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7th International Conference

Sustainable Agriculture, Food, and Energy

Phuket
THAILAND, 2019



**SAFE
2019
THAILAND**

SAFE 2019
International Conference
Sustainable Agriculture,
Food and Energy.
October 18-21, 2019
Phuket. THAILAND.

**Conference
Programme
Papers Abstracts**

**GREEN AGRI-FOOD ENERGY PRODUCTION
FOR A BETTER WORLD IN A CHANGING CLIMATE**

SAFE NETWORK
Asia Pacific Network for Sustainable Agriculture, Food and Energy

www.safe-network.org

7th International Conference
Sustainable Agriculture,
Food and Energy

**7thInternational Conference
Sustainable Agriculture, Food, and Energy
SAFE2019**

**October 19-21, 2019
Phuket Rajabhat University, Thailand**

**“Green Agri-food Energy Production for a
Better World in a Changing Climate”**

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WELCOME MESSAGE FROM SAFE-NETWORK

Welcome to the International Conference on Sustainable Agriculture, Food, and Energy (SAFE 2019)

We are proud to welcome you to the **International Conference on Sustainable Agriculture, Food, and Energy (SAFE2019): Green Agri-food Energy Production for a Better World in a Changing Climate** which will be held from October 19-21, 2019 in Phuket, Thailand. The host institutions are Phuket Rajabhat University, Chiang Mai University and Chiang Mai Rajabhat University. This conference is the 7th annual conference after the 1st International Conference on Sustainable Agriculture, Food, and Energy (**SAFE2013**) in Padang, Indonesia (12-14 May 2014), the 2nd conference **SAFE2014** in Bali, Indonesia (17-19 September 2014). The 3rd conference **SAFE2015** in Ho Chi Minh City, VIETNAM (17-19 November 2015), 4th conference **SAFE2016**, Colombo, Sri Lanka (October 20-22, 2016), the 5th conference **SAFE2017**, Malaysia, August 22-24, 2017 and the 6th SAFE2018 Conference is Makati, Manila. PHILIPPINES

Aside from the conferences, workshops and short course programs, SAFE-Network has expanded to producing **SAFE Rice Project** as an output of organic rice research conducted by Malaysian and Indonesian faculty-researchers. As the Network grows, the Network plans to embark on innovative platforms where “sustainability” can be served best especially to some group of learners who do not have sufficient background in agriculture science. The Network chooses Philippines, particularly CBSUA, to initially host the **Virtual Farm Academy** in collaboration with SAFE Network and eventually with universities from Malaysia, Indonesia, India, Pakistan, Iran, Thailand, Japan, Taiwan, Sri Lanka, Australia and Bangladesh who are also active members of the Network. CBSUA will take the lead in facilitating the modules to online participants and take the necessary actions in expediting the modular classes. The Network Head Coordinator, together with CBSUA President shall issue certificates of program completion to registered participants. We express our deep gratitude for the support given by Dr. ALBERTO N. NAPERI the President of CBSUA. The virtual farm academy will be launched in the opening ceremony of SAFE2019 and we invite all of us to discuss the operational plan of this Virtual Academy on October 19, 2019 in Phuket.

On behalf of SAFE-Network, we would like to say thanks and convey our appreciation to the Phuket Rajabhat University, Chiang Mai University and Chiang Mai Rajabhat University for co-hosting this conference.

We would like especially to thank Prof. Dr. Tafdil Husni, *Rector of Andalas University* for his strong support to this event, Assoc.Prof. Sermkiat Jomjunyong, Ph.D, *Local Conference Coordinator*, Dr. Worajit Setthapun, *Conference Secretary* and the members of the local organizing committee who helped with all the preparations required to make the conference a success, as well as the session organizers who worked to ensure a high level of science presented at the meeting. Moreover, of course, we thank all honorable speakers and participants who have agreed to attend and discuss your work! Finally, please understand that while every effort was made to publish this book as the “final” program, we know that unavoidable withdrawals and other changes will occur.

Welcome to SAFE-2019, Phuket! Please enjoy the friendship!
One planet! One happiness! Friendship creates wonders!

Prof. Dr. Novizar Nazir
SAFE-Network Coordinator



MESSAGE FROM THE RECTOR OF ANDALAS UNIVERSITY-INDONESIA

Sawasdi khap,

I would like to congratulate and convey my gratitude to the **SAFE Network** for undertaking the initiative to organize **SAFE2019** (7th International Conference on Sustainable Agriculture, Food, and Energy). Andalas University is delighted to be the organizer of this conference since the 1st International Conference on Sustainable Agriculture, Food, and Energy (**SAFE2013**) in Padang, Indonesia (12-14 May 2014), the 2nd conference of **SAFE2014 in Bali**, Indonesia (17-19 September 2014), the 3rd conference of **SAFE2015** in Ho Chi Minh City, VIETNAM (17-19 November 2015), 4th conference ([SAFE2016](#)) in Colombo, Sri Lanka, October 20-22, 2016, the 5th conference **SAFE2017**, Malaysia, August 22-24, 2017 and 6th **SAFE2018** Conference is Makati, Manila (Philippines).

The theme of this year's conference is "Green Agri-food Energy Production for a Better World in a Changing Climate". Climate change is one of the most complex problems we face today. This issue involves many dimensions - science, economics, society, politics and morals and ethical questions- and are global problems, felt on a local scale, which will exist for decades and centuries to come. Activities in the agricultural, food and energy sectors are sectors that have an impact on climate change, but on the other hand, that are heavily affected by climate change itself. Therefore, the participation of the scientific community from universities and research institutions to address the problems related to climate change is highly expected.

Through the conference, we hope to generate substantial contributions to create a better solution and new value on sustainability and sustainable development of agriculture, food, and energy. We are confident that valuable innovation that can change or create more efficient processes, products and ideas are forged after attending this conference. Sustainability is a difficult issue and complex. It is not a goal but a process. I would like to thank the organizing committee and the co-organizer institutions for the hard work and full commitment in preparation of this conference.

Finally, we congratulate Phuket Rajabhat University, Chiang Mai University and Chiang Mai Rajabhat University for hosting this conference. My personal respect and thanks go to all participants. Please enjoy the friendship, enjoy the culture of Thailand! I wish you an enjoyable and memorable conference in Phuket.

Khawp khun khap!

Prof. Dr. Tafdil Husni

Rector of Andalas University



OPENING AND WELCOME MESSAGE BY CONFERENCE COORDINATOR

Assoc.Prof. Sermkiat Jomjunyong, Ph.D.,
Country Coordinator of SAFE-Network (THAILAND)
Faculty of Engineering.. Chiang Mai University.

Prof. Dr. Tafdil Husni, Asst.Prof.Dr. Hiran Prasarnkarn, Dr. Alberto N. Naperi and Prof. Dr. Novizar Nazir,
Distinguished participants, Ladies and Gentlemen:

It gives me a great pleasure to welcome all of you and chair the Opening Ceremony this morning to the “International Conference on Sustainable Agriculture, Food, and Energy (SAFE 2019)” Green Agri-food Energy Production for a Better World in a Changing Climate” which will be held from October 18th - 21st, 2019, Phuket, Thailand. The host institution is jointly organized by SAFE Network, Chiang Mai University, Chiang Mai Rajabht University, Phuket Rajabhat University, THAILAND and ANDALAS University, INDONESIA.

