Proceedings of the 6th ITB International Graduate School Conference
Multidisciplinary Collaboration for Sustainable Energy: Science, Technology, Policy, and Society

Numerical Modeling of a High-Temperature Geothermal System in a Volcanic Complex: Case Study from The Kepahiang Field, Indonesia

Hardy Ferrysian Logiani[1,3,*], Sutopo[1], Heru Berian Pratama[1], & Yodha Yudhistira Nusiaputra[2]

[1]Geothermal Engineering Master's Program, Faculty of Mining and Petroleum Engineering, Institut Teknologi Bandung, Jl. Ganesha 10 Bandung 40132, Indonesia
[2]PT PLN (Persero), Jalan Trunojoyo Blok M-1 No. 135, Jakarta, Indonesia
[3]PT PLN Nusantara Power, Jalan Ketintang Baru No.11 Surabaya 60231, Indonesia
*Email: hardy.ferrysian.logiani@gmail.com

Abstract. The Kepahiang Geothermal Working Area, located in Bengkulu Province, Indonesia, is a high-elevation, high-enthalpy geothermal system characterized by fumaroles, solfataras, and steaming grounds around Mount Kaba and Sempiang. This study aims to update the conceptual model using integrated geoscience data and numerical simulation. Three main reservoirs were identified: Kaba (up to 370°C), Sempiang (240–300°C), and Grojogan Sewu (200–250°C), overlain by a cap rock ranging from 500 to 1,500 meters thick. A numerical model using VOLSUNG software was developed, covering the natural-state conditions and calibrated with data from the KPH-01 temperature gradient well (452 m depth) and geothermometer surface manifestations. The model results align well with field observations, indicating upflow zones near Sempiang and lateral outflows toward Grojogan Sewu. However, further validation using deep exploration wells is necessary to confirm reservoir geometry and productivity. The study concludes that Kepahiang hosts a promising liquid-dominated geothermal system with structurally controlled fluid flow. It is recommended to drill at least three exploration wells in key upflow zones, particularly around Sempiang to support production planning.

Keywords: *numerical simulation; natural state; kepahiang; volsung.*

1 Introduction

The Kepahiang geothermal field is located within the Kepahiang and Rejang Lebong Regencies in Bengkulu Province, Sumatra Island, Indonesia. The area is characterized by rugged volcanic terrain and moderate infrastructure access. Although not considered remote, steep topography and limited direct road access present logistical challenges for field development. The geothermal manifestations include fumaroles, hot springs, and steaming grounds, primarily distributed across the Sempiang, Suban, Grojogan Sewu, and Babakan Bogor sectors.

The structure of this paper is organized as follows: Section 2 reviews the conceptual model developed from geological, geochemical, and geophysical interpretations. Section 3 describes the numerical model setup, boundary conditions, rock property assignments, and calibration results. Section 4 presents the main findings and implications of the simulation results. Finally, Section 5 outlines the conclusions and development recommendations for future exploration and drilling programs in the Kepahiang field. This paper presents an integrated geothermal system study aimed at updating the conceptual model of the Kepahiang field based on multidisciplinary geoscientific data. The updated conceptual model is further validated through natural-state numerical simulation using VOLSUNG software. The simulation incorporates geophysical resistivity models, geothermometric data, and the temperature gradient well KPH-1 to define subsurface temperature distribution, reservoir geometry, and fluid flow patterns.

The conceptual model of the Kepahiang Geothermal Field reveals a high-temperature, structurally controlled geothermal system consisting of three main reservoirs: Kaba (up to 370°C) as the primary upflow, Sempiang (240–300°C) as a secondary upflow, and Grojogan Sewu (200–250°C) as a lateral outflow zone. These reservoirs are overlain by a 500–1500 m thick clay-rich caprock, with fluid pathways guided by NE–SW and NW–SE trending faults. A numerical model was developed using VOLSUNG software over a 113 km² area and 3.5 km depth, incorporating separate heat inputs of 40 TPH for each reservoir and calibrated against temperature gradient data from well KPH-1 and surface geothermometers. The simulation results successfully reproduced upward fluid flow beneath Sempiang and lateral outflow toward Grojogan Sewu, supporting the presence of a liquid-dominated system. It is concluded that Kepahiang hosts a promising high-enthalpy geothermal resource, though further validation through deep exploration wells is essential. It is recommended to drill at least three exploration wells in key upflow zones (Sempiang, Suban, and Grojogan Sewu), conduct high-resolution MT surveys, and expand geochemical and geophysical investigations to refine the reservoir model and support future development planning.

