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Rainwater Pressure Electic Generator Model Using Piezoelectric

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A B S T R A C T S

Renewable energy technology is needed to deal with climate change and reduce non-renewable energy such as oil and coils, which are still widely used until now. In this research, we design a rainwater pressure electric generator model using a piezoelectric. We use the pressure from water falling of drainage, and then turn it into electrical energy with a piezoelectric sensor. The sensor will generate an electric voltage that will be saved it into batteries. The results show the high pressure of waterfall will produce high electrical energy, and it depends on the volume and height of the falling water.

A R T I C L E   I N F O

1. INTRODUCTION

Indonesia is a country that has two seasons, namely the rainy and dry seasons (Ulil et al., 2019; Susanto et al., 2020; Saeri et al., 2019). One of the areas that have high rainfall is Bogor City, West Java. With a rainfall of 70% each year (Ramdhan et al., 2018). Therefore, it can be used as a source of energy in electricity through a piezoelectric circuit (Bhuvaneswari et al., 2021; Acciari et al., 2017; Wu et al., 2021).

Piezoelectric is a material that produces electrical energy based on the influence of pressure. With a piezoelectric circuit, rainwater in direct contact with the tool will create pressure and produce effective stress (Almanda et al. 2016; Ilyas & Swingler, 2015; Helset & Wen, 2017). The electrical energy produced by piezoelectric will be higher if the rainfall and wind speeds are of great value (Zebua et al., 2019; Zhao et al., 2019). Rainfall and electrical energy produced by a piezoelectric circuit are directly proportional; the more significant the rainfall, the higher the pressure, and the greater the electrical energy (Ong et al., 2016; Bao & Wang, 2020). However, the electrical energy produced piezoelectric will be low if the rainfall activity is low (Wong et al., 2017). Using rainwater, the circuit will produce more effective electrical energy. However, if the rainfall is slight, it will produce low energy (Abidin et al., 2018).

Previous research on piezoelectric produce electrical energy by the same method, that is using utilizing average rain pressure. In this research, we use a different method by collecting rainwater in the water tank. Then, it will have flowed in a piezoelectric circuit. Using this method, flowing water will be efficient and produce more optimal electrical energy.

2. METHODS

We use a study literature research method from various existing sources. We design a plan that can be applied it in their own house. The pressure is obtained from falling water of drainage and it collect in large container. So, the pressure of the water can be adjusted to produce electrical efficient energy. This design can generate electricity by converting pressure to electricity with a piezoelectric circuit. This circuit of piezoelectric is arranged with parallel system so the produce of electricity can stable and large. **Figure 1** illustrates the rainwater power plant model using piezoelectric.
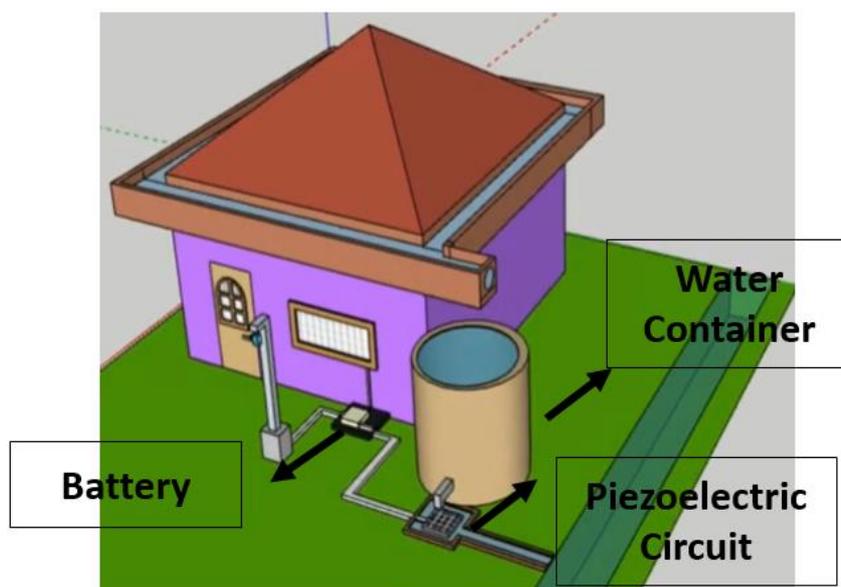
Figure 1. Rainwater power plant model using piezoelectric.

