The 2019 Conference on Fundamental and Applied Science for Advanced Technology

Certificate of Attendance

to

Elieser Tarigan

as

Presenter at Symposium B-Sustainable Energy and Smart Materials

The 2019 Conference on Fundamental and Applied Science for Advanced Technology

Yogyakarta, Indonesia on 21st January 2019

Dean of Faculty of Science
Universitas Ahmad Dahlan

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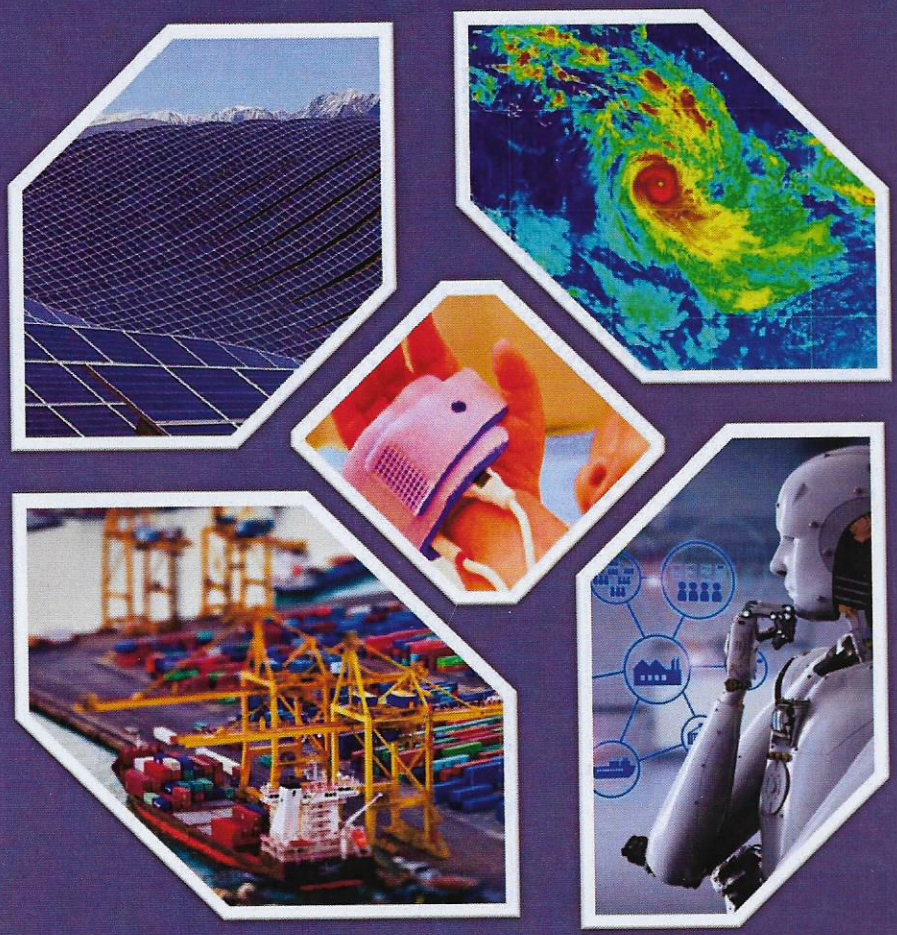
2019 ConFAST

The 2019 Conference of Fundamental and Applied Science for Advanced Technology



Yogyakarta, 21st January 2019

PROGRAM BOOK

E.Tg.

Preface

We are very pleased to welcome all presenters and participants of The 2019 Conference on Fundamental and Applied Science for Advanced Technology (ConFAST 2019), in Yogyakarta, Indonesia. This conference is organized by Faculty of Science, Universitas Ahmad Dahlan, supported by local and international partners. The theme for this year conference "Bridging the Gap: From Research to Application" aimed to strengthen the society with advanced science and technology in the wake of industrial revolution 4.0 in two folds: (1) Empowering the sci-tech-based enterprize by adopting advanced science and technology to compete globally and, (2) Imparting meaningful purpose on academic research through research to solve real problem faced by society and industry.

