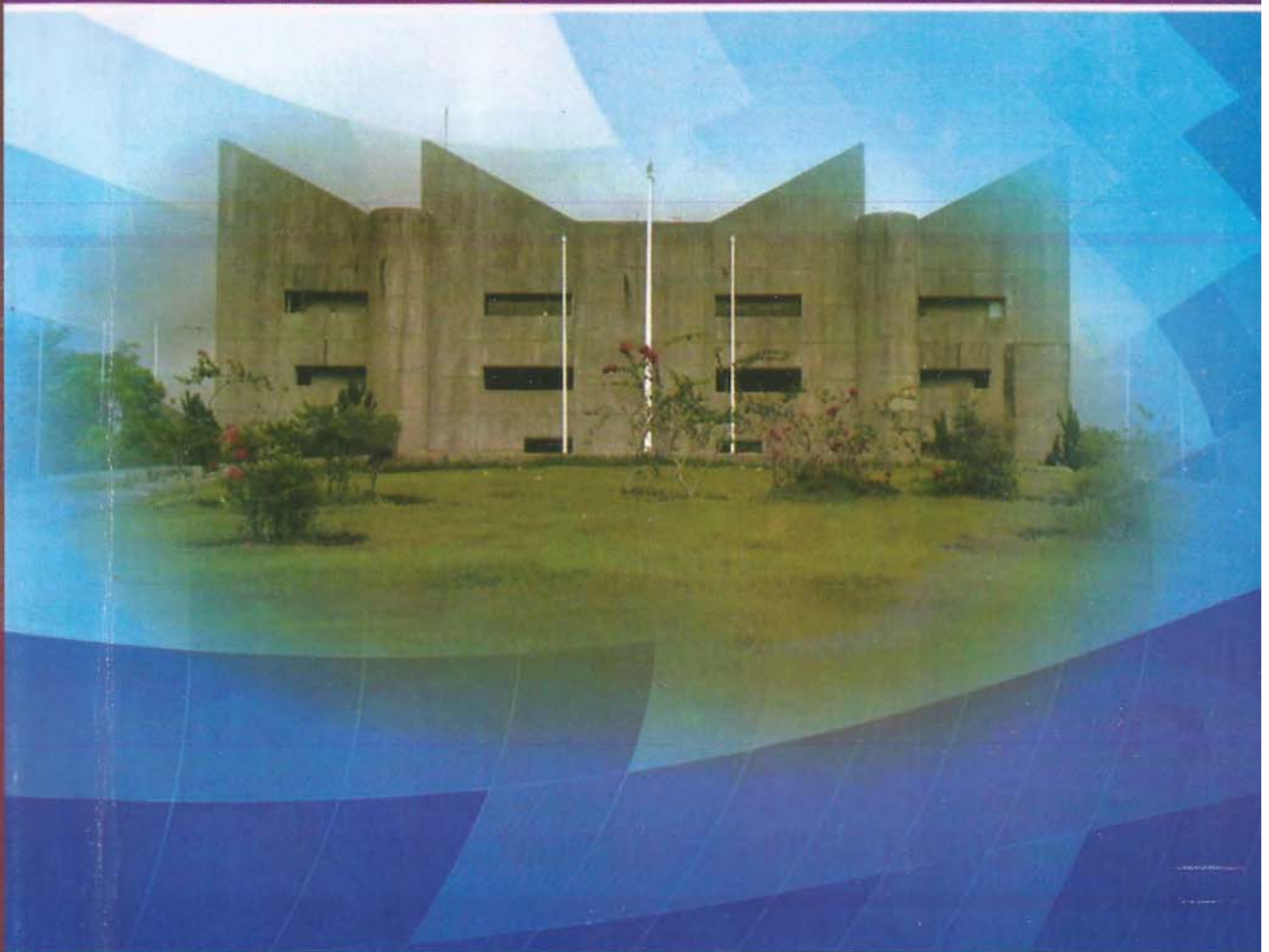




# PROGRAM BOOK

## THE 1<sup>ST</sup> CONFERENCE ON INNOVATION IN TECHNOLOGY AND ENGINEERING SCIENCE

Grand Inna Padang Hotel, West Sumatera, Indonesia  
November 8<sup>th</sup> - 9<sup>th</sup>, 2018



Supported by



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## Keynote Speakers



**Prof. Dr. Hadi Nur**

*Director, Centre for Sustainable Nanomaterials, Ibnu Sina Institute for Scientific and Industrial Research, Universiti Teknologi Malaysia*

*“Unveiling the Structure-activity Relationship in Material Science: Some Examples in Photocatalyst and Catalyst Materials”*

**Prof. Dr. Andrivo Rusydi**

*National University of Singapore  
NUS Nanoscience & Nanotechnology Initiative  
“More than Moore and Beyond”*



**Ir. Insannul Kamil, M.Eng, Ph.D, IPM**

*Dean, Faculty of Engineering, Universitas Andalas  
Director, Center for Innovation Studies (CINS)  
Universitas Andalas*

*“The Roles of Dams on Sustainable Water, Food and Energy Security Issues: A Global Perspective for Indonesia”*

**Prof. Dr. David Zhang**

*University of Exeter, United Kingdom  
Director, Exeter Manufacturing and Enterprise Centre  
(XMEC)*

*“Metal 3D Printing: New Technology Advances and Future Management Research to Open up its Potential”*



