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STAKEHOLDERS' COMMUNICATION ON GEOTHERMAL ENERGY IN INDONESIA

The Representation of Cultural-Religious Values



Anita Trisiah

**STAKEHOLDERS' COMMUNICATION
ON GEOTHERMAL ENERGY
IN INDONESIA**
The Representation of Cultural-Religious Values

Dissertation

for the purpose of obtaining the degree of doctor
at Delft University of Technology
by the authority of the Rector Magnificus,
Prof. dr. ir. H. Bijl,
chair of the Board for Doctorates
to be defended publicly on
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by

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Key words: stakeholders, local people, communication, frames, perceptions, geothermal energy, cultural-religious values, Tunggu Tubang

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To my family and to society

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This PhD journey is something I never imagined, especially in the Netherlands, Europe. My life has unfolded far beyond my expectations, and for that I am deeply grateful. The process has taken much longer than usual, and at times it has been very hard.

Two years into my PhD, the COVID-19 pandemic struck. During that time, my mother passed away in Indonesia, and I could not return home. That was the hardest moment of my life, and it deeply affected my progress. When my residence permits expired, I decided to return to Indonesia and continue my PhD there. This brought new challenges, as I had to balance my research with my responsibilities as a lecturer and the additional tasks entrusted to me.

Despite these difficulties, I kept moving forward. There were moments of exhaustion, doubt, and overwhelming responsibilities, yet I learned to persevere. Each obstacle became part of the journey, shaping not only my research but also my resilience and character. Now, after all the struggles and sacrifices, the story is finally reaching its conclusion. This dissertation is not only the result of academic work but also a testimony to endurance, faith, and the unwavering support of those around me.

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Summary

Geothermal energy is widely promoted as a renewable and environmentally friendly resource, yet its implementation worldwide has often encountered community resistance, including in Indonesia. With an estimated 23.36 gigawatts of reserves, Indonesia hosts nearly 40% of the world's supply, making it the most promising in geothermal development. Yet, despite this abundance, utilization remains limited, with only a fraction of the potential realized. Beyond technical, financial, and regulatory barriers, local resistance has emerged as a pivotal challenge, often rooted in cultural-religious values that shape community perceptions and acceptance.

This dissertation explores the social dimensions of geothermal energy in Indonesia, focusing on how cultural and religious values are articulated in stakeholder discourse and the critical role they play in shaping community acceptance. The research combines three complementary approaches: (1) a quantitative media framing analysis of 316 news articles, (2) surveys and interviews with 86 stakeholders across government, industry, academia, NGOs and associations, scientists, and media, and (3) qualitative interviews with residents from five villages directly affected by geothermal projects. Together, these studies provide a multi-layered understanding of how geothermal energy is framed, contested, and legitimized in Indonesia.

The findings reveal three major insights. First, media demonstrate that geothermal energy is communicated through multiple frames – energy security, economy, environment, regulation, and socio-cultural values. While national stakeholders emphasize technical feasibility and policy priorities, local communities foreground cultural and religious concerns, such as sacred sites and ancestral traditions. However, this social frame was the least represented and predominantly negative, highlighting resistance but rarely giving local communities a voice. This limited representation perpetuates conflict by leaving cultural issues unaddressed in national discourse.

Second, stakeholder perspectives diverged from media narratives. While the media acknowledged energy security and economic benefits, stakeholders consistently placed environmental concerns at the centre of their discussions, with social issues emerging as the second most salient category. Legitimacy and acceptance are shaped not only by technical and economic arguments but also by community resistance, employment impacts, and cultural traditions such as the *Tunggu Tubang* inheritance system. These findings underscore that cultural and religious values are deeply embedded in the geothermal energy debate, even if

marginalized in national media discourse, and that energy governance frameworks must move beyond conventional considerations to explicitly integrate socio-cultural dimensions. The divergence between stakeholder recognition and the lived realities of local communities demonstrates that cultural-religious values are not abstract but integral to everyday life and identity, shaping whether geothermal projects are embraced as legitimate contributions to sustainable development or resisted as threats to cultural continuity and belonging.

Third, the local community demonstrates that resistance is layered and deeply rooted in identity, continuity, and belonging. Initial opposition was shaped by technical anxieties, such as forest erosion, drilling-induced seismicity, or gas leakage, but soon expanded into religious and cultural domains. The *Tunggu Tubang* inheritance system, which prohibits the transfer of ancestral land, embodied more than property rights; it represented communal integrity and cultural continuity. Standard compensation measures proved inadequate, even counterproductive, as they risked fragmenting communities. Reconciliation was achieved instead through a layered process: delivering tangible public benefits (better roads, electrification), framing gains as collective rather than individual, and negotiating land issues in ways that respected both strict and flexible interpretations of *Tunggu Tubang*.

The South Sumatra case demonstrates that resistance is not simply rejection of modernization but a defence of cultural integrity. Communities were willing to negotiate when their values were respected and when benefits were framed as serving the wider public good. Government and industry collaboration, combined with culturally sensitive engagement, embedded negotiations within the community's social fabric, and legitimized outcomes.

In conclusion, this dissertation shows that geothermal energy in Indonesia is not only a technical or economic issue but a socio-cultural negotiation. Media narratives marginalize cultural concerns, stakeholders recognize them as central, and communities live them as integral to everyday identity. Successful geothermal development requires governance frameworks that embed cultural and religious values, mandate inclusive participation, and support interdisciplinary collaboration. By integrating these dimensions, Indonesia can more effectively harness its geothermal potential and contribute to a just and sustainable energy transition.

Samenvatting

Geothermische energie wordt wereldwijd gepresenteerd als een hernieuwbare en milieuvriendelijke bron, maar de implementatie ervan stuit vaak op weerstand van lokale gemeenschappen, ook in Indonesië. Met een geschatte reserve van 23,36 gigawatt beschikt Indonesië over bijna 40% van de mondiale voorraad, waardoor het land geldt als de meest veelbelovende locatie voor geothermische ontwikkeling. Toch blijft het gebruik beperkt en is slechts een fractie van het potentieel gerealiseerd. Naast technische, financiële en regulatoire obstakels vormt lokale weerstand een cruciale uitdaging, vaak geworteld in cultureel-religieuze waarden die de percepties en acceptatie van gemeenschappen bepalen.

Dit proefschrift onderzoekt de sociale dimensies van geothermische energie in Indonesië, met bijzondere aandacht voor de manier waarop culturele en religieuze waarden worden verwoord in het discours van belanghebbenden en hoe deze waarden de legitimiteit en acceptatie van projecten beïnvloeden. Het onderzoek combineert drie complementaire benaderingen: (1) een kwantitatieve media-analyse van 316 nieuwsartikelen, (2) enquêtes en gesprekken met 86 belanghebbenden uit de overheid, de industrie, de wetenschap, de NGO's en de media, en (3) kwalitatieve gesprekken met bewoners van vijf dorpen die direct door geothermische projecten zijn geraakt. Samen bieden deze studies een gelaagd inzicht in hoe geothermische energie in Indonesië wordt geframed, betwist en gelegitimeerd.

De resultaten tonen drie belangrijke inzichten. Ten eerste laten de media zien dat geothermische energie wordt gecommuniceerd via meerdere frames – energiezekerheid, economie, milieu, regelgeving en sociaal-culturele waarden. Terwijl nationale actoren vooral de technische haalbaarheid en beleidsprioriteiten benadrukken, leggen lokale gemeenschappen de nadruk op culturele en religieuze zorgen, zoals heilige plaatsen en voorouderlijke tradities. Het sociale frame was echter het minst vertegenwoordigd en overwegend negatief, waardoor lokale stemmen nauwelijks gehoord werden en conflicten bleven voortbestaan.

Ten tweede wijken de perspectieven van belanghebbenden af van die in de mediaverhalen. Hoewel de media energiezekerheid en economische voordelen benadrukten, plaatsten belanghebbenden milieu-aspecten centraal in hun discussies, met sociale kwesties als tweede dominante categorie. Legitimiteit en acceptatie worden niet alleen bepaald door technische en economische argumenten, maar ook door gemeenschapsweerstand, werkgelegenheidseffecten en culturele tradities zoals het Tunggu Tubang-erfgoed. Deze bevindingen onderstrepen dat culturele en religieuze waarden diep verankerd zijn in het geothermische energiedebat, ook al worden ze in nationale media gemarginaliseerd, en dat

energiebeleid verder moet gaan dan conventionele kaders door expliciet sociaal-culturele dimensies te integreren. Het verschil tussen de erkenning door belanghebbenden en de geleefde realiteit van lokale gemeenschappen toont aan dat culturele en religieuze waarden geen abstracte concepten zijn, maar een integraal onderdeel vormen van het dagelijks leven en de identiteit.

Ten derde blijkt uit de lokale gemeenschap dat weerstand gelaagd is en diep geworteld is in identiteit, continuïteit en verbondenheid. Aanvankelijke oppositie werd ingegeven door technische zorgen, zoals boserosie, seismische activiteit door boringen of gaslekken, maar breidde zich al snel uit naar religieuze en culturele domeinen. Het Tunggu Tubang-systeem, dat de overdracht van voorouderlijk land verbiedt, vertegenwoordigt meer dan alleen eigendomsrechten: het belichaamt gemeenschappelijke integriteit en culturele continuïteit. Standaardcompensatie bleek ontoereikend en soms contraproductief, omdat het gemeenschappen verdeelde. Verzoening werd daarentegen bereikt via een gelaagd proces: het leveren van tastbare publieke voordelen (zoals betere wegen en elektriciteit), het presenteren van baten als collectief in plaats van individueel, en het onderhandelen over landkwesties op een manier die zowel strikte als flexibele interpretaties van Tunggu Tubang respecteerte.

De casus Zuid-Sumatra toont aan dat weerstand niet simpelweg een afwijzing van modernisering is, maar een verdediging van culturele integriteit. Gemeenschappen bleken bereid tot onderhandeling wanneer hun waarden werden gerespecteerd en voordelen werden gepresenteerd als een bijdrage aan het algemeen welzijn. Samenwerking tussen overheid en industrie, gecombineerd met cultureel-sensitieve betrokkenheid, verankerde onderhandelingen in het sociale weefsel van de gemeenschap en legitimeerde de uitkomsten.

Samenvattend laat dit proefschrift zien dat geothermische energie in Indonesië niet alleen een technische of economische kwestie is, maar ook een sociaal-culturele onderhandeling. Media marginaliseren culturele zorgen, belanghebbenden erkennen ze als centraal, en gemeenschappen beleven ze als een integraal onderdeel van hun identiteit. Succesvolle geothermische ontwikkeling vereist beleidskaders die culturele en religieuze waarden verankeren, inclusieve participatie verplichten en interdisciplinair samenwerken bevorderen. Door deze dimensies te integreren kan Indonesië zijn geothermisch potentieel effectiever benutten en bijdragen aan een rechtvaardige en duurzame energietransitie.

Kesimpulan

Energi panas bumi secara luas difahami sebagai sumber energi terbarukan dan ramah lingkungan, namun implementasinya di berbagai belahan dunia kerap menghadapi resistensi dari masyarakat, termasuk di Indonesia. Dengan potensi panas bumi yang dimiliki Indonesia sebesar 23,36 gigawatt, setara dengan hampir 40% dari pasokan panas bumi dunia, Indonesia menjadi negara dengan potensi paling menjanjikan untuk pengembangan panas bumi. Namun, hanya sebagian kecil dari potensi panas bumi tersebut yang telah dimanfaatkan. Selain hambatan teknis, finansial, dan regulasi, resistensi lokal menjadi tantangan utama. Resistensi ini sering kali berakar pada nilai-nilai budaya dan religius yang membentuk persepsi serta penerimaan masyarakat.

Disertasi ini menelaah dimensi sosial energi panas bumi di Indonesia, dengan fokus pada artikulasi nilai-nilai budaya dan religius dalam konteks yang dipahami oleh para pemangku kepentingan, serta peran krusialnya dalam menentukan penerimaan masyarakat. Penelitian ini menggabungkan tiga pendekatan, yaitu: (1) analisis kuantitatif terhadap 316 artikel media, (2) survei dan diskusi dengan 86 pemangku kepentingan dari pemerintah, industri, akademisi, LSM dan asosiasi, ilmuwan, serta media, dan (3) kajian kualitatif dengan warga dari lima desa yang terdampak langsung oleh proyek panas bumi. Secara keseluruhan, penelitian ini memberikan pemahaman komprehensif mengenai bagaimana energi panas bumi dibingkai (*di-frame*), diperdebatkan, dan dilegitimasi di Indonesia.

Penelitian ini menghasilkan tiga hal utama. *Pertama*, media mengkomunikasikan energi panas bumi melalui berbagai bingkai (*frames*), yaitu keamanan energi, ekonomi, lingkungan, regulasi, dan nilai sosial-kultural. Pemangku kepentingan nasional menekankan aspek teknis dan kebijakan, sementara komunitas lokal lebih menyoroti aspek budaya dan religius, seperti situs yang dianggap sakral termasuk tradisi leluhur. Namun, representasi bingkai sosial ternyata paling rendah – ruang suara untuk masyarakat lokal hampir tidak ada. Suara yang muncul pun cenderung negatif dengan isu utama terkait resistensi. Representasi yang terbatas ini memperpanjang konflik karena isu budaya tidak terakomodasi dalam wacana nasional.

Kedua, perspektif pemangku kepentingan berbeda dari narasi media. Walaupun isu utama di media adalah keamanan energi dan manfaat ekonomi, hasil wawancara menunjukkan bahwa para pemangku kepentingan justru menempatkan isu lingkungan sebagai diskusi utama terkait panas bumi. Sementara, isu sosial menjadi kategori kedua yang paling banyak dibicarakan. Legitimasi dan penerimaan terhadap panas bumi tidak hanya ditentukan oleh

argumen teknis dan ekonomi, tetapi juga oleh resistensi masyarakat, dampak terhadap ketenagakerjaan, serta tradisi budaya seperti sistem warisan *Tunggu Tubang*. Temuan ini menegaskan bahwa nilai budaya dan religius sangat melekat dalam diskusi mengenai energi panas bumi, walaupun diskusi terkait hal ini tidak menempatkan panas bumi sebagai isu dominan di media. Hasil penelitian juga menunjukkan bahwa kerangka tata kelola energi harus melampaui pertimbangan konvensional dengan mengintegrasikan dimensi sosial-kultural secara eksplisit. Perbedaan antara pemahaman pemangku kepentingan dan realitas yang terjadi di masyarakat menunjukkan bahwa nilai budaya religius bukanlah abstraksi, melainkan bagian integral dari kehidupan sehari-hari dan identitas. Hal ini akan menentukan apakah proyek panas bumi diterima sebagai kontribusi nyata bagi pembangunan berkelanjutan atau ditolak sebagai ancaman terhadap kesinambungan budaya dan kebersamaan.

Ketiga, perspektif masyarakat lokal menunjukkan bahwa resistensi bersifat berlapis dan berakar kuat pada identitas, kesinambungan, dan rasa kebersamaan. Penolakan awal dipicu oleh kekhawatiran terhadap hal-hal yang bersifat teknis, seperti erosi hutan, aktivitas seismik akibat pengeboran, atau kebocoran gas. Namun, kekhawatiran ini kemudian meluas ke ranah religius dan budaya. Sistem warisan *Tunggu Tubang*, yang melarang alih kepemilikan tanah leluhur, mencerminkan lebih dari sekadar hak milik; ia juga mencerminkan integritas komunal dan kesinambungan budaya. Kompensasi konvensional terbukti tidak sesuai, bahkan berpotensi kontraproduktif, karena berisiko memecah belah masyarakat. Rekonsiliasi justru dicapai melalui proses berlapis: penyediaan fasilitas yang bermanfaat bagi publik (seperti perbaikan jalan dan elektrifikasi), pembingkai pesan pada keuntungan kolektif bukan pada kepentingan perseorangan, serta negosiasi terkait pertanahan dengan menghormati budaya *Tunggu Tubang*.

Kasus di Sumatera Selatan menunjukkan bahwa resistensi bukan sekadar penolakan terhadap modernisasi, melainkan pembelaan terhadap integritas budaya. Masyarakat bersedia bernegosiasi ketika nilai-nilai mereka dihormati dan manfaatnya dianggap berdampak pada kepentingan bersama. Kolaborasi antara pemerintah dan industri, yang dikombinasikan dengan pendekatan komunikasi yang peka budaya, berperan penting dalam proses negosiasi dalam struktur sosial masyarakat yang berlegitimasi.

Pada akhirnya, disertasi ini menunjukkan bahwa energi panas bumi di Indonesia bukan hanya persoalan teknis atau ekonomi, melainkan juga merupakan negosiasi sosial-kultural. Walaupun narasi media cenderung meminggirkan isu budaya, pemangku kepentingan mengakui bahwa isu ini adalah hal penting, dan masyarakat menjalaninya sebagai bagian integral dari identitas sehari-hari. Keberhasilan pengembangan panas bumi menuntut kerangka

tata kelola yang mengintegrasikan nilai budaya dan religius, mewajibkan partisipasi yang inklusif, serta mendorong kolaborasi lintas disiplin. Dengan mengakomodasi dimensi ini, Indonesia dapat memanfaatkan potensi panas bumi secara lebih efektif dan berkontribusi pada transisi energi yang adil dan berkelanjutan.

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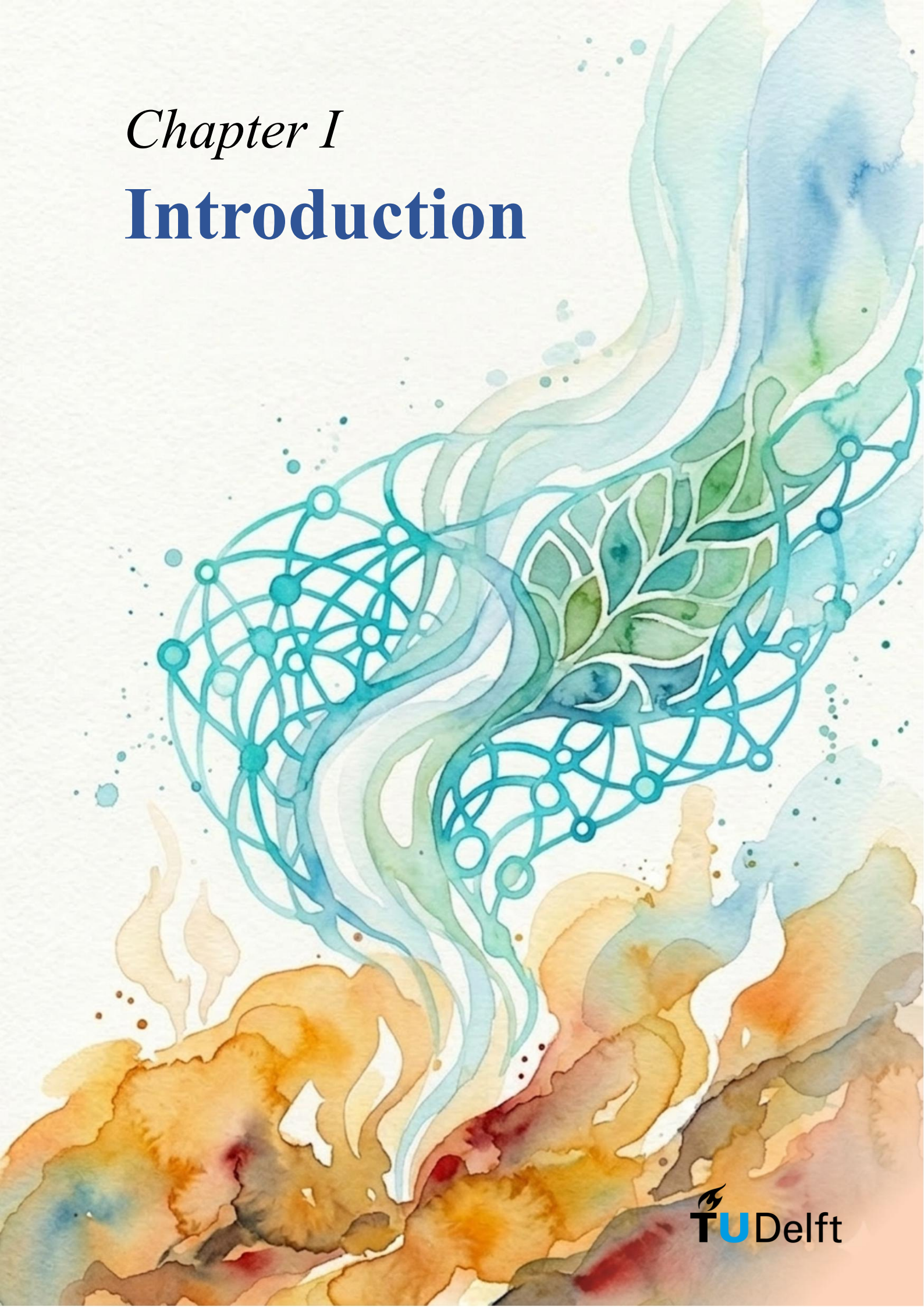
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Chapter I

Introduction



When in Rome, do as the Romans do
Dimana bumi dipijak, disitu langit dijunjung

1.1 Research Background

Geothermal energy, defined as the thermal energy stored beneath the Earth's surface, often generates controversy due to the complexities of its development and use. Local resistance has emerged as a particularly formidable challenge, often outweighing technical, financial, and political difficulties such as the tapping of geothermal energy near tectonic plate boundaries, which is sensitive to seismic effects of earthquakes (Noor, 2015; Saptadji, 2016), the long gestation period of geothermal projects frequently discourages investment (Li et al., 2015; Rayhanna, 2017), and regulations regarding the feed-in tariff (FiT) scheme¹ (Gunawan, 2019). Yet, beyond these technical and institutional barriers, the reactions of local communities have proven pivotal. In fact, local resistance has surfaced in nearly every part of the world where geothermal projects have been introduced, underscoring that community responses are not peripheral but central to the trajectory of geothermal development.

