WELCOME TO

IEIT 2023

2023 3rd International Conference on Electrical and Information Technology

🕐 14th - 15th September 2023   📍 Politeknik Negeri Malang

✎ CALL FOR PAPER

About IEIT

The 3rd International Conference on Electrical and Information Technology (IEIT) is an annual, reputable event organized with a motivation to provide an excellent international platform for the academicians, researchers, engineers, industrial participants and research students around the world to share their research findings.

The 3rd IEIT will be performed **online using Zoom** platform on **September 14th – 15th, 2023**. This year, IEIT theme is **"Emerging Technologies Collaboration Between Industry and Academic Institutions for The Sustainability of Small and Medium Business Development"**. It addresses researchers and industries from all areas of advanced technology and science. It provides an international forum to present advances in the state of the art, identify emerging research topics, and together define the future of these exciting research domains. The conference will be enriched with renowned keynote speakers. The accepted papers and those registered by IEIT 2023 must be presented on the conference date. The presented papers that are in line with IEEE's scope and of high quality will be considered for submission for inclusion into IEEE Xplore.

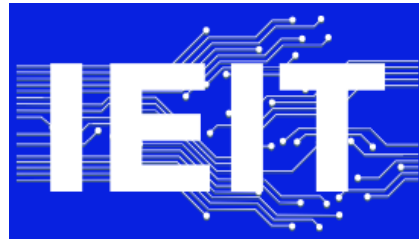## KEYNOTE SPEAKERS

Prof. Ming Shyan Wang

Ganett Isabel Jimenez Delgado, Ph.D

Prof. Dr. Ir. Bagus Wahyudi, M.T.

Book of Program

The 2nd International Conference on Electrical and Information Technology

(IEIT 2022)

15th -16th September 2022

PREFACE

Good morning, Ladies and Gentlemen, Dear Colleagues,

It gives me great pleasure to extend to you all a very warm welcome on behalf of Politeknik Negeri Malang and to say how grateful I am to all guests and presenters of the three conferences, namely:

1. The 4ᵗʰ Annual Technology, Applied Science and Engineering Conference (ATASEC 2022)
2. The 2ⁿᵈ International Conference on Electrical and Information Technology (IEIT 2022).
3. The 13ᵗʰ Joint National Seminar on Engineering / Seminar Nasional Gabungan Bidang Rekayasa (SNGBR) 2022.

I also would like to convey my special appreciation to all the committee member, reviewer, advisory board, keynote speakers, and whoever involves and makes this conferences held smoothly.

We are very grateful to be able to continue to hold this conference, despite of the limitations due to covid19 pandemic. Our plan was, to welcome all participants of conference to visit our beautiful city Malang. However, even though we cannot meet face to face we can still carry out this conference virtually with enthusiasm and joy.

The three conferences have their respective themes, namely:

1. The 4ʳᵈ ATASEC 2022 and 2ⁿᵈ IEIT 2022 has a theme "Science, Technology, Innovative Academic and Vocational Research Towards Product Development Through Industrial and Educational Cooperation".
2. As for the 13ᵗʰ SNGBR 2022 theme "IPTEK, Riset Akademik dan Vokasi yang Inovatif Menuju Pengembangan Produk Melalui Kerjasama Industri dan Pendidikan"

These theme will be a media for sharing knowledge from researchers and industry from all fields of advanced technology and science. The ATASEC and IEIT conferences will be attended by 3 distinguish keynote speakers, namely:

1. Richard Dwight, Ph.D., Associate Professor School of Mechanical, Materials & Mechatronics Engineering University of Wollongong, Australia.

2. Prof. Tsukasa Hirashima, Professor at Graduate School of Advanced Science and Engineering, Hiroshima University, Japan.

3. Ferdian Ronilaya, Ph.D, Associate Professor of State Polytechnic of Malang, Indonesia.

And the SNGBR conferences will be attended by 2 keynote speakers, namely:
1. Nugroho Wibisono, from PT Telkomsat Indonesia

2. Ratih Indri Hapsari ST., MT., PhD., from State Polytechnic of Malang, Indonesia

Please accept my high appreciation to all 5 keynote speakers for joining here with us today.

Ladies and Gentlemen,
Such a conference is an extraordinary opportunity, as a good time to share knowledge from a variety of affiliates and also a variety of concentrations in the scope of the field of Advanced Technology, Science and Vocational Engineering Education.
Thank you also to all experts, researchers, lecturers who come to share their knowledge today.

I assure you that we will have fruitful and rewarding exchanges today. I wish you all a very success with this important conference and I look forward to learning about the outcome.

So, let me now open these conferences officially by wishing you a delightful and vibrant day.

Bismillahirrahmannirrahiim.

Thank you.

Malang, 15th September 2022

Director of State Polytechnic of Malang

Supriatna Adhisuwignjo ST., MT.

About Conference

The 2nd International Conference on Electrical and Information Technology 2022 (IEIT 2022) was held online cause of Covid-19 Pandemic by using ZOOM platform on 15ᵗʰ -16ᵗʰ September 2022. IEIT 2022 theme is Science, Technology, Innovative Academic and Vocational Research Towards Product Development Through Industrial and Educational Cooperation. The conference will be enriched with renowned keynote speakers.

1. Prof. Tsukasa Hirashima
2. Richard Dwight, Ph.D.
3. Ferdian Ronilaya, Ph.D.

Aim and Scope

IEIT 2022 aims to provide a platform for academicians, researchers, students and practitioners to promote and to share ideas and knowledge and to create international networks for sustaining development of the science and technology in the future.

The scope of the conference will cover but not be limited to:

- Electronic And Embedded System
- Applied Mathematics, Computational Methods And Algorithm, Data And Signal Processing
- Communication And Networking
- Information Technology And Computer Science
- Big Data
- Machine Learning
- Artificial Intelligence, Automation And Control

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IEIT 2022 ONLINE CONFERENCE RULES AND ETIQUETTES

ORAL PRESENTATION

- Make sure that you have downloaded the Zoom application before the D-day
- Please prepare and join the conference or parallel session at least 10 minutes before it's started
- Please ensure your Zoom ID name is formatted **IEIT_(breakout room number)_name**
- We encourage every participant to activate their videos during the conference, so please ensure you wear a formal outfit and keep your good manners during the conference
- Please mute your microphone during conference or parallel sessions, you should only unmute the microphone during your presentation time
- Any questions should be submitted through chat box to the moderator (privately) at any time during the conference
- Considering the limited time of the QA session, only some chosen questions will be asked by moderator and answered by the presenter
- All the participants are required to fill up the online attendance form. The attendance taking will be done 2 times, first in the keynote speaker session and the second in the parallel session of the conference. The link will be provided during the conference through chat box
- The certificate will be given to the participant that attend the conference from beginning until the end, and filled up the both attendance sheets
- The participant that experience technical problem and need some assistance can contact the committee through email ieit@polinema.ac.id.

