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ACISE

PROGRAM BOOK

International Joint Conference of

2016 2nd International Conference of Industrial, Mechanical, Electrical, and Chemical Engineering (ICIMECE) and 2016 Annual Conference on Industrial and System Engineering (ACISE)

Supported by :

IEEE

RISTEKDIKTI

Yogyakarta, Indonesia
October 6 - 7, 2016

Organized by :

PROGRAM BOOK

International Joint Conference of 2016 2nd Industrial, Mechanical, Electrical, and Chemical Engineering (ICIMECE) and 2016 Annual Conference on Industrial and System Engineering (ACISE)

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Organized by :

Universitas Sebelas Maret (UNS)

Universitas Diponegoro (UNDIP)

Institut Teknologi Bandung (ITB)

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Yogyakarta, Indonesia

October 6 - 7, 2016

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Welcome Message

On behalf Organizing, Steering, and Technical Program Committee, it is my privilege to welcome you to the Joint International Conference of The Second Industrial, Mechanical, Electrical, and Chemical Engineering & Industrial and System Engineering (ICIMECE & ACISE 2016).

The ICIMECE & ACISE 2016 organized by Faculty of Enigeering - Sebelas Maret University in collaboration with Faculty of Enigeering - Diponegoro University, and the School of Electrical and Informatics, Institute Technology Bandung (ITB), and the Institute of Electrical and Electronics Engineers (IEEE) with technical co-sponsored by the Indonesia Section C Chapter and Indonesia Section SP/ED/E/PES Joint Chapter.

The first ICIMECE (formerly known as IMECE) was held in 2015 while the first ACISE was held in 2014 as a domestic conference. This year, these two conferences are joined together to be broad, widely provide opportunities for the different areas to exchange new ideas and also experiences, as well as to establish business or research relations and to find global partnership for future collaboration in the fields of Engineering. The conference is expected to be an effective platform for the three axis of triple helix namely ABG (Academic–Business–Government) forum, to share ideas and to present the works of scientists, engineers, educators and students. Speakers from Australia, Indonesia, Japan, Malaysia, South Korea, the Republic of the Philippines, the United Kingdom, The People's Republic of China and Turkey were submitted articles to this conference.

In closing, It was our great honor and pleasure to accept the responsibilities and challenges of Conference General Chair. We hope that the conference will be stimulating, informative, enjoyable and fulfilling experience for all who attend it.

Organization and Committees

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Sebelas Maret University
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Bandung Institute of Technology
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Anugerah Widiyanto

PROGRAM SCHEDULE
International Joint Conference of 2016 2nd International Conference of Industrial, Mechanical, Electrical, Chemical Engineering &2016 Annual Conference on Industrial and System Engineering (ICIMECE & ACISE 2016)

Royal Ambarrukmo Hotel Jogjakarta, Jl. Laksda Adisucipto No.81, Daerah Istimewa Yogyakarta 55281, Phone:(0274) 488488

Day-1: Thursday, October 06, 2016

TIME	PROGRAM ACTIVITIES
07.00 – 09.00 a.m	Conference Registration
09.00 – 09.10 a.m	Opening Ceremony by MC (support by HMTI UNS)
09.10 – 10.55 a.m	- National Anthem - Reporting Speech of SC of IC IMECE by Dean of Faculty Engineering, Sebelas Maret University, **Dr.techn.Ir. Sholihin As'ad, M.T** - Reporting Speech of SC of ACISE by Dean of Faculty Engineering, Diponegoro University, **Ir. M. Agung Wibowo, MM, MSc, PhD** - Opening Speech by UNS' Rector, Prof Dr. Ravik karsidi, MS - Keynote Speech by Director of Quality Asurance on behalf Ministry of Research, Technology & Higher Education : **Prof drh Aris Junaidi, Ph.D** - MoU signment between UNS and PT Festo Indonesia
09.55 – 10.15 a.m	***Coffe Break***
10.15 a.m – 12.10 p.m	Keynote Speech I : **Drs Slamet Ajji Pamungkas M.Eng.** Head of Sub-Directorate Information and Data Analisys Badan Ekonomi Kreatif
	Keynote Speech II : **Prof. Amran Rasli, Director of ICC**, Universiti Teknologi Malaysia Theme: "Contribution of innovation and technology commercialization at Universities to National Economic Growth: a case study from ICC-UTM Malaysia"
	Keynote Speech III : **Assoc. Prof Erdem Cuce, Ph.D - Bayburt** University. Theme"Technology Commercialization in Energy"
	Keynote Speech IV : **Mr.Safri Susanto, S.T. Didactic Manager PT Festo di Indonesia**. Title : Industri 4.0 is All about Future Production Process

	Discussion and Question/Answer with Keynote Speakers Moderator : **Retno Tanding Suryandari SE., M.E,.Ph.D (Sebelas Maret University)**
12.15 - 01.00p.m	**Photo Session & L U N C H**
01.15 –03.00 p.m	Parallel Session I (@presentation 20")
03.10 – 03.25 p.m	**Coffee break**
03.25 – 05.15p.m	Parallel Session II (@presentation 20")
07.30- 09.00 p.m	Conference Dinners - *Speech from International Office,* - *Sponsorship Reward* - *Award Announcement* - *Performace Art from*

*) Request from committee

Day-2, Friday, October 07,2016

TIME	PROGRAM ACTIVITIES
08.00 – 08.45 a.m	Conference Registration
08.45 – 09.15 a.m	**Coffe Break**
09.15 – 11.15 a.m	Keynote Speech V : **Prof. Muhammad Nizam, ST., MT., Ph.D** Professor of Power Systems, Universitas Sebelas Maret Theme: "Commercialization of Renewable Energy: Economic Opportunities and Energy Management"
	Keynote Speech VI: **Sarjiya, ST., MT., P.hD.** Chair of Power and Energy Society Chapter, IEEE Indonesia, Universitas Gadjah Mada, (UGM). Talk Title: "Commercialization of Renewable Energy: Power System and Technology"
	Keynote Speech VII : **Warsono M., ST., M.Phil.,** General Manager Transmission of East Java and Bali Region, PLN. Talk Title:"Commercialization of Renewable Energy: Policies and Regulations"
	Discussion and Question/Answer with Keynote Speakers Moderator : **Dr. Singgih Saptadi, ST. MT** (Diponegoro University)
11.15 a.m – 12.30 p.m	**Friday Shalah**
12.30 – 01.00 p.m	**Lunch Break**
01.00 – 03.10 p.m	Parallel Session III (@presentation 20")
03.10 – 03.25 p.m	Coffe Break
03.25 – 05.15 p.m	Parallel Session IV (@presentation 20")

Keynote Speaker

Chief of Badan Ekonomi Kreatif

Biography

Triawan Munaf

Triawan Munaf was born in Bandung, November 28th1958. Triawan is son from couple Bahar Munaf and Etty Munaf. He married with Luki Ariani. They are parents from Virania Munaf and Sherina Munaf. He became Kepala Badan Ekonomi Kreatifafter officialy inaugurated by the president of Indonesia, Ir. Joko Widodo, on26th January 2015, through Keputusan Presiden (Kepres) Nomor 9 P year 2015. He became the first chief for the new estabilished institution that has the same level with the ministry. Badan Ekonomi Kreatif is a new estabilished state institution that used to be a part of Ministry of Tourism and Creative Economy.

