

SUBSTITUTION DIESEL OF PT PLN WITH HYBRID SYSTEM (DIESEL – PHOTOVOLTAIC) IN ISOLATED REGION OF WEST KALIMANTAN

By :

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ABSTRACT

Dependency of PT. PLN (Electric State National Company) from Diesel Power Plant (PLTD) outside Java Island Region is still very big. Financially, PT PLN (State Electric company) at the moment have faced many loss, because electric price sale to consumers is not equal to the Electric Generation Base Cost (BPP) of PLTD. It is true the condition of in this time become dilemma to PT. PLN (Electric National Company of Government), one side have to increase the benefit, on the other hand PT. PLN claimed to improve customer service to consumer, with the increase of oil price which continue to rise and even tend to be uncontrolled. renewable energy development at the moment in Indonesia have to looked for by its solution as soon as possible, in order to renewable energy growth in Indonesia, considering big enough renewable energy potency, some alternative to improving renewable energy growth, exploiting system hybrid technology between PLTD and Photovoltaic. Regional of west Kalimantan there is 13 Isolated PLTD which included in priority group to be developed to become hybrid system (Photovoltaic- Diesel Generator), totally Installed Capacity equal to 1.148 kW or 2% from all Isolated PLTD capacities in West Kalimantan Province that is 50.823 kW. Before conducted by hybrid, produced electric energy equal to 1.947.996 kWh and after conducted by hybrid, yielded electric energy become equal to 2.782.851 kWh

I. BACKGROUND

Depended Power Station Diesel (PLTD) outside big enough Java at the moment, by financial condition in this time PT PLN (Electric National Company) have experiencing of many loss , because price sale of electric to ill assorted consumer with Production cost of Energy from PLTD, It is true the condition of in this time become dilematis to PT. PLN, one side have to look for advantage on the other hand PT. PLN claimed to improve service to consumer, with oil increase of price which continue to go up and even tend to do not in control in this time. Oil price at the moment have reached US \$ 70 per Barel and it is of course will affect at operational burden for the Diesel Generator and high cost for cash flow of PT PLN

Based on the real fact that energy alternative exploiting like renewable energy becomes right choice for the implementation for example development of renewable energy with hybrid power system between Photovoltaic or Wind Energy with Diesel Generator. But other problem emerge such as Investment for renewable energy at the moment is still very high, all of problem of renewable Energy have to be looked for best solution, considering big potential of renewable energy resources in Indonesia.

Renewable Energy development in Indonesia have to looked for best solution, in order to increase renewable energy growth in Indonesia, considering big enough renewable energy potency, some alternative to fasten renewable energy growth are to design subsidize system and to free import cost equipments of renewable energy.

II. OBJECTIVE

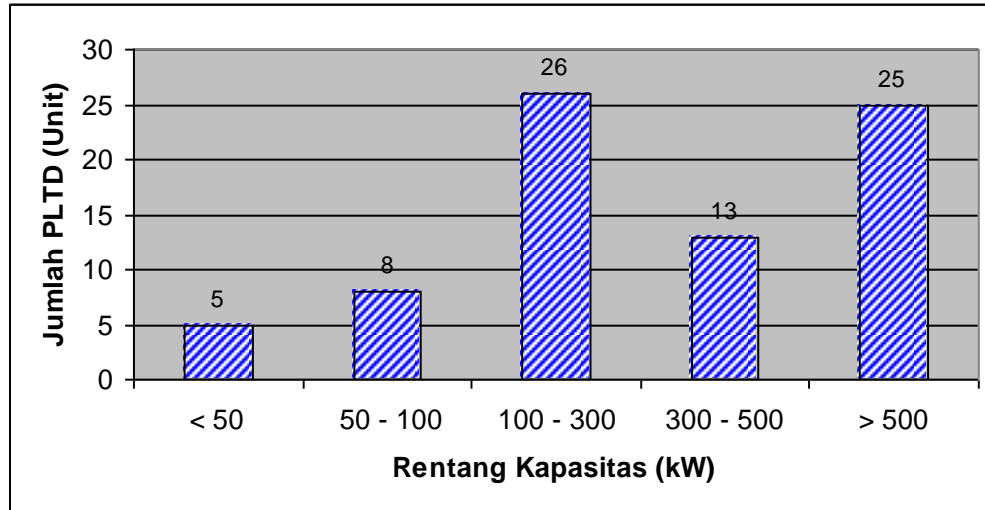
The purpose from Power Station Energy Diesel study with this New Generating Energi is to study loss and benefit from the implementation of photovoltaic diesel hybrid system or wind diesel hybrid power system owned by PT. PLN both from economic and financial aspects.