**Prof. Dr. Hikita Masayuki**

*Kyushu Institute of Technology, Japan*

*“Electrical Insulation Technology in Power Apparatus and Power Electronics”*

	<i>Krisadinata, Remon Lapisa, Asnil</i>
16.00 - 16.15	<b>ID 567</b> PWM Speed Control of DC Permanent Magnet Motor using PIC18F4550 Mikrocontroller <i>Mira Wellya Fatma, Muhammad Imran Hamid</i>
16.15 - 16.30	<b>ID 620</b> Robot Mobile Control Based on Three EMG Signals Using Artificial Neural Network <i>M Ilhamdi Rusydi, Illa Aryeni, Joefrinaldo, Zhulfan Romadhon, Andriyo Rusydi</i>
16.30 - 16.45	<b>ID 554</b> Performance Evaluation Image Transmission using Diversity Selection Combining Technique <i>Baharuddin, Rina Angraini</i>
16.45 - 17.00	<b>ID 622</b> Towards Hand Gesture Based Control of Virtual Keyboards for Effective Communication <i>M Ilhamdi Rusydi, Oktrison, Willy Azhar, O Williams Samuel, Febdian Rusydi</i>

**Room-5** : Kuantan 2  
**Topics** : Electrical Engineering  
**Session Chair** : Dr. Eng. Abdul Rejab

Time	Presentation
15.30 - 15.45	<b>ID 466</b> Design of Poka-yoke System Based on Fuzzy Neural Network for Rotary-Machinery Monitoring <i>Mumuh Muharam, Melda Latif</i>
15.45 - 16.00	<b>ID 542</b> Multichannel Audio Steganography Based on MPEG Surround using Direct Sequence Spread Spectrum <i>Micko Tomas, Baharuddin, Ikhwana Elfitri</i>
16.00 - 16.15	<b>ID 486</b> Understanding Public Perception of Domestic Solar Water Heating System: Case Study in Surabaya, Indonesia <i>Elieser Tarigan, Kenneth Ritter</i>
16.15 - 16.30	<b>ID 607</b> Design of Fuzzy Logic Controller for Temperature Control of Small-scale Food Storage <i>Melda Latif, Mumuh Muharam, Darmawan, Darwison, Reynaldo Revila Costa</i>
16.30 - 16.45	<b>ID 597</b> Dipole Planar Bowtie Printed Antenna for ISM Application <i>Hanalde Andre, Rudy Fernandez, Baharuddin</i>
16.45 - 17.00	<b>ID 662</b> Comparison of Partial Discharge Signal Denoisation Results using Hard Threshold and Soft Threshold Methods and Wavelet Transformation with Some Levels <i>Arpan Zaeni, Tria Kasnalestari, Umar Khayam</i>

**Room-6** : Arau  
**Topics** : Civil Engineering  
**Session Chair** : Taufika Ophyandri, Ph.D

Time	Presentation
15.30 - 15.45	<b>ID 178</b> The Effects of the Distance Between Groundsill and Double Cylinder-Piers Against the Scour Patterns <i>Muhammad Thaahaa, Mas Mera</i>
15.45 - 16.00	<b>ID 450</b> Identification of Construction Management System (CMS) in Construction Projects In Padang City <i>Benny Hidayat, Akhmad Suraji, Rio Frankly</i>
16.00 - 16.15	<b>ID 600</b> Shear Behavior of Fly Ash Reinforced Concrete Beam Without Shear Reinforcement <i>Ari Endra Nasution, Ruddy Kurniawan, Rendy Thamrin</i>
16.15 - 16.30	<b>ID 456</b> Analysis of Maintenance Management and building Care In State University of Padang (Case Study of Educational And Office Building In State University of Padang) <i>Budi A Kombino, Benny Hidayat, Taufika Ophyandri</i>
16.30 - 16.45	<b>ID 556</b> Infrastructure Maintenance System for Community Development Projects to Improve the Quality of Infrastructure Services in West Sumatra Province <i>Gusni Vitri, H Herman</i>
16.45 - 17.00	<b>ID 459</b> Building Official's Awareness in Term of Building Permit System in Indonesia <i>Eka Juliafad, Totoh Handayono</i>

