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PROCEEDING BOOK

"Uniting Geothermal Energy Stakeholders through Collaborative Efforts for Nation Prosperity"

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PROCEEDINGS, 7th ITB International Geothermal Workshop 2018 Institut Teknologi Bandung, Bandung, Indonesia, March 21–22, 2018

PREFACE

ITB International Geothermal Workshop (IIGW) is an annual event organized by *Prodi Teknik Panas Bumi, Fakultas Teknik Pertambangan dan Perminyakan (FTTM),* ITB. The workshop celebrated its 7th anniversary this year. It was held on March 19–23, 2018 and has become a special moment in supporting the geothermal development acceleration program in Indonesia.

The objective of the workshop was to create a knowledge sharing forum among the key stakeholders in energy and extractive resource sectors on the status of geothermal development in Indonesia. It focused on the latest condition after the approval of new regulation of geothermal energy law No 2014. The conference featured distinguished speakers, scientists, engineers, financiers, and other key players in geothermal and energy sectors worldwide.

Participants benefit the exchanges of view, knowledges and experiences on latest technologies and researches by bringing together scientists, engineers, academicians, experts, and industrial stakeholders involved in geothermal 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.

WOKSHOP WELCOME REMARKS

ITB International Geothermal Workshop 2018 was an event from ITB Geothermal Master Program held on March 19–23, 2018 in LABTEK I building in ITB. It was followed by over than 400 participants from many different aspects of geothermal community, such as academia, industries, and government. This year's theme is " UNITING GEOTHERMAL ENERGY STAKEHOLDERS THROUGH COLLABORATIVE EFFORTS FOR NATION PROSPERITY", which focused on discussions, sharing of knowledges and experiences, and solving technical and non-technical geothermal issues in Indonesia to reach the government target for geothermal energy utilization by 2025. The chairman of 7th ITB International Geothermal Workshop 2018 welcomed delegates before the workshop was officially opened by Prof. *Sri Widiyantoro* M.Sc.,Ph.D., Dean of Academic of Faculty of Mining and Petroleum Engineering ITB.

Participants consisted of academia delegates such as Institut Teknologi Bandung, Universitas Trisakti, Universitas Negeri Manado, Universitas Padjadjaran, Universitas Pembangunan Nasional "Veteran" Yogyakarta, Diponegoro University, Institut Teknologi Sepuluh November, University of Edinburgh Business School, Lampung University, Institute of Energy and Mineral, Auckland University, Gadjah Mada University, Robert Gordon University, Indonesia University, Delft University of Technology, China University of Petroleum, Pertamina University, Sriwijaya University, and Fukuoka University. The industries delegates are PT. Pertamina Geothermal Energy, Supreme Energy, PT. Geo Dipa, PT. NewQuest Geotechnology, Schlumberger, EBTKE-ESDM, Sarulla Operations Ltd, Geological Agency of Indonesia, PT. Jacobs Group Indonesia, KS. Orka, Baker Hudges, and of course from the government of Indonesia.

We would like to express our sincere gratitude to all the support that has been given for this event, from Geothermal Technology Magister Program Staff to all Chair Person, authors, presenters, paper reviewers and all the workshop sponsors and exhibitors for assistance and cooperation in support of this event.

Sincerely

Dr. Eng. Suryantini Chairman of the ITB International Geothermal Workshop (IIGW) 2018

WOKSHOP EVENTS

ITB International Geothermal Workshop 2018 was a masterpiece event organized by ITB Geothermal Master Degree Program as a contribution to the geothermal development all around the world especially Indonesia. This event held many activities such as pre-workshop course, plenary session, technical session, mid-workshop course, field trip and field camp, from March 19 to March 23, 2018.

The workshop consisted of 6 main events: pre-workshop, workshop (plenary and technical session), mid-workshop, field trip, and field camp. Pre-workshop session consist of Leapfrog training and Schlumberger training. Plenary session was attended by many distinguished speakers in geothermal such as Ida Nuryatin Finahari as Geothermal Director EBTKE, Prijandaru Effendi as a Chairman of INAGA, Hilmi Panigoro as a President Director of PT Medco Energi Internasional Tbk, Adi Pranasatrya from Sarana Multi Infrastruktur (SMI), Riki F. Ibrahim as a President Director of GeoDipa Energi, Ali Ashat from ITB, Alexander Richter as a Chairman of International Geothermal Association (IGA), Yudistian Yunis from Perusahaan Listrik Negara (PLN), Tavip Dwikorianto as Vice President Project Development PGE, Graeme Beardsmore & Gioia Falcone from IGA/UNECE, Ahmad Yuniarto from INAGA, Sanusi Satar from GEOCAP, Antonius Sumarlin from IGCOE, Indra Sari Wardhani from World Wide Fund for Nature (WWF), Jane Brotheridge from Jacobs/WINGS, and Farah Mulyasari from Pertamina University.

Many interesting and high quality papers were presented in technical and poster session. The total papers received this year were 78 papers presented in oral presentation sessions and 35 papers presented in poster sessions. Field trip was a visit to Darajat Field (Star Energy Ltd) and field camp was a one day trip to Kawah Domas for geochemistry sampling exercises.



ABSTRACTS OF IOP CONFERENCE SERIES

Available online at: IOP Conference Series: Earth and Environmental Science

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DETECTION OF GROUND THERMAL ANOMALY UNDER DENSE VEGETATION BASED ON ASTER TIR IMAGES

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Ground thermal anomalies associated with geothermal surface manifestations such as hot springs, fumaroles, altered surfaces, and steaming grounds serve as crucial indicator for geothermal explorations. In order to highlight the ground thermal anomalies, this study was raised to use the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data to estimate surface temperature under condition of dense vegetation. This study was focused to exploit the ASTER Thermal Infrared Radiometer (TIR) under lab and field scale conditions. The ASTER TIR bands were used to extract the Land Surface Temperature (Ts) from radiances by excluding surface emissivity (ε_s). The ε is a surface parameter dependent to the surface materials. In this paper, we demonstrated the performance of the Normalized Emissivity Method (NEM) to calculate the Ts by estimating the ε under condition of dense vegetation. The Patuha and Wayang Windu Geothermal field in West Java (Indonesia) were selected as study site due to existence of surface manifestations under canopy vegetation and open area. According to the method, we identified that the ground thermal anomalies are located at surface manifestations. Due to the different spatial scales of satellite and surface measurements and the lack of homogeneous areas, which are representative for low resolution pixels and ground measurements, ground-validation is necessary. The consistency between ASTER data and location of geothermal manifestations indicated that thermal remote sensing data integrated with a spatial-based model, provides an effective means for identifying geothermal potential.

Keywords: ASTER TIR, T_s, NEM, vegetation

GEOTHERMAL EXPLORATION IN INDONESIA BASED ON MINERALOGY AND HYDROTHERMAL ALTERATION

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Indonesia with its large, but partially unexplored geothermal potential is one of the most interesting and suitable places in the world to conduct geothermal exploration research. This study focuses on geothermal exploration based on fluid-rock geochemistry/geomechanics and aims to compile an overview on geochemical data-rock properties from important geothermal fields in Indonesia. The research carried out in the field and in the laboratory is performed in the framework of the GEOCAP cooperation (Geothermal Capacity Building program Indonesia- the Netherlands). The application of petrology and geochemistry accounts to a better understanding of areas where operating power plants exist but also helps in the initial exploration stage of green areas. Because of their relevance and

geological setting geothermal fields in Java (Wayang Windu, Tanguban Perahu) have been visited so far. Mount Salak, Gunung Slamet (Java) and Flores surveys are planned in the near future. Operators, universities and governmental agencies will benefit from this approach as it will be applied also to new green-field terrains. By comparing the characteristics of the fluids, the alteration petrology and the rock geochemistry we also aim to compile an overview of the geochemistry of several geothermal fields in Indonesia. The gathering of this information is the base for the geomechanical experiments on-going at TUD. At the same time the rock petrology and fluid geochemistry will be used as input data to model the reservoir fluid composition along with T-P parameters with the geochemical workbench PHREEQC. The field and laboratory data are mandatory for both the implementation and validation of the model results. If successful, this approach can be applied in many geothermal fields characterized by steep terrain and tropical vegetation, which hampers the classical seismic-geophysical exploration methods.

Keywords: geothermal exploration, capacity building, fluid chemistry and rock petrology

FLUID EVOLUTION OF UMBUL-TELOMOYO GEOTHERMAL SYSTEM

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Umbul-Telomoyo is located in the Quarter of Telomoyo Mount, Central Java. The geothermal system in this region is formed by the residual heat coming from the magma chamber with associated with recent activity of Telomoyo Mount complex. The estimation of geothermal reserve is approximately 92 MWe which was feasible to further development. The surface manifestations consisting of the Candi Umbul hot spring (APCU), Pakis Dadu hot spring (APPD) and Candi Dukuh hot spring (APPD). Based on Cl-SO₄-HCO₃ diagram, it shows that APCDbelongs to chloride-bicarbonate water, while APCU and APPD belongs to chloride water. All hot springs included to the immature water zone according to the Na-K-Mg diagram. The Cl-Li-B diagram described that this geothermal system consists of two different reservoirs in which this data was also supported by Magnetotellurik survey (MT). Temperature estimation of reservoir of Candi Dukuh is around 215-230°C and reservoir of Candi Umbul is around 235-250°C. Litology in CTL-1 and CTL-2 wells were generally dominated by products of Telomoyo volcanic, lava and pyroclastic rocks. Litology found in CTL-1 and CTL-2 wells has changed to range of intensity low and high. Minerals formed in CTL-1 and CTL-2 wells were generally clay minerals (smectite, kaolinite, chlorite, and illite), calcite, secondary quartz, anhydrite, and epidote, gypsum, siderite, hematite, zeolite and alunite, that altered primary minerals. This alteration rocks turned into a caprock in the Umbul-Telomoyo geothermal system.

Keywords: alteration, Telomoyo, evolution, volcanic rock, well

IDENTIFICATION OF ALTERATION ZONES USING A LANDSAT 8 IMAGE OF DENSELY VEGETATED AREAS OF THE WAYANG WINDU GEOTHERMAL FIELD, WEST JAVA

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Remote sensing is a method usually used for conducting geothermal reconnaissance surveys by mapping surface alteration anomalies, which are captured by a satellite sensor. This study analyzes the characteristics of the surface alteration zones in the Wayang Windu geothermal field (WWGF). It employs a remote sensing method using multispectral Landsat 8 imagery and is validated by ground truth data from field surveys. The WWGF is located in Pangalengan, West Java with an elevation of 1500–2600 m.a.s.l., and lies in a quaternary volcanic arc. The rock types in Wayang Windu consist of andesite, basalt, tuff, breccia, and pumice. Fractures and faults are identified as lineaments in this area and based on their structures, were directed to be oriented northwest-southeast and northeastsouthwest. This research combined a field survey and remote sensing methods to enhance the spatial data. Field surveys yield 18 spots for obtaining soil samples and laboratory analyses were performed. Spectral reflectance analysis was performed to determine the reflectance and mineral composition of the samples, X-ray diffraction was performed to determine the mineral composition, and X-ray fluorescence was performed to determine the abundance of elements. A scene from Landsat 8 image acquired on September 10, 2013 was evaluated using a principal component analysis-based method. The surface alteration zones in the WWGF correlated with joints and faults. Based on the mineral composition, the surface alteration zones in WWGF were identified as advanced argillic zone with the occurrence of secondary minerals such as cristobalite and halloysite, and a propylitic zone with the occurrence of secondary minerals such as epidote and chlorite.