3. RESULTS AND DISCUSSION
3.1. Model and how toolsets work

   Figure 2 shows the piezoelectric circuit shape in parallel and it is helpful for greater voltage. The current in the circuit is AC and converted to DC using a diode. Then, it can be stored in the battery. The taps in the water reservoir are adjusted so that the resulting pressure can be more significant. In the conversion process, rainwater falls, and water will be accommodated. In the bin, water is flowed using a tap that can hit the piezoelectric circuit that has been milked in parallel. When the water hitting, the circuit will produce a voltage, the voltage will be raised with a transformer and changed the current using diodes. Then, the electrical energy can be stored in the battery.
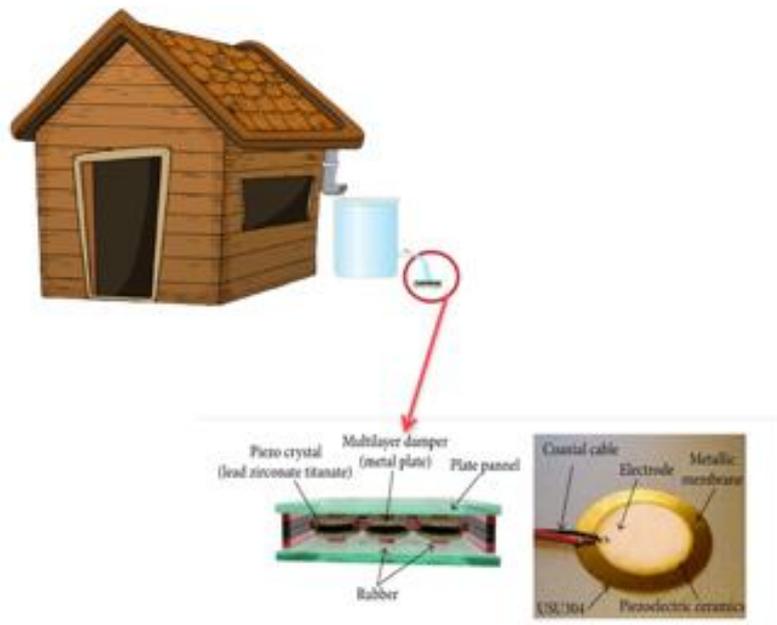
Figure 2. Model of rain water power plant using piezoelectric.

3.2. Research data

   According the data on **Table 1**, the wind speed and rainwater are directly proportional to the resulting voltage.

Table 1. Piezoelectric experiment data with direct rainwater (adopted from Zebua *et al.*, 2019)

Wind Velocity (m/s)	Rainfall (mm)	Voltage (V)
0.3	2.4	20
0.8	3.1	25
0.9	3.7	28
1.1	4.3	30
1.3	4.5	39

   Data in **Tabel 2** and **3** show that the hairdryer's high speed produces a high voltage as well and the voltage accumulated in the bin, respectively. By using a water tap that accommodated in the container, the falling of water will be use as a reference of the

container's height. The higher the container, the greater the water splash pressure hitting the piezoelectric circuit.

Table 2. The voltage accumulated in 30 minutes using hairdryer as a wind source and from falling water (Adopted from Zakaria & Loon, 2018).

Time	Type of Wave	Weak Gusty Wind (V)	Strong Gusty Wind (V)
5		0.39	0.524
10		0.741	1.288
15		1.109	1.534
20		1.498	2.578
25		1.943	3.562
30		2.204	4.512

Table 3. The voltage accumulated in the bin (Adopted from Zakaria & Loon, 2018).

Reading Voltage (V)	Height (cm)	4.5	11.8	19.1	26.4	30.9
1		1.56	3.09	2.86	2.12	1.56
2		1.69	2.63	2.91	2.45	1.69
3		2.22	2.58	2.70	2.63	2.22
4		2.26	2.85	2.42	3.76	2.26
5		1.4	2.73	2.72	1.82	1.45
Voltage Accumulated		8.24	13.88	13.65	12.78	9.18

$h = 70 \text{ cm} = 0{,}7 \text{ m}$

so :
$$v = \sqrt{2gh}$$
$$v = \sqrt{2(10)(0,7)}$$
$$v = 3,7 \ ^m/_s$$
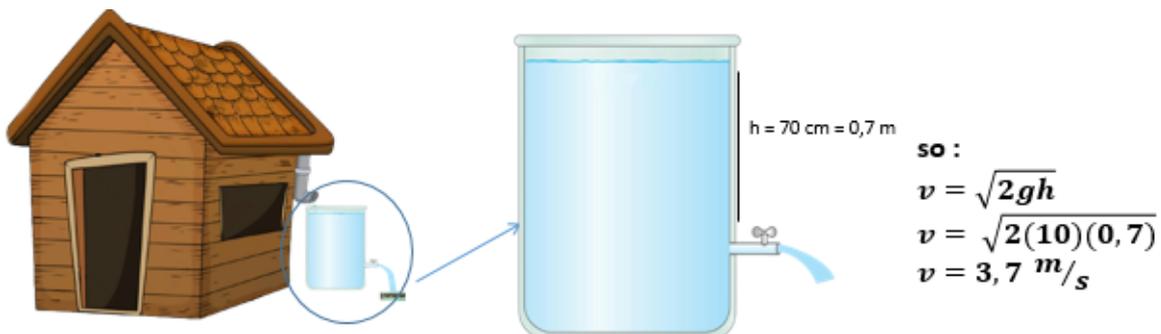
Figure 3. Tank's rainwater.

Figure 3 shows rainwater in tank. By setting the distance between the taps and the shelter surface in 0.7 m, we get 3.7 m/s speed of the falling of water. Thus, the tank's rainwater, that is accommodated first, will produce significant pressure and high electrical energy.

4. CONCLUSION

This piezoelectric pressure power plant uses a low-power producer of electrical energy. Although low-power, this plant is pollution-free. We hope that it can produce optimal and efficient energy. To get maximum electrical energy, it is necessary to increase piezoelectricity and considerable rainwater pressure.

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6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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