Journal of Ocean, Mechanical and Aerospace
-Science and Engineering-, Vol.54

April 30, 2018

Calculation of Power Losses in Primary Distribution Line 20 kV with Point-To-Point Sequential Method

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Paper History

Received: 10-October-2017
Received in revised form: 20-March-2018
Accepted: 30-April-2018

ABSTRACT

All electric power cannot be distributed well to consumers caused of Power-Losses caused by technical and untechnical losses. Power-Losses caused by technical issue in Distribution-Network caused-by resistance substance in conductor which is permanent. An ideal conductor must not has resistance, but in reality, every matter has resistance towards electric. Main possibility of Power-Losses in Distribution-Network is natural situation of network itself, such-as length of network always tends to increase. Aim of research is to calculate Power-Losses that absorbed by conductor in Primary-Distribution-Line-20kV with Point-to-Point Sequential Method while it loaded. The highest Power-Losses occurred in conductor OL–Melati Street with *RST*-Phases are 4766,441Watt, 4335,654Watt, 4003,747Watt, respectively. The biggest Power-Losses is on conductor of OL–Melati Sreet, whereas current and resistance are bigger than others. Total Power-Losses absorbed-by conductor is 72135.99Watt that the smallest losses, obtained from measuring of used real load on each Distribution-Transformer. Percentage of Power-Losses towards used power on Lobak-Feeder 1.3177%.

KEY WORDS: *Power Losses, Power Distribution Network, Conductor, Line Current, Point-To-Point Sequential Method*

NOMENCLATURE

EC	Electrical Company
OL	Overhead Line

1.0 INTRODUCTION

Indonesia Electrical Company (EC) is national electrical supplier in Indonesia. In electrical Power Distribution, all electric power can not be distributed well to consumers caused of Power Losses. (Putra, 2013)

Based on Law No. 30 year 2009 about Electricity article 28, permit holder of electrical supplier obligated to supply the electric power with the valid standard and provide the optimal service for consumer and society. (Setyawan, 2012)

According to General Director of Electricity Jarman in Seminar of Power Losses in Power Network in EC held by General Director of Electrification in Auditorium Samaun Samadikum, Wednesday (26/8/2015), that controlling of electrical power network losses is a case that should be understood by all parts, especially for electrification company. It is caused by government that only subsidize aroun one-third of EC's business, while the rest of it used for economic rate. Controlling losses is important to avoid financial loss of supplier and consumer. (https://www.djk.esdm.go.id)

In this case, Power Losses are caused by technical and untechnical losses. Power Losses caused by technical losses in Distribution Network is solely caused by resistance substance in conductor which is permanent. An ideal conductor must not has resistance, but in reality, every matter has resistance Towards electric. (Setyawan, 2012).

Furthermore, the main possibility of Power Losses in Distribution Network is natural situation of network itself, such as the length of the network always tends to increase.

All issues cause the Authors to do the research about Power Losses caused by conductor in Primary Distribution Network or Overhead Line (OL) from EC in Pekanbaru Area. By knowing Power Losses value, that expected it is easier for EC Pekanbaru

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

Area to analyze and evaluate Power and Energy Losses work field.

The aim of this research is to produce a study about calculation of Power Losses that absorbed by conductor in Primary Distribution Line 20 kV with Point-to-Point Sequential Method while it loaded. So, the problem statement is how much the power is absorbed by the conductor in its OL.

Scopes of research are :

1. Research area is in Lobak Feeder on Garuda Sakti EC – Pekanbaru Area.
2. Only discuss the calculation of Power Losses in Distribution Power Network's conductor while loaded in Lobak Feeder.
3. Do not discuss Power Losses in Installation Power Network.
4. Do not discuss Voltage Drop.
5. Do not calculate Power Losses caused by unbalanced load.
6. Do not discuss about reparation to reduce Power Losses.
7. Data collected in the night of September 2016.

Collected data from EC – Pekanbaru Area in Lobak Feeder would be analyzed to obtain the value of the Power Losses that absorbed by conductor. The data calculation using Microsoft Excel.

2.0 LITERATURE REVIEW

2.1 Distribution System of Electrical Power

Distribution process of Electrical Power consists of three systems, those are Generating, Transmission and Distribution System. Function of Distribution System is to distribute electric power to load. Process of electric power, is shown in Figure 1.