1.2 Local Reaction of Geothermal Energy Development in the Global Context

While geothermal energy development in New Zealand has benefited from strong local support – largely due to proactive stakeholder engagement with Māori communities and a demonstrated respect for indigenous cultural values (Neilson et al., 2010) – resistance to similar initiatives has been documented in various international contexts. In Australia, for example, cities such as Youth, Brisbane, Melbourne, Perth, and Adelaide have witnessed community opposition to geothermal development initiatives, primarily attributed to limited public understanding of the technology involved (Dowd, Boughen, Ashword, & Carr-Cornish, 2011). Japan offers another compelling case. In regions including Tokachi, Tokamachi, and Niigata, resistance from local governments, hot spring inn operators, and residents has emerged due to apprehensions regarding the irreversible impacts of geothermal production and reinjection on natural hot springs and subterranean formations (Jupesta et al., 2013; Kubota, 2015; Kubota et

¹ Feed-in Tariffs (FiT) are policy mechanisms about fixed electricity prices that are paid to renewable energy (RE) producers for each unit of energy produced and injected into the electricity grid.

al., 2013). This opposition is deeply intertwined with cultural values, as the tradition of *onsen* bathing is an integral part of Japanese society, and fears of the degradation of hot springs have intensified public resistance (Kubota et al., 2013).

Comparable cultural factors influence opposition in other parts of the world. In Chile's Araucanía region, the Indigenous Mapuche community has resisted geothermal development based on spiritual beliefs that regard volcanoes as living entities, perceiving drilling activities as a profound violation of cultural and cosmological principles (Vargas Payera, 2018). Similarly, in the Philippines, geothermal projects are predominantly situated on the lands of Indigenous Cultural Communities (ICCs). The entry of an outside geothermal developer, therefore, raises the issue of encroachment on ancestral lands, leading to the desecration of sacred sites and the erosion of the ICC's traditional way of life (Dejesus, 2005). In Hawai'i, cultural and spiritual opposition has likewise emerged, particularly among communities that revere Pele – the goddess of fire and volcanism – as embodied in Kīlauea's geothermal activity. This belief system has significantly impeded geothermal development efforts in the region (Kamana & Vaughan, 2024).

1.3 Cultural-Religious Issues of Geothermal Energy Development in the Indonesian Context

Similar patterns of local opposition have emerged in Indonesia, particularly in regions where geothermal development intersects with culturally significant landscapes and community livelihoods. For example, geothermal exploration on the active volcanic Mount Lawu in Central Java encountered resistance from local communities because they believed that the place is home to many ancient relics associated with King Brawijaya V, the last ruler of the Majapahit Kingdom (Pambudi et al., 2022). The project was ultimately suspended due to this resistance (Purnomo, 2025). In Bedugul, Bali, geothermal development has remained halted since 2005, largely due to sustained opposition from both local residents and government authorities at various levels (Iman et al., 2023; Nurdifa, 2025). This resistance is closely tied to the presence of 36 Hindu temples in the vicinity of geothermal manifestations, underscoring the cultural and religious sensitivities surrounding the project site (Berita Bali, 2013).

A distinct form of local resistance in Indonesia emerged in 2008, prior to the initiation of geothermal energy development in the South Sumatra Province. The resistance was exposed by the fearful reaction of local people to the arrival of unfamiliar geothermal developers whose backgrounds and lifestyles differed markedly from their own. Further, residents also feared that the project would disrupt the cultural integrity of the Semende community, the tribes living in

the region². One deeply rooted tradition, known as *Tunggu Tubang*, mandates that the eldest daughter in a family inherit and preserve the ancestral home and agricultural land. Unlike conventional inheritance systems, assets governed by *Tunggu Tubang* are considered non-transferable and must remain within the family lineage (Fauzi, 2016; Harsuno et al., 2018; Murdiati et al., 2018), thereby presenting significant challenges to the implementation of geothermal projects in the area.

These tensions reflect a broader dilemma: while the government and other stakeholders strive to expand universal access to electricity, particularly through environmentally friendly renewable energy sources, local communities often hold divergent views. Geothermal energy, though promising as a sustainable solution, is perceived by some as a threat to environmental balance and cultural heritage.

Despite the growing discourse on geothermal energy development in Indonesia, empirical data on local community perceptions and cultural framings remain scarce and fragmented. Existing literature predominantly emphasizes technical feasibility (Deon et al., 2015; Pan et al., 2019) and policy frameworks (Mary et al., 2017; Nasution, 2023; Utami, 2019), often overlooking the nuanced social dimensions (i.e., perceptions and frames) that shape public acceptance. Moreover, there is a notable gap in understanding how Indonesian key stakeholders, such as government agencies, energy developers, environmental groups, and academic institutions, perceive and frame geothermal energy within their respective domains.

Therefore, this thesis aims to investigate how social factors – particularly local cultural and religious considerations – impact the implementation of geothermal energy in Indonesia. It further explores the diverse perspectives of stakeholders, including the frames through which they articulate their positions in the ongoing discourse.

1.4 Geothermal Energy in Indonesia

a. The Potentials. Indonesia is home to approximately 500 volcanic cones and more than 200 volcanoes, of which 129 remain active, that stretch from the northern tip of Sumatra and pass through Java, Bali, Nusa Tenggara, Sulawesi, and the Moluccas islands (Darma, 2016; Mansoer & Idril, 2015). Strategically positioned along the Pacific Ring of Fire – a vast zone of intense tectonic and volcanic activity encircling the Pacific Ocean – Indonesia possesses one of the richest geothermal landscapes in the world (see Figure 1.1) (Pambudi et al., 2022; Pambudi & Ulfa, 2024; Sujono, 2004).

² Preliminary interview with local communities

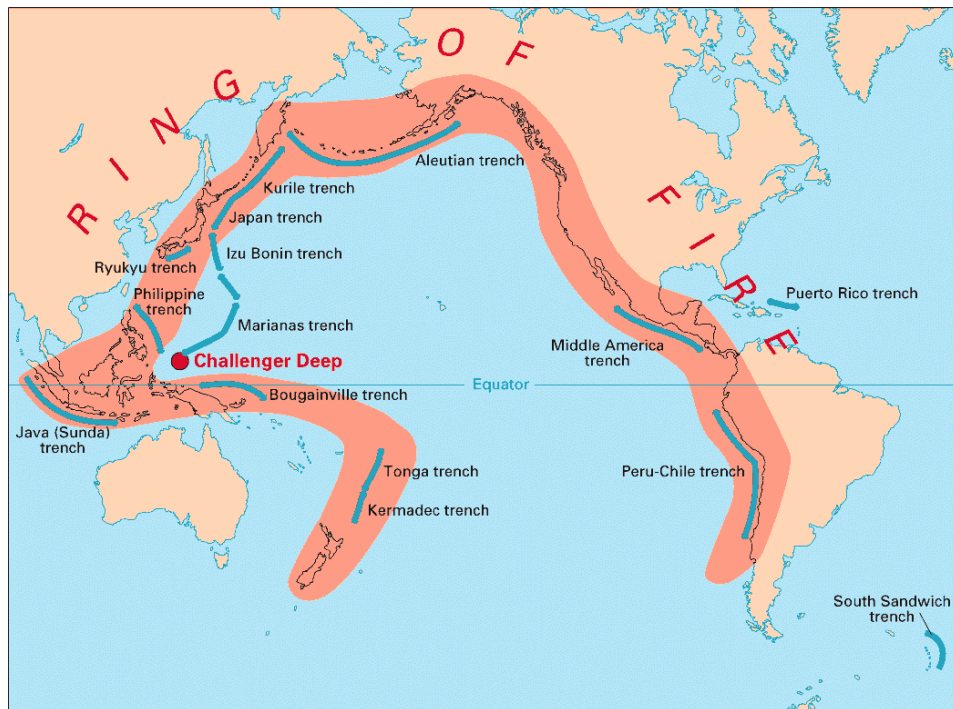


Figure 1.1 Map of Ring of Fire, adapted from (Kious & Tilling, n.d.)

This geophysical endowment translates into an estimated geothermal reserve of 23.36 gigawatts of potential across 356 geothermal locations (see Table 1.1), accounting for nearly 40% of the global supply (Alhusni et al., 2023; Mohammadzadeh Bina et al., 2018). Given its abundant potential and relatively low ecological impact, geothermal energy has gained increasing attention and plays a pivotal role in addressing Indonesia's growing electricity demand while supporting its national commitment to reduce carbon dioxide emissions by 29% by the year 2030, as outlined in the National Energy Plan (Presidential Regulation No. 22/2017).

Table 1.1 Geothermal Potentials in Indonesia (Alhusni et al., 2023)

No.	Island	Total location	Resources					Total Installed Capacity
			Speculative	Hypothetic	Reserves			
					Probable	Possible	Proven	
1	Sumatera	101	2.167	1.567	3.624	976	1.126,4	949,75
2	Jawa	75	1.259	1.191	3.260	377	1.820	1.253,8
3	Bali	6	70	21	104	110	30	0
4	Nusa Tenggara	34	215	146	783	121	12,5	19,08
5	Kalimantan	14	151	18	6	0	0	0
6	Sulawesi	90	1.352	342	989	180	120	1220
7	Maluku	33	560	91	485	6	2	0

8	Papua	3	75	0	0	0	0	0
Total		356	5.849	3.376	9.251	1.770	3.110,9	2.342,63
					14.131,9			
					23.356,9			

Despite Indonesia's vast geothermal reserves, utilization remains low. As of 2021, the installed geothermal capacity for electricity generation stood at merely 2,3 GWe – equivalent to just 7.6% of the nation's estimated potential (PLN, 2021). By 2024, geothermal contributed to 14% together with other renewable energy sources, far below what is needed to achieve the 23% target set by 2025 as stipulated in the Indonesian National Energy Policy (IESR, 2022, 2024).

b. The history. The exploration of geothermal energy in Indonesia dates back to 1918 during the Dutch colonial period, marking the early recognition of the archipelago's geothermal potential. Under the auspices of the Dutch East Indies government, J.Z van Dijck – who had studied geothermal exploration in Volterra, Italy – proposed harnessing energy from the Kawah Kamojang volcanic area, where subsurface temperatures were recorded between 90°C and 94°C (Kurnia, 2025). This initiative laid the groundwork for future development, culminating in the operational launch of the Kamojang geothermal field in 1983, which remains active to this day (Neumann Van Padang, 1983; Pambudi & Ulfa, 2024; Sumardi et al., 2022).

Subsequent exploratory efforts culminated in 1926, when five test wells were drilled in the Kawah Kamojang geothermal field, located in West Java. The third borehole yielded the first successful steam discharge, establishing Kamojang as Indonesia's inaugural geothermal site (Sumardi et al., 2022). During this formative phase, additional geothermal prospects were identified, including Dieng Plateau (Sikidang Sector), Gunung Tampomas, Gunung Salak, Gunung Perbakti, and Cisolok.

Outside Java, geothermal reconnaissance expanded in 1969, when the PLN Power Research Institute initiated preliminary surveys in Sulawesi (Radja, 1975). A pivotal development occurred in 1972, with the launch of a comprehensive feasibility study to assess the potential of geothermal energy for electricity generation. This initiative was supported by international technical cooperation involving New Zealand, Italy, the United States, and Japan. The outcomes of this study informed the formulation of national energy policies, which subsequently positioned geothermal energy as a strategic component in Indonesia's energy diversification agenda (Mansoer & Idral, 2015).

c. Geothermal Potentials in South Sumatera Province. South Sumatera Province is geologically situated along the Bukit Barisan Mountain range, a segment of the Sunda Arc, which confers substantial geothermal potential (see Figure 1.2). However, many of these energy resources are often located in ecologically sensitive zones, frequently overlapping with protected forest areas that serve as critical habitats for endemic flora and fauna (Wijaya, 2024). This spatial overlap has generated substantial concern among local communities, particularly following incidents in which Sumatran tigers encroached upon residential areas, resulting in human fatalities. (Agustina, 2019; CNN Indonesia, 2019). Camera-trap surveys conducted within geothermal working areas between 2014 and 2021 documented the presence of 14 large-mammal species, including the critically endangered Sumatran tiger. Direct sightings occurred during the initial exploration phase in 2014, and again in 2020, with additional photographic evidence captured throughout the monitoring period (Aji et al., 2022).

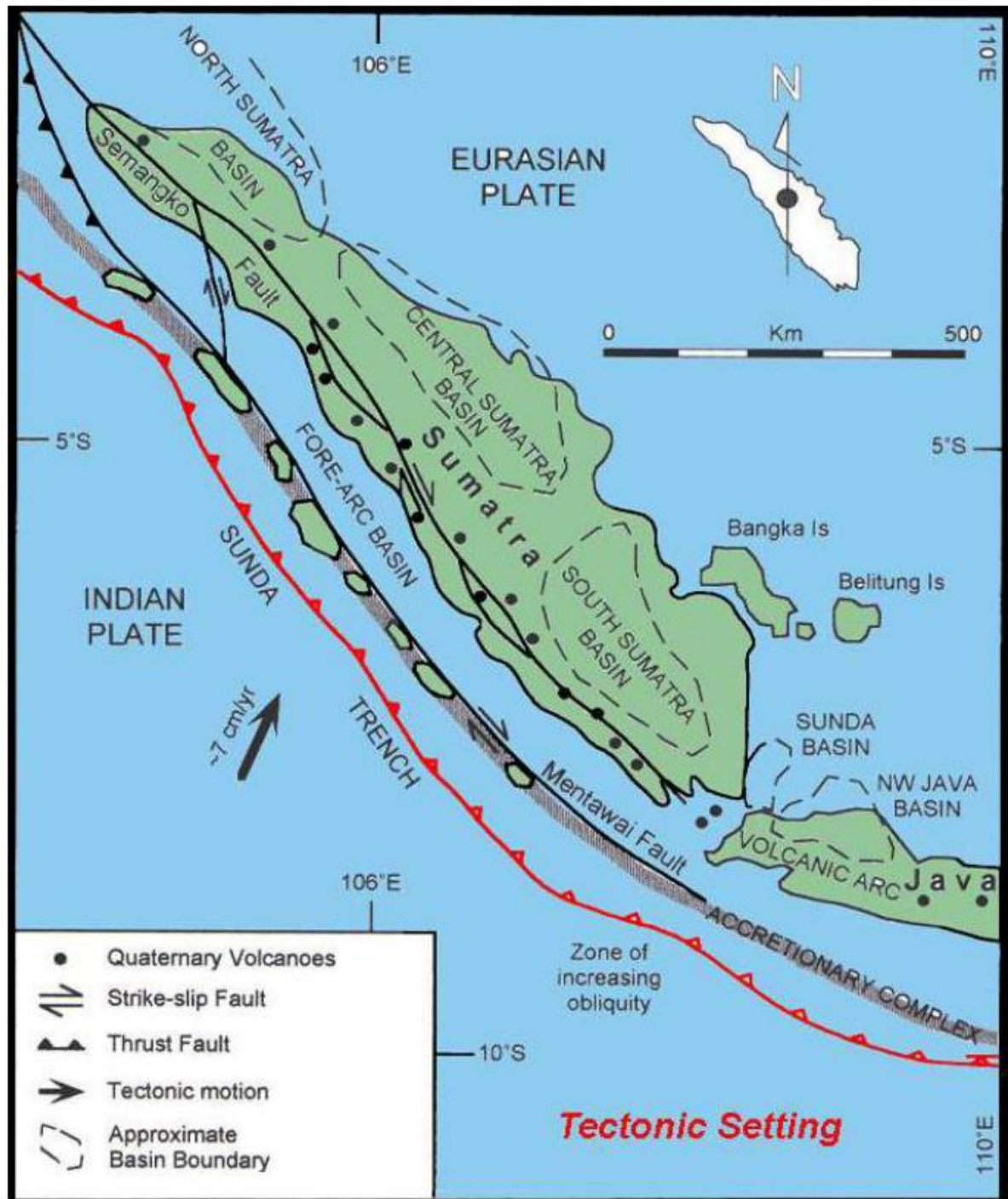


Figure 1.2 Map of the Sumatran Basin, adapted from (Pemerintah Provinsi Sumatera Selatan et al., 2006)

Initial assessments of geothermal resources in Sumatra were conducted by the Geological Survey of Indonesia (GSI) in the 1970s, identifying 138 geothermal prospects across the island (Hadikusumo et al., 1976). However, systematic investigations in South Sumatra only commenced in the early 2000s, culminating in the identification of approximately 918 MW of geothermal reserves. The province's installed geothermal capacity currently stands at 153.4 MW, supplying electricity to an estimated 110,000 households (EMR Agency of South

Sumatra, 2024). This figure represents merely 17% of the total identified reserves, underscoring the considerable untapped potential within the region (Pambudi & Ulfa, 2024).

1.5 Research Questions

Indonesia plays a pivotal role in the global energy transition, possessing an estimated 23.36 gigawatts of geothermal potential – approximately 40% of the world's total supply. Despite this strategic advantage, the *Indonesian Minerals, Coal, and Geothermal Resources and Reserves 2021: Executive Summary* indicates that only 10% of these resources have been explored to date (Ministry of Energy and Mineral Resources Republic of Indonesia, 2022). While global scholarship has increasingly examined the social dimensions of geothermal energy development, particularly in relation to public acceptance, it has received limited attention in how geothermal initiatives are perceived and experienced by local communities in Indonesia. This gap in the literature underscores the need for a nuanced understanding of how geothermal energy is framed, negotiated, and contested at the local level. Therefore, the main question for this research is:

“How does a nuanced understanding of local cultural-religious values represent in the stakeholders’ communication of geothermal energy in Indonesia?”

To understand how cultural and religious values are communicated, it is necessary to examine not only local community narratives but also the multilevel interactions that shape them. Local communities do not exist in isolation. Rather, they are embedded within broader socio-political and institutional networks that shape, and are shaped by, energy development processes. The emergence of geothermal projects is not merely a technical, financial, or environmental phenomenon; rather, it is situated within a complex web of actors – including governments, NGOs and associations, industries, scientists, and media – whose interactions influence how energy transitions are understood and received.

While technical and policy aspects have received considerable attention (Karang, 2017; Nasution, 2023; Poernomo & Effendi, 2017), the social and discursive dimensions remain underexplored. Media, as a powerful vehicle of public discourse, plays a pivotal role in shaping and reflecting stakeholder narratives. News coverage, opinion pieces, and public commentary not only influence public sentiment but also offer valuable insights into how geothermal energy is constructed, contested, and legitimized across different sectors. Therefore, the first sub-research question of this thesis– addressed in Chapter 2 – is as follows:

1. How do Indonesian media portray geothermal energy, and how are cultural-religious values represented in these portrayals?

This chapter captures stakeholder perspectives as reflected in media coverage, drawing on a sample of 316 news articles for systematic analysis. Supplementary data were obtained from scholarly literature, relevant texts, official policy documents, and reports issued by government bodies and project developers.

Complementing this media-based inquiry, extensive fieldwork was conducted to examine stakeholders' actual framings and perceptions. This is elaborated in Chapter 3, which addresses the second research sub-question:

2. How do Indonesian key stakeholders perceive geothermal energy, and how do they incorporate cultural-religious values in their communication?

A total of 86 stakeholders were surveyed, with 15 selected for in-depth interviews. These stakeholders represent five key groups: government, industry, academia, NGOs and associations, and media. The findings reveal salient issues surrounding geothermal energy, e.g., energy security, environment, financial, and socio-political issues, including its entanglement with local concerns.

Local communities do not perceive or frame geothermal energy in isolation; rather, their views are shaped by and embedded within a broader constellation of political and administrative actors. Accordingly, Chapter 4 addresses the third research sub-question:

3. What roles do cultural and religious values play in shaping local debates around geothermal energy?

To examine these dynamics, interviews were conducted with 15 residents representing five villages directly affected by geothermal development in the region. This study aims to capture local perspectives on geothermal energy, with a particular focus on the cultural values, traditional beliefs, and place-based attachments that shape their concerns (see Table 1.2).

Table 1.2 Research Questions

Research Questions			Chapters	Research strategies	Data sources
Main	<i>How does a nuanced understanding of local cultural-religious values represent in the stakeholders' communication of geothermal energy in Indonesia?</i>				
Sub	RQ1	<i>How do Indonesian media portray geothermal energy, and how are cultural-religious values represented in these portrayals?</i>	Chapter 2	Quantitative analysis of media database	Media (newspapers)
	RQ2	<i>How do Indonesian key stakeholders perceive geothermal energy, and how do they incorporate cultural-religious values in their communication?</i>	Chapter 3	Mixed research	Surveys, interviews, government and industry official reports, and websites
	RQ3	<i>What roles do cultural and religious values play in shaping local debates around geothermal energy?</i>	Chapter 4	Qualitative analysis	Interviews, supported news media, and documents

1.6 The Framework

In Indonesia's evolving energy landscape, geothermal energy has emerged as a strategic resource with the potential to contribute to national energy security, economic development, and environmental sustainability. However, the way geothermal energy is perceived and understood by local communities is shaped by a complex interplay of institutional narratives, media representations, and lived experiences. This study proposes a conceptual framework to explore how various actors influence perceptions and frames of geothermal energy, particularly in regions where development intersects with cultural and ecological sensitivities.

