2021 6th International Conference on Renewable Energy: Generation and Applications (ICREGA) | 978-1-7281-8301-5/20/$31.00 ©2021 IEEE | DOI: 10.1109/ICREGA50506.2021.9388219

Simulation of the Floating PV System to Supply Electricity Demand for the City of Surabaya, Indonesia

Elieser Tarigan
Electrical Engineering Departement, and
PuSLET Universitas Surabaya

Surabaya Indonesia
elieser@staff.ubaya.ac.id

***Abstract*— Solar photovoltaic (PV) is one of the promising renewable energy for replacing conventional fossil fuels. One of the limitation use of the solar PV system is it requires land or open space for mounting of the solar panel. The Floating Photovoltaic (FPV) would be the appropriate solution for a rapid expansion of solar PV. This paper studies the possibility of implementation of the FPV system to supply electricity demand for the city of Surabaya, Indonesia. The studies include FPV reviews, PV simulation, interpolation, and FPV estimation based on the energy demand in Surabaya. It is found that a 1,255 MWp capacity of the FPV system would be needed for electricity demand. The coastal area at the Northwest of the city is considered suitable for the FPV panel area for Surabaya.**

Keywords—photovoltaic, FPV, solar energy, electricity

I. Introduction

The use of conventional energy sources (fossil energy) continues to increase globally with population growth and the acceleration of technology and industrialization. On the other hand, fossil-based energy resources are depleted. Moreover, the impact on the global climate due to the consumption of fossil energy is becoming more real in recent years [1], [2]. To maintain the sustainability of energy and development, it is necessary for us to attempt alternative energy sources that are environmentally friendly.

The government of Indonesia has established The General National Energy Plan (*Rencana Umum Energy Nasional, RUEN*), which targeting renewable energy at 23% of the national energy mix by 2025 [2]–[4]. Of the various renewable energy resources available in Indonesia, solar photovoltaics (PV) energy is expected to be generated about 6.5 GW of the total renewable energy generation of 45 GW by 2025 [3].

One of the limitation use of the solar PV system, especially for the large power plant system, is it requires land or open space for mounting of the solar panel. A 1 MWp capacity of the PV system normally requires at least 10,000 m^2 of land [5]. This area would have a significant impact since the area cannot then be used for other purposes. An open space is to avoid objects that block (shadow) sunlight hits the panels. Moreover, the urban area with densely populated has very limited open space, and it is highly cost [5]–[7]. In Indonesia, the government is promoting the use of rooftops known as the rooftop PV system [1], [8]; still, it would only be able for relatives small of the PV system.

The Floating Photovoltaic (FPV) would be the appropriate solution for a rapid expansion of the solar energy sector. There have been quite a number of studies and implementation of FPV in many countries that were found in the literature [3], [9]–[12]. However, fewer studies and implementation on the FPV have been reported for the Indonesian situation [13]. On the other hand, Indonesia is an archipelago country, and most of the cities are located nearby coastal areas.

This paper studies the possibility of implementation of the FPV system to supply electricity demand for the city of Surabaya, Indonesia. The studies are carried out through literature reviews regarding FPV development, combined with the computer simulation work using SolarGIS PVplanner [14]. The objective of the study is to figure out and estimate the FPV system capacity needed and the possibility of the use of water surfaces nearby the city for the placement of the PV system power plant. The simulation methods are commonly used to estimate the PV system performance before constructing the system [15], [16].

II. Methods

A number of recently published studies about FPV were reviewed in this study to obtained information about the state of the art of the technology. A simulation of PV on the grid PV system is conducted using SolarGIS PV Planner for the site location of Surabaya, Indonesia. The software simulation uses numerical models that are implemented and developed by Geo Model based on 30 minutes time series of aggregated solar radiation and ambient temperature [14].

From the simulation, it was obtained the potential of the PV system in the site location.

Simulation is done by taking an open ground area as the place of solar panels, and the results are interpolate based on the previous work [17]–[19] to obtain the results if the system were installed in floating the water surface. The input parameter for the simulation is, as shown in Table 1.

TABEL 1. INPUT PARAMETERS FOR SIMULATION

Parameter	Input
Site name	Surabaya, Indonesia
Astronomic possition	07° 31' 39.67" S, 112° 42' 13.84" E
Elevation (from sea level)	5 m
Mounting system	fixed mounting, free standing
Slope azimuth	45° northwest
Slope inclination	15°
Installed power	1 kWp
Type of modules	crystalline silicon (c-Si)
Availability	99.0%
Inverter Euro eff.	97.5%
DC / AC losses	5.5% / 1.5%

Calculation of the required FPV capacity to supply energy demand was done based on the energy consumption of the city for the year 2019. The consumers of energy are divided into five categories, i.e. public facilities, households, business & commercials, industries, and governmental buildings. The information is obtained from secondary data [20], as shown in Table 2.