Triawan engaged in the field of advertising and founded *Euro RSCG AdWork*on 26th December1989. On of his klien is Partai PDI Perjuangan. The PDI Perjuangan icon,white mouthed bull is one of his creation.

Director, UTM Innovation and Commercialisation Center, UTM

Biography

Prof. Amran bin Muhammad Rasli Ph.D

Mr. Amran bin Md. Rasli is a respected figure in Innovation and Commercialization Center, Universiti Teknologi Malaysia. He was born on June 5th, 1961 in Kuala Lumpur,

Malaysia. On 1983 he got his B.A. (Statistics) with C.G.P.A. of 3.00 from California State University, Chico, California, until 2005 with his PhD in Society, Business &Globalisation from Roskilde University, Denmark.

Mr. Amran has many professional qualifications or memberships which he has been joining until now, from a member of SPSS User Group to an advisory member and board of Trustees to the Asia Pacific Business, Innovation and Technology Management Society (Jan 1, 2012-Dec 31, 2015). He also had a consultancy or training since 1991. Many awards have been given to him, such as Represented Malaysia for the APEC-HRD-BMN Project in Developing Cross-Cultural Training for SMEs on Interactive CD-ROM. He attended the first Project Meeting and Inception Workshop on January 18-20th, 1997 in Sydney, Australia, and the latest one is Anugerah Khidmat Cemerlang in conjunction with Citra Karisma Universiti Teknologi Malaysia 2013. Not only awards, he also has many research records which he had made since 1991 until now.

Technology Commercialization in Energy Bayburt University, Turkey

Biography

Erdem Cuce, Ph.D

Dr. Erdem Cuce has received his PhD from the University of Nottingham on sustainable building technologies.He has worked on numerous scientific projects in the scope funded by notably EU, TSB, DECC, EPSRC, BRITISH COUNCIL, TUBITAK and international based commercial companies. He has strong numerical, computational, experimental and simulation skills as well as comprehensive CFD techniques based on UDFs for thorough performance assessment of physical systems. Currently, he is the author or co-author of over 70 scientific papers notably in high-impact SCI journals and prestigious international conference proceedings.

His latest book “Toward thermal superinsulation technologies in buildings: Latest developments in glazing and building fabric” has been released in August 2015 by German Publisher LAP Lambert Academic Publishing.

He is currently working as a visiting scientist in the Institute of Sustainable Energy Technologies at the University of Nottingham. He is also working as an expert in energy optimization, energy conservation and energy management strategies with a consultant role.

Didactic Manager PT Festo

Biography

Safri Susanto, S.T.

Safri Susanto, he wa born February 29th 1976. He is currently working as a Didactic Manager PT Festo from 2007 until now. He is also working as trainer fit for change module 1, 2, dan 3 in Sales Training Program Festo A.G from 2012 until now. He worked as Product and Market Specialist Merger and Accuisition LabVolt Inc. Quebec Canada on period 2013 – 2014. In 2005 until 2008 he worked as Lecturer of Pneumatic and Hydraulic University of Indonesia F-MIPA Akademi Teknik Bogor.

Profesor of Power System, Universitas Sebelas Maret

Biography

Prof. Muhammad Nizam, ST., MT., Ph.D

Muhammad Nizam, He was born in Surakarta July, 20th 1970.He received his B.Eng and M.Eng degrees in Electrical Engineering from Universitas Gadjah Mada (UGM), Indonesia and Ph.D degree in Electrical Engineering, Universitas Kebangsaan Malaysia, Malaysia, in 1994, 2002 and 2008 respectively.

Since 1998, he had been with the Faculty of Engineering of Universitas Sebelas Maret (UNS) and was a full professor there since 2011.

He received Bronze Medal, in Intelligent Power Quality Monitoring Instrument 19th International Invention, Inovation and Technology Exhibition, Kuala Lumpur, Malaysia, 9th-11th May 2008 , Organized by MTI, Malaysia, 2008. His research interest includes reliability

and economic operation of power systems, optimization in the power systems, power system dynamic and stability. He is a member of IEEE, PII.

Chair of Power and Energy Society Chapter, IEEE Indonesia, Universitas Gadjah Mada

Biography

Sarjiya, ST., MT., P.hD.

He was born in Yogyakarta, Indonesia, in 1973.He received his B.Eng and M.Eng degrees in Electrical Engineering from Universitas Gadjah Mada (UGM), Indonesia and Ph.D degree in Electrical Engineering, Chulalongkorn University, Thailand, in 1998, 2001 and 2008 respectively.

He is Chair of Power and Energy Society Chapter, IEEE Indonesia. His research interest includes reliability and economic operation of power systems, optimization in the deregulated power systems. He is a member of IEEE, PII, and, MKI.

General Manager Transmission of East Java and Bali Region, PLN

Biography

Warsono M., ST., M.Phil.,

Warsono, graduated from the Department of Electrical Engineering and Information Technology Universitas Gadjah Mada, Indonesia in 1994. He received Master of Philosophy in Power Engineering & Management from University of Abertay, Dundee, UK in 2000. He is General Manager Transmission of East Java and Bali Region, 2015.

Oral Presentation Guidlines

1. **Prepare Presentation**
   Each oral presentation will be 20 minutes (long maximum) followed by Q&A. Length presentation material should be in accordance with your time allotted. You are kindly requested to be at the presentation room at least 15 minutes before the session starts. Please refer to conference book or schedule to find your assigned schedule and sesssion. The presentation format is in power point presentation (ppt and pptx) and pdf.
2. **Backup Copy Presentation**
   Recommended to copy your presentation file in conference location. You can update your file 1 hour before conference at Registration Desk.
3. **Suggestions for a good presentation**
   - Slide Detail
     Each slide should have a maximum of five points or short sentences. Slides should represent summary points of your discussion rather than your verbal presentation in totality. Please avoid using transitions between slides and within slides as these become distracting.
   - Number of slides
     The duration of your presentation will determine the number of slides that is acceptable. As a general rule, if your presentation takes 15 minutes in duration, 5 slides would be acceptable. However, your presentation style may suggest a different time required each slide. Please plan the slides carefully. Remember you'll talk about your slides not read them.
   - Font
     Font type and size is determined by personal preference. Basic fonts such as 'times new roman' or arial are easy to read. A font size of 26-30 is acceptable.
   - Content
     As described above, the content of your slides should be brief. Your presentation should have a distinct introduction, body conclusion and Acknowledgements.
   - Images and Illustrations
     Always check for the presence of copyright notices and watermarks on images downloaded from the Internet or copied from another source. Copyright notices are not always visible on images, however, this does not mean that one does not exist. When in doubt, you should seek written permission from the publisher before using any images or illustrations in your conference presentation, as this will most definitely be required if you submit your paper for Publication at a later stage. Additionally, if you are using personal photographs, you will need to obtain written permission from all of the people whose identity is visible in the photograph.

