THE MAPPING OF ELECTRICITY DISTRIBUTION BY USING GEOGRAPHICAL INFORMATION SYSTEM IN BLAWAN IJEN AREA

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ABSTRACT

East Java is a province that have geothermal potention, one is located in Blawan Ijen area, in Bondowoso district that since 2013 has been on first stage of exploration. This paper will be presenting about the usage of Geographical Information System (GIS) as the processor of spatial data, as for the mapping consists of SUTM tower, SUTR tower with additional information such as voltage, the length of channel, the type of conductor, the feeder code and dropping voltage. The mapping of electricity distribution network is based on survey result on geothermal exploration area.

Index Terms— geothermal, geographical information system, electricity distribution network

1. INTRODUCTION

Blawan Ijen mountains is one of the locations with geothermal potential in East Java, that is now on the exploration stage that is organized by PT. Medco Cahaya Geothermal, started in 2011. The projection of electricity of 110Mwe with an area of 62.620Ha, Blawan Ijen is border area between the three districts, they are Situbondo, Bondowoso, and Banyuwangi districts [1]. In planning and developing stage of geothermal in Blawan Ijen area, an information system about electricity distribution of substation in Situbondo that can support the activity in exploration stage and other stage is required. The mapping of electricity distribution network consists of SUTM 20 kV tower, SUTR 220V tower with some informations such as voltage, channel length, the conductor type, the feeder code and drop voltage analysis.

Geographical Information System is a computer-based system that is used to process and store data or information that is geographically referenced[2]. Geographical information system is databased system whinch is spatially or geographically. Spatial data is data about the objects or geographical elements below, above and on the earth's surface that can be identified based on specific or georeferenced coordinate system. The working principle of geographical information system can be described into several subsystems and can be described in Figure 1.

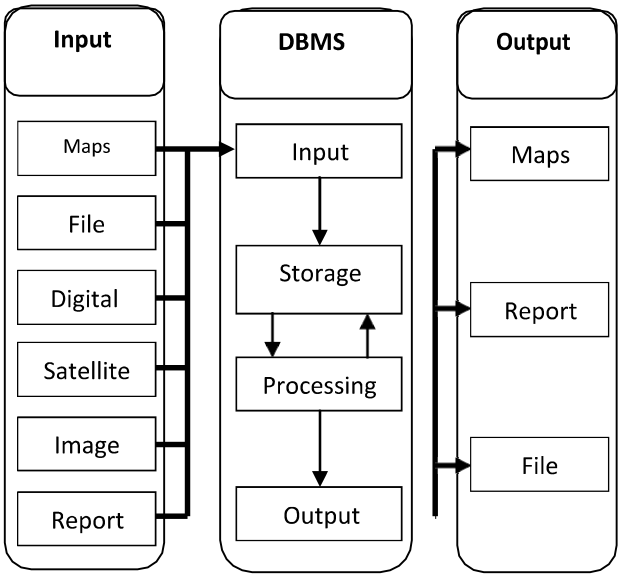

Figure 1. The working principle of geographical information system

This paper is mapping and analyzing the medium voltage network of 20kV and low voltage of 220kV, medium voltage is supplied by Jangkar feeder in Situbondo and low voltage is supplied by three distribution substations in Mlaten, Krepean and Jampit. The analysis of drop voltage is done to Mlaten distribution substation (LD 196), Krepean (LD195) and Jampit (LD197).

This contribution has been peer-reviewed

2. METHODOLOGY

The mapping process of the electricity distribution network in Blawan Ijen area has several research stages shown in figure 2.

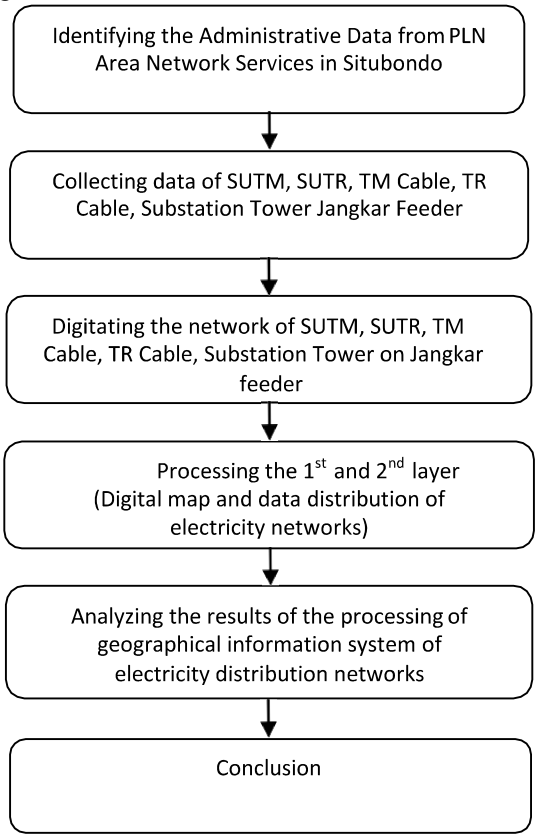

Figure 2. Flowchart of mapping the electricity distribution network

In processing stage of electricity distribution network data is using geograpichal information system shown in figure 3.