- Please note that the time allocated to each oral presentation is 10 minutes including questions and answers (10 minutes presentation and 5 minutes Q&A).
- The presentation file that has been prepared by author will be present by each author using their own device.

PUBLICATION

The papers accepted and registered by IEIT 2022 must be presented on the conference's date, and presented papers in line with IEEE's scope will be submitted to the IEEE Xplore digital library after the conference.

SCHEDULE

15th September 2022

Note: The time is in Waktu Indonesia Barat (WIB GMT+7)

Time		Agenda	Venue
07:30-08:00	30'	**Conference registration** Zoom room is created, participants join the room	Zoom Room 1 https://bit.ly/polinemaconf22
08:00-08:05		Director of Polinema, keynote speaker, moderator, and chairman of IEIT, ATASEC and SNGBR join the Zoom room	
08:05-08:30		The opening session is led by MC Sing National Anthem Indonesia Raya Playing Polinema Profile Video	
08:30-08:40		Welcoming speech and event opening by the director of State Polytechnic of Malang Supriatna Adisuwignjo, ST., MT.	
08:40-08:50		**Opening ceremony and greetings** IEIT, ATASEC and SNGBR 2022 short report by the chairman Dr. Eng. Rosa Andrie Asmara, S.T.,M.T. – Politeknik Negeri Malang, ID	
08:50-09:00		**Video of Malang City Introduction**	
		Keynote speaker session is led by Moderator Dr. Eng. Banni Satria Andoko	
09:00-09:30	30'	**Presentation by keynote speaker 1** Keynote speech by Richard Dwight, PhD	
09:30-10:00	30'	**Presentation by keynote speaker 2** Keynote speech by Prof. Tsukasa Hirashima	
10:00-11:00	30'	**Presentation by keynote speaker 3** Keynote speech by Dr. Ferdian Ronilaya	
	30'	Question and answer session (The QA session is held after all keynote speakers have delivered their speeches)	
11:00-12:00	60'	**Parallel presentation: Session 1-7** 10-15 presenter for each room	Format name IEIT_(breakout room number)_name Example: IEIT_1_Joko Tingkir
12:00-13:00		Break	
13.00-15.00	120'	**Parallel presentation: Session 1-7** 10-15 presenter for each room	Format name

			IEIT_(breakout room number)_name Example: IEIT_1_Joko Tingkir

PARALLEL SESSIONS

Breakout Room : 1
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Harmonic Fault Study and Analysis Procedures Using Portable Power Analyzer an Solutions Using Active Harmonic Filters	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Felix Ridwan Mas Noor (Indonesia)
2	Planning and Analysis of Medium Voltage Chamber as Protection of Mobile Stations	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Roy Hidayat Noor (Indonesia)
3	Integration of Fuzzy Logic Algorithms with Failure Mode and Effect Analysis for Decision Support Systems in Product Quality Improvement of Piano Cabinets	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Nazaruddin Nazaruddin, Muhammad Rizki, Muhammad Luthfi Hamzah, Muhammad Isnaini Hadiyul Umam and Sarbaini Sarbaini (Universitas Islam Negeri Sultan Syarif Kasim Riau, Indonesia)
4	Detection of Potato Leaf Disease Using Multi-Class Support Vector Machine Based on Texture, Color, and Shape Features	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Esti Suryani (University of Sebelas Maret, Indonesia); Muh. Syahabuddin Hylmi and Wiharto Wiharto (Universitas Sebelas Maret, Indonesia)
5	Investigation Learning Rate Parameter for Keypoint-Based UAV Object Detection	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Suryo Adhi Wibowo (Telkom University, Indonesia); Thomhert Suprapto Siadari (DDH Inc., Korea (South))
6	Performance Analysis of the Effect Euler Regression on Complex YOLOv4 Model for Autonomous Driving	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Suryo Adhi Wibowo (Telkom University, Indonesia)
7	Development of a Two-Factor Authentication System for Enhanced Security of Vehicles at a Car Park	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing	Ezilaan Irraivan and Swee King Phang (Taylor's University, Malaysia)
8	Catfish Seed Quality Determination Using Phase Only Correlation (POC) and Naive Bayes Methods	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing; Artificial Intelligence, Automation and Control	Ulla Delfana Rosiani and Oktaviano Andy Suryadi (Politeknik Negeri Malang, Indonesia); Mungki Astiningrum (State Polytechnic of Malang, Indonesia); Dwi Puspitasari (Politeknik Negeri Malang & Polinema, Indonesia); Falah Ahmad Sabila and Husnul Hotimah (Politeknik Negeri Malang, Indonesia)
9	Comparison of Image Extraction Model for Cocoa Disease Fruits Attack in Super Vector Machine Classification	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing; Artificial Intelligence, Automation and Control; Machine Learning	Basri Basri (Hasanuddin University, Indonesia & Universitas Al Asyariah Mandar, Indonesia); Indrabayu Indrabayu, Andani Achmad and Intan Sari Areni (Hasanuddin University, Indonesia)
10	Comparing User Rating-Based Similarity to User Behavior Based-Similarity in Movie Recommendation Systems	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing; Big Data; Machine Learning	Triyanna Widiyaningtyas (Universitas Negeri Malang, Indonesia); Teguh Bharata Adji and Indriana Hidayah (Universitas Gadjah Mada, Indonesia)
11	Implementation of Automatic Watering System and Monitoring of Nutrients for Grape Cultivation	Applied Mathematics, Computational Methods and Algorithm, Data and Signal Processing; Information Technology and Computer Science	Erlita P Wahyu, Ummi Rizki Stania, Reva Asih, Elsa Firmaniar, Alfina Novianti, Moechammad Sarosa and Mila Kusumawardani (State Polytechnic of Malang, Indonesia)