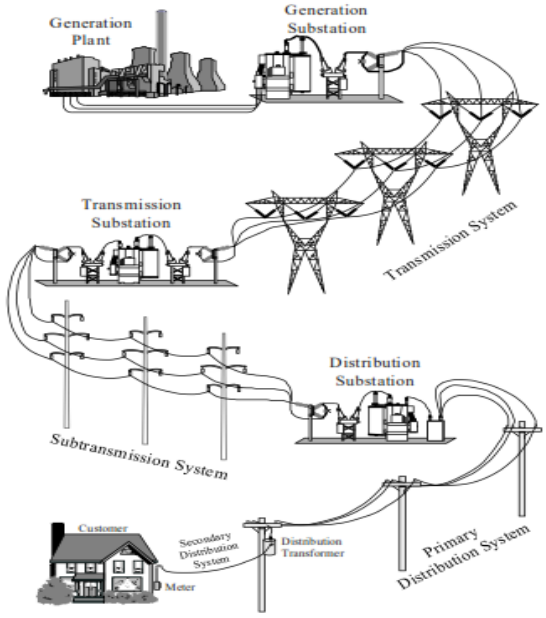

Figure 1: Process of electric power

Based on its voltage, there are two Distribution System, i.e. Primary Distribution System and Secondary Distribution System. Primary Distribution System distributes electric power from Power Station to Distribution Station, meanwhile Secondary Distribution System distributes electric power from Distribution Station to consumers.

2.2 Power Losses on Tranformer

Distribution Transformer decreases primary voltage (20 kV) to secondary distribution voltage (380/220 Volt). In distributing process of electric power from transformer to consumers, power losses can not be avoid. Power losses in Distribution Transformer consists of two types, there are Power losses in iron core and Power losses in copper.

To get the value of Power losses in iron core, normally, transformer is tested with no load. Power losses in iron core is permanent, almost never influenced by load addition.

Power losses in copper caused by load current that flows on transformer coil because flowed current load is fickle. So, it is not constant but depends on load.

2.3 Conductor

Conductor is a media that has function to distribute electrical current from one point to other point. Generally, there are two used conductors in Distribution System that are wire and cable. (Setyawan, 2012).

Wire conductor is conductor without isolation cover to wrap it. This conductor is used only on Primary Distribution System or Power Network. In this research, types of used wire conducter are *All Aluminium Conduktor* (AAC*)* and *All Aluminium Alloy Conductor* (AAAC*).*

Cable conductor is conductor with isolation cover to wrap it. Types of used cable conductor in Distribution Network of EC is AAAC-S and XPLE cable. XPLE Conductor resistance (Ground Cable) of Standard of National Electrical in Indonesia 43-5-4 1995can be seen in Table 1.

Table 1: XPLE Conductor resistance (Ground Cable) of Standard of National Electrical in Indonesia 43-5-4 1995

Area of Longitudinal (mm^2)	Resistance (ohm/km)	Inductance (mH / km)	Capacitance (mf / km)
150	0,206	0,33	0,26
240	0,125	0,31	0,31
300	0,100	0,30	0,34

(Sumber : Budi, 2015)

2.4 Losses Problems

Network losses can occur in Transmission Network and Distribution Network. Normally, appearance of losses can be divide into two, there are Technical Losses and Untechnical Losses. Aim of all of efforts in Electrical Power to reduce cost in generating electric power. So, all these actions are important and strategy activities that have to be done to increase efficiency of electrical company.

2.5 Power Losses on Conductor

Power Losses on conductor are proportional with resistance and and square of line current. This loss is called Dissipation Power on Conductor. It can be calculated with formulation in Equation 1. (Muchyi, 2009) :

$P = I^2 . R$ ……...…… (1)

Where as :

- P = Power Losses on conductor (W)
- I = Average current (A)

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

– R = Conductor resistance (ohm / Ω)

3.0 RESULTS

3.1 Load Current on Primer Distrbution Transformer

Load current on Primary Transformer is used to get the line current through conductor.

The calculation of load current on primary side in Distribution Transformer in Lobak Feeder near BTN ATM on Sukarno Hatta Street, could be calculated with Equation 2.