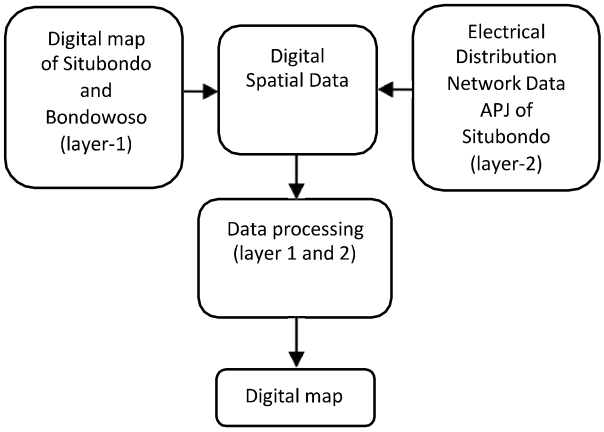

Figure 3. Overlay process of Geographic Information Systems

The data obtained from administrative identification of PLN APJ on electricity distribution network and data from the digital map with a scale of 1: 500,000 are managed using ArcGIS software. In the working principles of ArcGIS software, the data derived from digital maps will then be processed by digitizing the scope of the service area and network of Situbondo. Data distribution electricity networks will then be overlayed with the previous layer, so in this mapping, a digital maps with the incorporation of several additional layers and attributes among other types of cables, voltage, current and power burden on consumers is generated.

In this research is done an analysis of drop voltage on substation electricity system up to the end of the channel, that is from feeder Jangkar until the three final distribution substation. Drop voltage analysis is an analysis of the amount of lost voltage on a conductor. Theoretically, the number of drop voltage is affected by the channel length and the load[3]. The value of drop voltage is expressed in percentage(%), the scale of minimum limit and maximum limit of drop voltage is determined by electricity standart SPLN N0.72 1987. If the difference of voltage value exceeding the specified standards, then can be concluded that the quality of electricity distribution is low. In distribution channel, the nominal voltage is really concerned, the selection of conductor and the type of conductor becomes important in planning of electricity distribution[4]. The scale of drop voltage on distribution channel is measured from the last point or the very end point.

3. RESULT AND DISCUSSION

The mapping is done based on the electrical distribution in scale of 1:500.000, in this case the substation and the feeder around Blawan Ijen geothermal exploration area. The collecting of substation coordinate data (GI) that is connected with feeder Jangkar, the feeder Jangkar backs up the three

substation that is Krepean, Mlaten and Jampit. As for the statistic data consists of medium tower data (TM), low network tower data (TR), medium voltage cable data, low voltage cable data, customer data, voltage, conductor length and transformator capacity. The combining result by using ArcGIS from several layers about electricity distribution network is shown on figure 4. The mapping of medium voltage wires (SUTM) and low voltage wires (SUTR) on substation LD195 distribution is shown on figure 5. The mapping of medium voltage wires (SUTM) and low voltage wires (SUTR) on substation LD196 distribution is shown on figure 6. The mapping of medium voltage wires (SUTM) and low voltage wires (SUTR) on substation LD197 distribution is shown on figure 7.