SAFE Network is an Asia Pacific network of university and college educators, researchers, and activists, who collaborate in analysis, synthesis, connecting and educating the people for a better economy, ecology, and equity in agriculture, food and energy system.

This conference is the seventh conference since the year 2013 to 2018. The SAFE 2019 conference will provide us not only essential knowledge but also a great opportunity to share experiences both technical and regulatory issues.

I would like to take this opportunity to express my sincere thanks to the organizers and in particular our honorable speakers. All of them have been working with us since the beginning of the planning stage and they are still here today for all of us, even though they are both very busy with their responsibilities at their agencies. We truly appreciate your dedication. Again, this conference program could not have been made possible without SAFE Network and Phuket Rajabhat University, THAILAND.

Finally, this is an opportune time for me to declare the official opening of the “SAFE 2019” and I wish all 4 fruitful days of interesting and beneficial program and also that you have a pleasant stay in Phuket.

I warmly welcome you again.

Assoc.Prof. Sermkiat Jomjunyong, Ph.D



WELCOME SPEECH BY PRESIDENT OF PHUKET RAJABHAT UNIVERSITY

Welcome All delegates,

I am pleased to welcome you to this landmark conference on the International Conference on Sustainable Agriculture, Food, and Energy (SAFE2019): Green Agrifood Energy Production for a Better World in a Changing Climate” which held from October 19-21, 2019 in Phuket, Thailand. Through this conference, we would like to engage with all of you in an open and constructive dialogue about resources and opportunities to interact with prominent leaders in the field of sustainability and greatly expand your global network of scholars and professionals This event aims to bring together people from different areas and interests to share ideas, explore various discussions, maintain existing connections, establish new connections and partnerships, and share the achievements of the work.

I am honored and delighted to greet you all at the 7th International on Conference Sustainable Agriculture, Food, and Energy or SAFE 2019. For this The conference which brings together experts and academics from around the world, especially ASEAN Country. There are many sessions regarding keynote speech, oral presentation, and poster presentation etc. You can network and learn with the professionals in this conference.

I would like to thank you to our partners with the good relationship for long time. I am happy to see all of delegates in this international conference. I am sure that everyone will find the conference and your stay in Phuket both valuable and enjoyable.

Asst. Prof. Hiran Prasankarn, Ph.D.
President of Phuket Rajabhat University.

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Virtual Farm Academy

COLLABORATIVE INTEGRATED LEARNING ACADEMY



SAFE
NETWORK
Asia Pacific Network for
Sustainable Agriculture
Food and Energy

**BECOMING
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TOGETHER**

The SAFE Network

The Asia Pacific Sustainable Agriculture, Food, and Energy (SAFE) Network is a network of university and college educators, researchers and advocates who collaborate in analysis, synthesis, connecting and educating the people for a better economy, ecology and equity. Initially, it organizes scientific international conferences. The 1st International Conference on Sustainable Agriculture, Food, and Energy (SAFE2013) was held in Padang, Indonesia (12-14 May 2014); the 2nd conference SAFE 2014 in Bali, Indonesia; the 3rd conference SAFE 2015 in Ho Chi Minh City, Vietnam, the 4th conference SAFE 2016, Colombo, Sri Lanka, the 5th conference SAFE 2017 in Malaysia; and the 6th conference SAFE 2018 in Manila, Philippines. Also, one of its banner activities is the conduct of an annual short course program for students to address major sustainability challenges in agriculture, food and energy system. In 2016 and 2017, it was held at Warmadewa University in Bali, Indonesia and in 2018 at Central Bicol State University of Agriculture in Camarines Sur, Philippines. This year, the short course program was held in University of Padjadjaran, Bandung Indonesia.



**BECOMING
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TOGETHER**

Aside from the conferences and short course programs, the Network has expanded to producing SAFE Rice as an output of organic rice research conducted by Malaysian and Indonesian faculty-researchers. (<http://safe2019.safe-network.org>) As the Network grows, it plans to embark on innovative platforms where “sustainability” can be served best especially to some group of learners who do not have sufficient background in agriculture science.

SAFE Virtual Farm Academy

As the academe embraces industry 4.0, the next generation of learners is expected to exploit a virtual learning environment in the future. With the fast pace of technology, future learners are no longer interested in a traditional classroom setting. Technology has taught them to become independent learners with a short span of attention, hence, the creation of a virtual school. Minerva project is one classic example (<https://www.youtube.com/watch?v=Gk5iiXqh7Tg>)

A virtual academy is a learning space, usually online, where courses are taught to participants in the form of a web-based technology classroom. Often referred to as cyber-classroom, virtual schools deliver online learning platform either on a supervised class or an unsupervised education mode. The SAFE Network, through its partner-universities, will develop a similar model with emphasis on topics

that relate to sustainability and happiness. We may be concerned on productivity and regeneration of resources but at the end of the day what counts most is our happiness. We can begin with the most critical issues in food and environment. Experts on certain topics can volunteer to share to a group of 10-15 participants around the Asia Pacific region to start the ball rolling. Then, as a Network, we can expand this to a bigger and more structured discussions including a mini virtual SAFE course.

The Network chooses Philippines, particularly CBSUA, to initially host the virtual academy in collaboration with SAFE Network and eventually with universities from Malaysia, Indonesia, Thailand, Taiwan, Sri Lanka, Australia and Bangladesh who are also active members of the Network. CBSUA will take the lead in facilitating the modules to online participants and take the

necessary actions in expediting the modular classes. The Network Head Coordinator, together with CBSUA President shall issue certificates of program completion to registered participants. The virtual academy will be launched in the next international conference which will be held on October 20, 2019 in Thailand.

With the vast network it has, SAFE Network will provide resources and opportunities to interact with prominent leaders in the field of sustainability and greatly expand the global network of scholars and professionals. It shall serve as a collaborative arm of universities such as CBSUA to bring together people from different areas and interests to share ideas, explore various discussions, maintain existing connections, establish new connections and partnerships, and share the achievements of their work.

Module Preparation

The Network is already seven years in active existence and it was founded through volunteerism from senior lecturers and professors who wish to share their knowledge to others. Hence, the preparation and delivery of module will also be a voluntary act of professors, researchers and practitioners according to their field of expertise. The first module will center on “Small-holder family food security”. The module, like any other programs, shall consist of learning outcomes, discussion points and games/activities. It will be an activity-based program so it would be a stress-free class eliciting the participants happiness and creativity during the course of their learning.

The outline for this topic is as follows:

- Module A. Concept of Food Security (one week)
 - Module B. Models of Small-holder farms (three weeks)
 - Module C. Assessment of small-holder farms in various communities (five weeks)
 - Module D. Development of a pilot-project (eleven weeks)
- Implementation

Initially, this module will be delivered online by Prof. Dr. Helmi and Dr. Ravindra Joshi who are specialists in sustainability and food security in small-holder farms. The succeeding topics are farm tourism and stingless beekeeping which shall be delivered by CBSUA’s lecturers and professors.