Keywords: Geothermal, Wayang Windu, alteration, hydrothermal, remote sensing

REMOTE SENSING OF SURFACE HYDROTHERMAL ALTERATION, IDENTIFICATION OF MINERALS AND THERMAL ANOMALIES AT SVEIFLUHÁLS-KRÝSUVÍK HIGH-TEMPERATURE GEOTHERMAL FIELD, SW ICELAND

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This study used optical remote sensors to identify surface hydrothermal alteration and thermal anomalies in Krýsuvík geothermal field. Multispectral Landsat and ASTER satellite images were used to identify hydrothermal alteration minerals and thermal anomalies. A hyperspectral image from Hyperion was used for the analysis of absorption features. Spectral analysis from the visible (VIS) to the short wavelength infrared (SWIR) allowed the identification of possible sulfur, iron oxides, and montmorillonite. A time series analysis of thermal anomalies using the nighttime satellite images from 2002 to 2017 detected extinct surface hydrothermal activity southwest of the study area, and a thermal anomaly possibly affected by crustal deformation in the southeast. In Seltún area, thermal infrared (TIR)

images acquired by a camera on an unmanned aerial vehicle (UAV) were compared with ground measurements; the aim was assessing the accuracy of the TIR images regarding the distance between the camera and the ground. The TIR image taken at 30 m elevation was used to calculate radiative heat flux; values were in same order of magnitude than the heat flux through the soil estimated by using ground measurements. This study provides insights for monitoring natural or induced changes on the surface geothermal activity of geothermal fields.

Keywords: Krýsuvík geothermal field, Sveifluháls, hydrothermal alteration, thermal anomalies, satellite based remote sensing, UAV, drone

GEOTHERMAL RESERVOIR BOUNDARY DELINEATION USING 3D MAGNETOTELLURIC INVERSION CASE STUDY: THE "DELTA" GEOTHERMAL FIELD OF INDONESIA

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The "DELTA" geothermal field is a brown geothermal field in Indonesia. The field has been produced for many years. Most of productions wells are in the center of the reservoir, need to have step-out wells to reduce the well intervention risk. The first step-out well was drilled near reservoir boundary of conceptual model which is refer to "old" 3D Magnetotelluric (MT) inversion. The step-out well failed to produce steam and well data indicated outside the reservoir. After careful analysis, it found that the 3D MT model does not match with the well data. On this study, the author conducts 3D MT inversion re-modeling to re-delineate the reservoir boundary. To have comprehensive interpretation, the result of new 3D model which generate independently then compared with available data sets such as MEQ, gravity, geology map, geochemistry data and well data. The new 3D MT model shows better match to well data, re-delineate the reservoir boundary and give recommendation for well targeting areas.

Keywords: Magnetotelluric, Data Processing, 3D Inversion, MT Remodeling, Reservoir Boundary Delineation, Well Targeting

FAULT-RELATED FRACTURES CHARACTERISTIC OF KIJANG FAULT AT WAYANG WINDU GEOTHERMAL FIELD

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Understanding the characteristic of permeability in the reservoir is a challenge in order to enhance well targeting success ratio. The permeability of a geothermal field is often related to the structure control and/or the rock type of the reservoir. The availability of interconnected fractures as the secondary permeability in the reservoir is believed to give larger contribution to the production instead of matrix permeability. This study is aimed to gain more insights of fractures characteristic related to Kijang fault zone, as one of the most productive fault zone in the Wayang Windu geothermal field. Kijang fault zone is a NE-SW trending interpreted fault located at the northern part of the field, where the wells with the highest production rate are located. Better understanding of the permeable fractures related to the fault is expected by having further analysis of geologic and geophysics data. The approach using borehole

image as main data and using both microearthquake focal mechanism and shear-wave splitting as support data for beyond the wells concluded NE-SW dominant fracture orientation. The dominant fracture orientation derived from borehole image ranged from N 40°E to N 50°E, while from microearthquake analysis ranged from N 30°E to N 50°E.

Keywords: Geothermal, fractures, permeability, fault, microearthquake, Wayang Windu

FIRST HORIZONTAL DERIVATIVE AND EULER DECONVOLUTION IN APPLICATION FOR RECONSTRUCTING STRUCTURAL SIGNATURE OVER THE BLAWAN-IJEN GEOTHERMAL AREA

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A ground gravity survey was conducted over the Blawan-Ijen geothermal area covering about 176 km² area. A total of 72 stations were measured with 1.0 - 1.5 km spacing. The data obtained were then processed using several corrections for gravity data to get Complete Bouguer Anomaly (CBA). The gravity method was chosen because of the ability to detect geological structures corresponding to the rocks density of the field study. Two types of gravity technique, First Horizontal Derivative (FHD) and Euler Deconvolution (ED), have become widely used to interpret the structure condition. FHD technique delineates a geological boundary of different density body while ED technique estimates a source location and depth of structures. Furthermore, 3-D inversion of magetotelluric data result was also used as a reference to support 2-D gravity forward modeling. The main structure which probably controlled the emergence of Blawan-Ijen hotspring is indicated by maximum FHD value at the northern part area. Moreover, the ED result shows the depth of structures in Blawan-Ijen geothermal area is mostly about 250 - 1000 mters.

Keywords: gravity, FHD, ED, fault, Blawan – Ijen

STUDY OF GEOTHERMAL BRINE DIRECT USE FOR CRUDE PALM OIL (CPO) **FACTORY IN INDONESIA**

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Palm oil is edible oil which extracted from the pulp of fruit oil palms. The use of this oil is mainly for cooking purposes. In Indonesia, crude palm oil production has a huge role for Indonesia's economics, because Indonesia is the largest crude palm oil producers in the world, with expected annual production of 27 million tons in 2017. In crude palm oil factories, there are several components, mainly in crude palm oil purifier, which would need some heating process. The heating temperature would need around 45-100 oC for purifying processes and around 140 oC for fruits boiling process. In the conventional crude palm oil factories, this heating process is conducted by an industrial boiler. This paper would propose a design for a crude palm oil factory modification from the conventional factory into a modified factory where the heating process would be using geothermal brine. A study case of using geothermal brine for CPO factory utilization is also conducted in Y geothermal field in Indonesia. The purpose of this research is to determine whether the geothermal fluids can substitute industrial boiler in CPO factory.

Keywords: Crude Palm Oil, heating process, geothermal, brine.

STUDY OF HYDRAULIC FRACTURING STIMULATION TO IMPROVE GEOTHERMAL WELLS PRODUCTIVITY

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Wells that experience decrease in its production can be optimized by wells stimulation in order to increase its productivity. Stimulation have two types, they are reservoir stimulation and wells stimulation. Stimulation methods could be done with mechanical and/or chemical processes. Reservoir stimulation is divided into 3 methods. There are hydraulic stimulation, thermal stimulation, and chemical stimulation. This paper would be focusing the study in hydraulic fracturing method. Hydraulic fracturing method includes injecting fluids that could make fractures in the formation. Injection fluids contains proppant that could maintain the fractures after the fluid is injected to the formation. The purpose of this study is to analyze hydraulic fracturing stimulation method that could be done in geothermal wells to improve wells productivity.

Keywords: hydraulic fracturing, well stimulation, production.

EXPERIMENTAL DESIGN OF WELLBORE HEAT EXCHANGER IN BINARY OPTIMIZATION FOR LOW - MEDIUM ENTHALPY TO UTILIZE NON-SELF DISCHARGE WELLS IN INDONESIA

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Indonesia has a large potential in geothermal energy resources. However, the development of the geothermal industry in Indonesia is still focused on high-temperature or high-enthalpy fields. There are 246 geothermal areas in Indonesia which classified into low to medium enthalpy, which is potentially able to be developed with binary system. In this paper, an experimental design was studied by modifying the Organic Rankine Cycle at the wellhead generating unit. This design utilizes non-self-discharge wells to be used as "heat exchanger" where the working fluid is pumped into the well through a U-pipe and heated by the geothermal fluid. The outflow of the working fluid from the U-pipe is expected to be steam-phased and directly flowed into the turbine. Several working fluids have been studied to determine maximum power generation at a certain reservoir temperature. In this study, pressure and temperature profile of well XX-02 is used for case study. The working fluids evaluated were Isobutane, Propane, Isopentane, and Butane. The maximum generation output was found in Isobutane and Butane 8

with generation output 294 kW and 241 kW respectively, and flow rate needed was 5 kg/s. This unsignificant generation give flexibility in working fluid selection. Sensitivity analysis of the temperature decline was conducted to evaluate the feasibility of the design for 30 years project lifetime. Economics analysis was also have been done to study the feasibility of the design and electric price produced. ORC (Organic Rankine Cycle) price used in economic analysis is the average price of ORC (3,000 USD/kWh), resulting electricity price produced is 7.76 USD cents/kWh. This results conclude that Wellbore Heat Exchanger design is feasible to improve non-self discharge well to be economically developed.

Keywords: Wellbore Heat Exchanger (WHE), Organic Rankine Cycle (ORC), Low-Medium Enthalpy, Optimization

INTERFERENCE TEST SIMULATION IN GEOTHERMAL TWO PHASE FIELD USING PTA SOFTWARE AND TOUGH2

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Interference test simulation is conducted to find out the relationship between active well and observation well in a reservoir system through Bottom hole pressure (BHP) Transient analysis of interference test pressure data was performed using PTA software, while interference test simulation was performed using TOUGH2. The main parameters that become uinput data for transient pressure analysis are Bottom Hole Pressure and flow rate during interference test. Transient pressure analysis is used to determine the condition of wells, reservoir characteristic and the reservoir boundary conditions during the interference test. The research method are calculation of Bottom Hole Pressure with hydrostatic method, transient pressure analysis and reservoir simulation. The results are an interference indication between the WWA-4 and WWA-6 wells in the simulation model of interference test with the transmissivity value 4.7E3 darcy-meter and storativity value 23.4 m at aquifer thickness value 100 m.

Keywords: Interference test, reservoir simulation, PTA software

NATURAL STATE MODELING OF MATALOKO GEOTHERMAL FIELD, FLORES ISLAND, EAST NUSA TENGGARA, INDONESIA USING TOUGH2 SIMULATOR

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Mataloko Geothermal Field is located approximately 15 km east of Bajawa City in Southern Central Flores Island, Indonesia. The geothermal system of this field is two-phase dominated with steam dominated zone at the shallower part of the field and liquid dominated at the deeper part with temperature of 210°C and 275°C, respectively. From the exploration effort and preliminary study, the possible reserve of this field is up to 62.5 MWe. This study was carried out by numerical natural state modeling using TOUGH2 simulator. The objective of this study is to present numerical modeling of

the Mataloko Geothermal Field based on the currently published paper of previous geological, geophysical, and geochemical study, also the actual measurements on the established wells. The model was matched with actual shut-in temperature and pressure measurement on Well MT-3, also mass and heat flow on the conceptual model to achieve natural state condition. The results conclude that the area of the reservoir is up to 10.2 km^2 with exploitable reservoir thickness up to 1750 meter. Temperature of the suspected productive deep liquid dominated reservoir is 275° C. The final permeability of the reservoir is ranging from 18-40 mD with exceptional 91.5 mD at the main fault. Furthermore, this study proposes a more accurate prediction specifically on the shallow vapor region. The potential reserve was calculated using Monte Carlo simulation based on the simulation result. Calculated potential reserve is 52 MWe with 90% confidence level (P10). Expansion of 5x10 MWe power plant capacity is suggested by drilling effort to elevation of -1000 to 0 masl through the productive hot deep liquid dominated zone. This is the first natural state reservoir modeling of Mataloko Geothermal Field and the second natural state modeling for geothermal field reservoir in Eastern Indonesia that has been established successfully.

Keywords: Geothermal, steam field, power plant, Rajabasa

A KEY PROCESS OF NATURAL STATE MODELING: 3D GEOLOGICAL MODEL OF JABOI GEOTHERMAL FIELD, NANGRO ACEH DARUSSALAM, INDONESIA

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This project aims to develop a new natural state model of Jaboi geothermal area to obtain an improved understanding of the subsurface conditions and behavior of the reservoir. This paper describes the progress that has been made in the project so far which includes a new geological model developed in LEAPFROG Geothermal and the reservoir model setup and definition. The new geological model provides a very useful 3D visualization tool and compiles all of the exploration data. Jaboi geothermal field has been explored since the 1970's until today. However, no research has gone as far as creating a 3D model of the area. The construction process of the new 3D geological model of Weh Island was carried out using a compilation of geoscientific data derived from the Ministry of Energy and Mineral Resources exploration activities within 2005-2006. The 3D geological model assigns the related features such as the geological structures, water level, rock types, and surface manifestations and the model will be used as the basis for developing the new reservoir model. A description of the new reservoir model's setup and definition is given, and details of the proposed mode calibration are outlined. The simulations will be run using AUTOUGH2.