### Parallel Sessions III

**Date** : November 9, 2018 (Friday)

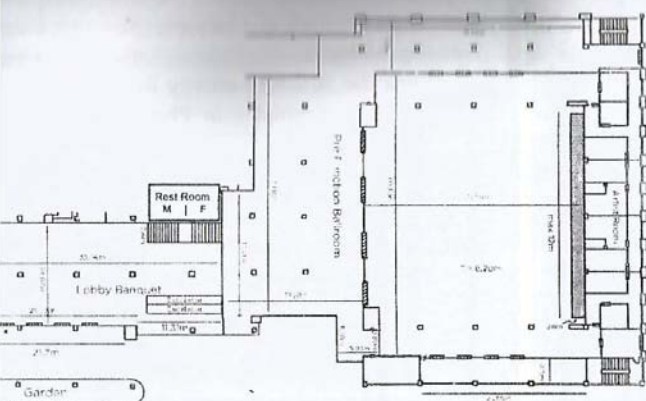
**Time** : 10.15 - 11.45

**Room-1** : Sumpur  
**Topics** : Industrial Engineering  
**Session Chair** : Elita Amrina, Ph.D

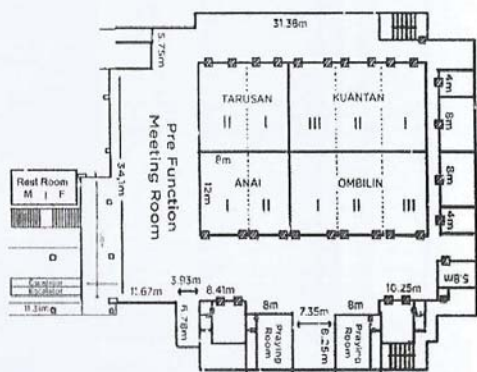
Time	Presentation
10.15 - 10.30	<b>ID 427</b> Analysis of the Application of Quality Management Systems in Rubber Industry Based on ISO 9001:2015 <i>Nofriani Fajrah, Nilda Putri, Elita Amrina</i>
10.30 - 10.45	<b>ID 575</b> Optimisation of Significant Factors of Cement Compressive Strength at PT Semen Padang <i>Prima Fithri, Difana Melani, Nilda Tri Putri, Chatimah F H</i>

Conference Venue

LAYOUT PADANG CONVENTION CENTER 1<sup>ST</sup> FLOOR



LAYOUT PADANG CONVENTION CENTER GROUND FLOOR



Conference Program

Day-1: November 8, 2018 (Thursday)

Time	Activity
07.30 - 08.30	Registration
08.30 - 10.00	Opening Ceremony Room: Ball Room
08.30 - 08.40	1. Safety Induction
08.40 - 08.50	2. Recital of Holy Qur'an
08.50 - 09.00	3. National Anthem: Indonesia Raya
09.00 - 09.15	4. Pasambahan Dance
09.15 - 09.25	5. Welcome Message: CITES 2018 Chair - Prof. Dr. Eng. Gunawarman
09.25 - 09.40	6. Welcome Speech and Conference Opening: Rector of Andalas University - Prof. Dr. Taidil Husni, SE, MBA
09.40 - 09.50	7. Traditional Dance
09.50 - 10.00	8. Do'a
10.00 - 10.30	Coffee Break
10.30 - 12.00	Keynote Sessions I Moderator: Ismet Hari Mulyadi, Ph.D Room: Ball Room
10.30 - 11.00	Keynote 1 "Unveiling the Structure-activity Relationship in Material Science: Some Examples in Photocatalyst and Catalyst Materials" Prof. Dr. Hadi Nur Director, Centre for Sustainable Nanomaterials, Ibnu Sina Institute for Scientific and Industrial Research, Universiti Teknologi Malaysia
11.00 - 11.30	Keynote 2 "More than Moore and Beyond" Prof. Dr. Andriwo Rusydi National University of Singapore NUS Nanoscience & Nanotechnology Initiative
11.30 - 12.00	Q & A
12.00 - 13.30	Lunch Break

13.30 - 15.00	Room-1: SUMPUR Room-3: OMBILIN 1 Room-5: KUANTAN 2	Room-2: OMBILIN 2 Room-4: KUANTAN 1 Room-6: ARAU
15.00 - 15.30	Coffee Break	
	Parallel Sessions II	
15.30 - 17.00	Room-1: SUMPUR Room-3: OMBILIN 1 Room-5: KUANTAN 2	Room-2: OMBILIN 2 Room-4: KUANTAN 1 Room-6: ARAU
17.00 - 19.00	Preparing to Gala Dinner	
19.00 - 21.00	Gala Dinner PIC: Dr. Oknovia Susanti Room: Ball Room	

Day-2: November 9, 2018 (Friday)

Time	Activity
07.00 - 08.00	Registration
08.00 - 09.30	Keynote Sessions II Moderator: Feri Afrinaldi, Ph.D Room: Ball Room
08.00 - 08.30	Keynote 3 "The Roles of Dams on Sustainable Water, Food and Energy Security Issues: A Global Perspective for Indonesia" <b>Ir. Insannul Kamil, M.Eng, Ph.D, IPM</b> Dean, Faculty of Engineering, Universitas Andalas Director, Center for Innovation Studies (CINS) Universitas Andalas
08.30 - 09.00	Keynote 4 "Metal 3D Printing: New Technology Advances and Future Management Research to Open up its Potential" <b>Prof. Dr. David Zhang</b> University of Exeter, United Kingdom Director, Exeter Manufacturing and Enterprise Centre (XMEC)
09.00 - 09.30	Keynote 5 "Electrical Insulation Technology in Power Apparatus and Power Electronics" <b>Prof. Dr. Hikita Masayuki</b> Kyusyu Institute of Technology, Japan

10.00 - 10.15	Coffee Break	
	Parallel Sessions III	
10.15 - 11.45	Room-1: SUMPUR Room-3: OMBILIN 1 Room-5: KUANTAN 2	Room-2: OMBILIN 2 Room-4: KUANTAN 1 Room-6: ARAU
11.45 - 13.30	Lunch Break	
	Parallel Sessions IV	
13.30 - 15.00	Room-1: SUMPUR Room-3: OMBILIN 1 Room-5: KUANTAN 2	Room-2: OMBILIN 2 Room-4: KUANTAN 1 Room-6: ARAU
15.00 - 15.30	Coffee Break	
15.30 - 16.30	Closing Ceremony PIC: Elita Amrina, PhD Room: Ball Room	

Day-3: November 10, 2018 (Saturday)