R Phase: $Ip = \frac{Pin}{\left(\frac{Vp}{\sqrt{3}}\right)\times Cos\varphi}$ ……..……..…….. (2)

$$Ip = \frac{Pout + \Sigma Rugitrafo}{\left(\frac{Vp}{\sqrt{3}}\right)\times Cos\varphi}$$

$$Ip = \frac{(Vs\times Is\times Cos\varphi)+Rugiinti+\left(\left(\frac{S2}{S1}\right)^2\times Pcu1\right)}{\left(\frac{Vp}{\sqrt{3}}\right)\times Cos\varphi}$$

$$Ip = \frac{(220\times 7\times 0{,}85)+100+\left(\left(\frac{220\times 7}{33333{,}3}\right)^2\times 533\right)}{\left(\frac{20000}{\sqrt{3}}\right)\times 0{,}85}$$

$$Ip = \frac{1309+100+1{,}14}{9814{,}95} = \frac{1410{,}14}{9814{,}95}$$

Ip = 0,144 A

S Phase : $Ip = \frac{Pin}{\left(\frac{Vp}{\sqrt{3}}\right)\times Cos\varphi}$

$$Ip = \frac{(220\times 1\times 0{,}85)+100+\left(\left(\frac{220\times 1}{33333{,}3}\right)^2\times 533\right)}{\left(\frac{20000}{\sqrt{3}}\right)\times 0{,}85}$$

$$Ip = \frac{187+100+0{,}023}{9814{,}95} = \frac{287{,}023}{9814{,}95}$$

Ip = 0,029 A

T Phase : $Ip = \frac{Pin}{\left(\frac{Vp}{\sqrt{3}}\right)\times Cos\varphi}$

$$Ip = \frac{(220\times 1\times 0{,}85)+100+\left(\left(\frac{220\times 1}{33333{,}3}\right)^2\times 533\right)}{\left(\frac{20000}{\sqrt{3}}\right)\times 0{,}85}$$

$$Ip = \frac{187+100+0{,}023}{17000} = \frac{287{,}023}{9814{,}95}$$

Ip = 0,029 A

Doing the same calculation could be applicated for all Distribution Transformer in Lobak Feeder provided in Table 2.

Table 2: Load Current Value on Primary Transformer

No	ID Distribution Transformer	Load Current on Primary Transformer (A)		
		R	S	T
1	Near ATM BTN Soekarno Hatta Street	0,144	0,029	0,029
2	Sukarno Hatta Street - Hotel Ema	0,201	0,239	0,239
3	Sukarno Hatta Street / Abadi Street	0,369	0,658	0,658
4	Soekarno Hatta Street near AKBID Helvetia	2,181	1,815	1,835
5	Sukarno Hatta Street	3,975	2,625	3,280
6	Soekarno Hatta Street – Empty House	5,917	5,314	5,936
7	Soekarno Hatta Street – Cemara Street	2,994	3,422	3,208
8	Soekarno Hatta Street – Nirvana Housing	1,568	1,798	2,086
9	Seokarno Hatta Street – BFI Finance	0,297	0,220	0,144
10	Sukarno Hatta Street – Hotel Swiss Berlin	0,949	1,491	1,588
11	Sukarno Hatta Street – Front of Inul Vista	2,278	2,008	1,353
12	Sukarno Hatta Street – SukaFajar Company	2,781	1,065	1,892
13	Sukarno Hatta Street – Transformer Tower, Kampar alley	0,043	0,215	0,024
14	Sukarno Hatta Street – Hotel Benteng	0,872	1,027	0,757
15	Sukarno Hatta Street – Dealer Honda	0,297	0,144	0,488
16	Sukarno Hatta Street –.TGI Company	1,507	0,969	1,065
17	Sukarno Hatta Street – TGI Company	0,455	0,321	0,512
18	Sukarno Hatta Street – Dealer Isuzu	0,033	0,109	0,109
19	Sukarno Hatta Street – Hotel Olgaria	0,035	0,703	0,550
20	Sukarno Hatta Street	3,282	3,883	2,605
21	Lobak Street – Front of Mega Cato	2,104	4,545	4,175
22	Lobak Street – Front of Ana Baby Shop	5,521	6,129	4,876
23	PGRI Street – Housing Kampung Residance – Front of PGRI Crossroad	2,876	3,689	3,282
24	PGRI Street – Villa Istana Bunga	0,220	0,354	0,220
25	Bella Vista Housing	1,338	1,109	0,898
26	Bella Vista Housing	0,650	0,612	1,377
27	PEMDA Crossroad – PEMDA Street	1,699	0,950	1,873
28	Sukarno Hatta Street –Surya Madistrindo Company	0,570	0,455	0,589
29	Lobak Street – Front of Grosir Eceran	4,876	3,476	2,953
30	Pertanian Street – Housing Villa Tani	1,104	1,569	1,297
31	Pertanian Street – Housing Ligako Alley	4,350	4,603	4,116
32	Lobak Street	0,258	0,010	0,010
33	Lobak Street – Amal Alley – Housing Mitra Garden	1,686	1,608	1,472
34	Delima Street – Four Road Intersctions	5,411	6,307	5,605
35	Housing 1	2,626	1,930	1,526
36	Housing 2	2,994	3,208	2,839
37	Housing 1	1,334	1,123	1,199
38	Housing 2	1,647	0,834	1,705
39	Melati Indah Street	6,719	4,954	5,208