Contraty to the conventional conference organization which organize symposium by similar academic field, ConFAST 2019 take a revolutionary step in organizing symposia based on common purpose to enable comprehensive discussion on certain topics from various perspectives and points of view. The 2019 ConFAST organized into 6 symposia, to allow for more focused discussion leading to a synergistic movement to address the unique challenge faced by each field of applications. The Conference receives over 180 abstracts, from which, only 119 are accepted for today's presentation. In addition to Indonesian communities, the conference also attended by international participants from Malaysia, Brunei Darussalam, Thailand, Singapore and the Netherland.

We would like to appreciate your attendance and participation to make this conference a lively event. We would also express our sincere gratitute to the organizing committee and the scientific committee for their excellent dedication to make this conference a success story.

Again, a warm welcome to all presenters and participants. We wish you a productive, fruitful, and enjoyable ConFAST 2019.

Sincerely

Damar Yoga Kusuma, Ph.D.
ConFAST 2019 General Chair

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2019 ConFAST
The 2019 Conference on
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Scopes and Symposium Programs

Symposium A – Maritime, Oceanic and Atmospheric Science

Fisheries; Aquaculture and marineculture; Fish preservation technology; Coral reef; Salt production technology; Seawater desalinisation; Menbrane technology; Reverse osmosis; Navigation; UAV, radar and satelite technology for maritime surveilance; Marintime telecommunications; Seafloor mapping technology; Meteorology and climate change; Coastal ecology; Marine life conservation; Marine biodiversity; Extreeme events; Maritime souvereignty; National and international policy in maritime.

Symposium B – Sustainable Energy and Smart Materials

Renewable energy: production, storage and integration; Energy conservation and eficiency; Photovoltaic; Solar thermal; Biofuel; Wind energy; Geothermal energy; Clean nuclear energy; Electrical power; Energy system and management; Advanced materials for energy applications, including: Organic electronics; Nanomaterials and nanotechnology; Metamaterials; Accoustic materials; Optical and photonic materials; Advanced composite materials; Ferroelectric; Piezoeletric; Pyroelectric; Thermoelectric; High-k materials; Chromogenic systems.

Symposium C – Life Science, Pharmaceutical Science and Medical Technology

Medical physics; Medicine science; Biomedical engineering; Bioinformatics; Pharmaceutical science; New drugs and targetted approach; Novel drug delivery systems; Medical device and electromedics; Novel diagnostic methods and tools; Food microbiology; Food safety; Halal technology; Agriculture; Aquaculture; Science for food security; Natural product and organic synthesis; Enzymes; Microbiotechnology; Biotechnology; Biochemistry and molecular biology; Genetics and bioengineering.

Symposium D – Environmental Science and Disaster Mitigation

Disaster management; Disaster analysis; Disaster monitoring and mitigation; Emergency preparadness; Risk mitigation; Risk and security; Community resilience; Socio-economic issue; Case studies; Human factor; Hazard risk assesment; Risk communication; Preparedness and training; Learning from disaster; Seismology; Volcanology; Geodynamics; Geophysics; Instrumentation; Telemetry technology; Remote sensing; Disaster early warning and early detection system; Reduce-Reuse-Recycle of wasteproduct; Biodegradable materials; Environmental preservation.

Symposium E – Intelligent Systems in Applied Mathematics, Computings and Informatics

Artificial intelligence; Robotics and computer vision; Human computer interaction; Data mining; Machine learning; Pattern recognition; Biometrics; Face recognition-detection; Medical image processing; Motion detection; Signaling; Self-driving vehicle; Soft computing technique; Image retrieval; Cloud computing; System, Telecommunication and networking; Virtual reality; E-governance; E-health; Internet of Things; Big data analitics; Business intelligent; Geometric modelling and processing; Statistics and applications; Dynamical systems; Financial mathematics; Game theory; Mathematical modeling; Applied algebra; Traffic optimizations; Transportation management; IT governance; Security and risk management; System and control; Digital forensic; and Network security.

