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Exploring the Awareness & Interest of Farmers About Renewable Piezoelectricity

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ABSTRACT—

Present investigation recommends Piezoelectricity as an alternate energy source for the farmers. The motive behind this survey is to suggest a pollution-free energy source to the farmers, to check the awareness and interest of them regarding piezo renewable energy. Current work illustrates the awareness among the farmers about piezoelectricity generation from cattle movement for a farm house among the farmers via Survey technique.

Keywords— Piezoelectric material, energy harvesting, Lead Zirconate Titanate(PZT), Mechanical energy, Stress,

1. Introduction

In present era, wireless data transmission techniques are commonly used in electronic devices. Harvesting of mechanical energy utilizes piezoelectric components where deformations produced by various means that are directly converted to electrical charge through piezoelectric effect. Piezoelectric energy is the process of converting mechanical energy into electrical energy, or vice versa, using piezoelectric materials. Piezoelectricity is a result of the coupling between the electrical and mechanical properties of certain materials, such as crystals and ceramics.The commonly used portable renewable sources are: solar power, wind energy and piezoelectricity.

Readers may imagine

- charging laptop/mobile by typing
- Powering a bathroom while using commode
- Power your kitchen while cooking by standing near kitchen otta
- Power your living room by sitting on a sofa
- Power your bedroom by sitting or sleeping on a bed

In the case of powering with batteries, there is a necessity to replace these batteries, which increases operating costs of monitoring system and makes the whole system non eco-friendly [2].This study is focused on production of piezoelectricity as it depends on the mechanical pressure or strains to obtain electrical energy, while the other sources are not reliable at all times. Hence the sensor used for research work is made of piezo ceramic material Lead Zirconate Titanate (PZT) is discussed in this manuscript. PZT is a mixed crystal of titanate and lead zirconate [3, 4].

Compared to Barium titanate, a previously discovered metallic oxide-based piezoelectric material, PZT exhibit greater sensitivity and has a higher operating temperature. Due to its physical strength, chemical inertness, tailor ability, and relatively inexpensive manufacture costs, it is one of the most commonly used piezo ceramics used in the industry [5, 6].

PZT is formed under extremely high temperatures. The particulates are filtered out using a mechanical filter. PZT causes a compound to change shape from an electric field [7, 8].

The higher energy storage density is the reason for opting piezoelectricity.er. In piezoelectric energy harvesting, piezoelectric sensor is used as a harvesting element and the storage element is a battery [9].

Before subjecting the material to external stress the centers of positive and negative charges of each molecule always coincide. Hence effects are reciprocally cancelled and electrically neutral molecule appears. But when mechanical stress is applied, the internal structure deforms causing the separation of positive and negative charges generating the dipoles [10].

2. Related Work

Examples of such piezo crystalline structures are Quartz, Rochelle salt, Topaz, Tourmaline, Cane sugar, Berlinite (AIPO4), Bone, Tendon, Silk, Enamel, Dentin, Barium Titanate (BaTiO3), Lead Titanate (PbTiO3), Potassium Niobate (KNbO3), Lithium Niobate (LiNbO3) etc.[11-15]. Many researchers studied on which type of circuit should be used at the output terminals of piezoelectric crystal in order to have maximum wattage [15-20].

3. Experimental Method/Procedure

The online survey through Google form was used as a data-collection source, where a set of questions was sent to a target sample and responses were collected automatically on Google drive. Then the attitude of farmers of Maharashtra for implementing the piezo energy plant at their farms was checked via Google form method.

- Customized a Google form
- Link of the Google form is made viral via different Whatsapp groups to farmers of Maharashtra region
- Responses of the respondents were collected automatically on Google drive in a spread sheet
- Responses were analyzed by using Automatic & Excel graph plots
- Conclusions were drawn from the analysis and interpretation of the received responses

4. Results and Discussion

Analysis of responses

4.1 Occupation of Respondents

In the context of the present study, out of the 50 respondents, 22 % were from Farming and business, 40 % from Farming and Service and 38 % from Farming only.