Conference Informations

Official Language

The official language of the conference is English. All presentation including discussion shall be made in English.

Badges

All the participants are asked to wear their name badges in order to enter the session room.

Registration Desk

The registration desk is available on Karaton I

Lunch

Lunch will be served at Royal Restaurant with Lunch Ticket.

Gala Dinner

Date : Thursday, October 6th 2016
Time : 07.30 – 09.00 PM (GMT +7)
Venue : Pendopo Royal Ambarukmo Hotel
Dress Code : Formal / Batik

All registered participants are invited to attend gala dinner free of charge. A full course meal and entertainment will be provided.

Necessary Information

Passport and Visa

Passport must be valid for minimum six months. Visa On Arrival (VOA) is granted to foreigners who intend to visit Indonesia for tourism, social and culture, business or government duties. This VOA is granted to foreign nationals who fulfill requirements and conditions upon arrival in indonesia. The following is the list of countries that can apply for VOA in Indonesia.

Algeria
Arab Emirate
Argentina
Australia
Austria
Bahrain
Belgium
Brazil
Bulgaria
Cambodia
Canda
China
Cyprus
Czech Republic
Denmark
Egypt
Estonia
Fiji
Finland
France
Germany
Greece
Hungary
Iceland
India
Ireland
Italy
Tunisia
Japan
Kuwait
Laos
Latvia
Libya
Liechtenstein
Lithuania
Luxembourg
Maldivies
Malta
Mexico
Netherland
Monaco
Norway
New Zealand
Oman
Panama
Poland
Portugal
Qatar
Romania
Russia
Saudi Arabia
Slovakia
Slovenia
South Africa
South Korea
Spain
Suriname
Sweden
Switzerland
Taiwan
United State of America
United Kingdom
United Arab Emirate

Airport and Airport Tax

Adi Sucipto International Airport *(Indonesian : Bandar Udara Internasional Adi Sucipto)* is an airport in Jogjakarta. It is located on Jalan Raya Solo Km 9. There is no airport tax because the tax include in price of ticket.

Currency

Only indonesian currency (Rupiah) is acceptable at regular stores and restaurants. Certain foreign currencies and major credit cards are accepted by most hotels, restaurants, and souvenir shops. The change rates 1 USD is about 13.300 IDR.

Language

Bahasa Indonesia is the national language.

IDD (International Direct Dialing)

Country Code : +62

City Code : Jogjakarta +62-274

Police

Magelang Km 12, Sleman 55514

T : (+62 274) 868424

Hospital and Drug Store

Hospital

1. JIH Hospital
   Ring road utara, Sleman, Jogjakarta
   T : (+62 274) 4463535
2. Panti Rapih Hospital
   Cik Di Tiro 30, Caturtunggal, Depok, Sleman, Jogjakarta.
   T : (+62 274) 563333
3. Condong Catur Hospital
   Manggis 6, Condongcatur, Depok, Sleman, Jogjakarta.
4. Dr. Sardjito Hospital
   Kesehatan 1, Sekip, Sinduadi, Sleman, Jogjakarta.
   T : (+62 274) 587333
5. Bestheda Hospital
   Jenderal Sudirman 70, Jogjakarta
   T : (+62 274) 586688
6. Jogja Hospital
   Wirosaban Barat 1, Sorosutan , Umbulharjo, Jogjakarta.
   T : (+62 274) 371195

Drug Store

1. K-24 Ambarukmo
   Laksda Adisucipto 150A, Ambarukmo
   T : (+62 274) 489233
2. Husada Bima Perkasa
   Laksda Adisucipto 56A, Jogjakarta
   T : (+62 274) 7103288

Transportation

There are some option transportation like bus, taxi, or train to get conference venue in Ambarukmo Hotel Jogjakarta.

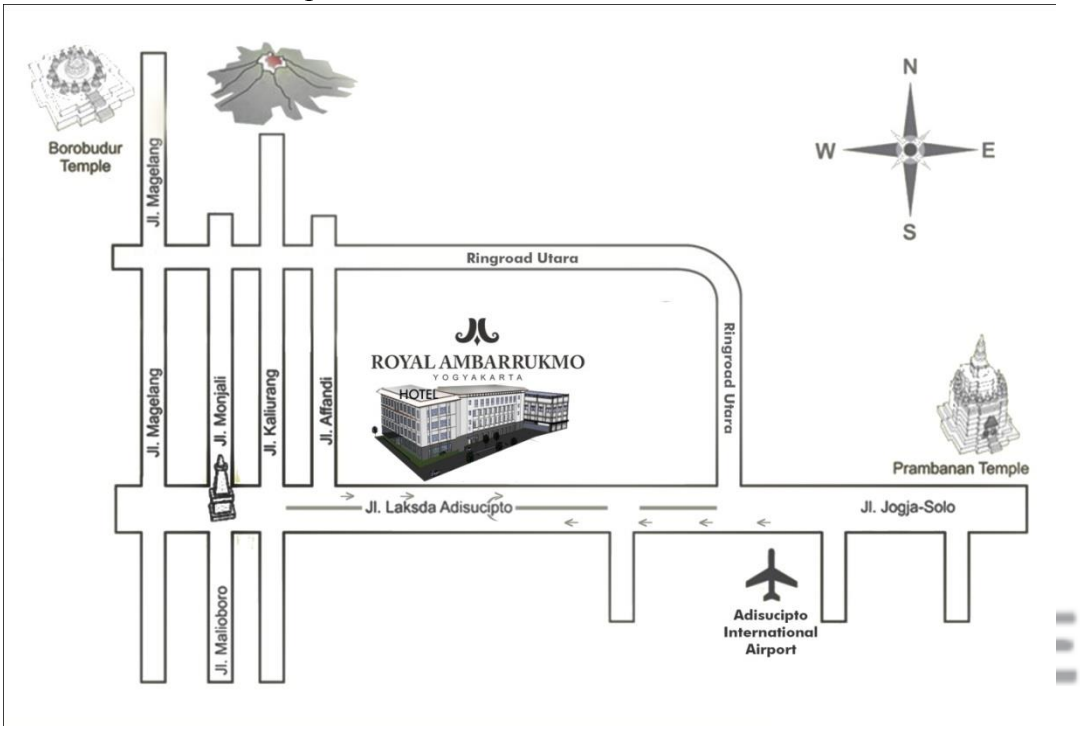
Transjogja

Transjogja is a city bus with many of facilities, such as air conditioner and services well. The bus is operated from 05.30 – 21.30 (GMT + 7 hour).