Schedule for Parallel Sessions

Symposium B – Solar and Wind Energy
Time: Monday, 21 Jan 2019, 15:15 – 16:45
Room: Arjuna 2
Moderator: Prof. Darsono Bahrun

B038	Sunarno Atmowiyono Rakino, Suherman Suherman, Syafruddin Hasan	A Passive Cooling System for Increasing Solar Panel Output	PT Inalum, Universitas Sumatera Utara, Politeknik Negeri Media Kreatif
B048	Sepdian Sepdian, Emmistasega Subama	Calculation of The Energy Storage Capacity of Hybrid Power Plant-Based Solar Energy And Wind Energy	Politeknik Jambi, Rumah Fisika
B058	Elieser Tarigan	The Effect of Dust on Solar PV System Energy Output Under Urban Climate of Surabaya, Indonesia	Universitas Surabaya
B059	Dan Mugisidi, Berkah Fajar, Tony Utomo, Syaiful Syaiful	Effect of water surface level in porous media in single basin solar still	Universitas Diponegoro
B080	Zulkarnaen Pane	Maximizing Power Tracking of an Offshore Wind Turbine Using Perturb and Observe Method	Universitas Sumatera Utara
B140	Nasori, Endarko	In Comparison p-type with the Photocathode CuBi2O4 Films and CuBi2O4 Nanopilars for Highly Performance Photoelectrochemical Water Splitting	Institut Teknologi Sepuluh Nopember

The Effect of Dust on Solar PV System Energy Output Under Urban Climate of Surabaya, Indonesia

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Abstract. Solar Photovoltaic (PV) electricity is one the most effective, eco-friendly, and sustainable source of energy. The amount of electricity produced by a PV system is directly affected by the level of solar irradiation incident to the PV panels. In the real operation, the dust from the surrounding environment falls and accumulates on PV panels. The accumulation of dust causes a decrease in the energy output of the PV system. This study was aimed to investigate the impact of dust on PV operation to its energy output under the urban climate of Surabaya, Indonesia. The study was conducted by comparing two identical PV panel systems, each of 300 Wp. For one system, the PV panels were manually cleaned regularly for the dust, while for another system is remained without any cleaning. Both systems were measured for its energy output, and the results are compared. The results showed that, during the dry season in Surabaya, the energy output from the cleaned PV panels system is higher by 20% in comparison with the uncleaned PV panels system. While, during the rainy season, both systems produce the same amount of energy. In total throughout the year, cleaning of PV panels system would increase the energy output of about 8%.

INTRODUCTION

The use of solar energy can reduce the need for fossil energy and in turn reduce the amount of greenhouse gasses being released into the atmosphere. Solar energy which is available and renewable in the form of the photon can be converted into electricity form directly using devices named photovoltaic (PV) system. The efficiency of energy conversion is affected by many factors such as temperature, radiation, and dust. The presence of dust on the surface of PV modules significantly affects the performance of a PV system[1], [2].

A quite number of studies on the subject of dust impact of PV system had been reported from different site of the world with different climates [2]–[6]. Study of dust effect on photovoltaic module for photovoltaic for various type of PV modules in Thailand was reported by Ketjoy and Konyu [1]. The results was used to derive a mathematical model for the local site. A study was reported by Mejia, e. al.,[5] from investigation of one year of power output from a PV site in Santa Clara, CA demonstrated how soiling decreases the efficiency of solar PV plants. Soiling effects were found to strongly depend on the dry exposure time of the panel. Soiling losses have their largest impact during the long dry summers. The losses caused by the accumulation of dust were estimated to be -0.0021 per day in relative solar conversion efficiency.

The effect of the dust depends on the local area where the PV system is mounted, therefore it might difficult to apply a general model or calculation in all cases [3]. From literature review it was found that a few studies for this subject under condition of Indonesia have been reported.

The objective of this study is to investigate the effect of dust on the energy output of solar PV system deployed in Surabaya, East Java, Indonesia. As situated in around the equator line, i.e., 07° 19' 17.83" South and 112° 46'

3.19" East, Surabaya has only two major seasons around the year, dry and rainy season. The dry season commonly occurs during April to October, while October – April is commonly rainy season. Based on the effect of dust on PV modules every season, the impact of action for cleaning modules is analyzed. The results and information from this study are expected to be useful for PV application development for larger scale in Indonesia.