The result of this study is expected to become an input and important consideration for PT.PLN (Persero) to take policy in the next future regarding electricity power supply in remote area reliably, efficient and economical. Hereinafter with reducing oil fuel usage, it can assist [in] period to come in order to is ready [of] electrics energi [in] purilieus reliably, economic and efficient. Hereinafter by lessening usage [of] BBM, hence directly strive this can assist national economy so that state's finance burden can be transferred to other productive sector. By decreasing oil fuel consumption [him/ it], hence environment will be assisted smaller [of] glasshouse gas emission specially CO2 CO2.

III. METHODOLOGY

The research study is basically limited to analyze Hybrid system Photovoltaic–Diesel considering looked at the other renewable energy resources such as Wind energy potency. Activity to be conducted are :

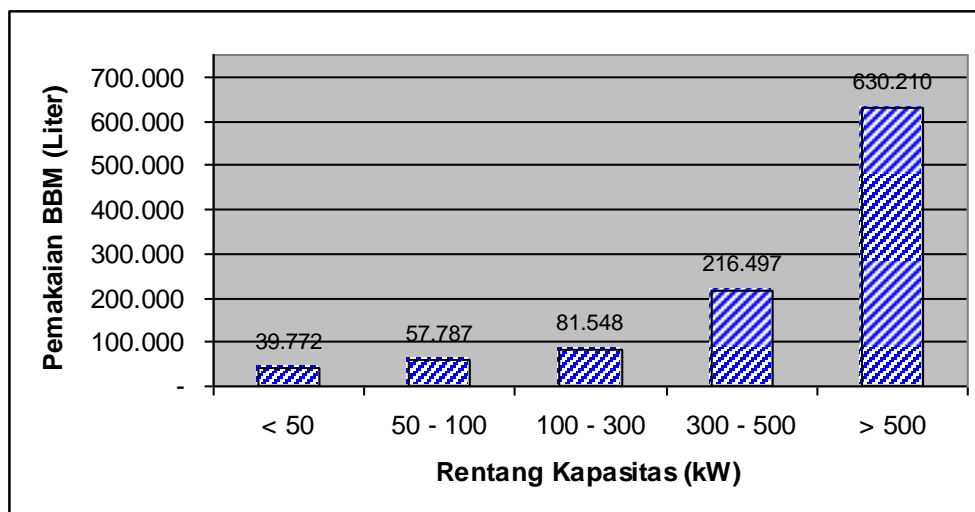
1. Data Diesel secondary analysis property of PT PLN. In activity this study will be executed by detail subdividing of Diesel had by PT.PLN. This Subdividing pursuant to some criterion which must have by the Diesel. Secondary data can be obtained by PT.PLN.
2. Survey Location to know character operate and condition of physical in field so that got data can become input for the calculation of financial eligibility Photovoltaic-Diesel hybrid systems generating or Wind energy –Diesel,. Besides with location survey can identify by technical configurations which most snugly from every Economic analysis and financial of each configuration so that obtain get most optimal configuration to every area type. Every area type need solution which specific relative but generic so that its analysis of amendable farther by PT.PLN. Activity above conducted by successively, so that reached by result of utilizable and maximal.