PARALLEL SESSIONS

Breakout Room : 2
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Design Monitoring Power System for Parallel Synchronization of Generators Set	Electronic and Embedded System	Aftariswan Aftariswan (Politeknik Negeri Malang, Indonesia); Ika Noer and Mohammad Hidayat (State Polytechnic of Malang, Indonesia)
2	AI-Enabled Conversational Agents in Service of Mild Cognitive Impairment Patients	Artificial Intelligence, Automation and Control; Communication and Networking; Machine Learning	Ioannis - Aris Kostis, Konstantinos Karamitsios and Konstantinos Kotrotsios (My Company Projects O. E., Greece); Magda Tsolaki (First Department of Neurology, Medical School, Aristotle University of Thessaloniki); Anthoula Tsolaki (Aristotle University of Thessaloniki, Greece)
3	ID Card Storage System Using Optical Character Recognition (OCR) on Android-Based Smartphone	Artificial Intelligence, Automation and Control; Information Technology and Computer Science; Machine Learning	Jeklin Harefa, Alexander Alexander, Andry Chowanda, Emir Haikal, Fedrick Fedrick and Stendy Wiranata (Bina Nusantara University, Indonesia)
4	Optimization of Binary Tournament and Reciprocal Exchange in the Genetic Algorithm for Flexible Teaching Problem	Artificial Intelligence, Automation and Control; Information Technology and Computer Science; Machine Learning	Irawan Dwi Wahyono (Universitas Negeri Malang, Indonesia)
5	Automatic Question Generation from Indonesian Texts Using Text-To-Text Transformers	Artificial Intelligence, Automation and Control; Machine Learning	Mukhlish Fuadi (Institute of Technology Sepuluh Nopember & Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia); Adhi Dharma Wibawa (Institut Teknologi Sepuluh Nopember, Indonesia)
6	The Naïve Bayes Algorithm for the Stride Length Classification	Artificial Intelligence, Automation and Control; Machine Learning	Ilham Ari Elbaith Zaeni and Wahyu Primadi (Universitas Negeri Malang, Indonesia); Dessy Rif'a Anzani (UIN Maulana Malik Ibrahim, Indonesia); Dyah Lestari and Anik Nur Handayani (Universitas Negeri Malang, Indonesia)
7	Vehicle Detection and Classification Using Deep Neural Networks	Artificial Intelligence, Automation and Control; Machine Learning	Shuva Chowdhury, Shithi Chowdhury and Jeba Tahsin Ifty (North South University, Bangladesh); Riasat Khan (North South University, Bangladesh & New Mexico State University, USA)
8	Crowd Counting During a Pandemic to Find Out Community Response to Activity Restriction Policy Using Deep Learning	Artificial Intelligence, Automation and Control; Machine Learning	Mustika Mentari, Wilda Imama Sabilla, Kadek Suarjuna Batubulan, Atmayanti Atmayanti, Aliza Rizqi Fitriana and Abdul Latif (Politeknik Negeri Malang, Indonesia)
9	Analysis and Design of Data Warehousing and Business Intelligence Guidelines Using DAMA-DMBOKv2	Big Data	Zahabia Zahabia, Tien Fabrianti Kusumasari and Rokhman Fauzi (Telkom University, Indonesia)
10	Real Time Sensor Monitoring Using Local Database Cache Method	Big Data; Information Technology and Computer Science	Mohammad Hidayat, Riyant Budi Setiawan and Ferdian Ronilaya (State Polytechnic of Malang, Indonesia)
11	Challenges and Opportunities of Mobile Cloud Computing	Big Data; Information Technology and Computer Science	Grace Kwagalakwe (Makerere University, Uganda); Samson Otieno Ooko (African Center of Excellence in Internet of Things & University of Rwanda, Rwanda); Rosemary Nalwanga (University of Rwanda, Rwanda)

PARALLEL SESSIONS

Breakout Room : 3
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Evaluation of Order Preserving Triclustering (OPTricluster) in 3 Dimensional Gene Expression Data Analysis Using Gene Ontology	Big Data; Machine Learning	Ghea Dwi Apriliana and Titin Siswantining (Universitas Indonesia, Indonesia); Setia Pramana (Politeknik Statistika STIS, Indonesia); Prasnurzaki Anki (Universitas Indonesia, Indonesia)
2	COVID-19 Pandemic Vis-à-Vis Zamboanga Peninsula Aviation: A Predictive Analysis	Big Data; Machine Learning	Urbano B Patayon (Jose Rizal Memorial State University, Philippines)
3	RSSI and Packet Loss Analysis of LoRa on the Ground Surface Application	Communication and Networking	Muladi Muladi (State University of Malang & Universitas Negeri Malang, Indonesia); Mokh Sholihul Hadi and Made Radikia Prasanta (Universitas Negeri Malang, Indonesia)
4	Internet of Things (IoT) Based Garbage Incinerator Monitoring System	Communication and Networking	Septriandi Wirayoga (Politeknik Negeri Malang, Indonesia)
5	Energy Consumption Comparison of Some WSN OOK Transmitters Through Minimum Energy Coding	Communication and Networking	Nukhet Sazak (Sakarya University, Turkey)
6	A Systematic Literature Review of Privacy, Security, and Challenges on Applying IoT to Create Smart Home	Communication and Networking; Electronic and Embedded System	Intan Saliya Utomo, Celine Pranoto, Daniel Daniel, Jurike Moniaga and Bakti Amirul Jabar (Bina Nusantara University, Indonesia)
7	Wireless Sensor Network for Energy Monitoring Based on Hybrid Power Plants AH Buildings	Communication and Networking; Electronic and Embedded System	Septriandi Wirayoga (Politeknik Negeri Malang, Indonesia)
8	NFC (near Field Communication)-Based Canteen Self Service Application in SMA Pomosda Nganjuk	Communication and Networking; Information Technology and Computer Science	Reva R Asih, Tania Sholikhah, Nabila Ulhaq, Annisa Permataning T Rachman, Mil'atuttoyyibah M, Moechammad Sarosa and Putri Mas'udia (State Polytechnic of Malang, Indonesia)
9	Custom Communication Channel to Handling Application Management Services: Using Salesforce	Communication and Networking; Information Technology and Computer Science	Kurniati Bunga Rindu, Muhardi Saputra and Warih Puspitasari (Telkom University, Indonesia)
10	A Development of Multi-Platform Based Forestry Wildfire Prevention System Using Incremental Model (Case Study: A Peatland Area in Siak Regency)	Communication and Networking; Information Technology and Computer Science	Diki Arisandi (Universitas Abdurrab & Multimedia University, Indonesia); Amir Syamsuadi and Liza Trisnawati (Universitas Abdurrab, Indonesia); Seri Hartati (Univeritas Abdurrab, Indonesia)
11	Integration of the Weather Station Monitoring System in the Wind Power Plant Prototype	Electronic and Embedded System	Mohammad Hidayat, Ferdian Ronilaya and Irwan Eryk (State Polytechnic of Malang, Indonesia)