Keywords: 3D Geological Model, Geothermal Reservoir Model, Jaboi

A STUDY OF BRINE SUPPLY SYSTEM TO BINARY CYCLE UNIT AT NAMORA I LANGIT GEOTHERMAL POWER PLANT

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The geothermal binary cycle's power plant is formed by two cycles. The primary cycle that contains the geothermal fluid and the secondary cycle in which the organic working fluid is enclosed. The geothermal fluid can either be water or steam. In Namora I Langit Integrated Geothermal Combined Cycle Power Plant if its water is called brine unit and if its steam is called bottoming unit. Main issues to consider in binary cycle unit are corrosion, scaling, fouling, working fluid flammability, cascade use / cogeneration, vapour plume, large footprint and noise emissions from the fans in case of air cooling. For this time focus on corrosion, scaling and fouling on surface equipment facility. As we know, the heat exchanger transfers heat from the brine to the working fluid in the pre heater and evaporator. Brine flows through the tube and working fluid in the shell tube. The problems found in the heat exchanger are corrosion, scaling and fouling. Because of that, it is to do as much work as possible to mitigate scaling and fouling in order to heat exchanger can function properly. This paper presents a study of brine supply system at Namora I Langit geothermal power plant. How the equipment, method and operation that used at brine line can deliver brine which is appropriate with binary unit.

Keywords: Binary, Brine supply, Heat exchanger, Scaling

MODELLING OF COMPLETION TESTS IN TWO WELLS IN THE WAIRAKEI – TAUHARA GEOTHERMAL SYSTEM, NEW ZEALAND

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A completion test in a geothermal well, usually conducted soon after drilling is completed, consists of pumping water at various rates into the well and carrying out pressure, temperature and spinner (PTS) runs. Then after injection is stopped pressure and temperature runs are carried out while the well warms up. The spinner test helps to identify the permeable zones (feed-zones) in the well especially the reservoir characteristics. The warming-up temperature profiles also help to identify feed-zones. The analysis of the completion tests at present is mainly qualitative and the aim of the present study is to make it more quantitative by using the geothermal reservoir simulator TOUGH2 to simulate completion tests. In this study, modelling is conducted for two completion tests carried out in the Wairakei -Tauhara geothermal field, New Zealand. The tests were for WK242 (Wairakei) and THM15 (Tauhara). The simulations were carried out using AUTOUGH2, the University of Auckland's version of TOUGH2. For both wells, manual calibration was used to improve the match of the model results to the measured data and additionally, for THM15 some inverse modelling was undertaken with iTOUGH2. For both wells, a reasonable match to the data was obtained. It was found that WK242 has two inflows (around depth 450 m and 750 m) and one loss zone (below 950 m). However, THM15 has only one inflow (around depth 135 m) and a minor loss (around 112 m). The inflows and losses indicate the location of potential feed-zones.

Keywords: Completion test, numerical model, permeability, porosity, feed-zone, AUTOUGH2, iTOUGH2, sensitivity analysis

GEOMECHANICAL MODELLING OF A GEOTHERMAL RESERVOIR IN TANZANIA

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Countries that are favored by being situated within the East African Rift System, Tanzania is among them. Geothermal energy is a potential renewable source that should be taken into account in Tanzania's energy mix. Computational Fluid Dynamic (Mathematical modeling and numerical simulation) are taking into account for predicting of geothermal reservoir. Preliminary, geothermal survey studies have been done in Tanzania. However, the available data is inadequate partly because of limitations in traditional measurements and visualization techniques for the geothermal reservoirs located deep underground. This paper presents computational fluid dynamics (CFD) technique which has been employed to address the limitations by giving an insight into these complex flows that are often difficult, expensive or impossible to study using traditional techniques. The discretized Euler-Eulerian equations are solved in Fluent 12 software for the conservation of mass, momentum, energy and species. The predicted results indicate that Thermodynamic properties such as the rate of temperature and pressure drop along the fractured porous rock (hole path) in the concerned study area were 0.02 ^oC per meter and 0.025 bar per meter, respectively. Further, the predicted steam quality at outlet is 0.9.

Keywords: CFD, Geothermal energy, Geomechanical modeling, Fractured rock, Steam.

UNDERSTANDING SOCIAL ACCEPTANCE OF GEOTHERMAL ENERGY: A CASE STUDY FROM MT. LAWU, INDONESIA

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Geothermal energy in Indonesia holds important role in country's transformations into renewable energy to ensure clean, reliable, and sustainable energy sources. In order to optimize geothermal energy project, it is important to consider the balance of economy, socio-cultural, and environmental aspects. The socio-cultural aspect is critical in the public acceptance of the project and overcome the social resistance. Understanding citizen's preferences towards the development of geothermal energy leads to the greater understanding of what shapes of strategies and policies should be taken in the project. Based on the interviews with local communities, they reject the construction of geothermal power plants in Mt. Lawu because they think geothermal power plants will give negative impacts to cultural, environmental, economic, and social life aspects in society. This perception may appear because of the lack of understanding of geothermal energy.

Keywords: Geothermal, social understanding, energy preferences

STUDY OF HYDRAULIC FRACTURING IN WATER DOMINATED GEOTHERMAL FIELD USING EXPERIMENTAL DESIGN AND NUMERICAL SIMULATION

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As a water-dominated geothermal field continues fluid production, production rate and pressure will decrease. To enhance production rate, hydraulic fracturing stimulation is normally conducted. This study is conducted to answer the uncertainty of hydraulic fracturing parameters problems specifically in a water-dominated geothermal reservoir by means of extending the experimental design for geothermal filed applications. In this study, experimental design will be applied to study the uncertainty parameters of hydraulic fracturing stimulation in a water dominated reservoir using CMG STARS simulator software for 30 years of constant bottom hole pressure followed by statistical analysis using MiniTab software and Monte Carlo probabilistic simulation. The result provides necessary steps to conduct hydraulic fracturing study in CMG STARS and proxy polynomial equation that describes mass rate response output. This study also concluded that fracture half-length appears to have the highest effect on mass rate even it is not too different from the other two parameters. Last, the most probable mass rate output is estimated to be 124 kg/s which is 7.1 times higher than the base case mass rate. The first section in your paper.

Keywords: Geothermal, water-dominated, hydraulic fracturing, experimental design

DEVELOPING LOW TEMPERATURE GEOTHERMAL PROJECTS IN INDONESIA USING PUMPED WELL TECHNOLOGY

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Indonesia's installed electrical-grade geothermal capacity is currently limited to developments at high temperature geothermal areas; however, survey data from Badan Geologi (Geological Agency of Indonesia) suggests that a large reserve of medium and low temperature geothermal resources also exists in the country. Using electric line shaft or submersible pumps, low to medium temperature geothermal fluids can be pumped from relatively shallow depths and electricity can be generated using binary power plant technology. This has been proven to be a commercially viable development approach for geothermal systems hosted in a range of geologic settings (e.g., structural/sedimentary basins, volcanic flanks, and metamorphic terranes), and are usually situated in regions of geologic structural complexity. The heat sources for these systems can be the conductive/advective heat transfer from a magmatic body or simply related to deep circulation of fluids in a non-magmatic setting. Lateral outflows of higher temperature geothermal systems are another category of low and medium temperature geothermal resources that may be attractive development targets, potentially allowing for the expansion of presently developed systems. This paper considers the utilization of pumped wells to exploit low and medium temperature resources considering recent trends internationally and with specific regard for the Indonesian context of this technology. As discussed herein, the commercial viability of pumped wells depends on the resource characteristics (namely temperature, depth, well productivity, and gas content) as well as a number of economic and development factors. We present results of modelling the potential productivity in terms of MW/well (net) for pumped wells over a range

of permeability and temperature conditions and compare the results with typical high temperature self-flow wells.

Keywords: power generation, pumped production, low temperature, Indonesia.

IMPROVED NATURAL STATE SIMULATION OF ARJUNO-WELIRANG GEOTHERMAL FIELD, EAST JAVA, INDONESIA

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Arjuno-Welirang Geothermal Field is a green field located across Mojokerto Regency, Malang Regency, Pasuruan Regency and Batu City in East Java Province, Indonesia. Geothermal system in Arjuno-Welirang Geothermal Field is estimated to be liquid dominated and has a reservoir temperature of about 260°C based on CO₂ gas geothermometry method (Hadi et al., 2010). Several manifestations are found at the surface; consist of hot springs, fumaroles and alterations. The field is now managed by Geo Dipa Energi. Geological, geophysical, geochemical and geothermometrical study has been conducted in the field but exploration drilling has not been carried out yet until recently. For reservoir characterization and resource estimation purposes, several conceptual models have been developed based on geoscience data available. Previously, a natural state modelling attempt which matched to existing conceptual models has been carried out by Wardana et al. 2016. An entirely new natural state numerical model is made in this study to improve the result from previous model by using smaller grid blocks (40% finer). In return, the result shows more accurate temperature matching of surface manifestations than the previous model. The numerical model is developed using TOUGH2 simulator to obtain natural state condition. The objectives of this study are to develop an improved natural state numerical model; to validate temperature of the manifestations in the model with measured manifestation data; to characterize geothermal reservoir including area, thickness, pressure, temperature and permeability distribution; and to determine resource potential using probabilistic method. All data used in this paper is based on published papers.

Keywords: Arjuno-Welirang Field, natural state, TOUGH2

A NATURAL STATE MODEL AND RESOURCE ASSESSMENT OF ULUMBU GEOTHERMAL FIELD

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Ulumbu Geothermal Field is located in Manggarai District, Flores Island, Indonesia. Downhole measurement results indicate that this field has a vapor-dominated reservoir overlying liquid-dominated reservoir with temperatures of 230-240°C. Based on the previous study it is the most promising prospect on the island of Flores with 100 MWe possible reserve. The objectives of this study are to discuss a natural state model of Ulumbu geothermal field and to assess its potential resource. The natural state model has been successfully constructed by using geological, geophysical, geochemical, and wells data from several published literature. The model can be categorized as valid since the model temperature,

mass flow, and heat flow agree with the observation data. Although there might be still room for further improvements. Based on the parameters obtained from the reservoir characterization, the potential resource of the field was successfully calculated by using heat stored method with Monte Carlo probabilistic simulation. The resource calculation result indicates the field has a good capability of supporting current installed capacity with a high level of confidence.

Keywords: Ulumbu geothermal field, natural state, resource assessment

PROCESS CONTROL OF MILK PASTEURIZATION USING GEOTHERMAL BRINE UNDER GEOTHERMAL BRINE TEMPERATURE AND FLOW RATE DISTURBANCE

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Geothermal brine can be used as a heating liquid for pasteurization unit either by directly use the brine to heat up the raw milk, or by heating secondary fresh water. The geothermal brine can be obtained directly from geothermal well or from geothermal power plant separator. Unlike conventional pasteurization, the flow rate and temperature of geothermal brine might fluctuate due to many factors such as rain, well decline, and well shut down. Inherently the geothermal reservoir tends to decline in pressure and temperature. If the geothermal brine is obtained from geothermal power plant, then the flow rate and temperature of geothermal brine is susceptible to many changes in plant's operation. A control system is needed for such utilization of geothermal brine. Simulation has been carried out to study the effect of PID feedback controller under geothermal brine temperature and flow rate disturbance. The result shows that PID controller could be used to compensate such disturbance. The PID controller controls milk inlet flow rate to balance the effect of both disturbances.

Keywords: direct use, pasteurization, brine, geothermal, milk

UPDATING CONCEPTUAL MODEL OF CIWIDEY-PATUHA GEOTHERMAL USING DYNAMIC NUMERICAL MODEL

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A study of Ciwidey-Patuha geothermal field using TOUGH2 reservoir simulation has been conducted. The purpose of this study is to verify and update previous Ciwidey-Patuha conceptual models. The numerical model of vapour-dominated reservoir with steam zone underlying liquid reservoir is constructed based on detail reservoir characterization from geoscience and well data. The reservoir boundary is defined based on TCH (temperature core hole) wells. The distribution of porosity, pressure, temperature and steam saturation are assessed. The model is validated by matching downhole data on pressure and temperature during exploration stage. Then for exploitation stage, the model is validated using reservoir pressure.