Picture 3.8 Installed Capacity Distribution of Isolated PLTD in West Kalimantan

IV. PLTD IN WEST KALIMANTAN

Amount of Isolated PLTD residing in Region west Kalimantan counted 77 unit totally Installed Capacity equal to 51.223 kW and the distribution is shown by Picture 3.8. From the picture seen that Diesel insulation unit which at most there are in spanning 100 - 300 kW that is 26 unit (33,77%) totally Installed Capacity by 4.548 kW. later; then followed with Diesel which have capacities more than 500 kW counted 25 unit (32,47%) totally capacities 40.371 kW, span between 300 - 500 kW counted 13 unit (16,88%) totally capacities 5.364 kW, span between 50 - 100 kW counted 8 unit (10,39%) totally capacities 740 kW and smallest, Diesel which have capacities to less than 50 kW counted 5 unit (6,49%) totally capacities 200 kW

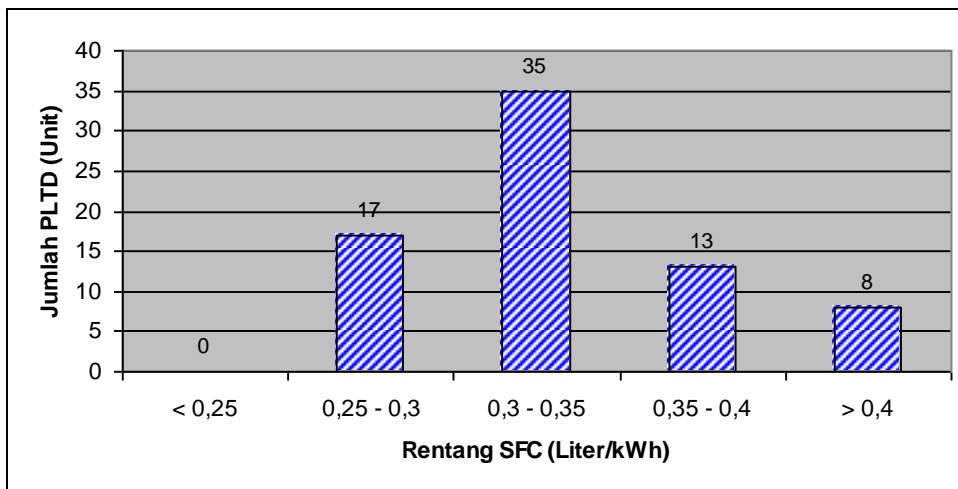


Gambar 3.41 Oil Fuel Usage Distribution for isolated PLTD in West Kalimantan

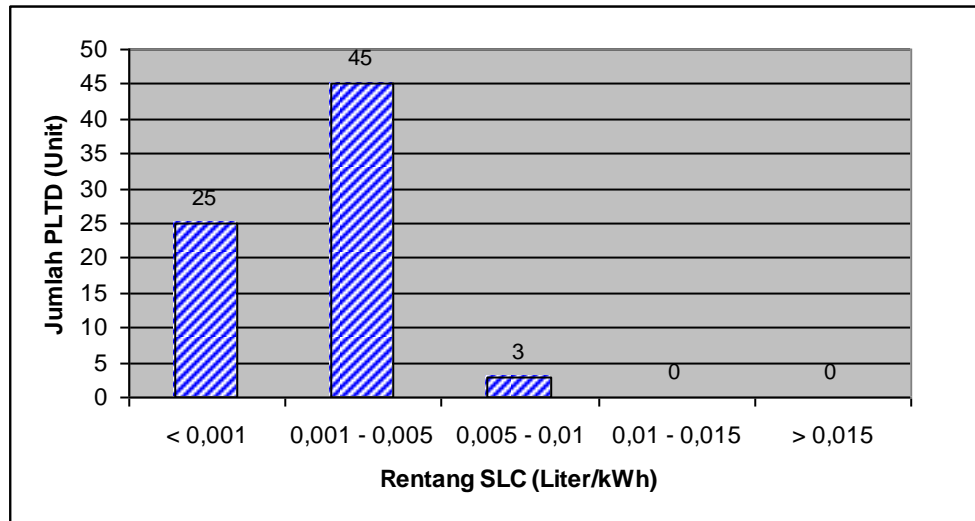
V. DISTRIBUTION OIL FUEL BY PT PLN IN L WEST KALIMANTAN

Volume consume Fuel to all Isolated PLTD in region west Kalimantan counted 1.025.813 liter per year which it distribution [showed by Picture 3.41. From the picture seen that highest Fuel consumption happened at Diesel (PLTD) group with Installed Capacity bigger 500 kW totally Fuel consumption counted 630.210 liter per year (61,43%) followed by Diesel Generator group with capacities 300 - 500 kW totally Fuel consumption counted 216.497 liter per year (21,10%), later; then Diesel Generator with capacities 100 - 300 kW totally Fuel consumption counted 81.548 liter per year (7,95%), Diesel with capacities 50-100 kW totally Fuel consumption counted 57.787 liter per year (5,63%) and for the group of Diesel Generator with capacities below/under 50 kW consume Fuel at least that is 39.772 liter per year (3,88%)