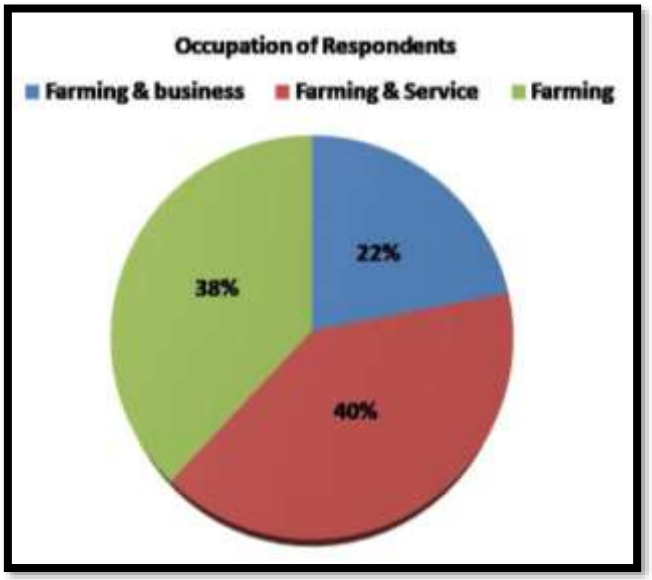

Figure 1. % of occupation of respondents

4.2. Energy consuming devices of respondents

Of the 50 respondent farmers studied the highest percentage of 44 % of respondent farmers use light to drive a motor on a well. They also use 24% light for LED bulbs. They use 9% light for tubes, while they use 23% light for additional equipment.

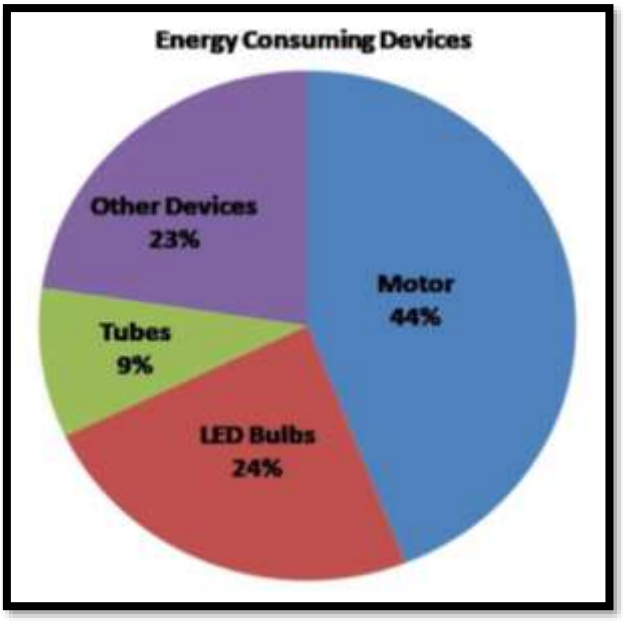

Figure 2. % of various energy consuming devices of respondents

4.3. Monthly energy consumption

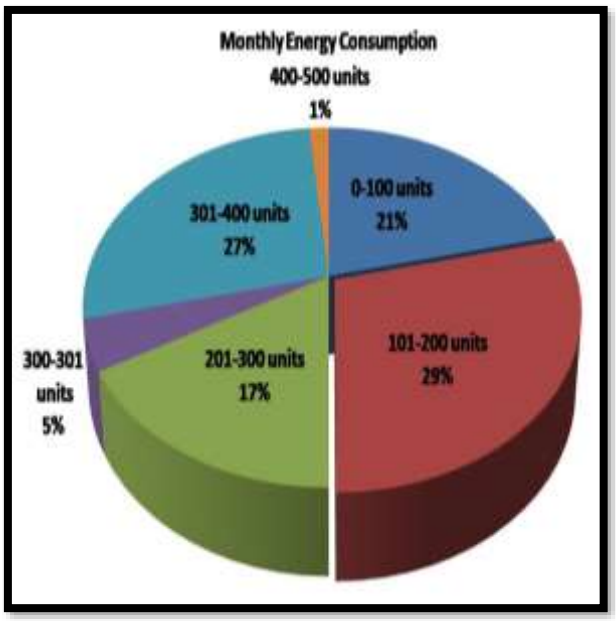

Figure 3. % of monthly energy consumption of respondents

In this present study, 29 % of the respondents said that their power consumption was 101 to 200 units. There are 27% respondents using 301 to 400 units and only 21% respondents using up to 50 units. Between 201 and 300 units use 27 % of the response and beyond 300 units only 5% of respondents use electricity.