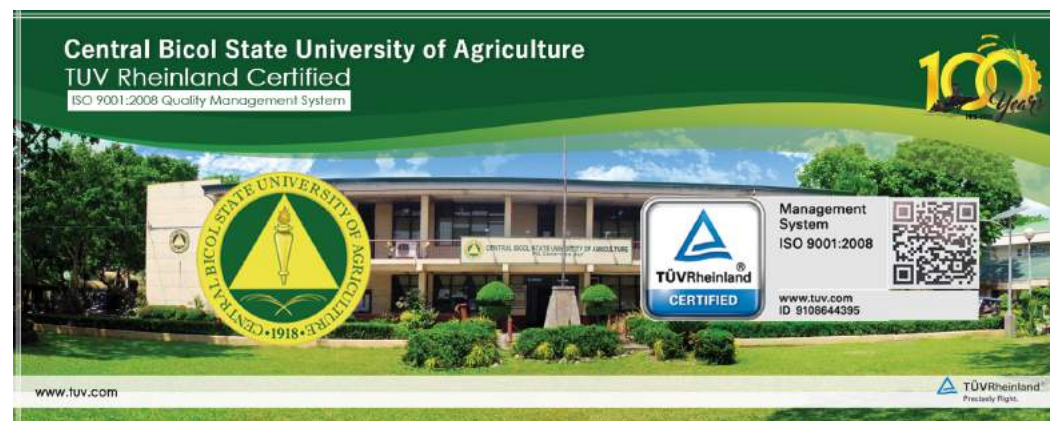


VIRTUAL FARM ACADEMY

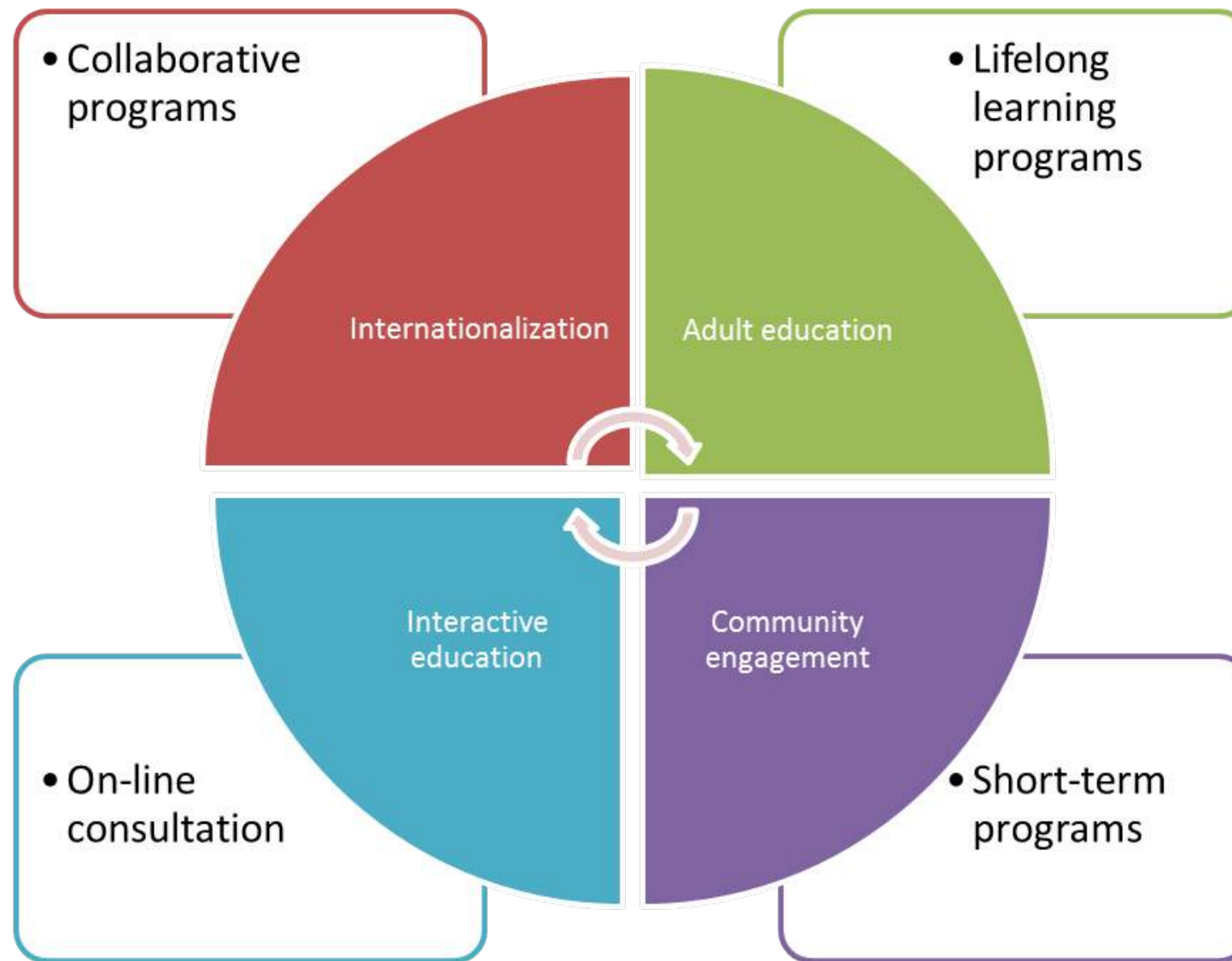
Implementation

The mode of delivery will be made through an online portal. The participants will be assessed to match their profile with the modules being offered. The participants can register any time to start and complete the module. The participants are required to develop an output as a means of measuring whether the learning outcomes have been achieved or not. The module instructor shall determine whether the participant is worthy of a certificate of completion after an evaluation of the output. The target audience of this virtual academy shall be the lifelong learners who are either potential farmers with no experience in farming and practitioners with insufficient educational background in agriculture. The other feature of the VFA is the on-line consultation program where a faculty-specialist is assigned on a specific day to answer the queries of the farmers.

The SAFE Network and its partner universities, including CBSUA, shall help in promoting the virtual academy program to its target participants. The virtual academy shall be under the Office of the External and International Linkages of CBSUA. It shall coordinate with the university's Lifelong Learning Center, College of Information and Technology (Sipocot campus), Information and Communication Center and Extension Division since its purpose traverse through the programs of the said offices. In order to reach the small farmers in the countryside, CBSUA, particular, will team up with the Local Government Units to facilitate the setting up of a virtual program in their municipalities.



VFA Framework





Project Team within CBSUA

Since the project is a partnership with Asia-Pacific SAFE Network, the **Office of the External and International Linkages** will supervise the implementation of the program. While the nature of the project cuts across our mandate on community engagement, the **Extension Office** will take the lead in facilitating and monitoring the implementation of the farm sustainability modules. As the University embarks on developing adult education programs, this project will be integrated in the **Lifelong Learning Center** of the University. The Center will assist in the development of modules and craft strategies on how they can be delivered effectively to the target market. On the technical side, the **College of Information and Technology** will develop the web platform that will enable the VFA to function as an online learning system. In order to maintain the connectivity, the **Information and Communication Office** will develop, implement and support Information Systems and Applications that support the academic and administrative processes of the VFA.

