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# Power Generation Using Sound by Piezo Electric Material

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**Abstract.** Pollution is a major problem all over the world. According to the energy conservation statement law states that energy cannot be created or destroyed but can be converted from one form to another. As it relates to nature, the sudden increase in urban and industrial growth has been completed with potentially hazardous waste. Sound is the electrical energy of the machine and can be converted into electrical energy through many provocative methods including heating using piezoelectric material and diaphragm. Other sounds are not preventable such as road noise, market noise, industry, train stations etc. and those unnecessary noises can be used to generate electricity. In this way we can reduce the use of piezoelectric power and energy generated by chemical materials where it is converted directly from energy to electrical energy. The widespread use of this space is to focus on how we can increase the electrical performance generated by the conversion of sound energy from non-renewable sources. When sound vibrations are in the diaphragm and are compressed and hard to convert into electrical energy.

**Keywords:**Diaphragm, Piezoelectric material, sound energy, Electricity, noise, sound vibration

## 1. Introduction

Pollution is a major problem facing all countries in the world. As it relates to the environment, the rapid growth of the urban and industrial sector has been incorporated into large-scale hazardous waste products. The huge increase in cars and citizens led to a major analysis about the "Noise Pollution". It has become a major problem facing communities. Unwanted noise affects institutional development that has a direct and indirect effect on human health activities for example, social factors, economic processes, education and production. The effect of noise has a direct or indirect effect on physical health, mental disturbances of daily activity that result in permanent or permanent hearing loss, ranging from insignificant deterioration to almost hearing loss. Traffic noise has been tested as a major source of noise pollution. These modes of transport such as trains, buses, motorcycles, heavy planes and trucks spread noise pollution [1].

Sound is a form of energy by the levels of sound pressure received by the human ear. As stated in the third law of thermodynamics mechanical energy can be converted into electrical energy. Sound as a form of



mechanical energy can be converted into electrical energy. There are various ways to convert electrical energy from sonic energy to heating with pie-making materials. Through the use of piping equipment this work focuses mainly on the use of sound in the process of transformation to generate stored green energy. It is used to reduce energy consumption generated from non-renewable sources. Compared to other application sources the electricity source can be very useful in human life. The presence of noise in a noise-like environment forms a necessary component of local pollution [2]. The use of sound is to use it to generate electricity which could lead to the process of finding another invisible energy source that is beneficial to non-renewable sources such as coal, crude, oil, etc.

The intermittent sound like water, solid and air like pressing waves is like a shear wave. Sound waves are generated by the sensation of sound like a vibrating diaphragm (stereo speaker). Sound source creates tremors in the embedded channels. The source start carries with the vibration and in the middle of the vibration that separates from the point detection by the speed of the sound, by creating a sound wave. Vitality and removal of medium area with varying pressures at a time will not change from source. Movement, pressure and speed vary in space at a specific time [3].

When these structures move as fast as they make sound, they can be seen over many categories of sensors (sound sensors). The most active sound sensors are piezoelectric objects. In response to mechanical pressures, piezoelectricity is the amount that accumulates in solid materials, certain clay materials and especially crystals. With respect to the mechanical pressure applied, the effect of piezoelectric is the ability of certain substances to generate electricity. Direct electromechanical contact between the electrical and mechanical state is well known as a piezoelectric effect. In crystalline materials it is subject to the possibility of unstable evolution. From the mechanical power, a process combined with a piezoelectric effect during the internal production of electrical energy emerges. One of the recurring features of the piezoelectric effect is that the indicators of the piezoelectric effect when applied to stress. In electrical production show the piezoelectric negotiating effect. Sound is defined as the vibration of a piezoelectric transducer and the wind that contains vibrations and pitching devices that are found to be suitable for application for sound acquisition and production. In the external electrical sector under pressure equipment where piezoelectric devices are installed, transfer negative and constructive billing facilities to what is happening. The external electric field expands (compresses) the piping material during conversion. The piezoelectric effect works on a wide range of applications including sound detection and production, electronic frequency production, microbalances, ultra-fine focus generation of high-speed telephones and visual cues. The most common sensor emissions used in piezoelectric images and in piezoelectric micoustic-electric guitar microphones are used to detect pressure differences in sound [4]

In current scenario electricity is generating from various non-renewable source. Solar is the biggest source of electricity in upcoming days. Conversion of sound to electric energy is less popular and very effective in major cities and most noisy areas. This process consumes some power in our day-to-day life. This can use implemented in many noisy areas like railway station, markets, industries etc. In our daily life we are facing the power problem. Since most of the Electronic devices consume more power, we require an alternate power system. The rapidly enlarge demand for high restriction and electrical energy on pollution levels have led to interest in large scale utilization renewable energy [5].

