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Renewable Energy for Sustainable Development

PROCEEDING

INTERNATIONAL CONFERENCE

OCTOBER 18-19, 2016

Held by:

POLITEKNIK NEGERI SRIWIJAYA

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International Conference

Forum in Research, Science, and Technology (FIRST) 2016

October 18 – 19, 2016

Palembang, Indonesia

Held by:

State Polytechnic of Sriwijaya – Indonesia

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REMARKS FROM DIRECTOR

AssalammualaikumWaRahmatullahiWaBrakatuh,
In the Name of Allah, the Most Beneficent, the Most Merciful
May the peace, the mercy, and the blessing of Allah be upon you.

Distinguished Participants, Ladies and Gentlemen,
On the behalf of State Polytechnic of Sriwijaya, I would like to welcome you all to the International Conference FIRST 2016 on Renewable Energy for Sustainable Development

Forum in Research, Science, and Technology(FIRST)is a meeting organised to accomodate researchers, academics, businessman, and government to follow up research results, to identify industry needs and to keep updated with the government policies. This forum has moved from national scale into an international conference which is conducted annually by State Polytechnic of Sriwiwijaya. This year, FIRST brings a theme "Renewable Energy for Sustainable Development". It is realised that efforts to solve environmental problems that we are facing today need long term potential actions for sustainable development; And renewable energy resources is one of the most appropriate solutions. Therefore discussing about renewable energy automatically deals with sustainable development.

All papers presented in the conference are documented in proceedings. The proceeding features 71 papers divided into several fields including Environment, Biomass to Energy, Renewable Energy, Audit Energy, Technology for Energy, Design/Modelling, Economic Sustainability and Management. In brief, the relations between renewable energy and sustainable development are described with practical cases and several issues relating to renewable energy, environment and sustainable development from both current and future perspectives.

Our thanks are conveyed to the Governor of South Sumaterafor providing us direction and views related to the importance of renewable energy resources. Also appreciation and gratitude to the keynote speakers, H. Alex Nurdin, Governor of South Sumatera Province, Prof. TjandraSetiadi, Ph.D., ITB, Indonesia, and Prof. Dr. Werner Rammensee, Cologne University, Germany. Also to invited speakers,Prof. Dr. ErryYulianTriblasAdesta, International Islamic University, Malaysia, Christian Overfeld, Lucas Nuelle, Germany, Dr. Sonny Zulhuda, International Islamic University, Malaysia,Ir. Tri Mumpuni, Kementerian ESDM dan IBEKA, Indonesia, Ir. Fahrurrozi, M.Si., Business Head Chemicals Group, PT. BASF Indonesia and Head of Business Development, FederasiIndustri Kimia Indonesia ontheirpresentation related to renewable energy for sustainable development.

Further we extend deepest gratitude and high appreciation to all presenters and contributors to make this conference possible and these proceedings published. It is realised that publication of these proceedings are still far rom being perfect; however, hopefully it will be useful for energy scientist, engineers, policy makers and any other readers as references for enriching their knowledge .

May God bless us all with the health to make this event a successful and enjoyable one!

Thank you.

Dr. Ing. Ahmad Taqwa, M.T.
Director of State Polytechnic of Sriwijaya

MESSAGE FROM THE CHAIRMAN

BISMILLAHIROHMANIRROHIM,
ASSALAMUALAIKUM WW.,
Good Morning Everyone
May the peace, the mercy, and the blessing of Allah be upon you.

The honorable governor of South Sumatra Province, Bapak H. Alex Noerdin
The honorable Director of State Polytechnic of Sriwijaya, Bapak Dr. Ahmad Taqwa
Distinguishedspeakers, Presenter, Guests, and Participants,

It is my great pleasure to welcome and thank you very much for your contributions to this renewable energy conference. This conference which will take place on 18 up to 19 of October 2016, is conducted firstly this year through the initiation of Chemical Engineering Department, State Polytechnic of Sriwijaya,aims toexchange the ideas from governments, non-governmental organizations, research and academic institutions, international organizations, and industries, to learn from each other and build on successes that advance renewable energy for sustainable development.