SAFE2019 PROGRAM

DAY 0: Thursday, October 17 2019

ARRIVAL OF PARTICIPANTS AND SECRETARIAT MEMBER & CHECK IN HOTEL: METROPOLE PHUKET HOTEL

DAY 1: Friday October 18 2019

PHI PHI ISLAND TOUR

SAFE Secretariat arrange Phi Phi Island Tour/participants should pay)

DAY 2: Saturday, October 19, 2019

10.00-12.00 AM | NETWORKING DISCUSSION

Agenda: Virtual Farm Academy, Conference, Workshop, Summer Course, Collaboration

Venue: METROPOLE PHUKET Hotel, THAILAND

01.00-09.00 PM | PRE-CONFERENCE TOUR (FREE FOR PARTICIPANTS)

Starting Point: METROPOLE PHUKET Hotel, THAILAND

DESTINATION: Phuket Old Town, Karon View Point, Big Buddha, Wat Chalong Temple, Promtep Sunset, Chilva Market

07.30-09.45 PM | WELCOME DINNER:

SAFE Network will provide food and drink

Registration: OC will provide conference kits

Venue: METROPOLE PHUKET Hotel, THAILAND

08.15-08.30 PM | INVITED SPEAKER

AGRICULTURE, FOOD, ENERGY, AND SUSTAINABILITY IN NEPAL

Prof. Dr. Megh Raj Pokhrel

Central Department of Chemistry, Tribhuvan University, Kirtipur, Kathmandu. Nepal

Venue: METROPOLE PHUKET Hotel, THAILAND

VENUE: PHUKET RAJABHAT UNIVERSITY, PHUKET-THAILAND

		Opening Ceremony Venue: PKRU CONVENTION HALL Person in Charge/MC: Dr. Worajit Setthapun, AdicET, Chiang Mai Rajabhat University, THAILAND	
	7.30-8.00 AM	Registration	
8.15-8.25	Thailand National Anthem Indonesia National Anthem		
8.25-8.30	Conference Program Introduction by Local Conference Coordinator, Dr. Serkiyat Jomjunyong , SAFE-Network National Co-ordinator (THAILAND). CHIANG MAI UNIVERSITY (CMU). THAILAND		
8.30-8.35	Welcome Remark from Rector of Andalas University, Prof. Dr. Tafdil Husni		
8.35-8.40	Opening Remark from President of Phuket Rajabhat University, THAILAND. Asst.Prof.Dr. Hiran Prasarnkarn		
8.40-9.00	Book Launching on <i>The Miracle Tree of Moringa I</i> , Co-writers: Dr. Ravindra Joshi and Dr. MC. Palada Presentation of Certificate of Appreciation and Special Gift from Prof. Dr. Novizar Nazir (SAFE-Network) to the host of SAFE2019: Andalas University, Chiang Mai University (CMU), Phuket Rajabhat University (PRU). Special Gift for Local Conference Coordinator Assoc. Prof. Dr. Sermkiyat Jomjunyong , and Local Conference Secretary, Dr. Worajit Setthapun , Official Photo Session.		
KEY NOTE ADDRESS: Session Chair: Dr. Norman de Jesus, (Country Coordinator, Philippines). Pampanga State Agricultural University, Philippines			
9.00-9.30	The Concept of Virtual Farm Academy Prof. Dr. Helmi, Andalas University-Indonesia Dr. Hanilyn Hidalgo, Central Bicol State Agricultural University (CBSUA). Philippines		
9.30-9.40	Discussion		
9.40-9.45	Signing Ceremony of Letter of Intent on the Establishment of Virtual Farm Academy between SAFE-Network and CBSUA, Philippines		
9.45-10.00	COFFEE BREAK		
Plenary Session I Venue: Main Conference Room Emerging Technology in Agriculture and Food		Plenary Session II Venue: Asian Workshop on Sustainable Energy	

	<p>Session Chair: Prof. Dr. Manggala de Chatura, (Country Coordinator, Sri Lanka). University of Ruhuna, Sri Lanka</p>	<p>Session Chair: Dr. Worajit Setthapun, AdiCET. Chiang Mai University, Thailand Note: The time allocated for each speaker is 20 minutes, consisting of 15 minutes for presentation and 5 minutes for question and answer</p>
10.10-10.30	<p>INVITED SPEAKER 1:</p> <p>EMERGING PLASMA TECHNOLOGY FOR NEXT GENERATION AGRICULTURE AND FOOD PROCESSES</p> <p>Prof. Jeon Geon Han Thai-Korea Collaboration Research Center,Chiang mai University, Thailand Center for Advanced Plasma Surface Technology, Sungkyunkwan University, Republic of Korea</p>	<p>INVITED SPEAKER 5:</p> <p>TOWARD SUSTAINABLE TRANSPORT VIA ASEAN FUEL ECONOMY ROADMAP Dr. Nuwong Chollacoop Lab Head, Renewable Energy Laboratory National Metal and Materials Technology Center (MTEC),National Science and Technology Development Agency, Thailand</p>
10.30-10.50	<p>INVITED SPEAKER 2:</p> <p>SUSTAINABLE DRYING SYSTEMS FOR AGRICULTURAL CROPS IN RURAL COMMUNITIES</p> <p>Romualdo C. Martinez, Ph.D. Chief Science Research Specialist Philippine Center for Postharvest Development and Mechanization (PHilMech) Munoz, Nueva Ecija, Philippines</p>	<p>INVITED SPEAKER 6:</p> <p>CONVERSION OF AGRI-WASTE INTO BIOMASS ENERGY INTEGRATED WITH MICROGRIDS Assoc.Prof. Keng-Tung Wu, PhD Director, Industry Promotion Office for Southeastern Asia (IPOSA) Head, Planning & Marketing Division, International College of Innovation and Industry Liaison (ICIL). National Chung Hsing University, Taichung, Taiwan (ROC)</p>
10.50-11.10	<p>INVITED SPEAKER 3:</p> <p>ENABLING ENVIRONMENT FOR ENTREPRENEURSHIP & DISRUPTIVE TECHNOLOGY Dr. Wibool Piyawattanametha Director, Advanced Imaging Research Center Department of Biomedical Engineering, Faculty of Engineering King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand</p>	<p>10.50-11.00 Presenter 1: AN OVERVIEW OF COMMUNITY EMPOWERMENT BY SOLAR ENERGY Dr Vivek Mandot V. K. B. Government Girls' College, Dungarpur, Rajassthan 314001, India</p> <p>11.00-11.20 Presenter 2: COMPOSITIONAL ANALYSES OF SELECTED LIGNOCELLULOSIC BIOMASS FROM MALAYSIA AGRO-WASTE USING VAN SOEST METHOD Dr. Masita Mohammad Solar Energy Research Institute, SERI, UKM, Malaysia</p> <p>11.20-11.30 Presenter 3: PRODUCTION OF BIOGAS FROM PALM OIL MILL EFFLUENT WITH INDIGENOUS BACTERIA Prof. Dr. Muhammad Said Chemical Engineering Department, Faculty of Engineering, Universitas Sriwijaya</p>
11.10-11.30	<p>INVITED SPEAKER 4:</p>	

	TRANSFORMATION OF GADONG TUBER STARCH INTO SOPHISTICATED MATERIAL Assoc. Prof.Dr. Azwani Mat Lazim Universiti Kebangsaan Malaysia. Malaysia	
11.30-12.00	DISCUSSION	11.30-13.00 Venue: Room1 Presentation: Energy-005 Energy 06 Energy 07 Energy 08 Energy 09 Energy-011 Energy 013 Energy 014 Energy 015 Energy 010 Energy 017 Energy 019 Energy 020 Energy 021 Energy 023 Energy 024 Energy 025 GPI-97
12.10-13.30	BREAKOUT SESSION 1 Venue: Room 1-8	
13.00-14.00	LUNCH BREAK	

