ISSN 2830-2818
Volume 10, 2022

ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021

July 26th - 29th

PROCEEDING BOOK

"Synergy for Energy Transition: The Role of Geothermal Energy in Energy Transition"

Editors:

Suryantini, Hendro Wibowo,
Taufiq Rachman, William Abraham Rasu,
After Helfert Pasaribu, Dinda Permatasari,
Esty Mustika Suud, Ahmad Fathoni

Organized By:

Seratus Satu Tahun Institut Teknologi Bandung

GEOTERMAL ITB

ISSN 2830-2818
Volume 10, 2022

Proceeding
10th ITB International Geothermal Workshop 2021

"Synergy for Energy Transition: The Role of Geothermal Energi Transition"

Bandung, Indonesia, July 26-29, 2021

Institut Teknologi Bandung

SPONSORED BY:

PT Geo Dipa Energi (Persero)

Schlumberger

PERTAMINA GEOTHERMAL ENERGY

DAGO ENERGI NUSANTARA

SMI

star energy geothermal

PT SUSTRACO ADIKREASI
www.sustracoenergy.com

Sarulla Operations Ltd

BNI

RIGSIS

Scientific Drilling

PT. Tunggal Buana Utama

supreme energy

PRA

Cogindo

PT. ANDALAN TUNAS MANDIRI

DEPRIWANGGA

ENDORSED BY:

INDONESIAN GEOTHERMAL ASSOCIATION INAGA

INTERNATIONAL GEOTHERMAL ASSOCIATION IGA

SUPPORTED BY:

IKATAN AHLI GEOLOGI INDONESIA 13.4.1960

AWPRB
IGA ASIA-WESTERN PACIFIC REGIONAL BRANCH

MEDIA PARTNER:

mudrock media PUBLICATIONS

THINK GEOENERGY

PABUM News

kanal geotermal

SRE

ECADIN
ENERGY ACADEMY INDONESIA

ORGANIZED BY:

INSTITUT TEKNOLOGI BANDUNG 1920

GEOTERMAL ITB

Seratus Satu Tahun
Institut Teknologi Bandung

ISSN 2830-2818
Volume 10, 2022

CONTENTS

This page is intentionally left blank

ISSN 2830-2818
Volume 10, 2022

COMMITTEE

Steering Committee	Sutopo (Chairman of ITB Geothermal Master Program) and Staffs of Geothermal Master Program, FTTM – ITB
Chairman	Suryantini
Vice Chairman I	After Helfert Pasaribu
Vice Chairman II	Afdhal Baravanni
Secretary	Yutty Hendrawati, Esty Mustika Suud
Treasurer	Dinda Permatasari RB
Sponsorship	Prihadi Sumintadiredja, Willy Adriansyah, Zuher Syihab, Irwan Iskandar, Jooned Hendrarsakti, Amerensia L F A Soetjahjo, Rai Gati, Patriks Vero Tongkeles
Creative, Publication and Media	Suhendi, Leonard Alvin, Rian Andriana, Ahmad Fathoni, Taufiq Rachman, Adrian Tawakal
Plenary Session	Nenny Miryani Saptadji, Ali Ashat, Rachmat Sule, Prihadi Setyo Darmanto, Hendro H. Wibowo, M. Ridwan Hamdani, Fadhil Karunia Hammad, Dedy Pramudityo, Yuniar Zhafira Abdillah, Irfan Berrizki Hermawan
Technical Paper	Hendra Grandis, Asep Saepuloh, Dimas Taha Maulana, Heru Berian Pratama, Angga Bakti Pratama, Betseba Sibaranai, William Abraham Rasu, Nashir Idzharul Huda, Nyora Donald Kobare, Renaldio Keintjem
Editorial	Suryantini (ITB), Hendro Wibowo (ITB), William Abraham Rasu (ITB), Taufiq Rachman (ITB), Esty Mustika Suud (ITB), After Helfert Pasaribu (ITB), Ahmad Fathoni (ITB), Dinda Permatasari RB (ITB)..

ISSN 2830-2818
Volume 10, 2022

Reviewer Team	Suryantini (ITB), Hendro Wibowo (ITB), Alfredo Battistelli (Italy), Romonchito Cedric Malate (The University of Auckland), Nyora Donald (Tanzania), Hendra Grandis (ITB), Nenny Miryani Saptadji (ITB), Sutopo (ITB), Jooned Hendrarsakti (ITB), Irwan Iskandar (ITB), Asep Saepuloh (ITB), Ali Ashat (ITB), Dimas Taha Maulana (ITB), Heru Berian Pratama (ITB), Angga Bakti Pratama (ITB), Jooned Hendrasakti (ITB), Prihadi Sumintadireja (ITB), Prihadi Setyo Darminto (ITB), Andri Hendriyana (ITB), Dadi Abdurrahman (ITB), Betseba Sibarani (ITB), Yuniar Zhafira Abdillah (ITB), Beta Kurniawahidayati (ITB), Khasani (UI), Muhamad Ridwan Hamdani (Star Energy Geothermal Salak), Jantiur Situmorang (AILIMA), Fitri Oktaviani (ADB), Mahesa Pradana Saputra (PT. Thermochem Indonesia).

KEYNOTE SPEAKERS

Name	Affiliation	Topic
Arifin Tasrif	Energy and Mineral Resources, Republic of Indonesia	Indonesian Regulation to Support Geothermal for Energy Transition
Ahmad Yuniarto	PT. Pertamina Geothermal Energy	PT. Pertamina Geothermal Energy Plan & Strategy for Geothermal in Energy Transition
Marit Brommer	International Renewable Energy Agency (IRENA)	Geothermal in Energy Transition from IRENA Point of View
Andrea (Andy) Blair	International Geothermal Association (IGA)	IGA Plan and Role in Energy Transition
Dadan Kusdiana	Directorate General New and Renewable Energy and Energy Conservation, Republic of Indonesia	Plan and Strategy for Geothermal in Energy Transition
Huong Mai Nguyen & Muchsin Qadir	World Bank	Investment in Geothermal Activities to Support the Energy Transition
Jantiur Situmorang	AILIMA	Artificial Intelligence for Geothermal
Remi Harimanda	Ormat Geothermal Indonesia	ORMAT'S Innovations to Deal with Medium & Low Enthalpy Geothermal Resource, Hybrid Technology Geothermal and Solar PV
Eko Budi Lelono	Geological Agency, Republic of Indonesia	Exploration Government Drilling
Shakiru Idrissa Kajugus	Tanzania Geothermal Development Company Limited	Update of Geothermal Exploration and Development of Tanzania
Dicky Fahnudi	Schlumberger	Fracture Characterization for Optimum Well Placement
Suryantini	Geothermal Master Program ITB	Hot Sedimentary Geothermal: First Study in Indonesia
Gioia Falcone	Energy and Sustainability Research Group at University of Glasgow, UK	Transforming Oil Well into Geothermal Well

ISSN 2830-2818
Volume 10, 2022

Kasumi Yasukawa	Asia Western Pacific Regional Branch IGA, Japan	Direct Use for Tropical Country "Cooling by Geothermal Energy"
Ruben Havsed	Country Manager & President of Climeon, Taiwan	Binary for Low Enthalpy Geothermal
Hendra Yu Tonsa Tondang	PT. PLN	Geothermal Update from PT. PLN Gas & Geothermal
Supremlehaq Taqwim	PT. Geo Dipa Energi	Geothermal Update from PT. Geo Dipa Energi
Novi Ganefianto	PT. Supreme Energy	Geothermal Update from PT. Supreme Energy
Hisao Nakano	Sarulla Operations Ltd	Geothermal Update from Sarulla Operation Ltd
Aquardi Rachmat Suminar	Star Energy Geothermal Salak Ltd	Geothermal Update from Star Energy Geothermal Salak Ltd
Julfi Hadi	Medco Cahaya Geothermal	Geothermal Update from PT. Medco Cahaya Geothermal
Riza Pasikki	KS Orka Renewables	Geothermal Update from KS Orka Renewables

This page is intentionally left blank

PREFACE

ITB International Geothermal Workshop (IIGW) is an annual event organized by *Prodi Teknik Geotermal, Fakultas Teknik Pertambangan dan Perminyakan (FTTM),* ITB. The workshop celebrated its 10th anniversary this year. It was held on July 26–29, 2021 and has become a special moment in supporting the geothermal development acceleration program in Indonesia.

The objective of the workshop was to improve community understanding toward geothermal energy is a part of renewable energy. This conference also discusses the latest condition of geothermal energy and other renewable energy in Indonesia and to draw attention from scientist, engineers, including academicians, industrial stakeholders, and also geothermal leaders about the initiatives, strategies, opportunities, and challenges toward geothermal development in Indonesia, and to show the commitment to the nation in achieving its 7200 MWe installed capacity in 2025.

Participants benefit is exchanges of view, knowledges and experiences on latest technologies and researches by bringing together scientists, engineers, academicians, experts, and industrial stakeholders involved in geothermal and other renewable energy studies and developments.

As part of this year commitment, selected papers are published as open access volume of *IOP Conference Series: Earth and Environmental Science*. Other papers are published in the conference proceeding in print version. We hope wider geothermal communities will gain the same benefits as our conference attendees.

This page is intentionally left blank

WORKSHOP WELCOME REMARKS

ITB International Geothermal Workshop 2021 was an event from ITB Geothermal Master Program which was held on July 26 – 29, 2021 and 25th September 2021 on an online basis through live virtual workshop (Webinar) via Zoom and YouTube. Followed by over than 1527 participants from many different aspects of geothermal community, such as academia, industries, and government. This year's theme is "**Synergy for Energy Transition: The Role of Geothermal Energy in Energy Transition"**, focusing more on Prospecting and Utilization of Geothermal Energy and collaborating Indonesia Geothermal Stakeholders by inviting speakers from various aspects in geothermal energy.

The Participants including from academia, industries delegates, and government of Indonesia. Academic delegates are from Institut Teknologi Bandung, Universitas Trisakti, Universitas Negeri Manado, Universitas Padjadjaran, Universitas Pembangunan Nasional "Veteran" Yogyakarta, Universitas Diponegoro, Institut Teknologi Sepuluh November, University of Aberdeen, Kyushu University, Friedrich Schiller University Jena, Universitas Lampung, Auckland University, Universitas Gadjah Mada, Universitas Sriwijaya, Universitas Indonesia, and Universitas Pertamina. The industries delegates are PT. Pertamina Geothermal Energy, Supreme Energy, PT. Geo Dipa, Star Energy, PT PLN, Schlumberger, World Bank, Sarulla Operations Ltd, Rigsis Energi Indonesia, KS. Orka, PT. Thermochem, West Japan Engineering Consultants, Inc., Fuji Electric and PT. Elnusa. Government representative is from Energy and Mineral Resources Ministry of Indonesia and Geological Agency of Indonesia.

We want to give many thanks for all the support that has been given for this event, from Geothermal Technology Magister Program Staff to all Chairperson, authors, presenters, paper reviewers and all the Webinar sponsors for assistance and cooperation in support of this event.

Sincerely

Dr. Eng. Suryantini, S.T., Dipl. Geothermal En. Tech., M.Sc.
Chairperson of the 10th ITB International Geothermal Workshop (IIGW) 2021

This page is intentionally left blank

WORKSHOP EVENTS

ITB International Geothermal Workshop 2021 was a masterpiece event organized by ITB Geothermal master's degree program as a contribution to the geothermal development all around the world especially Indonesia. These events are virtual workshop and was held from July 26 – 29, 2021 and Post Workshop by IAGI and was held on September 25th, 2021

The Webinar is consisting of two main activities, those are virtual workshop and post workshop. Every day there is one invited speaker, and after that it is filled with paper presentations consisting of various topics. Many interesting and high-quality papers were presented in virtual technical session. The total full papers submitted this year were 56 papers, and 22 papers were selected for presentation in our Youtube Channel. 18 of those can be watched in our youtube channel, Geothermal ITB. The post-workshop course was entitled "Geothermal Production Geochemistry: From Sampling, Analysis, and Interpretation" by IAGI.

This page is intentionally left blank

ISSN 2830-2818
Volume 10, 2022

ABSTRACTS OF IOP CONFERENCE SERIES

Available online at:
IOP Conference Series: Earth and Environmental Series
https://iopscience.iop.org/issue/1755-1315/1014/1

EXPLORATION

ENGINEERING

ISSN 2830-2818
Volume 10, 2022

EXPLORATION

PRELIMINARY RESULT OF MICROEARTHQUAKE MONITORING AT NAMORA-I-LANGIT AND SILANGKITANG, SARULLA, NORTH SUMATRA, INDONESIA

Drestanta Yudha Satya[1], David Sahara[2], and Doddy Astra[1]

[1]Sarulla Operations Ltd 7th Floor the Energy Building, SCBD Lot 11A Jakarta 12190, Indonesia
[2]Global Geophysics Research Group, Institut Teknologi Bandung Jalan Ganesha No. 10, Bandung, 40132, Indonesia

E-mail: drestanta.yudha@sarulla-geothermal.com

Namora-I-Langit (NIL) and Silangkitang (SIL) are two exploited geothermal fields within Sibualbuali WKP. SIL started commercial generation of 110 MW on Mar 18, 2017. Currently, 4 producers and 9 injectors support SIL full power generation. The NIL geothermal field has been operated 220 MW since May 2018 with the support of 11 production and 10 injection wells. NIL is a volcanic hydrothermal system that associates with distributed permeability while SIL is fault-controlled permeability system that relates with extensional regime along main Great Sumatra Fault (GSF). Since early 2020, the monitoring of microearthquake (MEQ) has been running in NIL and SIL. The MEQ network consists of 18 permanently installed seismometers which covers a total area of 224 km^2. The instruments record 3 – 4 events in average per day within 300-days monitoring. Four MEQ clusters are consistently detected, two clusters in NIL and other two in SIL. One cluster which is located South of NIL seems to correlate with non-benign water downflow where the clay cap is thin or absence. The intensity of MEQ occurrence and downflow process were dictated by production activity. In SIL, changing of injection activity coincides with the variation of MEQ event rate in East cluster. Those clusters are interpreted due to geothermal exploitation activities in this area. Further MEQ analysis needs to be carried out to understand the interplay between the geothermal conceptual model, geological structure, and injection/production activity.

Keywords: Sarulla, Namora-I-Langit, Silangkitang, great Sumatra fault, microearthquake.

AN APPLICATION OF COAST EFFECT CORRECTION TO MAGNETOTELLURIC DATA FROM JAILOLO GEOTHERMAL PROSPECT AREA, ON THE ISLAND OF HALMAHERA

Fikri Fahmi[1], Yunus Daud[1,2], and Wambra Aswo Nuqramadha[3]

[1]Geothermal Exploration Magister Program, Universitas Indonesia
[2]Geothermal Research Center (GRC), Universitas Indonesia
[3]PT NewQuest Geotechnology

E-mail: ydaud@sci.ui.ac.id.

