International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 03, March 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

CONVERSION OF NOISE POLLUTION TO ELECTRICAL ENERGY

Pulkit Tomar[1], Pavanesh kumar[2], Neyaz Ali[3], Sandeep Kumar[4], Tahseen Musharraf[5] , Pramod Kumar[6]

[1,2,3,4,5,6] *Department of Civil Engineering, IIMT College of Engineering, Greater Noida, Uttar Pradesh, (India)*

ABSTRACT

We all need electricity and when if someone asked what it's importance then it is much essential that many virtual possibilities are now becoming take the shape of the realistic world only due to the electricity if available abundant. Various approaches are used and commencement of these approaches help at a vast scale to provide or to fulfill the demand of the electricity. Now a day using alternate sources of energy such as sound energy,pressure(in the form of energy) to produce electrical energy. Piezometers and piezoelectric devices are used for the conversion of both the pressure energy and sound energy. At various places piezoelectric generators are used produce of electricity such as in Greater Noida Yamuna express way.

I INTRODUCTION

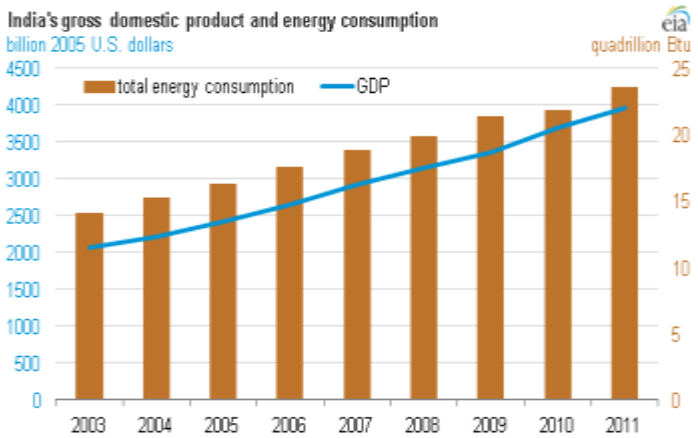
In our daily life there is greater need of electricity, without the electricity many of our work will shut down and stuck at the same point. There is a greater need and huge amount of electricity is required so various methods are adopted for the production of electricity. But use of electricity art 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. Can you guess..? . The big question in the production of electricity. 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 hoe noise pollution can be used to convert into electricity.

1.1 Nature of sound and it 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 as it need medium. 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 energy is a mechanical energy it 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 matter in that medium is periodically displaced and thus oscillates with sound wave. The sound wave displace back and forth between the potential energy compression and the kinetic energy of the oscillation. Sound energy could be easily and converted into heat energy which could be easily 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 it gave a new approach to produ -ce the electrical energy 2015.many countries are working on this matter.



Alternative methods to convert noise pollution to electrical energy and green energy:

Method 1

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.

Methods 2

By converting Sound energy into heat energy and then heat Energy into the electric energy

Method 3

This is a different approach just like the mechanism of microphone. In this method following material and sources will be used such as diaphragm, conductor and magnets combination and applying law and formula of emf.(faraday law).

II PRACTICAL APPROACHES

Method 1: Firstly understands the term piezoelectricity, it is 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. We can convert sound energy to electricity energy via. piezoelectric devices/materials (piezoelectric materials are the crystal which convert 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.

The basic equation for the resonant frequency of the cantilever type piezoelectric – $f_r = w/2\pi = 1/2\pi\ [k/m_e]^{1/2}$, f_r is the resonant frequency, w=angular frequency ,k=spring constant ,m_e=effective mass of the cantilever.

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 piezoelectric effect, and the crystals that exhibit it are classed as piezoelectric crystal.

