PROCEEDING

ICONETSI

International Conference on Engineering and Information Technology for Sustainable Industry **2022**

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MESSAGE FROM RECTOR

The Covid-19 pandemic has substantially posed challenges to the world of a magnitude that we did not specifically anticipate before. On the other hand, it has also opened up new possibilities for technology and innovation in our daily lives and workplaces. In the post-pandemic period that we are experiencing at present, technology and innovation play even bigger roles to improve effectiveness and sufficiency for sustainability on our planet with a particular emphasis on human wellbeing. Despite the size of the task and the current unpredictable path of the world, the transformation to a sustainable future is not impossible because we have the knowledge, tools, and capacity.

Therefore, bringing forward the theme "Fostering Innovation and Technology for the Sustainability of the Post-Pandemic Society", our International Conference on Innovation, Entrepreneurship, and Technology (ICONIET) this year serve as a forum where academics, researchers, industry practitioners, and government officials discuss the significance of innovation, research, and technology in presenting potential solutions for establishing a sustainable future for people and the environment.

For the last seven years, Swiss German University has been regularly conducting the ICONIET as a token of contribution to quality research and education. This year, the ICONIET consists of two sub-conferences, namely "International Conference on Engineering and Information Technology for Sustainable Industry 2022 (ICONETSI)" on 21-22 September 2022 and "International Conference on Biomedical and Pharmaceutical Sciences and Technology (ICOBIPST) on 1 and 2 October 2022.

I'd like to take this opportunity to welcome all honourable speakers, presenters, and participants from Indonesia and other countries. I wish to express my gratitude to the Minister of Communication & Information of the Republic of Indonesia, Mr. Johny G Plate for his tremendous support in this conference. I'd like to further thank the Ministry of Research and Technology as well as the National Research & Innovation Agency (BRIN) for their continuous support of our research. Our deep appreciation also goes to the University of Brawijaya Faculty of Medicine, the co-host of the first ICOBIPST at this conference. Last but surely not the least, I'd like to thank the Committee of ICONIET 2022, including the committee of ICONETSI and ICOBIPST 2022, who have put their utmost efforts into organizing these events.

I wish all participants to experience insightful and productive times in this conference. I hope this event will give invaluable new ideas and potential solutions for establishing a sustainable future in these challenging times. We look forward to seeing all of you at the ICONIET 2022.

Respectfully yours,

Dr. rer. nat. Filiana Santoso
Rector of Swiss German University

MESSAGE FROM CONFERENCE CHAIR

On behalf of the organizing committee, it is my pleasure and privilege to welcome you to the 2nd International Conference on Engineering and Information Technology for Sustainable Industry (ICONETSI 2022).

Under the theme of "Innovation and Technology for Resilient and Sustainable Industry", the conference offers a platform for scholars, engineers, scientists, practitioners, and students from universities and industries around the world to perform knowledge exchanges about research and development activities.

This conference features a rich program, including a keynote speech delivered by honourable Minister of Communication and Informatics Republic of Indonesia - Mr. Johnny G. Plate, and also keynote speech from Dr. R. Herdian – Deputy for Utilization of Research and Innovation BRIN. In the plenary session, the speeches will be delivered by Dr. Nuki Agya Utama - Executive Director at ASEAN Center for Energy and Assoc. Prof. Dr. Waseem Haider from Central Michigan University, while in the parallel session, we are delighted to have Prof. Dr. Dominik Aufderheide from Fachhochschule Südwestfalen, Germany, Prof. Dr.-Ing. Matthias Schirmer from Ernst-Abbe-Hochschule Jena, Germany, Prof. Dr. Wahyudi Sutopo from Lithium Battery Research and Technology Centre, Universitas Sebelas Maret, Surakarta, Indonesia, Dr. Selvakumar Ramachandran from Kerckhoffs Ltd, United Kingdom, and Kholis Abdurachim Audah, Ph.D from Swiss German University; Indonesia

All accepted and presented papers in this conference will have the opportunities to be published in ACM International Conference Proceeding Series and indexed by Scopus. The conference has received 92 submitted papers from Japan, France, Taiwan, Peru, Saudi Arabia, and Indonesia whereby 68 papers have been accepted by the committee for presentation and to be included in the proceedings. Each submission is evaluated by at least three reviewers in a blind review procedure to guarantee the high quality of the articles. Additionally, we thoroughly review each submission's writing style in accordance with the conference proceedings template and the similarity rating to prevent plagiarism.

I would like to express my highest gratitude to every one of the organizing committee members, the reviewers, the moderators, the session chairs, the collaboration partners, the volunteers, and the sponsors for their amazing efforts in making this conference successful.

Thank you for being here with us. We value your presence at this conference. Enjoy the conference!

Warm Regards,
Dr. Eng. Aditya Tirta Pratama
ICONETSI 2022 General Chair

Keynote Speaker

Development and Characterization of Thin Film Metallic Glasses for Biomedical Applications

Assoc. Prof. Dr. Waseem Haider
Central Michigan University, USA

Abstract:

Novel thin film metallic glasses are synthesized for advanced biomedical applications using magnetron co-sputtering. The formation and properties of metallic glasses are optimized via compositional variations using power densities of sputtering gun. These films are subsequently characterized for surface, electrochemical and mechanical properties. The structural characterizations are done using Glancing-angle X-Ray Diffraction, Transmission Electron Microscopy and X-Ray Photoelectron Spectroscopy. Moreover, the electrochemical characterizations are carried out using Potentiodynamic polarization and Impedance spectroscopy. This research offers a new way of synthesizing metallic glasses for advanced applications.

Short Biography:

Dr. Waseem Haider is a tenured associate professor at School of Engineering and Technology, Central Michigan University, USA. He earned his PhD in Mechanical Engineering from Florida International University in 2010. He got a post-doctoral fellowship in materials science and engineering at Pennsylvania State University. Afterwards, he joined orthopedic research labs as a research scientist at State University of New York. Soon after that, he joined University of Texas as tenure track assistant professor where he served for three years. Dr. Haider's research focuses on Materials Science and Biomedical Engineering with special emphasis on Biomedical Materials Surface Chemistry, Electrochemistry, Bulk Metallic Glasses, and Nanomaterials. His research is supported by National Science Foundation and Department of Defense.

Keynote Speaker

Strategic Energy Transition for ASEAN

Dr. Nuki Agya Utama
Executive Director of the ASEAN Centre for Energy (ACE)

Abstract:

The ASEAN economic growth has been one of the fastest in the world, which needs to be fueled by energy. The 6th ASEAN Energy Outlook (AEO6) projected that the primary energy supply in 2040 will be 2.1 times higher than the 2017 level. Still dominated by fossil fuels, ASEAN will become a net importer of gas starting in 2025 and coal starting in 2035—assuming no significant exploration. With the volatility of fossil fuel markets, energy security needs to be addressed in the region's energy transition.