PARALLEL SESSIONS

Breakout Room : 4
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Impact of Changes in the Number and Capacity of Wind Power Plant on Short Circuit Current Level in Distribution Network	Electronic and Embedded System	Langlang Gumilar (Universitas Negeri Malang, Indonesia)
2	Monitoring of Protection System for Overvoltage Faults in Distribution Networks	Electronic and Embedded System	Muhammad Nafis Hibatullah, Langlang Gumilar and Khalimatus Anisa Zain Anisa Zain (Universitas Negeri Malang, Indonesia)
3	Performance Optimization of Solar Powered Pump for Irrigation in Tanjung Raja, Indonesia	Electronic and Embedded System	Mustika Alam, Tresna Dewi and Rusdianasari Rusdianasari (Politeknik Negeri Sriwijaya, Indonesia)
4	Solar Energy as an Alternative Energy Source in Hydroponic Agriculture: A Pilot Study	Electronic and Embedded System	Elvis Novaldo, Tresna Dewi and Rusdianasari Rusdianasari (Politeknik Negeri Sriwijaya, Indonesia)
5	PV System Design, Economic Feasibility, and Environmental Impact as an Alternative Power Source for Hospital Application	Electronic and Embedded System	Andri Riyana, Tresna Dewi and Yohandri Bow (Politeknik Negeri Sriwijaya, Indonesia)
6	The Solar Panel Passive Cooling Using Circular Pipe Heatsink Filled with Water	Electronic and Embedded System	Arif Susilo (Politeknik Negeri Malang, Indonesia); Mohammad Hidayat (State Polytechnic of Malang, Indonesia); Ratna Ika Putri (Politeknik Negeri Malang, Indonesia)
7	Implementation of Automatic Transfer Switch on DC System	Electronic and Embedded System	Mohammad Hidayat and Wildan Surya Wijaya (State Polytechnic of Malang, Indonesia); Ratna Ika Putri (Politeknik Negeri Malang, Indonesia)
8	Modeling and Simulation of Smart Bidirectional DC Watt-Hour Meter for DC House	Electronic and Embedded System	Mohammad Hidayat, Muhammad Ikhwanul Khair and Ika Noer Syamsiana (State Polytechnic of Malang, Indonesia)
9	Hybrid Solar Heat Accumulator Control for Egg Hatcher Applying Power Hysteresis Method	Electronic and Embedded System	Budhy Setiawan, Eka Mandayatma, Widjanarko Widjanarko, Azis Isrofi and Virna Audiana (State Polytechnic of Malang, Indonesia)
10	Optimization of Output Power and Photovoltaic Efficiency with Adding Chromel Alumel Elements	Electronic and Embedded System	m. Irfan Isnaeni (Politeknik Negeri Sriwijaya & Home, Indonesia); Rd Kusmanto and Abu Hasan (Politeknik Negeri Sriwijaya, Indonesia)
11	Design and Build of the Mist Sprayer Powered by Solar Panels for Cultivating Oyster Mushrooms	Electronic and Embedded System	Muhammad Afnan Habibi, Widodo Laksono, A. Aripriharta, Quota Alief Sias and Langlang Gumilar (Universitas Negeri Malang, Indonesia); Adi Izhar Che Ani (Universiti Teknologi MARA, Malaysia)

PARALLEL SESSIONS

Breakout Room : 5
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Review of Perpetual Motion Machine Using Pendulum Force Method as DC Power Generation	Electronic and Embedded System	Mohammad Hidayat (State Polytechnic of Malang, Indonesia); Afif Nuril Musthofa (Politeknik Negeri Malang, Indonesia); Budhy Setiawan (State Polytechnic of Malang, Indonesia)
2	Motion Detection for Children with Cerebral Palsy Using K-Nearest Neighbor	Artificial Intelligence, Automation and Control; Big Data; Machine Learning	Anik Nur Handayani, Ilham Ari Elbaith Zaeni and DIka Laistulloh (Universitas Negeri Malang, Indonesia); Rosa Andrie Asmara (Politeknik Negeri Malang, Indonesia); Osamu Fukuda (Saga University, Japan)
3	An Effective Approach of Speed Estimation Using Position Detector on Six Step Inverter for Trapezoidal PMSM Drive	Electronic and Embedded System	Gigih Prabowo (Electronic Engineering Polytechnic Institute Of Surabaya, Indonesia); Indra Ferdiansyah (Politeknik Elektronika Negeri Surabaya, Indonesia); Era Purwanto (Electronic Engineering Polytechnic Institute Of Surabaya, Indonesia); Moh. Budiono (Electronic Engineering Polytechnic Institute of Surabaya, Indonesia)
4	Prevention of Battery Life Reduction Using Fuzzy Logic Controller-SEPIC Converter for Automatic Battery Charging	Electronic and Embedded System	Fifi Hesty (Politeknik Elektronika Negeri Surabaya, Indonesia)
5	Applying Demand Side Response Model on Mitigating Electrical Energy Cost for Residential Styrofoam Wall	Electronic and Embedded System	Marwan Marwan (Polytechnic State of Ujung Pandang Makassar, Indonesia); Andi Muhammad Subhan (Polytechnic State of Ujung Pandang, Indonesia); Muhammad Anshar (State Polytechnic of Ujung Pandang, Indonesia); Abdul Halim (The state Polytechnic of Samarinda, Indonesia); Jamal Jamal (Polytechnic State of Ujung Pandang, Indonesia)
6	Load Flow Analysis Due to Reconfiguration of AC to DC Electrical Distribution System on Trailing Suction Hopper Dredger (TSHD) Vessel	Electronic and Embedded System	Adi Kurniawan (Institut Teknologi Sepuluh Nopember, Indonesia)
7	Switching Time and Spurious Reduction Techniques Using PLL in Frequency Synthesizer	Electronic and Embedded System	Sindu Gr (BEL, India); Jayasheela C s (Bharat Electronics, India); Harikrishna M V (Bharat Electronics Ltd, India)
8	Cognitive Function Tools/Robot Design for Elderly Using Image-Processing	Electronic and Embedded System; Machine Learning	Anik Nur Handayani and Dyah Lestari (Universitas Negeri Malang, Indonesia); Muladi Muladi (State University of Malang & Universitas Negeri Malang, Indonesia); Rosa Andrie Asmara (Politeknik Negeri Malang, Indonesia); Osamu Fukuda (Saga University, Japan)
9	Usability Testing of MOOC Prototype Using SUS (System Usability Scale) Method	Information Technology and Computer Science	Asep Syaiful Hidayat, Paulus Insap Santosa and Indriana Hidayah (Universitas Gadjah Mada, Indonesia)
10	Jupyter Lab Platform-Based Interactive Learning	Information Technology and Computer Science	Noprianto Noprianto (Politeknik Negeri Malang, Indonesia); Vivi Nur Wijayaningrum (Politeknik Negeri Malang, Indonesia & Department of Information Technology, Indonesia); Vivin Ayu Lestari (Politeknik Negeri Malang, Indonesia)
11	Systematic Literature Review: Blockchain Security in NFT Ownership	Information Technology and Computer Science	Reyhan Mochram, Charles Makawowor, Kent Tanujaya, Jurike Moniaga and Bakti Amirul Jabar (Bina Nusantara University, Indonesia)