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

40	Housing 3	1,603	2,085	1,661
41	Housing 4	0,949	0,930	0,584
42	Front of Mosque Tower	5,678	4,857	4,428
43	Srikandi Street – Crossroad Gunung Tua alley	0,833	0,853	1,500
44	Srikandi Street –Villa Srikandi Elite Housing	1,491	0,892	0,469
45	Srikandi Street – Quen Park Housing – Crossroad Car Washing	1,603	2,723	2,065
46	Amarta Street – Pondok Ratu Housing	0,491	1,334	1,161
47	Amarta Street – Widya Graha 1 Housing – Front of Amanda Ponsel	4,642	4,584	3,786
48	Amarta Street – Crossroad Klinik	2,488	1,046	1,452
49	Amarta Street	4,292	4,545	3,922
50	Delima Street	1,988	2,143	2,220
51	Srikandi Street – Crossroad Sekuntum Street	4,828	4,828	4,867
52	Housing Widya Graha 3 – Near Mosque	5,150	4,935	4,837
53	Srikandi Street	1,472	0,661	1,027
54	Srikandi Street – Housing Teratai Garden	0,062	0,523	0,234
55	Sekuntum Street	5,695	4,105	3,597
56	Plamboyan Street – Housing Nuansa Plamboyan	2,723	2,201	2,781
57	Rajawali Street – Housing 3 Darastage 1	0,452	0,892	0,644
58	BIMA Street	0,988	0,911	0,584
59	Sekuntum Street – Crossroad Plamboyan Street	3,500	2,820	2,897
60	Raja Wali Street – Housing Rindu Serumpun	0,258	0,892	0,699
61	Raja Wali Street – Housing Puri Rajawali	0,718	1,027	0,949
62	Raja Wali Street – Housing Residance 56	1,143	1,259	0,815
63	Rajawali Street Tax office	1,564	2,046	1,449
64	SM Amin 1 Street	0,067	0,144	0,029
65	SM Amin 2 Street	0,761	0,264	1,010
66	SM Amin Street – Crossroad SPBU	0,970	0,717	0,989
67	SM Amin Street – Hotel Parma	0,147	1,046	0,720
68	SM Amin Street – Near Damai Mobil	1,353	0,185	0,873
69	SM Amin Street – Near Mitra Baru Restaurant	1,086	0,436	0,474
70	SM Amin Street – Crossroad. Agung Toyota Company	1,719	1,566	2,066
71	SM Amin Street – Suzuki	0,325	0,364	0,306
72	SM Amin Street – crossroad Kutilang Street	3,318	3,956	2,740
73	SM Amin Street – Indomaret	0,622	1,027	0,776
74	SM Amin Street –Front of Gemilang Motor	1,449	0,624	0,892
75	SM Amin Street –Royal Platinum Storeroom	2,297	1,584	1,123
76	SM Amin Street –Indomaret	2,972	1,815	2,104
77	SM Amin Street –Stadion Crossroad	0,005	0,234	0,330
78	Air Hitam Street/ Platinum Storeroom	1,218	0,950	1,046
79	Air Hitam Street/ Alfamart's Warehouse	2,682	3,126	3,241
80	Air Hitam Street –SPBU	0,330	0,446	0,234

(Source : EC, 2015)

From the value of load current from Primary Transformer in Table 2, line current through conductor in Lobak Feeder could be calculated. The value of line current through conductor in Lobak Feeder,provides in Table 3.