Figure 1 Kepahiang Geothermal Working Area Location (*Google Maps, 2025*)

2 Conceptual Model Review

2.1 Geoscience Review

2.1.1 Geology Review

The Kepahiang Geothermal Working Area (GWA) is located within the Sumatran segment of the Sunda Arc, where oblique subduction of the Indo-Australian Plate beneath the Eurasian Plate has generated a complex tectonic and magmatic environment. The geothermal system is tectonically influenced by the Great Sumatran Fault (GSF), particularly the Musi and Ketahun segments, which intersect to form a pull-apart basin structure—a favorable setting for magmatic intrusion, hydrothermal circulation, and fracture permeability (Figure 2). Structurally, the GWA is traversed by multiple fault sets, including normal, dextral, and sinistral faults that are aligned northwest–southeast and northeast–southwest (Figure 3). These faults serve as potential conduits for ascending geothermal fluids. Field mapping and lineament analysis highlight areas of elevated fault density around Grojogan Sewu and Sempjang, suggesting that these zones are prime targets for upflow. Fault intersection zones are of particular interest, as they typically enhance vertical permeability in geothermal systems. The surface thermal manifestation map (Figure 4) further supports the role of fault-controlled permeability in focusing upflow. Clusters of fumaroles, hot springs, steaming grounds, and altered zones are observed to align with fault traces. Grojogan Sewu and Sempjang in particular display strong surface expressions, which correlate well with the interpreted high-permeability structural corridors. Subsurface lithological information obtained from well KPH-1 (Figure 5) provides direct insight into the vertical stratigraphy and reservoir architecture. The composite log shows alternating layers of vesicular andesite, breccia, and clay-altered tuff down to 500 meters depth. These rock units exhibit varying physical properties—lava and breccia units display higher porosity and permeability, suggesting reservoir potential, while the tuff units show argillic alteration and low permeability, acting as natural caprock. Core measurements indicate porosity up to 4% and permeability values up to 143 mD in fractured intervals. Taken together, the tectonic setting, structural framework, surface manifestations, and well lithology suggest a structurally focused geothermal system with fractured andesitic lavas as the main reservoir units, overlain by low-permeability tuffs acting as a caprock. The main upflow zones are interpreted to be centered along the Grojogan Sewu and Sempjang faults, with thermal fluid recharge likely occurring from the higher elevation volcanic ridges to the west and southeast.

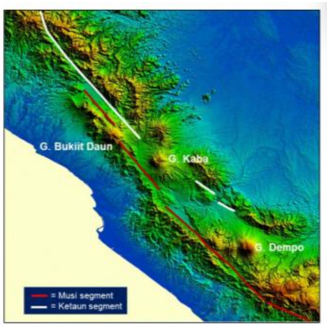


Figure 2 Step-over sytem of ketauan and Musi fault segments yileding Kepahiang pull-apart basin

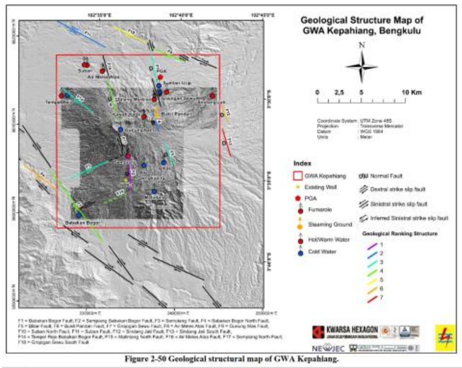


Figure 3 Geological Map Kepahiang Geothermal Working Area (*PLN, 2019*)

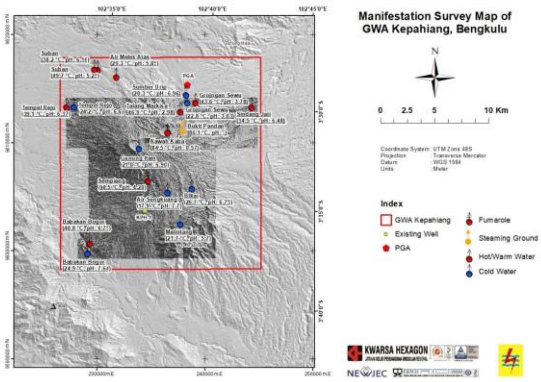


Figure 4 Surface Manifestation Map Kepahiang (*PLN, 2019*)

2.1.2 Geochemistry Review

Geochemical surveys conducted by the Geological Agency and further reviewed in the 2019 integrated study revealed that most of the thermal manifestations are aligned along structurally controlled zones, including NE–SW trending fractures near Sempiang, Suban, and Grojogan Sewu. Fluid samples collected from hot springs and fumaroles suggest a high-temperature geothermal system, with estimated reservoir temperatures ranging from 200°C to 370°C based on both gas- and silica-based geothermometers.