- From Adi Sucipto Airport, Jogjakarta
  The Adi Sucipto Airport is located on Jalan Raya Solo Km 9, it's about 5 km from Hotel. The covenient transportation to reach Ambarukmo Hotel is Bus Transjogja corridor 1A and 1B. The price about 3500 IDR. Another transportation to get Ambarukmo Hotel is to take an airport taxi. The taxi operate with argo system.
- From Tugu Station, Jogjakarta

Tugu Station is located on Jalan Pasar Kembang Sosro Menduran, it's about 5 km from Hotel. The transportation from this station to conference venue can take Bus Transjogja corridor 1A and 1B. The price about 3500 IDR.

- From Maguwo, Jogjakarta
  Lempuyangan Station is locaten on Maguwoharjo, Sleman, it's about 5.4 km from Hotel. The trasportation from this station to conference venue can take Bus Transjogja corridor 1A and 1B. The price about 3500 IDR.
- From Bus Station Giwangan
  Public transportation that can be used to get the conference venue is by Bus Transjogja corridor 3B and stop at Adi Sucipto Airport and then continue with bus transjogja corridor 1A or 1B. The price is about 3500 IDR.



Indonesia in Brief

Indonesia is the world's fourth-most-populous country in the world. The Indonesian national motto is "Unity in Diversity" or in Sansekerta language is "Bhineka Tunggal Ika". There are some 300 ethnisc groups, a result of both the country's unique geography and history. Indonesia has 250 distinct langugae with Bahasa Indonesia as natitonal language. Six religions are formally recognized in Indonesia and have official national holidays commemorating events of importance to their followers.

Indonesia is divided into 31 provinces, which 2 special regions (*Daerah Istimewa Yogyakarta* and *Nanggroe Aceh Darussalam*), and 1 special capital city that is Jakarta. Indonesia has three time zones that is Western Indonesia Time (GMT +7), Central Indonesia Time (GMT + 8), East Indonesia Time (GMT + 9).

Jogjakarta

Yogyakarta also **Jogja** or **Jogjakarta**, is a city and the capital of Yogyakarta Special Region in Java, Indonesia. It is renowned as a center of education (*Kota Pelajar*), classical Javanese fine art and culture such as batik, ballet, drama, music, poetry, and puppet shows. Yogyakarta was the Indonesian capital during the Indonesian National Revolution from 1945 to 1949, with Gedung Agung as the president's office. One of the districts in Yogyakarta,Kotagede, was the capital of the Mataram Sultanate between 1575 and 1640.

The city of Yogyakarta is an administrative part of the Yogyakarta Special Region which has the status of a province in Indonesia. The regencies of Bantul and Sleman have population densities far higher than the surrounding countryside (over 1,500 per square kilometer) and are effectively dormitory communities of the greater area of Yogyakarta. Within the greater Yogyakarta area lies the city of Yogyakarta called *Kota Yogyakarta*.

The area of the city of Yogyakarta is 32.5 square kilometres (12.5 square miles). While the city spreads in all directions from the *kraton* (the Sultan's palace), the core of the modern city is to the north, centered around Dutch colonial-era buildings and the commercial district. Jalan Malioboro, with rows of pavement vendors and nearby market and malls, is the primary shopping street for tourists in the city, while Jalan Solo, further north, is a shopping district more frequented by locals. At the southern end of Malioboro, on the east side is the large local market of Beringharjo, not far from Fort Vredeburg, a restored Dutch fort.

BEAUTIFUL DESTINATION of YOGYAKARTA

CANDI PRAMBANAN

Prambanan is the largest Hindu temple of ancient Java, and the construction of this royal temple was probably started by Rakai Pikatan as the Hindu Sanjayas answer to the Buddhist Sailendra's Borobudur and Sewu temples nearby.

Getting There : Using Transjogja take number 1A from Plaza Ambarukmo. The first one leaves around 6AM, then every 20 minutes. Depending on traffic, the journey normally takes around 30 minutes, but can take an hour when traffic is heavy. From the terminal station, cross the busy road, turn right, and walk around 300 metres to the pedestrian entrance.

Operating Hours : 7.30 A.M – 5.00 P.M
Website : http://corporate.borobudurpark.com/node/20

MALIOBORO STREET

Malioboro Street is a major shopping street in Yogyakarta. It lies north-south axis in the line between Yogyakarta Kraton andMount Merapi.

Getting There : Using Transjogja take number 1A from Plaza Ambarukmo, then stop at Maliboro Street Transjogja Stop.

Operating Hours :8.00 A.M – 9.00 P.M
Website :-

KASONGAN VILLAGE

Kasongan village is the dwelling place of kundis, which means earthenware jugs and later refers to people who make any earthenware jug-like as kitchen tools and ornaments.

Getting There : With a private vehicle, from the center of Yogyakarta . You can through the streets of Bantul . Upon entering km 5.6

in Bantul road on the west there is a red arch-shaped corridor that reads Kasongan .

Saptosari - Tepus Directions to Baron

POK TUNGGAL BEACH

Pok Tunggal Beach has a beautiful panorama with white sand and karst. On the east side and the west coast is flanked by towering cliffs.

Getting There : With a private vehicle route can be through : Yogyakarta - Piyungan - Patuk , Sambipitu -ArahBunder Forest - Ivory - Logandeng -Siyono - BPD Monument Roundabout - Jl . KyaiLegi- South Ring Road - Jl . KRT Djojodiningrat - Jl .Girisubo - Wonosari - Jl .Saptosari - Tepus - PokTunggal .Or : Yogyakarta - Imogiri , Bake - Jl .

Abstract

Kaskus.co.id is one of the biggest community site which ranks 1st in Indonesia and 257 positions for the world in 2010. As time went on, many other similar sites with kaskus.co.id that is able to meet the needs of Indonesian social-networking communities such as forum.detik.com. This gives the impact of a decline in the number of access to the site kaskus.co.id and shift its rank. The results of the interview against the user community site kaskus.co.id is there are some shortcomings on the site, i.e. the process of posting the increasingly complicated, too many ads that cover the main content, and the difficulty of organizing pictures.The purpose of the research is to determine the value of usability of the community site kaskus.co.id as Indonesia's largest sites which ranks 1st in Indonesia in 2010. There are 22 indicators divided into 3 indicators for performance task and 19 indicators Koohang model. Performance Task is used to find out the level of site performance directly while the indicator of Koohang models used for qualitative questionnaire assessment. The determination of the value of usability of the site kaskus.co.id obtained using WEBUSE with merit conversion scale. The whole valuation WEBUSE respondents will be processed to earn points for each questionnaire indicators and the level usability of the community site kaskus.co.id. The results of this study in the form of value of usability of the sites, the analysis of the 19 indicators that affect the value of usability and indicators guide the creation of community sites. In this kaskus.co.id case, we obtained information that kaskus.co.id has a moderate level of usability.