Distribution assesses SFC for the Diesel of insulation in Region West Kalimantan showed by Picture 3.64. From Picture 3.4 seen that Isolated PLTD group owning SFC value in spanning 0.30-0.35 liter / kWh, which many that is 35 unit (47,955%), followed by SFC value to span 0.25-0,30 liter / kWh counted 17 unit (23,29%), later; then span 0,35-0,40 liter / kWh counted 13 unit (17,81%) and in spanning bigger than 0,40 liter / kWh counted 8 unit (10,96%). From field survey is also known that [there] no PLTD having SFC value below/under 0, 25



Gambar 3.64 SFC Value Distribution for Isolated PLTD in West Kalimantan



Gambar 3.65 SLC Value Distribution for Isolated PLTD in West Kalimantan

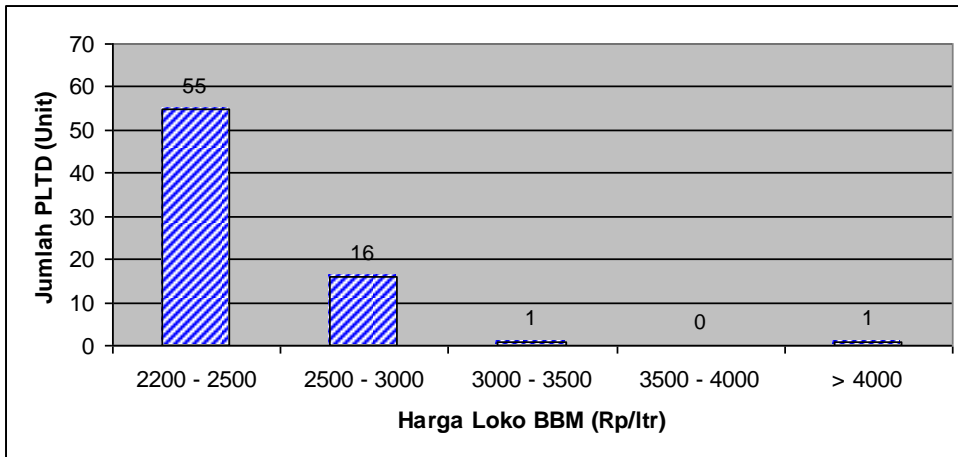
Still to the number of laboring PLTD (Diesel) insulation at bigger SFC value 0,4 liter / kWh indicate that pertinent Isolated PLTD do not operate efficiently, because to yield a number of kWh which is same to be needed by Fuel consumption more or more extravagant. Inefficient operation earn because of machine age have is old, not yet got conservancy or because low machine encumbering.

Distribution Assess SLC

Distribution assesses SLC for the PLTD (Diesel) of insulation in Region West Kalimantan showed by Picture 3.65. From Picture 3.65 seen that Isolated PLTD owning SLC value at spanning 0,001-0,005 liter / kWh is many that is 45 unit (61,64%), later; then followed by PLTD (Diesel) with SFC value under 0,001 counted 25 unit (34,25%) and also span 0,005-0,010 liter / kWh counted 3 unit (4,11%). While at spanning 0, 01-0,015 and more than 0,015 there did not