Several geothermal prospect areas are situated near coastal regions. One of them is Jailolo geothermal prospect area located on the island of Halmahera. Magnetotelluric (MT) data obtained in the vicinity of the coast may be suffered from coast effect. Boundaries between ocean and land may induce severe distortion of electrical fields due to its extremely high conductivity contrast. The effect mostly distorted MT data in low-frequency and may produce some artifacts in deep parts of resistivity inversion model. In order to get a reliable subsurface resistivity model in Jailolo, a 3-D inversion of acquired MT data was carried out by including an oceanic model, which was set as a prior model, to overcome coast effect distortion. Before that, to examine coast effect influence on acquired MT data, 3-D forward modeling of a simple synthetic model was performed using a similar 3-D inversion mesh grid. Conductive seawater around survey area was also built in the mesh grid and adjusted to bathymetry data. Furthermore, synthetic MT data were then inverted in two schemes with and without oceanic model. Based on inversion results, use of oceanic model can significantly improve inversion result and give a more comparable inversion model with a synthetic model. Meanwhile, 3-D inversion of real MT data, which was carried out with a similar approach, successfully produces a representative subsurface resistivity model to describe geothermal system in study area.

Keywords: Magnetotelluric, 3-D inversion, coast effect, ocean model.

SURFACE THERMAL MANIFESTATION MAPPING IN KAMOJANG GEOTHERMAL FIELD, WEST JAVA, INDONESIA

Aditya Yuda Kencana and Niniek Rina Herdianita

Department of Geological Engineering, Bandung Institute of Technology, Bandung, Indonesia

E-mail: adityayudakencana@gmail.com

Kamojang Geothermal Field is located in Bandung, West Java, Indonesia. Since 1978, this field has been producing electricity with total capacity about 235 MWe. Surface thermal manifestation monitoring is a powerful tool to monitor changes of reservoir condition. The investigation aimed at mapping new thermal manifestations and ground temperatures in Kamojang crater. The method employed is field mapping using drones and tracking. Ground temperatures were acquired directly in the field by measuring at 20 cm depth. Geologically, Kamojang Crater area is dominated by volcanic rocks such as andesite lava, pyroclastic breccia, tuff, and lapilli. It has undergone moderate to very strong alteration into clay, silica, iron oxide, and anhydrite minerals. The main geological structures that play a role in Kamojang area are Kendang, Patengteung, and Citeupeus Fault systems. Surface manifestations discharged in Kamojang area consist of mud pools/vents, hot springs/pools, steaming ground, and steam vents that are controlled by Citeupeus and Pateungteung Faults with a NE-SW orientation. The area was later referred to as Kamojang Crater, which consists of Manuk, Berecek, Sakarat, Kamojang, Kereta Api, Cikahuripan, Hujan, Loutak, Baru, Saar, and Inactive Craters. Several new hot spots have not been mapped in detail by previous research, including Timur Crater, Mud Pool Complex, and Tengah Crater. Meanwhile, an Inactive Crater to the north of study area indicates activity shown by boiling and bubbling hot pool. The thermal manifestation has a high temperature of 50.4 to 94.7°C. Manifestations in the form of liquids (mud and water) have an acidic fluid, with a pH ranging between 1.30 and 5.50. Ground temperatures in Kamojang Crater area range from 17 to 95°C. High temperature areas of 80 - 95°C are associated to thermal manifestations.

Keywords: Ground temperature, hot spots, Kamojang, thermal manifestation.

MICROSEISMIC AND FOCAL MECHANISM ANALYSES FOR STRUCTURAL INTERPRETATION – MUARA LABOH GEOTHERMAL FIELD

Djoko A. Wibowo[1], Irvan Ramadhan[2], Indra Agoes Nugroho[2], Marino C. Baroek[2], Novi Ganefianto[2], Herwin Azis[2], Suryantini[3], David P. Sahara[3], and Prima W. Mozef[3]

[1]Master degree Student Geothermal Engineering, FTTM, ITB, Jakarta, Indonesia
[2]PT Supreme Energy Muara Laboh, Menara Sentraya, 23rd floor, Jakarta 12160, Indonesia
[3]Institut Teknologi Bandung, Jl. Ganesa No. 10, Bandung, Jawa Barat, Indonesia

E-mail: djokoawibowo@gmail.com

Microseismic monitoring has been used for gathering subsurface information in Geothermal field as part of reservoir monitoring and management plan. New micro earthquake (MEQ) stations were installed in the Muara Laboh geothermal field in the end of 2019, coinciding with the first operation of Unit-1. They have been continuously used to monitor the MEQ events until now. This paper discusses MEQ data analyses to support the subsurface structural interpretation in the Muara Laboh geothermal field. Geothermal production and injection activities create micro seismicity which is triggered by stress failure in fractures / fault planes due to percolation of fluid within fractures network. Distribution of hypocenter locations and magnitude are analyzed, considering highly operational activities, rock mechanic and slip orientation. There are two micro seismicity clusters observed, namely South and North clusters. The South cluster represents 80% of the total recorded micro seismicity events, having NE – SW trend direction; while the North cluster consists of 10% of the total events, correlated with the NNW – SSE structural trend direction. Focal mechanism analysis explains that micro seismicity observed on extended fault zone in the south is thought to be correlated with the distributed fractured network on the hanging wall of normal fault. It is shown by some micro seismicity swarms identified in the south basin-sidewall fault area. These orientations support the current kinematic model of the Muara Laboh geothermal field derived from the structural geology mapping and borehole image logs.

Keywords: MEQ, Muara Laboh, monitoring, focal mechanism.

VOLCANOSTRATIGRAPHY STUDY OF WAY RATAI GEOTHERMAL PROSPECT IN PESAWARAN REGENCY, LAMPUNG PROVINCE

M. Arif Al-Hassan[1] and Mochamad Iqbal[2]

[1]Department of Geology, Sumatera Institute of Technology (ITERA)
[2]Petrology, Volcanology, and Geothermal Research Group, Geological Engineering, Sumatera Institute of Technology (ITERA), Jl. Terusan Ryacudu, Way Huwi, South Lampung, Indonesia

E-mail: marif.15117042@student.itera.ac.id

Way Ratai geothermal area is volcanogenic geothermal system located in Pesawaran Regency, Lampung Province, Indonesia. The presence of the geothermal system in this area is indicated by the distribution of geothermal manifestations such as hot pools and hydrothermal alteration. Understanding the geological setting of this area plays an important role in considering the prospect of geothermal resources. This paper aims to determine the prospect of the geothermal area by investigating the relationship between volcanic units, geological structures, and geothermal systems in the Way Ratai. The study was conducted with remote sensing analysis and volcanostratigraphy study to interpret the stress regime, the permeability zone analyzed by the lineament density, the lithological unit, and the dimension of the volcanoes. Three groups of structural lineaments are identified from remote sensing analysis: NW-SE trend, NNE-SSW trend, and circular feature. Mount Ratai Volcanic Crown consists of 19 lithological units such as lava dome, lava flow, pyroclastic products, and surface deposit. The estimation of the volcanic product dimension is about 55 km3 that widespread radially which indicates the presence of a significant heat source beneath the surface. The volcanic activities occurred during the Pleistocene to Holocene with andesitic composition. Based on the lineament density extraction, the prospect area located on the southern flank of Mount Ratai has good permeability. Lineament maps that are overlaid by volcanic rock distribution maps will result in the relationship between the volcanostratigraphy units and the geological structure pattern of the area. From this study, the characteristics of the area show that this area has a good geothermal prospect to be developed and needs further investigation.

Keywords: Volcanostratigraphy, remote sensing, geothermal, Mt. Ratai, Pesawaran.

ENGINEERING

THE EFFECTS OF PDC CUTTER GEOMETRIES TO THE DRILLING DYNAMICS IN VARIOUS GEOTHERMAL ROCKS: A COMPREHENSIVE STUDY USING ADVANCED DRILLING DYNAMICS SIMULATION

Ramadhan Yoan Mardiana and Sepanya Pasaribu

Schlumberger Indonesia, Wisma Mulia, Suite 4201, JL Gatot Subroto, No. 42, Jakarta Selatan, DKI Jakarta, 12710, Indonesia

E-mail: mmardiana@slb.com

Abstract. Polycrystalline Diamond Compact (PDC) bit has been used widely in drilling operations since a long time ago. However, the utilization of this bit in Indonesia's geothermal drilling has just recently started in 2016, thanks to the rapid development of PDC cutter grades and shapes in the last decade. Prior to that, the geothermal drilling operation relied on Tungsten Carbide Insert (TCI) bit to drill the hard formations. The crushing action of the insert bit is very durable to remove the rocks. However, the seal and bearing limit the life of these bit types, causing multiple bit runs in a long drilling section. PDC bit offers longer drilling periods if the cutters are still in good condition. However, the nature of geothermal formation usually consists of hard rocks with fractures that can reduce the durability of the conventional flat PDC cutters. To overcome this weakness and optimize drilling operation. Instead of having a flat surface, new PDC cutters have different 3D shapes. Each has different benefits: improving cutter strength against impact, increasing aggressiveness and depth of cut, or enhancing wear resistance towards abrasive formations. Advance drilling dynamics simulation helps analyze which cutter types will be more suitable for different geothermal rocks characteristics. The simulation is based on 4D Finite Element Analysis, which models the interaction between the cutting structures and the drilled formation. The result shows the dynamic drilling response of each cutter on different rocks, including the generated vibration, the cutter's depth of cut distribution on the bit face, and the potential wear pattern on the bit. This paper then discusses which cutter and PDC bit type will be more beneficial for geothermal drilling based on the bit aggressiveness and durability to optimize the drilling operation.

Keywords: Drilling bit, drilling dynamics, PDC, 3D cutters, drilling simulation.

RESERVOIR DYNAMICS MONITORING IN A LIQUID DOMINATED GEOTHERMAL FIELD BASED ON SURVEILLANCE DATA AND TRACER FLOW TEST

Basuki Arif Wijaya[1,3], Heru Berian Pratama[1], Ali Ashat[1], Sutopo[1], and Abu Dawud Hidayaturrobi[2]

[1]Geothermal Engineering Master Program, Institut Teknologi Bandung, Jl. Ganesha No.10, Bandung, West Java, Indonesia
[2]Star Energy Geothermal Salak Ltd, Wisma Barito Pacific II, JI. Letjen. S. Parman Kav. 60, Jakarta 11410, Indonesia
[3]PT. Mustikabumi Indonesia, Graha Pratama Building, Jalan MT Haryono Kav. 15, RT.11/RW.5, Tebet, Jakarta Selatan, Jakarta 12810, Indonesia

E-mail: basuki.a.wijaya@gmail.com

Two common characteristics changes in the liquid-dominated reservoir because of exploitation are a decrease in temperature in the liquid reservoir zone (due to injection breakthrough) and the development of a steam zone (because of lower liquid water level). Both phenomena are observed by using the tracer flow test (TFT) technique. The comprehensive analysis using enthalpy from TFT data, combined with the data of chloride in brine, NCG in steam, and subsurface temperature (from PT logging), can be used to identify the dynamics of the reservoir processes. The application of the comprehensive analysis is selected for this study by taking those various monitoring of surveillance programs from a liquid-dominated geothermal system. In the selected geothermal field, which the operation began in 1994, an injection breakthrough occurred in the western part of the field. On the other side, the development of a steam reservoir was observed in the eastern part of the field. TFT monitoring is carried out every three months in each active production well as stated in the surveillance program. Other chemical monitoring and (PT) log data are also carried out periodically. Two wells from the studied field are selected, in which one well experience with injection breakthrough and the other one is in steam cap development. Comprehensive analysis results from TFT data, geochemical monitoring data (NCG and Cl), and subsurface temperature are used to understand the dynamics in geothermal reservoirs. Injection breakthrough in production well is indicated by changes in chloride content, decrease in enthalpy and NCG in the steam. Whereas the formation of steam cap will be characterized by an increase in enthalpy and NCG. With a thorough understanding of the changing conditions in the reservoir, recommendations for appropriate surveillance strategies can be formulated to maintain an optimal and sustainable generation process.

Keywords : Injection breakthrough, steam cap, enthalpy, TFT, chloride, NCG.

A COMPARATIVE STUDY OF COOLING SOURCES IN ORGANIC RANKINE CYCLE FOR LOW-TEMPERATURE GEOTHERMAL HEAT SOURCES

Sindu Daniarta[1,2,3] and Piotr Kolasiński[1]

[1]Department of Thermodynamics and Renewable Energy Sources, Wrocław University of Science and Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland
[2]Department of Energy Engineering, Faculty of Mechanical Engineering, Budapest University of Technology and Economics, Műegyetem rkp. 3, H-1111 Budapest, Hungary
[3] Energy Academy Indonesia (ECADIN), Indonesia

E-mail: sindu.daniarta@pwr.edu.pl

Geothermal energy refers to ground heat sources exploited for many purposes (for example, generating electricity). A steam power plant, operating according to the Rankine cycle (RC) using water as a working fluid, is a prospective technology that can be installed to generate power from geothermal heat. However, due to the thermal properties of the applied working fluid, the steam power plant has the limitation that may not utilize cold source like liquefied dimethyl ether (DME) at the temperature of around -25°C or the extreme one, like liquefied natural gas (LNG) at the temperature of around -160°C. For this reason, it seems that RC using an organic working fluid (so-called ORC) is an appropriate technology to utilize heat sources of extremely low temperatures. Selected ORC working fluids are considered suitable to absorb the cold source. This paper presents the calculation model, thermodynamic analysis, and a comparison of geothermal power systems exploiting air, water, LNG, and DME as the cooling medium of the ORC. The simple scheme of ORC is used for modelling, furthermore, the Trilateral Flash Cycle (TFC) is described as a comparative study. Thanks to the LNG technology, it is already mature enough, and the method of altering the phase into liquefied form is likely to store the energy (i.e., the power to liquid). In the liquefied form, natural gas can be easily distributed and transported at a certain distance. In this model system, the result shows that LNG and DME appear to be excellent options for increasing the operating range of ORC. The modelling result shows that the combination of propane (CAS no. 74-98-6) as a working fluid and LNG as a cooling source has a wider operating range and is a good option to exploit low-temperature geothermal heat as a power generation system. Also, using DME for both cooling sources and the working fluid inside the geothermal power system employing ORC outperforms other ones. Taking advantage of using them as a cooling source is significantly boosting the potential deriving from low-temperature geothermal energy (i.e., below 90°C) as promising sources in the future.

Keywords: ORC, TFC, LNG, DME, working fluid, efficiency.

STUDY OF POTENTIAL OF CASCADE DIRECT USE TO UTILIZE EXHAUST STEAM FROM BACK PRESSURE TURBINE AT ULUMBU GEOTHERMAL POWER PLANT

Azaria Haykal Ahmad[1], Aby Lafkin[1], Sholihah R. Utami[2], Nur Hasyyati Luqiyana[1], Fadhil Karunia Hammad[3], Rian Andriana[3], and Jooned Hendrarsakti[1,3]

[1]Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung
[2]Faculty of Civil and Environmental Engineering, Institut Teknologi Bandung
[3]Geothermal Study Program, Institut Teknologi Bandung Jl Ganesha No 10, Bandung, Indonesia

E-mail: azariahaykalahmad@gmail.com

The Indonesian government has fixated Flores Island for geothermal utilization due to its potential to reach about 776 MW. Of these potentials, one that has been utilized is at PLTP Ulumbu with a 10 MW energy reservation. 2 backpressure units at PLTP Ulumbu generate power 2×2.5 MW. The exhaust on the backpressure unit of the PLTP Ulumbu has an average temperature of 99˚C with enthalpy ranging from 2,430 to 2,435 kJ/kg. Instead of releasing the steam to the environment, it would be wiser to utilize the brine's heat through cascade direct use based on Lindal Diagram. The cascading system will be arranged from high to low temperature to use excessive energy efficiently. The direct use application is selected based on the best potential-for-fit commodities and the energy of the heat source. This paper aims to perform a feasibility study of cascade direct use of geothermal energy that uses an exhaust steam backpressure turbine at Ulumbu geothermal power plant. The Ulumbu area will be transformed as the center of agricultural, stockbreeding, factory, and geothermal tourism. From potential commodities, the four applications selected are coffee bean drying, egg-hatching incubator, brick factory, and new tourism site. Additionally, several preliminary scenarios are available regarding plant development components (e.g., stakeholder and partnership type). Hence, the comprehensive determination of the 'best scenario' will be discussed in terms of feasibility and economic attractiveness.