Keywords: Numerical Model, TOUGH2, Patuha-Ciwidey

EXPERIMENTAL DESIGN AND RESPONSE SURFACE METHOD APPLICATION IN RESOURCES ASSESSMENT: CASE STUDY KARAHA-TALAGA BODAS, WEST JAVA, INDONESIA

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The objective of this study is to build a numerical model which combine with experimental design method as a probabilistic approach to overcome the uncertainty parameters of reservoir so that can be obtained more valid assessment result. A Plackett-Burmann design method was used to minimize experimental simulation run into 12 experiments by investigating six uncertainty parameters with two degrees level. This process assesses the impact of evaluated parameters affecting resources and interacting between these parameters. This methodology has been successfully estimated the maximum resources with polynomial function covering the entire range of possible values of important reservoir parameters.

Keywords: resources assessment, experimental design

COMPARISON OF RESOURCE ASSESSMENT METHODS WITH NUMERICAL RESERVOIR MODEL BETWEEN HEAT STORED AND EXPERIMENTAL DESIGN: CASE STUDY CIWIDEY-PATUHA GEOTHERMAL FIELD

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A successful geothermal field size assessment requires integrative data analysis of all aspects to determine the optimum capacity to be installed. Nowadays, numerical simulation becomes a powerful tool in a geothermal resource assessment process. However, this method involves significant uncertainty of subsurface information as an input. Then a study of resource assessment methods, such as heat stored and experimental design, needs inputs coming from the result/output of reservoir numerical. The calculation of both methods based on a range of reservoir parameter values can be carried out using stochastic methods (Monte Carlo Simulation). It applies a probabilistic method of resource assessment to capture uncertainties. A sophisticated numerical reservoir model of Ciwidey-Patuha Geothermal Field, West Java-Indonesia in the natural state condition was used as a case study to determine the generating potential of the reservoir

Keywords: Ciwidey-Patuha, Experimental Design, Heat Stored, Resources Assessment.

THERMAL DESIGN OF 5 KG CAPACITY COFFEE BEAN DRYER SIMULATOR USING GEOTHERMAL ENERGY

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A coffee bean dryer simulator that would be able to fully simulate the whole process of coffee bean drying using heat recovered from geothermal energy source has been thermally designed. This simulator is planned to educate people living near the geothermal resources or power plants about the direct use of geothermal energy, especially in coffe drying. The maximum capacity of this simulator is 5 kilogram of fresh coffee bean that is dried using hot air at 45°C and mass flow rate of 0,23 kg/s. The duration of drying is about 3000 seconds which should be adequate to represent the drying process. The heat exchanger proposed for this thesis is a compact heat exchanger with staggered pipe arangement. The total number of pipes is 10 pipes at 36 cm in length and 65 flat plate alluminium fins measured at 0,6m x 0,16m x 0,005m. The fin efficiency value and the overall surface efficiency value are 72% and 73% respectively.

Keywords: Direct use, Geothermal, Coffee Drying, Heat Exchanger

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Welcoming remarks by the chairman of the event, Dr. Suryantini



IGA presentation during the Mid-Workshop



The discussion among the experts during the IGA Mid-Workshop



Speakers in plenary session of 7th ITB International Geothermal Workshop 2018



Participants with enthusiasm were keep following the plenary session



Opening ceremony for ITB International Geothermal Workshop 2017 Exhibition event by Mr. Sanusi Satar on behalf INAGA

PROCEEDINGS, 7th ITB International Geothermal Workshop 2018 Institut Teknologi Bandung, Bandung, Indonesia, March 21–22, 2018



Paper presentation during the technical session



Paper presentation during the technical session



Paper presentation during the technical session

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March, 21 - 22

Committee

Organizing and Technical Committee Steering Sutopo (Chairman of ITB Geothermal Master Program) and Committee Staffs of Geothermal Master Program, FTTM - ITB Chairman Survantini Vice Chairman Ade Lesmana, Akbar Dwi Wahyono General Secretary Teguh Deo Prambudi, Chenchen Yoyakhin Siahaan, Yutty Hendrawati Treasurer Erwil Marbun, Ayu Gracia Ade Sumartha Sponsorship Agung Budi Tri Prasetyo, Agung Reynaldi Khrisna Wardana, Ayu Gracia Ade Sumartha, Abdul Hadi Harahap, Muhammad Jiehan Lampuasa Grandy Bilhan Danakusumah, Marchel Christian Supijo, Erwil Creative, Publication and Marbun, Muhamad Ridwan Hamdani, Hendro Wibowo Media Pre-Workshop Naufal Nandaliarasyad, Chenchen Yoyakhin Siahaan, Marchel and Mid Christian Supijo, Claudio Ricardo Imanuel Ponggohong, Rizky Workshop Wiradinata, Teguh Deo Prambudi Plenary Session Chenchen Yoyakhin Siahaan, Naufal Nandaliarasyad, Marchel Christian Supijo, Claudio Ricardo Imanuel Ponggohong, Rizky Wiradinata, Teguh Deo Prambudi Technical Paper Claudio Ricardo Imanuel Ponggohong, Iqbal Kurniawan, and Scientific Muhamad Ridwan Hamdani, Grandy Bilhan Danakusumah, Ribka Firtania Asokawaty, Riviani Kusumawardhani, Jonathan Sharon Widiatmo, Joshua Satriana, Nanda Hanyfa Maulida Marchel Christian Supijo, Naufal Nandaliarasyad, Rizky Field Trip Wiradinata Teguh Deo Prambudi, Chenchen Yoyakhin Siahaan, Claudio Field Camp **Ricardo Imanuel Ponggohong** Logistic and Hikmatyar Ghassan Fariz Hasbi, Muhammad Jiehan Lampuasa, Accommodation Abdul Hadi Harahap, Agung Reynaldi Khrisna Wardana, Agung Budi Tri Prasetyo, Suhendi Exhibition Rizky Wiradinata, Naufal Nandaliarasyad, Chenchen Yoyakhin Siahaan, Marchel Christian Supijo, Claudio Ricardo Imanuel Ponggohong, Teguh Deo Prambudi

ITB INTERNATIONAL GE THERMAL W&RKS

March, 21 - 22

Schedule - Pre-workshop 1

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19-20 March 2018, Pre-Workshop Course 1									
Title: LEAI	Title: LEAPFROG GEOTHERMAL, by: Seequent								
Instructor	Instructors: Andrew McMahon and Jeremy O'Brien								
Date: 19-2	20 March 2018								
Venue: Ex	Venue: Exploration Room, 2 nd Floor, Energy Building, Institut Teknologi Bandung								
	DAY 1 (19 March 2018)								
No.	Time	Agenda							
1	07:30 - 08.00	Registration							
2	08:00 - 08:15	Opening							
3	08:15 - 10:15	Viewing an Existing Project							
4	10:15 - 10:30	Coffee Break							
5	10:30 - 12:00	Importing data, Geological Modelling							
6	12:00 - 13:00	Lunch							
7	13:00 - 15:00	Editing Geological Data							
8	15:00 - 15:15	Coffee Break							
9	15:15 - 17:00	Adding faults and Dynamic Updating							
		DAY 2 (20 March 2018)							
No.	Time	Agenda							
1	08:00 - 08:15	Registration							
2	08:15 - 10:15	MT Data and Time Dependent Data							
3	10:15 - 10:30	Coffee Break							
4	10:30 - 12:00	Temperature Data							
5	12:00 - 13:00	Lunch							
6	13:00 - 15:00	Well Planning and Communcating							
7	15:00 - 15:15	Coffee Break							
8	15:15 - 17:00	TOUGH2 Integration							
9	17:00 - 17.15	Closing							

ITB INTERNATIONAL GE THERMAL W&RKS

March, 21 - 22

Schedule - Pre-workshop l

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19-20 March 2018, Pre-Workshop Course 1										
Title: LEAP	Title: LEAPFROG GEOTHERMAL, by: Seequent									
Instructors	Instructors: Andrew McMahon and Jeremy O'Brien									
Date: 19-2	Date: 19-20 March 2018									
Venue: Ex	Venue: Exploration Room, 2 nd Floor, Energy Building, Institut Teknologi Bandung									
DAY 1 (19 March 2018)										
No.	Time Agenda									
1	07:30 - 08.00	Registration								
2	08:00 - 08:15	Opening								
3	08:15 - 10:15	Viewing an Existing Project								
4	10:15 - 10:30	Coffee Break								
5	10:30 - 12:00	Importing data, Geological Modelling								
6	12:00 - 13:00	Lunch								
7	13:00 - 15:00	Editing Geological Data								
8	15:00 - 15:15	Coffee Break								
9	15:15 - 17:00	Adding faults and Dynamic Updating								
		DAY 2 (20 March 2018)								
No.	Time	Agenda								
1	08:00 - 08:15	Registration								
2	08:15 - 10:15	MT Data and Time Dependent Data								
3	10:15 - 10:30	Coffee Break								
4	10:30 - 12:00	Temperature Data								
5	12:00 - 13:00	Lunch								
6	13:00 - 15:00	Well Planning and Communcating								
7	15:00 - 15:15	Coffee Break								
8	15:15 - 17:00	TOUGH2 Integration								
9	17:00 - 17.15	Closing								



March, 21 - 22

Schedule - Pre-workshop 2

19-20 March 2018, Pre-Workshop Course 2

Title: GEOTHERMAL WELL DRILLING DESIGN, TECHNOLOGY, AND **MANAGEMENT**, by: **Schlumberger**

Wisnu, Yoan Mardiana, Allam Putra, Adithya Wicaksono, Azhar Al-Faqi Instructors: Febra S. Dewa, Sri Mulyani, Pasca, Agus Ziyad, Komang

Date: 19-20 March 2018

Venue: Hall Room, 1st Floor, Energy Building, Institut Teknologi Bandung

DAY 1 (19 March 2018)	Agenda	Registration	Opening	SLB Geothermal Services & Offerings	Magnetotelluric and Conceptual Subsurface Model for Reservoir Characterization "Processing and modeling MT data, Build conceptual 3D subsurface model in Petrel Platform and case studies"	Coffee Break	Subsurface Fracture Characterization for Optimum Well Design "Integrated subsurface fracture measurements and interpretation to reduce assumptions in decision making"	Lunch	Basic Geothermal Well Design & Construction "Basis of design, well construction methodology and critical elements in designing geothermal wells"	Coffee Break	SLB Integrated Geothermal Solutions "Integrated Drilling Project Management and its benefits"
	Time	07:15 - 07:45	07:45 - 08:00	08:00 - 08:15	08:15 - 10:15	10:15 - 10:30	10:30 - 12:00	12:00 - 13:00	13:00 - 15:00	15:00 - 15:15	15:15 - 17:00
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DAY 2 (20 March 2018)	Agenda	Registration	Day 1 Recap	Directional Drilling & Measurement While Drilling "Directional Drilling technologies for optimum well placement leading to maximumproductivity"	Coffee Break	Bits & Drilling Tools Technologies "Overview of bit design & drilling tools for geothermal wells, including Casing While Drilling technology."	Lunch	Well Integrity and Intervention "Achieving long-term zonal isolation and Intervention technologies in geothermal environment"	Coffee Break	Drilling Fluids and Solid Control "Drilling fluids design for Geothermal Wells and solids management system"	Closing
	Time	07:30-08:00	08:00 - 08:15	08:15 - 10:15	10:15 - 10:30	10:30 - 12:00	12:00 - 13:00	13:00 - 15:00	15:00 - 15:15	15:15 - 17:00	17:00 – 17.15
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ITB INTERNATIONAL GE THERMAL WORKSHOP