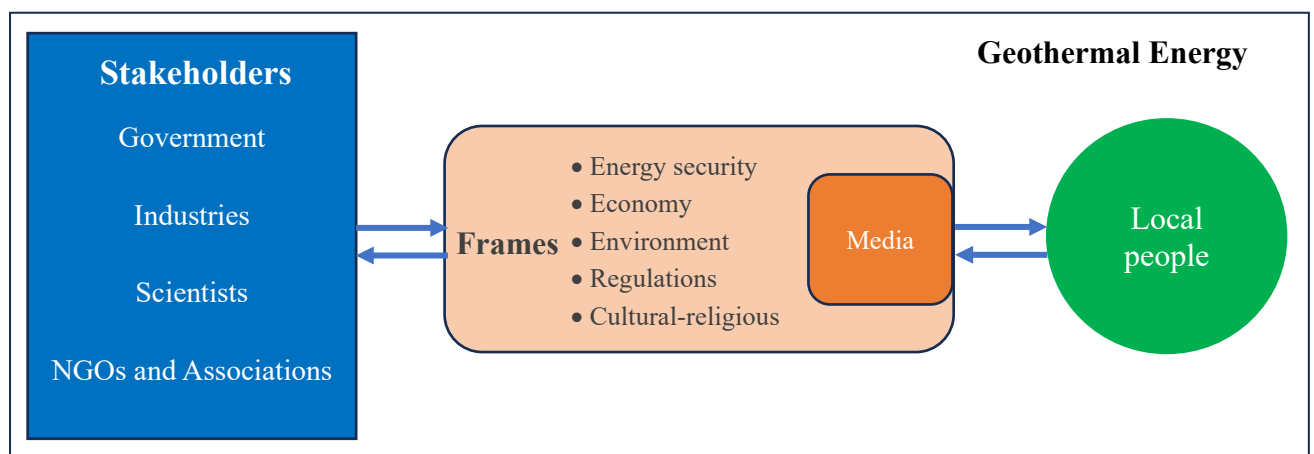


Figure 1.3 Research Framework

The framework (see Figure 1.3) is built on the recognition that multiple stakeholders – government, industries, scientists, NGOs, and associations – play active roles in framing geothermal energy according to their respective interests and mandates. These frames are not neutral; they reflect institutional priorities and are often embedded in broader discourses of energy security, economic opportunity, environmental stewardship, regulatory governance, and socio-cultural values. Through formal communication channels and public engagement, these stakeholders construct narratives that shape how geothermal energy is positioned within national and regional development agendas.

Media serves as a critical intermediary in this process, selectively amplifying stakeholder frames and translating them into public discourse. News outlets and other forms of mass media play a significant role in shaping the visibility and tone of narratives about geothermal energy. Yet, the influence of the media is not absolute. Local communities interpret these messages through their own lenses, informed by personal experiences, historical relationships with the land, and cultural belief systems. In some cases, stakeholders also engage directly with local people, bypassing media channels through consultations, outreach programs, or field-based interactions.

The framework also acknowledges the agency of local communities in this communicative ecology. Rather than being passive recipients of information, local people actively construct their own perceptions of geothermal energy. These perceptions are shaped by both mediated content and direct interactions with stakeholders, and they may evolve over time in response to new experiences or shifting social dynamics. Importantly, these community perceptions can feed back into stakeholder strategies and media narratives, creating a cyclical process of meaning-making and negotiation.

By mapping these relationships, the conceptual framework provides a lens for examining the construction of geothermal energy in Indonesia. It highlights the importance of framing, mediation, and feedback in shaping public understanding and provides a foundation for exploring how energy narratives are co-produced across institutional and local domains.

1.7 Dissertation Structure

This research performs several steps to achieve its objective and answer the research questions. Figure 1.4 below visualizes the research steps, the related research question, and the dissertation chapter. A brief explanation of each chapter is provided afterward.

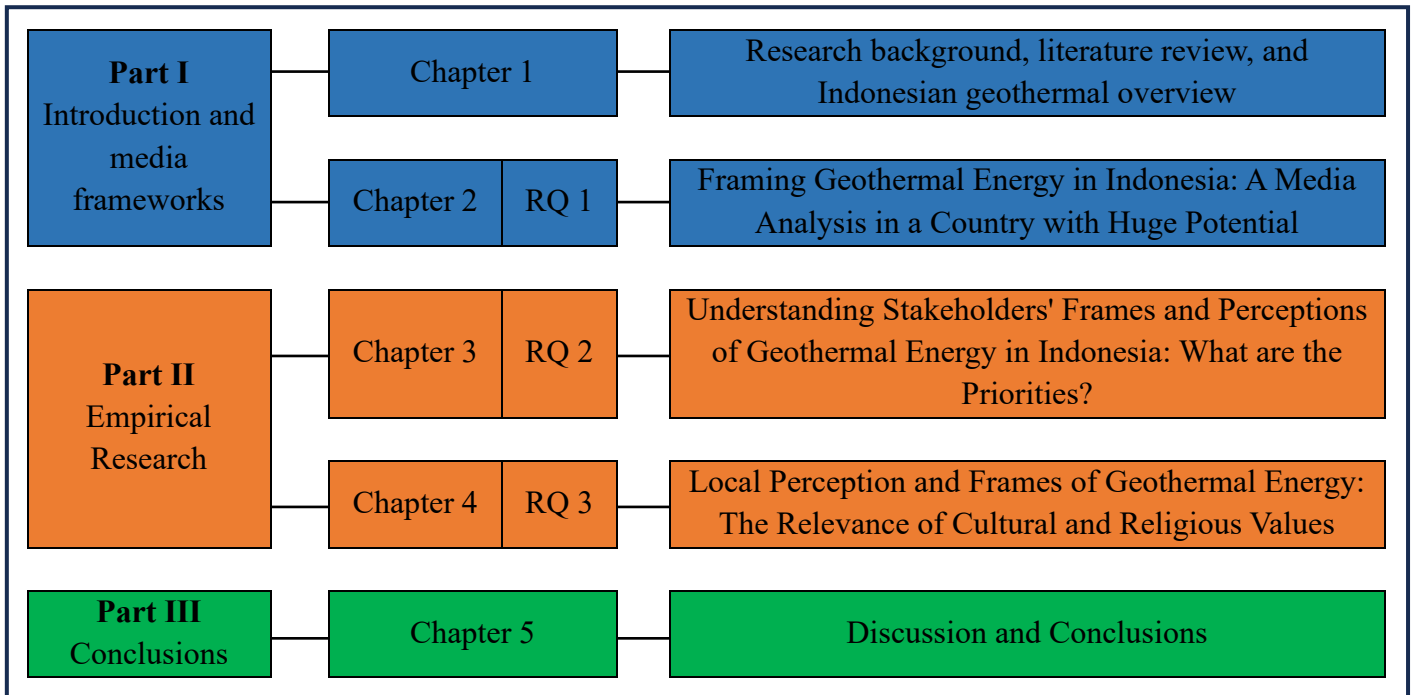


Figure 1.4 The Structure of the Dissertation

This dissertation is structured into three interconnected parts, each designed to progressively build a comprehensive understanding of how geothermal energy is framed and perceived within the Indonesian context.

Part I introduces and outlines the media frameworks, comprising two chapters. Chapter 1 begins with an overview of Indonesia's geothermal energy landscape, highlighting its strategic importance and the dynamics of its development. This section also engages with existing literature on media framing and energy discourse, establishing the conceptual lens through which geothermal narratives are examined. Chapter 2 then focuses on media analysis, investigating how geothermal energy is framed in Indonesian media outlets. This chapter addresses the first research question, which explores the dominant themes and representations that shape public discourse in a country with vast geothermal potential.

Part II explores the empirical core of the study. It consists of two chapters that explore the perceptions and framing practices of key actors involved in geothermal energy development in Indonesia. Chapter 3 examines how stakeholders, including governments, industries,

scientists, NGOs and associations, and the media, construct and prioritize frames surrounding geothermal energy. This chapter addresses the second research question, which aims to understand the logics and strategic narratives of stakeholders that influence the energy debate at the national level. Chapter 4 shifts the focus to local communities, exploring how cultural and religious values intersect with perceptions of geothermal development. This chapter addresses the third research question, emphasizing the role of lived experience and local wisdom in shaping perceptions and frames of energy.

Part III concludes the dissertation by synthesizing insights from both the media and the empirical analyses. Chapter 5 presents a reflective discussion that connects the findings to broader theoretical debates and implications for the geothermal energy sector. It also considers the feedback loops among all stakeholders, i.e., governments, industries, scientists, media, and local communities, highlighting the co-production of meaning in geothermal energy discourse.

Chapter II

Framing Geothermal Energy in Indonesia: A Media Analysis in a Country with Huge Potential

Chapter II

Framing Geothermal Energy in Indonesia: A Media Analysis in a Country with Huge Potential

This chapter is primarily based on a peer-reviewed article:

Trisiah, Anita, Gerdien de Vries and Hans de Bruijn (2022): Framing Geothermal Energy in Indonesia: A Media Analysis in A Country with Huge Potential, *Environmental Communication*, 16(7), 993-1001. DOI: 10.1080/17524032.2022.2144403

2.1 Introduction

Geothermal energy is a low-carbon energy source that can help reduce global CO₂ emissions (IRENA, 2021). Due to its volcanic geology, Indonesia is home to 40% of the world's geothermal resources (Mohammadzadeh Bina et al., 2018). Nonetheless, the potential is underutilized, with only about 9% realized (Ekuatorial, 2021). Barriers are technical (Pambudi, 2018), financial (Rayhanna, 2017), and legal (Darma, 2016), as well as public resistance (Candra, 2018).

The resistance is mainly due to negative perceptions fueled by residents' negative experiences (Floresa, 2019; Mardiasuti, 2019). However, those who benefit from geothermal development report positive perceptions (Pambudi et al., 2022). These perceptions can also be shaped by media frames (e.g. Carr-Cornish & Romanach, 2014; De Vries, 2017), which can be seen in other fields. For example, negative media frames could result in weak public support for biofuels (Delshad & Raymond, 2013), while positive media frames could be associated with public support of nanotechnology (Ho et al., 2010). A Swiss study found that close attention to media and related public reactions is essential to minimize future conflicts in geothermal energy development (Stauffacher et al., 2015). Therefore, it is interesting to know how Indonesian media frames geothermal energy.

In general, Indonesian media emphasize the drawbacks of renewable energy implementations (Rochyadi-Reetz et al., 2019, 2020). However, how they frame geothermal energy is yet to be known because empirical data are lacking. This paper provides this knowledge through a quantitative newspaper analysis. Specifically, it seeks answers to three questions: (1) How do Indonesian media frame geothermal energy? (2) Do these frames emphasize the technology's positive or negative aspects? (3) Who is the frame's primary source?

2.2 Method

I³ analyzed articles on geothermal energy in two major Indonesian newspapers: *Republika* and *Kompas*. These newspapers appear online and in print and have a high impact and a wide readership⁴. *Kompas* has the largest print circulation in Indonesia and Southeast Asia. *Republika* is the only Indonesian newspaper to combine general news with news on Islam, the country's main religion, and a crucial influencer of opinions (Nisbet, 2009; Verkerk & Hoogland, 2021).

I took a deductive approach to identify frames (de Vreese, 2005). Using the keywords “geothermal” and “panas bumi”⁵, I searched for articles published on www.kompas.com and www.republika.co.id between January 2009⁶ and December 2019. The search resulted in 352 articles. A sample of 316 remained after removing irrelevant articles: 118 from *Kompas* and 198 from *Republika*. Articles were evaluated as irrelevant because they contain too generic information, are unrelated, and are in-picture articles (see Appendix D).

I followed a three-step procedure for the content analysis (Mayring in Benighaus & Bleicher, 2019). Firstly, I manually coded the articles in *Atlas.ti* based on the salience of six frames mostly used in the communication of geothermal energy, following Entman's method (1993)⁷. The six frames are (1) energy security (Knoblauch et al., 2019); (2) economy (Curran, 2012); (3) legislation (Shortall et al., 2015); (4) environment (Kubota et al., 2013); (5) knowledge (Carr-Cornish & Romanach, 2014); and (6) social issues (Vargas Payera, 2018).

Secondly, I identified the frame's tone. In line with Gever (2019), I coded stories supporting geothermal energy as positive, unsupportive stories as negative, and disregarded the

³ This research uses I perspectives for consistency in the whole thesis, but some of the analyses were teamwork.

⁴ According to Statshow of *Kompas.com*, 2020, and Statshow of *Republika.co.id*, 2020, based on the page users and viewers, *Kompas.com* is among the top 200 most popular websites worldwide, and *Republika.co.id* is in the top 1,000. To add, I refer to the list of Indonesian Newspapers Web Ranking (4IMN, 2019) in which *Kompas* is at the top, and *Republika* is at the fourth. Regardless of its position, I chose *Republika* because it is the only Indonesian newspaper to combine general news with Islamic news.

⁵ Indonesian language for “geothermal energy.”

⁶ This year, an influential report for the start of geothermal energy development was published (Ermawati & Negara, 2014; Kasbani, 2009).

⁷ The data that support the coding procedures are available from the corresponding first author, upon reasonable request.

neutral stories, for they do not significantly influence perceptions (Entman, 1993). Thirdly, I identified sources based on the salience of the information in the articles (see Appendix C).

2.3 Results

In the 316 articles, the six frames occurred 927 times. See Table 2.1 for their distribution and tone. See Appendix A and B for the detailed arguments.

Table 2.1 Distribution of Frames

Frames	<i>N</i> = 927	<i>Positive (%)</i>	<i>Negative (%)</i>
Energy security	318	79	21
Economy	279	70	30
Legislation	143	53	47
Environment	94	67	33
Knowledge	54	72	28
Social	39	41	59

Energy security is the most prominent frame in Indonesian newspapers. This frame occurred 318 times in the articles. It emphasizes geothermal energy as a reliable energy source for Indonesia. The tone was mostly positive (79% of the 318 energy security frames). The remaining frames mainly reported on the uncertainties surrounding utilization and the pace of infrastructure construction, and not so much on energy security itself. For example:

The problem is the network coverage from PLN⁸ to reach the geothermal power points located not too far from the existing geothermal sources ... (Republika Online, 23 August 2010)⁹.

The articles also mentioned the economic frame quite often (279 times). This frame discusses the funding of geothermal energy development and its economic impact. Seventy percent of the 279 in total discussed the positive contributions to the Indonesian economy. However, around 30% of the frames acknowledged that geothermal development could come with high costs due to uncertainties regarding exploitation.

The legislation frame came in third (*N* = 143) and was evenly positive and negative in tone. For example, a positive frame stated that regulations assure a safe investment climate in

⁸ PLN (Perusahaan Listrik Negara, Indonesian State Electricity Company)

⁹ All direct citations from media were author's translation from Indonesian language.

the geothermal field. A negative frame focused on regulatory problems, including issues regarding permits.

To my surprise, only a small number of articles ($N = 94$) reported on the environmental impact of geothermal energy. This lack of attention is similar to the Indonesian coverage of other ecological technologies, including biodegradable technology (Yuliarti & Jatimurti, 2019). However, two-thirds of the frames reported the positive impact of geothermal energy on reducing CO₂ emissions and the ability to exploit geothermal resources while maintaining the balance of nature. For example:

Geothermal technology is safe for the environment because the cycle is closed. The steam water is reinjected, which produces steam and is reinjected again. (Kompas.com, 25 May 2018).

The negative frame mentioned adverse environmental effects. For instance, resource development can affect the local ecosystem, flora, and fauna in the protected forests (see also Kristmannsdottir et al., 2003).

The knowledge frame did not appear often, but the majority emphasized the benefits of knowledge and university research centres for reducing uncertainty and disagreement about technology implementation (see Carr-Cornish & Romanach, 2014). The other frames reported on - for example – the negative effects of public misinformation due to a lack of transparency of information.

The social issues frame, addressing cultural and social aspects of geothermal energy, was the least mentioned in the articles. And remarkably, unlike the other frames, most were negative in tone.

At the end of 2017, a group of unknown people who resisted the geothermal project near Gunung Talang burnt the company vehicles (Republika Online, 30 November 2019).

Further findings in this study revealed seven sources, or “owners” of the frames (see Appendix C). The national government was most prominent (40%), followed by the geothermal industry, consisting of state and private enterprises (35%). NGOs and associations owned 8% of the frames with their more sceptical view on geothermal energy development. The regional (6%) and local (4%) governments played a minor role, comparable with the share of scientists (6%) – a surprisingly low proportion considering their roles in geothermal technology development and public education. Local people had the weakest voice, owning just 1% of the frames. Among all sources, they expressed the most significant opposition to

geothermal energy development due to the environmental and social effects, including a spiritual relationship with resource sites.

2.4 Discussion

Our analysis sought to understand how major Indonesian newspapers framed geothermal energy for over ten years. I presented three questions that I will answer below:

First, the most dominant frames are the energy security and economic frames. Geothermal energy is presented as a reliable energy source offering financial opportunities for investment and jobs. These portrayals align with a Swiss media analysis that indicated geothermal energy as essential for a secure energy transition (Stauffacher et al., 2015). Further, social implications, such as cultural issues raised by geothermal development, are underrepresented in the media, which is remarkable because a successful transition of geothermal energy depends largely on the social context and the support of local communities (Ejderyan et al., 2019). Lastly, the environmental frame plays a limited role. This is also remarkable given geothermal energy's contribution to reducing carbon emissions.

Second, positive frames are dominant over negative frames. This finding contrasts with several other geothermal energy studies that presented predominantly critical perspectives on geothermal energy development (see Dowd et al., 2011; Kunze & Hertel, 2017; Ramírez et al., 2017).

Third, the primary source of the frames was stakeholders who would benefit from the technology, such as the national government and the geothermal industry. The industry was also the most cited source in a Swiss media analysis on geothermal energy (Stauffacher et al., 2015). Local people and critical stakeholders, such as NGOs, received much less media coverage. In contrast to the Swiss study, which reported scientists as the second most cited, I surprisingly found that scientists are minimally cited.

In conclusion, I found that the most influential parties in Indonesia (government and industry) had the most substantial influence on media framing. They mainly emphasize the positive effect of geothermal energy on energy security and the economy. Overwhelmingly positive framing can have two effects. It can increase support for geothermal energy. However, if readers suspect that the information is unbalanced, a boomerang effect can occur. Over time, people can perceive the positive framing of renewables as an attempt to manipulate their views (e.g. De Vries, 2017).

There is no objective standard for determining too much or too little media attention. However, there has been little coverage of social frames, which are important to communities

facing local geothermal energy development in Indonesia. This lack of attention to social frames is not without risk. Literature suggests it could escalate resistance as negative perspectives among local people burgeon (Kubota, 2015; Vargas-Payera et al., 2020a). Moreover, social media could provide an outlet for criticism, though perhaps more lacking in factual basis. Thus, the established media's lack of attention to criticism of the technology could lead to an explosion of attention in alternative media and rising opposition.

The goal in the current analysis was to gain an impression of media framings of this emerging technology in the national context of Indonesia. However, empirical quantitative and qualitative research (such as surveys and interviews) are needed to gain comprehensive insights into stakeholders' detailed perceptions and frames, including journalists (Nisbet, 2009). Furthermore, newspapers at the regional and local levels might pay greater attention to social aspects and negative local implications of geothermal development since they are closer to communities. A country like New Zealand proved that considering such values is key to successful public engagement in energy transitions (Bargh, 2012).

Investigating other media types is also relevant, mainly social media, radio, and television, as they may present geothermal energy differently. Indeed, many Indonesians rely on social media, such as Facebook, to voice their opinions, as it is accessible and personal (Kusnandar, 2021; Simangunsong, 2021). An integrated analysis of various media types and frame's sources at different levels would provide a more comprehensive overview of Indonesia's geothermal energy portrayal and further fulfil the media's influential role as "social watch" for Indonesia's successful energy transitions (Setyawati & Shaw, 2015).

Chapter III

Understanding Stakeholders' Frames and Perceptions of Geothermal Energy in Indonesia: What are the Priorities?

Chapter III

Understanding Stakeholders' Frames and Perceptions of Geothermal Energy in Indonesia: What are the Priorities?

This chapter is primarily based on a peer-reviewed article:

Trisiah, Anita, Gardien de Vries and Hans de Bruijn (under review): Understanding Stakeholders' Frames and Perceptions of Geothermal Energy in Indonesia: What are the Priorities? *Sustainable Futures Journal*.

