The Effects of Rain Intensity and Water Elevation with Energy Productivity of Kracak Hydro Power Plant, Bogor Regency – West Java

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Abstract. This paper was aimed to know the effects of rain intensity and water elevation with energy productivity of Kracak Hydro Power Plant, Bogor Regency – West Java. The method used multiple regression analysis with a quantitative approach to describe the effects of rain intensity and water elevation with energy productivity of Kracak Hydro Power Plant. Based on the data, the highest rain intensity was in February of 13.35 mm with water elevation of 346.09 cm and produced electrical energy of 198.296 kWh. The lowest rain intensity was in July of 0.86 mm with water elevation of 194.02 cm and produced electrical energy of 49.772 kWh. The average rain intensity was 8.9 mm with water elevation of 324.12 cm and produced electrical energy of 156.010 kWh. The results of testing the effect of rain intensity with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.002 (p <0.05) and a t value of 4.306. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that rain intensity has a significant positive effect with energy productivity at the Kracak hydropower plant. And the results of testing the effect of water elevation with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.003 (p <0.05) and a t value of 3.864. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that water elevation has a significant positive effect with energy productivity at the Kracak hydropower plant. The conclusion on this research is the rain intensity and water elevation have effects with energy productivity of Kracak Hydro Power Plant.

1. Introduction
The Kracak Hydro Power Plant is a reservoir type hydropower plant from the upstream of the Cianten River with an area of the Cikuluwung dam and river [1]. This plant is capable of producing an average of 150,000 kWh of electrical energy in one year, equivalent to 0.01% of Indonesia's hydroelectric production [2], or around 0.0001% of national energy production [3].
The electrical energy generated by hydroelectric power is closely related to climate change, rain [4-10] and water elevation [11-13]. Geographically, the Kracak Hydro Power Plant is in a fairly high rain area, located in Kracak village, Leuwiliang sub-district, Bogor regency.

The rain intensity can affect the water elevation in the reservoir which has an impact on the production of electrical energy. Therefore it is important to know the effects of rain fall and water elevation towards Kracak Hydro Power Plant, Bogor Regency – West Java.

2. Method
The method used in this study is a descriptive method through a quantitative approach. The data of rain fall, water elevation, and Power Plant Productivity were collected from BMKG and Kracak hydroelectric, then analyzed with application of SPSS IBM 24. The analysis results obtained from the SPSS application are concluded the effects of rain intensity and water elevation with energy productivity of Kracak Hydro Power Plant. The flow chart of methods was shown in Figure 1.

![Flow chart of method](image)

**Figure 1.** Flow chart of method

3. Results And Discussion
3.1. Result
The rain intensity, water elevation, and energy productivity of Kracak Hydro Power Plant during was listed in the Figure 2.
Figure 2. (a). Graph effect of rain intensity with energy productivity; (b). Graph effect of water elevation towards energy productivity

Based figure 2, the highest rain intensity was in February of 13.35 mm with water elevation of 346.09 cm and produced electrical energy of 198.296 kWh. The lowest rain intensity was in July of 0.86 mm with water elevation of 194.02 cm and produced electrical energy of 49.772 kWh. The average rain intensity was 8.9 mm with water elevation of 324.12 cm and produced electrical energy of 156.010 kWh.
The rain intensity and water elevation have a positive effect on increasing energy productivity. This means that the higher the rain intensity and water elevation, the higher energy productivity of Kracak hydropole power plant.

3.2. Discussion

The effect of rain intensity with energy productivity was shown in Figure 3.

The results of testing the effect of rain intensity with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.002 (p <0.05) and a t value of 4.306. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that rain intensity has a significant positive effect with energy productivity at the Kracak hydropower plant.

The effect of water elevation with energy productivity was shown in Figure 4.

The results of testing the effect of rain intensity with water elevation at the Kracak hydropower plant resulted in a significance value of 0.0024 (p <0.05) and a t value of 2.653. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that rain intensity has a significant positive effect with water elevation at the Kracak hydropower plant.

The effect of water elevation with energy productivity was shown in Figure 5.

The results of testing the effect of water elevation with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.003 (p <0.05) and a t value of 3.864. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that water elevation has a significant positive effect with energy productivity at the Kracak hydropower plant.
4. Conclusion
This article studied, the highest rain intensity was in February of 13.35 mm with water elevation of 346.09 cm and produced electrical energy of 198.296 kWh. The lowest rain intensity was in July of 0.86 mm with water elevation of 194.02 cm and produced electrical energy of 49.772 kWh. The average rain intensity was 8.9 mm with water elevation of 324.12 cm and produced electrical energy of 156.010 kWh.

The results of testing the effect of rain intensity with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.002 (p <0.05) and a t value of 4.363. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that rain intensity has a significant positive effect with energy productivity at the Kracak hydropower plant.

The results of testing the effect of rain intensity with water elevation at the Kracak hydropower plant resulted in a significance value of 0.0024 (p <0.05) and a t value of 2.653. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that rain intensity has a significant positive effect with water elevation at the Kracak hydropower plant.

The results of testing the effect of water elevation with energy productivity at the Kracak hydropower plant resulted in a significance value of 0.003 (p <0.05) and a t value of 3.864. This value indicates that the significance value is below 0.05 and has a positive coefficient direction. It means that water elevation has a significant positive effect with energy productivity at the Kracak hydropower plant.

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