I am very happy to inform that the committee is very lucky to have 3 keynote speakers, i.e Bapak H. Alex Noerdin, the governor of SS province, Prof. Chandra Setiady from ITB Bandung and Prof Werner Ramensee from Cologne University of Germany, who supported us from the very beginning with their capabilities to present, sharing kowledge and experiences with us here as well as the invited speaker i.e Prof. Dr. Erry Yulian Triblas Adesta, International Islamic University, Malaysia, Christian Overfeld, Lucas Nuelle, Germany, Dr. Sonny Zulhuda, International Islamic University, Malaysia, Ir. Tri Mumpuni, Kementerian ESDM dan IBEKA, Indonesia, Ir. Fahrurrozi, M.Si., Business Head Chemicals Group, PT. BASF Indonesia and Head of Business Development, Federasi Industri Kimia Indonesia.

Distinguished Guests, Presenter, and Participants,
On this special occasion, I would like to report that the conference manage to succesfully attract more than 71 academician to present their abstract, i.e from Kuwait, Germany, Algeria, Malaysia, Cambodia and of course Indonesia. Amongs others there 69abstract to be presented in this seminar under professional selective review. And for that reason, I personally would congratulate you all as distinguished speaker to this event.

This conference has collaborated with two international journal i.e Journal of Engineering and Technological Science, ITB and Gadjah Mada International Journal of Business.All selected papers are then peer-reviewed to meet the publication standard. The peer reviewer of each manuscript is rigorous and concentrates on objective and technical concern to determine whether the research has been sufficiently well conceived, executed and described.

Excellencies, Distinguished Guests, Ladies And Gentlemen

I would also like to give special welcome to Lucas Nuelle, PT. Merck Chemicals and Life Sciences, CV. BestariSetiaAbadi, PT. BangunEnergi, PT. Ditek Jaya, PT. Bank MandiriTbk., PT. Indofood SuksesMakmurand individual who support this conference through sponsorship. I believe that we could never thanks you enough for that.

Finally, I expect all participants have memorable moment through this conference and enjoy your stay in Palembang, South Sumatra Province, Indonesia. Thank you.

Sincerely
Chairman of Organizing Committee
H. Firdaus

KEYNOTE SPEAKER

H. Alex Noerdin
Governor of South Sumatera

Prof. Tjandra Setiady, Ph.D
ITB, Indonesia

Prof. Dr. Werner Rammense
Cologne University, Germany

INVITED SPEAKER

Prof. Dr. Erry Yulian Triblas Adesta
International Islamic University,
Malaysia

Christian Overfeld
Lucas Nuelle, Germany

Dr. Sonny Zulhuda
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Ir. Tri Mumpuni
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HYBRID TO SUPPORT CONTINUING ENERGY

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Abstract. Electrical energy is the energy which is very important in this life, without electricity all the works can stop or do nothing. It is necessary to make sustainable electrical energy. To overcome it,by combining two electrical powers from one to another that we can say hybrid. Hybrid, one way to overcome the shortage of electrical energy from one source of electrical or stop, we can find another energy easily. By joining two sources power, Electrical power covers each other hybrid covers the shortage of energy or replaces energy, although only temporary. One replacement or the incorporation of the most effective energy is solar energy that is always there every day or wind energy is also very close to our life and easily available in everyday life. For intance National elecrical power (PLN) or Diesel electrical power between solar electrical power.or kwown as one of renewable energy. Solar electrical power is the most effective, because we in Indonesia almost every day there is always, therefore, the utilization of this nature should be made to find solutions to find alternative energy as an energy substitute. There is a lecturer to think about the future search for renewable energy to solution overcomes the shortcomings-lack of energy.

Keyword: Energy, electricity, hybrid, alternative, renewable, solar, power

I. INTRODUCTION

For larger power requirements and high Electrical energy needs of the sector households today tend to increase, especially with the increase in the technology sector higher due to the many needs of household appliances that are practical and hygienic, resulting need for electrical power is increasing and the available power has become more limited, and when the addition of the electric power needs of installation costs will also increase.

To meet the needs of electrical energy ration necessary to find a solution to meet the demand for electrical energy is needed consideration of the use of electrical energy ration sources such as solar cells power by exploiting the potential of the sun is always there throughout the year and is an alternative renewable energy. although electricity is still problem but the future is the mainstay of future electricity let alone been able to be equipped with a reliable technician to be able to fix the equipment and crockery are also easily obtainable and inexpensive with good quality. With ration power, solar cell that can either be introduced to social to combine the two energy that can cover disadvantages of each ration so that the power is sustainable to cover the shortage of electrical energy that can meet the needs of everyday life need to use two power systems different combined to do the same load resulting in a synergy that can each cover the shortage of electrical energy that can conduct electricity energy continuity on an ongoing basis.