3.1 Introduction

Stakeholders – actors who are influenced by and/or that can influence decisions in any field (Kivits, 2011), e.g., the renewable energy sector, plays a crucial role in shaping the trajectory of geothermal energy development. They are the decision makers who determine whether projects move forward or stall, and their choices are strongly influenced by how they perceive the benefits and risks associated with geothermal energy (Cousse et al., 2021). Such perceptions, in turn, affect how stakeholders communicate and frame the technology within public and policy debates (Haemmerli & Stauffacher, 2020). While stakeholders' perceptions are formed by their existing knowledge, from personal experiences, and other sources, such as the media (Démuth, 2012; Entman et al., 2009; Willems et al., 2020), stakeholders' frames emerge from selected perceptions and are emphasized through communication processes (Entman, 1993). These perceptions and frames can be positive, highlighting opportunities for energy security (Karmazina & Steel, 2019) and economic growth (van der Zwaan & Dalla Longa, 2019), or negative, focusing on environmental risks and technological uncertainties (Lenzi et al., 2017).

The positive aspects of geothermal energy relate to three applications: electricity, heat power, and ground-source heat pumps (Lund et al., 2015). Electricity includes economic and environmentally friendly benefits of usage (Palomo-Torrejón et al., 2021). Heat power from geothermal energy includes the direct use of thermal sources for crop cultivation and hot springs (Maćkowski et al., 2019; Vasilevska et al., 2011). Lastly, ground-source heat pumps include the power for heating and cooling buildings (Sarbu & Sebarchievici, 2014).

In contrast, the risks associated with geothermal energy are primarily linked to potential disturbances from noise, subsidence, and seismicity (Kunze & Hertel, 2017; Moon et al., 2020), as well as financial and social issues challenges such as long lead times, costly additional

procedures, and the need for consensus-building with local stakeholders (Taghizadeh-Hesary et al., 2020). More specific concerns include uncertainties in direct thermal applications (Maćkowski et al., 2019; Vasilevska et al., 2011), investment risks (Curran, 2012; Vargas Payera, 2018), and environmental impacts in forested exploration areas (Kubota et al., 2013; Meijaard et al., 2019), and issues of local resistance and community development obligations (de Jesus, 2016; Vargas Payera, 2018).

Beyond the dichotomy of benefits and risks, the communication of renewable energy – particularly geothermal energy – plays a critical role in shaping public perception (De Vries, 2017). Media framing has proven influential; for example, drilling operations in Staufen, Germany, were reported as causing a ground-level rise of approximately 12 cm (Sass & Burbaum, 2010) while earthquakes linked to deep geothermal activities in Basel, St. Gallen, and Landau were widely covered (Edwards et al., 2015) and strongly influenced local perceptions (Benighaus & Bleicher, 2019). Concurrently, media outlets also convey industry perspectives, emphasizing issues such as economic feasibility and technological uncertainty. These narratives mirror the broader discourse surrounding geothermal energy as an emerging technology, as evidenced in Australia (see Romanach et al., 2015).

In Indonesia, which holds nearly 40% of the global geothermal potential (Alhusni et al., 2023; Mohammadzadeh Bina et al., 2018), media coverage similarly employs diverse frames. Preliminary analysis of two major national newspapers revealed six salient frames of geothermal energy, expressed with both positive and negative tones: (1) energy-security, portraying geothermal as a reliable source for Indonesia; (2) highlighting its contribution to national growth but also high costs and exploitation uncertainties; (3) the legislation, emphasizing regulatory measures for investment and exploration permits; (4) the environment, presenting geothermal as a means of reducing CO₂ emissions while noting adverse impacts; (5) the knowledge-frame such as university research center role to reduce public uncertainty and misinformation due to a lack of transparency of information; and (6) social issue, addressing local employment but also community resistance. Among these, the energy-security and economy frames were most dominant, followed by legislation, environment, and knowledge, all generally positive in tone. By contrast, the social-issues frame – linked to cultural, religious, and broader societal aspects – was the least represented and predominantly negative (Trisiah et al., 2022).

These media frames, however, do not arise in isolation. They are rooted in stakeholder perceptions, which themselves are shaped by assessments of risks and benefits as well as by knowledge and experience. Stakeholders approach geothermal projects from diverse vantage

points, reflecting their distinct priorities and responsibilities. Scientists, for example, highlight the role of geothermal energy in climate mitigation, framing it as a promising renewable resource capable of stabilizing national energy systems (Pambudi, 2018). International experiences further underscore this multiplicity of stakeholders' framings: in New Zealand, government actors present geothermal energy both as a traditional resource for daily needs (Neilson et al., 2010) and as a driver of economic growth (van der Zwaan & Dalla Longa, 2019) while industries on the North American West Coast actively deploy geothermal energy for direct and indirect applications despite comparatively limited subsidies (Karmazina & Steel, 2019).

At the same time, risks generate negative perceptions. Industry actors and NGOs emphasize potential adverse environmental impacts during project development (Fajri et al., 2020; Romanach et al., 2015), while the unpredictability of production reinforces economic concerns, fostering skepticism about project feasibility (Rayhanna, 2017). Media coverage reflects these tensions, with government actors, industries, NGOs, scientists, and local communities each contributing distinct perspectives (Trisiah et al., 2021).

Geothermal narratives are often constructed through information shared by stakeholders and mediated by journalists, thereby shaping public discourse (Stähler & Taylor, 2015). Yet, little is known about stakeholders' actual perceptions and frames, or whether the representations observed in media analysis reflect their views directly or are influenced by journalistic interpretation. A lack of clarity regarding these frames and perceptions may hinder the effective implementation of geothermal projects. Since the media influences public acceptance of geothermal energy and media frames are derived from stakeholders' perceptions of risks, benefits, and knowledge, understanding stakeholders' perspectives is essential. Importantly, this research also examines how stakeholders perceive social issues, specifically the cultural-religious dimensions of geothermal energy, which remain underrepresented in media analyses but are critical to project legitimacy and community acceptance.

This study, therefore, examines how Indonesian stakeholders perceive and frame geothermal energy, with particular attention to social considerations. To this end, surveys and interviews were conducted with diverse stakeholder groups. This research concentrates on stakeholders who actively shape public debate through media outlets, i.e., government, scientists, industries, and NGOs and associations (Trisiah et al., 2022). Because journalists may also influence media frames through what Stähler and Taylor (2015) describe as the "framing waterfall," they are included as an additional stakeholder group. By contrast, the perspectives of local actors, although recognized as stakeholders, are treated differently. Their views are

primarily mediated through media exposure and are addressed in Chapter IV in this dissertation.

3.2 Research Aim and Questions

This research investigates how Indonesian stakeholders perceive and frame geothermal energy. While previous studies have examined media representations, little is known about whether these narratives accurately reflect stakeholders' own views or are shaped by journalistic interpretation. To address this gap, the study engages stakeholders directly through surveys and interviews, uncovering their perceptions and the issues they emphasize in debates about geothermal energy. These insights provide an important reference for positioning geothermal energy within Indonesia's energy transition and for supporting its successful implementation.

Beyond identifying frames and perceptions, this study also examines the knowledge underpinning them. Understanding stakeholders' knowledge of geothermal energy and related issues, such as their awareness of the contribution of renewable energy to Indonesia's energy transition, is crucial, as knowledge strongly shapes perceptions and frames (Démuth, 2012; Dowler et al., 2006). In addition, this research explores how stakeholders perceive social dimensions, particularly cultural and religious values, which are often underrepresented in media analyses but are critical to project legitimacy and community acceptance.

Accordingly, the central research question guiding this chapter is:

“How do Indonesian key stakeholders perceive geothermal energy, and how do they incorporate cultural-religious values in their communication?”

3.3 Methodology

To address the research question, I employed two complementary methods: a questionnaire and semi-structured interviews. To assess stakeholders' perceptions and frames of geothermal energy, I distributed a closed-ended questionnaire via snowball sampling, reaching participants via email, social media, and professional networks from March 2020 to August 2021. The survey targeted key Indonesian stakeholder groups, including government actors at national, regional, and local levels; scientists; NGOs and associations; industries engaged in geothermal-related issues; and media journalists reporting on this emerging technology.

To explore the stakeholders' perceptions and frames of geothermal energy, I conducted semi-structured interviews designed to elicit deeper insights into how stakeholders perceive geothermal energy and the issues they emphasize in public debate (Adams, 2015). The study was conducted both online and offline. Conducting the study online was necessary due to

international travel restrictions in place during the COVID-19 pandemic (WHO, 2019), which limited in-person data collection. The references for the interview questions and results are disclosed in the interview section of this study.

a. Questionnaire

i. Instrument

The primary research instrument employed in this study is an online questionnaire designed to examine the frames and perceptions of Indonesian stakeholders regarding geothermal energy. The questionnaire was developed using Qualtrics, an online survey platform, which enables the implementation of dynamic question branching and the management of panels of potential respondents in a confidential manner (Fletcher, 2016). The distribution of the questionnaire was organized by stakeholder group. The survey items comprised four categories: demographic questions (e.g., educational background and place of work); questions assessing knowledge of energy-related issues; perception-oriented questions addressing perceived benefits and risks; and frame-related questions exploring respondents' preferences for particular interpretive frames.

I conducted a pilot questionnaire survey in February 2021 to test the robustness of its structure, wording, content, and language. The instrument was made available in both English and Indonesian. Ten Indonesian participants with strong English proficiency were invited to complete the pilot survey, including six doctoral scholars at Delft University of Technology in the Netherlands and four academics from two universities in Palembang, Indonesia. Each participant received both language versions of the questionnaire. Feedback from the pilot primarily focused on the wording and question format, particularly translation-related issues. For instance, the English term 'stakeholders' was replaced with the Indonesian equivalent *pemangku kepentingan* to ensure consistent comprehension among respondents.

Based on this feedback, the final questionnaire was structured into four parts, as outlined in Table 3.1, Part 1. The subsequent sections provide a detailed explanation of each part.

Part 1 Demography

This section collected demographic information from respondents, focusing on their educational backgrounds and institutional affiliations. These variables are essential for contextualizing and interpreting stakeholder perspectives in the subsequent analysis. The dimensions are as follows:

a. *Educational background.* Respondents were asked: “*What is your educational background?*” The response options were structured on a four-point scale

1 = senior high school

2 = bachelor's degree

3 = master's degree,

4 = doctoral degree

b. *Place of work.* Respondents were asked: “*Where do you work (Name of the Company/Institution)?*” This item employed a fill-in-answer format, requiring participants to provide the name of their workplace in the designated space.

Table 3.1 The Questionnaire Outline

Parts	Constructs	Dimension	Number of items
I	Demography	a. Education background	1
		b. Place of work	1
II	Knowledge	Energy-related issues	6
III	Perceptions	a. Perceived benefits	6
		b. Perceived risks	6
IV	Frames	Preference for frames	6

Part 2 Knowledge of energy-related issues

Stakeholders’ knowledge of energy technology significantly shapes their perceptions and interpretive frames (Démuth, 2012; Dowler et al., 2006). To assess respondents’ understanding of energy issues that are particularly relevant in the Indonesian context, the questionnaire included the question: “*How do you rate your knowledge regarding the following statements?*” Respondents were asked to evaluate six statements that refer to the previous studies (see Ahmad, 2021; Farduwin & Yuliansyah, 2011; Ibrohim et al., 2019; Mary et al., 2017; Rayhanna, 2017):

- 1) The availability of fossil energy in Indonesia is sufficient to meet national electricity needs.
- 2) Indonesia needs renewable energy to provide universal access to electricity for the nation.
- 3) Indonesia has the potential for the development of renewable energy technology.
- 4) Geothermal energy has great potential to be developed in Indonesia.
- 5) Indonesia has a high level of geothermal energy production.
- 6) There is strong resistance to geothermal energy development in some regions in Indonesia.

Understanding respondents’ knowledge of these six issues is pivotal for contextualizing their perceptions and frames. As Blumer et al. (2018) argue, perceptions of geothermal energy

and related technologies are strongly influenced by personal experiences and familiarity with the topic.

Responses were collected using a 5-point Likert scale, with options ranging from 1 = *no knowledge at all* to 5 = *extensive knowledge*. This scale allowed for nuanced measurement of agreement and provided a structured basis for subsequent analysis of stakeholder perspectives.

Part 3 Perceptions

As discussed in the introduction, perceptions of geothermal energy are strongly influenced by the perceived risks and benefits associated with its nature and development (Carr-Cornish & Romanach, 2014; Cousse et al., 2021). To ensure comparability of responses, participants were first provided with general background information on geothermal energy. This step was intended to establish a common baseline of knowledge, thereby reducing variation in responses attributable to differences in prior familiarity.

Following this introduction, respondents were presented with information concerning six categories of risks and benefits. These categories mirror the analytical framework employed in the previous media analysis study (see Trisiah et al., 2022), thereby ensuring methodological consistency across the different components of the research. They are: energy security (Knoblauch et al., 2019), economy (Curran, 2012), legislation (World Bank et al., 2017), environment (Kubota et al., 2013), knowledge (Carr-Cornish & Romanach, 2014), and social issues (Vargas Payera, 2018).

The text presented in the questionnaire was as follows:

“Geothermal energy development in Indonesia involves both potential benefits and risks. These issues can be grouped into six categories: energy security, economy, legislation, environment, knowledge, and social aspects. Considering these categories, please indicate your perceptions regarding the benefits and risks of geothermal energy development.”

This structured approach enabled respondents to evaluate geothermal energy across multiple dimensions, facilitating a nuanced understanding of stakeholder perceptions and allowing for direct comparison with media discourse.

Geothermal Energy in Indonesia – Benefits and Risks

Geothermal energy is energy derived from the Earth's internal heat. Naturally, it can reach the earth's surface to create hot springs. Otherwise, it can be drilled into the earth's subsurface to produce clean energy.

Data reveal that Indonesia hosts 40% of the world's geothermal energy supply. Among other countries, Indonesia is an archipelago located on the "Ring of Fire," a vast region in the Pacific Ocean basin that is home to the majority of the world's volcanoes. On the one hand, it is risky due to the potential for many earthquakes and volcanic eruptions. On the other hand, the characteristics of this geology are the potential source of geothermal energy supply, which benefits Indonesia the most.

Literature indicates that geothermal energy has benefits and risks related to several issues, including energy and security, economy, politics and law, environment, knowledge and information, and social issues. These issues and examples of benefits and risks are listed in the following table.

No.	Issues	Benefits	Risks
1.	Energy security	It provides universal access to electricity in Indonesia.	The seismicity during exploration is sensitive to triggering earthquakes.
2.	Economy	Its development can increase state, regional, and local revenue.	It needs a high investment.
3.	Legislation	Going global through collaboration with foreign stakeholders.	Some actors exploit geothermal issues for their own political needs.
4.	Environment	It is environmentally friendly.	The exploration might impact noise pollution.
5.	Knowledge	Scientific research improves geothermal energy.	A lack of knowledge and information might lead to resistance.
6.	Social	The project can boost the empowerment of the local people.	Some project areas are sacred in terms of local beliefs and culture.

Perceived Benefits. After reading the introductory text, respondents were asked to evaluate the perceived benefits of geothermal energy across six dimensions: energy security, economic benefits, legislation, environmental impact, knowledge, and social issues. Responses were collected using a 3-point Likert scale (1 = *low*; 2 = *moderate*; 3 = *high*). As Taherdoost (2019) notes, a 3-point Likert scale provides respondents with quick and straightforward options, thereby facilitating ease of use while maintaining analytical validity.

The specific question posed was:

“On a scale of low, moderate, and high, in your opinion, what is the level of benefit of geothermal energy as a renewable energy source to develop in Indonesia related to the

following issues: 1) energy security; 2) economy; 3) legislation; 4) environment; 5) knowledge; and 6) social?”

To minimize bias, respondents were not permitted to revisit the general information on geothermal energy provided earlier when answering these benefit-related questions.

Perceived Risks. In parallel with the benefits assessment, respondents were asked to evaluate the perceived risks of geothermal energy development using the same 3-point Likert scale (1 = *low*; 2 = *moderate*; 3 = *high*). The question was formulated as follows:

“On a scale of low, moderate, and high, in your opinion, what is the level of risk of geothermal energy as a renewable energy source to develop in Indonesia related to the following issues: 1) energy security; 2) economy; 3) legislation; 4) environment; 5) knowledge; and 6) social?”

This dual assessment of benefits and risks provided a balanced framework for analyzing stakeholder perceptions, enabling the identification of both supportive and critical viewpoints across multiple dimensions of geothermal energy development.

Part 4 Frames

The final variable investigated in this study concerns the interpretive frames through which stakeholders engage with geothermal energy. Consistent with the categories used in the benefit and risk assessments, six frames were examined: energy security, economy, legislation, environment, knowledge, and social issues.

Respondents were asked the following question:

"How is your preference to use the following frame of geothermal energy in the debate: 1. energy security; 2. economy; 3. legislation; 4. environment; 5. knowledge; and 6. social?"

Responses were measured using a 5-point Likert scale, ranging from 1=*very low* to 5=*very high*. This scale allowed respondents to indicate the relative strength of their preference for employing each frame in discussions about geothermal energy.

ii. Population and Sample

The population targeted for this questionnaire consisted of stakeholders in the geothermal energy sector. As identified in the Indonesian media analysis (Trisiah et al., 2022), five stakeholder groups are relevant to geothermal energy: government, scientists, NGOs and associations, industry, and local communities. However, the present study focused on stakeholders who actively influence public discourse through media outlets – namely, government, scientists, NGOs and associations, and industry (Mary et al., 2017; Pambudi, 2018; Poernomo & Effendi, 2017). Local communities were excluded from the survey population, as they represent the public exposed to media narratives rather than direct

contributors to framing processes (Dowd et al., 2011; Willems et al., 2020). In addition, given the uncertainty regarding whether stakeholder frames in media coverage reflect their actual perspectives or are mediated by journalistic framing, the media itself was included as a stakeholder group whose frames may influence public perceptions.

Due to the broad scope of these stakeholder groups, purposive and snowball sampling strategies were employed to recruit representatives. For instance, government respondents were purposively selected from energy-related institutions, such as the Ministry of Energy and Mineral Resources. Contact details for potential participants were obtained from multiple sources, including domestic and international conferences, official social media accounts, institutional websites, and snowball sampling referrals from senior government officials, NGO leaders, and academic institutions.

I first contacted the stakeholders via email or social media to gauge their willingness and availability to participate. I explained the objectives of the questionnaire and ensured that all survey data would guarantee the anonymity of the respondents¹⁰. Once participants confirmed their willingness to take part, they were provided with a Qualtrics survey link to complete the questionnaire online. To broaden the study's reach, respondents were also encouraged to share the survey with their colleagues (Etikan, 2016).

A total of 125 responses were recorded. Of these, 39 were excluded because they were incomplete and therefore unsuitable for analysis. The remaining 86 valid responses formed the dataset for further examination. An overview of the stakeholder groups and their respective roles is presented in Table 3.2.

Table 3.2 List of Stakeholders involved in the Survey

Stakeholders	Roles	N
		Questionnaires
Government	Responsible for assuring geothermal energy is well developed to achieve sustainable goals and unlock the potential for universal access to electricity	13
National		
Regional		
Local		
Scientists	Provide knowledge and propose extensive research by collaborating with the government and industries	8
National		
Regional		
NGOs and associations	Create awareness and collaborate with the public and other institutions to tackle challenges in developing renewable energy	17
International		
National		
Regional		

¹⁰ The research procedure follows the TU Delft HREC (Human Research Ethics Committee)

Media	Share the information about renewable energy to educate the readers	26
National		
Regional		
Industries	Support the government in reaching sustainable goals by exploring the potential	22
National		
Regional		
Total		86

3.4 Results of Questionnaire

a. Knowledge of energy-related issues

Stakeholders demonstrated a generally high level of knowledge regarding energy-related issues. Their understanding was particularly strong in relation to the potential ownership for the development of renewable energy technology ($M = 4.47$, $SD = 0.69$), the need for renewable energy to provide universal access to electricity ($M = 4.46$, $SD = 0.64$), the great potential of geothermal energy to develop ($M = 4.34$, $SD = 0.73$), and the high production of geothermal energy in Indonesia ($M = 3.97$, $SD = 0.91$).

By contrast, knowledge levels were relatively moderate regarding the strong resistance to geothermal energy development in some regions ($M = 3.49$, $SD = 0.95$), and the availability of fossil energy in Indonesia is sufficient to meet national electricity needs ($M = 3.07$, $SD = 1.1$) (see Table 3.3).

Overall, respondents' knowledge of energy-related issues was high, with the strongest consensus on the importance of renewable energy for achieving universal electricity access ($M = 4.46$, $SD = 0.64$). The lowest level of agreement was recorded for the sufficiency of fossil energy to meet national electricity needs ($M = 3.07$, $SD = 1.1$).