Time	Activity
08.00 - 18.00	Conference Tour PIC: Elita Amrina, PhD Picking Point: Grand Inna Padang Hotel

Room-4 : Kuantan 1  
 Topics : Electrical Engineering  
 Session Chair : Prof. Dr.Eng. Ariadi Hazmi

Time	Presentation
13.30 - 13.45	<b>ID 428</b> Design and Implementation of Microstrip Patch Ultra-wide Band Antenna for Detection of UHF Partial Discharge <i>Z Nawawi, M A B Sidik, M I Jambak, N Ahmad, M H Ahmad, C L G P Kumar, E P Waldi, Aulia</i>
13.45 - 14.00	<b>ID 433</b> Overcurrent Relay Coordination with Grid-Connected and Islanding Capability on Distribution Network with Distributed Generation <i>Adrianti, Sri Wahyuni, Muhammad Nasir</i>
14.00 - 14.15	<b>ID 660</b> Modification of Arm Patch of Double Layer Printed Antenna for Partial Discharge Detection <i>Umar Khayam, Yuda Muhammad Hamdani</i>
14.15 - 14.30	<b>ID 558</b> Development of HFCT seonsor for partial discharge sensors <i>E P Waldi, A Y Frenzi, R Fernandez, Darmawan, Darwison, H D Laksono, Aulia, Novizon, A Hazmi, H Abral, S Arief, Z Nawawi, M H Ahmad, N Hozumi</i>
14.30 - 14.45	<b>ID 661</b> Design and Application of Trapezoid Periodic Log Antenna to Detect Partial Discharge <i>Umar Khayam, Arpan Zaeni, Miftahul Husna</i>
14.45 - 15.00	<b>ID 534</b> Partial Discharge Pulses Characteristics of LDPE-NR Bionanopolymer as The Electrical Insulation under AC Voltage <i>Aulia, Eka Putra Waldi, Darwison, Novizon, M Heru Setiawan, Dwi Gustiono, Dody Andi Winarto, Yoggi Nugraha, M A Hafizi, Zainuddin Nawawi, M Abubakar Sidik</i>

Room-5 : Kuantan 2  
 Topics : Electrical Engineering  
 Session Chair : Dr. Eng. Ilhamdi Rusydi

Time	Presentation
13.30 - 13.45	<b>ID 514</b> Real Time Condition Monitoring System of Gapless Arrester Based on ZigBee Protocol and Third Harmonic Leakage Current as Indicator Parameters <i>Novizon, S Aliffianti Ulfiah, Z Abdul Malek, Syaifi, N Riska, Aulia, Darwison</i>
13.45 - 14.00	<b>ID 515</b> Condition Based Monitoring of Gapless Surge Arrester Using Electrical and Thermal Parameters <i>Novizon, Z Abdul Malek, Syaifi, M H Ahmad, Aulia, S Aliffianti Ulfiah</i>

	<i>Aulia, Eka Putra Waldi, M Heru Setiawan, Dwi Gustiono, Darwison, Novizon, Yoggi Nugraha, Abdurrahman, M A Hafizi, Zainuddin Nawawi</i>
14.15 - 14.30	<b>ID 516</b> Power Loss Estimation of Polymeric Housing Surge Arrester using Leakage Current and Temperature Approach <i>Novizon, Z Abdul Malek, M H Ahmad, E P Waldi, H D Laksono, N Riska</i>
14.30 - 14.45	<b>ID 580</b> Morphological Characteristic of Preliminary Breakdown Pulses of Hybrid Intra Cloud - Negative Cloud to Ground Lightning on Low Latitude Region <i>Primas Emeraldi, Muhammad Imran Hamid, Ariadi Hazmi</i>
14.45 - 15.00	<b>ID 611</b> Characteristics of acoustic signals from lightning using a microphone array observation system <i>Ariadi Hazmi</i>

Room-6 : Arau  
 Topics : Environmental Engineering  
 Session Chair : Dr. Eng. Slamet Raharjo

Time	Presentation
13.30 - 13.45	<b>ID 479</b> The Use of Protein Binder from Shaving Waste for Leather Finishing: Looking from the Physical, Chemical, and Morphological Properties of Lizard Skin Leather <i>Sri Sutycemi, Iwan Fajar Pahlawan, Gresy Griyanitasari</i>
13.45 - 14.00	<b>ID 483</b> Food Packaging Development of Bioplastic from Basic Waste of Cassava Peel (Mauritan utilisima) and Shrimp Shell <i>Dasumiati, N Saadawi, M Malik</i>
14.00 - 14.15	<b>ID 617</b> Preliminary Study of Solid Waste Management of Tourist Area in Pariaman City <i>Rizki Aziz, Amira</i>
14.15 - 14.30	<b>ID 628</b> The Effect of Additional Vegetables and Fruits Waste on the Quality of Compost of Cassava City Industry Solid Waste on Takakura Composter <i>Yommi Dewilda, Rizki Aziz, Adh Inaningsari</i>
14.30 - 14.45	<b>ID 505</b> Minimization of Hazardous Solid Waste (HHSW) with 4R Concepts (Reduce, Reuse, Recycle and Recovery) in Padang City, Indonesia <i>Yenni Ruslinda, Slamet Raharjo, Yenni Ruslinda, Hidayatullah, Rizki Aziz</i>
14.45 - 15.00	<b>ID 539</b> Greenhouse Gas Emission in Urban Area <i>Muchlis Alahudin, Reimsyah H. Alahudin, Dwi Laksmi Susantiningih</i>