II. METHODOLOGY

2.1. Solar Power Generation

Solar Power Plant (SPP) is a plant technology that converts the photon energy from the sun (solar) into electrical energy. This conversion occurs in the solar cell module consists of several solar cells (photovoltaic). These cells are thin layers of silicon (Si) pure and other semiconductor materials.SPP utilizing solar energy to generate direct current power DC (direct current), which can be converted into an alternating current electrical AC (alternating current) if necessary. SPP is essentially the power supply and can be designed to distribute the electricity needs of small to large, either independently or hybrid

2.2 Diesel

Diesel is used Deutz generator type F3M2011 with 20kVA capacity or rated power 16kW and the output voltage is 220V at 50Hz. It operated standby mode due to its function as a backup source of electricity portion when the electrical energy generated by the solar cell module or a battery backup cannot meet the power requirements of the device at the location of the BTS Wood Pumpkin.

2.3 Hybrid System

Hybrid system is also used in stand-alone systems consist of solar cells and modules combined with wind power generator driven or diesel engines. Hybrid systems typically used stability

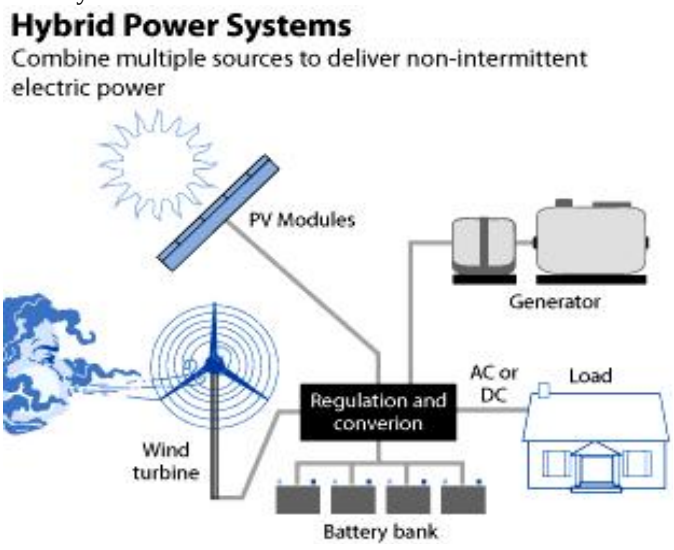

Figure 1. Hybrid system

An example of a system that is connected to the DC load is power generation for telecommunications equipment. For example, telecommunications equipment installed in the area off grid. While that is associated with the air conditioning load is a power generation system for remote islands. In this system, the battery plays a very vital role. If there is excess electricity generated, for example, during the day, the electricity stored in the battery. At night, the stored electricity is supplied to the load.

The flow of electricity derived from solar cell modules (photovoltaic modules) will be a DC power, partly saved to battery, some can be used directly for the equipment with DC power specifications, partly converted to AC power using the inverter to the equipment with AC power specifications.

2.4 Charger Contoller

A charge controller is used to set the over charging (excess charging as the battery is full) and excess voltage from photovoltaic . There are several types of charge controllers :

Shunt Controller : function to set the battery charging , the controller is basically connected in parallel with the photovoltaic array and battery .

Series Controller : The controller is generally used in small photovoltaic system and is connected in series between photovoltaic array and battery .

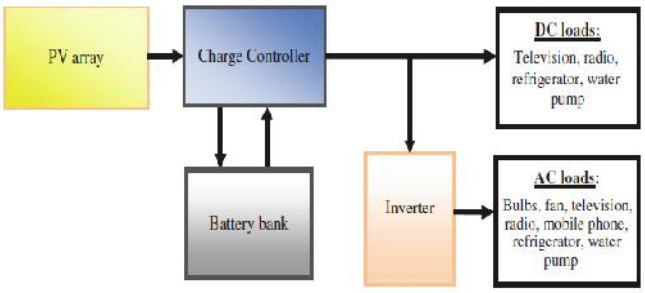

Figure 2. Charger controller

The flow of electricity derived from solar cell module will be a DC power , partly saved to battery , some can be used directly for the equipment with DC power specifications , partly converted to AC power using the inverter to the equipment with AC power specifications .

2.4. Inverter

The inverter serves to transform the DC current and voltage generated photovoltaic array into AC electric current and voltage. The inverter used is an inverter with an output voltage of 220 Vac and with capacity on demand equipment that use AC power.