Table 3.3 Mean and Standard Deviation of Stakeholder Groups' Perception of Energy-Related Issues

	Energy-related issues	Stakeholder's groups	N	Mean	Standard deviation
1	The availability of fossil energy in Indonesia is sufficient to meet national electricity needs.	Government	13	2.54	1.05
		Scientists	8	3.38	1.19
		NGOs	17	3.59	1.23
		Media	26	2.50	1.11
		Industries	22	3.32	0.89
		<i>Total</i>	86	3.066	1.094
2.	Indonesia needs renewable energy to provide universal	Government	13	4.77	0.60
		Scientists	8	4.63	0.52
		NGOs	17	4.53	0.51

access to electricity for the nation.	Media	26	4.19	0.98
	Industries	22	4.18	0.59
	<i>Total</i>	86	4.46	0.64
3. Indonesia has the potential for the development of renewable energy technology.	Government	13	4.77	0.44
	Scientists	8	4.63	0.52
	NGOs	17	4.53	0.62
	Media	26	4.00	1.27
	Industries	22	4.41	0.59
	<i>Total</i>	86	4.468	0.688
4. Geothermal energy has great potential to develop in Indonesia	Government	13	4.69	0.48
	Scientists	8	4.75	0.46
	NGOs	17	4.00	1.17
	Media	26	4.08	0.94
	Industries	22	4.18	0.59
	<i>Total</i>	86	4.34	0.728
5. Indonesia has a high level of geothermal energy production.	Government	13	4.00	1.08
	Scientists	8	4.13	0.84
	NGOs	17	4.00	0.79
	Media	26	3.88	0.86
	Industries	22	3.82	0.96
	<i>Total</i>	86	3.966	0.906
6. There is strong resistance to geothermal energy development in some regions of Indonesia.	Government	13	3.92	1.04
	Scientists	8	3.63	1.19
	NGOs	17	4.06	0.75
	Media	26	3.19	0.98
	Industries	22	2.64	0.79
	<i>Total</i>	86	3.488	0.95

An analysis of variance (ANOVA) was performed to examine differences in stakeholder knowledge of energy related issues. The results indicated statistically significant variation in knowledge regarding *Issue 1* – the sufficient availability of fossil energy to meet electricity needs – among stakeholder groups ($F = 3.96, p = .01$). Bonferroni post hoc comparisons revealed that NGOs ($M = 3.59$) reported higher levels of knowledge than media representatives ($M = 2.50, p = .02$). Significant differences also emerged for *Issue 6* – resistance to geothermal energy development ($F = 7.42, p = .00$). Post hoc tests again showed that NGOs ($M = 4.06$) perceived stronger resistance compared to media ($M = 3.19, p = .04$) particularly in relation to opposition observed in certain Indonesian regions. These findings suggest that NGOs tend to be more knowledgeable and critical about energy issues, while media representatives show

lower awareness and perceive less resistance to geothermal development. No statistically significant differences were found among stakeholder groups for the remaining issues ($p > .05$).

b. Perceptions of geothermal energy benefits

With respect to perceptions of geothermal energy benefits, the ANOVA results indicated no significant differences between stakeholder groups ($p \geq .05$). Overall, stakeholders consistently evaluated the benefits of geothermal energy development as high across several dimensions: environmental ($M = 2.57$, $SD = 0.61$), energy security ($M = 2.53$, $SD = 0.55$), knowledge ($M = 2.5$, $SD = 0.64$), economy ($M = 2.5$, $SD = 0.6$), and social issues ($M = 2.46$, $SD = 0.61$) (see Table 3.4). In contrast, the perceived benefits of legislation were less pronounced ($M = 2.23$, $SD = 0.61$). Furthermore, stakeholders expressed the view that collaboration with foreign actors contributes only marginally to the advancement of geothermal energy development in Indonesia.

Table 3.4 Mean and Standard Deviation of Stakeholder Groups' Perception of Geothermal Energy Benefits

The benefits	Stakeholder's groups	N	Mean	Standard deviation
Energy security	Government	13	2.83	0.39
	Scientists	8	2.63	0.52
	NGOs	17	2.43	0.51
	Media	26	2.25	0.74
	Industries	22	2.50	0.61
	Total	86	2.528	0.554
Economy	Government	13	2.83	0.39
	Scientists	8	2.50	0.54
	NGOs	17	2.43	0.65
	Media	26	2.38	0.65
	Industries	22	2.35	0.75
	Total	86	2.498	0.596
Legislations	Government	13	2.33	0.65
	Scientists	8	2.25	0.46
	NGOs	17	2.21	0.58
	Media	26	2.25	0.68
	Industries	22	2.15	0.59
	Total	86	2.238	0.592
Environment	Government	13	2.92	0.29
	Scientists	8	2.75	0.46
	NGOs	17	2.21	0.80

	Media	26	2.33	0.82
	Industries	22	2.65	0.67
	<i>Total</i>	86	2.572	0.608
Knowledge	Government	13	2.67	0.49
	Scientists	8	2.50	0.76
	NGOs	17	2.43	0.76
	Media	26	2.42	0.58
	Industries	22	2.50	0.61
	<i>Total</i>	86	2.504	0.64
Social	Government	13	2.75	0.45
	Scientists	8	2.63	0.52
	NGOs	17	2.36	0.84
	Media	26	2.25	0.68
	Industries	22	2.30	0.57
	<i>Total</i>	86	2.458	0.612

c. Perceptions of geothermal energy risks

An analysis of variance (ANOVA) revealed significant differences among stakeholder groups in their perceptions of the social risks associated with geothermal energy development ($M = 2.32$, $SD = 0.59$, $p < .05$), measured on a 3-point Likert scale – a format in general preferred by respondents (see Taherdoost, 2019). Bonferroni post hoc comparisons indicated that government representatives perceived greater social risks ($M = 2.75$) than NGOs ($M = 1.93$, $p = .01$) and media representatives ($M = 2.04$, $p = .02$).

To further explore these findings, I examined stakeholder perceptions of geothermal energy risks across multiple dimensions. All groups perceived legislative risks at a moderate level ($M = 2.15$, $SD = 0.66$). NGOs consistently evaluated all issues as moderately significant (see Table 3.5). Although no statistically significant effects were observed, scientists reported relatively higher risk perceptions across several domains, including social issues ($M = 2.63$, $SD = 0.52$), economy ($M = 2.63$, $SD = 0.74$), energy security ($M = 2.5$, $SD = 0.76$), knowledge ($M = 2.38$, $SD = 0.92$), and environment ($M = 2.5$, $SD = 0.76$). Similarly, members of the government perceived elevated risks in relation to social issues ($M = 2.75$, $SD = 0.45$), environment ($M = 2.42$, $SD = 0.67$), and knowledge ($M = 2.33$, $SD = 0.65$), while their perceptions of energy security ($M = 2.25$, $SD = 0.62$) and economic issues ($M = 2.08$, $SD = 0.67$) remained moderate.

Industries perceived social risks at a moderate level ($M = 2.26$, $SD = 0.45$) but reported higher risks in relation to environmental ($M = 2.53$, $SD = 0.7$), economy ($M = 2.37$, $SD = 0.5$), and energy security concerns ($M = 2.37$, $SD = 0.5$). This finding is notable because, despite

working closely with the public, these industries did not emphasize social risks as strongly as might be expected, instead prioritizing broader systemic concerns. In comparison, media representatives perceived environmental risks as relatively high ($M = 2.38$, $SD = 0.71$), while maintaining moderate perceptions across other domains.

Table 3.5 Mean and Standard Deviation of Stakeholder Groups' Perception of Geothermal Energy Risks

The benefits	Stakeholder's groups	N	Mean	Standard deviation
Energy security	Government	13	2.25	0.62
	Scientists	8	2.50	0.76
	NGOs	17	2.14	0.56
	Media	26	2.17	0.64
	Industries	22	2.37	0.50
	<i>Total</i>	86	2.286	0.616
Economy	Government	13	2.08	0.67
	Scientists	8	2.63	0.74
	NGOs	17	2.00	0.78
	Media	26	2.17	0.64
	Industries	22	2.37	0.50
	<i>Total</i>	86	2.25	0.666
Legislation	Government	13	2.08	0.67
	Scientists	8	2.25	0.71
	NGOs	17	2.14	0.66
	Media	26	2.21	0.66
	Industries	22	2.05	0.62
	<i>Total</i>	86	2.146	0.664
Environment	Government	13	2.42	0.67
	Scientists	8	2.50	0.76
	NGOs	17	2.14	0.77
	Media	26	2.38	0.71
	Industries	22	2.53	0.70
	<i>Total</i>	86	2.394	0.722
Knowledge	Government	13	2.33	0.65
	Scientists	8	2.38	0.92
	NGOs	17	2.21	0.70
	Media	26	2.08	0.65
	Industries	22	2.32	0.58
	<i>Total</i>	86	2.264	0.7
Social	Government	13	2.75	0.45

Scientists	8	2.63	0.52
NGOs	17	1.93	0.92
Media	26	2.04	0.62
Industries	22	2.26	0.45
<i>Total</i>	86	2.322	0.592

d. The frames of geothermal energy

An analysis of variance (ANOVA) was conducted to examine stakeholder preferences for framing geothermal energy in Indonesia (see Table 3.6). The results revealed significant differences only in the use of the economic frame ($M = 3.97$, $p < .05$). Bonferroni post hoc comparisons indicated that government representatives were more likely to employ this frame ($M = 4.58$, $SD = 0.67$) compared to NGOs ($M = 3.46$, $SD = 1.2$, $p = .07$) and media ($M = 3.63$, $SD = 0.97$, $p = .03$). This finding aligns with expectations, as NGOs tend to emphasize environmental concerns over economic considerations in geothermal energy debates (Mediaaceh.co, 2016; Wicaksono, 2024).

Media discourse is largely dominated by government narratives that foreground economic issues (Nasution, 2023; Saputri, 2016; Utami, 2019). However, survey results from this study suggest that media journalists themselves perceive environmental issues as more salient than economic ones. This discrepancy reflects a divergence between the government-led framing present in public discourse and the perceptions reported by media practitioners, suggesting differences in how frames are adopted across stakeholder groups.

The analysis also revealed that legislation frames ($M = 3.34$, $SD = 1$) were moderately preferred across all stakeholder groups. This result is somewhat unexpected, given that legislation-related issues – such as regulatory frameworks and political processes – are central to debates on geothermal energy, as they directly influence Indonesia’s ability to implement projects effectively (Sukmana, 2016). By contrast, environmental frames emerged as the most preferred across all groups ($M = 4.3$, $SD = 0.87$). This outcome is unsurprising, as geothermal energy is widely discussed for both its environmental benefits – as a clean, renewable source – and its potential risks, such as localized pollution.

As anticipated, NGOs demonstrated a strong preference for environmental ($M = 4$, $SD = 1.23$) and social frames ($M = 3.85$, $SD = 1.21$), while maintaining moderate use of energy security ($M = 3.54$, $SD = 1.45$), economy ($M = 3.46$, $SD = 1.2$), legislation ($M = 3.31$, $SD = 1.18$), and knowledge frames ($M = 3.62$, $SD = 1.19$). Media and industry actors, by contrast, favored energy security, environmental, knowledge, and social frames. Media representatives moderately preferred economic frames ($M = 3.63$, $SD = 0.97$), whereas industry stakeholders

rated them relatively highly ($M = 3.89$, $SD = 0.74$). Overall, environmental frames were the most widely used across stakeholder groups, followed by social frames. Notably, this finding diverges from prior media analyses, which identified social frames as the least prevalent (Trisiah et al., 2022). Consequently, interviews with stakeholders are essential to clarify the frames they actively employ in geothermal energy debates and to uncover the underlying knowledge and motivations shaping these preferences.

Table 3.6 Mean and Standard Deviation of the Geothermal Energy Frames likeliness used by Stakeholder Groups

The issues	Stakeholder's groups	N	Mean	Standard deviation
Energy security	Government	13	4.33	0.65
	Scientists	8	4.00	0.82
	NGOs	17	3.54	1.45
	Media	26	3.79	0.93
	Industries	22	4.05	0.71
	Total	86	3.942	0.912
Economy	Government	13	4.58	0.67
	Scientists	8	4.29	0.76
	NGOs	17	3.46	1.20
	Media	26	3.63	0.97
	Industries	22	3.89	0.74
	Total	86	3.97	0.868
Legislations	Government	13	3.50	0.91
	Scientists	8	3.71	0.76
	NGOs	17	3.31	1.18
	Media	26	3.25	1.07
	Industries	22	2.95	1.08
	Total	86	3.344	1
Environment	Government	13	4.83	0.39
	Scientists	8	4.57	0.79
	NGOs	17	4.00	1.23
	Media	26	3.92	1.06
	Industries	22	4.16	0.90
	Total	86	4.296	0.874
Knowledge	Government	13	4.00	0.85
	Scientists	8	4.29	0.95
	NGOs	17	3.62	1.19
	Media	26	3.88	0.99
	Industries	22	3.74	0.73
	Total	86	3.906	0.942

Social	Government	13	4.50	0.67
	Scientists	8	4.43	0.79
	NGOs	17	3.85	1.21
	Media	26	3.79	1.02
	Industries	22	3.95	0.78
	<i>Total</i>	86	4.104	0.894

3.5 Interview

The first author conducted interviews with selected respondents representing different stakeholder groups to further explore the knowledge underpinning their perceptions and framings of geothermal energy. These interviews were scheduled after the survey sessions and arranged according to respondents' availability, typically within two days to a week, though in some cases at a later time to accommodate scheduling constraints. Each representative was contacted individually, and interviews were conducted either via Zoom or in person, in accordance with COVID-19 restrictions.

a. Instrument

The interviews were open-ended and guided by a semi-structured checklist that covered the same thematic areas as the survey. The checklist was designed to ensure comparability across respondents while allowing flexibility for participants to elaborate on their perspectives. The topics included:

- i. *Knowledge*: To assess stakeholders' knowledge, respondents were asked about their educational background and professional experience related to geothermal issues. In addition, they were invited to share their general understanding of renewable energy, for example, by asking, "*How do you think about the potential of renewable energy in Indonesia?*" This information was considered essential, as knowledge of geothermal energy influences perceptions and shapes stakeholder opinions.
- ii. *Benefits and risks*: Given that perceptions of benefits and risks directly affect stakeholder attitudes, respondents were asked to articulate their views on both dimensions. For instance, they were asked, "*What are the benefits of exploring geothermal energy in Indonesia?*" Parallel questions addressed perceived risks, followed by prompts to elaborate on the reasoning behind their opinions. These insights were valuable for understanding how stakeholders construct arguments around geothermal energy.

- iii. *Frames*: Because frames reflect the perspectives stakeholders use to communicate about geothermal energy in public debates, respondents were asked open-ended questions to avoid constraining their responses. For example, they were asked, "*What perspective do you use to communicate about geothermal energy?*" This approach allowed participants to articulate the frames they employ and provided insight into how these frames shape broader discourse.

b. Demography

The sample consisted of fifteen respondents, including twelve males and three females. Of these, four had educational backgrounds directly related to geothermal energy, five had backgrounds in broader energy disciplines, and six represented diverse academic fields. Regarding organizational roles, five respondents held top management positions, while the remaining ten held middle-level management or employee positions. More detailed profiles of the interviewees are presented below (see Table 3.7):

Table 3.7 Details of the Interviewees

Stakeholders	Representatives	Background	N	Code
Government	State Government	Energy-related	1	G1
	Regional Government	Energy-related	1	G2
		Other disciplines	1	G3
			1	G4
	Local Government	1	G5	
Scientists	Researcher	Geothermal energy-related	1	S1
	Lecturer	Geothermal energy-related	1	S2
NGOs	Energy organization	Energy-related	2	N1
	Environmental organization	Other disciplines	1	N2
				N3
Media	Online media	Other disciplines	1	M1
	News Radio	Other disciplines	1	M2
Industries	Electricity industries	Energy-related	1	I1
	Geothermal industries	Geothermal energy-related	2	I2
				I3
Total			15	

c. Results

All interviews were audio-recorded and subsequently transcribed to ensure accuracy and completeness of the data. The transcripts were then systematically organized according to the main topics addressed: (a) general knowledge of energy-related issues, (b) perceptions of benefits and risks, and (c) knowledge underlying the frames of geothermal energy. Within each topic, responses were clustered thematically to identify recurring patterns and assess the salience of specific themes across stakeholder groups.

i. Knowledge. Of the fifteen respondents, nine were employed in energy-related fields, with four specifically engaged in geothermal energy projects. The remaining four worked in diverse sectors but had prior experience with energy-related topics. For instance, one radio journalist visited a geothermal site and subsequently produced a media report, while another respondent, a science columnist for an online newspaper, wrote several articles on energy issues. These experiences indicate that energy and geothermal topics were familiar to all respondents.

During the interviews, participants were asked about their general knowledge of Indonesia's energy potential. All respondents agreed that Indonesia possesses abundant renewable energy resources, largely due to its geographical location. Several highlighted solar power as a promising source¹¹, while others pointed to hydropower¹². *"I saw local people in a rural area where electricity is not available make simple hydro generators by using mountain streams to produce electricity for lights at their homes"*¹³. Six respondents additionally emphasized geothermal energy as a major potential resource, noting Indonesia's extensive volcanic landscape – from Sabang in the west to Merauke in the east – situated along active tectonic plate boundaries. They argued that the heat stored beneath the earth's surface, generated by volcanic activity, represents a significant and underutilized energy treasure for Indonesia's future¹⁴.

Despite the recognized potential of renewable energy, its development and utilization remain constrained by high costs. Public access is further limited by subsidies that are considerably lower than those provided for fossil fuel energy¹⁵. Another barrier to a successful energy transition is the limited sense of responsibility among local communities. One respondent¹⁶, representing an NGO, described a project to improve electricity access by

¹¹ Respondents N1, N2, I1, M2

¹² Respondents G2, G3, G4, G5, N3

¹³ Statement from G4

¹⁴ Respondents G1, S1, S2, M1, I2, I3

¹⁵ Statement from G3

¹⁶ Statement from N2

installing solar panels in nearby villages. The NGO also provided training on maintenance and technical issues to ensure the panels remained functional. However, after several years, reports indicated that most of the panels had fallen into disrepair and were no longer in use.

In addition to these challenges, respondents highlighted the lack of government attention to renewable energy, attributing it to bureaucratic complexity. One respondent¹⁷ illustrated, *"We once wanted to change the solar lamp for the public park in our city. The process is complicated. Firstly, we must apply for solar lamp stocks, which typically take around four to six months. Letting the park be without the lamp throughout the period is almost impossible. Therefore, with all the considerations, we decided to change the solar lamp to an electric one."*

In summary, the respondents demonstrated awareness of Indonesia's considerable renewable energy potential, despite the country's continued reliance on abundant fossil fuel resources. Solar power and hydropower were the most familiar sources identified, reflecting their visibility and accessibility within local contexts. Owing to Indonesia's geographical position along the Ring of Fire, respondents also recognized the significant potential of geothermal energy, evidenced by natural manifestations such as hot springs. Nevertheless, they emphasized that this potential remains constrained by several barriers. Limited public understanding, bureaucratic complexity, and high development costs were consistently cited as factors that hinder the effective implementation of geothermal energy initiatives.

b. Perceptions of geothermal energy benefits and risks.

1. Perceptions of benefits. In the interviews, respondents¹⁸ frequently highlighted Indonesia's geographic location along the Ring of Fire as a key factor in the abundant supply of geothermal energy. They emphasized that electricity from renewable sources, particularly geothermal energy, produces fewer adverse environmental impacts and is less disruptive to local communities than electricity from fossil-fuel alternatives.

Other respondents¹⁹ further noted that geothermal energy provides the country with an important additional source of electricity, thereby strengthening national energy security and diversifying the energy mix. One respondent²⁰ said, *"The South Sumatera Province has a Master plan to be a National Energy Storage²¹ because the government recognizes that our*

¹⁷ Statement from G5

¹⁸ Statement from S1 dan S2

¹⁹ Respondents N1, N2, G1, I1, I2, and I3

²⁰ Statement from G1

²¹ Translated from Indonesian term "Lumbung Energi Nasional"

province is rich in energy and mineral potential, including geothermal energy beneath the earth's surface. The target for the Master Plan is to be energy independent."

From an economic perspective, geothermal energy exploration makes a significant contribution to regional development. *"The project opens recruitment for local employees. Even after the years the project has operated, several local people still work in the company and even occupy middle management positions,"* mentioned regional government representatives²². Simultaneously, these factors contribute to the social environment of people living in the vicinity. These opportunities not only enhance household incomes but also improve living standards, enabling families to renovate homes from wooden to permanent structures, purchase vehicles, and invest in other aspects of their livelihoods²³.

Geothermal projects also strengthen regional economies through revenue-sharing mechanisms. Company representatives explained that profits are shared with local governments in accordance with established financial regulations, thereby increasing regional income²⁴. In addition, companies contribute to infrastructure development by constructing transportation facilities, educational institutions, and religious buildings such as mosques²⁵. Corporate social responsibility (CSR) initiatives further extend these benefits. For example, one company organized training programs for local coffee farmers, enabling them to improve product quality and enhance market competitiveness²⁶.

The legal framework governing geothermal energy in Indonesia is established under Law No. 21 of 2014. Article 6, paragraph 1, stipulates that national policies and regulations in the geothermal sector encompass permits for direct use, observation, geological information and data, exploration and exploitation, as well as research and development activities. Paragraph 2 further specifies that the implementation of these policies and regulations falls under the authority of the Minister of Energy and Mineral Resources (Undang-Undang Republik Indonesia No. 21 Tahun 2014 Tentang Panas Bumi, 2014). One government representative²⁷ stated, *"I first thought this new regulation was unfair for local, regional, or provincial governments. I confirmed this with the Ministry of Energy and Mineral Resources expert during an event in Jakarta. He advised us to view this energy source as a whole, not*

²² Statement from G2

²³ Respondent G4

²⁴ Respondent I2

²⁵ Respondent I3

²⁶ Respondents I2 and I3

²⁷ Respondent G5

from a location-based perspective. Otherwise, the ownership of the energy resource will be divided into many holders who might have different needs".