March, 21 - 22

2018

Schedule - Pre-workshop 2

19-20 March 2018, Pre-Workshop Course 2

Title: GEOTHERMAL WELL DRILLING DESIGN, TECHNOLOGY, AND MANAGEMENT, by: Schlumberger Instructors: Febra S. Dewa, Sri Mulyani, Pasca, Agus Ziyad, Komang Wisnu, Yoan Mardiana, Allam Putra, Adithya Wicaksono, Azhar Al-Faqi

visnu, toan Marqiana, Ailam Putra, Aqitnya Wicaksono,

Date: 19-20 March 2018

Venue:Hall Room, 1st Floor, Energy Building, Institut Teknologi Bandung

DAY 1 (19 March 2018)	Agenda	Registration	Opening	SLB Geothermal Services & Offerings	Magnetotelluric and Conceptual Subsurface Model for Reservoir Characterization "Processing and modeling MT data, Build conceptual 3D subsurface model in Petrel Platform and case studies"	Coffee Break	Subsurface Fracture Characterization for Optimum Well Design "Integrated subsurface fracture measurements and interpretation to reduce assumptions in decision making"	Lunch	Basic Geothermal Well Design & Construction "Basis of design, well construction methodology and critical elements in designing geothermal wells"	Coffee Break	SLB Integrated Geothermal Solutions "Integrated Drilling Project Monagement and its benefits"
	Time	07:15 - 07:45	07:45 - 08:00	08:00 - 08:15	08:15 - 10:15	10:15 - 10:30	10:30 - 12:00	12:00 - 13:00	13:00 - 15:00	15:00 - 15:15	15:15 - 17:00
	No.	1	2	£	4	ß	9	7	×	6	10

DAY 2 (20 March 2018)	Agenda	Registration	Day 1 Recap	Directional Drilling & Measurement While Drilling "Directional Drilling technologies for optimum well placement leading to maximumproductivity"	Coffee Break	Bits & Drilling Tools Technologies "Overview of bit design & drilling tools for geothermal wells, including Casing While Drilling technology."	Lunch	Well Integrity and Intervention "Achieving long-term zonal isolation and Intervention technologies in geothermal environment"	Coffee Break	Drilling Fluids and Solid Control "Drilling fluids design for Geothermal Wells and solids management system"	Closing
	Time	07:30-08:00	08:00 - 08:15	08:15 - 10:15	10:15 - 10:30	10:30 - 12:00	12:00 - 13:00	13:00 - 15:00	15:00 - 15:15	15:15 - 17:00	17:00 - 17.15
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	21 March 2018, PLENARY SE	SSION
	Venue: 1 st Floor Hall, Labtek I, InstituteT	eknologi Bandung
	Opening Ceremony and Keynote	Speaker
07.00-08.30	Registration	
08.30-08.35	Welcoming remark from the Chairman of IIGW 2018	Suryantini
08.35-08.40	National Anthem: Indonesia Raya	
08.40-08.45	Opening Speech of the IIGW 2018 by the Dean of Faculty of Mining and Petroleum Engineering	Sri Widiantoro (Dean FTTM)
08.45-09.05	Keynote Speech-1: "Government Commitment toward National Prosperity with Support of Geothermal Development"	Arcandra Tahar (Vice Minister of the Ministry of Energy and Mineral Resources)
09.05-09.25	Keynote Speech-2 : "INAGA Role in Uniting Geothermal Stakeholders to Increase 5000 MW Installed Capacity in Less than One Decade"	Prijandaru Effendi (Chairman of INAGA, Vice President of Relations and SHE of Supreme Energy)
09.25-09.40	Opening Performance	
09.40-10.00	Coffee Break and Press Conference	

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B)	Hilmi Panigoro (President Director of PT Medco Energi Internasional Tbk)	Darwin Trisna Djajawinata (Direktur Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI))	Riki F. Ibrahim (President Directorof Geo Dipa Energi)	Moderator	Host: Nenny Saptadji <i>(ITB)</i>	articipant (MC) f Geothermal Master Program FTTM –	eak
Moderator: Ali Ashat (IT	Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal Project	Geothermal Development Funding	Geothermal Development Strategy of Geo DipaEnergi	QUESTION and ANSWER	10th Anniversary Geothermal Master Program Award	OPENING EXHIBITION AND POSTER SESSION Presentation of Exhibition and Poster J Cutting Ribbon (Host: Sutopo / Head o ITB) Leapfrog Presentation 	Lunch Bre
	10.00 -10.20	10.20-10.40	10.40-11.00	11.00-11.20	11.20-11.40	11.40-12.00	12.00-13.30
	Moderator: Ali Ashat (ITB)	Moderator: Ali Ashat (ITB) Techno-Economy Strategy in Geothermal 10.00 -10.20 Development. Lesson learned from Sarulla Geothermal Project PT Medco Energi Internasional Tbk)	Moderator: Ali Ashat (ITB) Moderator: Ali Ashat (ITB) Techno-Economy Strategy in Geothermal Hilmi Panigoro (<i>President Director</i> of PT Medoc Energi Internasional Tbk) 10.00 -10.20 Development. Lesson learned from Sarulla Hilmi Panigoro (<i>President Director</i> of PT Medoc Energi Internasional Tbk) 10.20-10.40 Geothermal Project Darwin Trisna Djajawinata (<i>Direktur Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI)</i>)	Moderator: Ali Ashat (ITB)Moderator: Ali Ashat (ITB)10.00 -10.20Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal ProjectHilmi Panigoro (President Director of PT Medco Energi Internasional Tbk)10.20-10.40Geothermal ProjectDarwin Trisna Djajawinata (Direktur Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI)10.40-11.00Geothermal Development Strategy of Geo Dipa Energi)Riki F. Ibrahim (President Directorof Geo Dipa Energi)	Moderator: Ali Ashat (ITB)Moderator: Ali Ashat (ITB)10.00 -10.20Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal ProjectHilmi Panigoro (President Director of PT Medco Energi Internasional Tbk)10.20-10.40Geothermal ProjectDarwin Trisna Djajawinata (Direktur Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI))10.40-11.00Geothermal Development Strategy of Geo DipaEnergiRiki F. Ibrahim (President Directorof Geo Dipa Energi)11.00-11.20QUESTION and ANSWERModerator	Moderator: Ali Ashat (TB)Moderator: Ali Ashat (TB)10.00-10.20Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal ProjectHilmi Panigoro (President Director of Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI))10.20-10.40Geothermal Development Funding Development Strategy of Geo DipaEnergiDarwin Trisna Djajawinata (Direktur Pengembangan Proyek dan Advisory of Sarana Multi Infrastruktur (SMI))10.40-11.00DipaEnergiRiki F. Ibrahim (President Directorof Geo Dipa Energi)11.00-11.20QUESTION and ANSWERModerator11.20-11.40Ioth Anniversary Geothermal Master Program AwardHost: Nenny Saptadji (ITB)	Moderator: Ali Ashat (ITB) Moderator: Ali Ashat (ITB) 10.00-10.20 Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal Project Hilmi Panigoro (President Director of Pengemborgon Proyek dan Advisory of Sarana Multi Infrastruktur (SMI)) 10.20-10.40 Geothermal Development Funding Dipatenergi Darwin Trisna Djajawinata (Direktur Sarana Multi Infrastruktur (SMI)) 10.40-11.00 Geothermal Development Strategy of Geo Dipatenergi Riki f. Ibrahim (President Director of Geo Dipa Energi) 11.00-11.20 QUESTION and ANSWER Moderator 11.20-11.40 DUESTION and ANSWER Moderator 11.20-11.40 DUESTION and ANSWER Moderator 11.20-11.20 QUESTION and ANSWER Moderator 11.20-11.20 DUESTION and POSTER SESSION Host: Nenny Saptadji (ITB) 11.40-12.00 PENING EXHIBITION AND POSTER SESSION Host: Nenny Saptadji (ITB) 11.40-12.00 Terestation of Exhibition and Poster Program FTIM- TB) 3. Leapfrog Presentation



	21 March 2018, PLENARY SE	SSION
	Venue: 1stFloor Hall, Labtek I, InstituteT	eknologi Bandung
	Opening Ceremony and Keynote	Speaker
07.00-08.30	Registration	
08.30-08.35	Welcoming remark from the Chairman of IIGW 2018	Suryantini
08.35-08.40	National Anthem: Indonesia Raya	
08.40-08.45	Opening Speech of the IIGW 2018 by the Dean of Faculty of Mining and Petroleum Engineering	Sri Widiantoro (Dean FTTM)
08.45-09.05	Keynote Speech-1: "Government Commitment toward National Prosperity with Support of Geothermal Development"	Arcandra Tahar (Vice Minister of the Ministry of Energy and Mineral Resources)
09.05-09.25	Keynote Speech-2 : "INAGA Role in Uniting Geothermal Stakeholders to Increase 5000 MW Installed Capacity in Less than One Decade"	Prijandaru Effendi (Chairman of INAGA, Vice President of Relations and SHE of Supreme Energy)
09.25-09.40	Opening Performance	
09.40-10.00	Coffee Break and Press Conference	

		irector of anal Tbk)	(Direktur Advisory of (SMI))	irectorof			– MTTT A	
othermal Development	B)	Hilmi Panigoro (President D PT Medco Energi Internasic	Darwin Trisna Djajawinata Pengembangan Proyek dan Sarana Multi Infrastruktur	Riki F. Ibrahim (<i>President D</i> Geo Dipa Energi)	Moderator	Host: Nenny Saptadji <i>(ITB)</i>	articipant (MC) f Geothermal Master Progran	eak
PLENARY SESSION 1 Integrating Techno-Economy Strategy for Ge	Moderator: Ali Ashat (IT	Techno-Economy Strategy in Geothermal Development. Lesson learned from Sarulla Geothermal Project	Geothermal Development Funding	Geothermal Development Strategy of Geo DipaEnergi	QUESTION and ANSWER	10th Anniversary Geothermal Master Program Award	OPENING EXHIBITION AND POSTER SESSION 1. Presentation of Exhibition and Poster J 2. Cutting Ribbon (Host: Sutopo / Head o ITB) 3. Leapfrog Presentation	Lunch Bre
		10.00 -10.20	10.20-10.40	10.40-11.00	11.00-11.20	11.20-11.40	11.40-12.00	12.00-13.30
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Social an	Mod	Social and Env	Geothermal So		Education Deo	Development	Increasing Wo Development	QUESTION AN	GALA DINNER	MASTER PROC
		15.30-15.50	15.50-16.10			16.10-16.30	16.30-16.50	16.50-17.10	17 10-20 00	00.07 01.11
elopment Trend	rmal Association (INAGA))	Alexander Richter (<i>President of</i> International Geothermal Association	(IGA) and Founder & Principal–Think Geo Energy ehf.)	Yudistian Yunis (Representative	Perusahaan Listrik Negara (PLN))	Irfan Zainuddin (President Director of Pertamina Geothermal Energy (PGE))	Graeme Beardsmore and Gioia Falcone (RepresentativeInternational Geothermal Association (IGA) /United	Europe (UNECE))	Moderator	
PLENARY SESSION 2 National and Global Geothermal Dev	Moderator: Ahmad Yuniarto (Indonesia Geothe	World Geothermal Trend in 2025		Aggressive Exploration Program by BUMN		The Role of PGE as the Biggest Geothermal Concession Owner in Indonesia in Driving Geothermal Development Trend	Classifying Geothermal Resources in Harmony with Other Energy Resources using the United Nations Framework Classification (UNFC)	Scheme	QUESTION and ANSWER	COFFEE BREAK
		13.30-13.50		13.50-14.10		14.10-14.30	14.30-14.50		14.50-15.10	15.10-15.30

ermal Development iina University)	Sanusi Satar (Representative of GEOCAP)	Antonius Sumarlin (Senior Researcher of (Indonesia Geothermal Center Of Excellence (IGCOE))	Indra Sari Wardhani (Climate and Energy Manager Policy, Sustainability & Transformation Division of World Wide Fund for Nature (WWF))	Jane Brotheridge (Team Leader – Geoscience of Jacobs and Representative of Woman in Geothermal (WING))	Moderator	All Participants are invited	
PLENARY SESSION 3 Social and Environmental Issues in Geoth Moderator: Farah Mulvasari (Pertam	Social and Environmental Lesson Learned	Geothermal Social Mapping	Educating People around Geothermal Development Area	Increasing Woman Roles in Geothermal Development Worldwide	QUESTION AND ANSWER	GALA DINNER AND CELEBRATION OF TENTH YEARS ANNIVERSARY OF ITB GEOTHERMAL MASTER PROGRAM	
	15.30-15.50	15.50-16.10	16.10-16.30	16.30-16.50	16.50-17.10	17.10-20.00	