Keywords: Geothermal direct use, cascade, Ulumbu, back-pressure turbine.

GEOTHERMAL DIRECT USE ALTERNATIVES IN MATALOKO TO INCREASE PUBLIC ACCEPTANCE

Azaria Haykal Ahmad[1,3], Daniel W. Adityatama[2], Muhammad Akram Rusdianto[1,4], Gughy Mintorogo Pradana[1,5], Trisha Amanda Beryll[1,5], Pradana Vian Prasetyo[2], and Annisa Rachmadani[2]

[1]PT. Enerka Bhumi Pratama, Jakarta Selatan, Indonesia
[2]PT. Rigsis Energi Indonesia, Jakarta Selatan, Indonesia
[3]Institut Teknologi Bandung, Bandung, Indonesia
[4]UPN "Veteran" Yogyakarta, Yogyakarta, Indonesia
[5]Universitas Pertamina, Jakarta, Indonesia

E-mail: azariahaykalahmad@gmail.com

The island of Flores has a lot of geothermal potentials, so it is often called the geothermal island. However, there have been many rejections on the island of Flores, one of which is in the Mataloko Geothermal Working Area (WKP). This can be problematic if future geothermal development is about to take place in Mataloko. One alternative that has been widely discussed to increase public acceptance is by developing a geothermal direct use facility that can give benefit to the local communities while at the same time give education regarding the geothermal resource and utilisation to them. The purpose of this study is to identify the potential geothermal direct use in Mataloko that can fulfil those objectives. The literature study was conducted, combined with the site visit to verify the desktop study result. Several alternatives for geothermal direct use in Mataloko have been identified based on the geothermal resource, availability of commodities, and the current condition of local communities and industries in the proximity of Mataloko Power Plant. This study is admittedly still in the preliminary stage and a more detailed feasibility study for each of the alternatives is required in the future.

Keywords: Geothermal direct use, social acceptance, Mataloko.

IDENTIFICATION OF DIRECT-USE GEOTHERMAL ENERGY FOR EXTRACTING CAJUPUT OILS USED TO REDUCE RESPIRATORY DISORDER DUE TO COVID-19

Jooned Hendrarsakti[1,2], Adhi Brahmantya Herdhani[1], Afdhal Baravanni[2], Deyan Rianto[1], Mochammad Resha[1], Putra Andi Kolala[1], Triya Setia Febriatna[1], and William Abraham Rasu[2]

[1]Mechanical Engineering Study Program, Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung (ITB) Jl. Ganesha No.10, Bandung, 40132, Indonesia
[2]Geothermal Master Program, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung (ITB) Jl. Ganesha No.10, Bandung, 40132, Indonesia

E-mail: jooned@ftmd.itb.ac.id

The COVID-19 disease causes severe symptoms like fever, cough, and respiratory disorder like streptococcus pneumonia. Essential oil in cajuput is oil is believed to have effect to reduce respiratory disorder due to COVID-19. While the cajuput oil is not proven to prevent or to heal COVID-19 patients, the treatments using cajuput oil are proven helpful to ease the symptoms. Indonesia as a tropical country has large-scale cultivation of cajuput plants, for example in 2017, Sumedang and Majalengka areas produced up to 4 tons raw material or 10 kg in a day. In producing cajuput oil, there are some steps required for oil extraction and distillation including modified steam distillation method used in this study. This method of essential oil extraction process may use a large amount of heat to produce steam. Geothermal residual heat in the form of brine can be an alternative used to extract eucalyptus oil on small scale. This study shows the material balance analysis for the cajuput oil production with 10 kg cajuput leaves per day from Sumedang and Majalengka areas using Wayang Windu geothermal power plant brine at 180.7°C with 0.05 kg/s mass flow rate. Wayang Windu geothermal power plant itself was chosen because the distance is not too far from cajuput source, which is around 99.7 km. In this study the cajuput oil extraction produces around 57.918 x 10^{-3} kg of cajuput oil for daily production time 100 min/day.

Keywords: Oil extraction, COVID-19, direct use, Wayang Windu.

IDENTIFICATION OF POTENTIAL OF GEOTHERMAL ENERGY USED FOR VACCINE COVID-19 COLD STORAGE BOX USING ABSORPTIVE REFRIGERATION

Jooned Hendrarsakti[1,2], Dinda Permatasari RB[2], Erstrela Belia Muaja[1], Iqbal Muwahid[1], Leonard Alvin[2], Muhammad Romadhona[1], and Naufal Riyandi[1]

[1]Faculty of Mechanical and Aerospace Engineering, Institut Teknologi Bandung, Jl. Ganesha No.10, Bandung, West Java, Indonesia. 40132
[2]Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung Jl. Ganesha No.10, Bandung, West Java, Indonesia. 40132

E-mail: jooned@ftmd.itb.ac.id

A variety of vaccines of Covid 19 have been developed by different drug makers. Each vaccine brand requires different storage temperature ranged from 2-8°C, which then requires a cold storage box. In Indonesia, vaccine transportation and storage become big challenges to ensure the vaccines in good condition before use. This research focused to find out the possibility of using geothermal energy from Lahendong geothermal power plant unit 5 in Tompaso, North Sulawesi, for 5 liters-cold storage for Covid-19 vaccine using ammonia-water absorptive refrigeration and to identify the possible temperatures for storage of vaccine. Based on the absorption refrigeration system calculation, the current study found that the average evaporator temperature is 3°C, with cooling load of 1.03 kW and COP of 0.43. This cooling load requires a brine of 59.98 kg/s from the Lahendong geothermal power plant.

Keywords: Lahendong geothermal field, absorptive refrigeration, direct use.

FIELD APPLICATION REVIEW OF SCALE REMOVAL ON GEOTHERMAL WELLS AND SURFACE PRODUCTION FACILITIES USING TRUE FLUIDICS OSCILLATOR (TFO)-PULSATING WAVES METHOD TECHNOLOGY

Luhung Kushonggo[1,2], Heru Berian Pratama[1], Sutopo[1], and Anton Supriyono[2]

[1]Geothermal Engineering Master's Program, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Jl. Ganesha 10, Bandung 40132, Indonesia
[2]PT. DFI Indonesia, Graha Simatupang Tower 2B 1st Floor, Jln. TB. Simatupang Kav. 38, Jakarta Selatan, 12540, Indonesia

E-mail: luhungkushonggo@gmail.com

Mineral deposition or scale is the main problem faced in geothermal energy management activities that occur in wells and in production facilities that cause a decrease in power plants' capacity. Scales are formed naturally and cannot be prevented because it is associated with reservoir and operational conditions that are widely found in Indonesian geothermal systems, predominantly liquid dominated ones, therefore the advantaged technology is needed to clean the scale (scale removal) so that the ability of wells and power plant capacity is maintained. This research aims to offer the alternative method for scale removal using the True Fluidics Oscillator (TFO)-Pulsating Waves Method. This method combines mechanical processes, chemical processes, and wave processes simultaneously to provide solutions to clean scales inside or outside the production casing or perforation zone. This oscillator creates pulsating pressure waves within the wellbore and formation fluids. These pressure waves help to break up any type of near-wellbore damage and restore the permeability by carrying the fluid past the wellbore into the formation. The pressure waves expand in a spherical fashion from the point of origin providing 360º coverage while moving the tool across the interval. The TFO is not affected by standoff from the surface to be cleaned and TFO efficiently transfers the kinetic energy of the fluid pumped to the damaged zone. The use of TFO in conjunction with any chemical treatments will greatly enhance the chemical surface contact area. Technical and economic analysis of the operation of TFO is needed to be applied appropriately to the condition of geothermal systems in Indonesia by using examples of cases in the Central Java Geothermal Field to know the feasibility of the technology.

Keywords: Scale removal, inside casing, outside casing, liquid dominated, true fluidics oscillator, pulsating waves method, feasibility.

AWI A-4 COMPREHENSIVE WELL EVALUATION FOR SUCCESSFUL WELL INTERVENTION PROGRAM

Abu Dawud Hidayaturrobi[1,2], Ardian Dwi Yudhistira[2], Risa Prameswari Putri[2], Dimas Taha Maulana[1], Nenny Miryani Saptadji[1]. and Ali Ashat[1]

[1]Geothermal Engineering Master's Program, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Jl. Ganesha 10 Bandung 40132, Indonesia
[2]Star Energy Geothermal Salak, Ltd. Wisma Barito Pacific II, 17th Floor, JI. Tol S. Parman No. Kav 60, Jakarta 11410, Indonesia

E-mail: Abu.dawud@starenergy.co.id

AWI A-4 well has the highest Non-Condensable Gas (NCG) content among other production wells in the Salak field with NCG content 10%-wt. NCG interference study indicated that AWI A-4 has the most substantial connection/interference to several surrounding high NCG wells. AWI A-4 encountered wellbore obstruction (scaling) in 2012, which increased the NCG content of surrounding wells and power plant Unit-4, causing generation loss. Another impact is steam supply reduction by 71.8 kg/s because of maintaining Unit-4 NCG content below its maximum Gas Removal System (GRS) capacity by 2%-wt. Wellbore scale clean out was conducted in 2015 but failed and even plugged the wellbore. A comprehensive evaluation of well AWI A-4 wellbore condition and well characterization was conducted involving a multidisciplinary team (Drilling, Reservoir, Production, Geochemistry) in order to obtain a better understanding of the main cause of well AWI A-4 wellbore plug then develop the proper method to clean the wellbore plug and improve wellbore accessibility. After evaluating well AWI A-4 wellbore condition comprehensively, a new scale clean out program was developed using rotojet Coiled Tubing Unit (CTU) in 2017 which was finally able to improve wellbore accessibility well AWI A-4 including NCG content reduction of surrounding high NCG wells and power plant Unit-4. This successful wellbore accessibility improvement has a positive impact on additional/incremental steam supply by 84.4 kg/s, including other steam supply projects delay and cancellation, so that reduce the company's operational cost.

Keywords: Scaling, casing integrity, Non-Condensable Gas (NCG), wellbore clean out.

CARBON EMISSIONS REDUCTION IN GEOTHERMAL DRILLING PROJECT: A PRELIMINARY STUDY

M. Rizqi Al Asy'ari[1,2,3], Jerry Tobing[1], Dorman Purba[1,3], Ferdino R. Fadhillah[1,3,4], Shaquille B. T. Kandou[1,5], and Daniel W. Adityatama[1,3]

[1]Enerka Bhumi Pratama, Cibis Nine Building 11th Floor, Jakarta Selatan 12560, Indonesia
[2]Petroleum Engineering Department, UPN "Veteran" Yogyakarta, Yogyakarta 55283, Indonesia
[3]Geoenergi Solusi Indonesia (GEOENERGIS), Cibis Nine Building 11th Floor, Jakarta Selatan 12560, Indonesia
[4]Geoscience Department, Faculty of Mathematics and Natural Science, University of Indonesia, Depok 16424, Indonesia
[5]Mechanical Engineering Department, Faculty of Engineering, Universitas Udayana, Bali 80361, Indonesia

E-mail: rizqialasyari21@gmail.com

The global increase of carbon emissions needs to be reduced to keep incremental global warming below 2 degrees. However, in the last decades, Indonesia's energy supply and demand have been highly dependent on fossil fuels, contributing to high carbon emissions. Most of the non-renewable energy demand comes from transportation and electrification. While in drilling activity, diesel engines produce carbon emissions for mobilization, drilling operation, and site electrification. Carbon emissions reduction is part of the policy of several giant energy companies to achieve net-zero emissions to support environmental sustainability, echoed by Paris Agreement 2015. This preliminary study aims to comprehensively evaluate the activities that generate carbon emissions in geothermal drilling projects. With the case study, the authors offer a numerical approach of emissions calculation that covers from the planning phase until post-operation calculation, including logistics and equipment used in the drilling project. As a result, the authors provide an integrated analysis regarding efficiency options for geothermal drilling operations. This study also proposes a simple economic analysis to achieve lower carbon emissions. From an operational perspective, emissions reduction could be achieved by making resources movement and transportation more efficient, thus directly reducing fuel consumption and emissions. Furthermore, biodiesel and renewable energy to substitute diesel will lower emissions and energy consumption for regular generators and transportation. Moreover, several operational efficiency options that can help reduce carbon emissions are discussed in this research. Then, the digitalization era also plays an important role in increasing efficiency for lowering carbon footprint. Briefly, this research is considered useful for the industry that seeks to deliver an integrated effort to reduce carbon emissions during a geothermal drilling operation. It will serve as a reference to increase awareness in mitigating emissions in geothermal drilling projects to achieve lower carbon drilling operations.

Keywords: Carbon emissions, low carbon operation, drilling, net-zero future, geothermal, Indonesia.

EVALUATION OF SUCCESSFUL MATRIX ACIDIZING METHOD IN A GEOTHERMAL WELL WITH COMPARATIVE SENSITIVITY OF ACID FLUD MODELS, VOLUME, AND CONCENTRATION: A CASE STUDY ON WELL "X"

Muhammad Prasetya Dwi Aurianto[1,2], Dimas Taha Maulana[1,2], and Steven Chandra[1,2]

[1]Faculty of Mining and Petroleum Engineering, Bandung Institute of Technology (ITB)
[2]Petroleum Engineering Bachelor Program, Bandung Institute of Technology (ITB), Jl. Ganesha No.10, Bandung, West Java, Indonesia. 40132

E-mail: mprasetyadwi@gmail.com

One of the challenges in producing a well is formation damage. Stimulation treatment is known can improve the production by removing the formation damage. Matrix acidizing is the most known and proven effective for stimulation treatment. There are three matrix acidizing model for sandstone commonly used in the field which is Dowell model (1940), McLeod model (1984), and Kalfayan model (2008). Matrix acidizing in this study is conducted in geothermal sandstone formation well with quartz and silica dominated. There are five acid fluid model will be injected to compare and evaluate the result of skin factor and productivity index during acidizing. Five types of acid will be used are 12% HCl - 3% HF (Dowell model), 6% HCl – 1.5% HF (McLeod model), 10% HCl – 5% HF (Kalfayan model), 5% HF main acid, and using 9% HF main acid. In this study, well performance calculation and analysis are used to determine whether this well is a good candidate for acidizing. This study presents the sensitivity of acid fluid model, volume and concentration injected to determine the optimum result of matrix acidizing design in this well. The result consists of skin factor value after acidizing and ratio of productivity index dimensionless before acidizing and after acidizing (FOI).