Table 3: Line Current through Conductor

NO	Conductor ID	Remark	Line Current / Conductor (A)		
			R	S	T
1	OL – to PN 015	Tr1	0,144	0,029	0,029
2	OL – to Emma Graha	P1 + Tr2	0,345	0,268	0,268
3	OL – Housing 3 Dara	Tr3	0,369	0,658	0,658
4	OL – Toward Housing 3 Dara	P2 + P3	0,714	0,926	0,926
5	OL –Akbid Elv Crossroad	P4 + Tr4	2,895	2,741	2,761
6	OL – Pusri	Tr5	3,975	2,625	3,28
7	OL – Toward Pusri	P5 + P6	6,87	5,366	6,041
8	OL46	P7 + Tr6	12,787	10,68	11,977
9	OL – Toward PEMDA	Tr7	2,994	3,422	3,208
10	OL – PEMDA	P8 + P9	15,781	14,102	15,185
11	OL – Toward Nirvana	P10 + Tr8	17,349	15,9	17,271
12	OL – STIKES Maharatu	Tr9	0,297	0,22	0,144
13	OL – to STIKES Maharatu	P11 + P12	17,646	16,12	17,415
14	OL– Ultimate Transformator	Tr10	0,949	1,491	1,588
15	OL – Toward Inul Vista	P14 + Tr11	3,227	3,499	2,941
16	OL – Toward Sutan Kasim	P15 + Tr12	6,008	4,564	4,833
17	OL – Tower2	Tr13	0,043	0,215	0,024
18	OL – Toward Tower	P16 + P17	6,051	4,779	4,857
19	OL – Benteng Hotel	Tr14	0,872	1,027	0,757
20	OL – Toward Benteng Hotel	P18 + P19	6,923	5,806	5,614
21	OL–Toward	P20 + Tr15	7,22	5,95	6,102

