

# Generation of Usable Energy from Unwanted Sound

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**Abstract**— Life is intricately woven with many necessities. One such essential need of life is electrical energy. We are all aware about the load sheds and power cut which is all due to the scarcity of electrical energy. The fast moving pace of life would slow down drastically without generation of adequate amount of electrical energy. On the other side of the scenario the world is everywhere facing noise pollution in abundance. If we can ‘non -technically’ define what sound energy is, we would say it is the most neglected form of energy which is only considered to be a wastage. The theorem of energy conservation very well states that Energy can neither be created nor be destroyed; it can be converted from one form to another. So noise being one form of energy cannot be destroyed for reducing pollution but surely can be transformed into another form of energy. Here arises the idea of generating usable energy from unwanted sound, and this usable energy could be in the form of electrical energy.

**Key words:** Usable Energy, Unwanted Sound

## I. INTRODUCTION

Sound or noise is one of the widely available energy sources. Sound waves are nothing but vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear. Excessive noise that may harm the activity or balance of human or animal life termed to be noise pollution. There are abundant sources of noise such as nuclear power plants, transportation traffic, etc which in large amounts contribute to noise pollution.

Sound energy is a mechanical energy which travel in the form of wave, a mechanical wave that is an oscillation of pressure which needs medium to travel i.e. it could not travel through vacuum. The sound waves can be longitudinal as well as transverse as per direction of vibration of the sound particles called phonons. As sound wave travels through a medium, particles inside the medium are periodically displaced and thus oscillate with sound wave. Thus sound actually is a form of mechanical energy which causes motion in the particles of its medium.

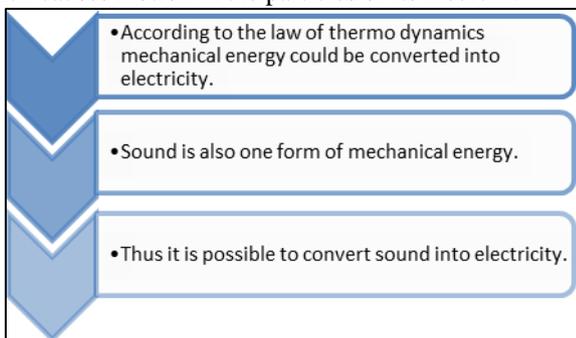


Fig. 1:

As per the law of thermodynamics, mechanical energy could be converted into electricity and so we can say that sound too can be converted into electrical energy.

Sound energy could be easily converted into heat energy which could further easily be converted into electricity but it is not highly efficient as the loss in conversion will be more. One method of conversion is based on ‘Faraday’s Law of electromagnetic induction whenever a conductor cuts magnetic flux, an e.m.f. is induced in that conductor whereas the other method is converting sound energy to electricity by piezo electric material, piezo electric materials are the crystal which converts mechanical strain to electric energy. So we know sound is a form of mechanical energy and thus piezo devices could be used for its conversion.

So it could be seen that theoretically sound energy could be converted into electricity.

## II. PRACTICAL IMPLEMENTATIONS

### A. Method I

#### 1) Sound to Heat and Heat to electricity:

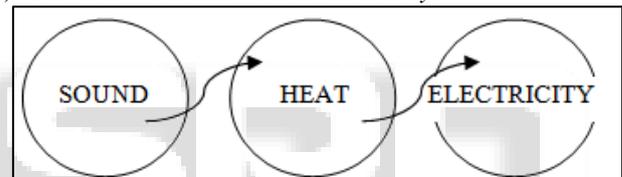


Fig. 2:

In this method the input sound is first converted into heat. The sound wave travels by oscillating the particles in a medium hence disturbing the particles in the medium. When sound wave strikes into a medium it pushes the particles of the medium which leads to collision of particles in the medium. The resultant collision causes generation of heat. This heat energy is then converted to electricity.

However while conversion of energy from one form of energy into another form of energy losses take place that is while converting sound to heat some sound energy may be converted into some other form and same kind of loss takes place while converting heat to electricity. Hence this method gives less efficiency and it is not feasible to implement this method.

### B. Method II

#### 1) Conversion using Magnetic Field

Faradays law very well states “Whenever a conductor cuts magnetic flux, an e.m.f. is induced in that conductor. And the magnitude of the induced e.m.f. is equal to the rate of change of flux linkages.”

The second method is thus based on this principle of generation of e.m.f.

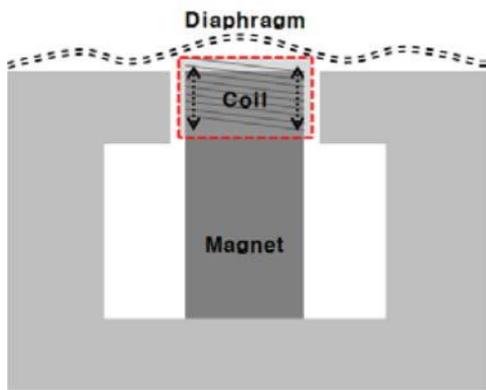


Fig. 3:

Here a very thin curtain like diaphragm is created which gets fluctuated by the oscillation and pressure created by the sound wave and the diaphragm is attached with a conductor which is placed between magnetic bars. Thus fluctuations in the curtain will create a movement in conductor which will affect the magnetic field of the magnet, this will generate motional emf and will generate voltage across it. As per Faraday's law generated emf is given by:

Generated voltage = Emf = velocity of conductor X magnetic field X length of conductor

Thus the oscillation created by the sound wave converts it into electricity and as the frequency is high the movement will be fast thus appreciable amount of electric energy is generated.