METHOD

Two identical PV systems named system 1 and system 2 , each 400 Wp, are mounted side by side on the roof of a building. Both systems are identical in term of the system components, size, and configuration. Each system consisted of PV modules, a solar charge controller (CC), battery, and inverter. Energy produced by the PV system is used daily for powering electricity appliances. The system configurations are as shown in Figure 1, while the specification of the components is shown in Table 1. The energy produced by each system are recorded using a power meter with data logger attached/connected right at the PV modules output (before the charge controller).

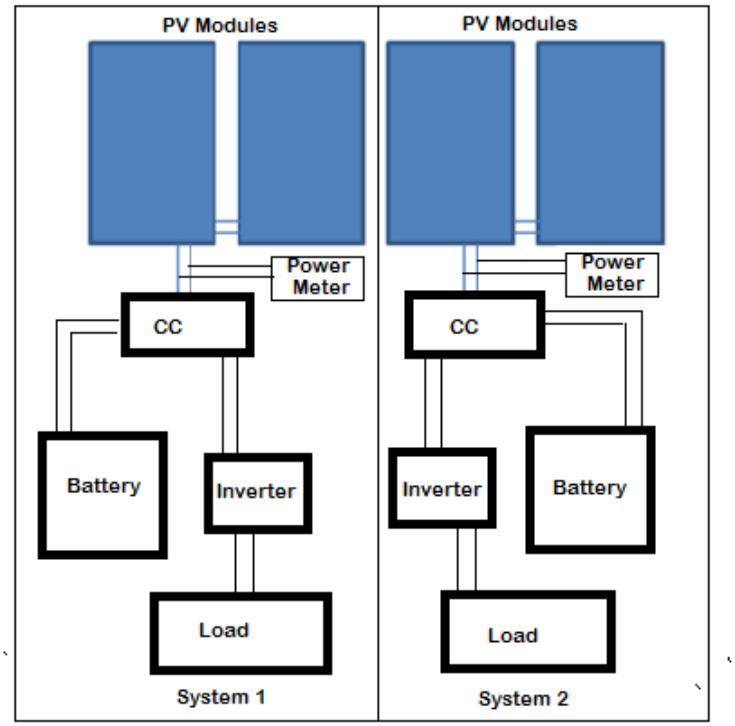

FIGURE 1. Experimental PV systems configuration

TABLE 1. System component and specification

Component	No	Brand	Model	Size	Other
PV Modules	2	I- Solar 1	SPU-180M	150 W Max Power	Mono Crystalline Module
Charge controller (CC)	1	S series	SC-20	Load Current 20 A	Self-consumption 6 mA
Battery	2	CIT BAT	CT12 100FR	12 Volt 100 Ah	No Data Sheet Found
Inverter	1	Intelligent	SP-1500	1500 W /Surge 3000 W 24 V DC => 220 V AC	Modified Sine Wave

During the dry season when the intensity of dust from surrounding commonly high, the PV modules for system 1were regularly and manually cleaned weekly using water, while PV modules for system 2 were left without any cleaning treatment (naturally). During rainy season both systems do not need any cleaning treatment as the PV modules were naturally cleaned by rainwater. Figure 2 shows the photograph the typical appearance of PV modules for both systems during a dry season.

FIGURE 2. Photograph of modules system 1 and system 2 during dry season.

RESULTS AND DISCUSSIONS

During the rainy season, the result of measurements for power and energy output from both system 1 and system 2 are similar. The PV modules for both systems were naturally cleaned by rainwater. The surface of the modules are relatively clean, and it can be clearly visible. In this period, the impact of dust on the power output of the PV systems is considered very small. Solar irradiation during the rainy season varies between 2.0 – 4.5 kWh/day.m^2 and the daily energy output ranged from 500 Wh to 1300 Wh per day.

During the dry season, the daily solar irradiation is relatively high and constant in Surabaya, i.e., within 4.2 – 5.8 kWh/day.m^2. With this level of radiation, system 1 (cleaned modules) produced electricity ranged from 1200 – 1400 Wh/day. During 15 – 20 days of the first month of the dry season, the energy output by system 1 (cleaned modules) relatively similar to the system 2 (uncleaned modules). The dust commonly falls onto the modules gradually, and it is accumulated day by day. The measurement indicated that the impact of the dust was significantly affected the energy output after about 25 – 30 days of dust accumulation without any rain. Therefore, during the dry season, whenever possible, a cleaning process for a PV system modules in Surabaya is recommended at least once per month to lower energy lost by dust impact. In this study, however, the cleaning process is applied every week (for system 1) to investigate the impact of dust on the energy output from the PV system.