DAY 3: Sunday, October 20, 2018

VENUE: PHUKET RAJABHAT UNIVERSITY, PHUKET-THAILAND

12.05-13.00 Breakout Session 1 (Previous Speaker will invite the next speaker to present, etc)
CHAIR: Dr. Ravindra Joshi, Country Coordinator (Fiji and Pacific Island))
Secretary: Dr. Rahmanta Setiahari (Merdeka University of Madiun, Indonesia)

Parallele Session	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
12.05-12.15	Energy	THE REGIONAL LAND USE CONTROL FOR SUSTAINABLE AGRICULTURE. Melinda Noer , Andalas University. Indonesia	BIOFERTILIZERS INCREASES THE GROWTH AND YIELD OF EDAMAME SOYBEANS ON THE COASTAL SOIL OF BENGKULU, INDONESIA Abimanyu Dipo Nusantara . Univ. Bengkulu. Indonesia	CATECHIN, EPICATECHIN AND EPIGALLOCATECHIN GALLATE OF GAMBIR TEA WITH TELANG PIGMENT. Tuty Anggraini . Andalas University. Indonesia	THE HOLISTIC COMPONENTS OF CATTLE PRODUCTION FOR SOLVING THE HAZE IN CHIANG MAI Sermkiat Jomjunyong . CMU-Thailand	ISOLATION AND CHARACTERIZATION OF POTENTIAL PROBIOTIC YEAST FROM FISH FERMENTED Yetti Marlida , Andalas University. Indonesia	VOLUME AND AVAILABILITY OF BANANA AND WATER LILY AND THEIR UTILIZATION AS FEED INGREDIENTS FOR GOATS IN LUZON-PHILIPPINES. Norman de Jesus , PSAU. Philippines	EFFECTS OF <i>BACILLUS THURINGIENSIS</i> -BASED BIO-INSECTICIDES ON THE PRESENCE OF INSECTS AND THEIR LEVEL OF ATTACK ON MELON FRUIT CULTIVATION IN POLYBAGS Yulia Pujiastuti . Unsri. Indonesia
12.15-12.20	Energy	GPI-01	AST-01	PD-02	Environment-15	FST-02	GPI-11	AST-11
12.20-12.25	Energy	GPI-02	AST-02	PD-03	Environment-16	FST-05	GPI-12	AST-12
12.25-12.30	Energy	GPI-03	AST-03	PD-06	Environment-17	FST-06	GPI-12	AST-13
12.30-12.35	Energy	GPI-04	AST-04	PD-08	Environment-18	FST-07	GPI-14	AST-14
12.35-12.40	Energy	GPI-06	AST-06	PD-10	Environment-19	FST-08	GPI-17	AST-15
12.40-12.45	Energy	GPI-07	AST-09	PD-12	Environment-20	FST-09	GPI-18	AST-16
12.45-12.50	Energy	GPI-08	AST-10	PD-14	Environment-21	FST-10	GPI-20	AST-17
12.50-13.00	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A

14.00-15.35 Breakout Session 2 (Previous Speaker will invite the next speaker to present, etc)
Chair: Assoc,Prof.Dr. Nurul Huda, Country Coordinator (Malaysia)
Secretary: Dr. Leily Nurul Komariah (Sriwijaya University, Indonesia)

Parallel Session	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
14.00-14.10	MODELING VISCOELASTIC PROPERTIES OF GLUTEN-FREE RED KIDNEY BEAN NOODLE Pavalee Chompoorat Postharvest program in Faculty of Engineering and Agro-Industry. Maejo University. Thailand	THE MORPHOLOGY OF CILEMBU SWEET POTATO AFTER COOKED BY BOILING IN WATER, BAKED AND MICROWAVE IRRADIATION. Bohari M. Yamin. UKM. Malaysia	WATER RAINFALL HARVESTING QUALITY AS A FERTIGATION RESOURCES USING AUTOPOT TOMATO CHERRY (SOLANUM L. VAR CERASIFORME) QUALITY. Nurpilihan, Unpad. Indonesia	THE EFFECT OF PROBIOTIC SUPPLEMENTATION ON LIVER BIOCHEMISTRY AND COLON MORPHOMETRIC IN BROILER CARCASS AT POST TRANSPORTATION Roostita L. Balia, Universitas Padjadjaran. Indonesia	O MOTHER EARTH-IS THE SOIL IN YOU IS SAFE FOR AGRICULTURE-? : AN EASY METHOD TO FIND IT SAFE! G.R. Rajakumar, AICRP for Dryland Agriculture. India	FRACTIONATION, ISOLATION AND CHARACTERISATION OF OIL PALM FRONDS XYLOOLIGOSACCHARIDES : A POTENTIAL SOURCE OF PREBIOTICS. Sabiha Hanim Saleh, UiTM. Malaysia	THE HALAL FOOD PROFILE IN THAI CONSUMER ATTITUDE BY USING FLASH PROFILE METHOD. Kallayanee Tengpongsathon . King Mongkut's Institute of Technology Ladkrabang, Thailand	IMPROVEMENT of MANGO PRODUCTION through SCIENCE and TECHNOLOGY INNOVATIONS and SUPPORT MECHANISMS for CAPACITY DEVELOPMENT in BATAAN and ZAMBALES Hermogenes M.Paguia, Bataan Peninsula State University. Philippines
14.10-14.15	GPI-21	GPI-40	AST-18	PD-15	Environment-02	FST-11	GPI-59	AST-36
14.15-14.20	GPI-22	GPI-41	AST-19	PD-16	Environment-03	FST-12	GPI-60	AST-37
14.20-14.25	GPI-23	GPI-43	AST-20	PD-17	Environment-04	FST-13	GPI-61	AST-38
14.25-14.30	GPI-24	GPI-44	AST-21	PD-18	Environment-05	FST-14	GPI-62	AST-39
14.30-14.35	GPI-25	GPI-45	AST-23	PD-19	Environment-06	FST-15	GPI-63	AST-40
14.35-14.40	GPI-26	GPI-46	AST-24	PD-20	Environment-07a	FST-16	GPI-64	AST-41
14.40-14.45	GPI-28	GPI-47	AST-25	PD-21	Environment-08	FST-17	GPI-65	AST-42
14.45-14.50	GPI-29	GPI-48	AST-26	PD-22	Environment-11	FST-18	GPI-67	AST-43
14.50-14.55	GPI-30	GPI-49	AST-27	PD-23	Environment-12	FST-19	GPI-68	AST-45
14.55-15.00	GPI-31	GPI-50	AST-28	PD-25	Environment-13	FST-20	GPI-69	AST-46
15.00-15.05	GPI-32	GPI-51	AST-29	PD-26	Environment-22	FST-21	GPI-70	AST-47
15.05-15.10	GPI-33	GPI-52	AST-30	PD-27	AST-53	FST-22	GPI-71	AST-48
15.10-15.15	GPI-34	GPI-53	AST-31	PD-28	AST-54	FST-25	GPI-73	AST-49
15.15-15.20	GPI-35	GPI-56	AST-33	PD-29	AST-55	FST-26	GPI-73	AST-50
15.20-15.25	GPI-38	GPI-57	AST-34	PD-30	AST-56	FST-27	GPI-74	AST-51
15.25-15.30	GPI-39	GPI-58	AST-35	PD-31	AST-57	FST-28	GPI-75	AST-52
15.20-16.00	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A