An inverter circuit is basically a type of cutter (chopper). In a series of cutters, ration DC alternately opened and closed, or "cut" by the switching apparatus such as a transistor or SCR. By changing the ratio of time either on until the cutting off of the output frequency can be controlled. The basic principle of the work can be described by a simple inverter by the circuit shown in Figure 2:10 (a). The circuit shown two manual switches, A and B. If the switch is open, then the circuit no current is flowing. If the switch A is closed, current flows IA as the indicated direction. And switch B is closed, current flows as shown IB. If the switch A and B are alternately opened and closed, then at the load terminals of the circuit output voltage will be raised back and forth. In practical inverter circuit, SCR or transistor used as a replacement for mechanical switch shown in Figure 3

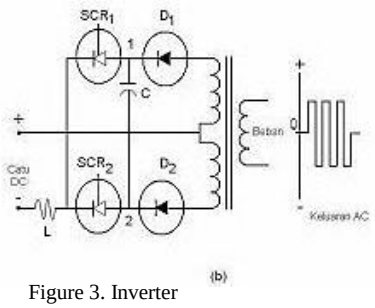

Figure 3. Inverter

2.4 The orientation towards the solar panel at its optimum (tilt angle)

Orientation of a series of panels towards the sun at its optimum is very important for maximum energy yield. In addition to orientation direction orientation angle (tilt angle) of the panel also greatly affect the energy yield maximum. For the location of which is located in the northern latitudes, the panel should be oriented to the south. So also, is located in the southern hemisphere latitude, then the panel should be oriented to the north. Although the panel is oriented to the west or to the east will still produce energy, but will not produce maximum energy. The position where the solar cells to the sun (sun altitude). Maintaining the sunlight falling onto a surface perpendicular solar modules will get the maximum energy ± 1.000 W / m ^ 2 or 1 kW / m ^ 2. To maintain an upright between sunlight to the solar cell module required setting position of the solar modules, because the sun altitude

2.5 BARGAINSER

Bargainser is a tool that serves as a barrier incoming electrical power to homes, could also serve as a measure of the amount of electric power used the dwelling house (in units of kWh). There are various restrictions issued by PLN power for residential consumption of 220 VA, 450VA900VA,VA ,1300

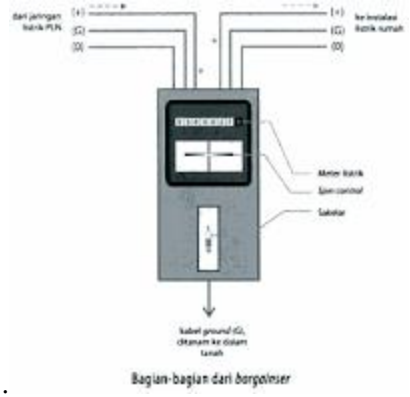

Figure 4. KWH Meter

In bargainser there are three main parts, namely:

1.MCB or Miniature Circuit Breaker, serves to cut off power automatically when power is delivered exceeds the limit value. The MCB is on / off and can also function as the main switch in the house. If the MCB is in a state bargainser off, then all the power in the house was stalled. This switch is usually turned off at the time will be repair of electrical installations in the home.

Electricity meters or kWh meter, this tool is used to measure the amount of power used by residential is in units of kWh (kilowatt hour). In bargainser, electric meters tangible rows of numbers in an analog or digital will change according to power usage.

2.Spin Control, a control device power usage in the residence and will always turning over the existing electrical power used. Turnover will spin control quickly if the electrical power used increasingly large, and will slow down if the electrical power used is reduced / less. On the output channel Bargainser usually there are 3 wires, ie the phase wires, neutral wires and ground wires connected to the ground. Of electricity to be connected with bargainser first before going into residential electrical installations.

2. Battery

Battery for maintaining the electrical current generated by the solar cell module before being used to drive the load. Battery size used depends on the size of the panel and load pattern. Size batteries that are too big either for the operating efficiency but result in investment needs are too great. Instead battery size too small can result power.