TABLE 2. ENERGY CONSUMPTION IN SURABAYA FOR FIVE DIFFERENT CATEGORIES OF CONSUMERS 2019

No	Consumer Category	Energy Consumption (kWh)
1	Public facilities	31,810,784
2	Households	865,743,809
3	Busnises and Commercials	955,769,115
4	Industries	250,423,000
5	Govermental Building	41,648,884
Total		**2,145,395,592**

The area of the water surface for the placement of the PV panels is determined by using the Polygon feature of Google Earth .™

III. RESULTS AND DISCUSSION

A. Floating Photovoltaic (FPV) Reviews

Floating photovoltaic (FPV) is a solar farm constructed on water. They are usually installed on lakes, ponds, coastal, etc., that have non-flowing water [21]. The FPV installations open up new opportunities for scaling up solar electricity generating capacity, especially in region with high population density and limited available land. However, the FPV system has not been fully explored [6]. Generally, the FPV system installation consists of :

- A floating structure where the solar panels are mounted. The floating structure is also called pontoon.
- The anchor system keeps the pontoon in a stable and static position.
- Cabling system with impeccable weather-proof characteristics.
- Solar panels that convert solar energy into electrical energy.

Figure 1 shows the schematic diagram structure of an FPV system [6], [22].

In comparison with the ground conventional PV system, the FPVs system has the following advantages [[5], [23]].

- Land occupancy reduction: The FPV system would be the limited surfaces necessary for electric cabinets.
- Higher radiation due to the albedo effect: The water surface albedo is reported to increase solar radiation around 5–8% so that floating plants leave the radiation balance [5].
- Hybrid system and coupling to the hydroelectric power plants (HPP). FPV plants can advantageously integrate other renewable energy resources.
- Reduction of specific energy costs: FPV technology brought the costs of FPV plants below that of standard PV.
- Installation and decommissioning: Floating PV plants are more compact than the conventional ground-based PV system. Their construction and decommissioning are simple and straightforward.
- Reduce evaporation: The partial coverage of basins has additional benefits such as the reduction of water evaporation. This result depends on climate conditions and on the percentage of the covered surface.
- Tracking system. Constructing the tracking system for FPV would be simpler than a ground-based system. The tracking system would increase the energy gain range from 15% to 25% [5].
- Cooling effect: Instaling the PV panels closed to the water surface would reduce the operating temperature of the PV panels, which means increasing the cells efficiency [5, 24]. In a study by Liu et al. (2017) [22] the ability of two identical PV panels system were compared, one was with a grounded based PV system, and another was mounted on a floating system. The results showed that during the operation, the temperature for the FPV system experience a lower than the ground-based system. The lower temperature of the FPV system would give higher energy gain up to 2% in comparison to the grounded based system.

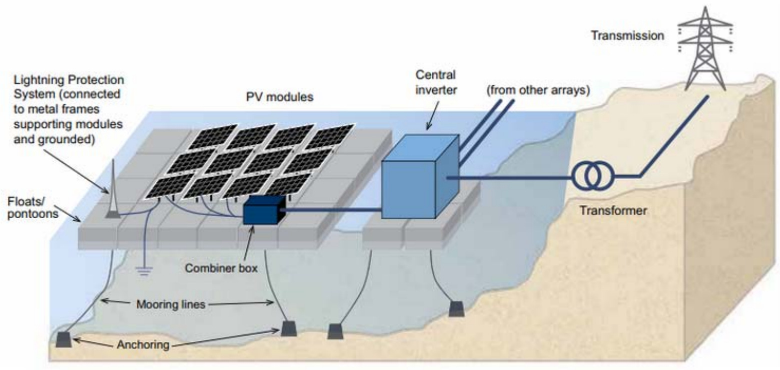

Fig. 1. Schematic diagram and components of FPV [6]

In terms of energy gain, the cooling and albedo effects itself would give about 10 % higher energy gain by the FPV system. This number is used in calculation and simulation in this study.

B. *Solar PV Simulation in Surabaya*

The results of the simulation show that the potential of solar energy in Surabaya, in terms of Global horizontal irradiation, is significantly high, as presented in Fig. 1. Global radiation consists of direct, diffuse, and reflected radiation components. The average daily sum of global irradiation varies from 4.82 to 6.81 kWh/m^{2,} with an average of about 5.54 kWh/m^2 per day. The diffuse component of radiation dominates during March – October. On the other hand, the reflected component relatively low throughout the year. Daily air ambient temperature is also shown in Fig. 2, which varies from 26 °C to 30 °C

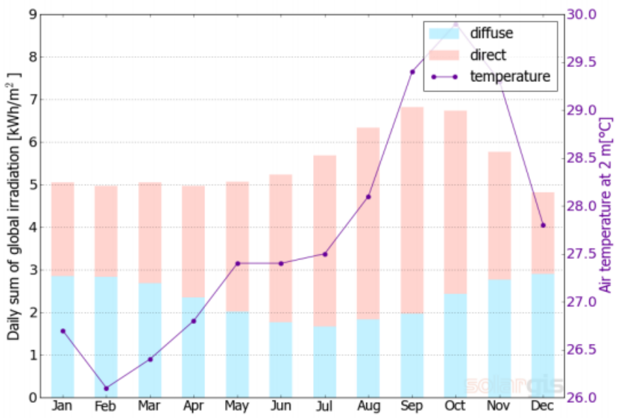

Fig.2. Global irradiation and air temperature in Surabaya

The previous simulation studies using SolarGIS-pvPlanner [17], [18], [25] was conducted to find out the optimum specific energy production in Surabaya by varying solar azimuth angle of the panels. It was found that in Surabaya, the optimum energy output of a fixed mounting position PV system is 45°, i.e., facing North-East.