PARALLEL SESSIONS

Breakout Room : 6
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Implementing A Star Algorithm for Bicycle Route Finding System Using OSM and GraphHopper. Case Study: Batu, Indonesia	Information Technology and Computer Science	Rudy Ariyanto (State Polytechnic of Malang, Indonesia); Erfan Rohadi (Politeknik Negeri Malang, Indonesia); Annisa Puspa Kirana (State Polytechnic of Malang, Indonesia)
2	Block-Based Image Reversible Data Hiding Based on the Visual Feature and Edge Entropy	Information Technology and Computer Science	Lusia Rakhmawati, Hapsari Peni Agustin Tjahyaningtijas and Wiyli Yustanti (Universitas Negeri Surabaya)
3	Measurement of Engagement Rate on Instagram for Business Marketing (Case Study: MSME of Dowry in Jember)	Information Technology and Computer Science	Hermawan Arief Putranto, Taufiq Rizaldi, Hendra Yufit Riskiawan and Dwi Putro Sarwo Setyohadi (Politeknik Negeri Jember, Indonesia); Ery Setiyawan Jullev Atmadji (State Politechnic Of Jember, Indonesia)
4	An Implementation of Automatic Dart Code Verification for Mobile Application Programming Learning Assistance System Using Flutter	Information Technology and Computer Science	Yan Watequlis Syaifudin and Agus Salim Hadjrianto (State Polytechnic of Malang, Indonesia); Nobuo Funabiki (Okayama University, Japan); Dewi Yanti Liliana (State Polytechnic of Jakarta, Indonesia); Andi Baso Kaswar (State University of Makassar, Indonesia); Usman Nurhasan (State Polytechnic of Malang, Indonesia)
5	Preliminary Analysis of Result and Log Data on Viat-Map in English Reading Comprehension	Information Technology and Computer Science	Banni Satria Andoko, Atiqah Asri and Putra Prima Arhandi (State Polytechnic of Malang, Indonesia); Budi Harijanto (Politeknik Negeri Malang, Indonesia); Tsukasa Hirashima (Hiroshima University, Japan); Bening Sukmaningrum (State Polytechnic of Malang, Indonesia)
6	Development of Hotspots Ground Check Module in the Mobile Application for Prevention Patrol of Forest and Land Fires	Information Technology and Computer Science	Ali Naufal Ammarullah (IPB University, Indonesia); Imas Sukaesih Sitanggang (Bogor Agricultural University, Indonesia)
7	Criticism of the Risk Management Process in Scrum Methodology	Information Technology and Computer Science	Marzuki Pilliang, Munawar Munawar, Budi Tjahjono and Puteri Sejati (Esa Unggul University, Indonesia); Habibullah Akbar (Universitas Esa Unggul, Indonesia); Gerry Firmansyah (Esa Unggul University, Indonesia)
8	Usability Testing of Forest and Land Fire Prevention Patrol Information System in Sumatera	Information Technology and Computer Science	Yuda Baskara and Imas Sukaesih Sitanggang (Bogor Agricultural University, Indonesia); Hendra Rahmawan and Rina Trisminingsih (IPB University, Indonesia)
9	Systematic Literature Review: Machine Learning in Education to Predict Student Performance	Machine Learning	Sebastianus Radhya and Muhammad Anka Syahfiera Tasik (BINUS University, Indonesia); Farhan Muhammad Sabran (Binus University, Indonesia); Alexander Agung Santoso Gunawan (Bina Nusantara University & University of Indonesia, Indonesia); Anderies Anderies (BINUS University, Indonesia)
10	The Improvement of Personal Service in the MSMEs Marketplace Using a Rank-Based Collaborative Filtering Approach	Machine Learning	Sri Lestari and Yulmaini Yulmaini (Institut Informatika dan Bisnis Darmajaya, Indonesia); Aswin Aswin (IIB Darmajaya, Indonesia); Sulyono Sulyono, Ruki Fikri and Yan Aditiya Pratama (Institut Informatika dan Bisnis Darmajaya, Indonesia)
11	Classification of Infectious Diseases in Chickens Based on Feces Images Using Deep Learning	Machine Learning	Moch. Kholil, Heri Waspada and Rafika Akhsani (Akademi Komunitas Negeri Putra Sang Fajar Blitar, Indonesia)

PARALLEL SESSIONS

Breakout Room : 7
Date/Time : Thursday, 15th September 2022

No	Title	Paper topics	Authors with affiliation and country
1	Prediction of Student Academic Performance in Practicum Courses Based on Activity Logs and Student Background	Machine Learning	Vivi Nur Wijayaningrum (Politeknik Negeri Malang, Indonesia & Department of Information Technology, Indonesia); Ika Kusumaning Putri (Politeknik Negeri Malang, Indonesia); Annisa Puspa Kirana (State Polytechnic of Malang, Indonesia); Titis Octary Satrio (Politeknik Negeri Malang, Indonesia)
2	Emotion Detection in Text Using Convolutional Neural Network	Machine Learning	Denis Eka Cahyani (Universitas Negeri Malang, Indonesia); Aji P Wibawa (Indonesia & Universitas Negeri Malang, Indonesia); Didik Dwi Prasetya, Langlang Gumilar, Fadhilah Akhbar and Egi Rehani Triyulinar (Universitas Negeri Malang, Indonesia)
3	Black Flight Identification Using Radar Cross Section (RCS), Speed, and Altitude from RADAR Data Using Supervised Machine Learning	Machine Learning	Arwin Datumaya Wahyudi Sumari (State Polytechnic of Malang & Indonesian Air Force, Indonesia); Rosa Andrie Asmara (Politeknik Negeri Malang, Indonesia); Helda Risman (Indonesia Defense University, Indonesia); Ika Noer (State Polytechnic of Malang, Indonesia); Anik Nur Handayani (Universitas Negeri Malang, Indonesia); Kohei Arai (Saga University, Japan)
4	LRFM Model Analysis for Customer Segmentation Using K-Means Clustering	Machine Learning	Muhammad Rasyid Kafif Ibrahim and Raras Tyasnurita (Institut Teknologi Sepuluh Nopember, Indonesia)
5	Gum Rosin Price Forecasting Using A Hybrid ARIMA - LSTM Model	Machine Learning	Muhammad Naufal Rasyad and Raras Tyasnurita (Institut Teknologi Sepuluh Nopember, Indonesia)
6	Graph Attention Network on Extracting Feature from Simplified Molecular-Input Line-Entry System for HIV Classification	Machine Learning	Gregory Hugo, Vincentius Loanka Sinaga, Ignatius Michael Dinata, Felix Indra Kurniadi and Maria Anggreainy (Bina Nusantara University, Indonesia)
7	Human Gender Detection from Facial Image Using Global and Local Feature	Machine Learning	Lusiana D Ningrum and Bima Sena Bayu Dewantara (Politeknik Elektronika Negeri Surabaya, Indonesia); Dewi Mutiara Sari (Electronic Engineering Polytechnic Institute of Surabaya, Indonesia)
8	Comparison of EEG-Based Biometrics System Using Naive Bayes, Neural Network, and Support Vector Machine		Andrew Prasetyo (Institut Teknologi Sepuluh Nopember & ITS, Indonesia); Adhi Dharma Wibawa, Bima Satria Yudha Mohammad, Fasha Amellia Nuraini and Mohammad Azis Khoirul Fata (Institut Teknologi Sepuluh Nopember, Indonesia); Yuri Pamungkas (ITS Surabaya, Indonesia)
9	A Bayesian Game of Multisource Energy Harvesting for Batteryless IoT Devices		Matteo Caligiuri, Daniele Galizio, Federico Lincetto and Elvina Gindullina (University of Padova, Italy); Leonardo Badia (Università degli Studi di Padova, Italy)
10	System for Determining the Rate of Roasting on Coffee Beans Using Fuzzy Logic		Septriandi Wirayoga (Politeknik Negeri Malang, Indonesia)