Keywords: Geothermal well, matrix acidizing design, acid fluid model, volume, and concentration injected.

PRELIMINARY STUDY ON GEOTHERMAL DIRECT UTILIZATION: A CASE STUDY OF GREENHOUSE OPTIMIZATION AT WAYANG WINDU GEOTHERMAL AREA

Zagy Yakana Berian and Reza Dzikri Khusaini

Energy Academy Indonesia, Jakarta, Indonesia

E-mail: zagyyakana@gmail.com

West Java Province in Indonesia has a geothermal district, one of the existing power plants is Wayang Windu. Besides the geological factors, the development of geothermal energy is determined by socio-economic. This paper examines the preliminary study of direct geothermal energy utilization in a tea plantation in Malabar, Indonesia. The land that has not been cultivated yet is available in that area, and it is near the Wayang Windu. The greenhouse design for 1 hectare which divided into six bays using a cascade cycle from Wayang Windu power plant. This study select capsicum annuum as a case study regarding the opportunity to produce in Bandung City. The minimum heat supply for the greenhouse is 1.25 MW from the hot wastewater from Wayang Windu. The estimation of the greenhouse will reduce carbon emission by around 84% compare with industrial diesel oil (IDO).

*Keywords***:** Wayang Windu, greenhouse, direct use, capsicum anuum, cascade cycle.

SOCIAL IMPACT MANAGEMENT OF LAND CLEARING PROCESS IN DIENG 2 SUB-PROJECTT PT GEO DIPA ENERGI (PERSERO)

Reyno Rivelino Duta Muhammad, Agdya Pratami Putri Yogandari, Muhammad Aunurrofiq, Ahmad Riyan Suryansyah, Hefi Hendri, and Supriadinata Marza

PT Geo Dipa Energi (Persero), Jl. Warung Jati Barat No. 75, Jakarta Selatan 12740, Indonesia

E-mail: reyno@geodipa.co.id

PT Geo Dipa Energi (Persero) "GeoDipa" has planned to expand its electricity generation with additional 110 megawatts (MW), 55 MW at the existing Patuha geothermal plant in Ciwidey, Bandung Districts, West Java and 55 MW at the existing Dieng geothermal plant in Wonosobo and Banjarnegara Districts, Central Java. The Dieng 2 sub-project will construct a new power plant, sub-station, transmission lines and pipelines. The expansion of the existing Dieng geothermal plant will require land in total of 30.83 Ha. Of this, 30.53 Ha of land is already owned by GeoDipa while the remaining 3,010 m^2 is privately owned land. This will be required for a 10 m wide and approximately 301 m long corridor to serve as the Right of Way (ROW) the construction of a new pipeline and access road from existing wellpad to the proposed site of the Dieng-2 power plant. This paper focuses on the social impact management of land clearing process, prepared for the proposed site of the Dieng-2 power plant. Approximately for 58,479 m^2 area that used to be cultivated by 23 (twenty-three) farmers/croppers; located in Karangtengah Village, Batur Sub Districts, Banjarnegara Districts. Land Clearing means to overtake GeoDipa's land and make use of it for the construction site of Dieng-2 power plant, and it has triggered involuntary resettlement. GeoDipa has avoided unanticipated involuntary resettlement potentially emerged during the process; and also reduced the social impact. The unanticipated involuntary resettlement was mitigated based on the Indonesia legal framework and lender's policy.

Keywords: Dieng, social impact management, land clearing.

This page is intentionally left blank

ISSN 2830-2818
Volume 10, 2022

ORAL PRESENTATION

EXPLORATION

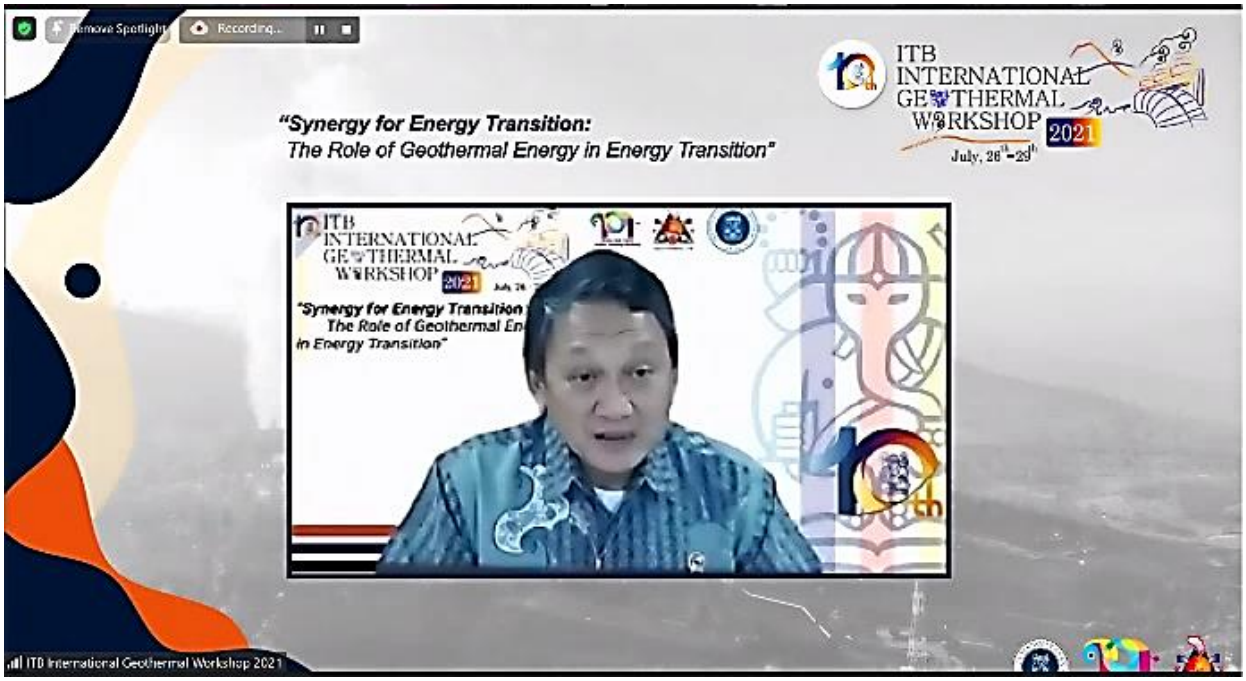
ISSN 2830-2818
Volume 10, 2022

ENGINEERING

DAY 1: JULY 26TH, 2021

Opening Remark by Rector ITB

Opening Remark by Chairperson IIGW 2021 ITB



Arifin Tasrif as keynote speaker
(Energy and Mineral Resources, Republic of Indonesia)

Photo session of opening ceremony

Talk Show Session 1: Geothermal in Energy Transition
Top left: Ali Ashat (Moderator, ITB),
Top right: Marrit Brommer (International Renewable Energy Agency / IRENA),
Bottom center: Andrea Blair (President of International Geothermal Association / IGA)

Talk Show Session 2: Geothermal Plan, Strategy, and Management to Accelerate Energy Transition
Top left: M. Ikbal Nur (Moderator, Director Business Kalimantan & Sumatera Regional - PT. PLN),
Top center: Tafif Azimudin (Director of Exploration and Development, PT. PGE),
Top right: Dadan Kusdiana (Directorate General New and Renewable Energy
and Energy Conservation, Republic of Indonesia),
Bottom left: Muchsin Chasani (Energy Specialist of World Bank),
Bottom right: Huong Mai Nguyen (Energy Specialist of World Bank)

DAY 2: JULY 27TH, 2021

Invited Speaker Session 1:
Data Science - Information Technology, Artificial Intelligence, and Advanced Technology in Geothermal
Top left: Dimas Taha Maulana (Moderator, ITB),
Top right: Eko Budi Lelono (Head of Geological Agency Republic of Indonesia),
Bottom center: Jantiur Situmorang (CEO of AILIMA)

Invited Speaker Session 1:
Data Science - Information Technology, Artificial Intelligence, and Advanced Technology in Geothermal
Top left: Dimas Taha Maulana (Moderator, ITB),
Top right: Remi Harimanda (Director of Ormat Geothermal Indonesia),
Bottom left: Jantiur Situmorang (CEO of AILIMA),
Bottom right: Eko Budi Lelono (Head of Geological Agency Republic of Indonesia)

Invited Speaker Session 2:
Data Science - Information Technology, Artificial Intelligence, and Advanced Technology in Geothermal
Top left: Alfend Rudyawan (Moderator, ITB),
Top right: Shakiru Idrissa Kajungus (Director Business Development of TGDC),
Bottom left: Dicky Fahnudi (Division Manager of Digital and Integration, Schlumberger),
Bottom right: Paul Hulztsch (Digital Subsurface Consulting Manager, Schlumberger)

DAY 3: JULY 28TH, 2021

Invited Speaker Session 1: Utilizing Non-Conventional Geothermal Energy
Left: Suryantini (Lecturer of ITB),
Right: Heru Berian Pratama (Moderator, ITB)

Invited Speaker Session 1: Utilizing Non-Conventional Geothermal Energy
Left: Heru Berian Pratama (Moderator, ITB),
Right: Gioia Falcone (Head of Energy and SustEngineering, University of Glasgow)

Invited Speaker Session 2: Utilizing Non-Conventional Geothermal Energy
Left: Jooned Hendrarsakti (Moderator, ITB),
Top right: Kasumi Yasukawa (Asia Western Pacific Regional Branch IGA, Japan),
Bottom right: Ruben Havsed (Country Manager of Climeon Taiwan)

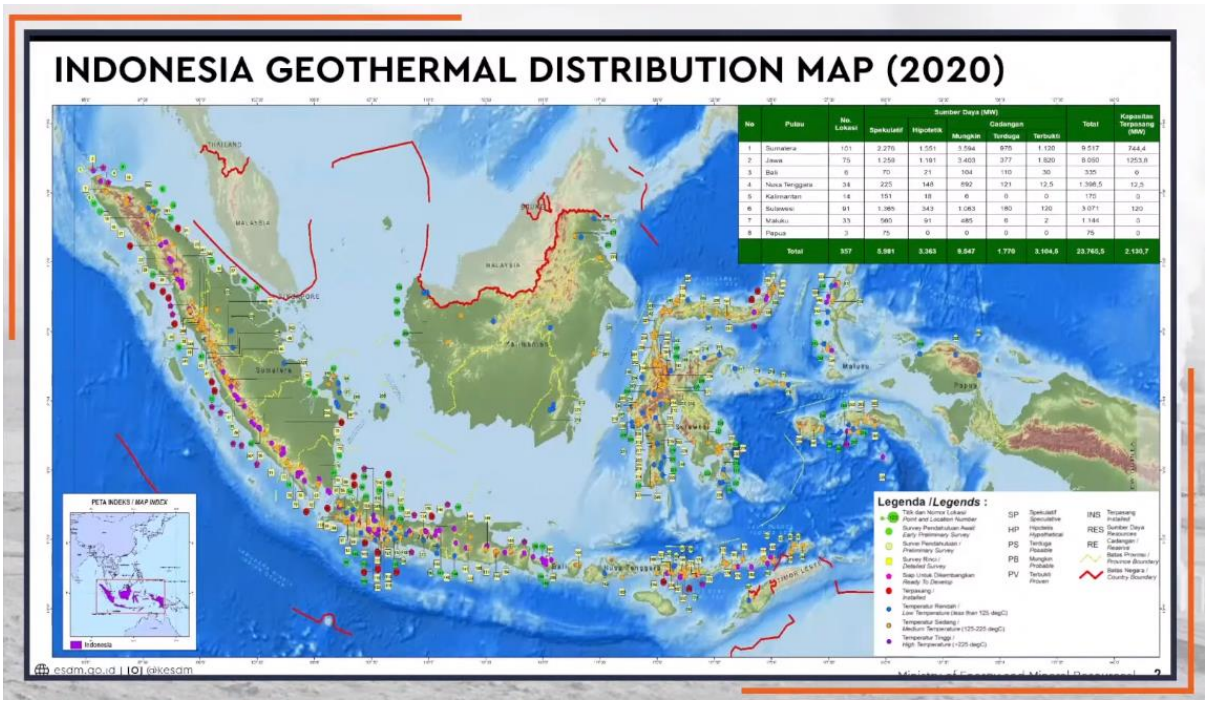
DAY 4: JULY 29TH, 2021

Invited Speaker Session 1: Industry Geothermal Update
Top left: Angga Bakti Pratama (Moderator, ITB),
Top right: Hendra Yu Tonsa Tondang (Vice President Geo EBT, PT. PLN),
Bottom center: Supremlehaq Taqwim (Business Development Assistant Manager, PT. PGE)

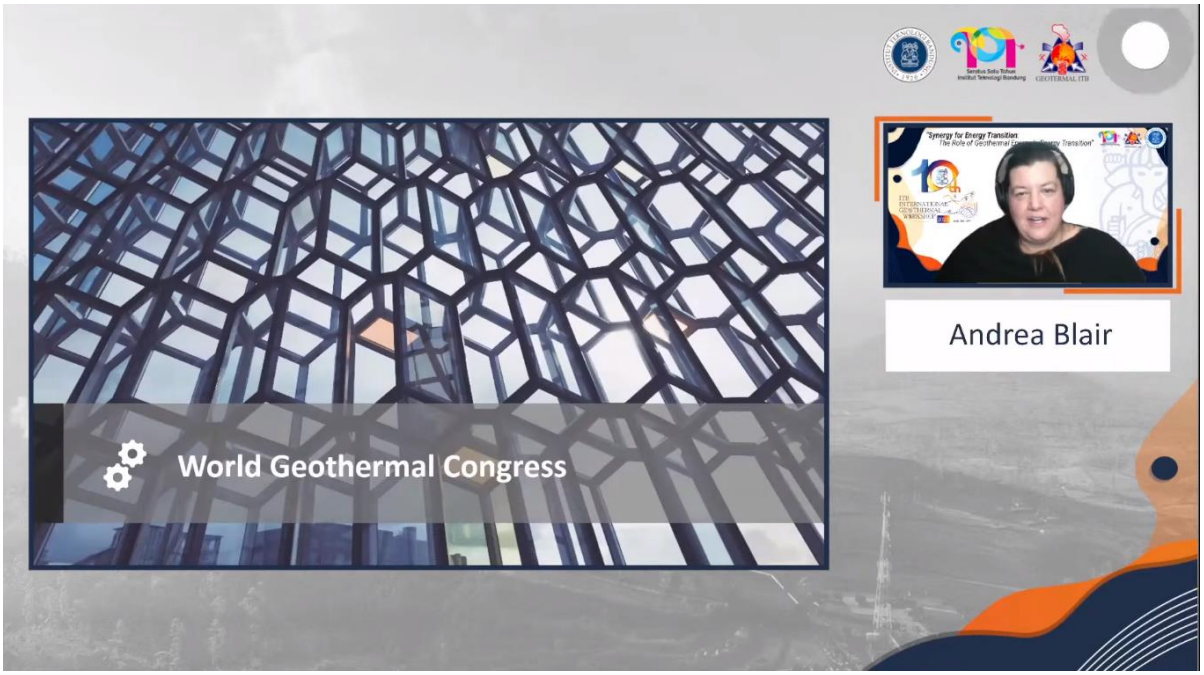
Invited Speaker Session 2: Industry Geothermal Update
Top left: Betseba Sibarani (Moderator, ITB),
Top right: Hisao Nakano (Chief Executive, Sarulla Operations Ltd),
Bottom left: Novi Ganefianto (Vice President Exploration and Subsurface Engineering, PT. Supreme Energy),
Bottom right: Aquardi Rachmat Suminar (Head of Assest Management, Star Energy Geothermal)