The region, through the ASEAN Plan of Action for Energy Cooperation (APAEC), put energy security as one of its four pillars, along with accessibility, affordability, and sustainability. Within that are the regional energy targets, achieving 23% of RE share in TPES, 35% of RE in installed power capacity, and 32% energy intensity reduction by 2025. Nevertheless, a just energy transition would require ASEAN to secure its energy supply by optimizing the energy mix from the indigenous primary energy sources. The importance of geopolitics, diversification of energy sources, and improvement of capacity and technology are seen to be key strategies.

Short Biography:

Dr. Nuki Agya Utama is appointed as the Executive Director of the ASEAN Centre for Energy (ACE) and reporting directly to an International organisation under ASEAN entities and reporting to Governing Council consist of ministries energy in ASEAN member states. He is currently an advisory board member of Asia Pacific Energy Research Centre (APERC) and World Economic Forum (WEF) Global Future Councils.

Dr. Nuki Agya Utama has academics and research background as Post-Doctorate in Graduate School Energy Science Kyoto University for energy scenario planning in South East Asia. Holding PhD, with research on Life Cycle Energy Analysis from Joint Graduate School of Energy and Environment, the University of Technology King Mongkut (KMUTT), Thailand.

Prior to assuming his position in ACE, he worked as a director various local companies and as a consultant in a well-known international Institutions. In his early career, he worked as a consultant in UNDP and UNEP, working on energy and environment-related issues. He also serves as an invited lecture in Diponegoro University as well as editor and reviewer in a various international journal.

Invited Speaker

The Indonesian Natural Products Library: an Indonesian Natural Products Database for Drug Discovery

Kholis Abdurachim Audah, PhD.
Director of Academic Research and Community Service
Swiss German University

Abstract:

Indonesia is one of megabiodiverse countries in the world which has abundant natural resources both on land and marine. Natural resources have been utilized as the resources for traditional medicines that have been practices for generations. The term natural product refers to natural resource, mainly biota, that has medicinal benefits. Various researches on natural products have been vigorously conducted in Indonesia, especially since 2015 when the Indonesian government launched a National Research Plan (2015-2044). In this plan, research on natural products had become country's top research priority. Despite this positive atmosphere for natural products researches, researches conducted are still scattered and lack of coordination, communication or collaboration among researchers and or institutions. One of the problems to this condition is due to the absence of a common database platform for scientist to display their works. The platform can be used as the source of information so that people can follow and learn about different research that have been conducted, on what areas and the stage of the researches.

The Indonesian Natural Products Library (INPL) is developed to solve this problem to ensure that all researches utilizing Indonesian biodiversity, particularly in the area of drug discovery or pharmaceuticals, are more effectively done. As the source of information, INPL will enable the synchronizing and synergizing Indonesia's natural products-based research so that unnecessary activities such as overlapping and discontinuation of researches can be avoided. In addition, INPL will also be useful for finding alternatives for other areas such as food and energy sources.

Short Biography:

Dr. Audah earned his PhD in Biochemistry from Auburn University, USA (2007). He did his Postdoctoral Research at Yale University School of Medicine, Section of Infectious Diseases (2009). Dr. Kholis Audah earned his Bachelor Degree in Chemistry/

Biochemistry from Bogor Agricultural University, Indonesia (1996) and a Master Degree in Molecular Biology from University of Malaya, Malaysia (2000). Currently, he serves as the Director of Research and Community Services and Senior Lecturer at Department

of Biomedical Engineering, Swiss German University (SGU), Tangerang (2015-present). Before joining SGU, he held different positions at different institutions in Indonesia, Saudi Arabia and USA.

His current researches focus on Drug Discovery on antibacterial and anticancer from Indonesian natural products as well as synthetic compounds and Telemedicine. His project in Development of Mangrove Extract Library for Drug Discovery and Development of Microscope Scanner for Telepathology were funded by the Ministry of Research and Higher Education, Republic of Indonesia. He also obtained international and industrial funding as well as Awards from various institutions. He is the inventor of the Indonesian Natural Products Library (INPL) and the Citizen Medicine (CitMed) databases.

Dr. Audah is actively involved in different scientific organizations and scientific activities as Editor in Chief, Editorial Board Members and Reviewer in several national and international journals. Before joining SGU, Dr Audah was the Head of Biochemistry Departments and Laboratory and Assistant Professor at the College of Medicine, University of Hail, Hail, Saudi Arabia. He was also the Lead Scientist (Research and Laboratory) for the establishment of the Indonesia Medical Education and Research Institute (IMERI), Faculty of Medicine, University of Indonesia. He earned some professional certifications such as Good Clinical Practice from the Indonesian Association for the Study of Medicinal, Certified Reviewer from Kemenristekdikti and ISO 17024 and Certified Biosafety Level 2 and Radioisotope handling, Yale University.

Invited Speaker

Therapeutic Potential of Organic Fermented Soybean Extract Against Lead (Pb)-Induced Zebrafish Via NMR Metabolomics Approach

Assoc. Prof. Dr. Intan Safinar Ismail
Dean of Faculty of Science, University of Putra Malaysia

Abstract:

Lead (Pb), even in small quantity, is harmful to multiple body systems. Dimercaptosuccinic acid (DMSA), one of the chelators that used to treat Pb toxicity also gives various negative side effects. Tempeh, one of the fermented soybeans is known having high antioxidant effect which might potentially be useful in alleviation of Pb toxicity. Organic foods are sold with a higher price than the non-organics as the organics are claimed to be better in terms of health benefits. However, the difference in the phytochemical content between organic and non-organic soybeans that related to their quali-ties is not well explored. Thus, this study assessed the therapeutic potential of organic fermented soybean extracts (FSE) against Pb toxicity using a zebrafish model. Non-targeted NMR metabolomics was used to study the difference in the chemical profiles between non-organic and organic soy-beans (Glycine max [L.] Merr.), and the metabolite changes after fermentation using Rhizopus oligosporus. The Pb and FSE concentrations were preliminary investigated before proceeding further with the therapeutic study of FSE against Pb toxicity in zebrafish model. All zebrafish samples were evaluated using NMR metabolomics with additional support behavioral test and transmission electron microscope (TEM) analysis. Zebrafish that exposed to 50 mg/L FSE significantly changed four metabolites namely glucose, isoleucine, sn-glycero-3-phosphocholine, and glutamine. Preliminarily study of Pb inducement significantly altered the behavior of zebrafish and non-lethal 5 mg/L Pb concentration which altered the metabolite profiles of zebrafish are selected for further investigation. In the therapeutic study, citrulline was significantly upregulated only in Pb-induced group without any treatment.