16.00-17.20 Breakout Session 3 (Previous Speaker will invite the next speaker to present, etc)
Chair: Dr. Norashikin Ab. Azis (Universiti Putra Malaysia, Malaysia)
Secretary: Dr. Addion Nizori (University of Jambi, Indonesia)

Parallel Session	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
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16.10-16.15	AST-58	AST-83	AST-105	PD-32	PD-55	PD-75	GPI-76	GPI-93
16.15-16.20	AST-60	AST-84	AST-106	PD-33	PD-56	PD-76	GPI-77	GPI-94
16.20-16.25	AST-61	AST-85	AST-107	PD-34	PD-57	PD-77	GPI-78	GPI-95
16.25-16.30	AST-62	AST-87	AST-108	PD-35	PD-59	PD-79	GPI-79	GPI-96
16.30-16.35	AST-63a	AST-88	AST-109	PD-36	PD-59	PD-80	GPI-80	GPI-98
16.35-16.40	AST-64	AST-89	AST-110	PD-37	PD-60	PD-81	GPI-82	GPI-100
16.40-16.45	AST-65	AST-90	AST-111	PD-38	PD-61	AST-125	GPI-83	GPI-101
16.45-16.50	AST-66	AST-91	AST-112	PD-39	PD-62	AST-126	GPI-84	GPI-103
16.50-16.55	AST-69	AST-94	AST-113	PD-41	PD-63	AST-127	GPI-85	GPI-104
16.55-17.00	AST-70	AST-95	AST-114	PD-42	PD-64	AST-128	GPI-86	GPI-105
17.00-17.05	AST-71	AST-96	AST-116	PD-43	PD-65	AST-129	GPI-87	GPI-106
17.05-17.10	AST-72	AST-97	AST-117	PD-45	PD-66	AST-130	GPI-88	GPI-107
17.10-17.15	AST-73	AST-98	AST-118	PD-47	PD-67	AST-131	GPI-89	GPI-108
17.15-17.20	AST-74	AST-99	AST-119	PD-48	PD-68	AST-132	GPI-92	GPI-109
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17.35-17.40	AST-76	AST-101	AST-121	PD-50	PD-70	AST-134	GPI-121	GPI-112
17.40-17.45	AST-79	AST-102	AST-122	PD-51	PD-71	AST-135	GPI-122	GPI-113

17.45-17.50	AST-80	AST-103	AST-123	PD-52	PD-72		GPI-123	GPI-114
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17.55-18.10	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A	Q&A

18.10 –18.20 CLOSING CEREMONY								
KEY POINTS/HIGHLIGHT FROM THE SESSIONS								
Dr. Worajit Setthapun (CMRU, Thailand), Local Conference Secretary								
Dr. Helen Martinez, SAFE2019 Networking Meeting Secretary, PhilMech, Philippines								
Dr. Irawati Chaniago, SAFE-Network Secretary, Andalas University-INDONESIA								
Closing Message: Dr. Sermkiat Jonjumnyong, Local Conference Coordinator. CMU, Thailand								

AST-Agricultural Science and Technology|

FST-Food Science and Technology|

PD-Product Development|

GPI-Green Production and Innovation|

Energy-Energy|

Environment-Environment|

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Made Deviani Duaja	Faculty of Agriculture, University of Jambi	ORGANIC FERTILIZERS FOR SUSTAINABLE AGRICULTURE AND SOYBEAN (GLYCINE MAX .L) GROWTH AND YIELD	AST-02
Wilyus	Faculty of Agriculture, Universitas Jambi	MODEL of AGROECOSYSTEM MANAGEMENT as RESERVOIR (BANK) NATURAL ENEMY in RICE AGROECOSYSTEM	AST-03
Edison	Universitas Jambi	SUPPLY RESPONSIVENESS MODEL OF CORN IN TANJAB TIMUR DISTRICT: APLICATION WITH META RESPONSE FUNCTION	AST-04
Aryunis	Faculty of Agriculture, Universitas Jambi	IDENTIFICATION OF GENETIC CHARACTERISTICS OF LOCAL RICE FIELDS OF ORIGIN JAMBI	AST-05
Ardhiyan Saputra	Faculty of Agriculture, Universitas Jambi	Influencing Factors of potatoes Production in Merangin Regency	AST-06
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Abimanyu Dipo Nusantara	Faculty of Agriculture, Universitas Bengkulu	BIOFERTILIZERS INCREASES THE GROWTH AND YIELD OF EDAMAME SOYBEANS ON THE COASTAL SOIL OF BENGKULU, INDONESIA	AST-08
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Analysis of Air Fuel Ratio on Combustion Flames of Mixture Waste Cooking Oil and Diesel using Preheating Method

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Abstract. Fossil fuels are a non-renewable energy source results in depletion of fossil fuel reserves. Utilization of used cooking oil as an alternative fuel is one solution to overcome this problem. This study objective is to design a stove fueled by waste cooking oil and determine the optimum air flow rate and fuel flow rate in combustion. This study uses the used cooking oil as the main fuel, and diesel fuel as a mixture with a mixture of 100% used cooking oil, used cooking oil 80:20, 70:30, and 60:40 to diesel fuel. Fuel valve opening variations used are $\frac{1}{4}$ open, $\frac{1}{2}$ open, $\frac{3}{4}$ open, and fully open, while the variation in air flow rate used is 14.91; 19.24; 27.64; and 31.28 m/s. The fuel samples used were tested for the heating value, flash point and fire point, fuel density, and water fuel ratio (AFR) analysis and water boiling test (WBT). The results showed that used cooking oil had a heating value of 37,231.11 kJ/kg, flash point 289°C, and fire point 305°C. To achieve optimum AFR conditions (12-16:1) at a fuel flow rate of 2.5 mL/min ($\frac{3}{4}$ valve open) and an airflow rate of 27.64 m/s, and WBT analysis with 221 mL fuel consumption requires a long time boiling water 16'23" minutes. Conversion of used cooking oil to kerosene fuel is 1 liter of used cooking oil equal to 0.3 liters of kerosene.

1. Introduction

Used cooking oil is waste from the frying process originated from many types of cooking oil such as corn oil, vegetable oil, refined oil [1]. According to the World Oil Database (2016), Indonesia's cooking oil production is 33.4 billion tons. Based on these data, that Indonesia has a high amount of cooking oil utilization, as well as the waste it generates.

The waste from the used cooking oil can be recycled into many products such as a floor cleaner, bath soap, liquid soap, as a plant fertilizer, and as an alternative fuel (biodiesel), but there are several uses of used cooking oil used as recycled cooking oil [2]. The consumption of non-industrial or household palm cooking oil by the Indonesian people currently reaches 4,444 million tons per year, of which 16.35% is consumed in the form of packaged cooking oil, and 73.65% in the form of bulk cooking oil [3].

Utilization of used cooking oil as an alternative fuel is not new but still has the potential to further development, one of which is used as biodiesel. Utilization of used cooking oil that is still being



developed is direct use as fuel. This use is an attractive option to reduce the cost of raw materials and processes compared to biodiesel [4-8].

The manufacture of cooking oil-fueled stoves is carried out using the pressurized tank and burner with the preheating method and fuel injection control. The applied waste cooking oil is processed by adding kerosene 75%, 50%, and 25% by volume. However, this research still has shortcomings that are still using fossil fuels, poor pressurization pump methods, and must increase fuel turbulence so that combustion is better [9, 10].