One respondent²⁸ emphasized that the growing need for geothermal energy as a new potential source in Indonesia has stimulated research and development in this field. Collaboration among government institutions, industry actors, and scientists has intensified, particularly in efforts to investigate geothermal manifestations and subsurface heat potential. Importantly, these initiatives are not limited to national expertise; international researchers from countries with advanced geothermal energy experience have also partnered with Indonesia to conduct exploration in selected regions. The respondent said, *"I worked on a project to provide data for government and industry about the possible geothermal energy supply beneath a region. I worked together with scientists from Germany, Iceland, and Switzerland"*.

In conclusion, respondents emphasized their awareness of the substantial benefits that geothermal energy offers to Indonesia. They highlighted regions such as South Sumatra, located along the Ring of Fire, as possessing significant subsurface heat potential that can be harnessed as a renewable source of electricity. This potential is reinforced by the enactment of new regulations and the acceleration of research initiatives in the field. Beyond its technical promise, geothermal development also contributes to both national and regional economies through profit-sharing mechanisms and employment opportunities, thereby benefiting local governments and communities alike.

2. Perceptions of risks. Respondents also shared their knowledge regarding the risks associated with geothermal energy. The respondents²⁹ emphasized that geothermal energy remains an uncertain source, as not all identified reserves can be reliably exploited for electricity generation. Of Indonesia's total geothermal potential, only a portion represents proven reserves that can be explored and converted into usable energy. One respondent³⁰ said, *"Geothermal energy is negatively perceived for its uncertainty. Of the total 40% of geothermal energy reserves available in Indonesia, only less than 10% have been explored as proven reserves"*.

Several respondents emphasized the inherent unpredictability of geothermal energy. One respondent explained, *"During the exploitation phase, we identified hot springs as the*

²⁸ Respondent S2

²⁹ Statement from S1 and S2

³⁰ Statement from S1

manifestation of geothermal energy supply. Therefore, we conducted research in the vicinity of the location to determine the amount of power it hosts, which we can use to calculate the amount of capital needed to develop the area. Unfortunately, like our project in South Sumatera Province, the total number of geothermal energy potentials is half of the number resulting from the research."³¹.

Another respondent³² states, *"The development of geothermal energy involved complicated bureaucracy from the initial stage until the project successfully produced the gas for electricity."* He contrasted this with other renewable energy sources, such as solar and hydropower, which involve simpler processes and yield energy more quickly, thereby appearing more attractive to investors and policymakers. Another respondent³³ has concerns about centralized regulatory frameworks³⁴, noting that recent regulatory changes have diminished the role of regional and provincial governments in decision-making, thereby reducing their attention and commitment to geothermal energy development.

The exploration and exploitation phases of geothermal energy, while considerably cleaner than fossil fuel alternatives, cannot be regarded as entirely clean or green³⁵. One respondent reported receiving complaints from local communities during site visits, explaining, *"This energy affects the balance of the environment—people complain about the water drought due to the geothermal exploitation in their surroundings and the clouds of dust from the trucks during the exploitation stages"*³⁶.

Other respondents³⁷ similarly emphasized that geothermal energy cannot be fully categorized as renewable without acknowledging its adverse environmental impacts. One respondent³⁸ recalled, *"I once visited the geothermal project area before the development began. Since the area is located on a mountainous surface within a protected forest, the weather was cold, so I wore a thick jacket to keep warm. Years later, after geothermal energy was explored, I revisited the area. I felt the temperature was higher than it used to be. Neither a jacket nor a sweater was needed. That's how I felt."*

³¹ Statement from I2

³² Statement from N1

³³ Statement from G2

³⁴ Indonesian Regulations year 2014 No. 21 about geothermal energy

³⁵ Statements from N2 and N3

³⁶ Respondent N3

³⁷ Statements from N1, N3, and G3

³⁸ Statement from G5

Beyond environmental concerns, respondents³⁹ consistently highlighted the high costs and lengthy timelines associated with geothermal development, which typically requires seven to 10 years before energy production begins. These investments extend beyond technical processes and infrastructure to encompass social engagement and knowledge sharing⁴⁰. As one respondent explained, *“acceptance is not only about how we educate and explain renewable energy, but also about how we get closer to local people, understand their culture, and live among them as they do. You know, when I visited a project location, I sat with the local people, wearing a sarung⁴¹, enjoying a cup of coffee, fried bananas, and chatting. I try hard to learn and speak their local language. By doing so, they feel that they are much appreciated.”*⁴²

Further findings from this research reveal that knowledge sharing regarding geothermal energy remains limited⁴³. Respondents emphasized the need for more effective dissemination of information about the benefits of renewable energy, including geothermal power, to the wider public. One respondent⁴⁴ argued, *“The related stakeholders should understand the habits of Indonesian people. For example, Indonesian youngsters spend most of their time on social media and follow many influencers' accounts. By encouraging influencers to speak up about geothermal energy, the youth will be familiar with it and later will positively perceive it as a renewable and sustainable energy source.”*

In conclusion, stakeholders perceive investments in geothermal technology as highly risky. These costs extend beyond financial support for exploring uncertain reserves; they also encompass long development timelines and significant social impacts associated with implementation. Moreover, respondents debated the claim that geothermal energy is inherently clean. They argued that geothermal heat power continues to exert adverse environmental effects. Although further research is required to determine whether geothermal exploration contributes to rising local temperatures, such perceptions nonetheless shape public attitudes toward this emerging technology. Finally, respondents identified complex bureaucratic procedures and insufficient public knowledge as critical barriers to the effective implementation of geothermal energy projects

³⁹ Respondents G1, G2, G3, S1, S2, N2, I1, I2, and I3

⁴⁰ Statement from I1, I2, I3 and S1

⁴¹ Sarung is a large tube shape of fabrics, wrapped around the waist, and mostly worn by local people in Indonesia

⁴² Statement from I3

⁴³ Respondents G4, M1 and M2

⁴⁴ Respondent M1

iii. Knowledge underlying the frames of geothermal energy. Interviewees identified several frames through which geothermal energy is perceived. Respondents⁴⁵ stated that the dominant frame emphasizes Indonesia's geothermal potential to support national energy security. Stakeholders also frequently described geothermal energy as a renewable resource with no adverse environmental effects⁴⁶. In addition, economic frames – particularly those related to investment opportunities and local employment – were commonly employed⁴⁷.

However, respondents⁴⁸ noted that the implementation of Indonesian Regulation No. 21/2014 on Geothermal Energy (see Undang-Undang Republik Indonesia No. 21 Tahun 2014 Tentang Panas Bumi, 2014) has constrained their ability to communicate directly with local communities. They argued that negotiations with residents over land permits and incentives from local or regional governments have become the primary issues in public debate. Respondents⁴⁹ further explained that they engaged with the public mainly when social concerns, such as local resistance, emerged. Otherwise, communication about geothermal exploration was centralized and conducted exclusively by the Ministry of Energy and Mineral Resources.

According to several respondents⁵⁰, however, they emphasized the limitations of framing geothermal energy as simply “renewable and green.” He explained, *“Local people don't understand the message. Sit with them, talk in their language, and prioritize their way of life, such as their culture and job as farmers.”*

However, according to other respondents⁵¹, it is essential to inform the public, particularly local communities, that geothermal energy is renewable and has fewer environmental impacts than fossil fuels. One respondent acknowledged the challenges of such efforts, noting, *“I know it takes effort, time, and money. Yet, it still needs to be done. Otherwise, people will only see this kind of energy development from an economic perspective; how much will I get from this project?”*⁵² She further emphasized that personal and cultural approaches remain crucial for fostering local acceptance.

Environmental concerns were also raised during the interviews. One respondent stressed the importance of transparency, *“Just be honest and open about the effects of energy*

⁴⁵ Respondents G1, S1, S2, I1, I2, and I3

⁴⁶ Respondents G1, S1, S2, N1, and N2

⁴⁷ Respondent G1

⁴⁸ Respondents G2, G3, G4, and G5

⁴⁹ Statements from G2 and G4

⁵⁰ Respondent G2

⁵¹ Respondents S1, S2, N1, and N2

⁵² Statement from S1

development on local people. As long as the communication is proper and suitable, they will understand. Of course, it won't be instant. However, you cannot say it's good when it's not, just to comfort them. The effects will be worse."⁵³.

Given that geothermal sites are often located near residential areas, respondents emphasized the importance of prioritizing community convenience. They⁵⁴ described efforts to build trust by informing residents about the potential geothermal resources in their region and the forthcoming development. One respondent explained, *"We did the socialization and informed the local people about what geothermal is and what benefits local people can receive. We also informed them that everything was safe. There would be no adverse environmental effects, and we would compensate them for any inconvenience during the development, such as dust, noise, etc."*

The dissemination of information about geothermal energy has not been well-received by the public⁵⁵. One respondent reflected on her experience as a science columnist, *"I have written many articles about science since I was placed in that column. Science encompasses many aspects, including energy. I've written about renewable energy and other related issues. But, as long as I can remember, I only wrote once about geothermal energy."*⁵⁶ She emphasized that geothermal energy receives limited media coverage, and when it does, it is typically framed solely as a renewable energy source. *"I don't think it's familiar enough for the public to understand, especially the youngsters,"* she added.

In summary, debates surrounding geothermal energy in Indonesia are largely driven by the country's vast potential, stemming from its location along the Ring of Fire. Stakeholders frame this potential as both a strategic opportunity for energy security and economic growth, and as a source of challenges related to environmental impacts, high implementation costs, regulatory adjustments, and social concerns such as community resistance. While technical, economic, and regulatory dimensions dominate stakeholder communication, cultural-religious values are incorporated more subtly. These values emerge in discussions about community acceptance, local traditions, and moral obligations toward environmental stewardship, highlighting that social legitimacy is as critical as technical feasibility. Thus, stakeholders perceive geothermal energy through a dual lens of opportunity and risk, while embedding

⁵³ Statement from N3

⁵⁴ Respondent I2 and I3

⁵⁵ Statement from M1 and M2

⁵⁶ Respondents M1

cultural-religious considerations into their communication, an aspect underrepresented in media narratives but vital for project acceptance and long-term sustainability.

3.6 Discussion

This research project was designed to investigate how different stakeholder groups perceive and frame geothermal energy development in Indonesia, as well as the forms of knowledge underpinning these perspectives. A mixed-methods approach was employed, comprising surveys with 86 stakeholders and in-depth interviews with 15 representatives. The study focused on six issue categories identified through prior media analysis (Trisiah et al., 2022), i.e., energy security, economy, legislation, environment, knowledge, and social issues, and five stakeholder groups, i.e., government, industry, NGOs and associations, scientists, and media.

Importantly, this research places particular emphasis on social issues, especially cultural-religious dimensions, which emerged from field research as the second most salient factors shaping stakeholder perceptions and framing preferences. While environmental concerns remain the dominant category, social issues consistently follow, highlighting that legitimacy for geothermal development depends not only on ecological safeguards and economic feasibility but also on sensitivity to local traditions, values, and belief systems. However, media coverage largely sidelines these dimensions in favor of energy security or economic framings (Trisiah et al., 2022). This gap arises because media are heavily reliant on press releases and straightforward news formats, which privilege elite-driven discourses and lack access to stakeholder deliberations. Journalists rarely pursue investigative reporting, with coverage often shaped by project events or company communications (Gunawan, 2019; Movanita, 2018; Pratiwi, 2021). This lack of independent inquiry means that critical socio-cultural concerns are not adequately represented, as journalists seldom ask and stakeholders seldom disclose. As a result, what drives decision-making does not trickle down into public discourse, distorting perceptions and marginalizing the social aspects crucial to legitimacy and accountability in the energy transition.

The findings reveal that stakeholders do not share a uniform understanding of geothermal energy, despite broad recognition of Indonesia's abundant geothermal potential and its contribution to environmental sustainability and national energy security (Pambudi, 2018; Pambudi & Ulfa, 2024; Poernomo & Effendi, 2017). Environmental concerns dominate stakeholder narratives, with government and industry actors emphasizing both benefits, such as its renewable character and contribution to sustainability, and risks, particularly those

associated with exploration in conservation areas. Social issues emerge as equally important, with stakeholders consistently highlighting cultural-religious sensitivities, community resistance, and employment impacts as critical factors influencing acceptance. These concerns are especially pronounced when projects overlap with lands held under customary rights. Examples are *Tunggu Tubang* inheritance, in which ancestral land remains within the family, preventing external ownership (Murdiati et al., 2018), or conservation zones, where legitimacy depends on respect for local traditions and moral obligations toward environmental stewardship. Although media coverage tends to underrepresent these dimensions (Trisiah et al., 2022), this field research demonstrates that social issues are deeply embedded in stakeholder narratives and cannot be considered peripheral.

Energy security is also a recurring theme, framed by government and industry stakeholders as a reliable baseload source that can reduce dependence on fossil fuels, aligning with broader literature on its contribution to national energy independence (Pambudi, 2018). The interviews confirm that energy security is frequently invoked as a central justification for expanding geothermal development. Economic considerations receive moderate emphasis, with the government emphasizing regional income for the benefits, while industry stakeholders stress employment creation but also point to difficulties in securing investment. These expectations are tempered by recognition of high development costs, bureaucratic barriers, and subsidy misalignments (Rayhanna, 2017). Comparative references to Switzerland suggest that stronger risk-sharing mechanisms and subsidy structures could enhance investment outcomes (Link et al., 2020).

Several methodological limitations must be acknowledged. First, data collection occurred during the COVID-19 pandemic, when travel restrictions and safety measures reduced flexibility. Consequently, the number of participants within each stakeholder group was low, constraining the robustness of statistical comparisons. Quantitative findings should therefore be interpreted with caution, while qualitative insights should be seen as indicative rather than representative. Second, restricting frames to six categories, derived from media analysis, may have excluded other relevant framings. Stakeholders could potentially emphasize additional dimensions, such as technological innovation, international cooperation, or equity concerns, within the semi-structured interviews, which provided room for exploration. However, no such additional framings emerged during the interviews.

Despite these limitations, the study highlights important implications. Technical and economic arguments alone are insufficient to secure legitimacy for geothermal projects. Environmental legitimacy and energy security are widely recognized, but social issues –

particularly cultural and religious sensitivities – play a pivotal role in shaping acceptance. These factors do not override all other concerns, but they inform how local communities interpret risk, trust, and legitimacy. Policymakers and industry actors must therefore embed socio-cultural considerations into governance frameworks, empower local governments in community engagement, and design participatory processes that respect local traditions (Alizar et al., 2025; Amriani & Alfian, 2025; Susilowati et al., 2025). Future research could address the limitations identified here by expanding stakeholder samples, incorporating additional frames, and employing longitudinal designs. Comparative studies across regions with strong customary or spiritual ties to land could illuminate how governance structures either exacerbate or alleviate resistance. Ultimately, exploring models of culturally embedded energy governance, where local institutions and religious authorities play a formal role in decision-making, could offer pathways toward more inclusive and sustainable geothermal development.

Chapter IV

Local Perception and Frames of Geothermal Energy: The Relevance of Cultural and Religious Values

Chapter IV

Local Perception and Frames of Geothermal Energy: The Relevance of Cultural and Religious Values

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4.1 Introduction

Local perceptions and frames are key factors in determining whether geothermal energy is successfully implemented. They are shaped not only by tangible technical, economic, and environmental considerations but also by deeply rooted cultural and religious narratives that affect how local communities perceive the implementation of energy technology.

Geothermal energy, an emerging and uncertain energy, might face doubt and resistance from the public when the technology goes against locals' beliefs and culture (Antara, 2013; Vargas Payera, 2018). In Chile, for example, the development of a geothermal project located on a mountain faced strong opposition from locals who had spiritual beliefs about the mountain. In such contexts, the act of drilling to produce geothermal energy is not merely a technical operation, but a culturally charged intervention that is difficult for local communities to accept (Vargas-Payera et al., 2020a). A parallel situation occurred in Japan, where local resistance emerged over fears that geothermal exploration could damage hot spring resources, an integral part of regional identity and cultural practice (Erfurt-Cooper, 2010; Kubota, 2015).

In contrast, locals accept the implementation of geothermal energy when it aligns with their traditions and values (Neilson et al., 2010) and supports their socio-economic well-being (Renoth et al., 2023). For example, when the heat power from the Earth's subsurface decreases local heat costs and raises household welfare (Meirbekova et al., 2024). In countries such as New Zealand and Iceland, geothermal development has provided local employment opportunities while respecting and preserving indigenous cultural practices (Bargh, 2012; Daysh et al., 2020; Jónsson & Rastrick, 2017; Neilson et al., 2010; Shortall & Kharrazi, 2017). In these contexts, geothermal resources have bolstered tourism by allowing local people to interpret and showcase traditional knowledge tied to geothermal phenomena, such as hot springs, while generating income through roles like tour guiding (Musembi, 2010; World Bank et al., 2017). These contributions subsequently led to a success story in geothermal exploration,

facilitating the successful integration of energy transition and culture (Neilson et al., 2010; Pavlakovič & Turnšek, 2019). Thus, the geothermal acceptability of local people living in the vicinity of the project is pivotal for the project owners to succeed. Otherwise, delays or even project cancellations are highly likely to occur (De Vries, 2017).

Indonesia, with a potential geothermal resource of 40% of the world's supply, faces similar challenges. In terms of benefits, research has shown that local acceptability increased when the implementation of a geothermal energy project included the recruitment of local employees, which increased locals' socio-economic status (Pambudi et al., 2022). Additionally, the direct application of geothermal energy for coffee drying, utilising geothermal heat vapour on Java Island, has enhanced local productivity, ensuring continuous coffee processing regardless of weather conditions (Azrian et al., 2023; Malik Ibrahim et al., 2022).

However, resistance also happens in Indonesia. Several factors contribute to these reactions, including opposition to exploring geothermal resources in West Sumatera due to environmental and social concerns. They perceived that exploration might reduce soil fertilisation, thereby threatening agricultural productivity, a critical component of local livelihoods (Sastra Hadi & Vidya Putra, 2019). In other regions, resistance is primarily caused by the location of energy resources. For example, in Bedugul, Bali, locals argued that exploring geothermal energy might disturb their sacred connection to nature, given the presence of 36 Hindu temples surrounding the geothermal manifestations (Berita Bali, 2013). Not only did local people resist this project, but local and regional governments were on the same side, opposing this project from 2005 onwards (Iman et al., 2023; Nurdifa, 2025).

Similar opposition to the development of geothermal energy, due to cultural-religious factors, also appeared in South Sumatera Province. The geothermal implementation in this province is slow, despite hosting a 10% potential of Indonesian total resources due to its location on the active volcanic arc along the Great Sumateran Fault that runs parallel to the southwestern coast of Sumatera (Artyanto et al., 2018; Darma, 2016). Literature indicates that the region in South Sumatera with the most potential geothermal resources is exclusive to its traditional culture, Tunggu Tubang (Anzari & Sarwono, 2019). This culture ensures that ancestral land remains within the family, preventing external ownership (Murdiati et al., 2018). Tunggu Tubang is a culture centred on land. Not only is land a symbol of the wealth of a family that spans generations, but in the Tunggu Tubang culture, land represents the care and responsibility to guide all families down the right path (Harsuno et al., 2018). Within this tradition, inherited land typically includes agricultural fields, residential properties, and, in

some cases, fish ponds (Ismi, 2025). The acquisition of this symbol for the needs of geothermal projects or for any other reason might be complicated for the local people to achieve.

This region is also renowned for its strong adherence to Islamic values in daily life. For example, after Maghrib prayer, children go to *Guru Ngaji's*⁵⁷ house to recite the Quran. Another example is that drinking alcohol, which is common in some other cultural backgrounds, is forbidden in the region because it is against Islamic values. These cultural-religious values became a source of resistance to the geothermal project, as local residents recalled experiences from other developments where external workers were reported to consume alcohol. Fears arose that such habits could negatively influence their own family members if they were employed alongside outsiders. Concerns of this nature surfaced from the very beginning of the project, particularly during the construction of infrastructure and drilling activities. Nevertheless, systematic research among residents to substantiate these claims remains lacking.

In general, despite its importance, analysis of Indonesian media revealed that social issues such as cultural-religious factors are less represented (see Chapter 2, Trisiah et al., 2021). Key stakeholders, such as the state government and companies, emphasised energy security and economic issues, but often overlooked cultural-religious issues in their debate (Ministry of Energy and Mineral Resources, 2021; Rayhanna, 2017; Saptadji, 2016). This oversight contributes to a limited understanding of the broader societal implications of geothermal energy, particularly as experienced by local communities. To bridge this gap, empirical research is essential for capturing local perspectives and providing a more nuanced, comprehensive analysis.

This knowledge gap leads to the following central research question:

“What roles do cultural and religious values play in shaping local debates around geothermal energy in South Sumatera?” To effectively explore this question, conducting fieldwork and engaging directly with local Indonesian communities through interviews is essential.

4.2 Methodology

a. Interview

To answer the research question, I collected information about local knowledge and how they perceived geothermal energy. Knowledge plays a critical role in shaping stakeholders'

⁵⁷ The teacher for reciting the Quran

perceptions (Cousse et al., 2021; Willems et al., 2020), whether derived from their experience or media exposure (Stauffacher et al., 2015). The semi-structured interview topics acknowledge the locals' dual role as both residents and key stakeholders in the geothermal energy project, thereby enabling meaningful comparisons across diverse Indonesian geothermal contexts. Moreover, exploring cultural and religious values was essential, as these dimensions critically inform local perceptions and framings of geothermal energy (Shortall & Kharrazi, 2017).