FSE-treated (50mg/L) Pb-induced zebrafish might potentially retrieve the effect of Pb toxicity by significantly upregulated four key differential metabolites (glutamine, glutamate, glutathione, and taurine). Even though the treatment groups (FSE and DMSA) did not normalize to control, yet they differ from Pb-induced group without any treatment. These results presumed that FSE has potential to ameliorate the Pb poisoning effect in this fish model.

Short Biography:

Associate Professor Dr. Intan Safinar Ismail completed her PhD and post-doctoral studies at Okayama University and Hoshi Medical University, Japan. She joined Universiti Putra Malaysia (UPM) in 2005 and became the Head of Laboratory of Natural Products at the Institute of Bioscience in 2011 until 2017. She is now the Head of Chemistry Department, Faculty of Science. Within the period of her affliation to the Universiti Putra Malaysia, she has published more than 190 papers in reputed journals and presentations at conferences as speakers including keynote and invited at international meetings. She led 14 research projects and leading 2 at the moment and more than 5 as a co-worker. Seven Ph.D. and 13 MSc students have graduated under her supervision, with 3 Ph.D. and 1 MSc students are currently enrolling. She co-supervised more than 50 postgraduates. She is editor for a few journals including Journal of Natural Medicines (Springer), review editor for Marine Biotechnology (Frontiers) and Specialty Section of Natural Products (Frontiers).

Invited Speaker

Current Challenges of the Energy Market - Between Net Zero Scenario and Security of Energy Supply

Prof. Dr.-Ing Matthias Schirmer
EAH Jena, Germany

Abstract:

With the adoption of the climate targets, the European energy market is facing a fundamental transformation. Fossil energy sources must be replaced by low-emission, renewable types of energy production. In the field of electricity generation, some successes have been achieved in the last decade. The share of renewable energies in electricity generation in the EU-27 was 22% last year. Greenhouse gas emissions have been reduced by 32% since 1990. These successes should not obscure the challenges that lie ahead, especially in the heat supply and mobility sectors. The war in Ukraine has further aggravated this situation. In addition to the goal of reducing emissions, the main concern now is to secure the energy supply. This raises the question of how to reduce dependence on Russian oil and gas supplies. Furthermore, how can we deal with energy prices, which have risen drastically in some cases? In the following, the current situation of the European energy market will be analyzed, and possible solutions discussed.

Short Biography:

Prof. Dr.-Ing. Matthias Schirmer is Professor for Energy and Environment (W2) at the Faculty of Industrial Engineering at the University of Applied Science Jena, Germany. He is currently a Vice- Dean of the Faculty Industrial Engineering and Director of the post graduate study program “Environmental and Geo resource Management”. Prof. Dr.-Ing. Matthias Schirmer has academics and research background as PhD thesis (Dr.-Ing.) Dresden University of Technology, with research on Waste characterization and energy generation by waste and biomass, and also Energy systems modelling and simulation. He has experienced in various teaching, research and project stays in Portugal, Greece, Peru, Chile, Ecuador, Indonesia, Vietnam, Thailand, India, Namibia and South Africa.

Invited Speaker:

Emerging Technologies for ALL

Dr. Selvakumar Ramachandran
Kerckhoffs Ltd, UK

Abstract:

In human history 'technological' revolutions brought in a greater level of playing field for society. It has not just created opportunities and created wealth, but it strengthened the connectivity, human bonding even stronger. Given the advancement in telecommunications, particularly 5G combined with VR/AR, innovators and researchers believe that it can bring a greater level of inclusion and accessibility in several domains. We, at Kerckhoffs Ltd, creating Eyemmersive - an inclusive VR-based tourism platform for all, connecting VR-content creators to the people who want to have alternative platform to have parallel tourism and a tool to plan before they travel. Dr Ramachandran will speak about VR in accessible tourism and how it can support inclusion in other domains

Short Biography:

Dr Selvakumar Ramachandran is the CEO of UK based software R & D company Kerckhoffs Ltd. Dr Ramachandran is one of the pioneers in the field of emerging technologies and a flag bearer promoting technology for all. Dr Ramachandran earned his PhD from University of Rome – Tor Vergata, Italy and he received his MSc degree from Blekinge Tekniska Hogskola, Sweden. Dr Ramachandran has for 20+ years of experience in the field of computer science, published several papers and was a recipient of Google Scholar award in the year 2012.

Invited Speaker:

Intelligent Systems and Strategies for a Sustainable Cement Manufacturing

Prof. Dr.-Ing. Dominik Aufderheide
Fachhochschule Südwestfalen, Germany

Abstract:

Approximately 4-8% of the total global emissions of carbon dioxide (CO2) are caused by the usage of concrete. Here, especially the process of cement manufacturing is very energy intensive and the usage of large amounts of fossil fuels is typically involved within the main clinkering process. Therefore, the usage of Alternative Fuel Resources (AFR) has become a main technique towards a greener cement production. Due to the volatile combustion characteristics of those bulk materials, the process control has become a challenge for plant operators. This talk provides an overview of recent methodologies for the optimization of cement plants in order to reduce the associated environmental impact. In this context, especially intelligent system architectures and model-based optimization techniques are introduced and discussed. Furthermore, the incorporation of sensors and vison-based approaches for a model-based process optimization are evaluated.

Short Biography:

Prof. Dr. Dominik Aufderheide is a full professor for industrially metrology at the Faculty of Electrical Engineering at the South Westphalia University of Applied Sciences. His research interests are intelligent sensor systems, computer vision, model-based design and optimisation techniques and energy optimization. Before he returned to academia in 2020, he worked for several years as the head of automation and research at the Di Matteo Group in Beckum, Germany, where he led several development and research projects related to the process optimization in energy-intensive industries, such as cement and steel production or in electrical power plants. He graduated in 2014 from the University of Bolton, U.K. as a Ph.D. with a dissertation about the self-acting 3D scene reconstruction based on a novel sensor-fusion approach. At the same university, he received his Master's degree in Electronic Systems and Engineering Management with Distinction in 2009. Before that he studied Electrical Engineering and Industrial Informatics at the South Westphalia University of Applied Sciences in Soest, Germany.