With the parameters as presented in Table 1, the specific energy production of the grounded-based PV system in Surabaya is shown in Table 3. It can be seen that the daily specific electricity production varies from 3.52 to 5.15 kWh/kWp, with an average of 4.26 kWh/kWp. The annual specific electricity production is about 1555 kWh/kWp. The simulation was also carried out for the different types of PV cells. The specific annual electricity production performance ratio for three different types of PV cells with the same other simulation parameters is showed in Table 4.

TABLE 3. ENERGY PRODUCTION PV SYSTEM C-SI CELLS AND FIXED MOUNTING IN SURABAYA

Month	Specific Energy (kWh)	
	Monthly	Daily
January	115.00	3.73
February	104.00	3.74
March	120.00	3.89
April	117.00	3.93
May	127.00	4.11
June	129.00	4.32
July	144.00	4.65
August	154.00	5.00
September	154.00	5.15
October	152.00	4.92
November	124.00	4.16
December	109.00	3.52
Yearly	1,555.00	4.26

TABEL 4. SPECICIFIC ENERGY PRODUCTION AND PERFORMANCE RATIO OF DIFFERENT TYPE SOLAR CELLS

Cells Type	Anual Specific energy prod. [kWh/kWp]	Performance ratio [%]
a-Si	1,742	84.40
c-Si	1,555	75.40
CIS	1,588	77.00

There are several type of the mounting structure of PV system that can be simulated in the software used. The purpose of selecting a type of mounting system system is to optimize solar irradiatin falling into the panel surface which means to optimize rhe enrgy output of the PV system. The mounting system significantly affects the specific electricity production of a PV system; however, it would also affect the installation and maintenance cost. Simulation results of annual specific energy production on the different type of mounting system is shown in Table 5. The simulation was for the c-Si PV cell type.

TABLE 5. THE ENERGY PRODUCTION FOR DIFFERENT PV MOUNTING SYSTEM IN SURABAYA

Mounting System	Specific energy prod. [kWh/kWp]
Free standing 1 angle (optimized)	1555
Building integrated (optimized)	1503
Roof mounted (optimized)	1529
Free standing 2 angle (optimized)	1580
Horizontal NS axis tracking	1887
Horizontal EW axis tracking	1603
Vertical axis tracking	1893
Inclined axis	1902
2 axis tracking	1959

C. *Interpolation of Simulation for FPV system*

As previously mentioned in Section A in this paper, information obtained from the literature, especially for the different energy gain between the ground-based PV system and the FPV system, is used in this study. It was found that energy gain by an FPV system is higher, about 10% in comparison with a ground-based PV system.

By taking the 10% difference of energy gain, then the specific energy production by the FPV system (fixed mounted) in Surabaya can be calculated. The results of the calculation are presented in Table 6. It can be seen that monthly specific energy production of the FPV system in Surabaya varies from 114.40 kWh/kWp to 169.40 kWh/kWp, and daily varies from 3.87 kWh/kWp to 5.66 kWh/kWp. Anual specific energy production is found about 1710.5 kWh/kWp.

TABLE 6. ENERGY PRODUCTION PV SYSTEM C-SI CELLS AND FIXED MOUNTING IN SURABAYA

Month	Specific Energy (kWh/kWp)	
	Monthly	Daily
January	126.50	4.10
February	114.40	4.11
March	132.00	4.27
April	128.70	4.32
May	139.70	4.52
June	141.90	4.75
July	158.40	5.11
August	169.40	5.50
September	169.40	5.66
October	167.20	5.41
November	136.40	4.57
December	119.90	3.87
Yearly	1710.50	4.68

D. *Electricity Demand of Surabaya City*

Surabaya is the second-largest city in Indonesia, with a population of about 2,8 million people. The city is located on coastal terrain and the occupied area of 327 square kilometers (km^2) the land. Population density is 8,458 inhabitants per km^2. The highest elevation point in Surabaya is about 30 meters. Surabaya has a river named Brantas.

The electricity in Surabaya is provided and distributed by the public company so-called *Perusahaan Listrik Negara*, *PLN*. The grid connection is one of the branches under The Java-Bali Grid. The Java-Bali grid is the largest and backbone of Indonesia's electricity grid and supply. The Java-Bali grid has been providing power to more than half the nation's citizens that living in Java dan Bali island of Indonesia. It powers production facilities and connects the major population entirely, Java and Bali. The modern grid infrastructure in the Java-Bali grid is so essential to ensure sustainable electricity supply to the consumers.

The electricity under the Java-Bali comes from many power plants around Java and Bali. Most of the power plants, however, are energy fossil (coal) based generation, only a small portion from renewable energy such as hydropower and geothermal power generation.

The capacity of the solar FPV system needed to supply energy demand should be calculated based on the energy demand of the users. This section is to calculate the daily and annual energy need for the entire activity in the city. The rough calculation is made based on the data, as presented in Table 2.

The electricity energy consumption by the city in 2019 was categorized into five categories,.i.e., public facilities, households, business & commercials, industries, and governmental buildings. From the five categories, it is obviously seen that the highest energy demand is by the business & commercial sector.

The total energy consumption in 2019 was about 2,145,395,592 kWh. It means that daily energy consumption is 2,145,395,592/360 = 5,959,432 kWh/day.