The Kaba reservoir, situated beneath the Kawah Kaba summit within the central caldera structure, represents the main upflow zone in the field. It is a high-enthalpy, liquid-dominated system, characterized by deep-seated faults and proximity to a potential magmatic heat source. Temperatures in this reservoir are estimated to reach up to 370°C, supported by gas geothermometry and high-density gravity anomalies. Magnetotelluric (MT) surveys show low resistivity values (<10 Ohm.m) at depth, consistent with deep upflow conditions. The Sempiang reservoir lies southeast of the Kaba system and is interpreted as a secondary upflow zone. It is structurally controlled by NE–SW faults and is characterized by fumaroles and acid hot springs. Geothermometric estimates suggest temperatures of 240–300°C. MT data in this area reveals a vertical low-resistivity conduit that likely serves as a path for upwelling thermal fluids. Surface manifestations with high sulfate and low Na/K ratios further confirm the presence of shallow vapor-dominated zones associated with deep upflow. Meanwhile, the Grojogan Sewu reservoir is located northeast of Kaba and is interpreted as a lateral outflow zone receiving fluids from deeper sources such as Kaba and Sempiang. Geothermometers indicate reservoir temperatures of 200–250°C, with bicarbonate-type waters indicating mature, mixed fluids. This reservoir is associated with moderate resistivity anomalies (100–200 Ohm.m) and is structurally aligned with NE–SW and NW–SE trending faults. Together, the Kaba, Sempiang, and Grojogan Sewu reservoirs form an integrated high-temperature geothermal system with vertically and laterally distributed thermal zones, each controlled by distinct structural features and fluid chemistries.

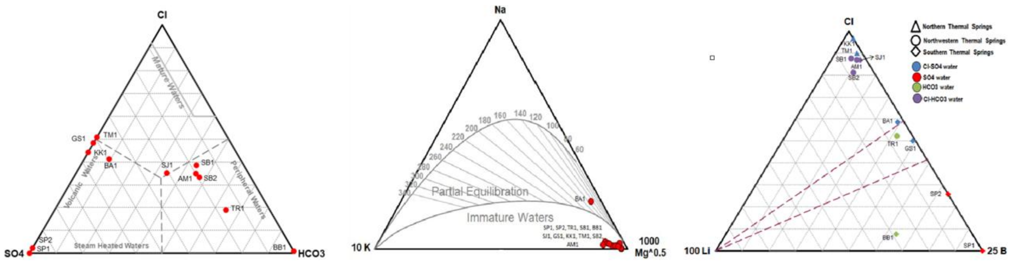


Figure 5 Ternary Diagram (*PLN, 2019*)

Stable isotope analysis ($\delta^{18}O$ and $\delta^{2}H$) confirmed that the fluids are primarily meteoric in origin, indicating significant recharge from high-elevation zones surrounding Gunung Kaba, including Bukit Malintang, Puncaklawang, and Grojogan Sewu. The dominance of steam-heated acid-sulfate waters in areas such as Sempiang and Babakan Bogor, along with bicarbonate and neutral-chloride waters in other parts, indicate a complex subsurface mixing and boiling process. Gas chemistry analysis shows the presence of soluble gases such as CO_2 and H_2S, suggesting active degassing and potential formation of localized steam caps in structurally favorable zones. However, no deep production wells have been drilled yet to validate gas ratio evolution over time.

2.1.3 Geophysics Review

Magnetotelluric (MT) and gravity surveys reveal a resistive reservoir zone overlain by a low-resistivity caprock. The caprock ranges in thickness from 500 meters to 1,500 meters and is interpreted as a clay-rich altered unit. The resistive reservoir lies between -500 to -1,500 meters above sea level, with resistivity values ranging between 30 and 300 Ohm-m. The top of the reservoir is shallower near Sempiang and deepens toward Grojogan Sewu. Gravity anomalies support the presence of a deep-seated heat source beneath Mount Kaba and Sempiang. The Bottom of Conductor (BOC)—interpreted as the top of the reservoir—was identified at elevations ranging from +1000 m to -1500 m based on 3D MT inversion results. In upflow areas like Sempiang, the BOC is located at shallower depths, consistent with geochemical indicators of active boiling and fumarole discharge. The MT model also aligns with the structural framework, confirming that fault zones are acting as fluid conduits from reservoir to surface.