Invited Speaker 4:

Accelerating A Commercialization of The Innovation Technology Using Early Supply Chain and Standardization:

A Case Study of Energy Storage Technology

Prof. Dr. Ir. Wahyudi Sutopo, ST., M.Si, IPM.
Universitas Sebelas Maret

Abstract:

In most cases, many technology products resulting from research happened to fail to be launched to the market due to the valley of death. This obstacle usually occurs in the transition process between technology development and technology commercialization. Hence, critical action is needed to accelerate the technology commercialization to ensure the commercialization potency of research output does not fall into the valley of death. The innovation of the Electric Motorcycle Swap Battery (EMSB) technology encourages the formation of a new ecosystem at the early of the supply chain, including technopreneurs and startups from manufacturers, suppliers, and distributors for commercialization. Swappable Batteries (SB), Electric Motorcycle (EM), and Battery Swap/Charging Station (BSCS) are key components of EMSB that have attracted the attention of supply chain players and government to find a thriving solution to enable faster adoption and diffusion of EMSB in Indonesia. Previously, the Center of Excellence for Electrical Energy Storage Technology, Universitas Sebelas Maret (or CoE-EEST UNS) has developed SB, EM, and BSCS prototypes with limited systems to operate the EMSB. However, to transfer technological innovations and/or facilitate operations of the EMSB on a large scale, there are various challenges and problems with products, processes, innovations, and businesses that are required to be solved. There are five interventions/models that were proposed by CoE-EEST UNS, namely circular business for EMSB, innovation diffusion and adoption, technology readiness and economic benefits prediction, location-allocation for smart charging, and Internet of Things based decision support system for distributing EMSB, and the technical requirements for interoperable of EMSB. The interventions/models are seen as alternatives to accelerate the downstream of EMSB technology innovation, and then maximize the economic benefits of a green economy in Indonesia

Short Biography:

Wahyudi Sutopo is a professor in industrial engineering and Head of Industrial Engineering and Techno-Economics Research Group, Department of Industrial Engineering, Universitas Sebelas Maret (UNS), Surakarta, Indonesia. He is also as researcher for center of excellence for electrical energy storage technology (CoE-EEST), the president of the industrial engineering and operations management (IEOM) society for Indonesia's professional chapter, and Director, IEOM Asia Pacific Operation. His

educational background is the profession of engineer from UNS (2018); Doctor and Bachelor in industrial engineering from Institut Teknologi Bandung (2011 & 1999); and master of management science from Universitas Indonesia (2004). His research interests include supply chain engineering, engineering economy & cost analysis, and technology innovation & commercialization.

Dr Sutopo has completed research projects with more than 45 grants and carried out research projects funded by Institution of Research and Community Services - UNS, Ministry of Research and Technology / National Agency for Research and Technology, Indonesia Endowment Fund for Educational (LPDP), PT Pertamina (Persero), PT Toyota Motor Manufacturing Indonesia, and various other companies. He has written 4 text books and 7-chapter books and made 5 intellectual property rights (IPR) in the form of copyrights, and 3 patents. He has initiated to commercialize research outputs of UCE-EEST UNS related to energy storage technology and electric vehicle conversion through start-ups where he is one of the founders, namely PT Batex Energi Mandiri and PT. Ekoelektrik Konversi Mandiri. Dr Sutopo has published articles over 185 documents indexed by scopus with H-index 13. His email address is wahyudisutopo@staff.uns.ac.id.

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The 1st International Conference on Engineering and Information Technology for Sustainable Industry.

(ICONETSI 2020)

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RESEARCH-ARTICLE

Wind Speed Measurements and Comparisons in Cakung Jakarta

Authors: Dena Hendriana, Mochamad Hamdan Aziz, Galih Akup Subekti, Umar Said, Gembong Baskoro, Henry Nasution Authors Info & Claims

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ABSTRACT

Standard procedure to find the highest wind speed in an office area is defined, exercised and verified. Different tools are used in the procedure to find and measure wind speed at different locations starting from already available wind speed data at the Global Wind Atlas, then verified with a handheld anemometer and with a weather station. Wind data collections using handheld anemometer and

We found that the wind speed average from the Global Wind Atlas at 10-meter elevation, 1.43 m/s, higher than any measurements done at 2-meter elevation in several spots using handheld anemometer and weather station, 0.5 - 1.4 m/s. The measurement results using handheld anemometer is consistent with using weather station. The highest wind speed at 2-meter elevation occurs at a site located between two large buildings which create tunneling effect and amplify the wind speed. This site has higher wind speed even compared to the site 2-meter on the roof of buildings due to obstacles from walls and other structures on the roof.

Wind speed measurements using weather station was also done at higher elevation with the support of air balloon. The height of the air balloon is around 10 – 15 meter above the ground. We found that the wind speed average at this level is 1.6 m/s, which is slightly higher than the data from the Global Wind Atlas due to slightly higher elevation and maybe due to air acceleration around the balloon which has 1.5-meter diameter.

Although the wind speed average is consistent for all three sources: Global Wind Atlas, handheld anemometer, weather station, but the daily wind speed hourly index is not consistent. Wind speed data from the Global Wind Atlas shows that the peak of wind speed occurs in the morning time, while the data from handheld anemometer and weather station shows that the peak of wind speed occurs in the afternoon time. More investigations will be done to explain this inconsistency in the future work.

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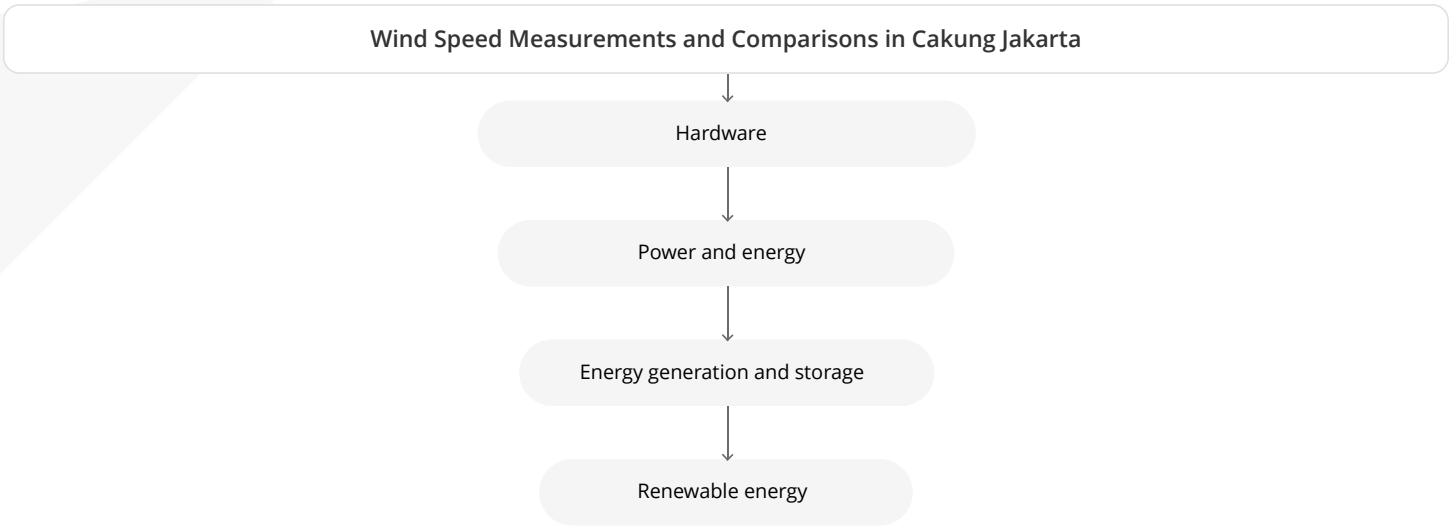
Index Terms



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Wind Speed Measurements and Comparisons in Cakung Jakarta

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ABSTRACT

Standard procedure to find the highest wind speed in an office area is defined, exercised and verified. Different tools are used in the procedure to find and measure wind speed at different locations starting from already available wind speed data at the Global Wind Atlas, then verified with a handheld anemometer and with a weather station. Wind data collections using handheld anemometer and weather station were done at 2-meter elevation and compared with the lowest elevation data available in the Global Wind Atlas at 10-meter height.