Room-2 : Ombilin 2  
 Topics : Mechanical Engineering  
 Session Chair : Dr. Eng. Jhon Malta

Time	Presentation
13.30 - 13.45	<b>ID 530</b> The Influence of Number of Solution Candidate on Performance of Boundary Element Inverse Analysis in Detecting Rebar Corrosion <i>Syarizal Fonna, Gunawarman, Syifaul Huzni, A K Ariffin</i>
13.45 - 14.00	<b>ID 557</b> Corrosion Resistance of $\beta$ type titanium (TNTZ) in NaCl 3% Solution <i>Jon Affi, Yuli Yetri, Nurbaiti, H Fajri, Syafrizal Fonna, Gunawarman</i>
14.00 - 14.15	<b>ID 599</b> Atmospheric Corrosion Map of Structural Steel in Industrial Area: A Preliminary Investigation <i>Syifaul Huzni, Affandi, Iqbal Tanjung, Syarizal Fonna</i>
14.15 - 14.30	<b>ID 624</b> Corrosion Potential of Reinforced Steel in Reinforced Concrete in Kabupaten Bireun: Analysis of Ground Water Content Used as a Concrete Mixture <i>Kurnia R D I, Suhaimi, Syifaul Huzni, Syarizal Fonna</i>
14.30 - 14.45	<b>ID 669</b> Corrosion Behavior of Ti6Al4V ELI Coated Bioceramics in Artificial Saliva at Fluctuating Temperatures <i>Riza Muharni, Gunawarman, Yuli Yetri</i>
14.45 - 15.00	<b>ID 649</b> Analysis of Cutting Forces and Surface Roughness of Fibre Reinforced Polymer for End Mill Processes <i>Firman Ridwan, Refki Havendri, Oknovia Susanti, Gusriwandi, Yulhizhar</i>

Room-3 : Ombilin 1  
 Topics : Electrical Engineering  
 Session Chair : Dr. Eng. Rahmadi Kurnia

Time	Presentation
13.30 - 13.45	<b>ID 497</b> Performance of Impedance Measurement Algorithm Applied in Line with Compensation Circuit <i>Nanang Rohadi</i>
13.45 - 14.00	<b>ID 605</b> Improving the Quality and Quantity of Cinnamon Drying Process Using Art Cave in Lambung Bukit West Sumatra <i>Amimul Ummah Baiqi, Pepi Putri Utami, Dicky Anugrah, Ade Al Fauzan, Windi Surya Ningsih, Muhammad Ihsamdi Rusydi</i>
14.00 - 14.15	<b>ID 500</b> Parametric Sensitivity Analysis of SEL-421 Distance Relay Algorithms Used in Compensated Line <i>Nanang Rohadi</i>
14.15 - 14.30	<b>ID 486</b> Understanding Public Perception of Domestic Solar Water Heating System: Case study in Surabaya, Indonesia <i>Ehezzer Turijuan, Kenneth Bites</i>

13.45 - 15.00  
 A. Rajab, F. E. Putra, J. S. Ramadhani, M. S. I. Situngkir, K. Kurniawan, K. Qibran, Melda L. M. I. Hamid  
**ID 674** Experiment of a Two-stage Propeller Wind Turbine in a Wind Tunnel Under Various Mechanical Loads  
*Uyung Gatot S. Dinata, Muhammad Harris*

Room-4 : Kuantan 1  
 Topics : Environmental Engineering  
 Session Chair : Dr. Eng. Shinta Indah

Time	Presentation
13.30 - 13.45	<b>ID 667</b> Utilization of Activated Bentonites as Adsorben Phosphor Elements Contained in WWTP Factory Palm Oil <i>Susila Arita, Widi Hartati, Lusi Septiarni, Desfournatalia, Naswir M.</i>
13.45 - 14.00	<b>ID 468</b> Fatigue Analysis to Driver of Intercity in Province (AKDP) West Sumatra A Case Study Route of Padang Bukittinggi Payakumbuh <i>Taufiq Ihsan, Yaumul Arbi, Intan Purnama Sari</i>
14.00 - 14.15	<b>ID 633</b> Molecular identification of lactic acid bacteria potentially as starter isolated from biogas sludge made by cattle feces and the application of biogas into elpiji tube <i>N Sari, H Purwanto, I Suliansyah and E Purwati</i>
14.15 - 14.30	<b>ID 668</b> Spatial Distribution of Coliform Bacteria in Batang Arau River, Padang, West Sumatera, Indonesia <i>Denny Helard, Shinta Indah, M. Wilandari</i>
14.30 - 14.45	<b>ID 655</b> Analysis of Water Balance Maninjau Lake West Sumatera <i>Sunarya, Yen Dwi Nola, Bambang Istijono, Junaidi</i>
14.45 - 15.00	<b>ID 691</b> Critical Success Factors in Post-Disaster Reconstruction, Lesson Learnt for Reconstruction Plan <i>Taufika Dhiyandri, Benny Hidayat, Bambang Istijono</i>

Room-5 : Kuantan 2  
 Topics : Industrial Engineering  
 Session Chair : Dr. Eng. Desto Jumeno