E. *Calculation of FPV capacity system*

Based on simulation on the ground-based PV system in Surabaya (in section B) and an interpolation of the simulation for the FPV system in (Section C), the capacity of the solar system can be calculated.

Based on the annual energy-specific production of the FPV system, i.e., 1710.5 kWh/kWp, and the annual energy demand of the city is 2,145,395,592 kWh per year, then the capacity of the FPV system would be needed is about 2,145,395,592/1710.5 = 1,254,617 kWp or about 1,255 MWp. This number is with the assumption that the installation is the position of a fixed panel. Using a tracking system would reduce the capacity up to 995.5 MWp. However, the additional cost should be considered for such a system. In this case, further feasibility studies interms of economic finacial, and other aspect should be made.

Fig. 3. The map of Surabaya showing Brantas River

Fig. 4. The proposed area for FPV system

F. Water Surface Area for FPV system

The map of Surabaya city is shown in Fig. 3. The city has the Brantas City, which flows from Southwest through the middle of the city and ends up in the South and East coast of the city. There are several spots of Brantas that actually possible for placement of FPV, however, as the river also is being used for many other purposes such as transportation, flood control, etc. It is considered that the river might not be suitable for the FPV power plan area.

As Surabaya is located at the coastal terrain, it should be possible to build FPV through the nearby coastal areas. Based on the estimation that 1 MWp capacity of PV system normally requires at least 10,000 m^2 of land [5], [22], [26], and considering FPV would be 10% higher energy gain that ground-based PV system, the area needed for 1,255 MWp of FPV system would be 11,295,00 m^2 or about 11.3 km^2. The coastal area at Northwest of the city is considered suitable for FPV panel area of Surabaya. The proposed area as shown in Fig. 4 is aproximately 11.5 km^2. It wouldbe appropraite for FPV power plant that supply entire electricity demand for the city.

VI. Conclusions and Recommendations

Simulation of the floating PV system to supply electricity demand for the city of Surabaya, indonesia has been carried out in this study. The total energy consumption in 2019 was about 2,145,395,592 kWh, while the anual specific energy production of FPV is found about 1710.5 kWh/kWp. Therefore, the capacity of FPV system would be needed about 1,255 MWp to fullfil electricity demand. The coastal area at Northwest of the city is considered suitable for FPV panel area of Surabaya. However, Further feasibily studies in terms of economic finacial, and other aspect is recomended.

REFERENCES

[1] IESR, "Indonesia Clean Energy Outlook Imprint Indonesia Clean Energy Outlook 2020," *IESR*, pp. 1–54, 2018.

[2] A. P. Tampubolon, "National Energy General Plan (RUEN): Existing, Current Policies Implication, and Energy Transition Scenario," 2020.

[3] M. Maulidia, P. Dargusch, P. Ashworth, and F. Ardiansyah, "Rethinking renewable energy targets and electricity sector reform in Indonesia: A private sector perspective," *Renew. Sustain. Energy Rev.*, vol. 101, no. February 2018, pp. 231–247, 2019.

[4] K. ESDM, "Rencana Umum Energi Nasional (RUEN)," 2016. [Online]. Available: https://www.esdm.go.id/id/publikasi/ruen.

[5] R. Cazzaniga and M. Rosa-Clot, "The booming of floating PV," *Sol. Energy*, 2020.

[6] W. Bank, "Where Sun Meets Water," 2019.

[7] Roedl.com, "Floating photovoltaics – is floating solar a new trend? | Rödl & Partner," *Roedl.com*. [Online]. Available: https://www.roedl.com/insights/renewable-energy/2019-02/floating-photovoltaics. [Accessed: 01-Nov-2020].

[8] E. Hamdi, "Indonesia' s Solar Policies: Designed to Fail?," 2019.

[9] P. J. Burke, J. Widnyana, Z. Anjum, E. Aisbett, B. Resosudarmo, and K. G. H. Baldwin, "Overcoming barriers to solar and wind energy adoption in two Asian giants: India and Indonesia," *Energy Policy*, vol. 132, no. April, pp. 1216–1228, 2019.

[10] C. J. Ho, W. L. Chou, and C. M. Lai, "Thermal and electrical performance of a water-surface floating PV integrated with a water-saturated MEPCM layer," *Energy Convers. Manag.*, vol. 89, pp. 862–872, Jan. 2015.

[11] R. Cazzaniga, M. Rosa-Clot, P. Rosa-Clot, and G. M. Tina, "Integration of PV floating with hydroelectric power plants," *Heliyon*, vol. 5, no. 6. Elsevier Ltd, 01-Jun-2019.

[12] H. Rauf, M. S. Gull, and N. Arshad, "Complementing hydroelectric power with floating solar PV for daytime peak electricity demand," *Renew. Energy*, vol. 162, pp. 1227–1242, Dec. 2020.

[13] Pv-magazine.com, "Masdar to install 145 MW of floating PV in Indonesia – pv magazine International," *Pv-magazine.com*, 2020. [Online]. Available: https://www.pv-magazine.com/2020/01/16/masdar-to-build-145-mw-of-floating-pv-in-indonesia/. [Accessed: 28-Oct-2020].

[14] SolarGis, "SolarGis PVPlanner," 2017. [Online]. Available: http://solargis.info/pvplanner. [Accessed: 01-Mar-2017].