Regional Oil Fuel Price in West Kalimantan

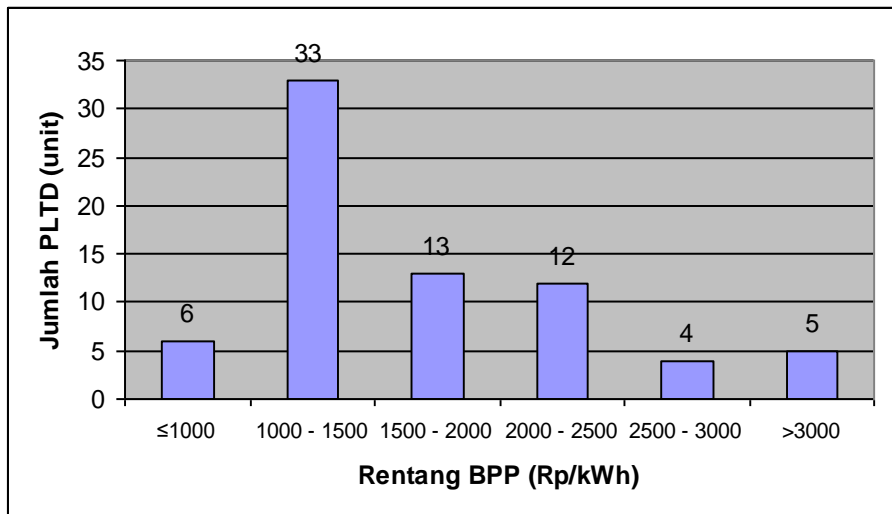
Distribution low Price Fuel at local for the isolated PLTD in West Kalimantan showed by Picture 3.89. From data result of survey in field, Price Diesel in Local of insulation in Region west Kalimantan is Rp. 2.261,- per liter and highest is Rp. 4.477,- per liter. From Picture 3.89 seen that at Isolated PLTD owning Fuel with local price at spanning Rp. 2.200 - 2.500, which many that is 55 unit (75,34%), followed to span Rp. 2.500 - 3.000 counted 16 unit (21,92%). To span Rp. 3.000-3500 and more than Rp. 4000, - each counted 1 unit (1,37%), while at spanning Rp. 3.500-4.000 there is not



Gambar 3.89 Oil Fuel Price Distribution for Isolated PLTD in West Kalimantan

DISTRIBUTION OF BASE PRODUCTION COST (BPP) IN WEST KALIMANTAN

Distribution assesses cost production for the PLTD in west Kalimantan showed by Picture 3.107. From result of calculation, assess low Cost Production for the PLTD (Diesel) of insulation in Region west Kalimantan is Rp. 872, - per kWh and highest is Rp. 9.244, - per kWh and also regional BPP average value is Rp. 1.187,8 per kWh. From Picture 3.107 seen that PLTD (Diesel) insulation owning BPP value at spanning Rp. 1.000-1.500 per kWh which many that is 33 unit (45%), later; then followed by Cost Production value to span Rp. more than Rp. 3.000,- per kWh counted 5 unit (7%), spanning Rp. 2.000-2.500 per kWh counted 12 unit (16%), spanning Rp. 1.500-2.000 per kWh counted 13 unit (18%), spanning less than Rp. 1.000 counted 6 unit (8%) and smallest is value span Rp. 2.000-2.500 per kWh counted 4 unit (5%)



Gambar 3.107 BPP Value Distribution for Isolated PLTD in West Kalimantan

VII. ANALYSE SUBSTITUTION PLTD (DIESEL) FOR THE HYBRID SYSTEM IN WEST KALIMANTAN

1. Installed Capacity

Totalize Installed Capacity by Isolated PLTD exist in region west Kalimantan equal to 50.823 kW and after Hybrid system Installed Capacity to round into 1,3 times Capacities PLTD (Diesel) Insulation that is equal to 66.070 kW is Make-Up of Installed Capacity by this because of addition energy from Photovoltaic system equal to 0,5 Isolated PLTD capacities

2. Energy Production

To serve request electric energy of regional west Kalimantan, before Hybrid system in Diesel Generator (PLTD) insulation in this region have to produce electric energy counted 67.465.044 kWh per year and its production energy hybrid system mount to become 96.378.634 kWh or experience of the make-up of equal to 28.913.590 kWh (mounting 30%) per its year. This matter can comprehend because hybrid system happen the make-up of service that is which at first Isolated PLTD only working 6 hour and 12 hour become to operate fully during 24 hour in one day. hybrid system, awakened energy do not only used to serve existing burden, but excess from produced by energy is PLTD (diesel) Insulation and PV during operating to be kept in battery which later this energy is exploited to close over lacking of when PV and Diesel do not operate.