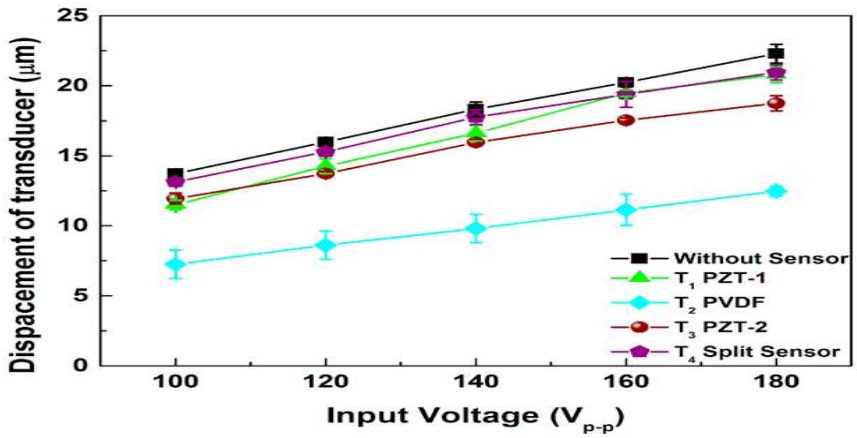
The direct piezoelectric effect

$f_n = v^2_n/2\pi L^2\ [E_o/m]$,

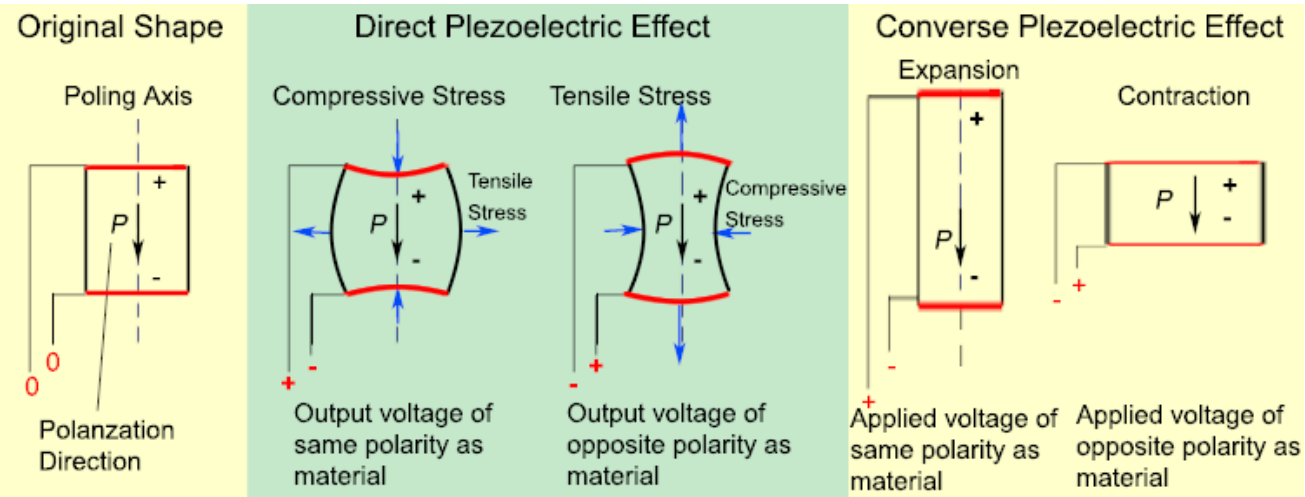
f_n is the n^{th} mode resonant frequency,

v_n is the n^{th} mode eigen value, L= length of the cantilever and m the mass per unit length of the cantilever.

E_o has its own equation for bimorph laminated composite cantilever and is a function of the young's moduli of the two material.



$E_o=2E_pT_P^3/3 +E_P T_S T_P^2 + E_P T_P T_S^2/2 +T_S^3E_S/12,$



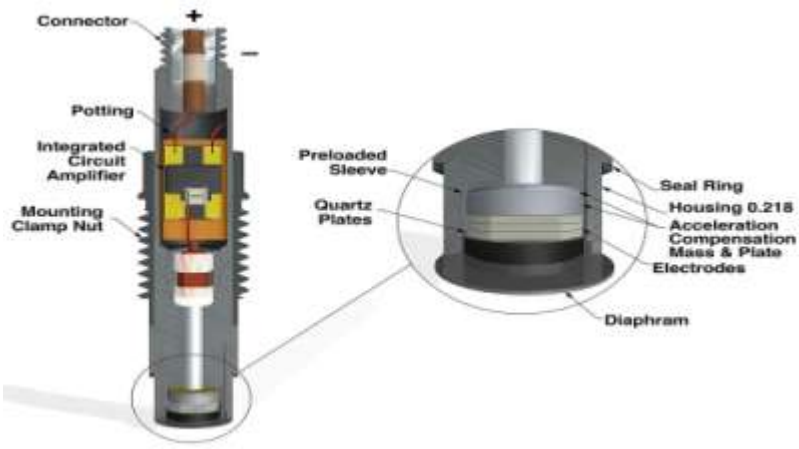
The inverse piezoelectric effect refers to the deformation in these materials like PZT etc. that results from the application of an electric field. So it could be seen that when the sound energy is applied to the piezoelectric material it create strain in the crystal then it reverse it and the strain is converted into electric energy .This direct piezoelectric effect property of an piezoelectric material could be used for making the device to convert sound energy to electric energy.