[15] E. Tarigan, Djuwari, and L. Purba, "Assessment of PV Power Generation for Household in Surabaya Using SolarGIS–pvPlanner Simulation," *Energy Procedia*, vol. 47, pp. 85–93, 2014.

[16] S. Sreenath, K. Sudhakar, A. F. Yusop, E. Solomin, and I. M. Kirpichnikova, "Solar PV energy system in Malaysian airport: Glare analysis, general design and performance assessment," *Energy Reports*, vol. 6, pp. 698–712, Nov. 2020.

[17] E. Tarigan, "Simulation and feasibility studies of rooftop PV system for university campus buildings in Surabaya, Indonesia," *Int. J. Renew. Energy Res.*, vol. 8, no. 2, pp. 895–908, 2018.

[18] E. Tarigan, Djuwari, and F. D. Kartikasari, "Techno-economic Simulation of a Grid-connected PV System Design as Specifically Applied to Residential in Surabaya, Indonesia," *Energy Procedia*, vol. 65, pp. 90–99, 2015.

[19] E. Tarigan, Djuwari, and F. D. Kartikasari, "Techno-economic Simulation of a Grid-connected PV System Design as Specifically Applied to Residential in Surabaya, Indonesia," in *Energy Procedia*, 2015, vol. 65, pp. 90–99.

[20] BPS Kota Surabaya, "Kota Surabaya Dalam Angka 2019," 2019. [Online]. Available: https://surabayakota.bps.go.id/publication.html?Publikasi%5BtahunJudul%5D=2019&Publikasi%5BkataKunci%5D=Surabaya+dalam+angka&yt0=Tampilkan.

[21] havenhillsynergy.com, "What you need to know about floating solar panels (floatovoltaics)," *havenhillsynergy.com*, 2020. [Online]. Available: https://havenhillsynergy.com/need-know-floating-solar-panels-floatovoltaics/. [Accessed: 01-Nov-2020].

[22] L. Liu, Q. Wang, H. Lin, H. Li, Q. Sun, and R. Wennersten, "Power Generation Efficiency and Prospects of Floating Photovoltaic Systems," in *Energy Procedia*, 2017, vol. 105, pp. 1136–1142.

[23] S. Gorjian, H. Sharon, H. Ebadi, K. Kant, F. B. Scavo, and G. M. Tina, "Recent technical advancements, economics and environmental impacts of floating photovoltaic solar energy conversion systems," *Journal of Cleaner Production*, vol. 278. Elsevier Ltd, 01-Jan-2021.

[24] A. El Hammoumi, A. Chalh, A. Allouhi, S. Motahhir, A. El Ghzizal, and A. Derouich, "Design and construction of a test bench to investigate the potential of floating PV systems," *J. Clean. Prod.*, vol. 278, Jan. 2021.

[25] E. Tarigan, Djuwari, and L. Purba, "Assessment of PV Power Generation for Household in Surabaya Using SolarGIS–pvPlanner Simulation," *Energy Procedia*, vol. 47, pp. 85–93, 2014.

[26] S. Oliveira-pinto and J. Stokkermans, "Assessment of the potential of di ff erent fl oating solar technologies – Overview and analysis of di ff erent case studies," *Energy Convers. Manag.*, vol. 211, no. November 2019, 2020.

IEEE
Advancing Technology for Humanity

UAEU
جامعة الإمارات العربية المتحدة
United Arab Emirates University

6TH INTERNATIONAL CONFERENCE ON RENEWABLE ENERGY: GENERATION AND APPLICATIONS (ICREGA)

TECHNICAL PROGRAM

ICREGA 2021

UAE UNIVERSITY, AL AIN, UNITED ARAB EMIRATES (UAE)
FEBRUARY 2ND TILL 4TH, 2021

الإمـــارات تبتكـــر
UAE INNOVATES
21-27 February 2021 21-27 فبراير

Organizers

Dr. Mahmoud F. Al Ahmad
General Chair

m.alahmad@uaeu.ac.ae

Dr. Khaula Al Kaabi
General Co-Chair

khaula.alkaabi@uaeu.ac.ae

Dr. Amine El Moutaouakil
Program Chair

a.elmoutaouakil@uaeu.ac.ae

Dr. Naeema Ibrahim Al Darmaki
Students Activities Chair

naeema.i@uaeu.ac.ae

Dr. Mohammed Noor Al Tarawneh
Logistics Chair

mn.altarawneh@uaeu.ac.ae

Dr. Adel Najar
Special issue coordinator

adel.najar@uaeu.ac.ae

Dr. Atef Abdrabou
Publicity Chair

atef.abdrabou@uaeu.ac.ae

Dr. Mohammed Abdul Ruhman Meetani
Social Activities Chair

mmeetani@uaeu.ac.ae

Dr. Eyas Mahmoud
Conference Secretary

emahmoud@uaeu.ac.ae

Important Updates and Information

ICREGA21

United Arab Emirates University

UNITED ARAB EMIRATES
MINISTRY OF ENERGY & INFRASTRUCTURE

IEEE Advancing Technology for Humanity

UAE INNOVATES

H.E. Suhail Al Mazrouei
Main Keynote Speaker , Minister of Energy and Infrastructure