Time	Presentation
13.30 - 13.45	<b>ID 434</b> Gap Analysis Between Production and Market Demand of Parahub Oil in West Pasamar Using System Dynamic <i>Inda Rahmayanti, Santosa, Novizar Nazir, Rika Ampuh Hadiguna</i>
13.45 - 14.00	<b>ID 657</b> The Evaluation of Bullwhip Effect on Distribution System of a Supply Chain Using Centralised Demand Information <i>Mahdi, Iqbal, Sholahudin, Ayu Bidiawati JR, Melani Eka Sari</i>
14.00 - 14.15	<b>ID 485</b> The Location-allocation Decision under the Dynamic Movement of Demand for Selecting the Local Distribution Center

# Understanding Public Perception of Domestic Solar Water Heating System: Case study in Surabaya, Indonesia

Elieser Tarigan<sup>1</sup>, Kenneth Ritter<sup>2</sup>

<sup>1</sup>Department of Electrical Engineering and Center for Renewable Energy Studies, PSET, University of Surabaya, Jl. Raya Kalirungkut, Surabaya 60292, Indonesia  
<sup>2</sup> European Solar Energy School, Dalarna University, Borlange 78100, Sweden

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**Abstract.** The present study deals with identification of causal factors and challenges in diffusion of solar water heating systems, particularly in the region of Surabaya, Indonesia. The study was carried out by surveying the residents and asking for their views as well as suggestions for the implementation. The study is intended to spread some awareness which will contribute to interest in solar water heating. It was found that the cost and awareness are the main issues in confining the utilization of SWH in Surabaya.

## 1. Introduction

Indonesia has had 7% increase in the demand for electricity in the last few years of which about 87% is from fossil fuels [1], [2]. As the reserves of fossil fuels are rapidly decreasing the electricity and fuel prices are increasing at an alarming rate. If no reduction occurs this will continue to grow at higher rates leading to scarcity and continuous increase in energy prices. Although the electricity tariff has increased by 15% just last year another 15% is predicted for 2020 therefore action should be taken to reduce the consumption of oil and gas [3]. Using alternate energy such as renewables as well as increasing their energy efficiency is vital for future generations.

Electricity being the most popular energy carrier is used in many household applications such as water heating, air conditioning, refrigeration, and lighting. Large amounts of Indonesia's scarce capital are invested in the generation, transmission, and distribution of electricity. As a large quantity of the consumption is going to household appliances the use of these is an important factor in energy consumption [4], [5]. To properly manage the energy demand action should be taken in the replacement of large electricity consuming appliances with ones that use renewable resources. Solar water heating (SWH) can be considered a realistic alternative especially in a tropical climate like in Indonesia.

Surabaya, Indonesia's climate seems to be very suitable for solar water heaters but they are not being utilized. There is economic, social, and environmental benefits that will accrue from using solar water heating as opposed to conventional water heating methods. With all these benefits, why are Surabaya residents still using conventional water heaters?

Solar water heating or heating water using solar energy utilizes natural sources of energy that do not run out. Using renewable energy in the domestic sector will not only save monthly energy bills but also reduce an individual's dependence on fossil fuels. As the demand of oil and natural gas has

increased each year in Surabaya, residents can not continue their current consumption trends until their resources are exploited.

There are many environmental benefits as well when compared with conventional hot water heaters (HWH) using electricity or gas which has a limited supply [6]. The conventional energy being used in the domestic sector for water heating can be significantly reduced by wide spread utilization of SWHs. Switching one electric HWH to a SWH can potentially reduce carbon emission by an average of 2.5-3.0 tonnes per year [7].

The present study deals with identification of causal factors and challenges in diffusion of solar water heating systems in the region. To assess the challenges in diffusion of SWH systems residents were questioned for their views as well as suggestions for the implementation. Also this research is intended to spread some awareness which will contribute to interest in solar water heating amongst Surabaya residents.

## **2. Methods**

Surveys were conducted for residents living in the city of Surabaya, Indonesia to assess the public perception. The surveys were designed to investigate various water heating practices and to make a preliminary assessment of the willingness of the potential users to adopt solar water heating systems to meet their hot water demand. The questions were dealt with the following issues:

- Desire in solar water heating
- Desire to use solar water heating
- Problem with solar water heating system
- Suggestions to implement solar water heating
- Concerns with solar water heating

A number of methods were used for survey distribution. A website was created and links were sent through email. In addition a Facebook page was created with links also distributed. Besides, flyers were made with take away links to the website and posted at various locations. All these methods were used because of translation issues from Indonesian to English. The surveys were in Bahasa (Indonesian language) along with the answers, and the results can easily be tabulated. About 200 respondents replied and answered the questionnaire.

## **3. Results and discussions**

Residents were surveyed regarding interest and desire to use solar water heating. Figure 1 shows the results interest and desire for using SWH. Regardless whether or not they currently used water heating 82% of surveyees were interested. Not only were they interested in learning more about the benefits of SWH the vast majority desires to use one. This can only lead to the question of: Why is solar water heating not being utilized? Although the answer to this question varies widely amongst consumers the most common answers are shown in Figure 2. The results were categorized into five groups shown below. The questionnaire allowed surveyees to select multiple answers ranking which they thought was more important. The most common first answer was low awareness followed by high cost. The most common second answer was high cost and this was most commonly select after selecting low awareness as the first choice. Many surveyees whom did not use water heating commented that there was little demand. Stating that with the tap water here running between 27 and 28°C there is little need for water heating. Although showering with warm water can be generally thought to be more relaxing and comfortable for some others see it as unnecessary. Lack of support for installation and maintenance and no roof space were the least selected reasons why the lack of SWH utilization in Surabaya. Although Surabaya is a large city population wise the majority of individual homes do not share roofs leaving adequate space for the installation of SWH.