Invited Speaker Session 3: Industry Geothermal Update
Top left: Riostantieka Mayandari Shoedarto (Moderator, Geothermal Researcher),
Top right: Julfi Hadi (President Director, PT. Medco Cahaya Geothermal),
Bottom right: Riza Pasikki (Chief Operations Officer, KS Orka)

PRESENTATIONS FROM INVITED SPEAKERS



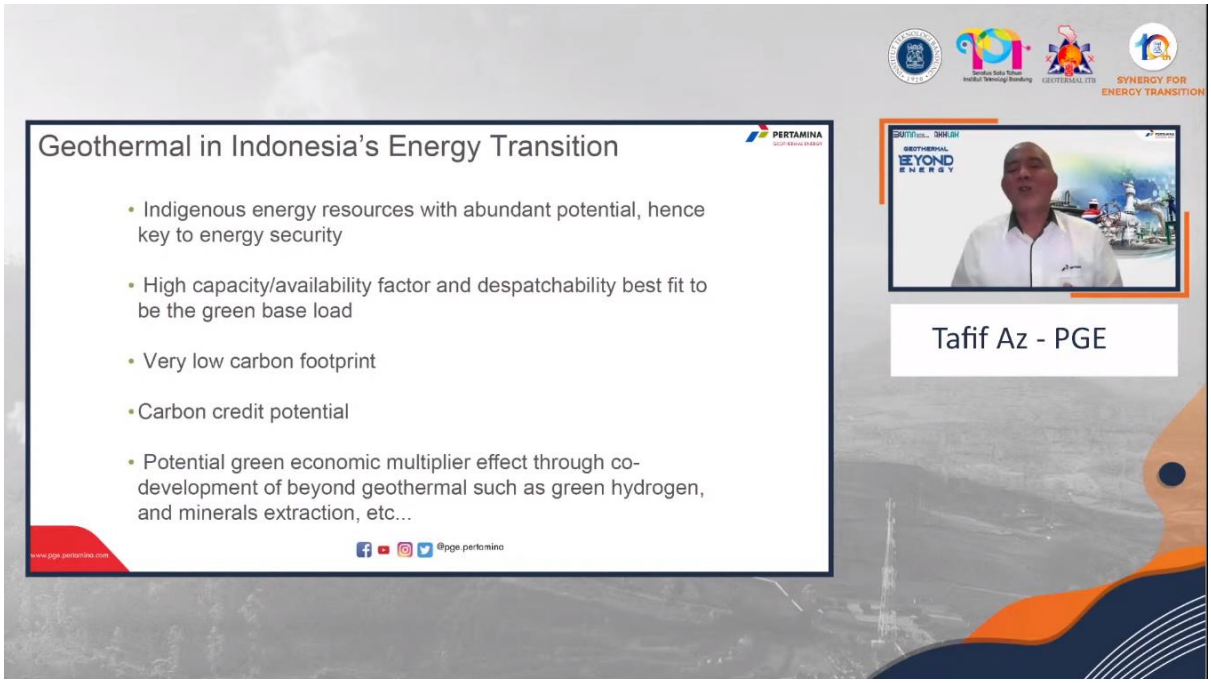
Presentation by Arifin Tasrif



Presentation by Andre Blair

Presentation by Marrit Brommer

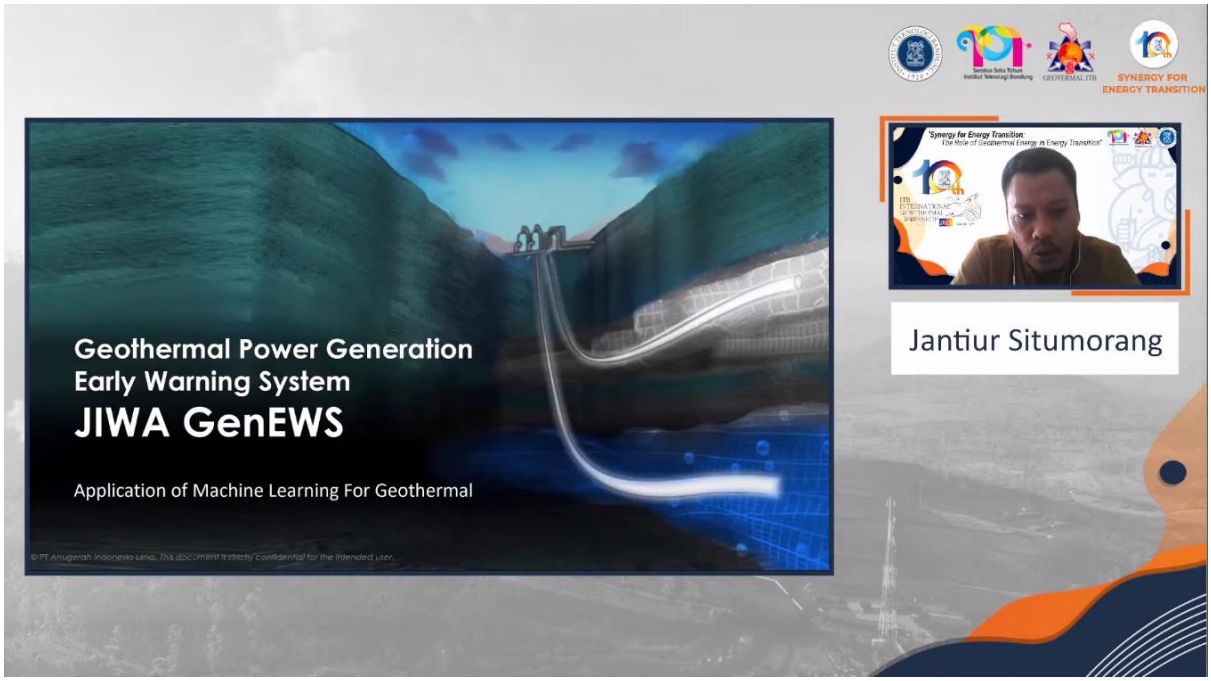
Presentation by Dadan Kusdiana



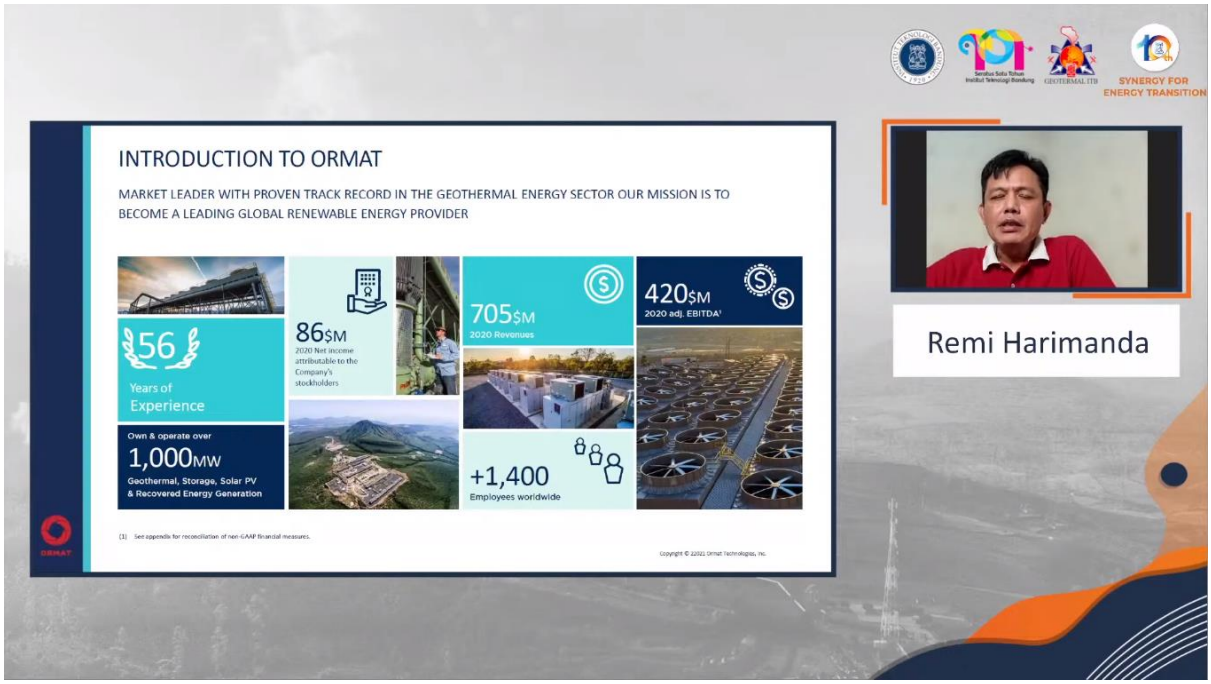
Presentation by Tafif Azimudin

Presentation by Muchsin Chasani

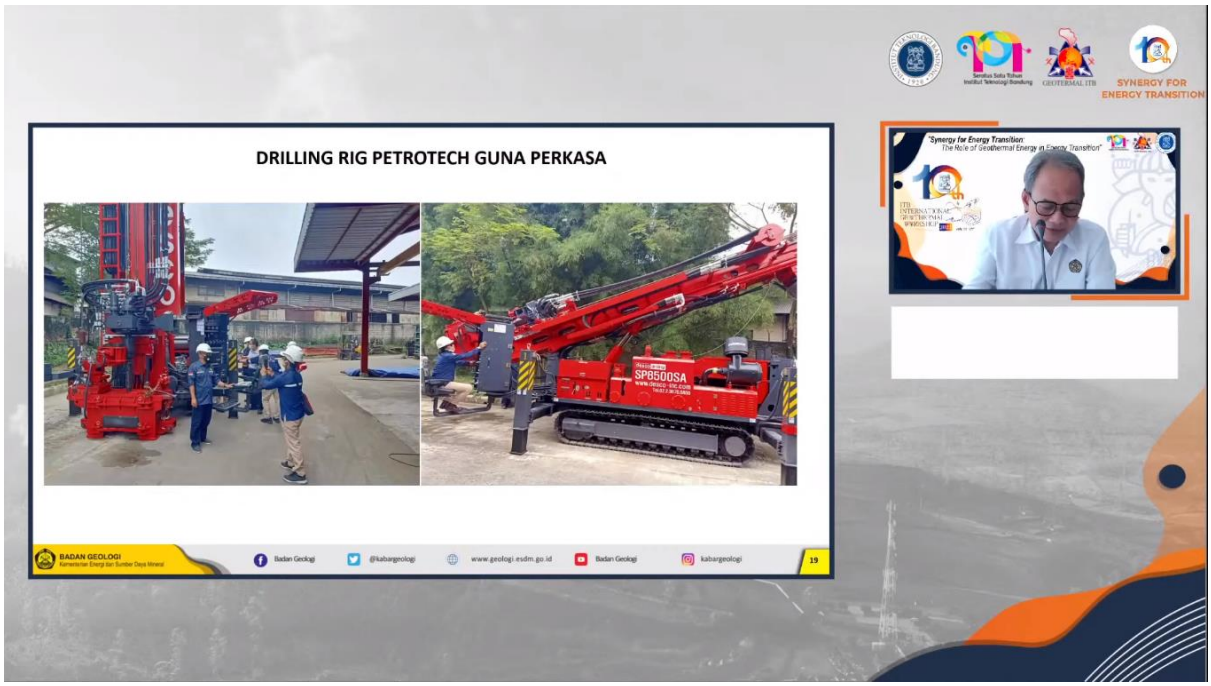
Presentation by Huong Mai Nguyen



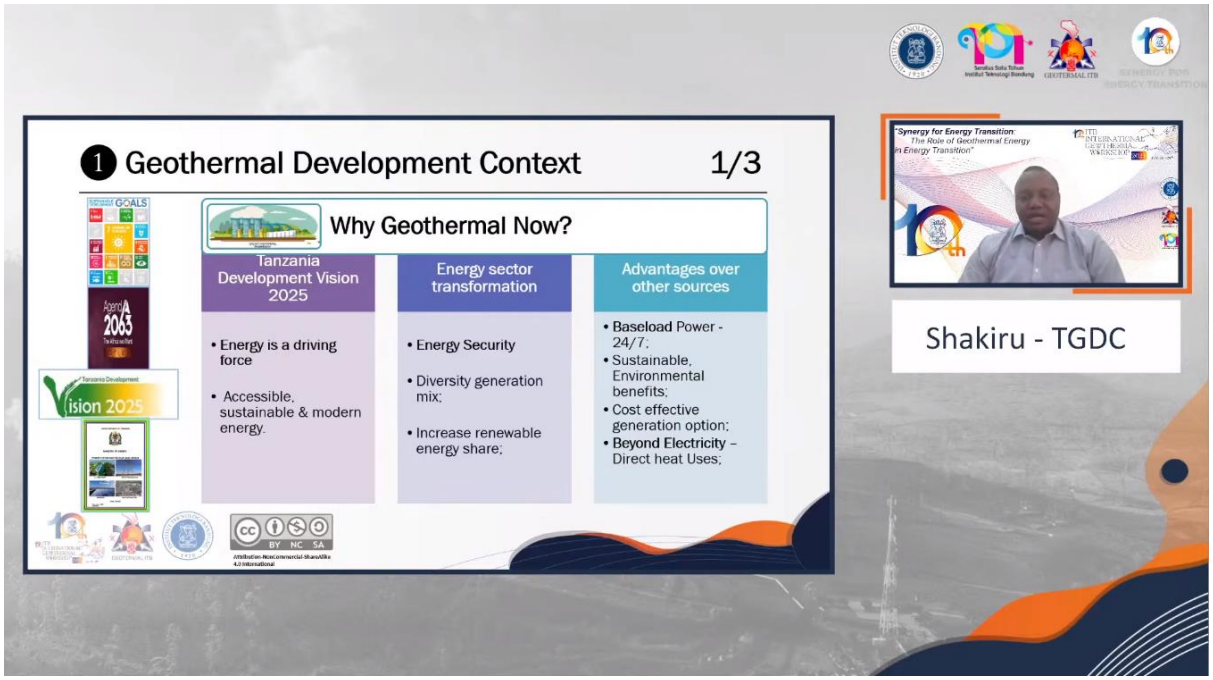
Presentation by Jantiur Situmorang



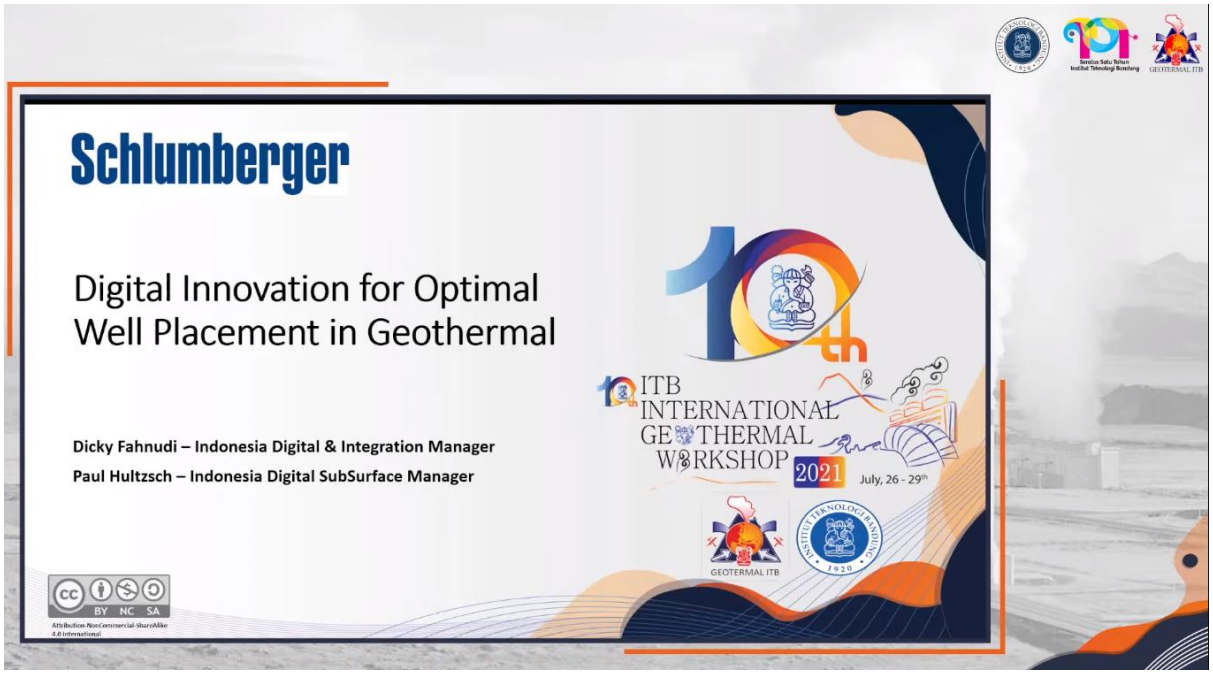
Presentation by Remi Harimada



Presentation by Eko Budi Lelono



Presentation by Shakiru Idrissa Kajugus



Presentation by Dicky Fahnudi and Paul Hultzsch

ITB Press

Gedung Perpustakaan Pusat ITB
Lantai Basement, Jl. Ganesa No. 10
Bandung 40132, Jawa Barat
Telp. 022 2504257/022 2534155
e-mail: itbpress@itb.ac.id
web: www.itbpress.itb.ac.id
Anggota Ikapi No. 034/JBA/92
APPTI No. 005.062.1.10.2018

ISSN 2830-2818

Online Conference Technical Report

10th ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021

Bandung, July 26–29, 2021

INSTITUT TEKNOLOGI BANDUNG

Contents

1 Introduction

Conference name	:	10th ITB International Geothermal Workshop 2021
Conference theme	:	Synergy for Energy Transition: The Role of Geothermal Energy in Energy Transition
Date	:	July 26–29, 2021
Venue	:	Online Virtual Conference, Kampus ITB, Bandung

ITB International Geothermal Workshop (IIGW) is an annual event organized by *Prodi Teknik Geotermal, Fakultas Teknik Pertambangan dan Perminyakan (FTTM), ITB*. The workshop celebrated its 10th anniversary this year. It was held on 26 – 29th July 2021 and 25th September 2021 on an online basis through live virtual workshop (Webinar) via Zoom and YouTube. It was followed by more than 1527 participants from many different aspects of geothermal community, such as academia, industries, and government. This year's theme is "**Synergy for Energy Transition: The Role of Geothermal Energy in Energy Transition**", focusing more on Prospecting and Utilization of Geothermal Energy and collaborating Indonesia Geothermal Stakeholders by inviting speakers from various aspects in geothermal energy.

The objective of the workshop was to improve community understanding toward geothermal energy is a part of renewable energy. This conference also discusses the latest condition of geothermal energy and other renewable energy in Indonesia and to draw attention from scientist, engineers, including academicians, industrial stakeholders, and also geothermal leaders about the initiatives, strategies, opportunities, and challenges toward geothermal development in Indonesia, and to show the commitment to the nation in achieving its 7200 MWe installed capacity in 2025.

Participant's benefit is exchanges of view, knowledges and experiences on latest technologies and researches by bringing together scientists, engineers, academicians, experts, and industrial stakeholders involved in geothermal and other renewable energy studies and developments.

Due to COVID-19 pandemic which does not allow physical IIGW activities to be carried out, this year's activities will be held virtually or via Webinar. Information about the event and its activities can be access in the following address:

- IIGW 2021 website: https://geothermal.itb.ac.id/workshop2021/
- IIGW 2021 YouTube playlist: https://www.youtube.com/playlist?list=PLtqSR-V6HMjShKQlp7zgy9OR3_7GPAeBj

This document contains information about Committee and Personnel, Keynote Speakers, Documentary Pictures, detailed report on ZOOM Teleconference, and lastly the amount of video views on YouTube and ZOOM.

2 Committee and Personnel

ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021

The Committee

Steering Committee	Sutopo (Chairman of ITB Geothermal Master Program) and Staffs of Geothermal Master Program, FTTM – ITB
Chairman	Suryantini
Vice Chairman I	After Helfert Pasaribu
Vice Chairman II	Afdhal Baravanni
Secretary	Yutty Hendrawati, Esty Mustika Suud
Treasurer	Dinda Permatasari RB
Sponsorship	Prihadi Sumintadiredja, Willy Adriansyah, Zuher Syihab, Irwan Iskandar, Jooned Hendrarsakti, Amerensia L F A Soetjahjo, Rai Gati, Patriks Vero Tongkeles
Creative, Publication and Media	Suhendi, Leonard Alvin, Rian Andriana, Ahmad Fathoni, Taufiq Rachman, Adrian Tawakal