But its limitation will be that it will be efficient only in the place where high decibel of sound is available, for example nuclear power plant, industries using huge and noisy machines.

### C. Method III

#### 1) Generation using Piezo Electric Transducers

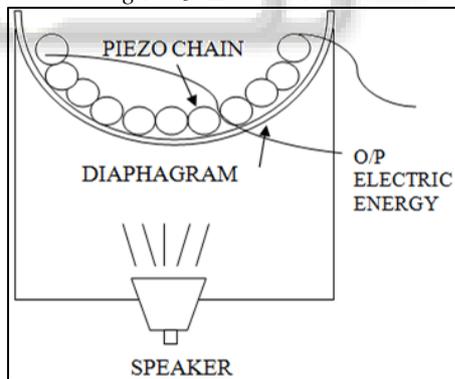


Fig. 4:

In this method the sound wave is made incident on piezo transducers. Electricity can be directly generated using piezoelectric effect. When mechanical energy from sound waves is applied to the ceramic piezoelectric chain the piezo transducers tend to vibrate. On vibration a small voltage is developed at the output of piezo transducers which can be regulated and amplified for usage.

### III. PIEZO ELECTRIC MATERIALS

The piezoelectric materials are materials which generate electrical energy when subjected to mechanical stress or in the reverse manner i.e. generating a strain on application of electricity.



Fig. 5:

When the piezoelectric material is placed under mechanical strain, a shifting of the positive and negative charge centres in the material takes place, thus resulting in an external electric field. On reversing an external electric field either compresses or expands the piezoelectric material.

### IV. PIEZOELECTRIC EFFECT

The piezoelectric effect is very useful for many applications involving the production and detection of sound, generation of high voltages, generation of electronic frequency, microbalances, and ultra fine focusing of optical assemblies. Piezoelectric Effect is the ability of certain materials to generate an electric charge when applied mechanical stress. One of the unique characteristics of the piezoelectric effect is that it is reversible, i.e. it can exhibit the reverse piezoelectric effect. The reverse piezoelectric effect is such that it can generate stress when an electric field is applied to it.

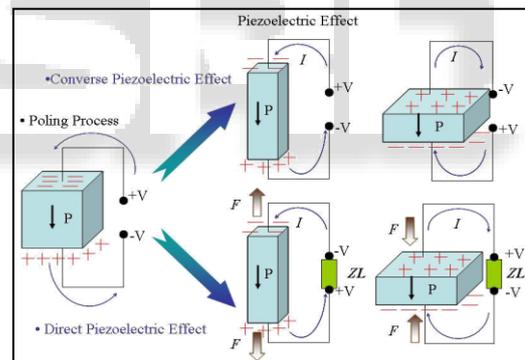


Fig. 6:

### V. APPLICATION OF PIEZOELECTRIC GENERATED ENERGY

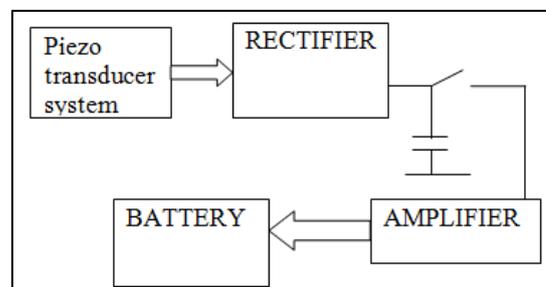


Fig. 7:

The voltage from piezoelectric transducers is AC and thus it is rectified and stored in a super capacitor for charging a battery. This voltage stored in the battery can be further used for mobile charging or to drive applications with small voltage.

## VI. FUTURE SCOPE

On implementation of this idea on a large scale like places at nuclear stations or airports it is possible to generate a huge amount of electric energy. Thus it may lead to solve the problem of noise pollution as well as scarcity of electricity to a certain extent.

## VII. CONCLUSION

- If conversion of noise to electrical energy is performed on large scales then it can solve the major problems related to scarcity of electricity.
- Sound energy could be converted by different methods
- Method 1: Converting Sound energy to heat energy and then heat energy to electric energy or
- Method 2: Creating apparatus using curtain (diphogram) magnet and conductor
- Method 3: By using transducers such as piezoelectric material which converts mechanical strain to electric energy and vice versa.
- Piezoelectric materials are transducers which generate electric energy when subjected under mechanical stress and also possessing reverse piezoelectric effect i.e. they compress or expand on applying electric energy.

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