PLENARY SESSION 2

		15.30-		16.10-	16.30-	17.10-	
lopment Trend	mal Association (INAGA))	Alexander Richter (<i>President of</i> International Geothermal Association (IGA) and Founder & Principal–Think Geo Energy ehf.)	Yudistian Yunis (Representative Perusahaan Listrik Negara (PLN))	Irfan Zainuddin (President Director of Pertamina Geothermal Energy (PGE))	Graeme Beardsmore and Gioia Falcone (RepresentativeInternational Geothermal Association (IGA) /United Nation Economic Commision for Europe (UNECE))	Moderator	
National and Global Geothermal Deve	Moderator: Ahmad Yuniarto (Indonesia Geother	World Geothermal Trend in 2025	Aggressive Exploration Program by BUMN	The Role of PGE as the Biggest Geothermal Concession Owner in Indonesia in Driving Geothermal Development Trend	Classifying Geothermal Resources in Harmony with Other Energy Resources using the United Nations Framework Classification (UNFC) Scheme	QUESTION and ANSWER	COFFEE BREAK
	2	13.30-13.50	13.50-14.10	14.10-14.30	14.30-14.50	14.50-15.10	15.10-15.30

PLENARY SESSION 3 Social and Environmental Issues in Geothermal Development	Moderator: Farah Mulyasari (Pertamina University)
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	Moderator: Farah Mulyasari (Pertam	ina University)
15.30-15.50	Social and Environmental Lesson Learned	Sanusi Satar (Representative of GEOCAP)
15.50-16.10	Geothermal Social Mapping	Antonius Sumarlin (Senior Researcher of (Indonesia Geothermal Center Of Excellence (IGCOE))
16.10-16.30	Educating People around Geothermal Development Area	Indra Sari Wardhani (Climate and Energy Manager Policy, Sustainability & Transformation Division of World Wide Fund for Nature (WWF))
16.30-16.50	Increasing Woman Roles in Geothermal Development Worldwide	Jane Brotheridge (Team Leader – Geoscience of Jacobs and Representative of Woman in Geothermal (WING))
16.50-17.10	QUESTION AND ANSWER	Moderator
17.10-20.00	GALA DINNER AND CELEBRATION OF TENTH YEARS ANNIVERSARY OF ITB GEOTHERMAL MASTER PROGRAM	All Participants are invited

ITB INTERNATIONAL GE THERMAL W&RKSHO

March, 21 - 22

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Schedule - Invited Speaker

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22 Venue: 2 nd	March 2018, Technical Sessi ^d Floor, Labtek I, Intitut Teknolog	on i Bandung	
	List for Invited Speaker s		_
Speaker	Торіс	Room	Time
Geo Dipa Energi	Production Engineering: Case Study	Δ	13 20 - 14 00
	Dieng Geothermal Field		13.20 14.00
Sarulla Operation Limited	Sarulla Geothermal C ombined Cycle	Λ	16.00 - 16.40
	Operation	~	10.00 - 10.40
Toshiba Asia Pacific Indonesia	Well Head Generating Unit	В	09.20 - 10.00
Halliburton	Drilling Technology	В	11.20 – 12.00
Star Energy	Star Energy's Corporate Social	C	11 20 - 12 00
	Responsibility	C	11.20 - 12.00
KSB Indonesia	Pump Application for Geothermal	С	15.00 - 15.40
Supreme Energy	Muara Laboh Development Drilling	D	09 20 - 10 00
	Execution	U	05.20 10.00
Sokoria Geothermal Indones ia	Sokoria Exploration Drilling Update	D	15.00 - 15.40
PLN	Tulehu Geothermal Update	E	11.20 - 12.00
Center of Mineral Resources,	Update The Status of Indonesian		
Coal and Geothermal	Exploration	E	13.00 - 13.40
(PSDMBP)			



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March, 21 - 22 2018

Schedule - Mid-Workshop

	22 Mar	cn 2018, Iviia-worksnop Course 1	
Title: Geoth	ermal for Everyone,	by: ITB Geothermal Study Program	
Instructors	: ITB Geothermal Tech	nology Master Program Lecturers*	-
Date: 22 Mé	arch 2018		
Venue: 2 nd F	Floor Hall, Labtek 1, In	istitute Teknologi Bandung	
No.	Time	Agenda	-
1	07.30-08.00	Registration	
2	08.00 - 08.15	Opening	
ĸ	08.15 - 09.15	Geothermal System (Suryantini)	
4	09.15 - 10.15	Geothermal Manifestation and Exploration (Suryantini)	
S	10.15 - 10.30	Coffee Break	
9	10.30 - 11.30	Engineering and Exploration of Geothermal Energy (Nenny Saptadji)]
7	11.30 - 12.30	Economic and Environmental Issue of Geothermal Energy Utilization	
		(Ali Ashat dan Fitri Oktaviani)	
8	12.30 – 13.00	Lunch	

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: IAGI		(Pertamina Geothermal Energy), Alfiady (Supreme Energ		itute Teknologi Bandung	Agenda	IAGI Session 1	Coffee Break	IAGI Session 2	Lunch
oduction Geochemistry, by	Ors:	Geo Dipa Energi), Mulyanto	2 March 2018	1 st Floor Hall, LABTEK I, Ins	Time	08:15 – 09.45	09.45 - 10.00	10.00 - 11.45	11.45 - 13.00
Title: PI	Instruct	Elfina (Date: 2	Venue:	No.	1	2	ε	4

22 March 2018, Mid-Workshop Course 2	search Progress of the BAGUS SATREPS Projectby: BAGUS SATREPS	LOTS: (to be confirmed)	2 March 2018	2 nd Floor Hall, Labtek 1, Institut Teknologi Bandung	Time Agenda	13.00 – 14.30 BAGUS SATREPS session 1	14.30 – 14.45 Coffee Break	14.45 – 16.15 BAGUS SATREPS session 2
	esearch	ctors: (to t	22 March	: 2 nd Floc		13.00	14.30	14.45
	Title: R	Instruc	Date:	Venue	No.	1	2	ε

22 March 2018, Mid-Workshop Course 4

IIIIE: A UNIVERSAL CLASSIFICATION FRAMEWORK FOR RENEWABLE ENERGY SOURCES: Application of UNFC-2009 to
Geothermal Energy, by: IGA and UNECE
Instructors: Graeme Beardsmore, Gioia Falcone, Robert Hogarth*, and Greg Ussher*, Malcolm Grant,
Manfred Hochstein, Varun Chandrasekhar, HarmenMijnlieff
Date: 22 March 2018
Venue1 st Floor Hall, LABTEK I, Institute Teknologi Bandung

	Agenda				
		IGA Session 1	Coffee Break	IAGI Session 2	
	Time	13.00 - 14.45	14.45 - 15.15	15.15 – 17.00	
Tanilan	No.	1	2	ε	



March, 21 - 22 2018

Schedule - Mid-Workshop

	22 Mar	ch 2018, Mid-Workshop Course 1
Title: Geoth	ermal for Everyone,	by: ITB Geothermal Study Program
Instructors :	ITB Geothermal Tech	nology Master Program Lecturers*
Date: 22 Ma	arch 2018	
Venue: 2 nd F	⁻ loor Hall, Labtek 1, In	istitute Teknologi Bandung
No.	Time	Agenda
1	07.30-08.00	Registration
2	08.00-08.15	Opening
ĸ	08.15 - 09.15	Geothermal System (Suryantini)
4	09.15 - 10.15	Geothermal Manifestation and Exploration (Suryantini)
5	10.15 - 10.30	Coffee Break
9	10.30 - 11.30	Engineering and Exploration of Geothermal Energy (Nenny Saptadji)
7	11.30 – 12.30	Economic and Environmental Issue of Geothermal Energy Utilization
8	12.30 - 13.00	Lunch

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by: IAGI		to (Pertamina Geothermal Energy), Alfiady (Supreme Energy)		nstitute Teknologi Bandung	Agenda	IAGI Session 1	Coffee Break	IAGI Session 2	Lunch
oduction Geochemistry,	ors:	Geo Dipa Energi), Mulyan	2 March 2018	1 st Floor Hall, LABTEK I, Ir	Time	08:15 - 09.45	09.45 - 10.00	10.00 - 11.45	11.45 - 13.00
Title: Pr	Instruct	Elfina ((Date: 22	Venue:	No.	÷	2	с	4

22 March 2018, Mid-Workshop Course 4

Geothermal Energy, by: IGA and UNECE

IAGI Session 2

IGA Session 1 Coffee Break

13.00 - 14.45 14.45 - 15.15 15.15 - 17.00

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ITB INTERNATIONAL GE THERMAL WORKS

March, 21 - 22

Schedule - Fieldcamp

 7^{TH}

22-23 March 2017, Post-Workshop

22-23 March 2018, Post-Workshop Activity 1							
Title: Geothermal Field Camp, by: ITB Geothermal Master Program							
Instructors: Suryantini (ITB) and Thermochem							
Date: 22-23 March 2018							
Venue: Tangkuban Parahu							
DAY 1 (22 March 2018)							
Time	Activities	Instructor					
18.00-18.30	Gathering at ITB Campus Gate	Committee					
18.30-20.00	Trip to Geothermal Field Camp, Lembang	Committee					
20.00-20.30	Dinner	Committee					
20.30-22.00	Night Discussion and Lecture	Suryantini					
22.00-06.00	Private time	Committee					
DAY 2 (23 March 2018)							
06.00-07.00	Breakfast	Committee					
07.00-08.00	Trip to Tangkuban Parahu Volcano	Committee					
08.00-10.45	Practical: Collecting Gas Samples at Fumaroles in	Thermochem					
	Domas Crater, CollectingWater Samples and						
	Alteration Observation						
10.45-11.15	Trip to Ratu and Upas Crater	Committee					
11.15-12.45	Lunch Break& Friday Praying	Committee					
12.45-13.15	Observation of Ratu and Upas Crater	Thermochem					
13.15-14.15	Trip to Geothermal Field Campus, Lembang	Committee					
14.15-16.00	Data Interpretation and Discussion	Suryantini					
16.00-16.30	Closing of the Field Camp Program	Committee					
16.30-18.00	Return Trip to Bandung	Committee					

ITB INTERNATIONAL GE THERMAL W&RKS

March, 21 - 22

Schedule - Fieldcamp

 7^{TH}

22-23 March 2017, Post-Workshop

22-23 March 2018, Post-Workshop Activity 1								
Title: Geothermal Field Camp, by: ITB Geothermal Master Program								
Instructors: Suryantini (ITB) and Thermochem								
Date: 22-23 March 2018								
Venue: Tangkuban Parahu								
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Time	Activities	Instructor						
18.00-18.30	Gathering at ITB Campus Gate	Committee						
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20.00-20.30	Dinner	Committee						
20.30-22.00	Night Discussion and Lecture	Suryantini						
22.00-06.00	Private time	Committee						
DAY 2 (23 March 2018)								
06.00-07.00	Breakfast	Committee						
07.00-08.00	Trip to Tangkuban Parahu Volcano	Committee						
08.00-10.45	Practical: Collecting Gas Samples at Fumaroles in	Thermochem						
	Domas Crater, CollectingWater Samples and							
	Alteration Observation							
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11.15-12.45	Lunch Break& Friday Praying	Committee						
12.45-13.15	Observation of Ratu and Upas Crater	Thermochem						
13.15-14.15	Trip to Geothermal Field Campus, Lembang	Committee						
14.15-16.00	Data Interpretation and Discussion	Suryantini						
16.00-16.30	Closing of the Field Camp Program	Committee						
16.30-18.00	Return Trip to Bandung	Committee						