This study designs cooking oil-fired stoves using the fuel atomization method and the fuel preheating method. Fuel atomization method is a method of dripping fuel in front of compressed air causes atomized fuel grains, to be smaller granules so that the combustion process occurs more quickly. This compressed air is produced by a blower. The method of preheating the fuel is bypassing the fuel through the heater before entering the combustion chamber, so the fuel temperature rises before entering the burner [15-16]. The technology for utilizing used cooking oil as fuel is intended to reduce the use of fossil fuels as the main fuel and reduce the energy crisis [17-18].

2. Methods and Materials

Research on the use of used cooking oil as fuel on the stove was carried out using variations in air flow rate and variations in fuel flow rate, as a mixture of fuel used diesel. Air and fuel flow rate variations produce a ratio between the air and the fuel used or the so-called air-fuel ratio. Sampling data analysis is the analysis of density, and hotspots and flashpoints. Retrieval of data analysis on the experiment is the water boiling test (WBT) analysis. The results of the used cooking oil stove design in Figure 1.



Figure 1. Waste cooking oil-fueled stove

3. Result and Discussion

3.1. Fuel Sample Analysis

The experiment is started by the preparation of samples of raw materials (waste cooking oil) received from micro industries such as the frying food industry. Variations of the sample are done in mixing raw materials with diesel fuel, with variations of 80:20, 70:30, and 60:40. Mixing with diesel fuel is to optimize the ignition of combustion fire, to ensure the fuel gets more combustible. Variations of the sample are shown in Table 1.

Table 1. Fuel Analysis Results

No	Sample	Parameters		
		Density (gr/mL)	Flashpoint (°C)	Fire point (°C)
1	Waste cooking oil 100%	0.90	289	305
2	Waste cooking oil 80:20 Solar	0.90	273	281
3	Waste cooking oil 70:30 Solar	0.89	255	263
4	Waste cooking oil 60:40 Solar	0.89	221	229

This fuel analysis aims to determine the value of each sample that supports its use as a fuel used in cooking oil-fired stoves.

3.2. Fire and Flash Points

The flashpoint is the temperature at which the sample is burned, and the fire is marked by the appearance of sparks. The fire point is the temperature at which the sample is burned as the fire occurs. Flash and fire point experiments were carried out to find out the flashpoint temperature and the hotspot temperature of the sample.

Based on the measurement results of 100% used cooking oil has the highest flash point compared to other samples, 289°C, while the lowest flashpoint is 60:40 diesel used cooking oil sample which is 221 °C. The mixture of used cooking oil with diesel has a lower flash point than 100% used cooking oil fuel. The higher the composition of diesel fuel to the mixed fuel, the lower the flash point produced.

The measurement results of 100% used cooking oil fire point, the highest flash point compared to other samples is 305°C, while the lowest fire point is 60:40 diesel used cooking oil sample which is 229°C. The mixture of used cooking oil with diesel has a lower fire point than 100% used cooking oil fuel. The higher the composition of diesel fuel to the mixture of fuel, the lower the point of fire produced.

The relationship of the flashpoint and fire point is the flashpoint determines the temperature value of the sample ignites into the fire, while the fire point determines the temperature value of the sample burned to fire. Fire point ignites continuously if exposed to a flame, so before the point of fire, the first point of fire is the flashpoint [10]. This indicates that the higher the flashpoint, the higher the point of fire.

The flashpoint is affected by cetane numbers in the fuel. Diesel fuel which has a cetane number of 45 - 48 makes the fuel combustible, so used cooking oil also burns. The greater the composition of diesel fuel in a mixture of fuel, the cetane number in the mixture fuel increases so that the flashpoint of a fuel sample is lower and the sample is easier to burn.

3.3. The Relationship of Variation of Fuel Flow Rate to Fire Temperature in Analysis Air Fuel Ratio (AFR)

The relationship of the variation of fuel flow rate to the temperature of a fire in various fuels with fixed variables is the airflow rate shown in Figure 2. The relationship of fuel variation to fire temperature in various fuel samples based on Figure 2 can be analyzed that the waste cooking oil mixture 60: 40 diesel has the highest fire temperature compared to other fuels, while waste cooking oil 100% has the lowest flame temperature compared to other fuels. The higher the composition of diesel fuel to the mixture, the higher the temperature of the fire produced. The heating value of the fuel influences the high temperature of the fire from the fuel. The higher the heating value of the fuel, the higher the temperature of the fire produced.

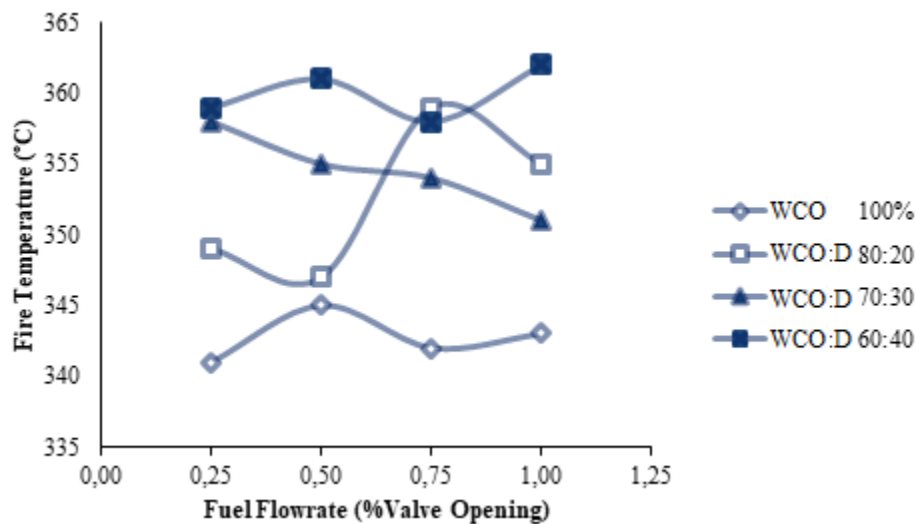


Figure 2. Relationship of Fuel Flow Rate Variation to Fire Temperature

The relationship of the variation of fuel flow rate to the temperature of the fire is experiencing fluctuations, and it is seen in Figure 2 that the 70:30 diesel used cooking oil mixed fuel has decreased flame temperature for the variation of fuel flow rate used. Based on Figure 2, there are valve openings 1/4 open, 1/2 open, and fully open with the highest flame temperature at 60:40 diesel used cooking oil mixture, while at open valve 3/4 open the highest flame temperature at 80:20 used cooking oil mixture solar.

3.4. Water Boiling Test (WBT) Analysis

3.4.1. The Relationship between Water Boiling Time and Fuel in WBT

The duration of boiling water in the WBT analysis of various experimental samples in Figure 3. From Figure 3, 100% used cooking oil has the longest boiling time of about 983 seconds while the fastest is 60:40 diesel used cooking oil sample, which is about 341 seconds. The mixture of used cooking oil with diesel has a shorter boiling time compared to used cooking oil. Mixed fuel samples have faster water boiling time records because the heat value of the sample is high; the fire temperature to be generated is also high. High fire temperatures accelerate the process of heating the water to boiling.