Residents were also asked about suggestions on how to implement SWH in Surabaya and many results were obtained (see Figure 3). The results are categorized into the five most common answers and the weight or percentage is the amount of people whom answered one of these in comparison with the other four possible answers. In other word all other answers that did not fall into these five

categories were omitted from the percentages. The majority of the answers related to different ways of spreading information to educate potential users on benefits of SWH. Some of the suggestions included holding

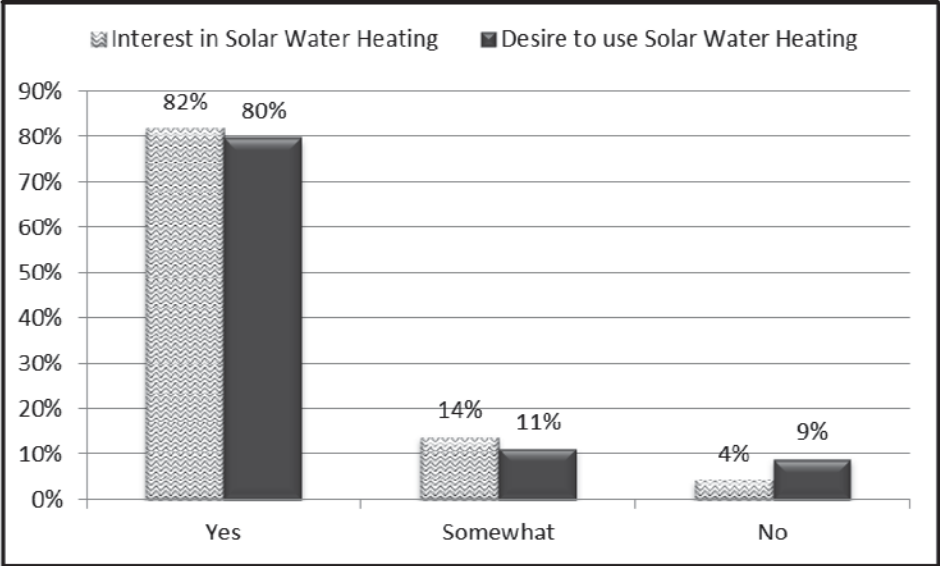


Figure 1. Interest in and desire to use SWH

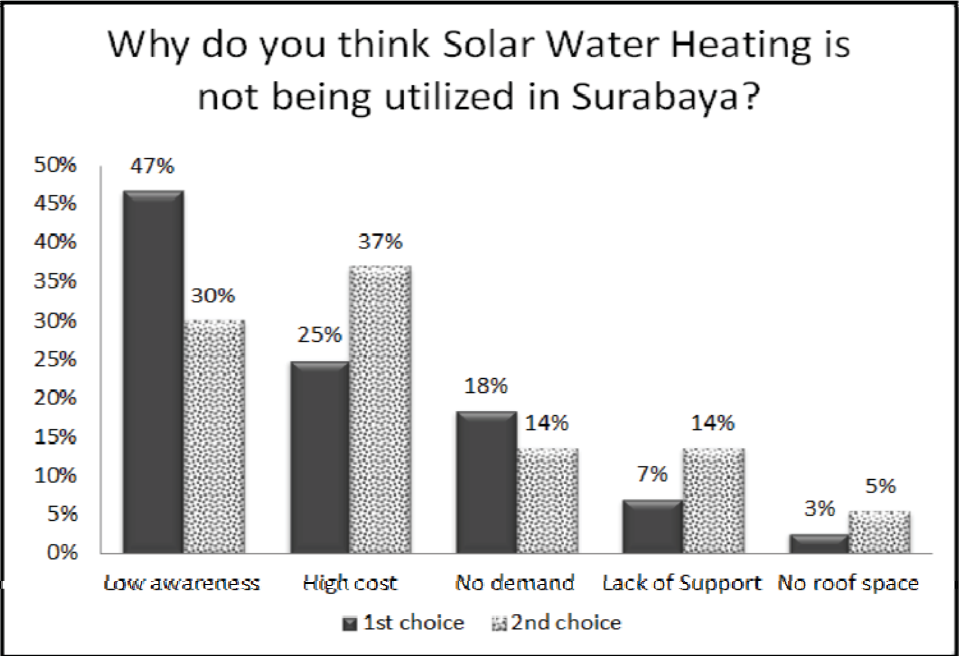


Figure 2. Problems with SWH utilization in Surabaya

a seminar and advertising with billboards. The next most common suggestion was locate a more financially feasible price as this is not available right now in Surabaya. As of now the potential to install a local SWH only caters to the upper class. Several people suggested that SWHs should cater to public places such as hospitals which were the most common one. Other suggestions included increasing the technology so that the collector could provide multiple services such as air conditioning along with water heating.