Battery must undergo a process of charging and discharging cycles, depending on the presence or absence of sunlight. Over time there is sun, the array of panels produces electrical energy. Power that is not used immediately it is used to charge the battery. During the hours of absence of sun, any demand of electrical power supplied by the battery

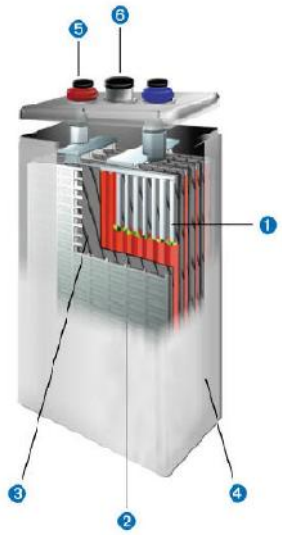

Figure. 5 Battery

3.Panel ATS - AMF

Panel ATS (Automatic Transfer Switch) is a control panel that serves to move the connection between the source of the power supply voltage from the power supply and others are automated. Because these functions are often also referred to the ATS Automatic CO (Change Over Switch)

While the panel AMF (Automatic Main Failure) is controlled panel serves to operate the engine, generator set if the load on serve to lose the main source of electrical energy.

From the brief description, above can be seen that the function of the ATS panels - AMF operate the generator when the main power source die / off via AMF and connect the electricity produced by the generator to the load through the ATS.

III. RESULTS

3.1 Scheme Hybrid System

In a hybrid system of solar cells and generators, main power source portion is a solar cell module that utilizes solar energy as an energy source that is environmentally friendly, cost-effective operations and is always available almost all days. ration backup power source is battery and generator.

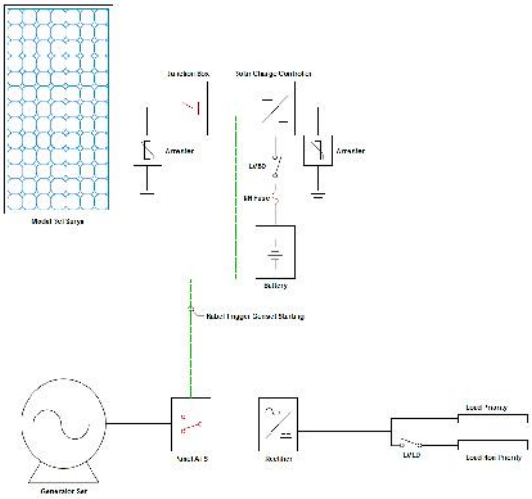

Figure.6.Single Line Hybrid System Diagram

In normal conditions the electrical power generated by the solar cells will be used to meet the needs of the BTS, the rest is used for charging the battery. When the solar cell module can not generate electric power, especially at night, the battery is fully charged by solar cell module during the day will provide ration power to devices commonly called the discharge process.

During the discharge process, the battery voltage will fall jikapada when the solar cell module is still not able to generate electrical energy so when the battery voltage reaches the value <46Vdc according to the charge controller parameter settings are hybrid system will automatically instruct the generator to operate and provide the electrical portion toward the BTS and the battery through the rectifier .

During generator operation voltage read by the hybrid system through the charge controller will continue to rise until it reaches > 48 Vdc and automatically the hybrid system will instruct the generator stop , but because their timers on additional circuit then the stop will be retained by the timer for a time be set on a timer and the generator will stop operating after the time runs out .

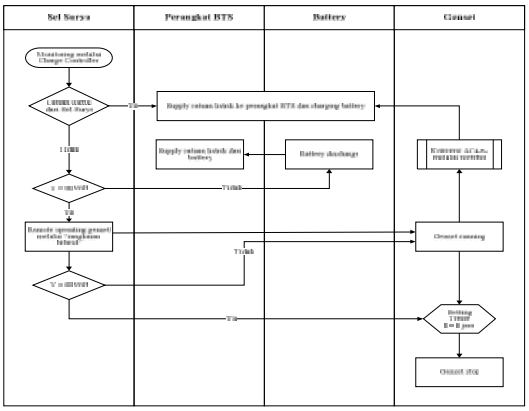

Figure. 7 Process Systems Hybrid Solar Cells – Diesel

The data processing simulation of the availability of energy to the energy needs in BTS sites Wood Pumpkin fully within the span of one (1) year with energy demand 4,5kWh can be seen in table 3.1 below.