4.4. Monthly MSEB Light bill

Out of the 50 respondents included in the study, 32 per cent respondents have a monthly light bill of up to Rs 2,000 and 30 per cent respondents have a monthly light bill of up to Rs 1,000. Bills for 20 percent of respondents range from 4,000 to 5,000.

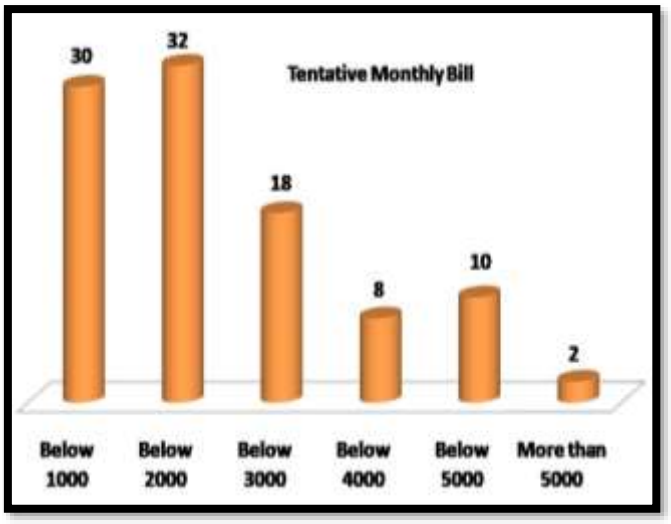

Figure 4. Monthly Light Bill of respondents

4.5. Energy Sources of respondents

Out of the 50 respondents included in the study, the majority of respondents (54%) relied on electrical or energy sources, while the remaining 46% appeared to use energy sources such as biogas and biomass.

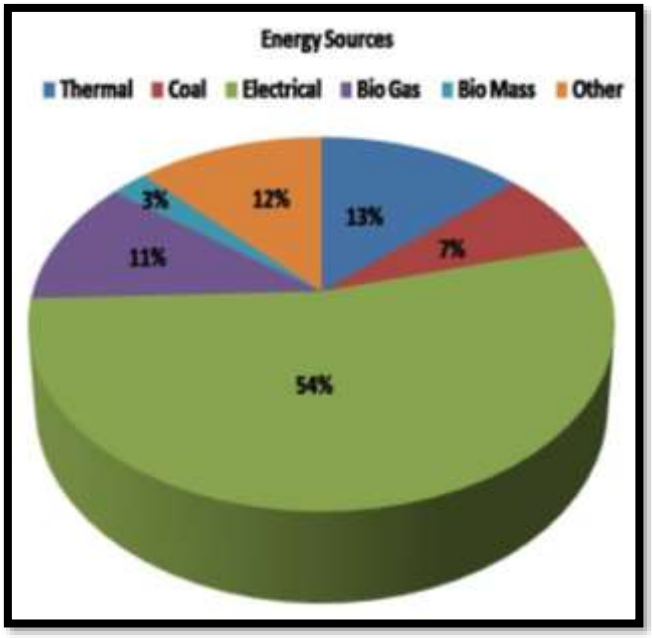

Figure 5. Different energy sources used by respondents

4.6. Awareness about piezoelectricity

Do the 50 respondents involved in the study know about renewable energy? When asked, the majority said that 68% of the respondents were aware of the issue, 18% were ambivalent and 14% were unaware of renewable energy.

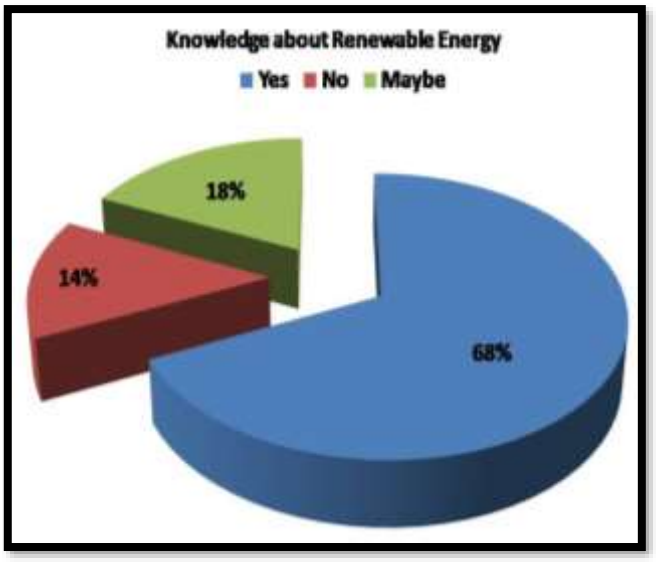

Figure 6. Proportion of awareness about piezoenergy

4.7. Awareness about piezoelectricity

The majority of respondents, 80 %, said they would like to use renewable energy in their fields when they were asked if they would use renewable energy in their fields. So 18 % of respondents were found to be in a dilemma. Only 2 % of respondents answered in the negative.