3. Usage of Oil Fuel

Usage of Oil Fuel to operate for all Isolated PLTD in region west Kalimantan in one year reach 21.252.420 liter with purchasing value in Local place is Rp 50.566.750.870,-. Amount of this Fuel is needed to produce totally of electric energy one year equal to 67.465.044 kWh. But after Hybrid System, usage of Fuel at natural Region west Kalimantan of degradation become equal to 19.086.523 liter per equivalent or year with purchasing of Fuel price in local place equal to Rp 45.346.288.566, per year

a. Maintenance Cost

Total cost Conservancy per year to all PLTD (Diesel) Insulation in region west Kalimantan .730.576. - and after Hybrid system o down to become equal to Rp.900.030.766,- or experience of conservancy decreasing cost equal to Rp 1.306.699.810 ,- (59%) per year

b. Depreciation Cost

Total cost Decrease from all Isolated PLTD in region west Kalimantan before hybrid System equal to Rp 15.871.150.551, - mounting to become equal to

Rp.1.745.367.675.188, - after hybrid system. Make-Up of this decrease is used to purchase of PV, battery and inverter in hybrid system

Composition of Production Cost

In one year required by evocation total cost for the PLTD of Insulation in region west Kalimantan equal to Rp 79.920.693.531 consisting of fixed cost equal to Rp 28.432.649.924,- (35%) and variable cost equal to Rp.51.488.043.607,-.(65%), while in hybrid system required by evocation total cost one year equal to Rp.169.462.182.918,- what raveled to become fixed cost equal to Rp.123.226.435.520,- (73%) and variable cost equal to Rp 46.235.747.397 ,- (27%). From expense composition can perceive that after hybrid system on the contrary, its fixed cost bigger than its variable cost

Base Production Generation Cost (BPP)

Before hybrid system Isolated PLTD, to yield energy equal to 67.465.044 kWh cost money by evocation fundamental equal to Rp 79.920.693.531., - per year or when expressed in per kWh unit obtained by cost production value equal to Rp1.812, - per kWh, while after hybrid system, produced electrics energy mount to become equal to 96.378.634 kWh per year and cost money by production equal to Rp 169.462.182.918- or with cost production value equal to Rp.2.224 per kWh. Assess this cost production express cost production mean value all Isolated PLTD to be is regional west Kalimantan seen that if all Isolated PLTD exist in region west Kalimantan made by hybrid system, hence will happened increase assess cost production from Rp 1.812,- per kWh become equal to Rp.2.224 per kWh or go up equal to 23%, but on the other side will improve expressed earnings from make-up of electrics energy which produced by hybrid system and existence of increase usage of Fuel BBM