7B1-2

01.30 P.M

Evaluation and Designing Street Lighting with Solar Cell: A Case Study

Ika Shinta Mardikaningsih[1], Wahyudi Sutopo[2], Roni Zakaria[3], Muhammad Nizam[4] and Evizal Abdul Kadir[5,6]

[1]*Laboratory of Bussiness and Logistic System, Industrial Engineering Department Sebelas Maret University, Indonesia*

[2]*Industrial Engineering and Techno-economics Research Group, Industrial Engineering Department Sebelas Maret University, Indonesia*

[3]*Industrial Engineering Department Sebelas Maret University, Indonesia*

[4]*Electrical Engineering Department Sebelas Maret University, Indonesia*

[5]*Wireless Communication Centre, Faculty of Electrical Engineering, Universiti Teknologi Malaysia. Malaysia*

[6]*Fakultas Teknik, Universitas Islam Riau, Indonesia*

Abstract

Street lighting problems are high operating costs, lux incompatible with the standards, and then the lamps are inefficient. In addition, one effect of the use of street lighting which does not effectively and efficiently can cause electrical energy crisis. Currently, street lighting is still use fossil fuels to generate electricity. Even though fossil fuels known inexpensive and mostly used to generate energy, it is non-renewable and environmentally unfriendly caused by carbon dioxide. The street lighting at University incompatible with the standard and does not function properly, so it can reduce the level of safety and convenience on campus. Based on the problem we need an alternative to overcome it. This article aims to evaluate and making plans the design of street lighting at the University, as a case study, to compare with the Indonesian Standard of Street Lighting. The evaluation conducted to determine the existing condition of street lighting and to analyze compatibility with the standard. Evaluation related with lux, distance, pole, and the amount of lamp power. Basedon the evaluation known that street lighting is not compatibility with the standard so that needed planning and design of street lighting. Planning and design can be used as an alternative to solve the problem. Design covering the structure of street lighting, the type of installation, and the material used. It is known that the design of street lighting using solar energy is a good alternative to solve the problems.

7B1-3

01.50 P.M

Designing Size of Batik Shirt For Male College Student in Surakarta Using Anthropometric Data (Case Study: Male College Student of Industrial Engineering Major in Surakarta)

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Abstract

Batik is one of Indonesian culture that is growing very rapidly proved with inaugurated batik into the world cultural heritage by UNESCO. Batik should be developed in various aspects in order to meet the needs of consumers, one of them in batik shirt size aspect. But unfortunately in terms of size, batik still has the disadvantage, there are difference in male size batik shirt between one batik shop and other batik shop. This makes the performance of selling batik is not optimal because consumers have difficulty in finding the appropriate size of batik shirt with anthropometry, eg in shop A consumer obtain batik shirt with size M but when it is at the store B, this consumers gain size L. This will make consumers confused while looking for the appropriate batik shirt size based on their anthropometry. The author tried to make a proposal in batik shirt size corresponding with male college student anthropometric data of Industrial


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Evaluation and Designing Street Lighting with Solar Cell: A Case Study

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***Abstract*— High operating costs, lux incompatible, and inefficient become a great problem in the street lighting of campus area that generated by fossil energy. In a case study at Sebelas Maret University, it is possible to shift the street lighting that generated from fossel to Solar Cell. This article aims to evaluate and design Street Lighting with Solar Cell. An evaluation framework was developed to evaluate the performance of current condition related to lux, distance, pole, and the amount of lamp power. We design the alternatives of Street Lighting by using DIALux application to fullfill the technical standard of Street Lighting. The specification of street lighting, the type of installation, and the material used were studied for designing new Street Lighting. A simulation-based analysis was used to determine the specifications of new design of street lighting. The results shows that the alternative of design street lighting that generated by Solar Cell can be used to substitute the existing one with better performance and reliability aspects.**

Keywords—Evaluation Street Lighting; Designing Street Lighting with Solar Cell;

I. INTRODUCTION

Electricity is an important energy for activities, to generated large scale production, office, street lighting, etc. High demand for electricity is inversely proportional to the growth of the supply of electric energy in Indonesia. Previous research showed that electricity reserve of approximately 25-30% in Java, 10% in Sumatra, and Eastern Indonesia less than 10% [1]. As the times increasing of electrical energy, it can be seen the use of electronic tools and the industry continues to grow. If the electricity continues to grow without balanced providence so it will lead to an energy crisis. The energy crisis is a fundamental in Indonesia, especially the problem of the electrical energy crisis. Electrical energy is necessary for modern living. In the event of a power outage, many activities will be halted at once [2]. Power outages, especially in the street lighting due to ineffective and inefficient power used obstruct activities that may affect the safety and comfort of society.

Based on the problems, development of the use of energy storage has good prospects to resolve the energy crisis that occurred at this time. One of development is applied on a solar street lighting. Street lighting using solar power to be used as a power source of lighting, it's low cost because the solar energy is unlimited free [3]. Sebelas Maret University is one of the green campus universities and has the development of energy storage by utilizing the lithium battery. As one of the colleges that have a work culture ACTIVE (Achievement Orientation, Customer Satisfaction, Teamwork, Integrity, Visionary, Entrepreneurship) see it as an opportunity resource that should be developed. As it is known that Sebelas Maret University still use the street lighting that use conventional power, so the application Solar Street Lighting it is applicable in the campus to support the energy efficiency.

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Solar energy had lots applied in around the world, if properly managed, solar energy has potential to be an alternative energy in the future. Sunlight received at the earth's surface that is 3 x 1024 joules per year, equal to 2x 1017 watt. That amount of energy equivalent to 10,000 times the energy consumption in the world [4], [20]. As a country located around the equator, Indonesia has great potential to generate solar energy for approximately 4.8 kwh / m^2 or equal to 112,000 solar energy GWP [5]. Certainly these benefits should be carefully studied. In addition to utilizing solar energy with PV technology can replace the conventional energy so as to provide a positive economic impact [6].