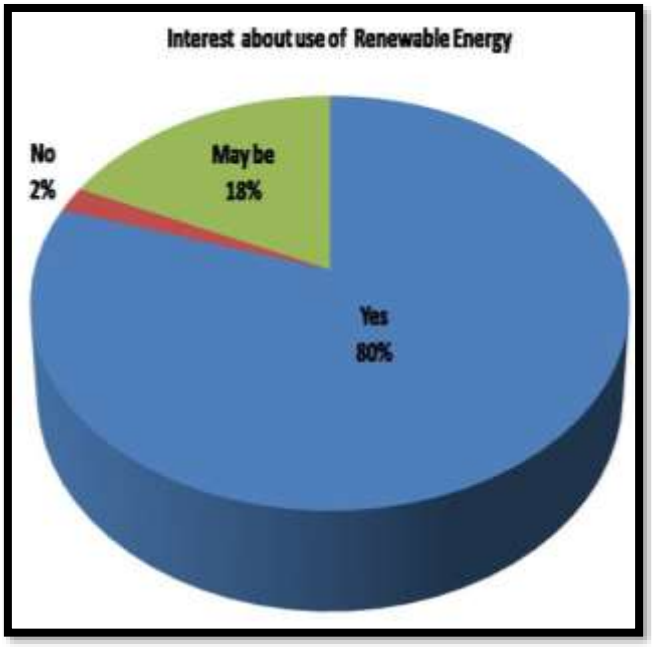

Figure 7. Proportion of interest about renewable piezo-energy

4.8. Reason behind using Piezoenergy

Out of the 50 respondents included in the study, when asked why they are keen to use renewable energy, 27% of the respondents said that they are keen to use these energy sources as electricity is not regular. The 23 % of the respondents were keen to use renewable piezoenergy to protect the environment, 19 % of the respondents were keen to use renewable energy as the light bill was increasing day by day while 17% of the respondents were keen to use renewable piezoenergy due to MSEB problems.