This procedure is applied in West Cakung Office area which is in an industrial complex in East of Jakarta. This project can contribute to other companies in the industrial complex to develop wind energy projects.

We found that the wind speed average from the Global Wind Atlas at 10-meter elevation, 1.43 m/s, higher than any measurements done at 2-meter elevation in several spots using handheld anemometer and weather station, 0.5 - 1.4 m/s. The measurement results using handheld anemometer is consistent with using weather station. The highest wind speed at 2-meter elevation occurs at a site located between two large buildings which create tunneling effect and amplify the wind speed. This site has higher wind speed even compared to the site 2-meter on the roof of buildings due to obstacles from walls and other structures on the roof.

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CCS CONCEPTS

• **Hardware**; • **Power and energy**; • **Energy generation and storage**; • **Renewable energy**;

KEYWORDS

wind speed, measurement, comparison, cakung, Global Wind Atlas, anemometer, weather station

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1 INTRODUCTION

Electrical energy can be regarded as the primary need of every human being in every sector starting from the industrial sector, transportation, households, power plants, public facilities, and so on. World Energy Outlook [1] shows that global demand for electrical energy is growing by 2.1% per year until 2040. This increase is expected to be very strong in developing countries, one of which is Indonesia. Based on data published by Perusahaan Listrik Negara (PLN) in 2021 [2], the main source of electrical energy in Indonesia is dominated by coal-fired steam power plants (PLTU) as much as 62.59% of the total electrical energy produced. Considering that coal is a non-renewable energy, it is necessary to prepare for the transition to renewable energy.

The Ministry of Energy and Mineral Resources (ESDM) has noted that the achievement of the New Renewable Energy (NRE) mix in 2021 has only been realized at 11.5% [3]. The Government of Indonesia has targeted the NRE mix of 23% in 2025 and 31% in 2050. As a form of the government of Indonesia's seriousness in developing NRE, the government formed a regulation in "Peraturan Pemerintah Nomor 79 tentang Kebijakan Energi Nasional pada Pasal 22 Ayat 1" states that the government and local governments provide fiscal and non-fiscal incentives to encourage diversification

of energy sources and the development of renewable energy. All support for NRE development is based on the achievement of the Sustainable Development Goals (SDGs), especially point number seven on clean and sustainable energy. Therefore, this is a challenge for the government of Indonesia to encourage the development of each NRE that is effective and efficient with supporting factors in Indonesia so it can achieve the specified target.

Wind turbines or Wind Power Plants (PLTB) are one of the implementations of NRE to produce electrical energy with the principle of changing the kinetic energy of the wind then mechanical energy and finally into electrical energy through the rotation of the generator. The advantages possessed by PLTB include relatively low operational costs and do not require large areas of land such as Solar Power Plants (PLTS). Until 2021, only 131 MW of PLTB have been installed, or 0.2% of the energy mix in Indonesia [4]. Meanwhile, the target capacity in 2025 is 255 MW or 7.7% of the energy mix in Indonesia. This is because Indonesia is located on the equator where the wind speed often turns and is not constant. Therefore, Indonesia has not worked optimally on the development of PLTB as a massive producer of electrical energy. The development of PLTB in Indonesia is still challenging and different design of Vertical Axis Wind Turbine for the application in Indonesia has been studied in Refs. [5, 6].

An accurate survey of wind energy potential locations throughout Indonesia is very necessary as the first step in identification, selection of the appropriate type of turbine, and selection of PLTB installation locations. It can provide information about wind characteristics in various regions such as average, maximum, and minimum wind speed. Measurement of wind speed has been done, namely tracing the value of wind speed in the building area in Bandar Lampung and the average yield obtained is around 1.56 m/s [7]. Similarly, study of available wind speed in the south coastal area of Gorontalo Regency has been done in [8] and the highest average wind speed was around 4.2 m/s. Wind farm design for Oelbubuk in East Nusa Tenggara has been studied in [9] and they found yearly average wind speed of 7.3 m/s at 50-meter elevation. Measurements of wind speed in different locations were also done in Refs. [10][11][12][13][14][15].

In this EBT research projects, we are tracking wind characteristics data in Cakung office area to find out the most optimum locations. This aims to obtain the best method for wind speed data collection, especially about the characteristics of the wind source as one of the main factors determines before installing a wind turbine as an electricity generator. Several methods will be considered and compared, such as Wind Speed data collection from the Global Wind Atlas website, wind speed measurement using a handheld anemometer, wind speed measurement using a weather station, and higher altitude measurement supported by air balloon.

2 RESEARCH METHODOLOGY

2.1 Global Wind Atlas

The easiest data collection of wind speed is from the Global Wind Atlas website [16]. This website can provide maps of wind speed distribution in almost everywhere on the Earth. In example, Global Wind Atlas can show wind speed distribution in the Java island at the elevation of 10 meters above the ground as shown in Fig. 1.

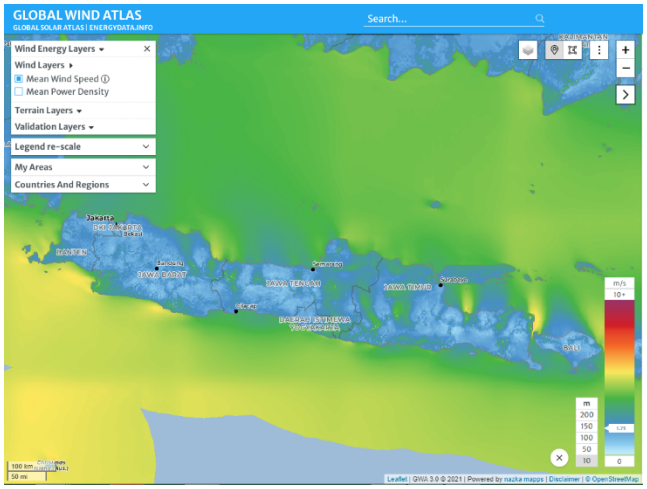

Figure 1: Wind Speed Distribution at The Elevation Of 10-Meter Above the Ground in Java Island from The Global Wind Atlas

Figure 2: Simple Handheld Anemometer.