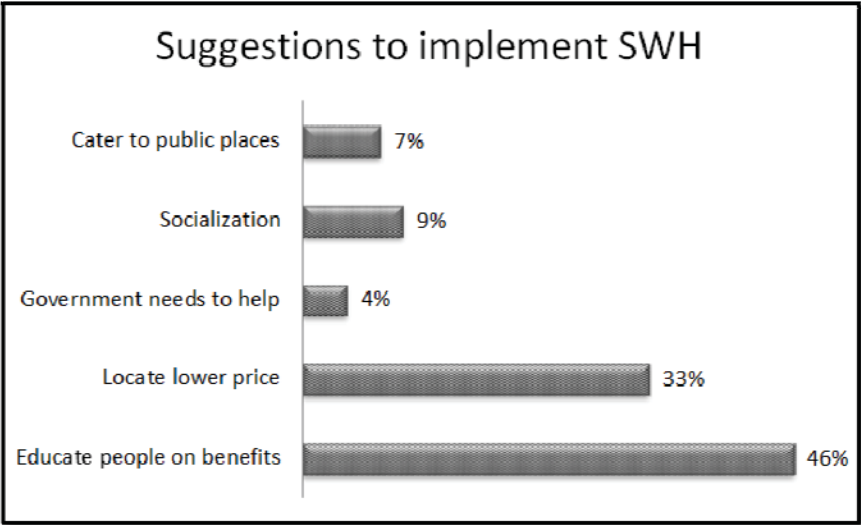


Figure 3. Survey results for SWH implementation suggestions

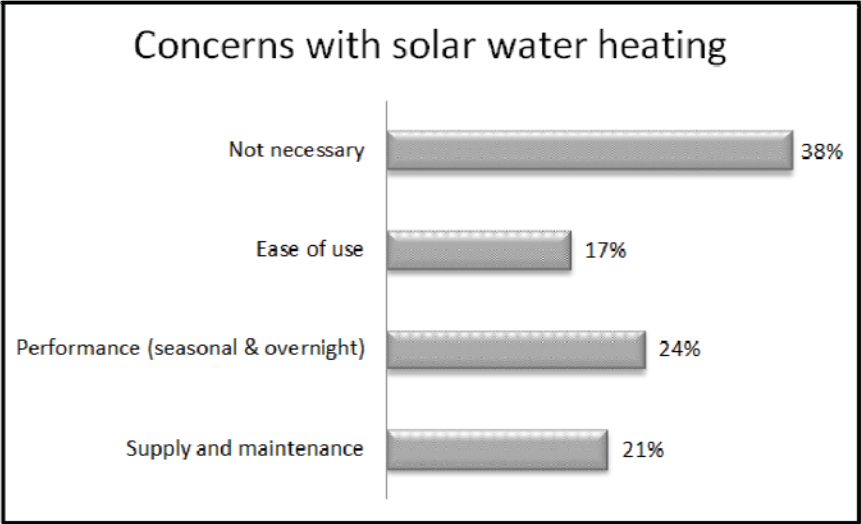


Figure 4. Survey results for SWH concerns

The existing DHW users were asked about any concerns with water heating. About 38% of surveyees replied that it was not necessary , as seen in Figure 4. Other concerns were of the overnight performance of the system. As the majority of showers were found to be taken in the morning according to the survey results the overnight losses were a concern. Other concerns were the supply of

replacement parts and the availability of support for maintenance of the system. As only two local suppliers were found in Surabaya whom both import their supply from other countries replacement parts could be quite costly. Many have stated that providing hot water to residents is not a great concern when compared with poverty issues in Indonesia.

The survey results showed that cost and awareness are the main issues in confining the utilization of SWH in Surabaya. Although these are separate issues they tend to have a direct correlation. If more people were aware there will be more potential buyers which will increase the demand or market for suppliers and costs tend to be driven down by competition. An upgrading of advertising campaigns, focusing on quality of life, energy-saving and environmental aspects, and funded by a combination of national and international sources could be good idea to help wide spread a financial feasible technology.

From a simple calculation it was found that a family of 5 in Surabaya can save over 3500 kWh a year if they use SWH instead of gas or electricity. As for Indonesia (with the population of about 155 million), if those 33 million people did switch from conventional based WH to SWH that could potentially save 23.1 TWh/yr which constitutes to nearly 20% of Indonesia's total electricity consumption. Also it could potentially save 16.5 million tons of CO<sub>2</sub> emissions resulting from energy consumption assuming 2.5 tones/yr are saved with each family of 5[7]. That being so if 15% of the population of Surabaya switched from conventional to solar that would be over 580 MWh of saved energy potentially reducing carbon emissions by 2.8 million tones.

#### 4. Conculssions

According to the survey results, cost and awareness are the main issues in confining the utilization of SWH in Surabaya. Although these are separate issues they tend to have a direct correlation. If more people were aware there will be more potential buyers which will increase the demand or market for suppliers and costs tend to be driven down by competition. According to this study a family of 5 in Surabaya can save over 3500 kWh a year from using SWH intead of using gas or electricity. As for Indonesia the switch from conventional based WH to SWH that could potentially save 23.1 TWh/yr which constitutes to nearly 20% of Indonesia's total electricity consumption. Also it could potentially save 16.5 million tons of CO<sub>2</sub> emissions resulting from energy consumption assuming 2.5 tones/yr are saved.

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# CERTIFICATE

This is to certify that

**ELIESER TARIGAN**

has participated in the

**CONFERENCE ON INNOVATION IN TECHNOLOGY  
AND ENGINEERING SCIENCE (CITES 2018)**

as **Presenter**

November 8<sup>th</sup> – 9<sup>th</sup>, 2018 in Padang, Indonesia

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