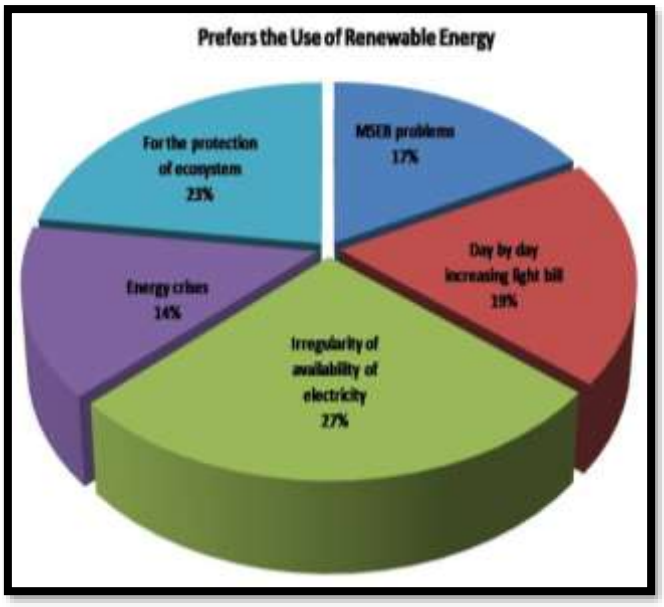

Figure 8. Various reasons for opting piezoenergy

4.9. Advantages of using Piezoenergy

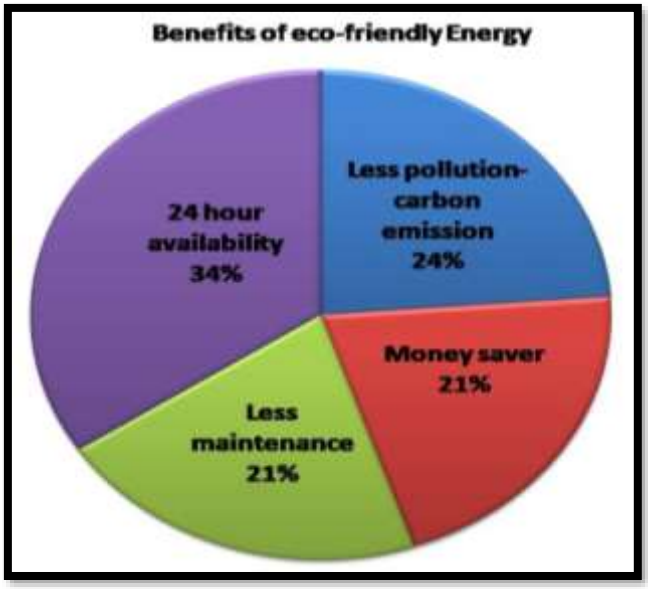

Figure 9. Advantages of opting piezoenergy

When asked that what would be the benefits of using renewable **Piezo**energy, the 34 % of the 50 respondents replied that there will be 24 hours availability of light and 24 % respondents thought that environment would be protected due to use of **Piezo**energy, Whereas 21 % of respondents said that there will be money saving and less maintenance due to piezoenergy.

4.10. Problems due to irregular electricity supply

Out of the 50 respondents in rural areas, 47% respondents are facing water problems due to irregular light supply. So 27 % of respondents have a tension of protection of home, animals and agriculture. About 15 % farmers experienced the problem of mobile discharge. Only 11 % of farmers have a problem of entertainment.

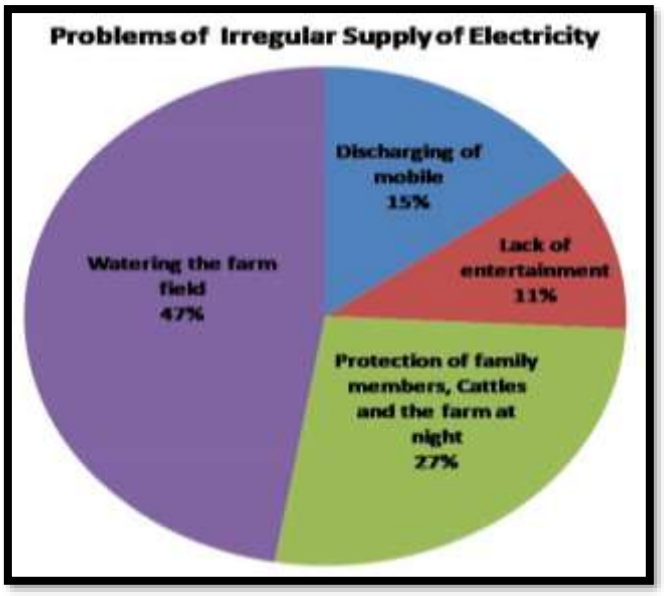

Figure10. Various Problems faced by respondents due to irregular electricity

4.11. Mindset of respondents about piezoenergy

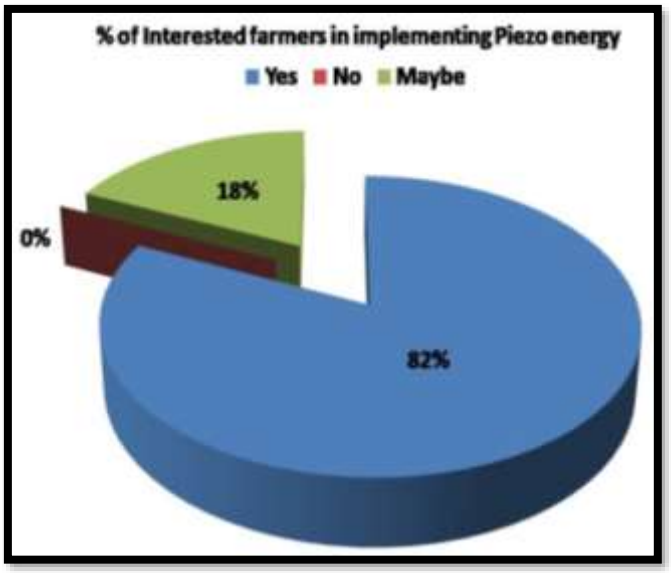

Figure11. Mindset of respondents for piezoelectricity

Farmers in rural areas are facing various problems due to regular electricity. Thus, 18% of the respondents in the study appeared in a dilemma in this regard and 82% are eagerly waiting to implement piezoenergy.