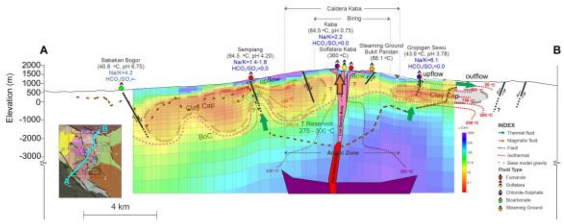


Figure 6 Integrated 3G model Kepahiang Geothermal Prospect Area (*PLN, 2019*)

These geophysical interpretations provided the basis for constructing a natural-state numerical model using VOLSUNG software, which supports the updated conceptual understanding of the Kepahiang geothermal system

2.2 Well Data

A single temperature gradient well, KPH-1, was drilled in 2010 by the Geological Agency (PSDG) to a total depth of 500 meters. The purpose of this well was to understand the vertical temperature profile and to confirm the presence of an anomalous geothermal gradient. The well is located on the southern flank of Mount Kaba, within an area of active hydrothermal alteration and fumarolic activity. The result of KPH-1 drilling revealed a temperature gradient significantly above the regional background level, reaching up to 96.5°C at a depth of 450 meters, which is consistent with conductive heat transfer from a deeper heat source. The lithological analysis of the well confirmed the presence of altered volcanic rocks including andesitic tuffs and lava flows, further supporting the interpretation of a geothermal system at depth.

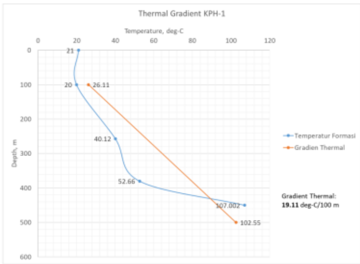


Figure 7 Temperature Gradient KPH-01 (*Geological Agency ,2011*)

distribution, structural trends, and geophysical anomaly alignments. The future exploration wells aim to delineate the extent and productivity of the reservoir, particularly in the upflow zones around Sempiang and Suban, as well as outflow margins such as Grojogan Sewu. The drilling prognosis suggests that the top of the reservoir is expected between -500 m to -1500 m elevation, with anticipated reservoir temperatures between 200°C and 240°C, as inferred from geothermometry and MT resistivity models. At present, the initial conceptual model developed from 3G (geology, geochemistry, geophysics) studies illustrates a geothermal system with deep fluid upflow beneath Sempiang, controlled by NW-SE and NE-SW fault intersections. However, due to the lack of deep well data, the model remains semi-deterministic and will be further validated and refined through natural-state reservoir modeling using VOLSUNG software. It is expected that the results of the planned exploration wells and numerical simulation will significantly enhance confidence in defining reservoir geometry, permeability distribution, and fluid flow pathways—thus enabling a more robust and optimized development plan for the Kepahiang geothermal project.

3 Numerical Model

3.1 Model Description

3.1.1 Gridding and layering

The numerical model of the Kepahiang geothermal system was developed using VOLSUNG software, aligned with the updated conceptual model derived from recent geoscientific studies. from North to follow the dominant structural orientation, particularly the NW–SE and NE–SW trending faults identified from geophysical surveys.

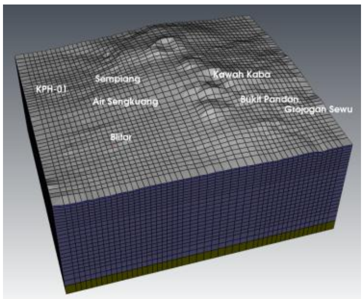


Figure 8 3D view of Kepahiang gridding model

The computational domain covers an area of 11.2 km × 10.1 km, totaling ~113.12 km², with a vertical thickness of 3.5 km from the surface down to –3500 masl. The model comprises 24 vertical layers, with finer discretization near the reservoir and shallow structures to improve simulation accuracy. Grid block sizes vary horizontally, with smaller blocks (200 m × 200 m) in the reservoir zone and larger blocks up to 400 m × 400 m in peripheral areas. The total number of blocks in the model is 51.450, utilizing a structured rectangular grid system.