Table 3.1.Data simulation of energy needs per month

No	Mon	SunRadW/m	Pout (kW)	Cell E kWh	Battery E (kWh)	DemandE (kWh)	Lack E(kWh)	Diesel E(H/day)
1	Jan	170	2,5	299,8	1,6	4,5	2,6	5,45
2	Feb	180	2,6	317,4	1,6	4,5	2,6	5,41
3	Mar	212	3,1	373,4	1,6	4,5	2,6	5,29
4	Apr	169	2,4	2,98,0	1,6	4,5	2,6	5,45
5	May	189	2,7	333,3	1,6	4,5	2,6	5,38
6	Jun	163	2,4	287,4	1,6	4,5	2,6	5,47
7	July	182	2,6	320,9	1,6	4,5	2,6	5,40
8	Aug	191	2,8	336,8	1,6	4,5	2,6	5,37
9	Sept	196	3,0	345,6	1,6	4,5	2,6	5,35
10	Oct	202	2,7	356,2	1,6	4,5	2,6	5,39
11	Nov	183	2,6	322,7	1,6	4,5	2,6	5,49
12	Des	158	2,3	278,6	1,6	4,5	2,6	4,49

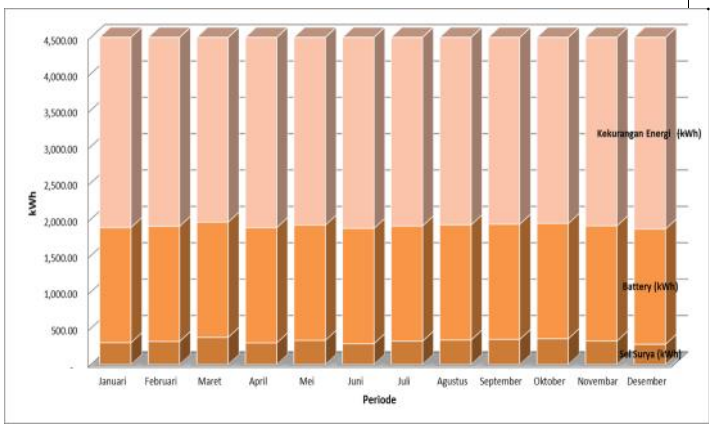

Figure.8 Energy avaible and demand (battery)

IV. CONCLUSION

The results of the discussion can be concluded :

The hybrid system of solar cells and generators to maintain and improve system reliability ration electricity to BTS device optimally for second generation systems can operate together automatically so that overlap each other's shortcomings.

The function generator in a hybrid system not only as a backup (backup electric power source) to meet the shortage of power due to the limited capacity of solar cells but can also be the main source of electrical power when the weather is very extreme during the rainy season.

REFERENCES

[1] A Buyer's Guide. (2002). *Photovoltaic Systems*, Canada

[2] Boylestad'2011Electronicdevices", Prentice Hall International, Fifth Edition, New York

[3] Besenhard, Jurgen O. (1999). *Handbook of Battery Matterial*, Germany

[4] Collombet C., Lupin, J.M., Schonek, J. (2008, Desember). Harmonic disturbances in networks, and their treatment. Cahier technique no. 152.Availalble:http://www.schneiderelectric.com.tr/schneider_en/pdf/publications_ect/ ECT152.pdf. [29 April 2008]

[5] Dedy, Kemas S,Skripsi(2014), System HybridSolar Cell Hybrid - Generator As Back Up, Pondok Labu BTS.

[6] De La Rosa, Francisco C. (2006). *Harmonics and Power Systems*. New York: Taylor & Francis, LLC

[7] Djiteng Marsudi (2005), *Generation Electric Power* , Erlangga Jakarta

[8] Exide Technologies (2003). Handbook for Gel-VRLA-Batteries Part.1, Germany

[9] Hibbard, John F., Lowenstein, Michael Z. *Meeting IEEE 519-1992 Harmonic Limits (Using Harmonic Guard® Passive Filters)*.[online]. Available: http://www.transcoil.com/meetieee.pdf. 09 Februari 2008

[10] Mohan, N., Undeland, TM., Robbins, WP. (2003). *Power Electronics Converters, Applications and Design*. Jhon Wiley & Sons

[11] Rekioua, Djamila,Ernerst Matagne (2012). *Optimization of PhotovoltaicPower Systems*, London: Springe

[12] Tiwari, G.N, Swapnil Dubey (2010). *Fundamental of Photovoltaic Modules and their Applications*, Cambridge: RSC Publishing.

[13] Westindo (2012), Technical Site Survey Report (TSSR) Solar Cell Site Kayu Labu, PT. Telkomsel Jakarta.

[14] www.meteonorm.com

[15] Zuhal , 2009, "Basic Electrical Power Engineering " ,

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