4.12. Annual Income of respondents

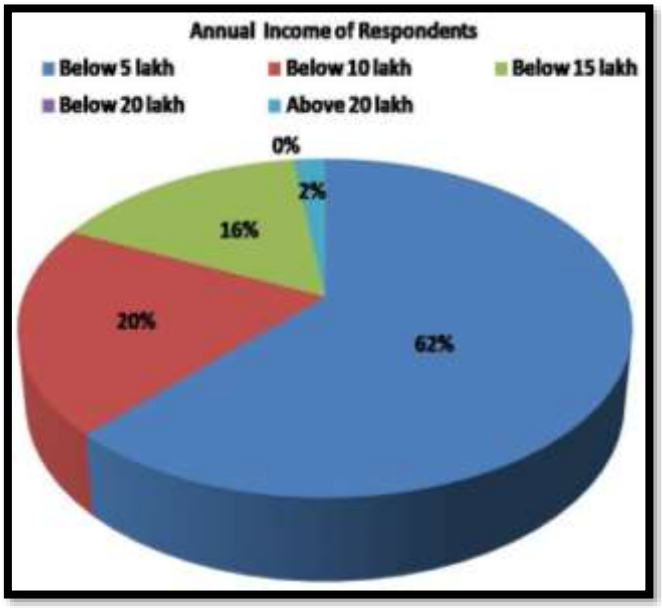

Figure12. Annual income of respondents for implementing piezoelectricity

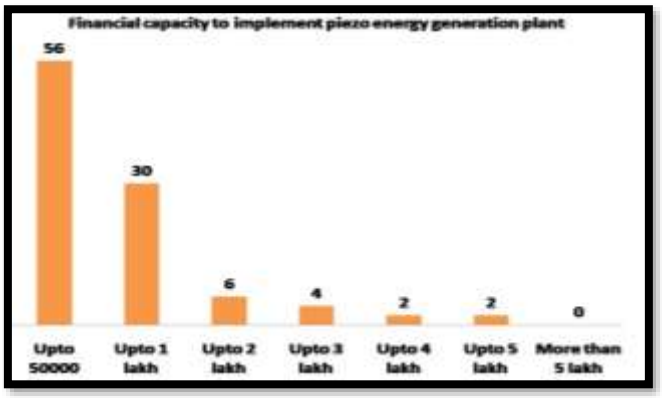

Figure13.Financial capacity of respondents for implementing piezoelectricity

From the above two graphs, it is seen that when the annual income of the respondents in the rural areas was studied, 62% of the respondents earned less than 5 lakh rupees and 20 % of the respondents earned less than 10 lakh rupees. The majority of those willing to spend on the plant, 86% of respondents, appear to be willing to do so because of the problems they face due to lack of light in rural areas. So 14% respondents appear to be willing to spend Rs 2 lakh to Rs 5 lakh on this piezo energy.

6. Conclusion and Future Scope

From the present survey the confirmed facts are,

- Every respondent has farming as a profession doing parallel with a service or a business.
- Major portion of the required electricity (44%) for the farm is for motors i.e. watering the crops.
- Since most of the farmers use 100-400 units of electricity.
- Major respondent farmers (62%) pay the monthly electricity bill of up to two thousand.
- Respondent farmers are ready to spend a portion of their income on renewable energy as they are known about it through various media.
- Major source of energy at a farm house is electrical energy (54%).
- Most of the respondent farmers (68%) are aware about renewable energy. Majority number of farmers (80%) has shown interest in implementing renewable energy at a farm.

- As farmers are suffering from huge number of power problems at their farm such as day by day increasing light bill, energy crises, irregular supply, majority (82%) farmers are ready to construct a piezo energy plant at their farm.
- Majority number of farmers (62%) has their annual income below 5 lakh, but though 86 % farmers are ready to invest up to 1 lakh amount for the piezo energy plant at their cattle farm.
- The positive attitude of the respondent farmers will move towards reducing the hazards to the environment, 24-hours availability of electricity, money saving and less/no maintenance.

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