3.1.2 Initial and boundary condition

In the numerical simulation of the Kepahiang geothermal system, boundary conditions were defined to represent the complex geological and thermal structure, which consists of three separate reservoir systems: Sempiang, Kaba, and Grojogan Sewu. These systems are geologically isolated by a caldera rim fault that acts as a barrier, preventing inter-reservoir fluid flow. The top boundary was set under fixed atmospheric conditions of 25°C and 1 bar, using a large volume factor to maintain constant properties, ensuring it remains unaffected by reservoir dynamics over time. The side boundaries were treated as no-flow and impermeable, restricting lateral flow and focusing the simulation on vertical heat and mass transfer from the heat source to the reservoirs. The bottom boundary includes two main components: the heat sources and the basement layer. with initial locations based on gravity anomaly data and later adjusted during model calibration. The Sempiang and Grojogan Sewu systems are interpreted to be influenced by magma intrusions, while the Kaba system lies directly beneath Mount Kaba. Additionally, a hotplate condition was applied to simulate a deeper, uniform heat zone with initial values of 294 bar pressure, 952.75 kJ/kg enthalpy, and 220°C temperature. The basement layer was treated as an impermeable zone to prevent downward flow and ensure upward heat migration toward the reservoir.

3.1.3 Rock properties (assign material)

The assignment of rock properties, especially permeability, was a critical step and iteratively adjusted to achieve steady-state conditions matching field observations. Rock zones were defined as follows:

1. Cap rock with low permeability at shallow depths, dominated by clay-rich alteration zones (identified from MT low-resistivity layers and surface geology).
2. High-permeability reservoir rocks at intermediate depths, consisting of volcanic breccias and lava flows, supported by lithology, MT resistivity highs, and geochemical anomalies.
3. Low-permeability basement rocks at greater depths, corresponding to intrusive or massive volcanic units, confirmed by gravity and magnetic data.
4. Fault zones were modeled as either permeable conduits or barriers. The Kaba caldera boundary fault acts as a barrier, isolating the Sempiang, Kaba, and Grojogan Sewu systems, while other faults (NE–SW and NW–SE trending) serve as conduits facilitating upflow, as indicated by MT, gravity breaks, and soil gas (CO_2, Hg) anomalies.

These permeability structures were validated using integrated 3G data and applied in the numerical model using zonal distribution and fault permeability multipliers.Litologi Properties Kepahiang Geothermal System.

Litologi	Porosity	Density	Permeability			Thermal Conductivity	Spesific Heat
	[%]	[kg/m3]	X [mD]	Y [mD]	Z [mD]	[W/M*K]	[kJ/Kg.K]
atm	5	2500	10	10	10	2	1
caldera Fault	1	2500	1.00E-05	1.00E-05	1.00E-05	2	1
Basement	1	2500	1	1	1	2	1
Boundary	1	2500	0.005	0.005	0.005	2	1
ACIDIC ZONE	1	2500	5	5	5	2	1
Caprock 1	1	2500	0.005	0.005	0.005	2	1
Caprock 2	1	2500	0.001	0.001	0.001	2	1
caprock grojogan	1	2500	1.00E-05	1.00E-05	1.00E-05	2	1
Fault	1	2500	1	1	1	2	1
Fault grojogan	1	2500	20	20	20	2	1
Fault sempiang	1	2500	50	50	50	2	1
Ground Water	1	2500	0.1	0.1	0.1	2	1
Heat Source	1	2500	50	50	50	2	1
Res Bottom 1	1	2500	5	5	5	2	1
Res Bottom 2	1	2500	5	5	5	2	1
Res Kaba	1	2500	30	30	30	2	1
Res Prospek	1	2500	1	1	1	2	1
Res Main	1	2500	5	5	5	2	1
Res sempiang	1	2500	5	5	5	2	1

3.2 Numerical Modelling Result

3.2.1 Initial State Calibration

Natural-state calibration was performed to replicate the temperature and pressure distribution within the system prior to exploitation. As only one temperature gradient well (KPH-1) was available, the calibration used temperature data from KPH-1 and matched it with estimated reservoir temperatures derived from geothermometers (e.g., silica, gas, and cation-based methods). Dummy wells were also placed in key upflow zones such as Sempiang, Grojogan Sewu, and Suban to validate model results against expected thermal profiles. The model successfully simulated the upflow of deep geothermal fluids beneath the Sempiang area, with lateral outflows directed toward Grojogan Sewu, in accordance with surface manifestation distribution and structural alignments.