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

	Honda				
22	Line23	Tr16 + Tr17	1,962	1,29	1,577
23	OL44	P21 + P22	9,18	7,24	7,68
24	OL – Toward Isuzu	P23 +Tr18	9,22	7,35	7,79
25	OL43	P24 + Tr19	9,25	8,05	8,34
26	OL42	P25 + Tr20	12,53	11,94	10,94
27	Line15	P13 + P26	30,18	28,06	28,36
28	OL41	P27 + Tr21	32,28	32,60	32,53
29	OL40	P28 + Tr22	37,80	38,73	37,41
30	OL – PGRI	Tr23	2,88	3,69	3,28
31	OL – to Villa Istana BU	Tr24	0,22	0,35	0,22
32	Line16	P30 + P31	3,10	4,04	3,50
33	OL – PGRI Street	P29 + P32	40,90	42,77	40,91
34	OL – to Bella Vista	Tr25	1,34	1,11	0,90
35	OL – before Bella Vista	P34 + Tr26	1,99	1,72	2,28
36	OL38	P35 + Tr27	3,69	2,67	4,15
37	OL37	P36 + Tr28	4,26	3,13	4,74
38	OL36	P33 + P37	45,16	45,90	45,65
39	OL – Toward Bintang Cendi	Tr29	4,88	3,48	2,95
40	OL35	P38 + P39	50,03	49,37	48,60
41	OL – Toward Per Villa Tan	Tr30	1,10	1,57	1,30
42	OL – Toward Pertanian Street	P41 + Tr31	5,45	6,17	5,41
43	OL34	P40+P42+Tr32	55,74	55,56	54,02
44	OL – Toward Griya Amal	Tr33	1,69	1,61	1,47
45	OL33	P43 + P44	57,43	57,16	55,50
46	OL32	P45 + Tr34	62,84	63,47	61,10
47	OL – End Road	Tr35	2,63	1,93	1,53
48	OL31	P47 + Tr36	5,62	5,14	4,37
49	OL – Toward Villa Melati	P48 + Tr37	6,95	6,26	5,56
50	SKTM – Melati Indah Street	P48 + Tr37	6,95	6,26	5,56
51	OL – Pondok Daun	Tr38	1,65	0,83	1,71
52	Line14	P50 + P51	8,60	7,10	7,27
53	Line13	P52 + Tr39	15,32	12,05	12,48
54	OL – Jasmine	Tr40	1,60	2,09	1,66
55	OL – Toward Jasmine	P53 + P54	16,92	14,13	14,14
56	OL – Serasi Crossroad	P55 +Tr41	17,87	15,06	14,72
57	OL – Traverse Lobak Street	P46 + P56	80,71	78,54	75,82
58	OL – before PTS	P46 + P56	80,71	78,54	75,82
59	OL – Tower	P58 + Tr42	86,39	83,39	80,25
60	Line11	P59+Tr43+Tr44	88,72	85,14	82,22
61	Line10	P60 + Tr45	90,318	87,86	84,285
62	Line9	Tr46	0,491	1,334	1,161
63	Line8	P62 + Tr47	5,133	5,918	4,947
64	Line7	P63 + Tr48	7,621	6,964	6,399
65	OL – Traverse Srikandi	P64 + Tr49	11,913	11,509	10,321
66	OL – Stopan W.G.Ii	Tr50	1,988	2,143	2,22
67	OL – Traverse 4 Way W.G	P65 + P66	104,219	101,512	96,826
68	OL – Srikandi to Delima	P67 + Tr51	109,047	106,34	101,693
69	OL – Widya Graha III	Tr52	5,15	4,935	4,837
70	OL – Widya Graha III	P68 + P69	114,197	111,275	106,53
71	OL – Teratai Garden	Tr53	1,472	0,661	1,027
72	OL – Teratai Garden2	Tr54	0,062	0,523	0,234
73	OL – Teratai Garden 1	P71 + P72	1,534	1,184	1,261
74	OL – Traverse Sekuntum 1	P70 + P73	115,731	112,459	107,791
75	OL30	Tr55	5,695	4,105	3,597
76	OL29	P75 + Tr56	8,418	6,306	6,378
77	OL28	P76 + Tr57	8,87	7,198	7,022
78	OL27	P74 + P77	124,601	119,657	114,813
79	OL – PN 136	Tr58	0,988	0,911	0,584
80	OL26	Tr59	3,5	2,82	2,897
81	Line4	P78+P79+P80	129,089	123,388	118,294
82	OL – Rindu Serumpun 2	Tr60	0,258	0,892	0,699
83	OL25	P81+P82+Tr61	130,065	125,307	119,942
84	OL – Residence 56	Tr62	1,143	1,259	0,815
85	OL24	P83 + P84	131,208	126,566	120,757
86	OL –Tax Office	Tr63	1,564	2,046	1,449
87	OL23	P85 + P86	132,772	128,612	122,206
88	OL21	Tr64	0,067	0,144	0,029
89	OL20	P88 + Tr65	0,828	0,408	1,039
90	OL – Traverse Ring Road	P87 + P89	133,6	129,02	123,245
91	Line2	Tr66	0,97	0,717	0,989
92	OL18	P91 + Tr67	1,117	1,763	1,709
93	OL17	P92 + Tr68	2,47	1,948	2,582
94	OL – PN 179	Tr69	1,086	0,436	0,474
95	OL16	P93 + P94	3,556	2,384	3,056
96	OL15	P95 + Tr70	5,275	3,95	5,122
97	OL19	Tr71	0,325	0,364	0,306
98	OL14	P96 + P97	5,6	4,314	5,428

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

99	OL13	P98 + Tr72	8,918	8,27	8,168
100	OL –PU Office	Tr73	0,622	1,027	0,776
101	OL12	P99 + P100	9,54	9,297	8,944
102	OL11	P101 + Tr74	10,989	9,921	9,836
103	OL – Platinum	Tr75	2,297	1,584	1,123
104	OL10	P102 + P103	13,286	11,505	10,959
105	OL9	P104 + Tr76	16,258	13,32	13,063
106	OL – Naga Sakti Street	P90 + P105	149,858	142,34	136,308
107	OL8	P106 + Tr77	149,863	142,574	136,638
108	OL6	Tr78	1,218	0,95	1,046
109	OL5	P108 + Tr79	3,9	4,076	4,287
110	OL4	P107 + P109	153,763	146,65	140,925
111	SKTM –AKAP Terminal	P107 + P109	153,763	146,65	140,925
112	OL - Melati Street	P107 + P109	153,763	146,65	140,925
113	OL	P112 + Tr80	154,093	147,096	141,159
114	Cable1	P112 + Tr80	154,093	147,096	141,159

(Source : EC, 2015)

From Table 3, there are several conductors have same current with other conductor because one segment obtains several conductors. Furthermore, line load or line current through conductor is same with the others.

3.2 Power Losses on Conductor

Power Losses calculation could be calculated with Equation 3. These Power losses are produced by OL – to PN 015.