The interview instrument encompassed three main constructs, and all respondents were asked the same set of questions. The constructs are as follows:

- a. *Knowledge*: To assess local people's understanding of geothermal energy, they were asked questions such as, "*What do you know about the exploration that occurred in the village?*" Follow-up questions were developed based on the information given by the respondents.
- b. *Benefits and risks*: To assess respondents' perceptions of geothermal energy, they were asked about the benefits and risks of geothermal development. The questions that followed were about the arguments for these perceptions.
- c. *Cultural-religious issues* were explored by questions such as: "*To what extent do you think local cultural-religious issues affect geothermal exploration?*"

b. Research Process

I conducted field research in the Sumatera Selatan province in Indonesia, in five villages across two districts. From the capital city of South Sumatera, it is 190 km away (a five-hour drive) to the first capital regency of the affected areas. From there, another four hours of driving on asphalt and rocky roads through the trees are needed to reach the first destination, the nearest village to a geothermal energy project site. To reach the other four villages, two were higher up the mountain; each trip takes one to two hours.

Among other locations, this site has significant potential for geothermal energy, as it hosts 10% of Indonesia's total supply (Pengkajian et al., 2006). Besides its potential, I chose this place because the implementation of a geothermal project faced considerable challenges. Locals opposed the project for several reasons. First, the plant is located in preserved forests, as most of Indonesia's geothermal supply is, which may disturb the flora and fauna ecosystems (Agustina, 2019). Second, the exploration may also impact the groundwater (Haryanto & Supriatma, 2020), which is crucial to the locals' lives in their paddy farming fields. Third, the

projects need land, which contradicts the locals' lives related to the Tunggu Tubang culture,⁵⁸ as explained above.

I personally travelled to the region to conduct interviews with local residents. Given the remote location of the villages and the limited internet connectivity, telephone or online surveys were not feasible. Interviews were carried out in participants' homes and fields to ensure accessibility and comfort. Conducting interviews in these natural settings was intended to provide a deeper understanding of the local context (Garcia & Sunderlin, 2011).

To facilitate communication and ensure that the data collection ran smoothly, I contacted a local person to guide and interpret, helping me better understand the local language, as it differs from my native language. The guide also helped me find a local house where I could stay during data collection, as the location is remote and no hotels are available nearby.

c. Methods

The field research was conducted between July and August 2021, during the COVID-19 pandemic, when restrictions were still in effect worldwide. I needed to be quarantined for eight days after arriving in Indonesia. During data collection, regular COVID-19 protocols were followed, including wearing masks, maintaining social distancing, and washing hands frequently. The data collection for the five villages took five days, including a two-day journey.

Respondents consisted of fifteen local participants drawn from all five affected villages (see Appendix E), selected through stakeholder mapping and snowball sampling (Etikan, 2016). I began by conducting interviews with the five village heads, each lasting between one and two hours. During these sessions, I outlined the objectives of the data collection and emphasized that respondent anonymity would be strictly maintained.⁵⁹ The village heads serve as the formal leaders of their respective communities. In the Indonesian context, a village head (*kepala desa*) is an elected official responsible for local governance and representing the collective interests of the community in matters such as land use and development projects. They are chosen through community voting and hold the position for a five-year term, which may be extended if re-elected. Their position as gatekeepers made them crucial entry points for identifying additional respondents.

From the head villages' references, ten respondents were gathered who met the following criteria: local people aged 18 years or older, and affected directly or indirectly by the

⁵⁸ Preliminary interviews with local people

⁵⁹ The research procedure follows the TU Delft HREC (Human Research Ethics Committee)

project, e.g., their land was used for the project's infrastructure. Among the interviewees, three held postgraduate degrees, four had bachelor's degrees, and eight respondents were senior high school graduates. While local people's views may not reflect those of the entire community, they often appear as legitimate spokespersons with influence within their community. Therefore, their views on the project are important for its general acceptability.

Interviews were conducted with the assistance of a DMP to ensure clarity and cultural sensitivity. In most cases, respondents were interviewed individually; however, in two instances, respondents were accompanied by their spouse. For consistency, only the statements provided directly by the respondents were included in the analysis.

This study employed a qualitative data analysis approach as outlined by Faherty (see Joseph, 2025). The process involved five sequential steps. First, the interview recordings were transcribed and subsequently translated from the local language into English. Second, all transcripts were carefully reviewed, and responses were coded according to the main constructs of the interview, namely, knowledge, perceived benefits and risks, and cultural-religious considerations. Third, the codes were grouped based on their similarities and differences (see Appendix F). Fourth, the findings were organized and discussed. Finally, selected results are disseminated through this paper as part of the fifth step.

4.3 Results

I first elaborate on local knowledge about the regional development of geothermal energy projects. The following sections will further explain the pivotal issues of geothermal energy development from local people's perspectives relating to risks and cultural-religious issues.

a. Knowledge of Geothermal Energy and Other Related Information

All fifteen respondents were aware that the geothermal energy project was being developed in their region. However, only one demonstrated a proper understanding of geothermal energy, describing it as water vapor heated in the Earth's subsurface and drilled to reach the Earth's surface⁶⁰. Some interviewees mentioned that geothermal energy is electricity, meaning that whatever comes out of drilling beneath the earth's surface is electricity and can be directly used by households.⁶¹ Some likened the project to coal mining operations in a neighbouring area.

⁶⁰ Interview with respondent In8

⁶¹ Interview with respondents H1, H2, H3, In2, and In3

This perceived similarity with coal mining is not without reason, as local people have been exposed to negative experiences associated with coal mining. A mining area, located 131 km from the geothermal project, remained barren despite reforestation initiated by the coal company. The majority of workers were outsiders, with only a few locals, and a smaller number of them were permanent workers. Although employment benefits the region, interviewees expressed concern that the influx of culturally diverse outsiders posed a social risk to the community⁶².

Media exposure also served as an important source of information about the project's development. Respondents noted that online news outlets reported negative experiences of geothermal exploration in other Indonesian provinces, such as depletion of groundwater resources, raising concerns among locals about similar environmental impacts in their region⁶³. Furthermore, media coverage shaped negative perceptions among community members who viewed geothermal development as a threat to cultural heritage regarding the potential disruption of *Tanah Ulayat* (customary ancestral land)⁶⁴.

Despite prior socialisation from the project owner, high resistance and tension surrounding the geothermal project emerged during the planning phase. Local people protested the project plan by blocking the access roads. One of the respondents stated, *"They invited the local representatives, especially those whose land was directly affected. They also negotiated with the elders and the religious leaders to smooth the implementation."*⁶⁵

Several meetings were held, but stakeholders were unable to reach an agreement on exploring geothermal energy.⁶⁶ Local people argued that opening energy exploration in their area would disturb the environment, much as coal mining does. Furthermore, the project would harm the environment, increase pollution, damage their coffee plantation, and contribute to deforestation⁶⁷. The regent affirmed these arguments and officially rejected the implementation plan. This decision triggered a wave of protests from local people against the project, halting its implementation⁶⁸.

⁶² Interview with respondent In7

⁶³ Interview with respondents H3, H4, and In3

⁶⁴ Interview with respondents In2 and In4

⁶⁵ Interview with respondent In6. The original statement: *"Perusahaan waktu itu ngundang beberapa perwakilan masyarakat sini, terutama yang rumahnya tekeno proyek. Wong perusahaan jago ngundang tetuo-tetuo disini, samo pemuka agama, agar proyek mereka nih pacak bejalan."*

⁶⁶ Interview with respondents H4, In1, In4, and In7

⁶⁷ Interview with respondents H3, In2, In3, and In8

⁶⁸ Interview with respondents H1, H2, In6, In7, and In8

Prolonged negotiation and the dynamic political situation in the regions caused the project, initially planned in 2005, to be delayed until 2012 (Mudassir, 2022; Pemerintah Provinsi Sumatera Selatan et al., 2006; PT Marubeni Indonesia, 2013). The decision to resume the geothermal project was made between the newly appointed regent, the province, the State government, the company, and the local people's representatives.⁶⁹ Despite the agreement, up until the time of the interviews, local people remained unaware of geothermal energy's potential as a renewable, sustainable, and environmentally friendly energy resource.

b. The Roles of Cultural-Religious Issues of Geothermal Energy in Local Debate

Cultural-religious issues were quite dominant in the debate, especially at the beginning of the project's development. Central to these concerns was the traditional *Tunggu Tubang* practice, which prohibits the transfer or trade of land and its associated properties, such as farming fields and fish ponds, thereby reinforcing the region's exclusivity. In addition, the religious values of Islam, shared by all local residents, were perceived as in conflict with the values and practices of incoming outsiders, further intensifying apprehensions about the project's social and cultural implications.⁷⁰

In general, locals were concerned about three important topics: economic, environmental, and quality of life issues.

i. Economic Issues

Issues related to employment were the most dominant economic concerns in the debate. This topic relates to *Tunggu Tubang*'s traditional culture because one of its legacies is the cultivation of inherited farming fields by the inheritors. If locals were more interested in working at the company, the farming field would be wasted. Regardless of the situation, working in the company was attractive for local people. Compared to being farmers, they earn more from the company, thereby raising their economic level. One respondent claimed, "*It was good when I worked in the company. I could buy a motorcycle and even buy a new house.*"⁷¹

However, the different levels of economic status between those who worked in the company and those who did not revealed social jealousy among the locals. One respondent

⁶⁹ Interview with respondents H5, In6, and In8

⁷⁰ Interviews with respondents In6 and In7

⁷¹ Interview with respondent In7. The original statement: "*Dulu aku lumayan Bu, walaupun cuma begawe sebentar, pacaklah mbeli motor samo mbenerin rumah.*"

stated, *“It is nice to see those working in the company. They can buy furniture and motorcycles, and live in luxury houses. Therefore, people in the villages are keen to work for the company.”*⁷²

Locals mostly worked as temporary workers during the construction of the infrastructure. Their contracts typically lasted for one year, and workers from other villages often substituted for them. A respondent noted that the company employs a rotational hiring system, alternating recruitment among five villages to mitigate potential inter-community tensions: *“During this term, employers are hired from villages A and B. Next term, the turn is for other villages, C, D, and E.”*⁷³ Although the company had coordinated with the village heads and religious leaders to ensure employment was fairly distributed, tension among local people continued to increase due to a structural imbalance between labour demand and community expectations.⁷⁴

Given the legacy of the Tunggu Tubang tradition in which the farming field needs to be exploited to support the family, the situation where locals prefer to work in the company instead of working in the farming field raised concerns among the elders. Such a shift was seen as potentially disruptive to the cultural equilibrium, as the Tunggu Tubang fields are vital for sustaining the livelihoods and identity of Tunggu Tubang families⁷⁵.

Another economic issue is the compensation provided by the project owners. The company incurred substantial financial costs to mitigate risks at the affected houses, including noise pollution, structural damage to homes caused by construction activities, and land acquisition for infrastructure development⁷⁶. *“Thank God we received good compensation and can renovate our house.”*⁷⁷ However, the compensation, particularly for noise pollution, was distributed only during the early stages of the project⁷⁸. When the interviews were conducted, the locals were no longer receiving benefits, despite the pollution remaining.

⁷² Interview with respondent In5. The original statement: *“oi lemak kaba yang begawe di perusahaan itu, rato-rato lah mbagusi rumah, beli isi rumah, motor, mewahlah pokoknya, makonyo wong maseh berijo nak begawe disano.”*

⁷³ Interview with H3. The original statement: *“Nah misalnya di periode ini, yang nak begawe tuh diambek dari dusun A samo B. kagek periode selanjutnya gentian Dusun C, D samo E.”*

⁷⁴ Interview with respondents H3 and H4

⁷⁵ Interview with respondents H5, In7, and In8

⁷⁶ Interviews with respondents H4 and In3

⁷⁷ Interview with respondent In3. The original statement: *“Alhamdulillah Ganti ruginyo kemarin lumayan besak, jadi kami pacak mbeneri rumah.”*

⁷⁸ Interviews with respondents H4 and In3

ii. Environmental Issues

Tunggu Tubang culture is represented through a set of symbolic artifacts, including a fishing net, spear, axe, jar, and *tubang* (rice storage) (see picture 1). These symbols carry deep philosophical meaning. The fishing net signifies the role of unifying and safeguarding the family, preserving ancestral wealth, serving as a central gathering point, and demonstrating decisiveness in family leadership. The spear (*tombak*) symbolises visionary guidance, underscoring the need for the *Tunggu Tubang* to direct the family toward a clear and sustainable future. The axe (*kapak*) embodies justice and the capacity to resolve intra-family conflicts equitably. The jar (*guci*) represents the ability to mediate differences, accommodate diverse familial aspirations, and protect both honourable and difficult family narratives. The rice storage (*tubang*) reflects the family's preparedness to face any circumstances that may affect their well-being (Harsuno et al., 2018). The symbols also serve practical functions closely tied to environmental stewardship. The fishnet facilitates fishing in community ponds, the spear aids in forest hunting, the axes are essential for cutting firewood for cooking, and the *tubang* ensures the proper storage of harvested rice from paddy fields. Together, these symbols reflect the harmonious relationship between tradition and the environment.



Figure 4.1 Tunggu Tubang symbol

The symbolic representations in Tunggu Tubang⁷⁹ culture reflect the profound interdependence of local communities with their surrounding environment, including farms, forests, and ponds. Meanwhile, the environmental concerns regarding geothermal energy, as discussed by local people, primarily focus on the adverse effects of geothermal project development on the local environment and the natural imbalance that disrupts wildlife⁸⁰.

The regencies where this research was conducted are well-known for their potential energy resources. There has been a long history of coal exploration, dating back to the Dutch colonization era in the 17th century, and continuing to the present day (Sumardi et al., 2022). The project area is barren, and pollution persists despite the company's reforestation efforts. Although this coal location is 131 km away from the geothermal project site, local people who lived close to the area where the heat power was manifested were exposed to the negative experiences of the coal company.

Environmental issues were raised in 2008, at the project's early stage. They argued that opening energy exploration in their surroundings would disturb the environment. Like coal mining, the project would harm the environment, increase pollution, deplete the land's water resources, disrupt their coffee plantation, and lead to deforestation.⁸¹ *"If the trees were cut and the land was getting unfertilized, how can we live when our life depends on nature?"*⁸² In response, the local community protested the project plan by blocking the access roads.

The company and state government representatives worked hard to negotiate with the local people⁸³. *"The meeting occurred many times, but no agreement was reached then."*⁸⁴ Furthermore, the regent supported this argument by stating that the regions declined the geothermal energy implementation plan. The regent's decision sparked a high wave of protests from local people against the project, thereby halting its implementation.⁸⁵ The agreement was finally reached in 2012, following further negotiations and the dynamic political situation (Mudassir, 2022; PT Marubeni Indonesia, 2013).

⁷⁹ <https://kebudayaan.kemdikbud.go.id/ditkma/pancapedia-keseruan-pernikahan-tunggu-tubang/>

⁸⁰ Interview with respondents H2, H3, In3, and In5

⁸¹ Interview with respondents H3, In2, In3, and In8

⁸² Interview with respondent In3. The original statement: *"Kalu segalo pohon nih ditebang trus tanah nih kan laju jadi dak subur lagi, cakmano kami nak idup Bu, sementaro idup kami tergantung dari sinilah."*

⁸³ Interview with respondents H4, In1, In4, and In7

⁸⁴ Interview with respondent H4. The original statement: *"Lah berapa kali pokoknya pertemuan nih Pak, maseh dak sepakat tula."*

⁸⁵ Interview with respondents H1, H2, In6, In7, and In8

Environmental concerns resurfaced during the construction of the project infrastructure. The development of roads, pipelines, towers, and related facilities was perceived to increase pollution levels, particularly noise and dust. Beyond air pollution, the dust had direct consequences for local agriculture: coffee farming became less productive as dust settled on the flowers, rendering them infertile⁸⁶. These impacts not only disrupted livelihoods but also reinforced negative community perceptions of energy technology implementation.

Another environmental issue emerged with the unexpected presence of tigers appearing dangerously close to residential areas during the well-drilling phase, an occurrence that had never been reported previously⁸⁷. Media coverage noted five accidents linked to these encounters, resulting in three fatalities and two injuries (Agustina, 2019). The governor attributed this phenomenon to the clearing of approximately 2,000 acres of forest for geothermal exploration (CNN Indonesia, 2019). Although some reports claimed that biodiversity had increased and that exploration activities did not disturb the wildlife ecosystem (Aji et al., 2022), evidence suggested that seismic activity from drilling contributed to tiger displacement. This situation posed risks not only to local communities but also to the tigers' safety and well-being.

iii. Quality of Life Issues

The development of geothermal projects impacts the quality of life for local people. The effects primarily benefit local people by improving access to electricity and infrastructure. For details, two of the affected villages are located in a remote area of the region's highlands. The National Electricity Enterprise (PLN)'s access to electrify the villages is lacking. The power the villages used came from generators or hydropower, but it was insufficient to meet local needs. The current power supply can only be used for lights and phone chargers, not for refrigerators, fans, air conditioners, or other electricity-consuming devices, in households with a significant power supply.⁸⁸ Therefore, local people highly expected that geothermal energy would benefit them by providing full access to electricity.⁸⁹ However, at the time of the interviews, the electricity access was still limited.

Regarding infrastructure, transportation access was mentioned positively in the local debate. People talked about the easier access between villages, thanks to the roads and bridges

⁸⁶ Interview with respondents H3 and In3

⁸⁷ Interview with respondent In4

⁸⁸ Interviews with respondents In2, In6, and In7

⁸⁹ Interview with respondents H1, H2, and I5

built by the company. Although dust and noise were the consequences, local people agreed that the project infrastructure eased their lives.⁹⁰ *“It took some time to reach Village B because we had to go around the forest. However, it is now accessible due to the new road being open.”*⁹¹

However, there is a price to be paid for this ease. Locals needed to consider trading their ancestral land for the construction of the electricity tower and for access to roads. Despite it being for a wider public purpose, locals learned from their ancestors that the land was not only about inheritance but also a symbol of family unity that goes over the generations (Harsuno et al., 2018; Velinda et al., 2017). Trading the land for any purpose was considered a violation of cultural values.⁹²

This situation led to a dilemma for the indigenous people. On one hand, they need to preserve the tradition; on the other hand, this project is designed to meet the broader public's needs. Therefore, locals allowed the company representatives to negotiate regarding the land acquisition. The representatives must meet and talk to all heirs, following the mother's line, until the agreement is reached⁹³. *“In some cases, the project owners need to move the tower locations because they could not reach a good agreement with the heirs. However, at least one case resulted in a mutually accepted agreement between the heirs and the project developer.”*⁹⁴

The issue of compensation raised was not limited to the monetary restitution given to the locals; it also encompassed cultural considerations associated with land ownership. In cases where the land is part of the Tunggu Tubang inheritance system, it is forbidden to be traded unless no living heirs remain in the region.⁹⁵ In this geothermal project case, the negotiation proved particularly challenging, as the project owners were required to obtain approval from all ancestral custodians.⁹⁶ One respondent said, *“The company owner needs to find a new place*

⁹⁰ Interview with respondents H5, In2 and In3

⁹¹ Interview with respondent H5. The original statement: *“Dulu kalo nak ke dusun B itu jalannyo muter, sekarang lah terbuka oleh proyek ini.”*

⁹² Interview with respondents H3, H4, In8, and U1

⁹³ Interview with respondents In2, In3, U1, and U2

⁹⁴ Interview with respondent H2. The original statement: *“Ado beberapa kejadian, pihak Perusahaan laju mindahken Lokasi tower karena dak sepakat dengan keluarga pewaris ini kan. Tapi ado jugo sikok tower yang pacak dibangun dilokasi itu karena lah ado kesepakatan akhirnya.”*

⁹⁵ Interview with respondents In1, In6, In7, In8, and U2

⁹⁶ Interview with respondents H1, H3, In4, and In5

for the tower construction site because they don't have access from the Tunggu Tubang ancestors.”⁹⁷.

The locals stated that if only other places were still possible without using the Tunggu Tubang heritage land, they would support the project even more.⁹⁸ *“I can understand why people in my villages resist using their Tunggu Tubang land property for the project. It is not only a property but also an inheritance that goes through generations.”⁹⁹ “If no other choice is available, I would say, for the sake of wider public needs, sacrificing the land is allowable.”¹⁰⁰*

Another quality-of-life issue is the cultural effects of outsiders. Locals learned from coal mining in the neighbouring region that some skilled workers were foreigners; others were from different provinces in Indonesia and had diverse cultural backgrounds. Some had habits like drinking alcohol, which were against the locals' values. Few mingled with the locals, which widened the gap. This situation frightened the local people in the area where the geothermal project was developed. They worried that these external habits might negatively affect their traditional cultures¹⁰¹.

4.4 Discussion

Geothermal energy can be found everywhere, not only in these five villages described in this chapter. Its implementation is not solely about renewable energy exploration but also about ensuring harmonious coexistence with local communities.

This research has underscored the importance of taking local perspectives on geothermal energy into account. From this finding, I further discuss the roles of cultural-religious values in the local debate on geothermal energy in Indonesia by elaborating on the cultural-religious embeddedness of other issues and their relation to regional decision-making.