6TH INTERNATIONAL CONFERENCE ON RENEWABLE ENERGY GENERATION AND APPLICATIONS

UNITED ARAB EMIRATES UNIVERSITY, AL AIN, UAE

2ND -4TH FEB 2021

Technical Program Committee

#	TPC member and affiliation
1	Dr. Said Al-Hallaj UIC salhallaj[at]allcelltech.com
2	Prof. Mohammednoor Altarawneh UAEU mn.altarawneh[at]uaeu.ac.ae
3	Mr. M. Danang Birowosuto Research Center for Physics mdbirowosuto[at]gmail.com
4	Dr. Rachid Errouissi UAEU rachid.errouissi[at]uaeu.ac.ae
5	Prof. Mohamed Farid The University of Auckland m.farid[at]auckland.ac.nz
6	Dr. Eyas Mahmoud United Arab Emirates University emahmoud[at]uaeu.ac.ae
7	Dr. Mohammed Meetani UAEU mmeetani[at]uaeu.ac.ae
8	Dr. Yahya Meziani Universidad de Salamanca meziani[at]usal.es
9	Dr. Adel Najar UAEU adel.najar[at]uaeu.ac.ae
10	Prof. Hamid Nebdi Chouaïb Doukkali University nebdi.h@ucd.ac.ma
11	Prof. Padmanaban Sanjeevikumar Aalborg University sanjeevi_12[at]yahoo.co.in
12	Dr. Rahmat Agung Susantyoko Dubai Electricity and Water Authority rahmat.susantyoko[at]dewa.gov.ae

PROGRAM AT A GLANCE

TUESDAY
2ND FEBRUARY 2021

08:45 AM UNITIL 08:50 AM

UAE NATIONAL ANATHEM

OPENING REMARKS: DR MAHMOUD F. AL AHMAD, CONFERENCE CHAIRMAN & DR KHAULA ALKAABI, CONFERENCE CO-CHAIR

08:50 AM UNTIL 09:00 AM

WELCOMING SPEECH: H.E. ZAKI NUSSEIBEH, MINISTER OF STATE AND CHANCELLOR OF UAE UNIVERSITY

09:00 AM UNITIL 09:15 AM

DIALOGUE SESSION WITH H.E. SUHAIL MOHAMED FARAJ AL MAZROUEI, MINISTER OF ENERGY AND INFRASTRUCTURE

09:15 AM UNITIL 10:15 AM

PROFESSOR RACHID YAZAMI, PROFESSOR EMMANOPANEL DISCUSSION: "CHALLENGES AND OPPORTUNITIES FOR GREEN ENERGY TECHNOLOGY DEPLOYMENT". PANELISTUIL M TENTZERIS, PROFESSOR SAIFUR RAHMAN. MODERATOR: PROFESSOR MICHAEL G. PECHT.

All of the above are on this link:

https://uaeu-ac-ae.zoom.us/j/93316451442?pwd=YTVCTW9HUHhjUnlKRHV5bE9RY0JZdz09

10:15 AM UNTIL 10:25 AM

KEYNOTE DR FATIMA TAHIR, IEEE UAE SECTION CHAIR

https://uaeu-ac-ae.zoom.us/j/93730607348

10:30 AM UNTIL 11:30 AM

KEYNOTE PROFESSOR RACHID YAZAMI, THE KEY ROLE OF LITHIUM BATTERIES IN THE FUTURE ENERGY TRANSITION

https://uaeu-ac-ae.zoom.us/j/95764945538?pwd=a2h5dkhpQTNEZDczcUpTRk9RdXpMQT09

01:00 PM UNTIL 03:50 PM

CONCURRENT TECHNICAL SESSIONS (S1)

https://uaeu-ac-ae.zoom.us/j/97991182326?pwd=QXNuNlowcUk0NllDMlJ1WC8ySU9yZz09

04:00 PM UNTIL 05:40 PM

CONCURRENT TECHNICAL SESSIONS (S2)

https://uaeu-ac-ae.zoom.us/j/98810195575?pwd=VkhLdUJNVTZXVEtPNHVTMnhVdThhUT09

04:00 PM UNTIL 05:40 PM

CONCURRENT TECHNICAL SESSIONS (S3)

https://uaeu-ac-ae.zoom.us/j/91779706442?pwd=cTc3T2VUcHdWWE40WW4wbzdyMHZZZz09

WEDNESDAY
3RD FEBRUARY 2021

09:00 AM UNTIL 11:30 AM

CONCURRENT TECHNICAL SESSIONS (S4)

https://uaeu-ac-ae.zoom.us/j/98884595420?pwd=UzVJUi8zTDY5WVRrUHFmY2daRjUrQT09

09:00 AM UNTIL 11:30 AM

CONCURRENT TECHNICAL SESSIONS (S5)

https://uaeu-ac-ae.zoom.us/j/92081768771?pwd=bllqQzU4bXlrR3lhbDM4dmNCbDNKQT09

01:00 PM UNTIL 04:10 PM

CONCURRENT TECHNICAL SESSIONS (S6)

https://uaeu-ac-ae.zoom.us/j/94398822409?pwd=MG9qcklILzJRT0lsaVNXbWJKbDBOZz09

04:20 PM UNTIL 06:00 PM

THURSDAY
4TH FEBRUARY 2021

09:00 AM until 11:50 AM

CONCURRENT TECHNICAL SESSIONS (S8)