Plenary Session	Nenny Miryani Saptadji, Ali Ashat, Rachmat Sule, Prihadi Setyo Darmanto, Hendro H. Wibowo, M. Ridwan Hamdani, Fadhil Karunia Hammad, Dedy Pramudityo, Yuniar Zhafira Abdillah, Irfan Berrizki Hermawan
Technical Paper	Hendra Grandis, Asep Saepuloh, Dimas Taha Maulana, Heru Berian Pratama, Angga Bakti Pratama, Betseba Sibaranai, William Abraham Rasu, Nashir Idzharul Huda, Nyora Donald Kobare, Renaldio Keintjem
Editorial	Suryantini (ITB), Hendro Wibowo (ITB), Nyora Donald Kobare (ITB), Taufiq Rachman (ITB), Adrian Tawakal (ITB), Irfan Berrizki Hermawan (ITB).

Reviewer Team	Suryantini (ITB), Hendro Wibowo (ITB), Alfredo Battistelli (Italy), Romonchito Cedric Malate (The University of Auckland), Nyora Donald (Tanzania), Hendra Grandis (ITB), Nenny Miryani Saptadji (ITB), Sutopo (ITB), Jooned Hendrarsakti (ITB), Irwan Iskandar (ITB), Asep Saepuloh (ITB), Ali Ashat (ITB), Dimas Taha Maulana (ITB), Heru Berian Pratama (ITB), Angga Bakti Pratama (ITB), Jooned Hendrasakti (ITB), Prihadi Sumintadireja (ITB), Prihadi Setyo Darminto (ITB), Andri Hendriyana (ITB), Dadi Abdurrahman (ITB), Betseba Sibarani (ITB), Yuniar Zhafira Abdillah (ITB), Beta Kurniawahidayati (ITB), Khasani (UI), Muhamad Ridwan Hamdani (Star Energy Geothermal Salak), Jantiur Situmorang (AILIMA), Fitri Oktaviani (ADB), Mahesa Pradana Saputra (PT. Thermochem Indonesia).

KEYNOTE SPEAKERS

Name	Affiliation	Topic
Arifin Tasrif	Energy and Mineral Resources, Republic of Indonesia	Indonesian Regulation to Support Geothermal for Energy Transition
Ahmad Yuniarto	PT. Pertamina Geothermal Energy	PT. Pertamina Geothermal Energy Plan & Strategy for Geothermal in Energy Transition
Marit Brommer	International Renewable Energy Agency (IRENA)	Geothermal in Energy Transition from IRENA Point of View
Andrea (Andy) Blair	International Geothermal Association (IGA)	IGA Plan and Role in Energy Transition
Dadan Kusdiana	Directorate General New and Renewable Energy and Energy Conservation, Republic of Indonesia	Plan and Strategy for Geothermal in Energy Transition
Huong Mai Nguyen & Muchsin Qadir	World Bank	Investment in Geothermal Activities to Support the Energy Transition
Jantiur Situmorang	AILIMA	Artificial Intelligence for Geothermal

Remi Harimanda	Ormat Geothermal Indonesia	ORMAT'S Innovations to Deal with Medium & Low Enthalpy Geothermal Resource, Hybrid Technology Geothermal and Solar PV
Eko Budi Lelono	Geological Agency, Republic of Indonesia	Exploration Government Drilling
Shakiru Idrissa Kajugus	Tanzania Geothermal Development Company Limited	Update of Geothermal Exploration and Development of Tanzania
Dicky Fahnudi	Schlumberger	Fracture Characterization for Optimum Well Placement
Suryantini	Geothermal Master Program ITB	Hot Sedimentary Geothermal: First Study in Indonesia
Gioia Falcone	Energy and Sustainability Research Group at University of Glasgow, UK	Transforming Oil Well into Geothermal Well
Kasumi Yasukawa	Asia Western Pacific Regional Branch IGA, Japan	Direct Use for Tropical Country "Cooling by Geothermal Energy"
Ruben Havsed	Country Manager & President of Climeon, Taiwan	Binary for Low Enthalpy Geothermal
Hendra Yu Tonsa Tondang	PT. PLN	Geothermal Update from PT. PLN Gas & Geothermal
Supremlehaq Taqwim	PT. Geo Dipa Energi	Geothermal Update from PT. Geo Dipa Energi
Novi Ganefianto	PT. Supreme Energy	Geothermal Update from PT. Supreme Energy
Hisao Nakano	Sarulla Operations Ltd	Geothermal Update from Sarulla Operation Ltd
Aquardi Rachmat Suminar	Star Energy Geothermal Salak Ltd	Geothermal Update from Star Energy Geothermal Salak Ltd
Julfi Hadi	Medco Cahaya Geothermal	Geothermal Update from PT. Medco Cahaya Geothermal
Riza Pasikki	KS Orka Renewables	Geothermal Update from KS Orka Renewables

3 Documentary Pictures

Complete event videos and paper presentations are available at:
https://www.youtube.com/playlist?list=PLtqSR-V6HMjShKQlp7zgy9OR3_7GPAeBj

3.1 Day 1, July 26, 2021

Opening Speech by Prof. Ir. N. R. Reini Djuhraeni Wirahadikusumah, MSCE, Ph.D.
(Rector of Institut Teknologi Bandung 2020-2025)

Keynote Speech by Arifin Tasrif
(Minister of Energy and Mineral Resources)

Photo session : Talkshow 1

Photo session : Talkshow 2

3.2 Day 2, July 27, 2021

Photo session 1 with invited speakers day 2

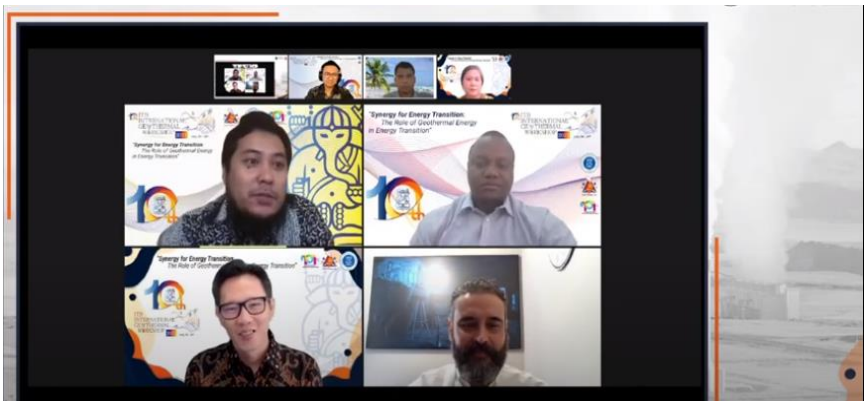


Photo session 2 with invited speakers day 2

3.3 Day 3, July 28, 2021

Photo session 1 with invited speakers day 3

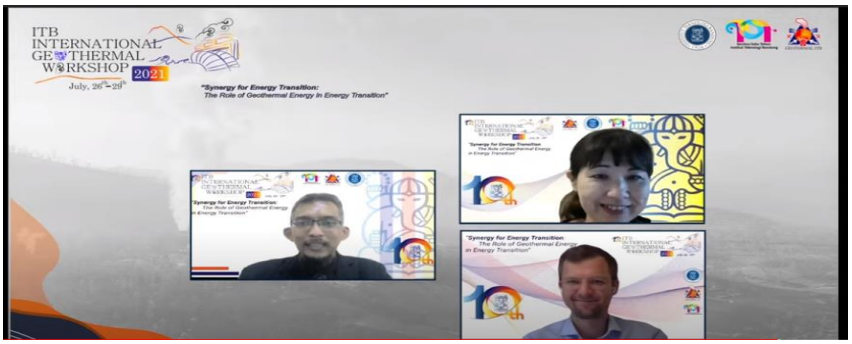


Photo session 2 with invited speakers day 3

3.4 Day 4, July 29, 2021

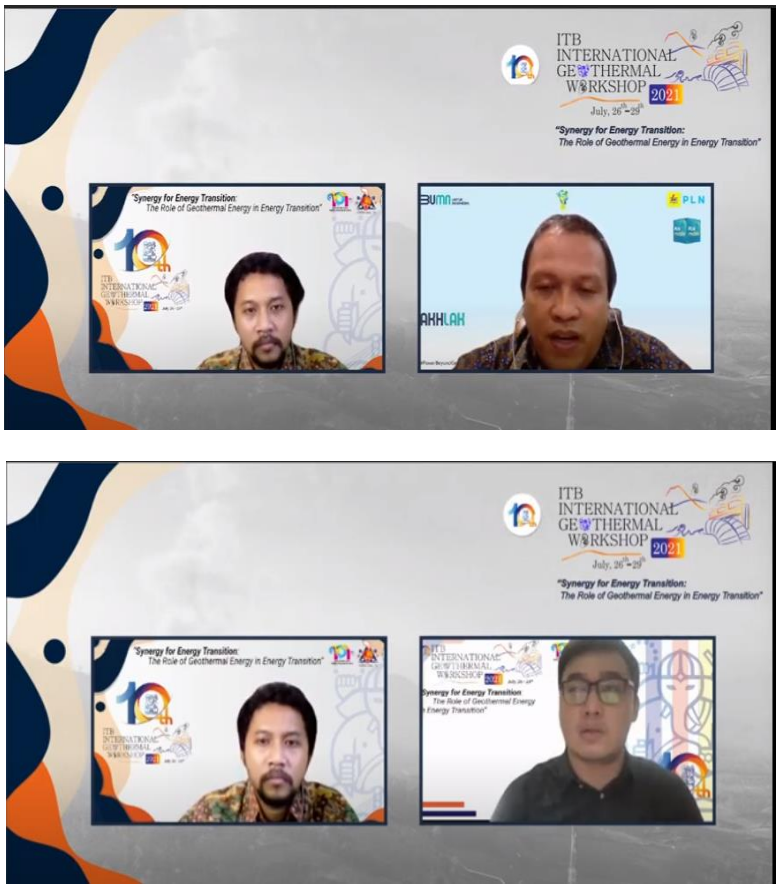
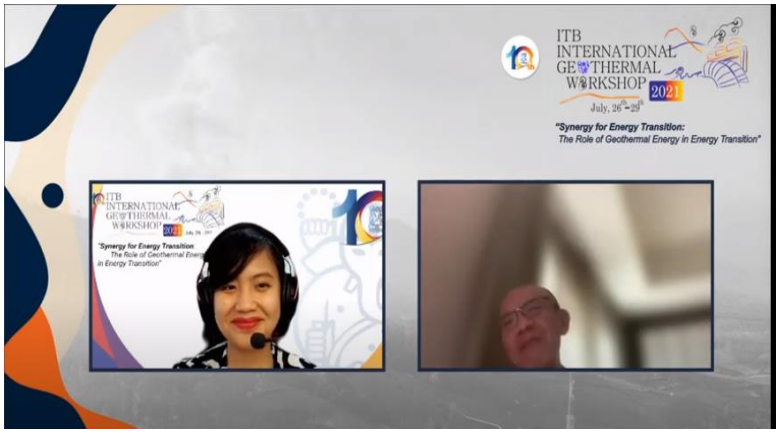