PV System Design, Economic Feasibility, and Environmental Impact as an Alternative Power Source for Hospital Application

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Abstract—**Renewable energy is currently promoted to substitute the ever-diminishing fossil fuel. Indonesia has a high potential for solar energy, which can be implemented in every sector of everyday life, including building-integrated PV systems such as hospital applications. This paper presents the design, economic feasibility, and environmental impact of a PV system applied as the alternative power source for a hospital in Palembang, Indonesia. The economic feasibility and environmental impact are given by simulation using System Advisory Model (SAM) and SimaPro for LCA analysis. The power produced by the PV system in the study shows that the implementation of the PV system as the alternative source to supply ventilators and monitors in ICU rooms is profitable considering how expensive and short life-time of the UPS used previously as the source.**

Keywords— *Building Integrated PV System, On-Grid PV System, LCA, Solar Energy*

I. Introduction

Renewable energy use has been promoted on a large scale worldwide, including in Indonesia. Given the diminishing supply of fossil fuel reserves, renewable energy is vital, and solar energy is the most promising alternative or substitutes for conventional energy in areas with tropical climates such as Palembang [1]-[3].

In Indonesia, the dependence on fossil energy sources to meet domestic energy needs remains high at 96%, with oil consumption at 48%, gas consumption at 18%, and coal consumption at 30%. However, this fossil energy source is rapidly depleting. To meet national energy demand, Indonesia will eventually have to abandon fossil fuels in favor of new energy sources. In response to the government-issued Government Regulation No. 79 of 2014 concerning the National Energy Policy. According to this regulation, the government intends renewable energy sources to meet 23% national energy needs by 2025 [4][5].

According to Presidential Regulation No 22 of 2017, concerning the General National Energy Plan, solar power development for electricity is projected at 6.5 GW in 2025 and 45 GW in 2050, or 22% of the solar potential of 207.9 GW [2]. Furthermore, there is a Regulation of the Minister of Energy and Mineral Resources No 49 of 2018 concerning Roof-top mounted PV systems, which encourages the application of roof-mounted PV systems. Solar Power Plants projections are optimistic, given the investment trend, and the price of electricity from global PV systems is becoming cheaper over time, thanks to technological advances.

Palembang has a high potential for solar energy, and this potential has been investigated by scientists such as Dewi et al. in 2018, Harahap et al. in 2019, and Sasmanto et al. in 2020 [7]-[16]. The educational institution and state-own enterprises have been developing the application of solar energy for substituting conventional energy such as Hanafiah et al. in 2018, Hamdi et al. in 2019, and Nurjanah et al. in 2021. [17]-[22] Hence, participation from all levels of society is required to ensure the government's objective is met. Educational and medical institutions can play an active role in developing and implementing PV systems as alternative energy sources and pilot projects to develop the technology and improve the output yields and efficiency [23]-[28].

PV system implementation gives room for many applications, such as for solar charging robots investigated by Tito et al. and Septiarini et al. in 2021 [29]-[31]. Other implementation includes solar panels for irrigation and wearing systems [32][33]. The building-integrated PV system is another alternative to increase the implementation of solar energy without sacrificing the arid land, such as a power source for a hospital [34]-[36]. Given the high cost of backup batteries during Palembang's frequent blackouts, using a PV system as a source of electricity in a hospital would be beneficial; thus, this is a topic worth researching.

This paper presents the design, economic feasibility, and environmental impact of a PV system as the alternative power source for a hospital in Palembang, Indonesia. The economic feasibility and environmental impact are given by simulation using System Advisory Model (SAM) and SimaPro for LCA analysis.

II. Methods

This paper presents the possibility of implementing an on-grid photovoltaic system in a hospital environment. The system is installed as the backup power for the ICU unit in RSI Siti Khadijah Palembang, Indonesia.

Material
A. Simulation Software
The assessment for this research is conducted by using the simulation program SAM (System Advisor Model) by

NREL to show the design, materials choice, system design, and economic analysis of the system. The System Advisor Model (SAM) is a free techno-economic software model that assists people in the renewable energy industry in making decisions for Managers of projects and engineers, Policy experts, Creators of cutting-edge technology, and Researchers. The interface of SAM is presented in Fig. 1, where the first step is setting up the Palembang location by its latitude and altitude.

Fig. 1. SAM interface and Palembang altitude and longitude location

The environmental impact of the On-Grid PV system installed on the roof-top of RSI Siti Khadijah will be analyzed using life cycle assessment (LCA). The analysis is made possible using SimaPro, whose interface is shown in Fig. 2. SimaPro is a powerful solution for those seeking to effect long-term change. The sustainability software, which is based on solid science and life cycle thinking, is ideal for product designers, decision-makers, and sustainability experts. Its fact-based LCA approach provides the insights needed to make better decisions, empower better choices, and reduce the environmental footprints of products and services.
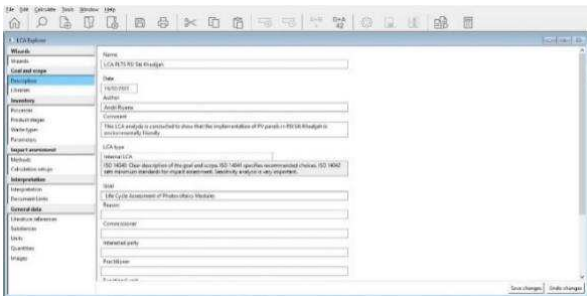
Fig. 2. LCA interface of PV system design installed on the roof-top of RSI Siti Khadijah

B. PV Panel Material

The PV panels implemented in this study are monocrystalline with the specification technics shown in Fig. 3.

