
ICITACEE
2018
icitacee.undip.ac.id
SEMARANG
SEPTEMBER 26-28, 2018
IEEE
COPYRIGHT
ISBN : 978-1-5386-5527-6 (PRINT)
ISBN : 978-1-5386-5528-3 (DVD)
ISBN : 978-1-5386-5529-0 (XPLORE COMPLAINT)
DEPARTEMENT OF
ELECTRICAL ENGINEERING
DIPONEGORO UNIVERSITY
Jalan Prof. Sudarto, S.H., Tembalang
Semarang, 50275, Indonesia

The 5th International Conference on Information Technology, Computer and Electrical Engineering

ICITACEE 2018

Semarang, Indonesia, September 26th – 28th, 2018

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Homepage

The conference entitled "The 2018 5th International Conference on Information Technology, Computer, and Electrical Engineering (ICITACEE 2018)" provides a forum for researchers, academicians, professionals, and students from various engineering fields and with cross-disciplinary working or interested in the development and design of information technology, computer system, and electrical engineering to interact and disseminate the latest issues and researches. It also offers opportunity to enjoy the heritage and the beauty of Semarang.

ICITACEE is an annual conference organized between Electrical Engineering Department and Computer Engineering Department and in 2018 this conference will be organized by Electrical Engineering Department.

The theme of ICITACEE 2018 is "Green Technology and Smart Environment for a Connected World". The conference covers the topics but not limited to information technology, information systems, power systems, signal processing, electronics, micro-electronics, biomedical engineering, and communication systems as well as other field that corresponds, such as intelligent systems, intelligent transportation applications, health care applications, and environmental protection. ICITACEE 2018 invites the scholars and encourages the researchers to submit high quality manuscripts and papers to this conference.

The papers accepted and presented will be forwarding for consideration to be published in the IEEE Xplore Digital Library.

2018 5th International Conference on Information Technology, Computer and Electrical Engineering (ICITACEE) took place 26-28 September, 2018 in Semarang, Indonesia.

IEEE catalog number:	978-1-5386-5529-0
ISBN:	978-1-5386-5528-3

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Program

Thursday, September 27

Thursday, September 27 9:30 - 11:30

INV: Invited Paper

Green Computing: Opportunity of Using Breadth Fixed Gossip Algorithm for Optimizing Power Supply Route in Power Plant
Mauridhi Purnomo (Institut Teknologi Sepuluh Nopember, Indonesia)
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A1: Electronic Circuit & Control

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Communication Protocol on 64-Channel ECVT Data Acquisition System
Arbai Yusuf (Universitas Indonesia & C-Tech Labs Edwar Technology, Indonesia)
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Cooling System Design Based on Thermoelectric Using Fan Motor on-off Control
Munnik Haryanti (Universitas Dirgantara Marsekal Suryadarma, Indonesia)
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Design of The 3D Surface Scanning System for Human Wrist Contour Using Laser Line Imaging
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Temperature Controlling Using PID Controller on Rice Grain Fluidized Dryer Prototype
Aris Triwiyatno (Diponegoro University, Indonesia)
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PID Based Air Heater Controller Implemented With Matlab/Simulink and Arduino Uno
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Design A Low Cost Wind Direction Sensor With High Accuracy
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The Effect of Excitation Capacitors on Induction Generators in Loss-of-Grid Events
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Transient Stability Study in Grid Integrated Wind Farm
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A Single Phase 11-Level Inverter for Photovoltaic Application
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Marker Image Variables Measurement of Augmented Reality in Mobile Application
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Organized by **Department of Electrical Engineering Diponegoro University**
Prepared by **EDAS Conference Services**.

Energy Saving Measures and Potential of Energy Efficiency at the University of Surabaya, Based on EDGE Simulation

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Abstract— **Higher education institutions play an essential role in promoting and developing sustainability. Implementation of energy efficient technology would reduce the amount of energy used significantly, in particular in buildings. The energy saving measures and potential for energy efficiency for a university campus are discussed and simulated in this paper. The simulation was done based on the parameters in EDGE (Excellence in Design for Greater Efficiency) simulation software. There are nine measures can be done without significant building renovation. Yet those changes still affect significantly to the energy efficiency if done simultaneously. The total energy savings that can be obtained by doing all those nine changes is 18.9%. This improvement will give operational carbon savings 769.78 tCO2/year.**

Keywords—energy saving, energy measure, energy efficiency University of Surabaya

I. INTRODUCTION

Energy issue has been one of the primary issues, along with an environment, food, and population[1][2]. Energy consumption has increased at a rapid rate, by means of extracting and combusting of fossil fuels. This situation causes environmental problems, particularly related to the global warming and climate change [3][4][5]. Studies indicated that the implementation of energy efficient technology would reduce the amount of energy used significantly, in particular in buildings[6].