The main objectives of this work are

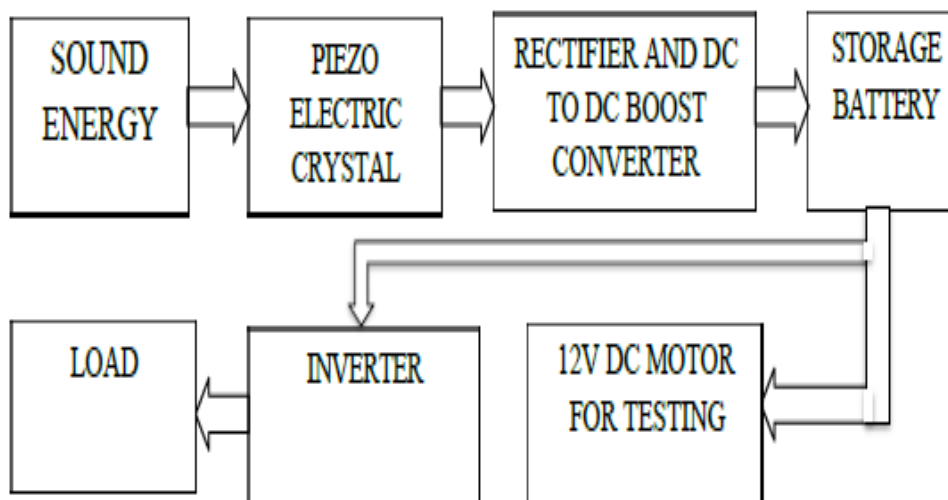
- Generation of electrical energy using sound energy.
- To develop a piezoelectric energy harvesting system from sound using piezoelectric crystal.
- Store and forwarding electrical energy for efficient usage of noise using storage batteries.

## 2. Methodology and Implementation

### 2.1 Sound to electrical energy using piezoelectric crystal

As non-renewable sources, accumulation of noise required to generate electricity that led the way to invent another unseen source of energy. When sound wave travel through a medium periodically replaced and with sound waves it oscillates. Because of kinetic energy of the oscillation and potential energy compression sound wave displaces back and forth. Before sound energy converted into electricity it can be transformed into heat energy, but not extremely systematic. By piezoelectric material, the loss conversion is added additionally whereas dissimilar method is converted to electricity. From mechanical strain, Piezoelectric materials are the crystal which transform to electric energy. Third law (3<sup>rd</sup> law) of thermodynamics states that mechanical energy might be converted into electric energy. The Piezoelectric material used for transformation of noise pollution to green energy and then to electric energy [6-11].

In response to pertain mechanical stress the word piezoelectricity explains electric charges will accumulate in some specific materials (solid materials). In some materials (crystalline materials) the effect of Piezoelectric is defined as the electro-mechanical relation between electrical state and mechanical state with no inversion symmetry. Figure 1 shows the Conversion of sound energy into electrical using piezo electric crystal.



**Figure 1.** Conversion of sound energy into electrical using piezo electric crystal

When charges are applied in an electric field by extrinsic means when a piezoelectric crystal is placed, the crystal indicate strain and the dimensions of the crystal changes. The inverse piezoelectric effect defined as the direction of the pertain electric field is reversed then the direction of the resulting strain is also reversed. when sound energy is applied to the piezoelectric material creates strain in crystal then it reverses. The strain is converted into electric energy by piezoelectric material. The effective property of piezoelectric material can be used for the device to transform to electric energy from sound energy.

Single crystal materials indicate the following event when the crystal is deformed by implementation of an external stress. When the crystal is mechanically strained either electric charges or sound energy emerge on the crystal surfaces. When control of the strain reverses, the polarity of the electric charge is also reversed direct piezoelectric effect. Sound energy could be used to perform different functions by converting into useful electric energy.

## 2.2 Implementation

The sound source is speaker in order to produce more vibrations, the piezoelectric quartz crystal is connected directly to the speaker since the sensitivity of the material is low due to the size of material. The sensors are connected in series, springs used in between each sensor in order to create more pressure, these elements are converting sound into electrical signal, the converted voltage and current is very low, in order to boost signal the LM2596S DC to DC buck power converter uses various steps to boost the input signal, we can adjust the output voltage to required level to charge the battery. The battery is used to store is sealed lead acid battery of 12V which is low cost efficient, firstly a DC motor is used to verify the voltage and current is sufficient to run the motor. After testing of motor, the inverter is used to convert the 12V DC to 220V AC to light an LED Lamp of 9W. We can use other load also for simplicity purpose we are using the LED lamp.

## 3. Results and Discussion

The sound is measured by using Sound meter android app; the respective voltages are measured using the digital multimeter. As the input sound is sensed by the piezoelectric sensor the sound is captured and in turn converted into electrical energy the respective output is measured. The measured output voltage is tabulated with respective input sound. As the intensity or pressure of the sound is more, more amount of voltage we could obtain. With the process of rectification using filter the enhancement of the voltage is seen. It is observed that in the presence of filter more voltage is produced than without filter. The necessary components are interconnected to form a system that could generate power using sound as an input. The sound is sensed using the sensor and the respective output voltage is produced. The below figure 2 shows the maximum output voltage obtained. Table 1 shows the Tabulation of output voltage to respective input sound



**Figure 2.** Maximum output result

**Table 1.** Tabulation of output voltage to respective input sound

Sound Level(dB)	AC output voltage (V)	Rectifier DC output voltage without filter (V)	Rectifier DC output with filter (V)
40-45	0.4	0.3	0.5
50-55	0.8	0.7	0.9
60-65	1.1	1.0	1.6
65-70	1.6	1.5	2.8
70-75	2.1	2	3.6

#### 4. Conclusion

Sound is present enormous quantity in nature it can be utilized into suitable electrical energy. The efficiently converted energy helps us to reduce the scarcity of electric energy across the globe. The purpose of converting sound to electricity is to reduce the power usage from alternatives sources like solar and inverter. Sound is not continuous form of energy and it is difficult to harvest but it can be overcome with the help of piezoelectric material. This system is more efficient and less expensive compared to the existing solar systems; the power rating can be increased or decreased according to the applications.

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