Fig. 3. Specification technics of PV panels installed in this study

Methods

A. Simulation Methods

The methods conducted in this study to show the PV System Design, Economic Feasibility, and Environmental Impact as an Alternative Power Source for Hospital Application in Palembang, Indonesia is by generating the simulation in SAM and environment impact of PV system using SimaPro.

The PV system design and the possibility of its development in SAM are conducted by setting with the PV panels specification and installation, inverter use, and PV panels materials, as shown in Fig.s 4-6. The first step in simulating the possibility of PV system application in hospitals is setting the location of RSI Siti Khadijah in Palembang, which is latitude -2.9908620143202236 and longitude 104.73128454003884, as shown in Fig. 1.

The PV panel configuration setting is based on specs in Fig. 3, and the resulted fill factor is given in Fig. 4. The following configuration is inverter selection, including specs and number of inverters, and panels' tilt angle determination based on Palembang's latitude and longitude. The environmental impact investigation is conducted in SimaPro by listing of materials implemented in this study, as shown in Fig. 5.
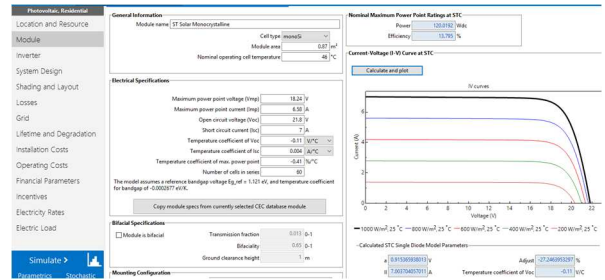

Fig. 4. PV panel selection based on PV panels installed on the roof-top of RSI Siti Khadijah
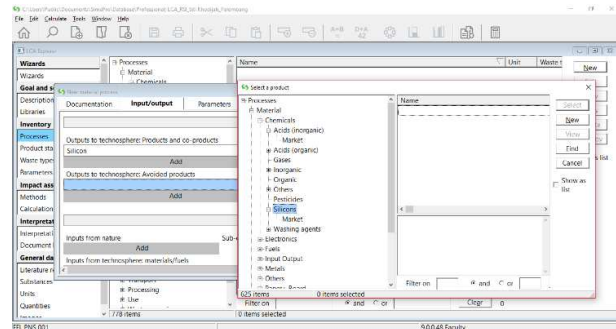

Fig. 5. SimaPro for environmental impact analysis.
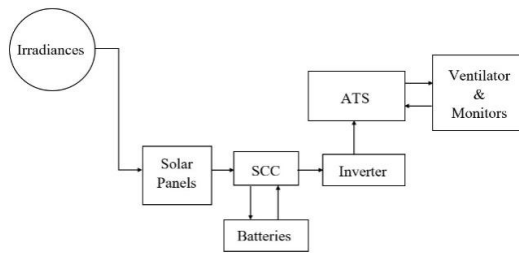
B. PV Panels' Sizing

Fig. 6. PV system diagram blok

The PV panels' sizing is started by calculating the load that needs to be powered, shown as a diagram block in Fig 6.

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The loads are ventilators and monitors for ICU rooms; details are given in Table I.

Table I shows data on daily electrical power usage, and it shows that the total daily use of electricity is 3,330 Watt. It should be noted, however, that the electrical energy generated by PLTS is not entirely usable because up to 20% of the electrical energy is lost during the transmission from the solar panels to the load (electronic devices). As a result, 20% of the total power used must be added. So, mathematically, it is as follows [38]:

TABLE I. LOADS CONSIDERED IN THIS STUDY

No	Load	Qty	Power	Hour	Total Power
1	Ventilator	2	450	2	1.800
2	Monitor	10	30	5	1.500
Total Watt		**1.200**			**3.300**

The total daily energy Watt-hours (E), the average sun hour per day Tmin, and the DC-voltage of the system (V_{DC}) are determined before sizing the array, and the losses should be included to avoid undersizing. Losses are determined by dividing the total power demand in Wh.day^{-1} by the product of efficiencies of all components in the system to get the required energy Er as below:

$$E_r = \frac{\text{Daily Average Energy Consumption}}{\text{Efficiency}} \quad (1)$$

The peak power obtained by the system is given by

$$P_p = \frac{\text{Daily Energy Consumption}}{\text{Minimum Peak Sun} - \text{Hours per Day}} \quad (2)$$

The number of modules needed based on Eq. (1) is

$$N_p = \frac{\text{Total DC Current}}{\text{Rated Current of One Module}} \quad (3)$$

$$N_s = \frac{\text{Total DC Voltage}}{\text{Rated Current of One Module}} \quad (4)$$

$$N_m = N_s \times N_P \quad (5)$$

III. RESULT AND DISCUSSION

This study discusses the feasibility and advantage of installing a PV system on the roof-top of RSI Siti Khadijah Palembang, South Sumatra, as shown in Fig 7, the google map position.

Fig. 7. RSI Siti Khadijah position in Palembang

Sizing PV System

A. PV Panel Sizing

Knowing the Watt peak (Wp) is necessary to determine the number of solar panels required. Watt Peak is the amount or maximum power generated by the PV panel (P_H). The optimal power generated from the PV panels during the day in Indonesia is about 4 to 5 hours, from 09.00 AM to 01.00 PM. The total Watt Peak is calculated by

$$P_H = \frac{P_T}{T_{opt}} = \frac{4125}{4} = 1.031 \text{ Wp} \quad (6)$$

Hence, the total panels required is

$$N_M = \frac{P_H}{\text{Panel Capacity}} = \frac{1.031}{100} = 10.31 \text{ pcs} \quad (7)$$

However, to accommodate the possibility of load addition in the ICU room, the installed panels are increased to 15 panels.

B. Battery Sizing

During the day, the battery is used directly and is also charged by solar panels, allowing it to use electrical energy without relying on the utility's electricity network at night. However, the battery's electrical energy is not entirely usable due to the potential for energy loss at the time of the inverter can be as high as 5%; therefore, a 5% reserve must be added, and the required battery capacity (B_C) can be calculated as below.

$$B_C = \frac{P_H}{100\% - 5\%} = \frac{4.125}{95\%} = 4.342 \text{ W} \quad (8)$$

The battery's electric power reference is 4,342 Watt, and the battery specification (B_S) used in this study is 12 V 100 Ah; therefore, the number of batteries (N_B) required is

$$N_B = \frac{B_C}{B_S} = \frac{4342}{12 \times 100} = 3.6 \text{W} \quad (9)$$

C. Inverter Sizing

The inverter is a device that converts direct current (DC) to alternating current (AC). According to Table I, the total power is 1200 W; therefore, the inverter used in this study should be more than 1,200 watts. The inverter installed in this study is 1,500 watts.