The heat sources were modeled separately for each system: Sempiang (40 TPH, 2198.3 kJ/kg, 400°C), Kaba (40 TPH, 2953.43 kJ/kg, 470°C), and Grojogan Sewu (40 TPH, 1610.36 kJ/kg, 350°C),

3.2.2 Reservoir characterization

Simulation results indicate a liquid-dominated reservoir system with potential thin steam caps forming in upflow zones near Sempiang and Babakan Bogor. The top of the reservoir is interpreted between –500 to –1500 masl, while upflow areas may locally reach shallower levels due to doming. Temperature profiles in dummy wells showed rising temperature gradients consistent with estimated reservoir temperatures of 200–270°C. Heat and mass flow simulations demonstrate that hot fluids ascend through fault-controlled vertical conduits, spread laterally at reservoir levels, and eventually discharge as fumaroles and hot springs in peripheral zones

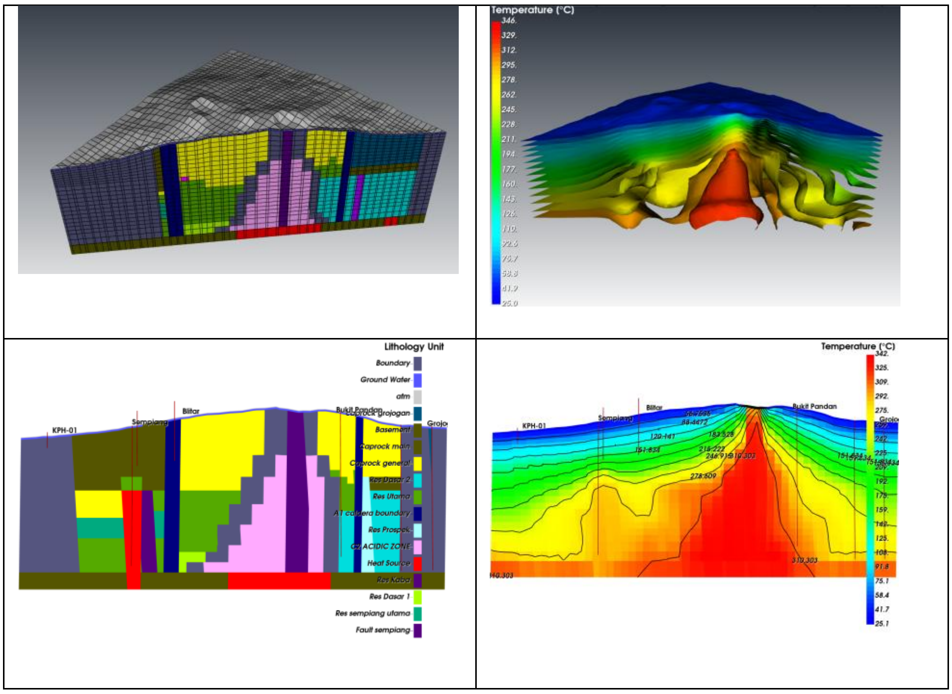
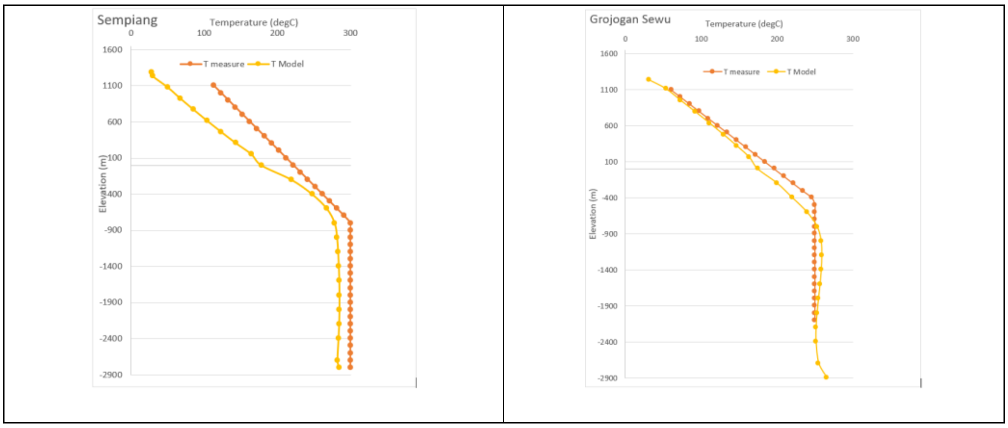