ITB INTERNATIONAL GE THERMAL WORKS

March, 21 - 22

Schedule - Fieldtrip

 $\mathcal{T}^{\mathrm{TH}}$

	23 March 2018, Post-Workshop Activity 2
Title	e: Geothermal Field Trip, by: ITB Geothermal Study Program
Instructors: ITB Geother	mal Technology Master Program Lecturers and Star Energy Geothermal Darajat
	(SEGD) Representatives
	Date: 23 March 2018
	Venue: Star Energy Geothermal Darajat Power Plant
Time	Activities
05.00 - 05.30	Gathering at ITB Main Gate
05.30 - 09.00	Trip to Darajat
09.00 - 09.15	Coffee Break
09.15 - 09.25	Safety Induction
09.25- 09.35	Welcome Speech
09.35–10.15	Plant Overview (from Well to Power Plant)
10.15 - 11.20	Sharing Best Practice (Resources Management, Production, etc.)
11 20 - 11 30	Giving Memento from IIGW Committee to PT Star Energy Geothermal Darajat
11.20 11.50	(SEGD)
11.30 - 13.30	Lunch Break& Friday Praying
	Plant Tour:
12 20 15 00	- Well Head/Well Pad Area (Pad-9)
13.30 - 15.00	- Improvement/Best Practice Area
	- Power Plant and Control Room
15.00 - 15.10	Taking Pictures with Power Plant Background
15.10 - 15.40	Site Visit to Darajat Crater
15.40 - 19.40	Return Trip to Bandung

ITB INTERNATIONAL GE THERMAL WORKS

March, 21 - 22

Schedule - Fieldtrip

 $\mathcal{T}^{\mathrm{TH}}$

	23 March 2018, Post-Workshop Activity 2
Title	e: Geothermal Field Trip, by: ITB Geothermal Study Program
Instructors: ITB Geother	mal Technology Master Program Lecturers and Star Energy Geothermal Darajat
	(SEGD) Representatives
	Date: 23 March 2018
	Venue: Star Energy Geothermal Darajat Power Plant
Time	Activities
05.00 - 05.30	Gathering at ITB Main Gate
05.30 - 09.00	Trip to Darajat
09.00 - 09.15	Coffee Break
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15.40 - 19.40	Return Trip to Bandung

ITB INTERNATIONAL GE & THERMAL W&RKSHOP

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ROOM E	GEOCHEMISTRY	Hydrogeochemistry Approach to Determine Fluids Reservoir Characteristic in Geothermal Field Simisuh, West Sumatra, Indonesia (Hasbi Fikru Syabi et al Geological Engineering, Padjajaran University) [ID 095]	Geochemical and Alteration Comparison of Geothermal Potential Field : Study Case Candi Umbul and Kawah Sikidang, Central Java (Petrus Aditya Ekananda et al Geological Engineering, University of Diponegoro) [1D 123]	Hydrochemistry Characteristic of Warm Spring in Kaliulo, Klepu, Semarang Regency and Benefits for The Society Welfare (Andrew Y. Siregar et al Geological Engineering, University Of Diponegoro) [1D 088]
ROOM D	EXPLORATION DEVELOPMENT	The Application of Thermolumenescence Dosimeter for Determining Thermal History of Torro Geothermal Prospect, Central Sulawesi Province. (Dikdik Risdianto et al Center For Mineral, Coal, And Geothermal Resources) [10 156]	Comparison of Magnetotelluric Model Results With Drilling Data in Patuha Geothermal Field (Chevy Iskandar et al. – Geo Dipa Energi) [ID 166]	Muara Laboh Development Drilling Execution (Supreme Energy)
ROOM C	MANAGEMENT & INVESTMENT	How to Make Indonesian's Geothermal Attractive in Investor's Eye (Muhammad Rizaldi Farsah, Hadyan Pratama – Pertamina University) [ID 083]	Ceiling Price Policy of Geothermal in Indonesia: Perspective of Monopsony Market (Putu Dede Udayana Laksmana Putra et al. – FEB, Universitas Indonesia) [1D 130]	Design of PT Geo Dipa Energi Long Term Geothermal Development Plan (Supremlehaq Taqwim - Geo Dipa Energi) [ID 177]
ROOM B	LOW-MEDIUM ENTHALPY	Experimental Design of Wellbore Heat Exchanger in Binary Optimization for Low - Medium Enthalpy to Utilize Non-Self Discharge Wells in Indonesia (Immanuel L. G. et al. – Geothermal, ITB) [ID 007]	Developing Low Temperature Geothermal Projects in Indonesia Using Pumped Well Technology (Ridwan Febrianto et al. – Jacobs Group Indonesia) [1D 141]	Wellhead Generating Turbine (Toshiba Asia Pacific Indonesia)
ROOM A	RESERVOIR	Natural State Modeling of Sileri Area at Dieng Geothermal Field, Central Java, Indonesia (Rheza Akbar et al Mechanical and Industrial Engineering, Universitas Gadjah mada) [ID 082]	Improved Natural State Simulation of Arjuno-Welirang Geothermal Field, East Java, Indonesia (Rio Pradana Manggala Putra et al. Petroleum Engineering, ITB) [ID 149]	Natural State Modeling of Mataloko Geothermal Field, Flores Island, East Nusa Tenggara, Indonesia Using TOUGH2 Simulator (Yehezkiel David Pradhipta et al. – Petroleum Engineering, ITB)
110TIME	SESSION	08:40 09:00	09:20 09:20	09:20 - 09:40



COFFEE BREAK

ROOM E	GEOLOGY	Geothermal Exploration in Indonesia Based on Mineralogy and Hydrothermal Alteration (Fiorenza Deon et al Faculty of Geosciences and Engineering, Delft University of Technology) [ID 162]	Geological Control of Geothermal Surface Manifestation Occurrences in Pusuk Buhit and Simbolon-Samosir Geothermal Prospect: Preliminary Study (Betseba Sibarani et al Geothermal, ITB) [ID 176]
ROOM D	GEOPHYSICS/MT	Geothermal Reservoir Boundary Delineation Using 3D Magnetotelluric Inversion Case Study: The "Delta" Geothermal Field of Indonesia (Riki Irfan, Yunus Daud - Physics Department, Universitas Indonesia) [ID 017]	Identification of Songa Wayaua Geothermal Area Based on 3D Inversion Model of Magnetotelluric Data (Wiwid Joni, Ahmad Zarkasyi- Center for Mineral, Coal, and Geothermal Resources) [ID 048]
ROOM C	SOCIAL	Understanding Social Acceptance of Geothermal Energy: A Case Study from Mt. Lawu, Indonesia (Abdillah Ibrohim et al. – UPNV Yogyakarta) [ID 64]	Empowerment of Disabled Woman in Geothermal Area: Case Study of Caang Village Program in Darajat-Garut West Java (Heri Mohamad Tohari et al. – The Creative Insitute) [ID 157]
ROOM B	DRILLING	Drilling Technology	(Halliburton)
ROOM A	RESERVOIR	Geomechanical Modelling of A Geothermal Reservoir in Tanzania (Georgia George Mwaipopo, Cheng Yuanfang - Oil and Gas Well Engineering Department, China University of Petroleum) [1D 063]	Resource Assessment of Ulumbu Geothermal Field, East Nusa Tenggara, Indonesia Based on Natural State Model (Iqbal Kurniawan et al. – Geothermal, ITB) [ID 155]
TIME	SESSION	10:20 - 10:40	10:40 - 11:00

10:20

A0- Dynamical Modeling of Patuha- Support of Indonesian National (FLN) A0- Dynamical Modeling of Patuha- Support of Indonesian National (Star Energy) Constrained by MT Data for (PLN) A0- Numerical Simulation Standard (SNI) for (Star Energy) Constrained by MT Data for (PLN) A0- Numerical Simulation Indonesia (Nugroho: Yb. Agastyo et al System System 2.00 (Ali Ashat, Heru Berian Pratama - (Nugroho: Yb. Agastyo et al System Mohamad Luffi Ismail et al Physics Department, Universitas (ID 171) (ID 171) (ID 014) (ID 122) (ID 122)	ITB INTERNATIONAL GE THERMAL W&RKSHOP March, 21 - 22 2018	
	Resource Assessment of Tolehu Geothermal Area, Ambon, Indonesia Based on Natural State Geothermal Area, Ambon, Indonesia Based on Natural State Mitgaring Social Risks for available (Hadi Madi Fermana et al. Geothermal (TB) Mitgaring Social Risks for its Relation with total Case: Hund Amplituation Social Mage admined (Hadi Madi Fermana et al. Geothermal) (1000 (Hagi Mand et al. Geothermal) (1000 (Hagi Madi et al. Geothermal) (Hadi Madi Fermana et al. Geothermal) (Hadi Madi Fermana et al. Geothermal) (Hadi Madi Fermana et al. Geothermal) (1000 (Hadi Madi Fermana et al. Geothermal) (1000 (Houssin)) (10000 (Houssin)) (1000 (Houssin)) (Houssin)) (1000 (Houssin	ITBINTERNATIONAL GB #THERMAL W\$ RKSHOP March, 21-22 2015 Becource Assessment of Tolehu Geothermal Area, Annto, IL00- Lesson Lesmed and Performance mprovement Drilling Case Study from Surial Geothermal Operation from Surial Geothermal Operation (rongs Amma et al.) March, 21-22 2015 11200 Geothermal Area, Annto, motoreia Based on Natural State from Surial Geothermal Operation from Surial Geothermal Operation (rong and and mprovement Drilling Case Study from Surial Geothermal Operation (rong and and magnetic accorderation from Surial Geothermal Operation (rong and and magnetic accorderation from Surial Geothermal Operation motoreis) Volcanostratigraph Analysis (section accorderation motoreis) 11200 (rong Area Study from Surial Geothermal Control Application in Resource from Surial Geothermal Control motoreis) (rong Area Study (rong Area Study from Surial Geothermal Control from Surial Geothermal Control from Surial Geothermal Control motoreis) (rong Area Study (rong Area Study from Surial Geothermal Control from Surial Control from Suri
	Resource Assessment of Tolehu Geothermal Area, Ambon, Indonesia Based on Natural State (from Sarula Geothermal Operation ModelLeason Learned and Performance Mitigating Social Risks for is Relation with Hot Springs Based on Magnetotelluric Method at The Mitigating Social Risks for (anded and Mitigating Social Risks for Indonesia Based on Natural State ModelVolcanostratigraphy Analysis for Geothermal Preliminary Survey in Volcanic Area, Study Case: Hululais Geothermal Field, Bengkulu, Indonesia Based on Natural StateLeason Learned and Performance Its Relation with Hot Springs Based on Magnetotelluric Method at The ModelVolcanostratigraphy Analysis for Geothermal Study (Gloria G. Sondakh et al. – Geo Dipa (Gloria G. Sondakh et al. – Geo Dipa (Gloria G. Sondakh et al. – Geothermal, ITB)Volcanostratigraphy Analysis for Geothermal Field, Bengkulu, Indonesia (Gloria G. Sondakh et al. – Geo Dipa (Gloria G. Sondakh et al. – (Gloria G. Sondakh et al. – (Gloria G. Sondakh et al. – Geo Dipa (Gloria G. Sondakh et al. – (Gloria G. Sondakh et al. – Geo Dipa (Gloria G. Sondakh et al. – (Gloria G. Sondakh et al.	Induction
Experimental Design and Response Surface Method Application in Resources Application in ResourcesExperimental Considerations in Minimizing Basic Considerations in Minimizing The Uncertainty During Developing Geothermal Exploration Drilling Talaga Bodas, West Java, I 1:40Reducing Geothermal Exploration Drilling Risks by Optimizing 3D Magnetotelluric Imaging Technology (Yunus Daud et al Physics Department, Universitas IndonesiaReducing Geothermal Exploration Drilling Risks by Optimizing 3D Magnetotelluric Imaging Technology (Yunus Daud et al Physics Department, Universitas IndonesiaReducing Geothermal Exploration Drilling Risks by Optimizing 3D Magnetotelluric Imaging Technology (Yunus Daud et al Physics Department, Universitas IndonesiaReducing Geothermal Exploration Department, Universitas Indonesia11:40(Welly Prabata et al (Welly Prabata et al (10 165)(Nonesia) (Tonesia)(Yunus Daud et al Physics Department, Universitas Indonesia11:40(Welly Prabata et al (Bothermal, ITB)(10 086)Star Energy's Corporate Social ID 127Tulehu Geothermal Update		ITB INTERNATIONAL GE THERMAL W&RKSHOP March, 21 - 22 2018