Implementation of solar power in street lighting be expected as a solution, street lighting with solar power has an important to support daily activities. Solar street lighting use lithium battery to be developed by the University as the depositary of energy derived from the sun. The importance of this research not only to do analysis the investment in implementation of solar energy for street lighting, but as well in support of lithium battery research currently developed at Sebelas Maret University. Besides, as a support strategy, develops lithium battery also meant to improve global competitiveness in Indonesia [7], [20]. The plan was to establish a mini plant to manufacture lithium battery to be implemented by an electric vehicle [8], [17] - [18].

An important stage to apply new technology is to study feasibility business plans using a several criteria that developed by management [7]. Feasibility Investments consist of both the technical and economic aspects. To implement street lighting by using solar power requires a technical analysis phase. Technical analysis of this study is an evaluation and design phase of street lighting

II. Components of Street Lighting

Street lighting as part of building installed on the left or right or in the middle (median) used to light the road and the surrounding roads, including the intersection of roads, bridges and the underpass. The detail unit consists of light source optical elements, electric elements, base, pole and lamps [8]. Street lighting is not only related to the driver's needs, but also required by the general public [10]. Street lighting has the function for [11]:

1. Generate the contrast between the object and the road surface
2. As a navigation tool
3. Improve the safety and convenience for the driver, especially as the night
4. To secure the region
5. To provide aesthetics

The source energy of solar power coming from sunlight to operate street lighting [3]. Solar street lighting is an energy-saving. Street lighting with solar power is cost-efficient because it uses energy derived from sunlight infinite. Solar street lighting using solar cell panels that function to receive sunlight and then convert it into electrical energy through the photovoltaic process. The lights can work automatically at night and off in the morning with an easy and inexpensive treatment [3]. A solar street lighting system consists of electricity generation, storage and management device (solar panel, battery and controller) and lamps [12]. Street lighting with solar power consist of several components which solar cells, LEDs, pole, and battery power regulator.

A. Solar Cell Panel

The most important parameter in the performance of solar panels are solar radiation intensity, the number of sunlight surface per board area [4]. Solar radiation can be used to define power to produce solar cells. The solar cells consist of silicon, that function to convert the intensity of sunlight into electricity. Photons moving to electrons and generate current and voltage. Electric current is an electric direct current or DC [3]

B. Battery Charge Regulator

In one package battery charge regulator there are several components, *i.e.* a battery, controller, block terminal, and battery management system [13]. It uses lithium battery as a storage of energy. Lithium battery was chosen because it has advantages than others battery, lithium has no memory effect, rechargeable battery without vacating the completely before disposal. A life time is more durable than VRLA battery. Lithium battery for solar street lighting life time estimated for five years. The Battery can store in large capacity.

Another component is a solar charge controller (SCC), which functioning as control time and storage control of street lighting and maintains a direct current filled to the battery and extracted from the battery to the load. Besides battery and SCC there are BMS (Battery Management System) which functions to cut off If the battery is fully charged, and function to set the power outputs required. BMS manage and monitor the condition of the battery, and the maintain the balance of battery [14]. Terminal block in the box function as current divider, in a case which is needed of damage does not occur difficult to repair process and to minimize sparks.

C. LED

Application of street lighting with solar power using LED as a lighting output. Majority, street lighting using neon, mercury and sodium, compared with LED course more profits LED lights. The average life cycle of LED is 50,000 hours - 10.000. If it is assumed that life time is 50,000 hours with 12 hours per day, so can estimate life time of the lamp can last up to 11 years. Compare with fluorescent lamps with a life cycle is 2,000 hours. If used for 12 hours per day, then less than 1 year of usage. Use LED power consumption is more efficient, because with capacity 40-120 watts, can replace fluorescent in 150-350 watts [20].

LED is environmentally friendly because not contain mercury. UV emits a fluorescent light, can contaminate the environment if disposed carelessly. It also provides reduced rate of higher performance, lower efficiency and a shorter life than LED, which is needed a higher initial investment [15].

Research and analysis shows that LED have great potential to replace fluorescent light, driven by the reduction in power related to the replacement of lamp one-to-one (or retrofit). But, consumers should be aware inherent characteristics of LEDs, such as the quantity and quality of light levels in areas of the working [16].

III. Study Area

The problem in this research is to evaluate and design related planning street lighting at Sebelas Maret University. Fig. 1 is described about process evaluation street lighting on campus. Fig.2 Show method for designing street lighting to choose the best alternative based on comparative advantages and disadvantage each alternative. And then in Fig.3 show method to redesign street lighting using solar power. Application of solar street lighting on campus certainly needed to design simulations to be performed. It can determine in advance the research object, which is the object of observing to be simulated. Observation by measuring illumination using a Lux meter and for distance and light centre height using LDM (Lases Distance Meter). Street lighting measurements carried out in the Faculty of Engineering UNS.

In this study will be made the object of the simulation is a street lighting in the Faculty of Engineering, Sebelas Maret University. Existing condition of street lighting that is known there are 17 light points spread across the main street area of the engineering faculty, mapping with Google Maps. The following will be presented a map of the location of the lamps on campus in Fig.4