Figure 9 Litologi and Isothermal Kepahiang Geothermal System



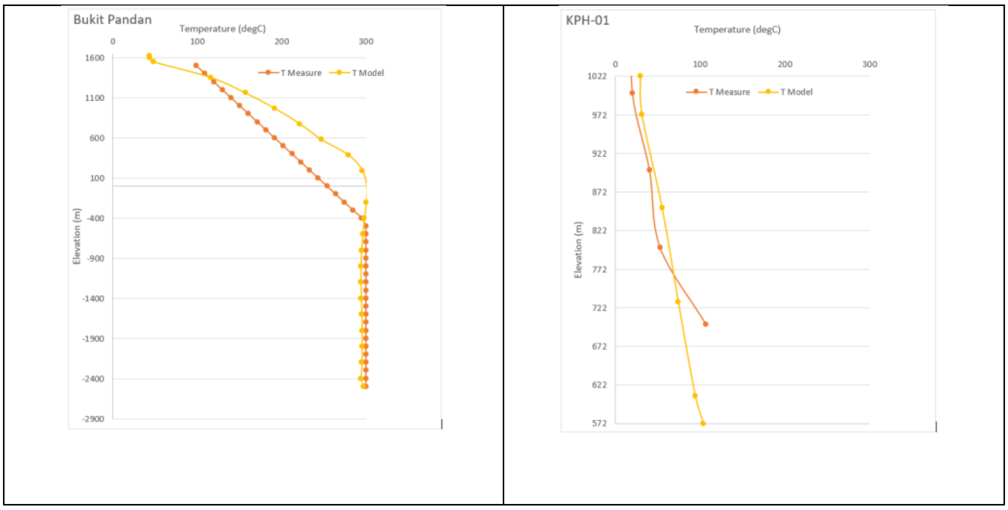


Figure 10 Temperature Model and Temperature Measurement Kepahiang Geothermal system

3.2.3 Updated conceptual model

The updated conceptual model (based on numerical simulations and 3G data) shows that deep geothermal fluids upwell beneath Mount Kaba and Sempiang, channeled by structurally controlled high-permeability zones. The main faults responsible for vertical fluid migration are the Ketahun Fault, Musi Fault, and their associated splays. Some fluids rise to the surface along fault intersections forming surface manifestations, while others circulate within the reservoir or flow laterally toward the Grojogan Sewu and Suban sectors as outflow.

Unlike earlier conceptual models that were mostly qualitative, this updated model provides a quantitative interpretation of the thermal structure and fluid dynamics of the field, supported by MT data and natural-state modeling results. The top of the reservoir is now consistently placed between –800 to –1500 masl, with exceptions in Sempiang where it may be shallower due to structural doming

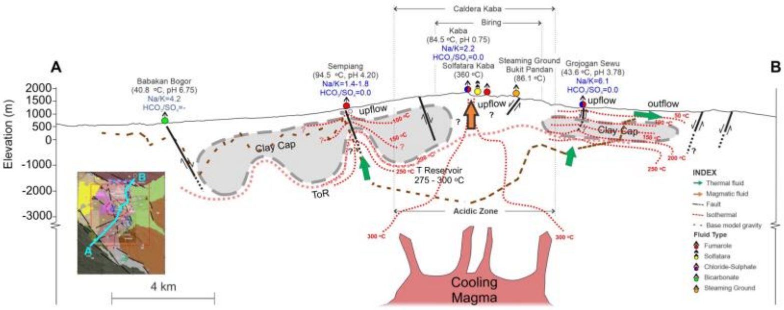


Figure 11 Update Conceptual Model Kepahiang Geothermal System

4 Conclusion

Based on integrated geoscience data and reservoir simulation, the Kepahiang geothermal system can be classified as a magmatic-related liquid-dominated geothermal play, associated with a deep-seated heat source beneath the Kaba volcanic complex. The geothermal system is structurally controlled and displays characteristics typical of a high-enthalpy volcanic system, with clear upflow and outflow zones

5 Recommendation

1. Drill at least 3 deep exploration wells targeting the upflow zones in Sempiang, Suban, and Grojogan Sewu, to validate temperature profiles and confirm the existence of a steam cap or two-phase zones. development plan of five full-diameter exploration wells, namely KPH-A1, KPH-A2, KPH-B1, KPH-B2, and KPH-C1, to depths ranging from 2,000 to 2,500 meters. These wells will be drilled from three separate wellpads (KPH-A, B, and C) that have been selected based on surface manifestation
2. Prioritize well targeting in the Sempiang sector, which is interpreted as the main upflow zone with the most promising thermal anomalies and structural control.
3. Conduct additional high-resolution MT surveys to refine the connectivity and continuity of low-resistivity zones between upflow and outflow areas.
4. Complement MT with gravity and magnetic surveys, especially to better define basement structures and the possible location of the magmatic heat source beneath Mount Kaba.

5. Expand water and gas geochemical sampling, especially from future exploration wells, to confirm fluid type and improve confidence in modeling steam fraction and reservoir productivity potential.