Implementation of energy efficiency plan would reduce energy consumption. There have been few studies of identifying the measures for energy saving. However, it is obviously seen that the potential to implement energy saving measures exists [3]. Many Attempts to seize the energy efficiency opportunity, accelerating the deployment energy saving measures have been made through: supporting innovation of energy efficiency; connecting technologies and knowledge on energy efficiency to finance feasible returns; harnessing the information on the power improvement of energy use of, driving its disclosure and availability; and encouraging action [7].

Higher education institutions such as universities, play an important role in promoting and developing sustainability. A university has the responsibility to integrate sustainable development into all its operations [1]. The University of Surabaya is one of the prime universities in the eastern area of Indonesia. From previous research it was revealed that, along with the development of the campus, the need for electrical energy in this university continues to increase every year. On the other hand, the results also detect a number of opportunities for electricity savings [8]. The management of the university has a high concern for energy saving issues. This study discusses the energy measures and simulates the energy savings potentials in the University of Surabaya (Ubaya) campus. The objective of the study is to find the most feasible way of energy efficiency. It is expected that the results from this study would be useful and applicable for scaling up to a wider scope energy efficiency.

II. METHODS

For the first step, an analysis of the current conditions is performed. Based on the number of active students and campus area, it can be calculated that the occupancy density is 3 m^2/student. Campus operational in accordance with the provisions is 8 hours per day, 5 working days per week, and about 60 national holidays per year. These data are used as inputs on the EDGE software to calculate the current conditions as the baseline.

Software to run this simulation study is so called EDGE (Excellence in Design for Greater Efficiency), provided by IFC, group of World Bank and open for public use. An account needs to be created (at the website : https://app/edgebuildings.com) [9] prior to full access and utilization of the system. The software enables to assist stakeholders in designing a resource efficient building. Several applicable parameters are included and can be simulated based on local condition resulting in measurable and comparable resource utilization for buildings.

This software has three components representing the resource used in a building; those are energy, water and material components. The system is able to calculate the amount of resource used in a building, and by simulating several parameters, comparison of several options can be

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made. Thus, the utility saving can be described. Moreover, EDGE software also able to measure reduced carbon footprint following the utility saving pattern. However, in this study simulation study was conducted with a focus on energy measures for all building in the campus area. Detail information regards to the energy utilization has been collected and used to run the software. Some parameters (system/solution) in the program had been chosen based on the current condition in the University and simulated in order to find the most feasible option for energy efficiency scenario.

III. RESULTS AND DISCUSSIONS

The object of this simulation study is all buildings in the campus area of the University of Surabaya, which is located in Jalan Raya Tenggilis, Surabaya, East Java. With a total area of nearly 14 hectares, there are 29 permanent buildings for various functions such as classroom, laboratory, library, administration office, and cafeteria. All buildings are typically constructed from brick and plaster, but differ in number of storey. The abbreviations is used for building names, represent the name of each building; the first letter describes the name of faculty in which the building belongs to, for example, P for Psychology, E for Economic, and T for Engineering (Teknik in Bahasa Indonesia). Therefore TA refers to building A of Faculty of Engineering, FA refers to building A of Faculty of Pharmacy (Farmasi in Bahasa Indonesia) and so on. This abbreviation system is not applied for common purpose building (eg. International Village, Library, Canteen/Cafeteria). Typical building is as shown in Figure 1., meanwhile the number of storey in each building that is included in this study is provided in Table 1 [10].

TABLE 1. STOREY BUILDING AT UNIVERSITY OF SURABAYA

Storey Building	Buildings
Two-storey	EB, FA, TA, PA, International Village, Canteen
Three-storey	TB,ED
Four-storey	EA, EC, FB, FC, FD, FE,HA,HB,TC, TD, TE, TF,PB, PC, PD, PE
Six-storey	FF, FG, Library, TG

Electricity for all buildings is supplied by National Electricity company (PLN) and used mainly for lighting and cooling purposes. For lighting, all building use fluorescent (FL) type of lamp; as for cooling most of building use non-centralized cooling system – only library building uses centralized system. Electricity is turned on during working hours, 08.00 – 17.00, except for Library, which is operated 08.00 – 19.00 daily.

With the current campus condition applying 5 working days with a total of 40 working hours per week and the occupancy density is 3 m2/person, it appears that the largest energy absorption is used for air conditioning systems. This condition is used as a base case in this study. This base case is generated from the software by entering the basic parameters that correspond to the real conditions. Furthermore from the base case will be simulated changes that can be made according to EDGE measurement indicators to estimate energy efficiency.

The simulation results from EDGE software are shown in Table 2. It shows the codes, the referred measures, and energy savings gained when applying the corresponding measures. There are 2 measures that give an energy efficiency impact of more than 10%, i.e. EDE05 and EDE10. EDE05 requires a significant reshuffle on the roof of every building. Meanwhile EDE10 will affect the comfort of indoor activities. Therefore those two measures are not recommended.