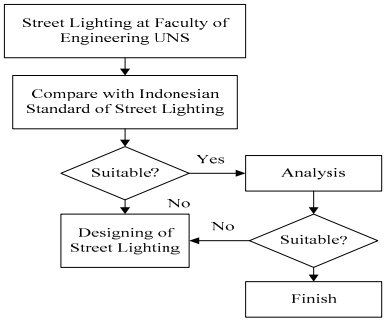

Fig. 1. Approach to Evaluation Street Lighting

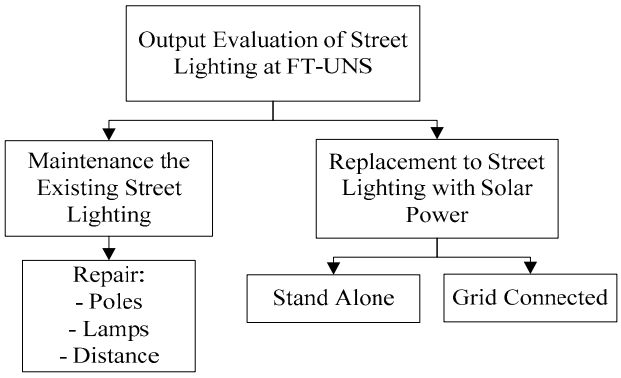

Fig. 2. Method to Designing Street Lighting

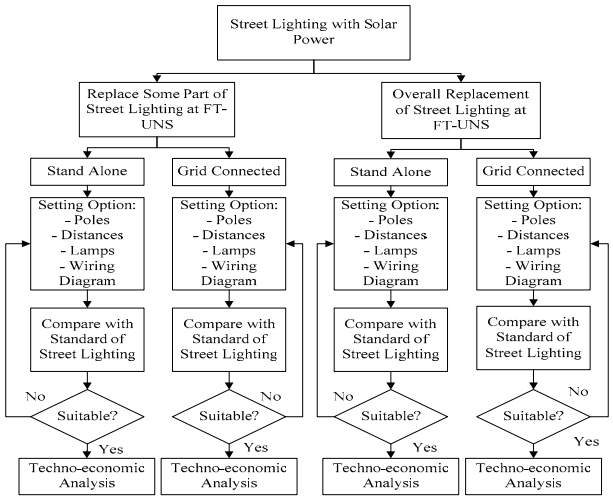

Fig. 3. Method to Redesign Street Lighting at FT UNS

Fig. 4. Location Street Lighting at Faculty of Engineering UNS

IV. Evaluation and Design Street Lighting

Evaluation of the condition street lighting is applied at this time is not only the number and location of the reference point of lamps in decision-making, also the specifications of an existing street lighting. It is needed as a basis for determining the amount of power used for the first lamp unit and serves as a basis of comparison component in designing street lighting based solar power. Based on the results of field studies that have been done can be seen from the street lighting specifications in the Faculty of Engineering, Sebelas Maret University. There are two types of street lighting used in the campus, the main street lighting and street lighting support. In this research study focused only street lighting on the main road. For street lighting on the main campus of street uses manifold mercury lamp. Power is used for each lamp of diverse, yet for street lighting on the main road using 125 watts. The lamp used Philips lamp HPL-N 125 watt / 542.

For sources of energy used street lighting in the Faculty of Engineering still use conventional electricity as the main source of energy. Street lighting in campus work using key Switch ON / OFF. Operating hours for street lighting lamps

for 12 hours at 6 p.m. until 6:00 pm. To evaluate the existing street lighting in the Faculty of Engineering, Sebelas Maret University is taking the measurements the existing condition. The measurement as an evaluation whether the existing lighting is in conformity with standards [11]. The following measurements have been done in Table I.

After finding out the results of measurements next steps is calculate the requirement of lighting, and the last stage is to evaluate. Here are the results of the calculation of the requirement of street lighting. And the result of evaluation can be seen in fig. 5

The first calculation is to calculate light intensity (Candela)

$$\boldsymbol{i = \frac{\emptyset}{\omega}, \omega = 4\pi} \quad (1)$$

$$\boldsymbol{K = \frac{\emptyset}{P} \quad \emptyset = KxP} \quad (2)$$

$$\mathbf{i = \frac{K\,x\,P}{\omega}} \quad (3)$$

$i = light\ intensity\ (cd)$

$K = luminous\ efficacy$

$\emptyset = Flux\ (lm)$

The K average luminous efficacy of 125 watt lamp types HPLN is 49.6 Lumens / watt with power (P) 125 watts and the angle ω = 4π space

$$\mathbf{i = \frac{K\,x\,P}{\omega} = \frac{49{,}6\ x\ 125}{4.3{,}14} = \frac{6200}{12{,}56}} \quad (4)$$

$$\mathbf{i = 493{,}63\ cd} \quad (5)$$

The next step is to calculate the luminance at the road. The distance to the end of the street lamp (r):

$$\boldsymbol{r = \sqrt{5^2 + 4{,}9^2} = 7\ m} \quad (6)$$

$$\mathbf{E_B = \frac{i}{r^2}\cos\beta = \frac{493{,}63}{7^2}.\frac{5}{7} = \frac{2468.15}{343} = 4{,}71\ lux} \quad (7)$$

After calculating the luminance of the existing lighting conditions and Indonesian standard street lighting, which should be a difference in the result. For existing condition can be known luminance at point 1 is 4 lux while the conditions that should be owned by a street lighting is supposed to have is 6 lux.

TABLE I. MEASUREMENT RESULT OF STREET LIGHT AT CAMPUS

Existing Condition							Standard of Street Lighting		
Point	Lamp Condition	Lamp Type	Lux (lx)	Distance (m)	Width of the Road (m)	Light Centre Height (m)	Width of the Road (m)	Light Centre Height (m)	Lux (lx)
1	ON	HPLN 125 watt	4	26	4.9	6.3	5	6	6
2	OFF	HPLN 125 watt	0	97.5	5.0	7.0	5	6	6
3	OFF	HPLN 125 watt	0	26.6	5.0	6.2	5	6	6
4	ON	HPLN 125 watt	4	21.37	5.0	6.1	5	6	6
5	OFF	HPLN 125 watt	0	40.23	5.0	6.0	5	6	6
6	ON	HPLN 125 watt	6	40.2	4.1	5.9	4	6	3.5
7	OFF	HPLN 125 watt	0	43.1	4.1	5.1	4	5	3.5
8	ON	HPLN 125 watt	13	47.1	4.1	4.4	4	4	3.5
9	ON	HPLN 125 watt	48	46.2	4.1	2.8	4	4	3.5
10	OFF	HPLN 125 watt	0	75.5	4.1	3.5	4	4	3.5
11	OFF	HPLN 125 watt	0	24.2	4.1	3.4	4	4	3.5
12	ON	HPLN 125 watt	21	72.4	4.1	4.1	4	4	3.5
13	ON	HPLN 125 watt	6	21.4	4.7	6.7	5	6	6
14	ON	HPLN 125 watt	18	29.5	4.7	4.3	5	4	3.5
15	OFF	HPLN 125 watt	0	40.4	4.9	6.0	5	6	3.5
16	ON	HPLN 125 watt	17	84.1	4.9	3.6	5	4	3.5
17	ON	HPLN 125 watt	9	32.9	4.9	5.6	5	5	3.5

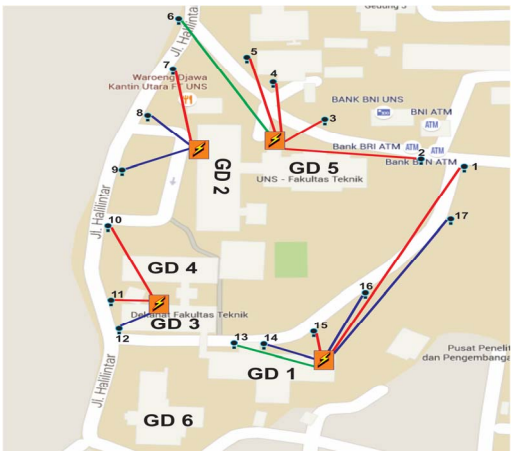

Fig. 5. Evaluation Result of Street Lighting

Based on the results in figure 5 can be know there are 9 lamps that not suitable with standard of street lighting, it be known from the red line on the figure. Green line stating that the lighting is good. While in the blue line stating that the lighting is not efficient because a considerable difference in height between the existing conditions and standards required.