Notice that the wind speed in most of the java area is quite low, around 1.5 m/s with some local areas with higher wind speed.

Wind data at different elevation are available in the Global Wind Atlas, at 10, 50, 100, 150 and 200 meter above the ground. This is suitable for different wind turbine tower heights. The lowest elevation is 10 meter which is higher than most obstacles on the ground, such as houses, fences and trees.

2.2 Handheld Anemometer

To support the initial data, wind speed data was collected in a conventional way, namely using a handheld anemometer at several locations. Data retrieval is carried out with different time variations during working hours, from 8:00 to 16:00 o'clock with a span of one hour. The handheld anemometer used in this project is shown in Fig. 2. This tool can measure not only wind speed, but also air temperature. To measure the wind speed properly, the blades need to be directed along with the wind direction. To do that, simply by rotating around the tool until the highest wind speed measurement is found.

Figure 3: Weather Station Consists of Outdoor Sensors and Indoor Monitor. Outdoor Sensors Are Supported By 2-Meter Pole with Cemented Bucket.

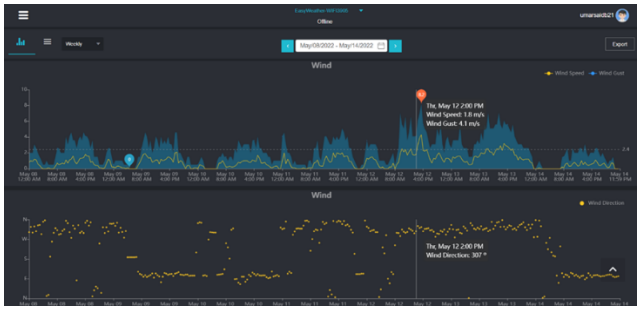

Figure 4: Display from ecowitt.net Website to Show Wind Data from The Weather Station.

2.3 Weather Station

Wind speed data retrieval is also done using a weather station at several locations in the Cakung office area at the elevation of 2-meter from the ground. Real-time data will be visible on a monitor with integrated Wi-Fi and can be monitored on the website and application as well. Wind speed data retrieval is carried out for approximately one week at each location. The monitor must be connected to electrical power and also connected to Wi-Fi continuously for data sending everytime to be recorded on the website and application. The maximum distance between the monitor and the weather station is 100 meters. The weather station configuration is shown in Fig. 3

Data will be monitored through the website at ecowitt.net and available to be downloaded in the form of an Excel document. The front page displayed on the website is in the form of a graphic as shown in Fig. 4. Not only the wind speed recorded at the weather station but also wind gust. A wind gust is a sudden, brief increase in the speed of the wind followed by a lull, usually less than 20 seconds. However, wind gust is not a parameter that is used as a wind energy indicator but for a construction consideration parameter of a wind turbine.

Wind speed data collection is carried out for one to two weeks whose overall data is averaged based on the hour and day. The weather station outdoor sensors are mounted on 2-meter pole that

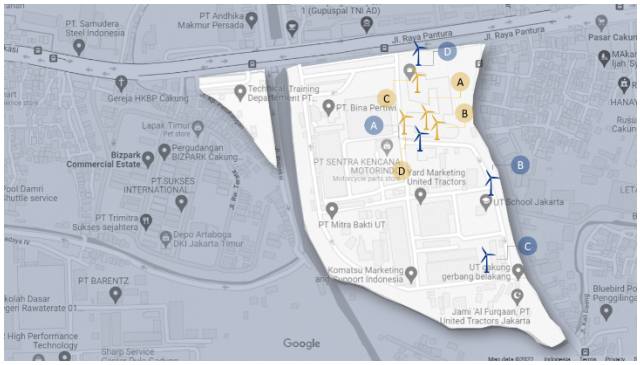

Figure 5: Eight Locations of The Weather Station in Cakung Office Area for Wind Speed Measurements.

Figure 6: Air Balloon With 3 Anchoring Ropes for Position Stability. Weather Station Outdoor Sensors Are Hung to The Air Balloon.

is given a dry cement in container with a mass of approximately 70 kg so the support is sturdy and does not fall easily but still moveable. There are 8 locations of weather station to retrieve wind data around the Cakung office area as shown in Fig. 5

2.4 Air Balloon

It is necessary to retrieve wind speed data at a higher altitude to avoid obstacles such as buildings and trees. Wind speed data retrieval for this elevation is carried out using air balloon for a week in the altitude about 10 to 15 meters in the Cakung office area as shown in Fig. 6. The air balloon has 1.5-meter diameter and it is made of PVC material. The PVC air balloon is durable in the air and quite thick, 0.17 mm so the gas inside the air balloon does not come out easily. The gas used is hydrogen because it has good lifting power, and also commonly used for outdoors. Although hydrogen is flammable, but as long as there is no contact with fire, it should be safe.

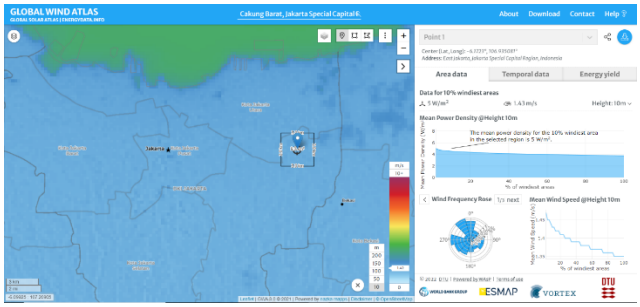

Figure 7: Wind Speed Distribution at The Elevation Of 10-Meter Above the Ground in West Cakung Area.

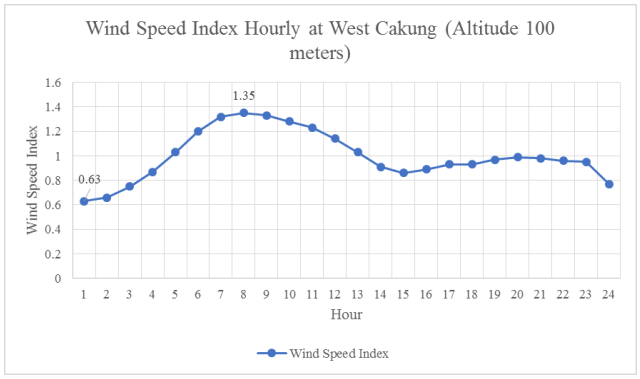

Figure 8: Wind Speed Index as A Function of Time at The Elevation Of 100-Meter Above the Ground in West Cakung Area.

3 RESULT AND ANALYSIS

3.1 Global Wind Atlas

Wind speed data in the Cakung office area, which is part of West Cakung region at 10-meter elevation from the Global Wind Atlas is shown in Fig. 7. The average wind speed was recorded at around 1.43 m/s.