R Phase : $P = I^2 \times R$ ……...……...……..……. (3)
$P = 0{,}144^2 \times 0{,}02126$
$P = 0{,}0004$ Watt

S Phase : $P = I^2 \times R$
$P = 0{,}029^2 \times 0{,}02126$
$P = 0{,}00002$ Watt

T Phase : $P = I^2 \times R$
$P = 0{,}029^2 \times 0{,}02126$
$P = 0{,}00002$ Watt

Power Losses from Conductor, is shown in Table 4.

Table 4: Power Losses from Conductor

No	Conductor ID	Power Losses (Watt)		
		R	*S*	*T*
1	OL – to PN 015	0,0004	0,00002	0,00002
2	OL – to Emma Graha	0,008	0,005	0,005
3	OL Housing 3 Dara	0,015	0,047	0,047
4	OL – Toward Housing 3 Dara	0,006	0,009	0,009
5	OL – Traverse Akbid Elv	0,181	0,162	0,165
6	OL – Pusri	0,171	0,074	0,116
7	OL –Toward Pusri	4,592	2,801	3,550
8	OL46	3,535	2,466	3,101
9	OL – PEMDA	0,485	0,633	0,556
10	OL –Toward PEMDA	16,153	12,898	14,956
11	OL –Toward Nirvana	19,522	16,397	19,347
12	OL – STIKES Maharatu	0,001	0,0005	0,0002
13	OL –STIKES Maharatu	10,098	8,427	9,835
14	OL – Last Transformer	0,010	0,024	0,027
15	OL – Toward Inul Vista	0,675	0,794	0,561
16	OL – Toward Sutan Kasim	1,561	0,901	1,010
17	OL – Tower2	0,000	0,001	0,000
18	OL – Toward Tower	1,187	0,741	0,765
19	OL – Hotel Benteng	0,008	0,011	0,006
20	OL – Toward Hotel Benteng	4,145	2,915	2,726
21	OL – Toward Honda	1,127	0,765	0,805
22	Line23	0,042	0,018	0,027
23	OL44	3,646	2,267	2,550
24	OL – Toward Isuzu	0,918	0,584	0,656
25	OL43	7,399	5,607	6,012
26	OL42	6,791	6,159	5,178
27	Line15	9,845	8,508	8,693
28	OL41	11,265	11,488	11,441
29	OL40	15,448	16,214	15,128
30	OL – PGRI	0,179	0,294	0,233
31	OL – to Villa Istana BU	0,001	0,001	0,001
32	Line16	0,518	0,883	0,663
33	OL – PGRI Street	18,082	19,776	18,093
34	OL – to Bella Vista	0,019	0,013	0,009
35	OL – before Bella Vista	0,128	0,096	0,168
36	OL38	0,735	0,386	0,930
37	OL37	1,567	0,845	1,941
38	OL36	22,042	22,773	22,525
39	OL – Toward Bintang Cendi	1,028	0,522	0,377
40	OL35	81,179	79,058	76,602
41	OL – Toward Per Villa Tan	0,053	0,106	0,073
42	OL – Toward Pertanian Street	1,608	2,059	1,584
43	OL34	100,773	100,094	94,650
44	OL – Toward Griya Amal	0,123	0,112	0,094
45	OL33	213,922	211,945	199,756
46	OL32	42,689	43,549	40,357
47	OL – End Road	0,224	0,121	0,076
48	OL31	1,366	1,141	0,824
49	OL – Toward Villa Melati	3,137	2,543	2,008
50	SKTM – Melati	1,511	1,225	0,967

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Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