FIG. 1. Typical Building of University of Surabaya

There are several measures that can be done without significant building renovation. Yet those changes still affect significantly to the energy efficiency if done simultaneously. Those are the use of reflective paint on the roof and walls (EDE02 and EDE03), the addition of external shading devices (EDE04), the use of energy-efficient bulbs in all campuses areas (EDE23 and EDE24), occupancy sensors in all indoor areas (EDE25, EDE26 and EDE27), and photoelectric sensors to harvest daylight (EDE28). EDE02 and EDE03 together will provide an energy saving impact of 6.6%. EDE04 contributes 3% energy savings. Use of energy-saving lamps will save energy by 2.9%. While the overall use of the sensor will save energy by 9.3%. The total energy savings that can be obtained by doing all those nine changes is 18.9%. This figure is very close to the standard set by EDGE of 20%. The comparison between the base case and improved case are shown in figure 2. The improved case is the one that applies all those nine measures which give 18.9% energy efficiency. In this case, it will save energy around 280 MWh/year. Since the current electricity demand is fully obtained from the state power company whose majority of the energy source is still from fossil fuel, this efficiency will also contribute to reducing CO_2 emissions. Assuming a reduction in emissions of 0.6 kg.CO_2/kWh, these improvements will give operational carbon savings about 769.78 tCO2/year.

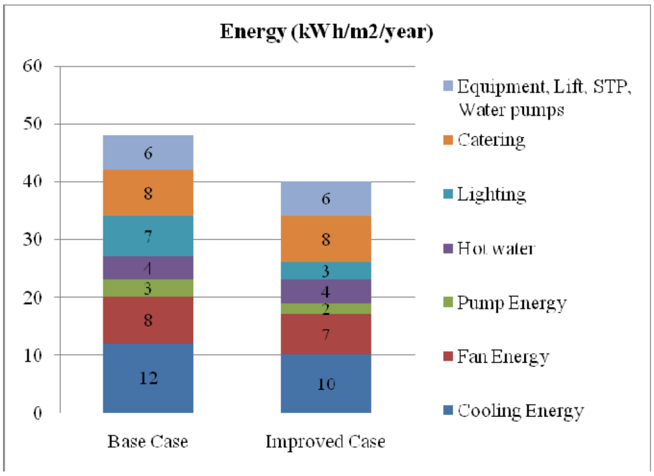

FIG. 2. Energy Saving Comparison between Based Case and Improved Case

TABLE 2. SIMULATION RESULT OF ALL ENERGY SAVING MEASURES

Code	Measure	Energy Saving (%)
EDE01	Reduced Window To Wall Ratio	3.1
EDE02	Reflective Paint/Tiles For Roof	6.1
EDE03	Reflective Paint For External Walls	0.5
EDE04	External Shading Devices	3
EDE05	Insulation Of Roof	13
EDE06	Insulation Of External Walls	1.7
EDE07	Low-E Coated Glass	1.7
EDE08	Natural Ventilation For Corridors	0.9
EDE09	Natural Ventilation For Classrooms	0
EDE10	Ceiling Fans In All Classrooms	15.8
EDE11	Variable Refrigerant Volume (Vrv) Cooling System	-7.9
EDE12	Air Conditioning With Air Cooled Chiller	-13.1
EDE13	Air Conditioning With Water Cooled Chiller	2.1
EDE14	Ground Source Heat Pump	-8.1
EDE15	Absorption Chiller Powered By Waste Heat	7.2
EDE16	Recovery Of Waste Heat From The Generator For Space Heating	0
EDE17	Variable Speed Drives On The Fans On Cooling Towers	0.8
EDE18	VARIABLE SPEED DRIVES IN Ahus	0
EDE19	Variable Speed Drive Pumps	-0.5
EDE20	Sensible Heat Recovery From Exhaust Air	7.4
EDE21	High Efficiency Condensing Boiler For Space Heating	0
EDE22	High Efficiency Boiler For Water Heating	0
EDE23	Energy Saving Light Bulbs For Internal Spaces	1.9
EDE24	Energy Saving Light Bulbs For External Areas	1
EDE25	Occupancy Sensors In Bathrooms	0.3
EDE26	Occupancy Sensors In Classrooms	5.4
EDE27	Occupancy Sensors In Corridors	0.2
EDE28	Photoelectric Sensors To Harvest Daylight	3.4
EDE29	Solar Hot Water Collectors	4.7
EDE30	Solar Photovoltaics	Depend on the annual electricity gained
EDE31	Other Renewable Energy For Electricity Generation	Depend on the annual electricity gained

IV. CONCLUSION

The simulation studies show that by applying the combination of nine measures of 31 measures of energy saving in the simulation would result in the total energy efficiency of 19 % for buildings of the University of Surabaya. The measures refer respectively to: the use of reflective paint on the roof and walls, the addition of external shading devices, the use of energy-efficient bulbs in all campuses areas, occupancy sensors in all indoor areas, and photoelectric sensors to harvest daylight. The implementation of the measures will give operational carbon savings 769.78 tCO2/year. However, energy efficiency for existing building could be attempted by many ways.

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