The impact of the accumulated dust was significant and relatively stable (the daily energy lost was relatively constant) for system 2 after 30 days of the dry season until the next rainy season arrived. Measurement results for output energy by system1 and system 2 for 6-consecutive days during the dry season is shown in Figure 3. The data was from measurements during the days after 2 months of dry season. Calculation results showed that during the dry season in Surabaya, the energy output from the cleaned PV panels system is higher about 20% in comparison with the uncleaned PV panels system as can be seen day by day in Figure 3.

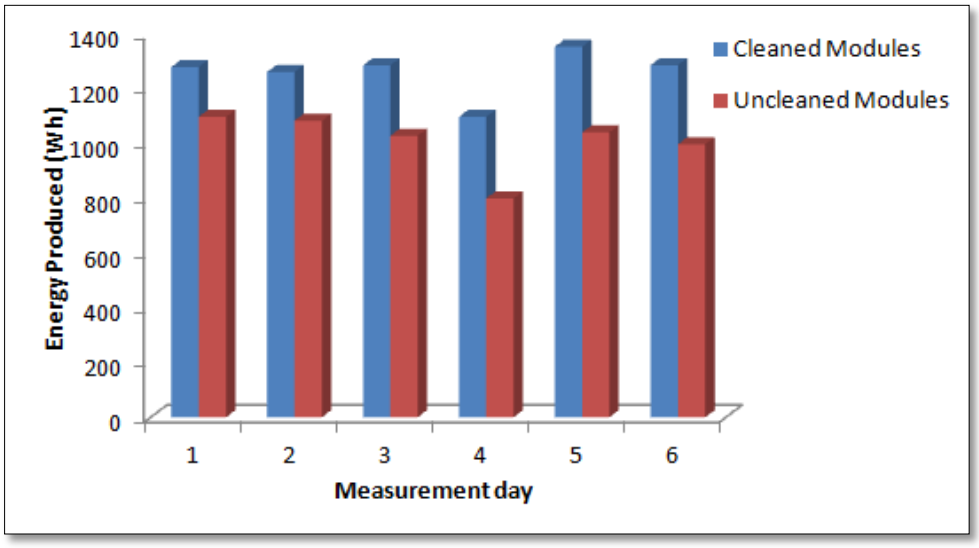

FIGURE 3. Daily energy output by system 1 (cleaned modules) and system 2 (uncleaned modules)

The daily energy output from PV systems is from the accumulation of energy produced since morning to evening, i.e. the accumulation of the power produced by time. The comparison of power output between system 1and system 2 for one day is shown in Figure 4. During higher solar radiation, the power output by system 1 was reached 296 Watt, at the same time system 2, produces power about 170 Watt. However, for a lower radiation the difference power output by both systems was lower, means that the impact of the dust is significant during high solar radiations.