International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 03, March 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Piezoelectric sensors

It is a device can be made by using piezoelectric material. Piezoelectric material will collect the sound wave which are present near it and will be used to cause a strain due to pressure created by its oscillation in the piezocrystals and resulting the flow of electric charge on the surface of the crystal thus sound energy could easily converted into electricity because of the properties of the piezoelectric material convert mechanical strain to electric energy.

There are various types of piezoconverters that are used for noise to electrical conversion and two main groups of materials used for piezo sensors are piezoelectric ceramics and single electric material. The ceramics materials are PZT ceramics and less sensitive, natural single –crystal materials are (gallium phosphate and quartzs ,tourmaline)



PIEZOELECTRIC TRANSDUCER
PRESSURE SENSOR

III PRINCIPLE OF OPERATION

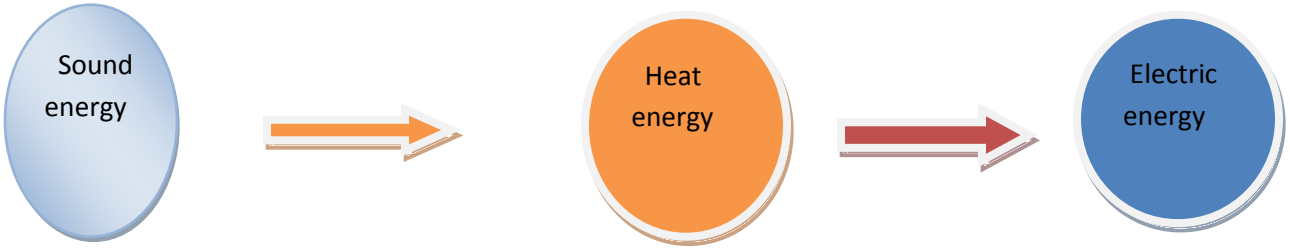
1. Transverse - $C_x = d_{xy} F_y b/a$, i.e the amount of charge depends on the geometrical dimensions of the respective piezoelectric element.
2. Longitudinal- $C_x = d_{xx} F_x n$, d_{xx} is the piezoelectric coefficient for a charge for a change in x-direction .
3. Shear - $C_x = 2d_{xx}F_x n$, this is applicable for n elements mechanically in the series and electrically in parallel the charges

The diagram as show below is representing a creative way of development and production of electricity using noise pollution

Method 2: This is an another form of the conversion of sound to heat energy then to the electric energy as sound wave travel by oscillating the particles of the medium thus when sound energy travel through the medium it will disturbs the particle of the medium this will cause disturbance in medium avail and due to this phenomenon created by particles of the medium ,the conversion from sound to heat energy takes place thus the particles of the medium collides with each other and vigorous random motion this energy automatically turns or converts into electrical form of the energy.

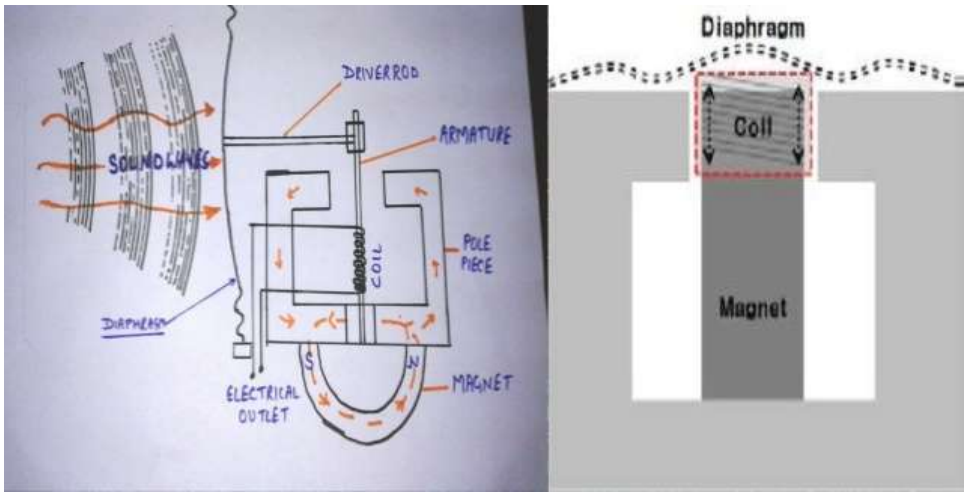
The production of heat energy will be more in the denser medium so for more heat production we will need a material with very high density.