Potency Hybrid system

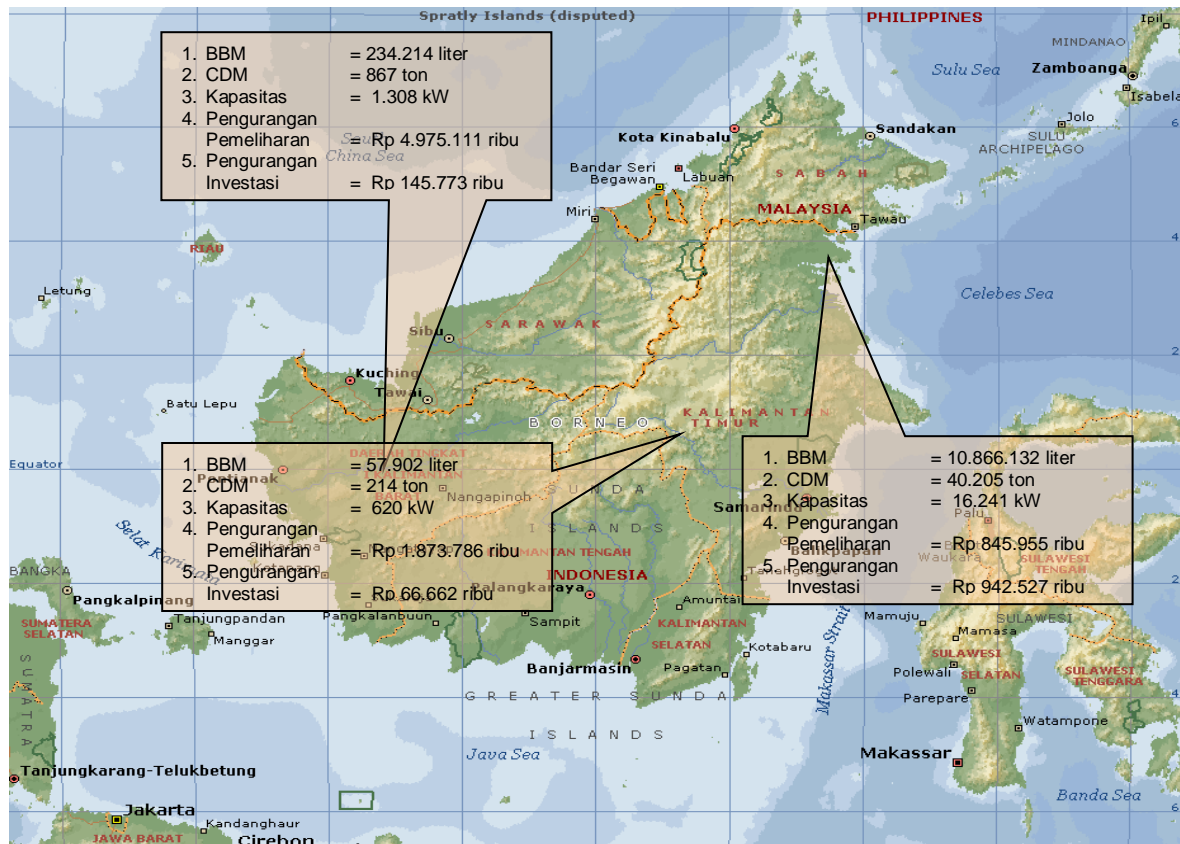
By comparing cost production Isolated PLTD value before and after hybrid system from Tables of cost production can know that in region west Kalimantan there is 13 PLTD (Diesel) insulation which included in priority group to be developed to become hybrid system that is Unsteady Isolated PLTD Island, Nanga Ketungai, Nanga Kemangai, Nanga Kayan, Tontang, Sleepy Nanga, Delicious Nanga, Piasak, Nibung, Island Majang, White Cempaka, Right Kendawangan, and Isolated PLTD Marau, as can be seen in Enclosure Report Draft of Final totally Installed Capacity equal to 1.148 kW or 2% from all Isolated PLTD capacities in region west Kalimantan that is 50.823 kW. Before conducted by] hybrid, produced electrics energy equal to 1.947.996 kWh and after conducted by hybrid, yielded electrics energy become equal to 2.782.851 kWh

Usage of Fuel for the ke-13 of Isolated PLTD before Hybrid system in one year reach 780.180 liter totally purchasing value in local equal to Rp 4.072.777.394.,- per and year usage of natural Fuel degradation become equal to 545.966 liter totally purchasing value in local equal to Rp 1.467.744.904,- after hybrid system

Maintenance cost for the 13 of Isolated PLTD before hybrid system equal to Rp.658.274.036, - and downhill become only equal to Rp160.762.954, - or experience of degradation [at] maintenance cost equal to Rp 497.511.082 (75%) after hybrid system needed to Decrease total cost is hybrid system development from Isolated PLTD priority group (13 Isolated PLTD) is equal to Rp 40.921.314.000., - or mount drastic the than decrease value initially that is equal to Rp.964.939.572.

VIII. CONCLUSION

This matter explain about situation Isolated PLTD, hybrid system with Photovoltaic, especially about Isolated PLTD which have potency to be developed to become hybrid power system, reduction of Oil Fuel Usage, reduction of Green House Gas Emission, maintenance cost reduction and investment needed by each region.



Picture 8-1. Potency Map of Hybrid Power System in Kalimantan Island

System hybrid potency for Isolated PLTD distributed over Kalimantan Island consisted in three provinces covering PT PLN West Kalimantan branch, PT PLN East Kalimantan branch, PT PLN South Middle Kalimantan branch. PT PLN

in East Kalimantan branch on the real condition have potency to be developed to become hybrid system, this matter it is of course also give an effect to the Oil Fuel reduction and environment, namely green house gas reduction. To find out the potency map of isolated PLTD that can be developed to be Hybrid Power System can be seen by Picture 8-1

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