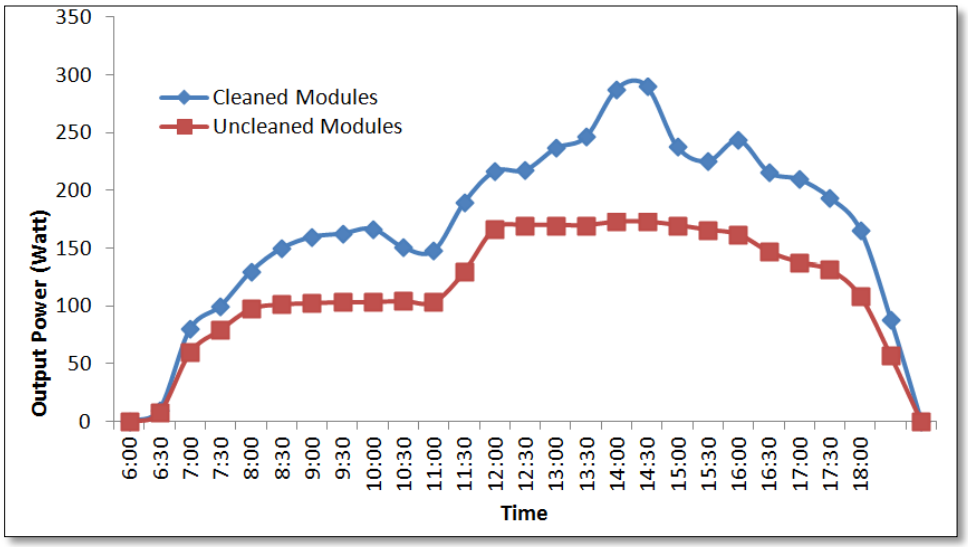

FIGURE 4. Daily power output by system 1 (cleaned modules) and system 2 (uncleaned modules)

As previously mentioned, the dry season in Indonesia, including in Surabaya where this study was taken place, commonly occurs during April to October, while October – April is commonly rainy season. However, in the recent past years, the dry or rainy seasons became more unpredictable. A particular study should be attempted to find the reasons for this situation. A rainfall intensity for a typical year (2012) in Surabaya, taken from Meteorology, Climatology, and Geophysical Agency (Indonesian: Badan Meteorologi, Klimatologi, dan Geofisika, abbreviated BMKG) [7] is shown in Figure 5.

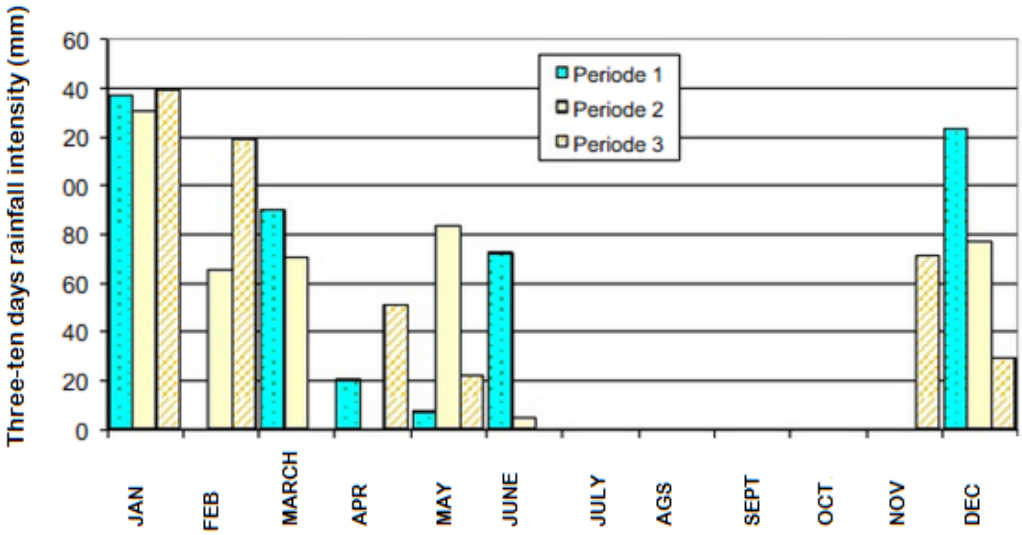

FIGURE 1. Rainfall intensity in Surabaya 2012. (Data source: BMKG [7]).

With the reference of data in Figure 5, it can be seen that rain occurs during December to June (with different intensity). During this period the dust would not impact to the PV system power output. However a long dry season occur during June – November, means that the dust will impact on PV system about 5 months. Using this scenario, cleaning of PV panels system would increase the energy output of about 8% in total for one year.

CONCLUSIONS

The presence and accumulation of dust on the PV modules significantly affect the performance of a PV system. The dust commonly falls onto the modules gradually, and it is accumulated day by day. It was found that dust was significantly affected the energy output after about 25 – 30 days of dust accumulation without any rain. Therefore, during dry season, whenever possible a cleaning process for a PV system modules in Surabaya is recommended at least once per month to lower energy lost by dust impact. Cleaning of PV panels system would increase energy output of about 8% in total for one year.

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