



## CONVERSION OF SOUND ENERGY TO ELECTRICAL ENERGY

<sup>1</sup>,K. Kusuma Kumari<sup>2</sup>,M. Manasa Chowdary<sup>3</sup>,N.Gangadhara Reddy<sup>4</sup> ,P. Vaishnavi<sup>5</sup> K. Sai Krishna<sup>6</sup> M.Shobha

<sup>1,2,3,4,5</sup>Students, <sup>6</sup> Assistant Professor

<sup>1,2,3,4,5,6</sup>Department of Electrical and Electronics Engineering,

<sup>1,2,3,4,5,6</sup>Sanskriti School of Engineering, Puttaparthi, Andhra Pradesh, India

**Abstract:** Nowadays the main problem is noise pollution . However we cannot either control it or reduce it but we can use it as a source of energy. There is huge scarcity of electrical energy though there are numerous sources since we need electricity for running our most appliances and to carry out our daily work. sound is a mechanical form of energy which travel in the form of wave, wave that is an oscillation of pressure this pressure created by the sound could be used to convert it into electric energy or other form of energy using a transducer.

**Index Terms - Diaphragm, Piezoelectric materials, Transducer, Sound energy, Thermodynamics.**

### I. INTRODUCTION

According to law of conservation "the energy neither be created nor be destroyed but can be converted to one form to another form of energy". Using this concept various so-called eco-friendly sources of energy are discovered. Some of them are implemented to great extent to overcome the short run of energy. Some renewable sources of energy are solar, wind, hydro, Biomass.

But the above discussed renewable sources of energy have major issues in the terms of efficiency and cost. Hence we need other kind of sources for our conventional uses. 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. But the electrical current generated by a microphone is very small and is typically measured in milli volts. Before it can be used for anything 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. Sound energy act as a boon to non-renewable sources such as coal, crude oil etc. which are on line of extinction.

### II. INTRODUCTION TO SOUND ENERGY

Sound is what a human ear can hear and detect whereas noise is an unwanted sound. Sound basically is mechanical wave that is an oscillation of pressure transmitted through some medium (like air or water),composed of frequencies which are within the range of hearing. Thus, considering sound as the wave we can imagine it as the flow of energy from one point to another with the help of a medium as air. The sound waves can be longitudinal as well as transverse as per direction of vibration of the sound particles called phonons. 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 17mm.Since sound is a mechanical wave that can be easily converted to electrical energy.

### III. PRACTICAL METHODS OF CONVERSION

There are three methods to convert sound energy to electrical energy.

#### METHOD 1:

In this method we could convert sound energy to heat energy as sound wave travel by oscillating the particles of the medium so when sound energy travel through the medium it will disturbs the particle of the medium these disturbance created by sound will be used to convert it into heat energy as when the particles of the medium will be pushed by the sound wave it will collides with adjacent particle of the medium this collision will result in production of heat energy the production of heat energy will be more in the denser medium so for more heat production we will need a material with very high density. This heat energy will be converted into electricity.



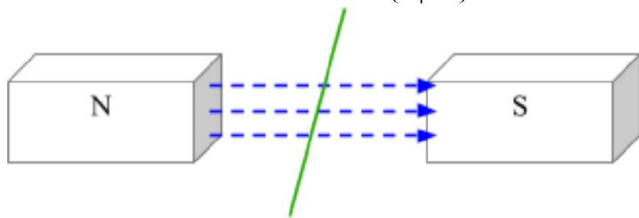
But this method is less efficient due to more loss of energy while converting sound energy to heat energy and then to electrical energy.

## METHOD 2:

### Use of Diaphragm

Another method of conversion is the use of a Diaphragm. Microphone is an example of transducer. Transducer is a device that converts the energy from one form to another form. we create a thin curtain like diaphragm. A conductor is attached behind the curtain. Whenever sound is created the diaphragm gets fluctuated due to the oscillations produced by a sound wave. Hence automatically the conductor also moves which is placed in between the magnetic bars which affect the magnetic field of a magnet. This will produce motional emf and will generate voltage across it. When a closed circuit is formed it produce electricity. Hence sound energy is converted to electrical energy using a diaphragm. This method works on the principle of electromagnetic induction which defines that when a conductor is placed in the varying magnetic field an emf is induced across the conductor.