The wind speed will not always be the same at each hour. According to the Global Wind Atlas, the West Cakung area recorded the highest wind speed index at 8:00 o'clock with a value of 1.35 and the lowest wind speed index at 1:00 o'clock with a value of 0.63 as shown in Fig. 8. This index is a relative value to the wind speed average. Based on this graph, relatively higher wind speed would occur in the morning time, regular wind speed from afternoon time till just before the mid-night and low wind speed from mid-night until dawn.

The Global Wind Atlas also provides information on wind speed monthly variation for the whole year. This information is usually related to the seasons in the area. Wind Speed Index Monthly is shown in Fig. 9. Based on the graph, from the month of April until November, wind speed is less than average. Peak of wind speed occurs in the month of December and January.

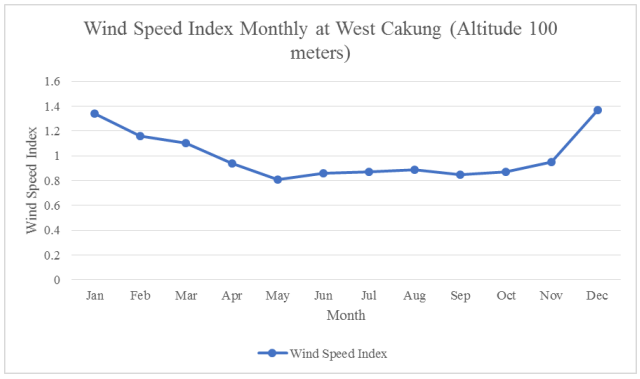

Figure 9: Wind Speed Index Monthly at The Elevation Of 100-Meter Above the Ground in West Cakung Area.

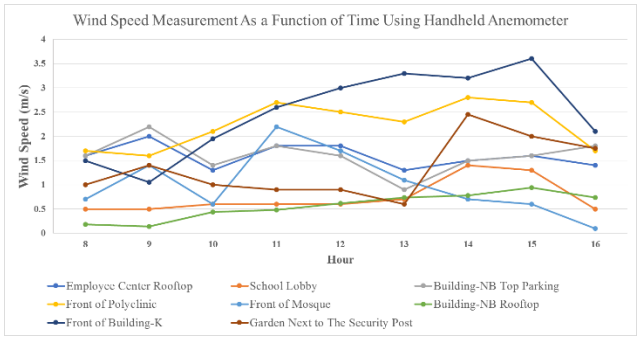

Figure 10: Wind Speed Measurements At 8 Locations as A Function of Time Using Handheld Anemometer.

3.2 Handheld Anemometer

The locations of wind speed data retrieval using the handheld anemometer are the same locations as the weather station. The results of wind speed data retrieval using the handheld anemometer are presented in Fig. 10. The graph shows that the highest wind speed curves are for the locations in front of Building-K and in front of Polyclinic. While in School lobby and Building-NB rooftop are the lowest curves in the graph because for those two locations, there are obstruction objects from several directions, especially blocked by buildings.

Based on the graph in Fig. 10, the peak of wind speed occurs in the afternoon time while the data from Global Wind Atlas in Fig. 8 shows that the peak of wind speed occurs in the morning. This means that the trend of wind speed hourly from the Global Wind Atlas does not match the data from the handheld anemometer.

3.3 Weather Station

The wind speed measurement results from the weather station are presented in Table 1 and in Fig. 11 and the results are similar to the data taken by the handheld anemometer.

The highest wind speed measurements are taken in front of Polyclinic and in front of Building-K, which have wind speed averages

Table 1: Wind Speed Average at 8 Locations Using Weather Station.

No	Location	Wind Speed Average (m/s)
1	Employee Center Rooftop	1.2
2	School Lobby	0.5
3	Building-NB Top Parking	1.2
4	Front of Polyclinic	1.4
5	Front of Mosque	0.6
6	Building-NB Rooftop	0.5
7	Front of Building-K	1.3
8	Garden Next to the Security Post	1.1

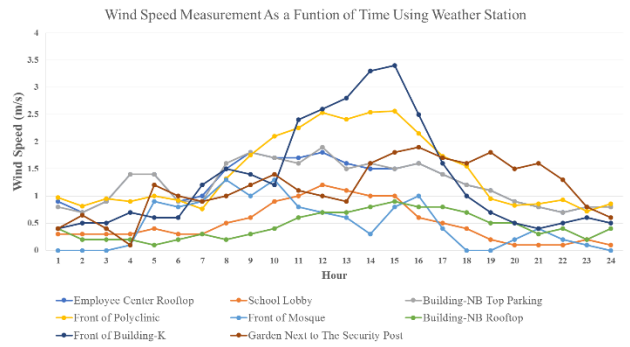

Figure 11: Wind Speed Measurements at 8 Locations as A Function of Time Using Weather Station.

Figure 12: Tunneling Effect Between Two Large Buildings Resulting Higher Wind Speed Measurements.

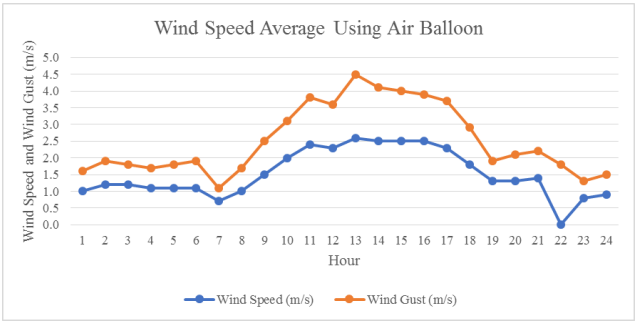

Figure 13: Wind Speed Measurements as A Function of Time Using Weather Station Hung To the Air Balloon.

of 1.4 and 1.3 m/s. While the lowest are taken in School lobby and Building-NB rooftop with wind speed average for both of 0.5 m/s.

The wind speed average from weather station measurements at 8 locations are similar to the data from the handheld anemometer. The weather station measurement data in Fig. 11 is quite comparable to the handheld anemometer measurement data in Fig. 10, that the peak of wind speed occurs in the afternoon time. However, both data are inconsistent with the wind speed index hourly from the Global Wind Atlas in Fig. 8

Comparing the results in Table 1 to the wind speed average from the Global Wind Atlas, 1.43 m/s, the averages at 8 different locations are less than the one from the Global Wind Atlas. This is to be expected because all data in the table are collected in elevation of 2-meter, which is less than the Global Wind Atlas data at elevation of 10-meter. However, we learned that in some conditions, wind speed average is higher at different locations than areas with a lot of blockages. As shown in Fig. 12, the site in front of Polyclinic is between two large buildings creating tunneling effect that can accumulate wind energy resulting higher wind speed average.