https://uaeu-ac-ae.zoom.us/j/93720747655?pwd=Vy9ZVTljaTY2bW1DdGhMZEttZVhkdz09

09:00 AM until 11:30 AM

CONCURRENT TECHNICAL SESSIONS (S9)

https://uaeu-ac-ae.zoom.us/j/98740793952?pwd=VWhPTzlEOGRzTVk1N3dDT3VoZGtBdz09

05:00 PM until 05:50 PM

KEYNOTE PROFESSOR EMMANOUIL M TENTZERIS, "ZERO-POWER" FLEXIBLE WIRELESS MODULES FOR "GREEN" SMART CITIES, SMART PRECISION AGRICULTURE AND INTERNET OF THINGS APPLICATIONS

https://uaeu-ac-ae.zoom.us/j/93918745791?pwd=QnJ1algvbFJsSHdreWl2VlpUUG40Zz09

06:00 PM until 06:50 PM

KEYNOTE PROFESSOR SAIFUR RAHMAN, ROLE OF THE SMART GRID IN FACILITATING THE INTEGRATION OF RENEWABLES

https://uaeu-ac-ae.zoom.us/j/95620711722?pwd=S2pzNmFEcUJwU1RxajBDNDNESWxKZz09

06:55 PM until 07:00 PM

CLOSING CEREMONY

https://uaeu-ac-ae.zoom.us/j/99704365114?pwd=b0RrWHhmNnVUN1dYMDFSWVRaeTg5QT09

CONCURRENT TECHNICAL SESSIONS

S1: Harvesting, Materials and Storage I [Tuesday, 01:00 pm - 03:50 pm]

S2: Solar cells and PV I [Tuesday, 04:00 pm - 05:40 pm]

S3: Models and predictions I [Tuesday, 04:00 pm - 05:40 pm]

S4: Sustainability and Economic Considerations I [Wednesday, 09:00 am - 11:30 am]

S5: Models and predictions II [Wednesday, 09:00 am - 11:30 am]

S6: Hybrid and Electric Vehicles [Wednesday, 01:00 pm - 04:10 pm]

S7: Solar cells and PV II [Wednesday, 04:20 pm - 06:00 pm]

S8: Harvesting, Materials and Storage II [Thursday, 09:00 am - 11:50 am]

S9: Sustainability and Economic Considerations II [Thursday, 09:00 am - 11:30 am]

CONCURRENT TECHNICAL SESSIONS

S1: Harvesting, Materials and Storage I
[Tuesday, 01:00 PM until 03:50 PM]
Session Chair: Dr Mahmoud Al Ahmad m.alahmad@uaeu.ac.ae
https://uaeu-ac-ae.zoom.us/j/97991182326?pwd=QXNuNlowcUk0NllDMlJ1WC8ySU9yZz09

01:00 PM: Design methodology for efficient vibration energy harvester based on electromagnetic induction principle. Rim Abidi (UAE University, United Arab Emirates); Asma Abdelrazaq (UAE University, United Arab Emirates); Huda Al Nuaimi (UAE University, United Arab Emirates); Khulood Al Marzooqi (UAE University, United Arab Emirates); Mahmoud Alahmad (UAEU, United Arab Emirates).

01:20 PM: Porous Silicon NWs with FiTC-doped Silica Nanoparticles. Amine El Moutaouakil (United Arab Emirates University, United Arab Emirates); Mahmoud Al Ahmad (United Arab Emirates University, United Arab Emirates); Abdul Kareem Kalathil Soopy (United Arab Emirates University, United Arab Emirates); Adel Najar (UAEU, United Arab Emirates).

01:40 PM: Rf Energy Harvesting system for GSM900 and GSM 1800 bands. Marwan Malaeb (Rochester Institute of Technology, United Arab Emirates); Boutheina Tlili (Rochester Institute of Technology dubai, United Arab Emirates).

02:00 PM: Removal of heavy metals in sub-surface horizontal flow constructed wetland: approach to energy free treatment. Abdul Mannan Zafar (United Arab Emirates University, United Arab Emirates); Ifrah Kamil (University of Engineering and Technology Lahore, Pakistan); Asad Javed Bhutta (United Arab Emirates University, United Arab Emirates); Ashraf Aly Hassan (United Arab Emirates University & University of Nebraska Lincoln, United Arab Emirates); Zainab Cheema (University of Engineering and Technology Lahore, Pakistan); Aasiya Sarwar (University of Engineering and Technology Lahore, Pakistan); Mahnoor Ishtiaq (University of Engineering and Technology Lahore, Pakistan); Khalid Mehmood (Technical University of Cologne, Germany).

02:20 PM: Coffee Break

02:30 PM: Facile development of InP nanowires via metal-assisted chemical etching and their optical properties. Abdul Kareem Kalathil Soopy (United Arab Emirates University, United Arab Emirates); Adel Najar (United Arab Emirates University, United Arab Emirates, United Arab Emirates).

02:50 PM: Optical Properties of Porous InP Generated via Metal Assisted Chemical Etching. Abdul Kareem Kalathil Soopy (United Arab Emirates University, United Arab Emirates); Adel Najar (UAEU, United Arab Emirates).

03:10 PM: Identifying Highly Stable Structures of ABX3 Compounds: Cases of CaTiO3 and CsGeCl3 Perovskites. Fahhad H Alharbi (King Fahd University of Petroleum and Minerals, Saudi Arabia); Abduljabar Alsayoud (King Fahd University of Petroleum and Minerals, Saudi Arabia); Saad Alqahtani (King Fahd University of Petroleum and Minerals, Saudi Arabia).