$$\text{Induced emf } e = -N(d\phi/dt)$$



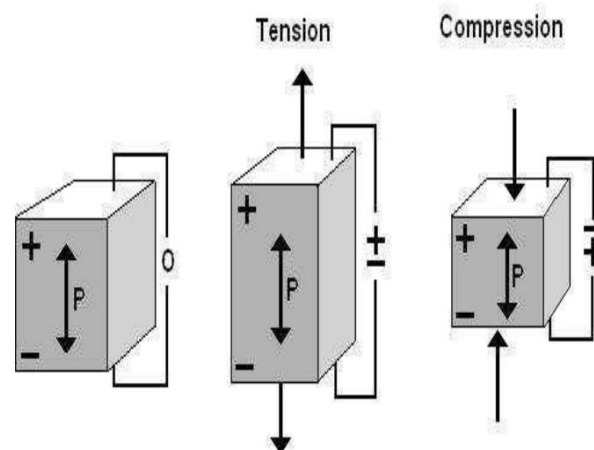
## METHOD 3:

### PIEZO ELECTRIC MATERIAL

Piezoelectric materials are transducers crystals could convert mechanical strain to electricity, crystals are formed naturally eg. quartz, bone, DNA...whereas artificially ZnO, lithium niobate, LeadMetaniobate the sound energy could be converted into electricity using piezoelectric material.

#### Direct piezoelectric effect:

When a piezoelectric material is subjected to strain or deformed by external stress electric charges appear on the surface of crystal. When the direction of strain reverses the polarity. The polarity of electric charges reversed. This is called as Direct piezoelectric effect. Hence, when a sound is produced near the crystal there will be strain on the face of a crystal hence generation of electric charges occurs. Hence sound energy is converted to electrical energy.



#### Inverse Piezoelectric Effect:

When a piezoelectric material is placed in an electric field or when charges are applied externally to its faces the material exhibits strain i.e., deformation occurs to a crystal. This is known as inverse piezoelectric effect.

## CONCLUSION

- Since sound is present in enormous quantity in nature therefore it can be utilized by converting into suitable Electrical Energy
- Sound energy can be converted by using various methods into Electrical form. This includes following methods:
  - 1.Method 1-by converting sound energy to heat energy and further to electrical energy.
  - 2.Method 2-by creating a thin curtain like a diaphragm.
  - 3.Method 3-by using piezoelectric materials
- In this aspect lot of research is to be done but on a positive note this could surely be done which could solve the energy problem of the entire world.

## FUTURESCOPE

- If sound energy is able to be converted into electric energy efficiently it could help us to reduce the scarcity of electrical energy across the globe.
- It is a clean energy hence it helps in the reduction of CO2 emission.
- The energy can be stored and can used for lightening of street lights, signals and various other appliances.

## REFERENCES

1. Alankrit, Gupta. "conversion of sound to electrical energy." International Journal of Scientific & Engineering Research, January 2014.
2. Attia, Mohana Faraoug saeed. "Evaluation of Electric Energy Generation from Sound Energy Using Piezoelectric Actuator." International Journal of Science and Research, 2014.
3. Bhatnagar, Shalabh Rakesh. "Converting Sound Energy to Electric Energy." International Journal of Emerging Technology and Advanced Engineering 2, no. 10 (october 2012).
4. Cha, Seung Nam. "Sound-Driven Piezoelectric Nanowire Based generator."
5. Fang, Liew Hui. "Exploring Piezoelectric for Sound Wave as Energy Harvesteter." The 8th International Conference on Applied Energy, 2017.
6. G, Revathi. "Piezoelectric Energy Harvesting System in Mobiles with Keypad and Sound Vibrations." International Journal of Engineering Research & Technology 1, no. 4 (june 2012).
7. Ge, Qingyu. "Prospect of Electric Generation Using Sound." AIP conference Proceedings, 2017.
8. Jo, Byung-Wan, and Dong yon Lee. "An Experimental investigation of Noise energy Generation." ICCECE, november 2012.
9. Neha. "Study of Conversion of Sound Energy into Electrical Energy." International Journal on Emerging Technologies (Research Trend) 8, no. 1 (2017): 101-103.
10. Jr, cesario A.Bacosa. "An Electric Source of Noise Pollution Based POWER Bank." IRCHE, 2017.
11. park, joon Cheol, kim Yoon shin, and kang Dae joon. "Propagation Characteristics and Effects of Road Traffic Noise."
12. Priya, Shashank, and D Robert. "Piezoelectric Energy Harvester." United States Patent application Publication, march 2008.
13. Rakin, Jamie Sue. "Study of Piezoelectric Device for Conversion of Sound to Electricity."