3.4 Air Balloon

Wind speed at altitude of 10 to 15 meters has a slightly higher average value, although it is not very significant. The wind speed measurement using air balloon as a function of time is shown in Fig. 13. The average value of wind speed (blue curve in Fig. 13) obtained in one week is 1.6 m/s. The value of the wind speed average obtained is still close to the wind speed average value recorded on the Global Wind Atlas, which is 1.43 m/s.

When this data compared to the wind speed index hourly in West Cakung recorded in the Global Wind Atlas, the profile value is inconsistent. This data is more consistent with the measurement data from the handheld anemometer and the weather station at 2-meter elevation.

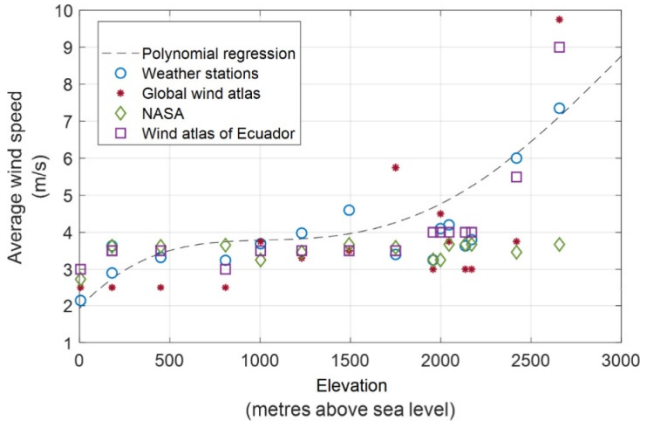

Figure 14: Average Wind Speed and Terrain Elevation Obtained from Weather Stations, Along with Other Data Sources for The Same Geographic Locations: Global Wind Atlas, NASA, And Wind Atlas of Ecuador. Source: Ref. [17].

Higher value of wind speed with increasing altitude has been studied in [17]. The paper showed that the wind speed is mainly a function of terrain elevation. Correlation of wind speed curve along with other data sources such as Weather stations, Global Wind Atlas and NASA is shown in Fig. 14. For the elevation range of 10 to 200 of our interest, the wind speed average curve in Fig. 14 shows that wind speed average is continuously going higher as the elevation going higher.

This justifies that the wind speed measurement using air balloon should be higher than using 2-meter elevation of weather station and handheld anemometer. The second reason is because at the altitude of 10 - 15 meter, there are fewer obstructions compared to the height of 2 meters. These obstructions will block the wind and reduces the wind speed.

4 CONCLUSION

The wind speed average at 10-meter elevation from Global Wind Atlas in Cakung office area is comparable to the data from handheld anemometer and weather station supported by 2-meter pole and by 10-15-meter elevation air balloon.

The daily wind speed index hourly from the Global Wind Atlas is not consistent with the data from handheld anemometer and weather station. The peak of wind speed from the Global Wind Atlas occurs in the morning time, while from handheld anemometer and weather station, the peak occurs in the afternoon time.

The highest wind speed average at 2-meter elevation from handheld anemometer and weather station measurements occurs in the front of Polyclinic and in front of Building-K with the value of 1.4 and 1.3 m/s. There is a tunneling effect happened at these two locations due their position between two large buildings.

The lowest wind speed average at 2-meter elevation occurs at the spots with large obstacles, such as trees, walls, buildings.

The wind speed average measured using air balloon is larger than any measurements done at 2-meter elevation. This follows the theory that wind speed average is higher at higher elevation.

ACKNOWLEDGMENTS

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SGU Alam Sutera Campus, Prominence Tower, Jalan Jalur Sutera Barat no. 15, Tangerang, Indonesia

Tangerang – September 16th, 2022

SUBJECT: INTERNATIONAL CONFERENCE ON ENGINEERING AND INFORMATION TECHNOLOGY FOR SUSTAINABLE INDUSTRY (ICONETSI 2022) INVITATION

To: Mr/Mrs. Dena Hendriana, BSc., S.M., Sc.D,,
Head of Master of Mechanical Engineering Study Program Swiss German University

We would like to inform you that Swiss German University is hosting an online **"International Conference on Engineering and Information Technology for Sustainable Industry 2022 (ICONETSI 2022)" in conjunction with "International Conference on Innovation, Entrepreneurship and Technology (ICONIET 2022)"**. This year, ICONETSI 2022 has received strong support from Central Michigan University USA, ASEAN Center for Energy, Fachhochschule Südwestfalen - Germany, Ernst-Abbe-Hochschule Jena - Germany , Pusat Unggulan Iptek (PUI) Baterai Lithium Universitas Sebelas Maret, Kerckhoffs Ltd - United Kingdom, Universitas Brawijaya, Institut Teknologi Bandung, Universitas Trisakti, Industrial Engineering Higher Education Organizing Cooperation Agency (BKSTI), and Asosiasi Perguruan Tinggi Informatika dan Komputer (APTIKOM).

On behalf of the committee of ICONIET 2022 and ICONETSI 2022, herewith we cordially invite you to join our International Conference on Engineering and Information Technology for Sustainable Industry or ICONETSI 2022 that will be held as online conference from Indonesia

Day/date : Wednesday - Thursday / 21 – 22 September 2022
Venue : Zoom - Online Conference: https://bit.ly/ICONIET_2022

Rundown can be found on link: https://bit.ly/rundownICONIET202 and details of conference can be found on website: https://iconetsi.sgu.ac.id/2022/

This conference will be a great opportunity among the academia, researchers, professionals, and other personals from various industries, entrepreneurs, academic institutions and policy makers to perform knowledge - exchanging about innovation, research, and development activities. With the theme of ***"Innovation and Technology for Resilient and Sustainable Industry",*** the conference aims to bring together the fields of engineering and information technology for fostering the sustainable industry and society.

Finally, we would like to take this opportunity to thank you for your participation in ICONETSI 2022.

For further information, please do not hesitate to contact us.

Faithfully Yours,

Dr. Ir. Yosman Bustaman, MBuss
Chairman of ICONIET 2022
Swiss German University

Dr. Eng. Aditya Tirta Pratama
Chairperson of ICONETSI 2022
Swiss German University

Hendriana, Dena

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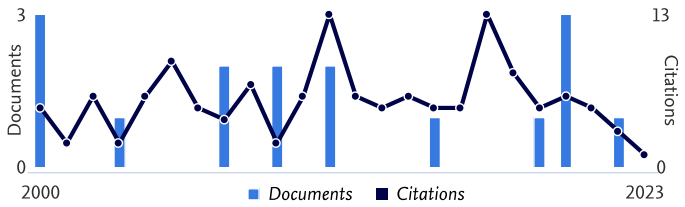

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