This heat energy will be converted into electricity.



But there is a point to understand that there is loss of energy and it is more than that in other methods of production of electricity. Newton's law is applicable here during the conversion of sound to electric energy because according to this law energy can't be created and nor destroyed. In this method there is a disadvantage that during the conversion the some heat energy would be converted into another form of energy thus not much effective.

Method 3: In this method a diaphragm, a conductor and magnetic bars are taken. This diaphragm which will get fluctuated by the oscillation and pressure created by the sound wave and a conductor will be attached to this diaphragm will be placed between magnetic bars these fluctuation 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 faradays law generated emf is given by:

$\Phi_B = \iint B(r,t)^* dA$, dA is the element of the surface area of moving surface , B is the magnetic field and B*dA is the vector product .

Generated voltage = emf=velocity of conductor X

magnetic field X length of conductor.

$E=-d\Phi/dt$. where, $d\Phi$ = rate of the change of magnetic flux and E=electromotive force, Φ_B=magnetic flux

Maxwell- Faraday equation –

$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t}$, where $\nabla \times$is the curl operator and again **E**(**r**, t) is the electric field and **B**(**r**, t) is the magnetic field.. These fields can generally be functions of position **r** and time t.

$$\oint_{\partial\Sigma} \mathbf{E} \cdot d\boldsymbol{\ell} = -\int_{\Sigma} \frac{\partial \mathbf{B}}{\partial t} \cdot d\mathbf{A}$$

Σ is a surface bounded by the closed contour ***∂*Σ**, **E** is the electric field, **B** is the magnetic field, d**ℓ** is the infinitesimal vector element of the contour ***∂*Σ**, d**A** is an infinitesimal vector element of surface **Σ**.

In this method much amount of electric energy will be produced and this amount vary with the speed of the conductor motion. This method is not suitable for producing electricity via. roads can be use in places like: nuclear power plant, industries using huge and noisy machines.

3.1 Advantages, advancement (with a technological attitude) and Scope in the coming era are as follows

- Due to conversion from the sound to the electric energy it is the possible to use energy in abundant.
- It helps in the reduction of CO_2 at vast scale.
- 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 many others ways also□ □ □
- The noise or sound produce in places likes nuclear power plants, industries and noisy area such as airports can be used to produce high electric energy nonstop.
- In civil engineering, the noise from cars can be which leads to electrical energy production.
- Moscow like places can become such places leads to efficient amount of electrical energy production.
- This method is very effective and therefore the scope of this smart approach never ends.

3.2 Demerits

- Lots of work is to be done in this field.
- 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.
- It's initial cost is high number.

- Cost basically depends upon the mechanism used for converting noise to electrical energy and the level and area.

IV CONCLUSION

- The first one is that sound energy has high packet of energy thus useful to produce electrical energy unstopabble.
- The second point and the important one is the sound energy is a mechanical form of energy therefore according to law thermodynamics mechanical energy could be converted into electric energy.
- Specifically, during conversion numerous processes are not involved and procedures convert the noise to electricity conversion.

V ACKNOWLEDGEMENT

We want to thanks Mrs Tabassum Abbasi (HOD Civil Department IIMT College of Engineering), Mr Pankaj Jha (HOD Electronics Department IIMT College of Engineering), Mrs Mona Khosla(Assistant Professor IIMT College of Engineering) for guiding us throughout and providing facilities and motivation during the work.

REFERENCES

[1] Advance piezoelectric materials by kenji Uchino.

[2] Ceramics innovation in the 20th century by John B.Wachtman.

[3] Piezoelectric Transducers and Applications by ArnauVives, Antonio (Ed.)

[4] Intelligent Sensing, Instrumentation and Measurements by Mukhopadhyay , Subhas Chandra.

[5] Talk and charge research paper by Suresh Pawar, Abhijit Raut, Sabah Gowhar, Nilakshee.