Photo session 1 with invited speakers day 4



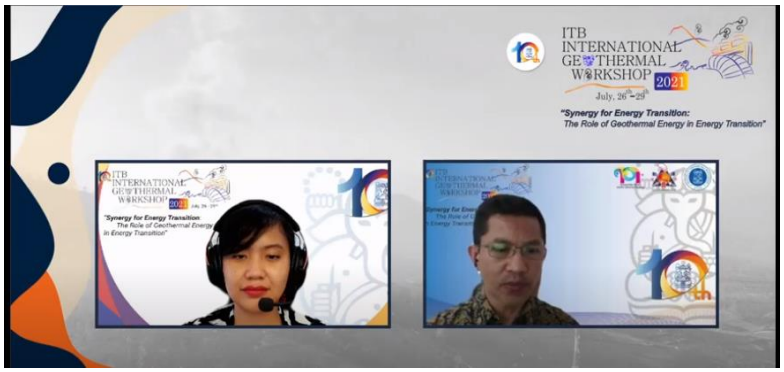
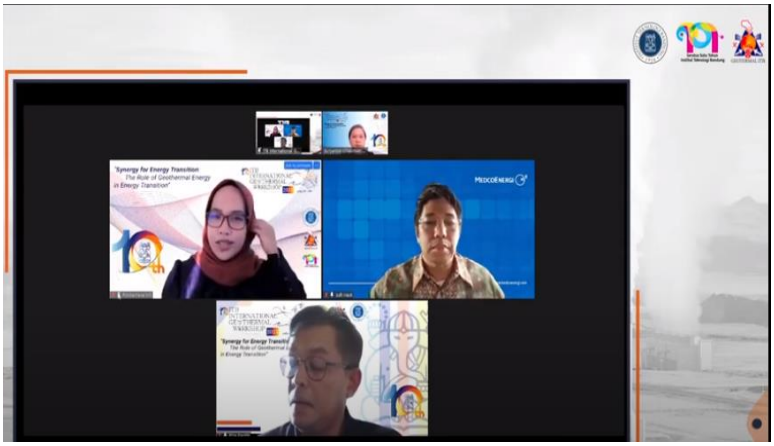


Photo session 2 with invited speakers day 4



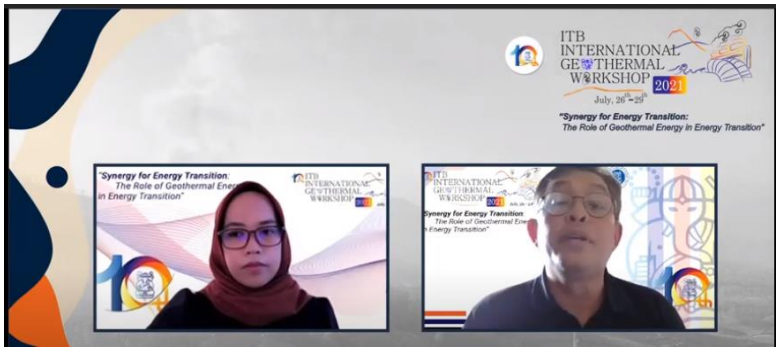


Photo session 3 with invited speakers day 4

Presentation from invited speaker

Presentation from speaker

Post workshop course in collaboration with IAGI (Indonesian Geologist Society)

4 Report on ZOOM Teleconference

4.1 Monday, July 26, 2021

Participant: 1020 attendees

Country: Indonesia, New Zealand, Germany, Belgium, India, United States, United Kingdom, South Korea, France

4.1.1 Opening and keynote speaker

a. Reini Wirahadikusumah (Rector of ITB)
b. Suryantini (Chairman of IIGW 2021)
c. Arifin Tasrif (Minister of Energy and Mineral Resources, Indonesia)
d. Moderator: Prof. Fauzi Soelaiman (Lecturer of ITB)

4.1.2 Talk show session 1

Moderators

Ali Ashat (Lecturer of ITB in Getohermal Master's Program)

Speakers

Marit Brommer (Advisory Board of International Renewable Energy Agency) & Andy Blair (President of International Geothermal Association)

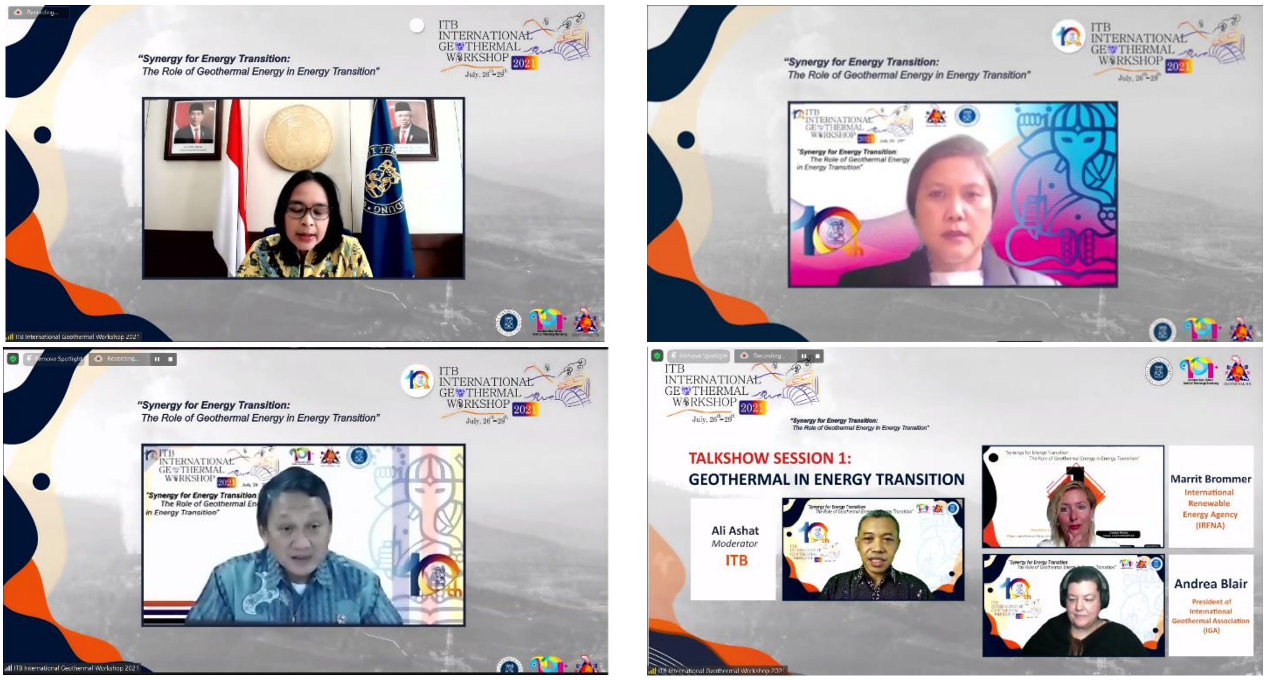
4.1.3 Talk show session 2

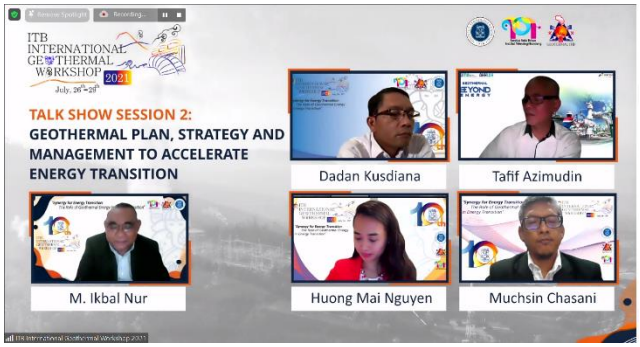
Moderators

M. Ikbal Nur (Director Business Kalimantan & Sumatera Regional PT. PLN)

Speakers

Tafif Azimudin (Director of Exploration and Development PGE), Huong Mai Nguyen (Energy Specialist – The World Bank Group), Muchsin Chasani (Energy Specialist – The World Bank)





4.2 Tuesday, July 27, 2021

Participant: 597 attendees

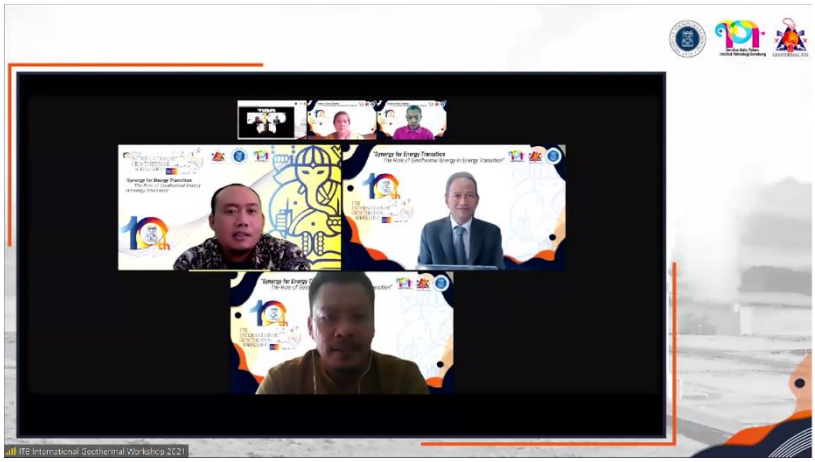
Country: Indonesia, New Zealand, Germany, Belgium, India, United States, United Kingdom, South Korea, France

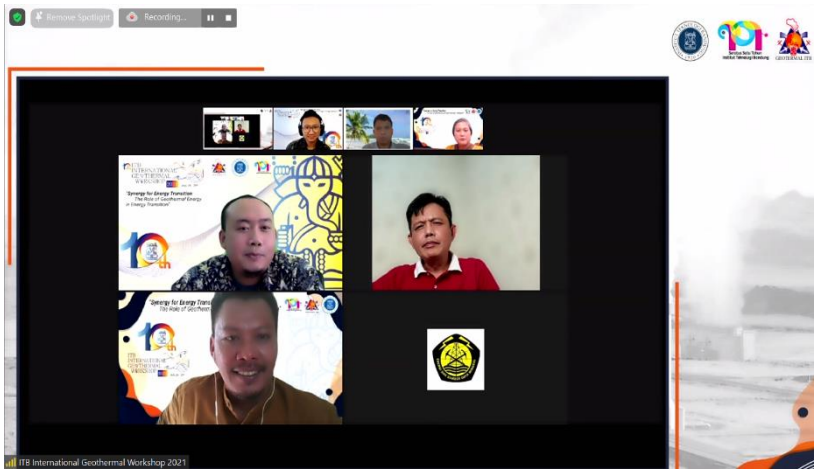
4.2.1 Moderators

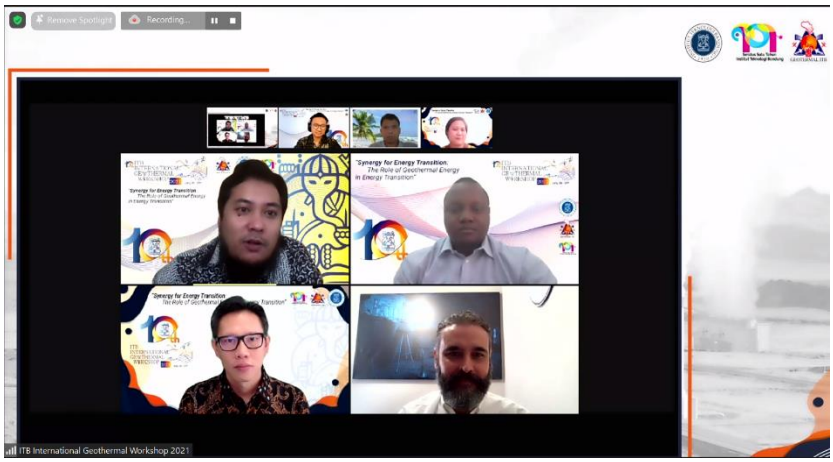
Dimas Taha Maulana (Lecturer of ITB in Geothermal Master's Program) & Alfend Rudyawan (Lecturer of ITB)

4.2.2 Speakers:

Jantiur Situmorang (CEO Ailima), Remi Harimanda (Director of Ormat Indonesia), Eko Budi Lelono (Head of Geological Agency Republic of Indonesia), Shakiru Idrissa Kajugus Director Business Development of TGDC), Dicky Fahnudi (Division Manager - Digital & Integration Schlumberger Indonesia), Paul Hulztsch (Digital Subsurface Consulting Manager Schlumberger Indonesia)







4.3 Wednesday, July 28, 2021

Participant: 368 attendees

Country: Indonesia, New Zealand, Germany, Belgium, India, United States, United Kingdom, South Korea, France