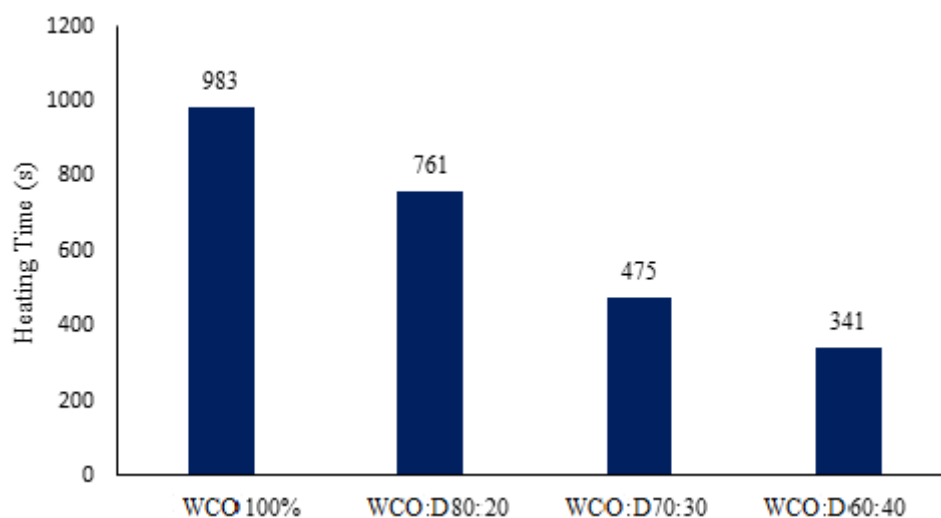


Figure 3. Water Boiling Time Diagram in WBT Analysis

3.4.2. Relationship of Fuel Consumption to Fuels used in WBT

The fuel consumption of each fuel sample is shown in Figure 4. Based on Figure 4, 100% used cooking oil samples in the WBT analysis have higher fuel consumption compared to mixed fuel samples, while 60:40 diesel used cooking oil mixed fuel samples have the lowest fuel consumption compared to other fuels. This is because the heating value of the used cooking oil sample is low, so that the resulting fire temperature is also low. Low fire temperature causes water heating to be longer and result in more fuel consumption.

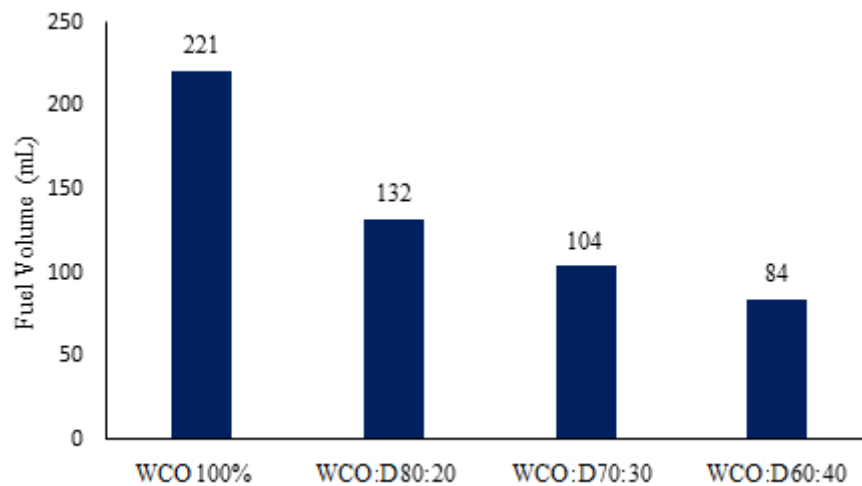


Figure 4. Fuel Consumption Diagram in WBT Analysis

3.5. Analysis of Cooking Oil Burner Efficiency Stoves on Water Boiling Test (WBT)

The energy efficiency of the stove to the variation of fuel used in WBT is shown in Figure 5. Based on Figure 5, the 60:40 diesel used cooking oil mixed fuel has the highest energy efficiency of 8.45% compared to other fuels, while the lowest efficiency at used cooking oil 3.45%. The higher the composition of the diesel fuel mixture, the higher the efficiency, since the energy produced from the mixture fuel (heating value) is more utilized with a small volume of fuel consumption. The higher the calorific value of the fuel, the lower the volume of fuel consumption used for heating water.

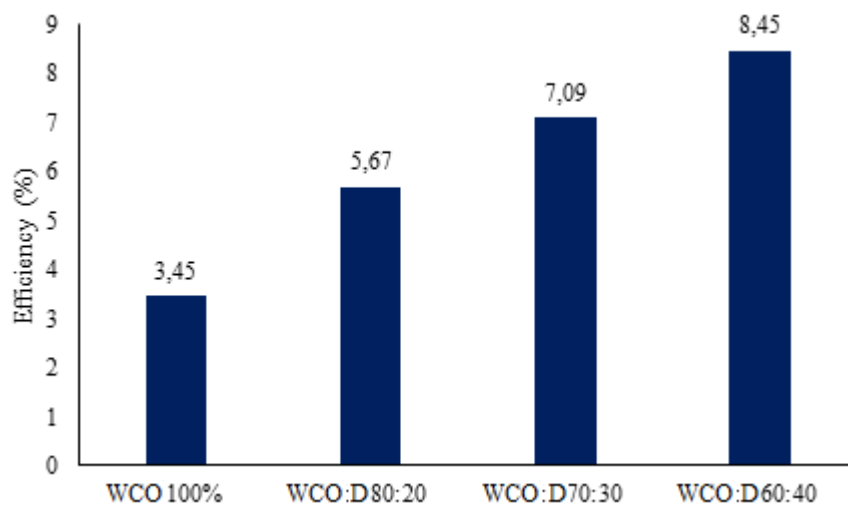


Figure 5. Stove Efficiency Diagram for Fuel Variations

3.6. Economic Analysis

Break-Even Point (BEP) analysis is needed to find out the time of breakeven or when the return of capital and costs have been incurred to produce a number of products. In the BEP analysis, it is known that the capital to produce the product is Rp. 3,091,515.00/day, while the savings created by the product are Rp. 44,000.00/day. The time needed to reach BEP is 71 days or 2 months 11 days. The BEP point on 71 days is the savings made every day if it continues to be collected can replace capital in the manufacture of equipment. Fuel conversion analysis is needed to find out the exchange rate of waste cooking oil with commonly used fuels (kerosene) and biodiesel. The calculation results obtained that 1 liter of used cooking oil equal 0.3-liter kerosene equal 0.32 liter of biodiesel.

4. Conclusions

The optimum standard AFR of 12:1 produce maximum energy, while the AFR of 16:1 produces maximum economic value for combustion. On used cooking oil stoves to achieve optimum conditions using a fuel flow rate of 2.5 mL/min (valve opening $\frac{3}{4}$ open), while the airflow rate used is 27.64 m/s. Mixing the fuel using diesel fuel aims to increase the calorific value of the fuel and increase the cetane number so that it is easy to ignite the fire and produce a proper combustion temperature. The optimum composition is 70:30 diesel used cooking oil mixture. The combustion flame depends on AFR, and the highest temperature is at AFR 10:1 with a temperature of 357°C and the higher the AFR, the resulting flame is getting bigger and longer. The energy efficiency of a stove using 100% used cooking oil is 3.45%. Conversion of used cooking oil to kerosene fuel, which is 1 liter of used cooking oil is equal to 0.3 liters of kerosene.

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