Nomenclature

BOC	= Bottom of Conductor
FS	= Feasibility Study
GWA	= Geothermal Working Area
KPH-1	= Temperature Gradient Well 1 in Kepahiang
MT	= Magnetotelluric
Cap rock	= Low permeability layer that traps geothermal fluids
Upflow zone	= Area where geothermal fluids rise from depth
Outflow zone	= Area where fluids move laterally or toward surface discharge
Steam cap	= Zone with vapor-phase geothermal fluid

References

[1] Afiat, O. I., Rera, G. F., Wardoyo, G. K., Sutopo, Pratama, H. B., & Hamdani, M. R., *Updated conceptual model and resource assessment using numerical reservoir simulation of Danau Ranau geothermal field, Indonesia*, IOP Conf. Ser.: Earth Environ. Sci., 732(1), pp. 2021. (Conference Proceedings)

[2] Ashat, A., Ridwan, R. H., Prabata, T. W., Situmorang, J., Elfina, S., Adityawan, S., & Ibrahim, R. F., *Numerical simulation update of Dieng geothermal field, Central Java, Indonesia*, Proc. of the 41st New Zealand Geothermal Workshop, Auckland, New Zealand, pp.–, 2019. (Conference Proceedings)

[3] Ashat, A., Pratama, H. B., & Itoi, R., *Updating conceptual model of Ciwidey-Patuha geothermal using dynamic numerical model*, IOP Conf. Ser.: Earth Environ. Sci., 254(1), pp. 2019. (Conference Proceedings)

[4] Hasbi, H. G. F., Hamdani, M. R., Prasetyo, A. B. T., Khrisna, A. R. W., Lampuasa, M. J., Sutopo, Pratama, H. B., & Prabata, T. W., *Application of numerical simulation to update conceptual model and resource assessment of Songa-Wayaua geothermal field*, IOP Conf. Ser.: Earth Environ. Sci., 417(1), pp. 2020. (Conference Proceedings)

[5] Hamdani, M. R., Pratama, H. B., & Sutopo, *Updating the conceptual model of Lumut Balai geothermal field, South Sumatera, Indonesia using numerical simulation*, IOP Conf. Ser.: Earth Environ. Sci., 417(1), pp., 2020. (Conference Proceedings)

[6] Jatmiko, B. W., Assiddiqy, M. H., Ediatmaja, P., Prabowo, R., Sutopo, Pratama, H. B., & Hamdani, M. R., *Resource assessment of Ungaran geothermal field using numerical model and Monte Carlo simulation*, IOP Conf. Ser.: Earth Environ. Sci., 1031(1), pp, 2022. (Conference Proceedings)
[7] Jatmiko, B. W., Pratama, H. B., & Sutopo, *Updated numerical model of Mataloko geothermal field*, IOP Conf. Ser.: Earth Environ. Sci., 732(1), pp., 2021. (Conference Proceedings)
[8] Keintjem, R. J., Elfajrie, I., Iskandar, C., Sujarmaitanto, H., Pratama, H. B., & Ashat, A., *Dynamic numerical simulation for sustainability of geothermal reservoirs: An enhanced model of Patuha geothermal field*, Proc. of the IIGCE 2024, pp. –, 2024. (Conference Proceedings)
[9] PT PLN (Persero), *Final Pre-Feasibility Study Report: Consultancy Services for Pre-Feasibility Study of Kepahiang Geothermal Working Area (GWA)*, PT PLN (Persero), 2019. (report)
[10] Sumartha, A. G. A., Kurniawan, I., Wiradinata, R., Nandaliarasyad, N., Sutopo, Pratama, H. B., & Prabata, T. W., *Updating the conceptual model of Cisolok-Cisukarame geothermal field, West Java, Indonesia*, IOP Conf. Ser.: Earth Environ. Sci., 417(1), pp. 2020. (Conference Proceedings)
[11] Supijo, M. C., Wahyono, A. D., Lesmana, A., Harahap, A. H., Sutopo, H., & Prabata, W., *Updating conceptual model using numerical modelling for geothermal green field prospect area in Atadei, East Nusa Tenggara, Indonesia*, Proc. of the 6th Indonesia International Geothermal Convention & Exhibition (IIGCE), pp. –, 2018. (Conference Proceedings)

Acknowledgement

I would like to express my sincere gratitude to PT PLN (Persero) for the support provided through the PBJJ (Pendidikan Belajar Jarak Jauh) Batch 2 program at Institut Teknologi Bandung (ITB). This program has significantly contributed to my academic journey and professional growth. I also deeply appreciate the technical data support and information access granted for my research on the geothermal system modeling in the Kepahiang Geothermal Field. This support has been vital in enhancing the quality and reliability of the research outcomes.