D. Solar Charge Controller Sizing

The specifications on the back of the solar panel can be used to determine the SCC (Solar Charge Controller). Hence, based on I_{SC} listed in Fig. 3, the SCC required in this study is

$$SCC = I_{SC} \times N_m = 6 \times 15 \text{ panels} = 90 \text{ A} \quad (10)$$

where the panels installed in this study are 15 panels.

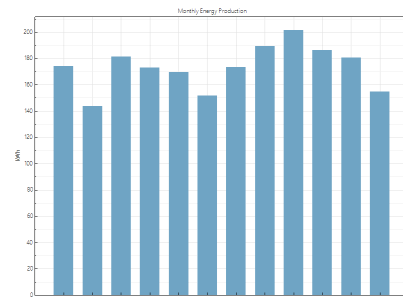E. PV System Output in SAM

Fig. 8. The projection of monthly production of the On-Grip PV system installed in RSI Siti Khadijah

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Fig 8 shows the monthly projection of the On-Grid PV system installed on the roof-top of RSI Siti Khadijah. It shows electricity produced by 15 PV panels of 100 Wp each year.

F. PV System Results

Fig 9 shows the PV system installed on the RSI Siti Khadijah Palembang roof-top, where Table II shows the total cost of the installation.

TABLE II. THE TOTAL COST OF INSTALLING PV SYSTEM

No	Items	Qty	Total Cost
1	Solar Panel 100Wp	15	Rp. 22.500.000
2	Battery 100 Ah	4	Rp. 10.000.000
3	Inverter 1500W	1	Rp. 4.000.000
4	SCC 100A	1	Rp. 750.000
5	Combiner Box	1	Rp. 3.500.000
6	Battery Box	1	Rp. 2.000.000
7	Cable	2	Rp. 700.000
8	Connector MC4	10	Rp. 400.000
9	BOS	1	Rp. 4.000.000
10	Protection Installation	5	Rp. 1.500.000
11	Installation Cost	1	Rp. 5.000.000
	Total Cost		RP. 55.350.000

Fig. 9. The projection of monthly production of the On-Grip PV system installed in RSI Siti Khadijah

The total cost of installing a PV system for an alternative power supply of 2 ventilators and 5 monitors for the ICU room in RSI Siti Khadijah, as shown in Fig 10, is Rp. 55.350.000,-. This cost is much cheaper than the price of UPS which is Rp.18.430.000- for one UPS and the ICU room needs 2 UPS.

Fig. 10. Ventilator and monitors as the load for PV system considered in this study

Fig 11 shows the irradiance taken for 7 days as the sample of how much Palembang owns the potential in terms of Solar Energy. Fig 12 shows the power produced daily in 7 days relative to irradiance in Fig 11.
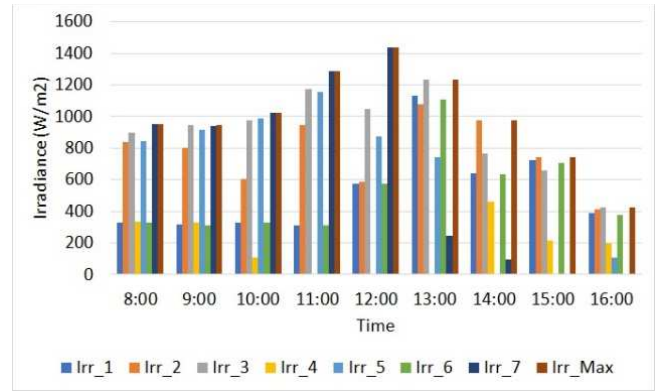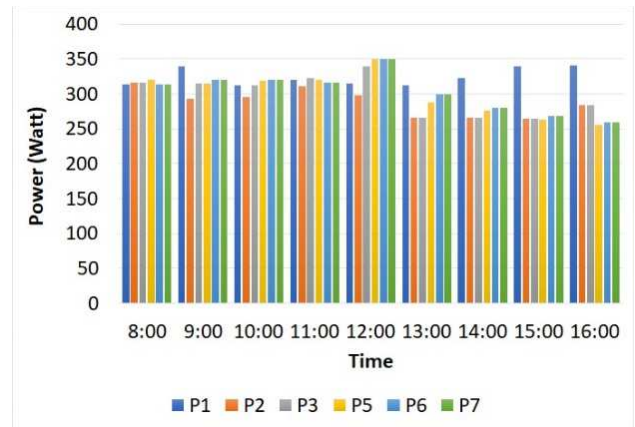

Fig. 11. Irradiance in 7 days.

Fig. 12. The power produced in 7 days.

G. Environmental Impact of PV Panels Installation

The environmental impact of PV system installation on RSI Siti Khadijah Palembang's roof-top is investigated using SimaPro. Fig. 15 shows the significant impact of PV panels during the fabrication and installation, including transport. While, during the application, PV panels give minimum impact since no CO_2 emission is released.

The environmental impact will be released after 20-25 years when the PV panels stop functioning and need to be dismantled. Aside from PV panels, batteries can be dangerous to the environment due to their chemical composition. However, solar energy is one of the safest renewable energies to be implemented since it creates no pollution in terms of CO_2 emission and noise. Hence, the PV system is the perfect solution for Palembang, blessed with all year-long sunlight and high irradiance, as shown in Fig. 13.
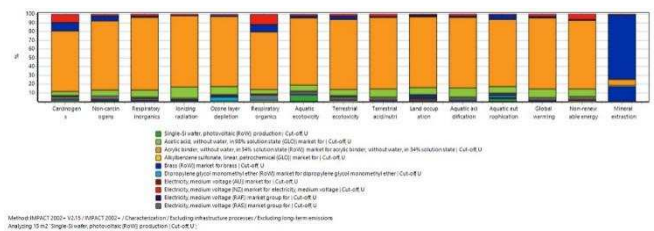

Fig. 13. SAM interface and Palembang altitude and longitude location

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IV. Conclusion

This paper presents the design, economic feasibility, and environmental impact of a PV system applied as the alternative power source for a hospital in Palembang, Indonesia. The economic feasibility and environmental impact are given by simulation using System Advisory Model (SAM) and SimaPro for LCA analysis. The power produced by the PV system in this study shows that the implementation of the PV system as the alternative source to supply ventilators and monitors in ICU rooms is profitable considering how expensive and short lifetime the UPS used previously as the source.

Acknowledgment

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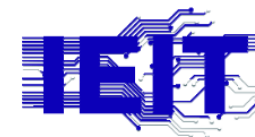
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