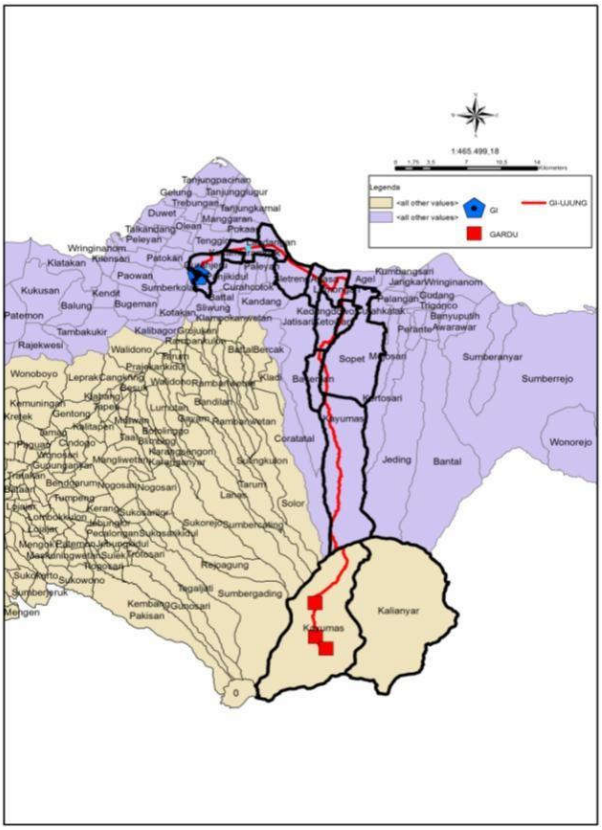

Figure 4. The Mapping of GI-Blawan Electricity Distribution Network

Figure 5. The Mapping of SUTM and SUTR in LD195 Substation

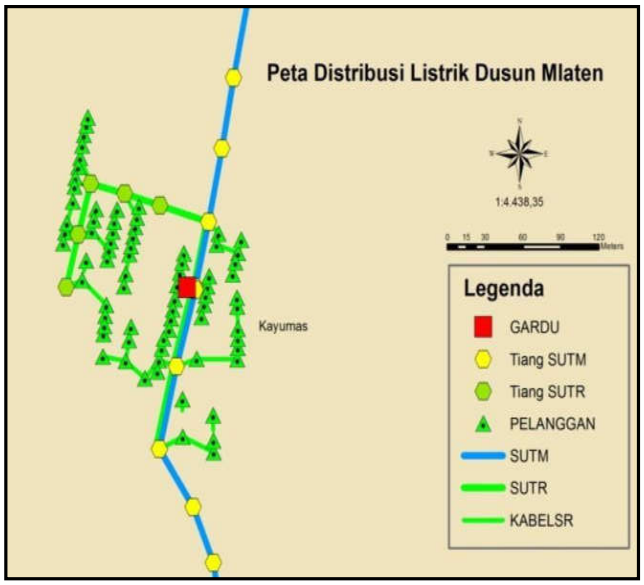

Figure 6. The Mapping of SUTM and SUTR in LD196 Substation

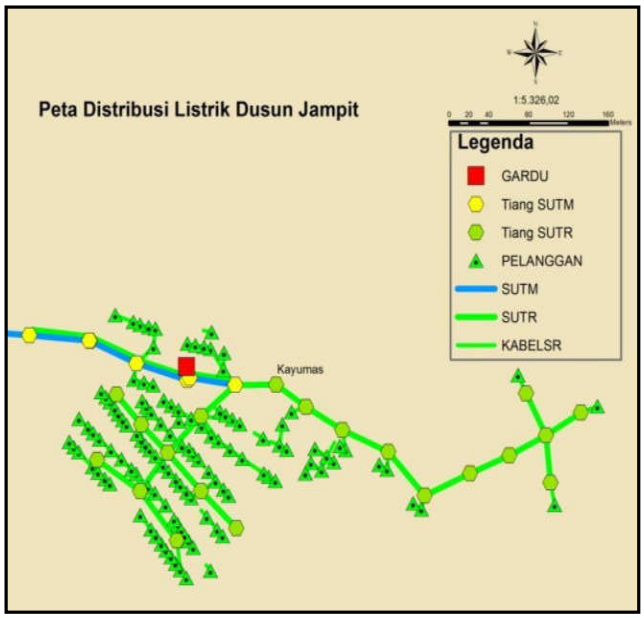

Figure 7. The Mapping of SUTM and SUTR in LD197 Substation

Based on PLN data APJ Situbondo and survey data shows that electricity distribution in Kayumas village is divided into three substations in each countryside that is Krepean, Mlaten and Jampit.

This three countrysides are located on coordinate of 801'50,4''S 11407'38,2''E until 804'22,2''S 11407'38,2''E, generally those countrysides are official residences, barracks, storage and PTPN XII office that is becoming the final network of distribution of electricity in Blawan Ijen Area.

Drop voltage analysis on electrification system of substation up to the end of channel, that is feeder Jangkar until the three final distribution substation.

Drop voltage is difference between sent voltage and the voltage on receiver side, the calculation of drop voltage is based on measurement data that is analyzed from source point until load point within the length of conductor. In this research is done drop voltage analysis from GI to the first tower, first tower to LD195, LD195 to LD196 and LD196 to LD197 as shown in Table 1.

Table 1. Drop Voltage

Substation Code	V (kV)	I (A)	Length	Type	ΔV (%)
GI	20,8	80,2	0,3	XLPE	0,048
LD195	20	4,1	61,5	AAACS	0,716
LD196	20	3,9	65,6	AAACS	0,759
LD197	20	3,5	67,6	AAACS	0,769

From the calculation can be known that drop voltage channel from the main substation to the first tower has value of drop voltage of 10,015 volt with percentage from first voltage that is 0,049% of channel length of 300m.

On the next calculation from the first tower to LD195 substation in Krepean, with the channel length of 61,5km, the drop voltage value is 145,5 volt with percentage from first voltage of 0,716%. LD196 substation is located in Mlaten with the channel length of 4,1 km, the drop voltage value is 154,1 volt with percentage from first voltage of 0,75%. The biggest drop voltage value is located in LD197 substation that is 0,76% from the first voltage of 20,3kV, this substation is located in Jampit with channel length from LD196 substation of 2 Km.

4. CONCLUSION

Based on the result and the research discussion of mapping of electricity distribution network in Blawan Ijen area by using geographical information system, then can be concluded that the mapping of electricity distribution network consists of SUTM network, SUTR network, customers and distribution substation in Blawan area. From the analysis result of drop voltage value from main substation to LD197 distribution substation tower of 0,769%, the drop voltage value is affected by distribution of channel length of 67,65Kms. The drop value is still under the standart value that is 5% on middle voltage network (JTM), so the development of new network and adding more number of load can still be done.

5. REFERENCES

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Acknowledgments
The authors wish to thank PT.PLN (Persero) Unit Distribusi APJ Situbondo and Sepuluh November Institute of Technology(ITS) Surabaya for supporting this research.