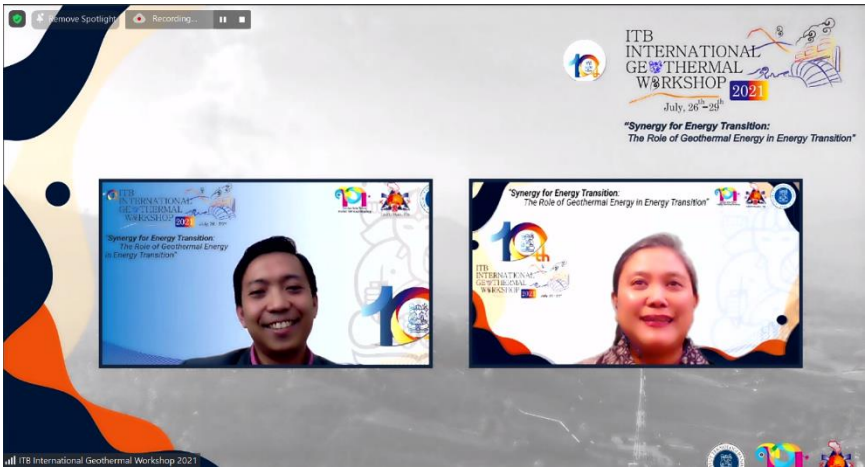
4.3.1 Moderators

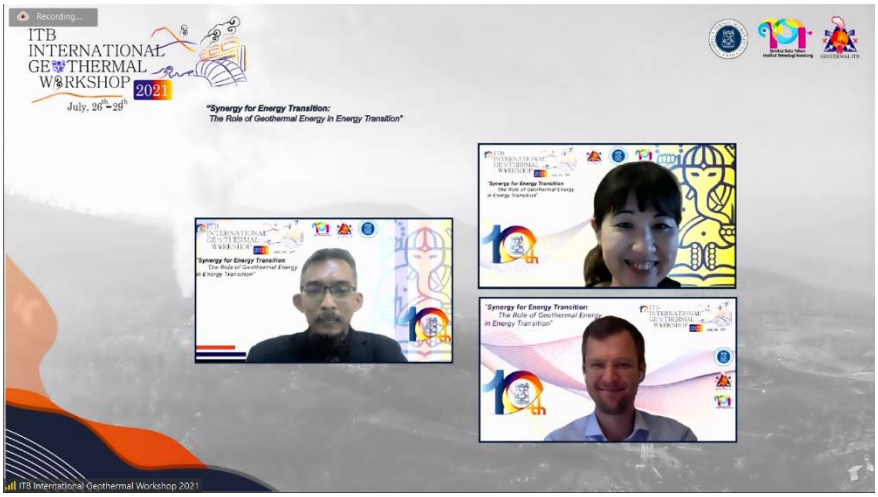
Heru Berian (Lecturer of ITB in Geothermal Master's Program) & Jooned Hendrarsakti (Lecturer at Faculty of Mechanical and Aerospace Engineering & Geothermal Master's Program ITB)

4.3.2 Speakers

Suryantini (Lecturer in Geology FITB-ITB Lecturer in Geothermal Exploration FTTM – ITB), Gioia Falcone (Rankine Chair of Energy Engineering University of Glasgow), Kasumi Yasukawa (Asia West Pacific Regional Branch IGA – JAPAN), Ruben Havsed (Country Manager & President of Climeon Taiwan)


Remove Spotlight
Recording...
ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021
July, 26th–29th
"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
ITB International Geothermal Workshop 2021


Remove Spotlight
Recording...
ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021
July, 26th–29th
"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
ITB International Geothermal Workshop 2021


Recording...
ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021
July, 26th–29th
"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
ITB International Geothermal Workshop 2021

4.4 Thursday, July 29, 2021

Participant: 506 attendees

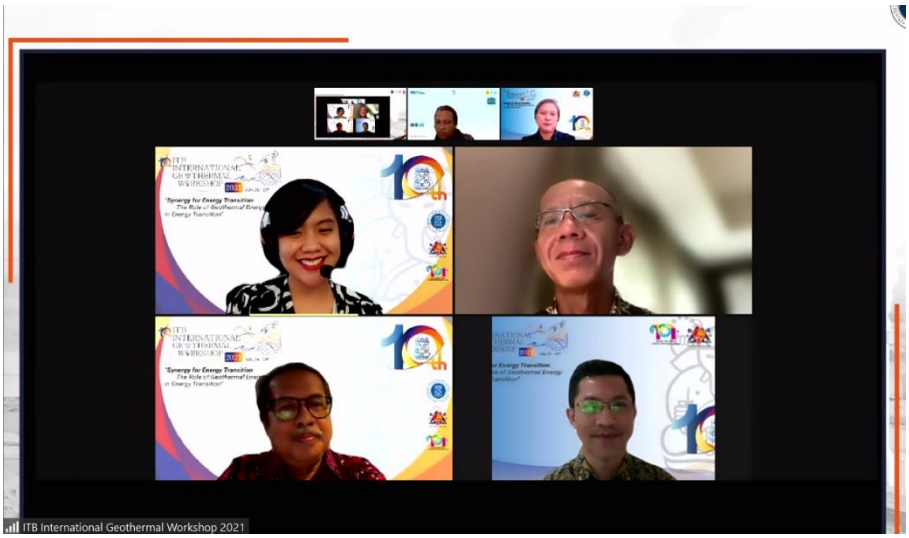
Country: Indonesia, New Zealand, Germany, Belgium, India, United States, United Kingdom, South Korea, France

4.4.1 Moderators

Angga Bakti Pratama (Lecturer of ITB in Geothermal Master's Program), Betseba S. Sibarani (Lecturer of ITB in Geothermal Master's Program) & Riostantieka Mayandari Shoedarto (Researcher Geothermal)

4.4.2 Speakers

Hendra Yu Tonsa Tondang (Vice President Geo EBT PT. PLN (Persero)), Supremlehaq Taqwim (Business Development Assistant Manager at PT Geo Dipa Energi (Persero)), Novi Ganefianto (Vice President Exploration & Subsurface Engineering PT. Supreme Energy), Aquardi Rachmat Suminar (Head of Asset Management in Star Energy Geothermal), Julfi Hadi President Director of PT. Medco Cahaya Geothermal), Riza G. Pasikki (Chief Operations Officer KS Orka), & Hisao Nakano (CEO Sarulla Operations Ltd.)




"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
AKHLAK
ITB International Geothermal Workshop 2021

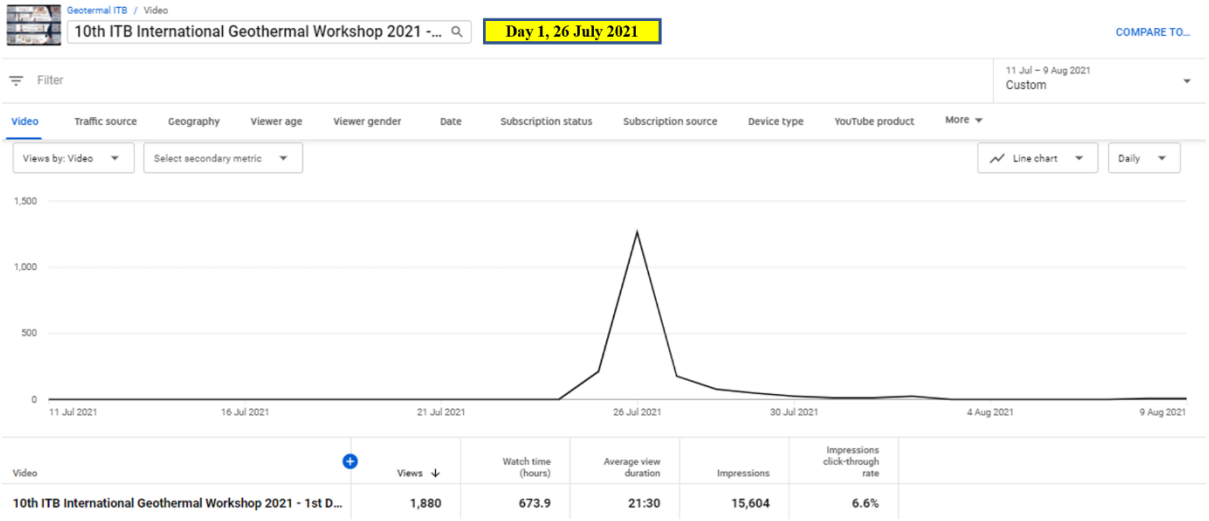

Recording...
"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
ITB INTERNATIONAL GEOTHERMAL WORKSHOP 2021
July, 26th - 29th
"Synergy for Energy Transition:
The Role of Geothermal Energy in Energy Transition"
MASTER OF CEREMONY
ITB Geothermal Master Program
ITB International Geothermal Workshop 2021

5 Video views and attendances

5.1 Youtube views screenshots

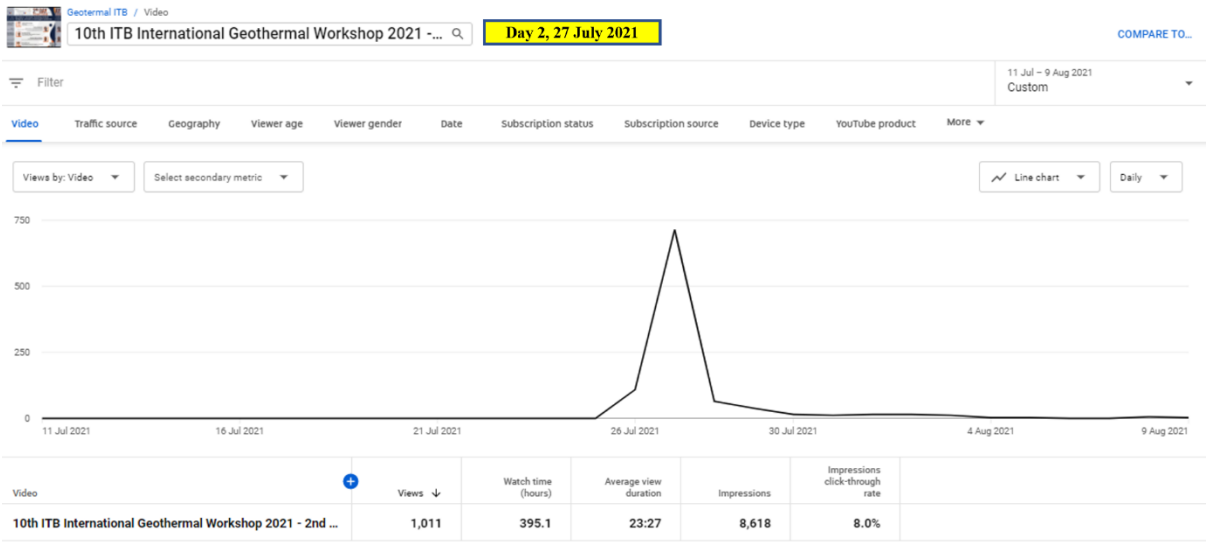
5.1.1 Day 1, July 26, 2021

Link: https://www.youtube.com/watch?v=KhZ_fhPwhAI&t=2380s



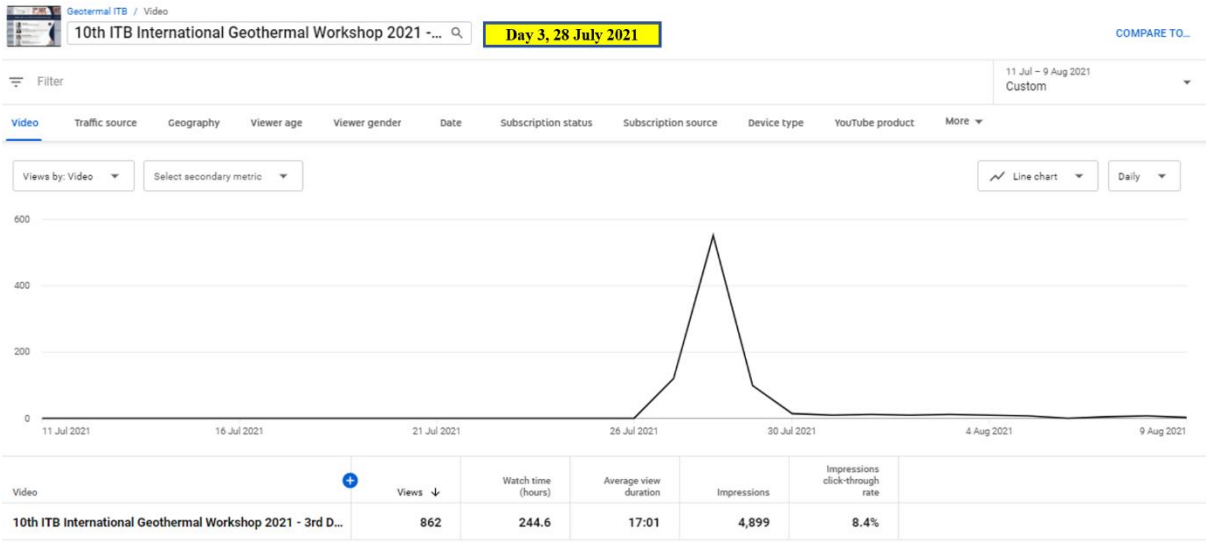
5.1.2 Day 2, July 27, 2021

Link: https://www.youtube.com/watch?v=jJjf8cxExMg&t=6874s



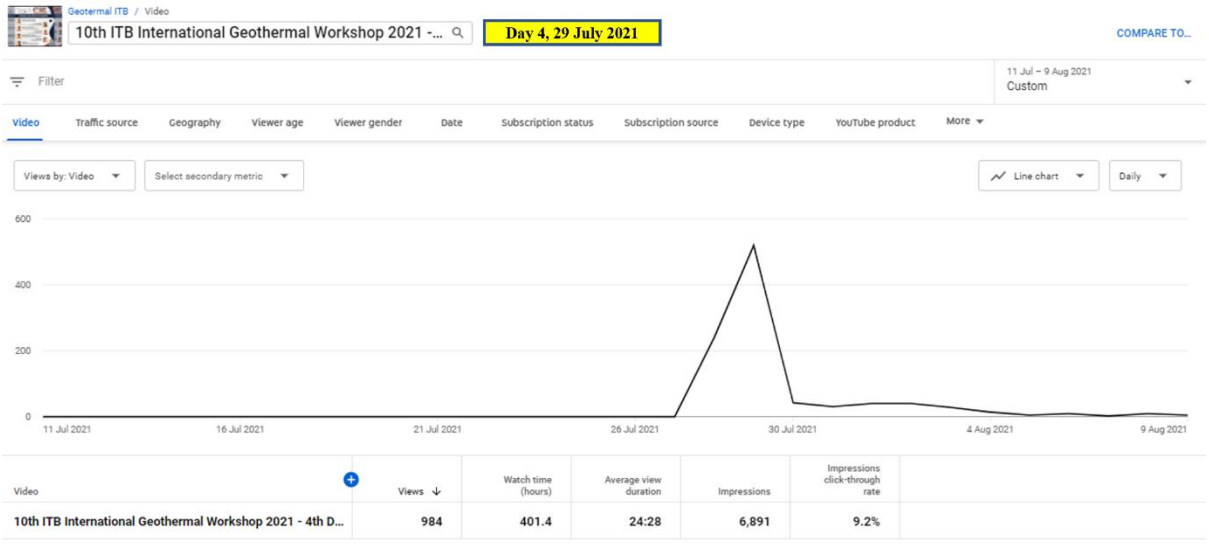
5.1.3 Day 3, July 28, 2021

Link: https://www.youtube.com/watch?v=Awk231SfMHM&t=1s



5.1.4 Day 4, July 29, 2021

Link: https://www.youtube.com/watch?v=iWV5Ej5qNPE&t=5s



5.2 Zoom attendances

- Day 1: 1020 attendees
- Day 2: 597 atteendees
- Day 3: 368 attendees
- Day 4: 506 attendees