03:30 PM: Modular Hybrid Energy System for Refugee Camps. Bassel Soudan (University of Sharjah, United Arab Emirates); Abdollah Masoud Darya (University of Sharjah, United Arab Emirates).

S2: Solar cells and PV I
[Tuesday, 04:00 pm until 05:40 pm]
Session Chair: Rachid Errouissi rachid.errouissi@uaeu.ac.ae

https://uaeu-ac-ae.zoom.us/j/98810195575?pwd=VkhLdUJNVTZXVEtPNHVTMnhVdThhUT09

04:00 PM: Analysis and Design of a Solar Home System. Md. Nasir Uddin (Northern University Bangladesh, Bangladesh); Zahidul Rony Islam (Northern University Bangladesh, Bangladesh).

04:20 PM: Design and Analysis of an AC Coupled Photovoltaic System for an Off-grid Community in Chittagong Hill Tracts. Subrata Das (SEMwaves Ltd., United Kingdom (Great Britain)); Yee Kwan Tang (University of Glasgow, United Kingdom (Great Britain)); Suman Marma (SEMwaves Ltd., United Kingdom (Great Britain)); Kamrul Hasan (SEMWaves Ltd, United Kingdom (Great Britain)); Kaysar Ahmed (J&C Impex Limited, Bangladesh); Azizun Nessa (Middlesex University, United Kingdom (Great Britain)); M. T. Bin Ali (SEMwaves Ltd., United Kingdom (Great Britain)); Sudip Kumar Pal (Chittagong University of Engineering and Technology, Bangladesh); Chong Li (Rankine Building & University of Glasgow, United Kingdom (Great Britain)); Dhou Aong Gya Marma (J&C Impex Limited, Bangladesh); Shimul Saha (SEMwaves Ltd., United Kingdom (Great Britain)).

04:40 PM: Embodiment Design and Detailed Design of a Pyramid Solar Still with an Automatic Feedwater System. Mahmoud M Elgendi (UAE University & Minia University, United Arab Emirates); Alyaa AlHefeiti (UAE University, United Arab Emirates); Houreyah Almarshoodi (UAE University, United Arab Emirates); Aysha Aldhaheri (UAE University, United Arab Emirates); Wafa Alshehhi (UAE University, United Arab Emirates); Mohamed Y. E. Selim (UAE University, United Arab Emirates).

05:00 PM: Power Flow Control of a Hybrid Battery/Supercapacitor Standalone PV System under Irradiance and Load Variations. Nahla Ezzeldin Zakzouk (Arab Academy for Science and Technology and Maritime Transport, Egypt).

05:20 PM: Simulation of the Floating PV System to Supply Electricity Demand for the City of Surabaya, Indonesia. Elieser Tarigan (University of Surabaya & Electrical Engineering, Indonesia).

S3: Models and predictions I
[Tuesday, 04:00 pm until 05:40 pm]
Session Chair: Dr Atef Amin Abdrabou atef.abdrabou@uaeu.ac.ae

https://uaeu-ac-ae.zoom.us/j/91779706442?pwd=cTc3T2VUcHdWWE40WW4wbzdyMHZZZz09

04:00 PM: Heat loss analysis of the linear Fresnel concentrator solar receiver. Dr Hani Beltaggy, Uniersitie de Tizi Ouzou, Algeria.

04:20 PM: Estimation of starting voltage of PEMFC by using statistical analysis and artificial neural networks. Amine Abbou (Mohammadia School of Engineers, Morocco); Saad Khan (United Arab Emirates University, United Arab Emirates); Abdennebi Hsnaoui (ENSM of Rabat, Morocco); Waqar Ali Sher (Bahaudin Zakaria University, Pakistan); Muhammad Haris (Multan, Pakistan); Faisal Yamin (Abaysn University Islamabad, Pakistan); Hussain Shareef (United Arab Emirates University, United Arab Emirates)

04:40 PM: Design and Analysis of a Morphing Trailing Edge System. Md Zishan Akhter (United Arab Emirates University, United Arab Emirates); Ahmed Ali (Nanyang Technological University, Singapore); Farag Omar (UAEU, United Arab Emirates)

05:00 PM: The Use of a Probabilistic Model for the Economic Operation and Lifetime Extension of a Photovoltaic-Wind Distribution Network. Amir Abdul Majid (University of Science and Technology of Fujairah, United Arab Emirates)

05:20 PM: Managing Energy Consumption of Wireless Multipath TCP Connections Using Software-Defined Networking: A Review. Ramiza Shams (UAE University, United Arab Emirates); Atef Abdrabou (UAE University, United Arab Emirates)

6TH INTERNATIONAL CONFERENCE ON RENEWABLE ENERGY: GENERATION AND APPLICATIONS (ICREGA)

جامعة الإمارات العربيـة المتحدة
United Arab Emirates University

CERTIFICATE

This certificate is awarded to

ELIESER TARIGAN

AS PRESENTER

IN

The "6th International Conference on Renewable Energy: Generation and Applications, ICREG'21"

Amine El Moutaouakil

ICREGA'21 Conference Chair

United Arab Emirates University