	Indah Street			
51	OL – Pondok Daun	0,088	0,023	0,094
52	Line14	4,798	3,265	3,427
53	Line13	15,223	9,416	10,097
54	OL – Jasmine	0,056	0,094	0,060
55	OL –Toward Jasmine	18,575	12,957	12,964
56	OL –Serasi Street Intersection	17,264	12,265	11,715
57	OL – Traverse Lobak Street	281,691	266,693	248,592
58	OL – before PTS	281,691	266,693	248,592
59	OL – Tower	322,718	300,701	278,475
60	Line11	255,235	235,063	219,231
61	Line10	352,723	333,786	307,175
62	Line9	0,005	0,038	0,029
63	Line8	1,994	2,650	1,852
64	Line7	2,511	2,097	1,771
65	OL – Traverse Srikandi	6,137	5,727	4,606
66	OL – Stopan W.G.Ii	0,043	0,050	0,053
67	OL – Traverse Intersection4 W.G	939,311	891,149	810,774
68	OL – Srikandi to Delima	128,544	122,242	111,791
69	OL – Widya Graha III	2,580	2,369	2,276
70	OL – Widya Graha III	704,864	669,254	613,394
71	OL – Teratai Garden Ujung	0,023	0,005	0,011
72	OL – Teratai Garden2	0,000	0,003	0,001
73	OL – Teratai Garden 1	0,076	0,045	0,052
74	OL – Traverse Sekuntum 1	289,571	273,429	251,201
75	OL30	1,402	0,729	0,559
76	OL29	4,596	2,579	2,638
77	OL28	1,701	1,120	1,066
78	OL27	839,148	773,877	712,488
79	OL – PN 136	0,063	0,054	0,022
80	OL26	0,795	0,516	0,544
81	Line4	180,138	164,578	151,269
82	OL – Rindu Serumpun 2	0,001	0,017	0,011
83	OL25	365,743	339,474	311,027
84	OL – Residence 56	0,014	0,017	0,007
85	OL24	744,400	692,659	630,537
86	OL –Tax Office	0,053	0,091	0,045
87	OL23	2477,320	2324,513	2098,718
88	OL21	0,000	0,000	0,000
89	OL20	0,022	0,005	0,035
90	OL - Traverse Ring Road	192,947	179,945	164,197
91	Line2	0,031	0,017	0,032
92	OL18	0,040	0,101	0,095
93	OL17	0,528	0,328	0,577
94	OL - PN 179	0,013	0,002	0,002
95	OL16	0,547	0,246	0,404
96	OL15	0,602	0,337	0,567
97	OL19	0,002	0,003	0,002
98	OL14	1,356	0,805	1,274
99	OL13	1,719	1,479	1,442
100	OL –PU Office	0,013	0,034	0,020
101	OL12	4,919	4,672	4,324
102	OL11	2,611	2,128	2,092
103	OL – Platinum	0,114	0,054	0,027
104	OL10	17,173	12,878	11,684
105	OL9	20,001	13,426	12,912
106	OL – Naga Sakti Street	242,765	219,018	200,848
107	OL8	1213,905	1098,693	1009,110
108	OL6	0,016	0,010	0,012
109	OL5	0,164	0,180	0,199
110	OL4	3578,141	3254,752	3005,591
111	SKTM – AKAP Terminal	3694,228	3360,347	3103,102
112	OL – Melati Street	4766,441	4335,654	4003,747
113	OL	3350,845	3053,446	2811,938
114	Cable1	148,404	135,233	124,537
Power Losses Total for each Phase		26088,358	23972,494	22075,138
Power Losses Total		72135,99 Watt		

(Source : EC, 2015)

From Table 4, the highest Power Losses occurred in conductor OL – Melati Street with *RST* Phases of Power Losses are 4766,441 Watt, 4335,654 Watt, 4003,747 Watt, respectively, whereas value of line current and resistance from its conductor has caused it be the conductor that has the highest value of Power Losses.

Total Power Losses occur in conductor in Lobak Feeder with *RST* Phases are 26088,358 Watt, 23972,494 Watt, 22075,138 Watt, respectively. Meanwhile, Power Losses of three phases is 72135,99 Watt.

4.0 CONCLUSION

1. The highest Power Losses occurred in conductor OL – Melati Street with *RST* Phases of Power Losses are 4766,441 Watt, 4335,654 Watt, 4003,747 Watt, respectively.
2. The biggest Power Losses is on conductor of Overhead Line (OL) – Melati Sreet, whereas current and resistance are bigger in this conductor than the others.
3. Power Losses Total absorbed by conductor is 72135.99 Watt. This Power Losses is the smallest losses because losses counted just occur on conductor. It is also obtained from measuring of used real load on each Distribution Transformer.
4. Percentage of Power Losses Toward used power on Lobak Feeder 1.3177%.

JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085

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JOMAse | Received: 10-October-2017 | Accepted: 30-April-2018 | [(54) 1: 1-8]
Published by International Society of Ocean, Mechanical and Aerospace Scientists and Engineers, www.isomase.org., ISSN: 2354-7065 & e-ISSN: 2527-6085