installation of the entire device is bit costlier.
- Its initial cost is high number.

## IV. FUTURE SCOPE

In near future if we are able to use this kind of energy then it will cause revolution in the field of the renewable sources of energy. Due to development of new sources like sound we can overcome the deficiency of electricity that we are facing in the developing countries across the world.

With the advancement of this technology we can also imagine the charging of various battery operated devices such as our mobile phones just by making a call to a friend and talking. The mobile devices will literally satisfy their name as they

will be-come quiet portable without much concern about their battery life.

Its other application field includes the lightening of the street lamps and traffic lights just by extracting the sound energy of the noise that is produced by the vehicles on the road. In this way we are not only able to reduce the noise pollution and but also utilize it as a source of electricity.

Also in the industries with the mechanical forte where very huge amount of the noise is produced as result of functioning of heavy machineries this sound can be trapped and can be used to run the low power machines used in production process.

## V. CONCLUSIONS

The sound energy is the unexplored source which has enormous potential to meet the future growing requirements of the electricity and serve as the eco-friendly and renewable source of energy.

This technology is not practically usable up till now due to efficiency concerns but the present work on this field makes its future quiet promising.

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