Se TITLE 20	ROOM E	ADVANCED EXPLORATION	Update The Status of Indonesian	Exploration (IGCOE)
MAL W&RKSHOF 1, 21 - 22 201	ROOM D	EXPLORATION REMOTE SENSING	Determining Mercury Distribution Based on Matérn Model of Geostatistical Analysis to Identify Geothermal Permeabilty Zone: Case Study of Lainea, South Konawe, Southeast Sulawesi (Stephen Simamora et al Geological Engineering, Padjajaran University) [ID 131]	Remote Sensing of Surface Hydrothermal Alteration, Identification of Minerals and Thermal Anomalies at Sveifluháls- Krýsuvík High-Temperature Geothermal Field, SW Iceland (Lucía Magali Ramírez-González et al Institute of Earth Sciences, University of Iceland) [10 076]
NAL GE THER	ROOM C	DIRECT USE	Thermal Design of 5 Kg Capacity Coffe Bean Dryer Simulator Using Geothermal Energy (J. Hendrarsakti, M.R. Firmansyah - Faculty of Mechanical and Aerospace Engineering & Geothermal ITB) [ID 159]	Process Control of Milk Pasteurization Using Geothermal Brine Under Brine Temperature and Flow Rate Disturbance (Jonathan Widiatmo et al. – Geothermal, ITB) [ID 161]
ITB INTERNATIC	ROOM B	DRILLING	Deep Slim Hole Performance Evaluation for Geothermal Exploration Well by Using Wellbore Modelling (Fauzan Makarim - ITB) [ID 173]	Key Considerations for Utilizing Acidic Water Source for Water Drilling Distribution System in Geothermal Exploration Activity (Arvin Putranto et al. – Jacobs Group Indonesia) [ID 139]
	ROOM A	RESERVOIR & PRODUCTION	Comparisson of Resources Assessment Method with Numerical Reservoir Model Between Heat Stored and Experimental Design: Case Study Ciwidey-Patuha Geothermal Field (Ali Ashat, Heru Berian Pratama – Geothermal, ITB) [10 163]	Production Engineering: Case Study Dieng Geothermal Field (Geo Dipa Energi)
	TIME	SESSION	13:00 - 13:20	13:20 - 13:40

13:40 - 14:00 - 14:20 - 14:20 - 14:20 - 14:20 - 14:20 -	Modelling of Completion Tests in Two Wells in The Wairakei – Tauhara Geothermal System, New Zealand (Sylvania Marchellina et al. – University of Auckland) [ID 051] Study of Hydraulic Fracturing in Water Dominated Geothermal Field Using Experimental Design and STAR CMG Simulator (Luthfan Hafizha et al Faculty of Mining and Petroleum Engineering, ITB)	TBINTERNATIO Using Deep-Shear Waves to Image Fracture Corridors up to 60 Feet from The Borehole in Geothermal Fields Using Deep-Shear Waves to Image Fracture Corridors up to 60 Feet from The Borehole in Geothermal Fields (Cahyo Nugroho et al. – Baker Hughes) Fields (Bhakti Nuryadin - BPPT) (Bhakti Nuryadin - BPPT) (ID 174) Mode Shape and Vibration Level Investigation of A Vertical Separator With Application of A Vertical Separator With Application of Damping Layer (Ilham Perdana Sayuti et al. – Mechanical and Industrial Engineering, Universitas Gadjah Indode	DNAL GB Chermal Direct Use Facility as an Alternative Approach in Community Engagement at Early Exploration Phase in Indonesia (Daniel Adityatama et al. – University of Auckland) Initiative Program at Darajat Geothermal Brine Direct Use Facility as an Alternative Approach in Community Engagement at Early Exploration Phase in Indonesia (Daniel Adityatama et al. – University of Auckland) IDO77] Greenhouse Gas Emission Reduction Initiative Program at Darajat Geothermal Brint (Muhyidin – Star Energy Geothermal Darajat II) ID 152] Study of Geothermal Brine Direct Use for Crude Palm Oil (CPO) Factory in Indonesia Indonesia Almas G.S.F. Utami et al. – Geothermal, ITB) Indonesia Indonesia Indonesia (Do02]	AAL W&RKSHOF Fault-Related Fractures Fault-Related Fractures Characteristic of Kijang Fault at Wayang Windu Geothermal Field (Wahyuddin Diningrat et al. – FMIPA, Universitas Indonesia) FMIPA, Universitas Indonesia) (10 110) Potential at Cubadak Area Based on FFD And SMF Method (Gilang Suryawan et al. – Geological Engineering, Padjajaran University) (10 113) Comparison of Application Faults and Fracture Density (FFD) Method Using SRTM 90-m, SRTM 30-m and ASTER GDEM 30-m for Geothermal Exploration: A Case of Ile Ange Prospect (Husin Setia Nugraha et al Directorate of Geothermal, Directorate of Geothermal,	Measurements of The Density, Porosity and Resistivity Properties of Arjuno-Welirang Geothermal Field (Anik Hilyah et al Geophysical Engineering, Sepuluh November Institute of Technology) Institute of Technology) Institute of Technology) (ID 121] Seismicity and Frequency-Magnitude Distribution Analysis of Desert Peak Geothermal Field (Nanda Hanyfa Maulida et al. Geothermal, ITB) (ID 164) Preliminary Results of Micro Seismic Survey in Patuha Geothermal Field (Akhmad Fanani Akbar et al Geo Dipa Energi) (ID 168)
14:40 – 15:00			COFFEE BREAK	[ID 056]	

ITB INTERNATIONAL GE THERMAL WORKSHOP

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ROOM E	INTERGRATED EXPLORATION METHOD	Analyze on Boiling Control and Exploration Probability in Awibengkok Geothermal System by Andesite and Breccia Hydrothermal Microstructure with Pore Pressure, Temperature and Dry Shear Modulus Value Using Electrical Resistivity Measurement and Ultrasonic Velocity (Farhan Rijal Giffari, Ahmad Lutfi – Geological Engineering, Padjajaran University) [ID 012]	Integrated of Geological, and Geochemistry Data Analysis of Kadidia Geothermal Area, Sigi, Central Sulawesi (Faiz Akbar et al. – UPNV Yogyakarta)
ROOM D	ADVANCED EXPLORATION	Sokoria Exploration Drilling Update (Sokoria Geothermal Indonesia)	
ROOM C	SURFACE FACILITIES	Pump Application for Geothermal (KSB Indonesia)	
ROOM B	PRODUCTION	Surface Monitoring, Groundwater Monitoring, and Production- Injection Strategies for Geothermal Reservoir Management (Almas G.S.F. Utami - Geothermal, ITB) [ID 001]	Work Over Breakthrough : Coiled Tubing Unit Cleaned Out Totally Plugged Scales (Redha Bhawika Putra et al. – Star Energy Geothermal) [ID 079]
ROOM A	PRODUCTION	A Study of Brine Supply System to Binary Cycle Unit at Namora I Langit Geothermal Power Plant (Arnaldo Napitu – Medco Geothermal Sarulla) [ID 039]	Steam Well Spinner Data Analysis Using Conversion Factor from Known Wellbore Diameter and Mass Rate Data (Denni Fariz Sbekti, Mapriansyah – Star Energy Wayang Windu) [ID 013]
TIME	SESSION	15:00 – 15:20	15:20 – 15:40

		ITB INTERNATI	ONAL GE WTHER	MAL W&RKSHOF 1, 21 - 22 2018	
15:40 – 16:00	Thermodynamic Analysis of Steam Ejector and Hybrid Systems at Lahendong Geothermal Power Plant, North Sulawesi Indonesia (Dhanimsya Hudasaputra et al. – Mechanical and Industrial Engineering, Universitas Gadjah Mada) [ID 100]	Study of Hydraulic Fracturing Stimulation to Improve Geothermal Wells Productivity (Riviani Kusumawardani et al. – Geothermal, ITB) [ID 004]	Development of Algoritms for Designing Computer Appication of Geothermal-Based Absorption Refrigeration System (J. Hendrarsakti, R.A. Guntara - Faculty of Mechanical and Aerospace Engineering & Geothermal ITB) [ID 160]	Comparative Study of Microearthquake Hypocenter Relocation Using GAD, SED and Double Difference Methods in Wayang Windu Geothermal field, West Java, Indonesia (Naraswari Probowat – Geothermal Master Program, Universitas Indonesia) [ID 080]	Modeling of Parang V Geothermal Syst on Bantul Regency, Yo Based on Geological, Ge and Geochemical (Bella Restu Juliarka University of Lamp [ID 042]
16:00 – 16:20		Interference Test Simulation in Geothermal Two Phase Field Using PTA Software and TOUGH2 (Fidya Varayesi et al. – Geothermal, TB) [ID 009]	Implementation of Plant Information Management System (PIMS) as Condition Based Monitoring Approach in Strengthening Non- Intrusive Maintenance Strategy in Star Energy Geothermal Salak (Ilham Kurniawan et al Star Energy Geothermal Salak) [ID 098]	Identification of Permeability Structures Using Moment Tensor and Focal Mechanism Analysis of MEQ Data at Wayang Windu Geothermal Field (Nur Inna Alfianinda – Geothermal Master Program, Universitas Indonesia) [10 085]	Identification of Geot Reservoir Zone Using Ir Magnetotelluric, Geolo Geochemical Data Analys Ranau, Lampung, Inc (Faiz Akbar Prihutama et Yogyakarta)
16.20-	Sarula Geometrial Comprise Cycle Operation (Sarula Operation Limited)	Revisiting Liquid Loading: Application of Liquid Loading Concept in Liquid Dominated Geothermal Reservoir to Inflow Performance Curve (Steven Chandra - Well Stimulation Laboratory, ITB) [ID 015]	Development of Flores as A Geothermal Island (Iwan Nursahan et al Geological Agency of Indonesia) [IID 081]	Estimation of Prospect Areas of Volcanic and Intrusion Hosted Geothermal Fields: A combination of geostatistics methods, HG anomalies, and fault fracture density (Meilani - Geological Engineering, ITB [ID 055]	Hot Springs Manifest Identification by Blawa Structure and Tempe Structure and Tempe Measured Using Bouguer Landsat Thermal Imag Magnetotelluric to Det Geothermal System in Bl Area (Mirza Muhajir et al. – G Engineering, Padjajaran L
16:40 - 17:00			CLOSING		

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Poster Session

Wednesday – Thursday, 21-22 March 2018

No.	Paper Title	Paper ID
1	Magnetotellurics Survey Design and its Implication to Geothermal Exploration. Case Study: Geothermal Area "X" (Riki Irfan-UI)	018
7	Study of Groundwater Quality in Area of Geothermal Manifestations and Potential Impacts of Water Use on Environment and Public Health Aspect: Case Study of Dhiwak Village, Klepu, Semarang Regency (Sinatrya Diko Prayudi-UNDIP)	026
£	Geology and Geochemistry of Surian Geothermal System, West Sumatra (Aulia Bunga Arini-UNDIP)	036
4	The Impact of Semangko Fault on Geothermal Potential in Bonjol Region, Pasaman Regency, West Sumatera (Khairul Fajri-UNPAD)	038
Ŋ	Hydrothermal Manifestation Identification and Smectite Clays Analysis Using the Methylene-Blue (MeB) Method in Namora-I-Langit Geothermal Field (Josua Washington Sihotang-UNPAD)	041
9	Integrated Research for Geothermal Prospect Zone of Lawu Mountain Based on Geothermal Manifestation, Rock Alteration, Geochemical Analysis of Fluid, Fault Fracture Density and Magnetotelluric Data (Nindyan Agna Ramadhan-IndoGeo Social Enterprise)	044
7	Geothermal Potency on Tarakan Basin North Kalimantan Based on Geological and Geophysical Studies (Adilla Muhammad Yustin Kamah, Alfian Usman, Adi-UTC Pertamina)	045

	ITB INTERNATIONAL GE THERMAL WORKSHOP	TL
	March, 21 - 22 2010	
No	Paper Title	Paper ID
8	Direct Utilization Prospect of Geothermal Energy in Indonesia Geothermal Fields (Untung Sumotarto-Universitas Trisakti)	047
σ	Outflow Identification based on 2D Resistivity Model at Talu-Tombang Geothermal Prospect Area, Pasaman Barat regency, West Sumatra Province (Adilla Armando Damairul-UI)	049
10	Tectonic Control to Geothermal Manifestation on Non-Related Young Volcanic Setting in Sumenep-Madura, East Java (Topan Ramadhan-AKPRIND)	052
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