Based on evaluation street lighting on the campus is inefficient, so that require to design the existing street lighting. There are several design alternatives, all designed with consideration structure road and Indonesian Standard of Street Lighting. The first alternative perform maintenance on the street lighting at campus, can be done by changing the entire street lighting or even by improving over of street lighting that does not comply with standards. Repair includes replacement or installation of the power needed, adjusting the height of the light center height, and adjust the distance between the lamps. For the first alternative is to use conventional power. A second alternative for street lighting with solar power, to do some of this alternative option, first make improvements in whole or several point lights only. After the election of the system will have is to use stand alone or grid connected.

Table II describes the advantages and disadvantages of both alternatives. Based on the results of the street lighting by using solar power is more profitable than conventional electricity, so select the street lighting with solar power. Based on the table it is known that street lighting with solar power

not using conventional energy (fossil fuel), but using solar power to generate the lighting. Solar energy is free to consume, so the street lighting with solar power is more efficient than conventional street lighting that using fossil fuel. Table III and IV describe the design of street lighting at Faculty of Engineering UNS based on Indonesian Standard of Street Lighting [11]. In this study using LED lights, then adjusting the lamp power to the lamp power suggested by the standard.

TABLE II. COMPARISON OF CONVENTIONAL AND SOLAR POWER STREET LIGHTING

Conventional Street Lighting		Street Lighting with Solar Power	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Lower initial investment cost	Maintenance cost and limitations Expensive manual failure check	Street lighting with solar power are independent, so the operation cost are	Initial Investment is higher
	Street Lighting operational cost is higher	Non-Polluting source of electricity	Risk of theft is higher
	Light pollution, energy wasted illuminating the sky ecological damage to birds and insects	Street lighting with solar power require much less maintenance compared to	
	Street Lighting energy cost is higher	Easy to use	
	Dark area and broken lights lower safety and security	Environmentally Friendly	

TABLE III. DESIGN STREET LIGHTING

Lamp Type	Lights Centre Height (m)	Width of the Road (m)		Lux
		4	5	
LED 30 W	4	31	30	3.5
	5	33	32	3.5
LED 50 W	6	48	47	3,5
LED 50 W	6	34	33	6
LED 80 W	6	48	47	6

The distance between the light pole in meters.

TABLE IV. QUANTITY OF LAMPS

Roadway (m)	Distance (m)									
	31	30	33	32	48	47	34	33	48	47
276	9	9	8	9	6	6	8	8	6	6
218	7	7	7	7	5	5	6	7	5	5
281	9	9	9	9	6	6	8	9	6	6

The quantity of lamps in units.

In this study conducted a simulation of the alternative design street lighting. In Fig. 6 and Table V can be seen the results of the simulation using the software DIALux. If the result known that the specifications of the lamp 50 watt lamp 6 meters high and results for this alternative is suitable for street lighting condition at campus.

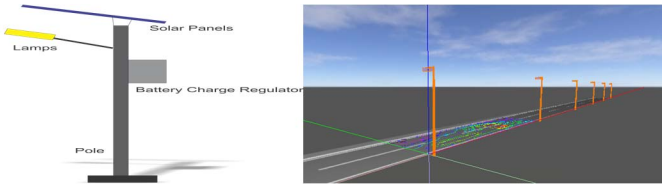

Fig. 6. Design of Street Lighting

TABLE V. SIMULATING RESULT USING DIALUX

	Lm (cd/m2)	U0	UI	TI(%)	EIR
Actual Value according to calculation	0.86	0.54	0.62	8.26	0.44
Required values according to class	≥ 0.50	≥ 0.40	≥ 0.60	≥ 15.00	≥ 0.30
Fulfilled/ Not Fulfilled	√	√	√	√	√
Assigned observer (2):					
Observer	Position (m)	Lm (cd/m2)	U0	UI	TI(%)
Observer 1	(-60.000, 1.250, 1500)	0.86	0.58	0.86	4.52
Observer 2	(-60.000, 3.750, 1.500)	0.91	0.54	0.62	8.26

As previously known that the street lighting with solar power using sunlight as an energy source. Therefore, the operating system street lighting solar power is divided into two systems, namely a stand alone system, it is street lighting solar power is not connected to the electricity network and street lighting system with solar power connected to the grid or grid connected system.

The use of solar cells as an alternative source of energy has been widely applied, one application in street lighting. For the application itself can independently or not connected to the electricity grid and can be operated by plugging in the power grid. For street lighting with independent network equipped with a backup battery, the battery is used to store electrical energy that will be used to turn on the lights at night.

As for street lighting solar power system connected to the grid output of the inverter that converts DC power to AC directly linked (fused) with the electrical installation systems for interior synchronized with the output power of the PLN. In such a system is necessary KWH meter two-way function to read the electricity from two directions, namely electricity flowing from utility to utility and flows [20]. Street lighting systems with electric power systems connected to the electricity grid without battery backup in case of outage on the main source of conventional electricity, then the system must be extinguished although at the same time the panels were generating electricity and it is referred to as the anti-islanding.

Street lighting solar power can also be combined among the above model, the street lighting grid connected solar power with battery backup. In this system allows electricity generated from solar power can be used as a backup energy, to turn on the AC load without the need to have multiple installations, as well as being able to send power to the utility. Purposes that can be obtained with the use of street lighting system network-connected solar electricity with battery backup is to [20]:

1. The electricity will be generated by the panels can be directly used by the electrical load without double installation in solar street lighting
2. When the electric power consumed bean is smaller than the power produced by the panel, the more power can be supplied to utilities

3. Using this system, the user has the option to choose whether to use the power of the PV to supply power to the load or save it to a battery for later use when night
4. If the power of the PV module is used to load and store the battery at the same time it will not be efficient.

V. CONCLUSION

Based on evalution performance of existing street lighting in campus consist of lux, distance, pole, and the amount of lamp power compare with Indonesian Standard of Street Lighting. There are several lamps not suitable with standard such as the pole is too short, low brightness of the lamps makes lux incompatible, distance between the lamps does not fit with requirement, so it can makes street lighting in campus inefficient and ineffective. Based on comparison result, the lux, distance, pole, and the amount of lamps not suitable with standard. Evaluation street lighting in campus is obtained that street lighting it need to improvement.

Improvement of this problem is to designing street lighting in campus based on technical standart of street lighting. In designing street lighting that considering several factors there are specification of street lighting, the type of installation, and the material. To determine the specification of street lighting using DIALux application for simulating the several alternative design. A simulation based on specification of street lighting such us distance, lights center height, pole distance, width of road, and lamps. Selected material for battery using lithium battery because it has advantages than others battery. Application of street lighting with solar power using LED as a lighting output because LED more efficient than other lamps. The type of installation of street lighting is using a grid connected system. In grid connected system the user has the option to choose whether to use the power of the PV to supply power to the load or save it to a battery. Based on results shows that the alternative of design street lighting that generated by Solar Cell can be used to substitute the existing one with better performance and reliability aspects.

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