I found that the dominant issues in the local debate on geothermal energy, embedded in cultural-religious concerns, were the economy, the environment, and quality of life. Employment and compensation were the economic topics mentioned most during the

⁹⁷ Interview with the respondent In4. The original statement: *“Dulu pernah Perusahaan laju mindahke rencana posisi tower karena tanahnya dak dilepas oleh keluarga Tunggu Tubang.”*

⁹⁸ Interview with respondents U1 and U2

⁹⁹ Interview with respondent U1. The original statement: *“Ngerti sih ngapo masyarakat di sano kuat nian nolak nggunoke tanah Tunggu Tubang mereka untuk proyek. Karena ini bukan cuma urusan tanah tapi peninggalan dari generasi ke generasi.”*

¹⁰⁰ Interview with respondent U2. The original statement: *“kalo memeang katek pilihan laen, dan ini untuk kepentingan masyarakat luas, tanah ini boleh bae digunoken.”*

¹⁰¹ Interview with respondents In6 and In7

interviews with local people. Employment benefits local people by providing new work schemes and payment. However, it creates a socio-economic gap between those who were recruited and those who were not, which, if not properly managed, could lead to polarisation in the future.

The shift from being farmers to company workers also raised concerns among the local elders. This alteration affected, more or less, the balance of local cultural traditions because the Tunggu Tubang field needed to be exploited to earn a living for the Tunggu Tubang families, as represented in the Tunggu Tubang symbol (Harsuno et al., 2018). Local traditions might be affected if being a farmer were no longer the only option. Compare this to what happened in New Zealand, where the development of geothermal energy projects also employed local people and boosted the local culture simultaneously (Daysh et al., 2020; Neilson et al., 2010). Local people promote their living culture with heat power as a tourist attraction, which the company and the government fully support. In Japan, local employment was proposed intensively by the project proponents for various local benefits, while putting their concerns on the economic effect on the hot springs business (Kubota, 2015).

Compensation for land acquisition, as well as noise and dust pollution, was another economic topic frequently mentioned during the interview. These were also common topics in local debates, particularly in developing countries (see Ochieng, 2019; Ramírez et al., 2017). The adverse effects of geothermal energy exploration are the most mentioned environmental issues in this research. The drainage of land water, the noise, and air pollution were among the topics. These findings stand in contrast to prevailing narratives in Indonesian media and stakeholder analyses, which predominantly portray geothermal development in a positive light (see Chapter 2, Trisiah et al., 2021). While geothermal energy is widely recognised as a renewable energy resource by state governments, companies, and stakeholders at the national level (Baek et al., 2021), local communities experience the adverse effects of geothermal energy exploration in their neighbourhoods. The construction of infrastructure causes pollution, either water, air, or noise, and people fear incidents such as pipe leakage, which releases poisonous gas and even causes death (Wicaksono, 2024).

Geothermal energy development in this region inevitably benefits local people by increasing their quality of life in terms of facilities development, such as roads and bridges, as well as access to electricity, which, at the time of the interview, was still in process. The direct use of geothermal energy at the local level in Indonesia, however, is not comparable to that of other countries, such as Turkey. Direct-use applications, such as district heating, greenhouse agriculture, and thermal tourism in Turkey, are not only technologically feasible but have

become economically empowering for local communities (Kilic, 2016). This community-centred deployment may offer lessons for enhancing social acceptability of geothermal projects in Indonesia.

In conclusion, I found that local understanding of geothermal energy as a valuable renewable energy source is not yet represented in local perspectives. This makes the local decision to agree on renewable energy for a sustainable future less likely and delays the implementation of renewable energy, i.e., geothermal energy, in Indonesia (Anggur, 2025; Waluyo, 2025).

Cultural-religious issues and their embeddedness in the economy and environment are reasons for local resistance at the beginning of the project, as geothermal energy may pose potential adverse effects on livelihoods, particularly for farming-dependent communities. However, this current research limits its method to field interviews with local people over a limited time. Further research must account for the relationships between the communities and their natural surroundings, especially in the context of energy exploration (Mardiastuti, 2019; Vargas-Payera et al., 2020a). Approaches such as action research or ethnographic inquiry can provide more nuanced and context-rich data, enabling more profound insights and more targeted findings (Cannon et al., 2023; Gobbo, 2022; Jorgenson & Stephens, 2022).

These results also have little scope for generalisation. This is because the survey was conducted in Indonesia, which has a distinctive culture and potential for energy resources that prevent the validated results from being applied to other nations. Future studies can employ the findings of this research and learn the values of locals' respect for nature to maintain local engagement, as in Alaska, where Pilgrim Hot Springs, located in northwestern Alaska on the Seward Peninsula, was reinvigorated using ecological, historical, and cultural sensitivity to drive the design and maintain a good relationship with the locals (Hallbert & Marie, 2013).

Lastly, while geothermal energy exploration offers undeniable economic benefits and enhances local living standards, it also poses significant environmental risks that may threaten cultural and religious traditions. Additionally, the uncertain natural characteristics of geothermal energy and the location of geothermal resources in Indonesia in the preserved forests in which wildlife lives, thorough analysis and examination from all perspectives, e.g., technical, economic, social, and cultural-religious aspects, whether or not the benefits outweigh the risks or vice versa, must be referred to decide the geothermal project implementation.

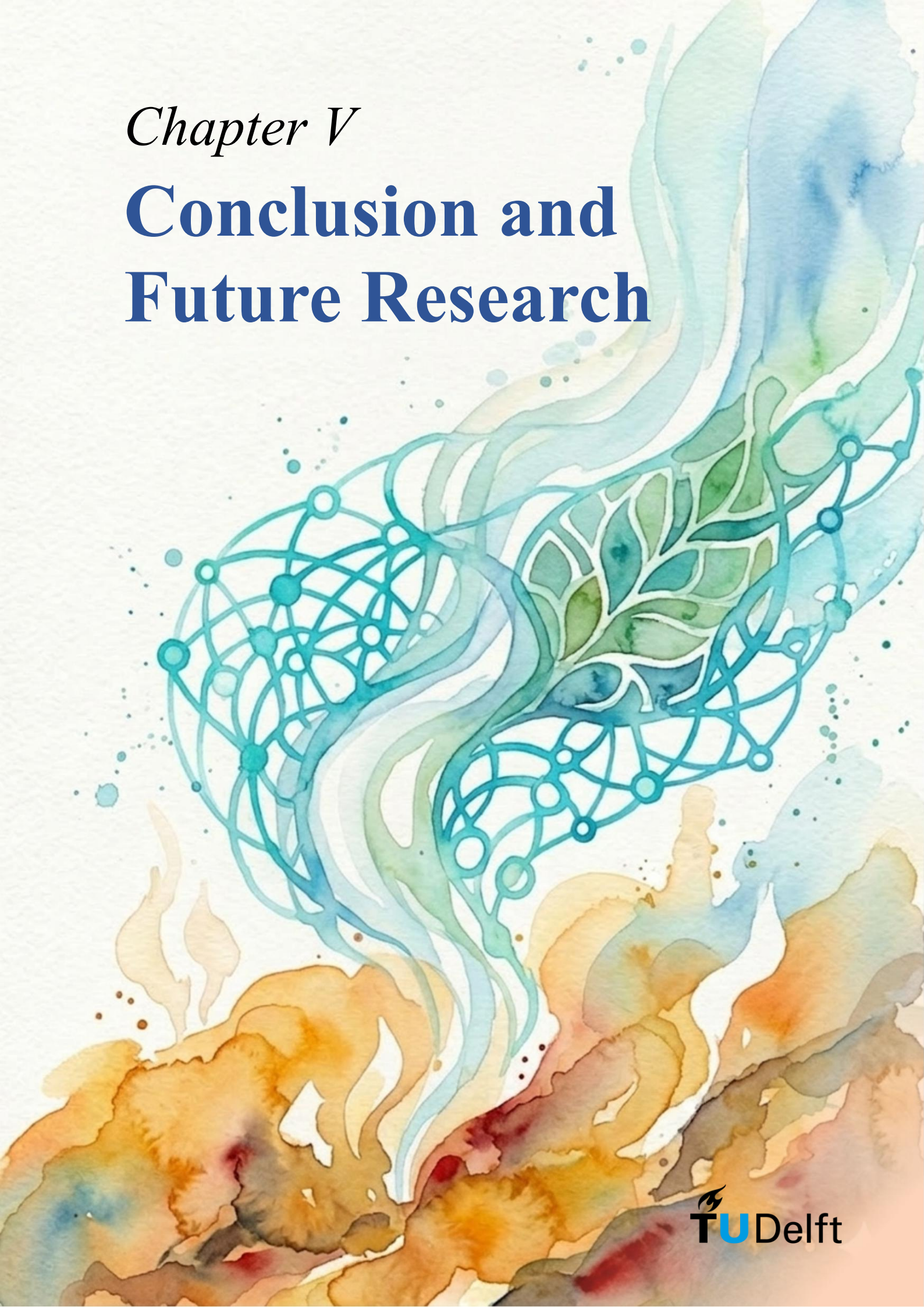
4.5 Conclusion

Advocates of geothermal energy projects, such as project owners and the government, could approach local communities not merely as stakeholders but as co-inhabitants of place, whose wisdom, traditions, and lived experiences must shape the contours of any proposed intervention. Cultural and religious values are not merely peripheral concerns; they are deeply embedded in how local people perceive change, assess risks, and define what constitutes a meaningful future, including the adoption of new energy resources.

This context creates space for negotiation. Engaging in open-ended dialogues, building long-term relationships, and conducting participatory research that values community members as knowledge holders are essential strategies. Respect for sacred spaces, belief systems, and ecological symbols must be integrated from the earliest stages of the project planning. Ultimately, asking not only "Can we build here?" but "How do we belong here?" invites a deeper ethic of care, one that grounds innovation in respect, reciprocity, and place-based understanding.

Chapter V

Conclusion and Future Research



5.1 Introduction

The implementation of geothermal energy across different parts of the world has frequently encountered community resistance (see Kubota, 2015; Shortall & Kharrazi, 2017; Vargas Payera, 2018). While technical and economic considerations are often emphasized in project planning, the persistent challenges arise from social dimensions, particularly cultural and religious concerns (Chester et al., 2008; Shibata et al., 2016; Stephenson et al., 2015; Vargas Payera, 2018). Although geothermal energy is widely promoted as environmentally friendly, its unpredictable resource availability and location make this claim more complicated. In several cases, exploration sites overlap with areas considered sacred, making local acceptance difficult, if not impossible. These cultural and religious attachments are deeply ingrained, representing traditions that have endured for generations. Consequently, resistance has led to the suspension or cancellation of multiple geothermal projects, especially in Indonesia.

Examples from Bali and the eastern provinces of Indonesia illustrate how cultural and religious objections have halted projects. In Bali, geothermal exploration was cancelled because the proposed site was considered sacred, being home to temples central to local religious practice (Iman et al., 2023). In Flores, the Catholic Church opposed geothermal development, emphasizing that preserving the environment is a divine mandate, while geothermal exploration was perceived as potentially harmful to nature (Amriani & Alfian, 2025). For stakeholders, such resistance raises significant concerns – even with substantial financial commitments, local opposition can outweigh anticipated benefits.

The findings of this research, however, present a more nuanced perspective. Local resistance is not always permanent. Social issues, particularly cultural and religious concerns, are indeed critical, and without deliberate engagement, they can delay or even cancel projects. Yet, there is room for negotiation, though the process is neither easy nor fast.

This study was conducted in South Sumatra, the province with the highest geothermal potential in Indonesia. Initial exploration efforts were marked by chaos and strong opposition. Local communities resisted geothermal development, citing conflicts with their cultural heritage, particularly the *Tunggu Tubang* – a culture that ensures ancestral land remains within the family, preventing external ownership – and Islamic religious values. Resistance persisted

for years, leading to the suspension of the project. Over time, however, negotiations enabled the project to resume, and it has now reached the stage of energy production.

To develop a nuanced understanding of how cultural and religious values manifest in stakeholder communication about geothermal energy, this research employed a multi-method approach. First, a media analysis was conducted to examine how geothermal energy was framed in Indonesia and how cultural and religious values were represented in public discourse, as the media both reflects public perspectives and influences public beliefs. Second, the actual stakeholder frames and perceptions of geothermal energy were examined through questionnaires and interviews to understand how concerns about cultural and religious values shaped project development. Finally, fieldwork was undertaken in five villages affected by the project. These visits, conducted during the COVID-19 Pandemic under restrictions, included interviews with community representatives that provided insights into local perceptions and the ways cultural and religious values are embedded in everyday life.

This chapter concludes by addressing the main research question and its sub-questions introduced in Chapter I. Section 5.1 synthesizes the findings from the preceding chapters, demonstrating how they collectively contribute to a nuanced understanding of how local cultural and religious values are represented in stakeholder communication about geothermal energy in Indonesia. This includes an examination of how geothermal energy is debated in the media, how stakeholder frames are constructed, how cultural and religious issues are articulated within these debates, and how such values are embedded in local communities. Section 5.2 outlines the study's limitations, acknowledging both methodological and contextual constraints. Section 5.3 provides recommendations for future research, identifying areas that could further deepen the understanding of stakeholder perceptions, framing processes, and socio-cultural dynamics in Indonesia's energy transition. Finally, Section 5.4 offers policy recommendations for geothermal stakeholders and local communities, emphasizing pathways toward negotiated solutions that support the more effective and inclusive implementation of renewable energy.

5.2 Answers to the Research Questions

This dissertation posed the main research question “How does a nuanced understanding of local cultural-religious values represent in the geothermal energy communication in Indonesia?” This overarching question was broken down into three sub-questions, each investigated in the preceding chapters. The main findings are summarized below.

a. Sub-question 1. *How do Indonesian media portray geothermal energy, and how are local cultural-religious values represented?*

The answer to sub-question 1 is presented in Chapter 2, which analysed coverage of geothermal energy in two major Indonesian national newspapers. This preliminary desk-based phase, conducted prior to field research, aimed to examine how stakeholder frames are reflected in the media and how cultural and religious values are represented in it, given its crucial role in shaping public perceptions of energy technologies. A systematic review of 316 articles published between 2009 and 2019 identified 927 instances across six frames – energy security, economy, legislation, environment, knowledge, and social – used to construct narratives around geothermal energy in Indonesia.

The findings reveal that the energy security frame was the most prominent, with a largely positive tone, presenting geothermal energy as a reliable source for Indonesia's energy future. The economic frame followed closely, highlighting investment opportunities and job creation, though some references acknowledged risks, such as high costs and uncertainties around exploitation. The legislation frame was evenly split between positive and negative portrayals, reflecting both regulatory support and bureaucratic challenges. Surprisingly, the environmental frame was relatively limited, despite geothermal energy's contribution to reducing carbon emissions. The knowledge frame appeared infrequently, while the social frame was the least represented and, unlike the others, predominantly negative, often highlighting local resistance rooted in cultural and religious concerns. Frame ownership was concentrated among actors who benefit most from geothermal development: the national government and industry. NGOs and associations contributed, often critically, while regional and local governments and scientists played minor roles. Local communities had the weakest voice, yet their contributions were the most oppositional, emphasizing environmental risks and spiritual ties to geothermal sites.

This finding is significant: although social issues have delayed or cancelled several geothermal projects in Indonesia, they were the least prominent in media coverage. The limited representation of local voices and cultural-religious concerns in national discourse suggests that these issues are marginalized, leaving resistance unaddressed and perpetuating conflict.

b. Sub-question 2. *How do key stakeholders perceive geothermal energy, and how do they incorporate local cultural and religious values in the communication?*

Chapter 3 addresses sub-question 2. It was designed to examine stakeholders' actual frames and perceptions, and to assess how cultural and religious values are incorporated into

geothermal debates. The analysis also considered whether media narratives accurately reflect stakeholders' views or are shaped by journalistic interpretation. These insights provide a critical foundation for positioning geothermal energy within Indonesia's energy transition and underscore the importance of integrating cultural legitimacy into communication strategies to support successful implementation.

Survey data from 86 stakeholders, complemented by in-depth interviews with 15 representatives across government, industry, NGOs and associations, scientists, and media, revealed that stakeholders do not share a uniform understanding of geothermal energy, despite broad recognition of Indonesia's abundant geothermal potential. Their perspectives also differed markedly from national media portrayals. Newspapers emphasized energy security and economic growth, whereas stakeholders acknowledged these issues but treated them as less dominant in practice. Energy security was frequently invoked as a justification for geothermal expansion, aligning with broader literature on national energy independence. Economic considerations were discussed in terms of regional income and employment creation, but they did not constitute the central focus of stakeholder narratives.

Instead, stakeholders consistently placed environmental concerns at the centre of their discussions. Social issues emerged as the second most salient category, far more prominent than in media coverage. Interviews revealed repeated references to cultural and religious sensitivities, community resistance, and employment impacts as pivotal factors shaping project legitimacy. Importantly, stakeholders emphasized the need to engage with communities in culturally appropriate ways—for example, “speaking the local language” by visiting *warung kopi*¹⁰², wearing a *sarung*¹⁰³, and sharing coffee and fried bananas while conversing with residents. Such practices were described as essential for building trust and fostering engagement.

Interviews also highlighted those local traditions, such as the *Tunggu Tubang* inheritance system, and religious ways of life, strongly influence community responses to geothermal projects. By foregrounding these dynamics, the study underscores the need for energy governance frameworks that move beyond environmental, economic, and security considerations to explicitly integrate social dimensions and cultural-religious sensitivities. Recognizing these factors is essential for understanding how stakeholder influence and cultural

¹⁰² A small local coffee shop where people gather to drink coffee, eat snacks, and socialize

¹⁰³ Traditional garments are usually wrapped around the waist and extend to the ankles, not only practical clothing but also a symbol of cultural identity and modesty

legitimacy shape the trajectory of geothermal energy development within Indonesia's broader energy transition.

In conclusion, stakeholder perspectives demonstrate that social and cultural-religious concerns are deeply embedded in the geothermal energy debate, even if they are marginalized in national media discourse. Unlike media framing, stakeholders acknowledge these issues as central to legitimacy and community acceptance, recognizing that cultural traditions and religious values strongly influence how projects are received. However, while stakeholders highlight the importance of these dimensions, their perspectives are often mediated through national narratives. This creates a divergence between stakeholder recognition and the lived realities of local communities, where cultural-religious values are not abstract considerations but integral to everyday life and identity.

This divergence underscores the need to move beyond stakeholder-level analysis and examine how local communities themselves experience geothermal development. At the community level, concerns are expressed not only in terms of environmental risks and economic opportunities, but also through religious practices, cultural traditions tied to the land, and moral obligations toward environmental stewardship. These values are not peripheral but central, playing a pivotal role in shaping local debates and determining whether geothermal projects are embraced as legitimate contributions to sustainable development or resisted as threats to cultural continuity and identity.

c. Sub-question 3. *What roles do cultural and religious values play in shaping local debates around geothermal energy in South Sumatera?*

Chapter 4 addresses sub-question 3 and represents the culmination of this research. Having examined how geothermal energy is portrayed in the media and how stakeholders frame cultural and religious concerns, this chapter turns to the local community level to explore how these values directly shape debates around geothermal development.

Field research was conducted during the COVID-19 pandemic, requiring an eight-day quarantine upon arrival in Indonesia from the Netherlands and strict adherence to health protocols, including negative test results before visiting villages. Data collection involved a nine-hour journey from the provincial capital to five affected villages, where interviews were conducted with village heads and local representatives.

The findings reveal that resistance to geothermal development in South Sumatra was not a single-issue rejection but a layered response shaped by technical, environmental, and cultural-religious concerns. Initially, opposition was rooted in fears about exploration itself –

concerns that echoed experiences from other geothermal sites, such as forest erosion, drilling-induced seismicity, or gas leakage (Agustina, 2019; Armanto, 2016; Wicaksono, 2024). These technical anxieties soon expanded into social-religious domains, particularly unease over the arrival of outsiders whose practices, such as alcohol consumption, were perceived as incompatible with local Muslim values.

Beyond these environmental and religious concerns, resistance was also anchored in the deeper cultural foundation of *Tunggu Tubang*, a customary inheritance system that prohibits the trading of ancestral land. This principle represents more than property rights that it embodies identity, continuity, and communal belonging. As such, it could not simply be offset with financial compensation.

In many places, compensation is the standard remedy for tensions surrounding resource projects. Indeed, project owners attempted to address grievances by compensating for noise, dust pollution, or cracked houses caused by heavy construction. Yet in South Sumatra, these measures proved inadequate and even potentially counterproductive. Instead of unifying the community, compensation risked fragmenting it, creating polarization between those who accepted benefits and those who did not. While damages were paid and land was purchased, the cultural weight of *Tunggu Tubang* meant that monetary remedies alone could not resolve the conflict.

The process of reconciliation unfolded in clear steps. The first step was the delivery of proven improvements in quality of life, such as better roads and expanded electricity access. These were not abstract promises but tangible benefits that opened the door to dialogue by showing the community that geothermal development could bring real, visible gains. The second step was the recognition that these benefits were collective rather than individual. Electrification, for example, was understood as a gain for the wider public, not a zero-sum game where some won and others lost. This sense of shared improvement helped reduce tensions and created a foundation for trust. The third step was culturally sensitive negotiation around land, which required acknowledging that there are two types of local people the industry must consider. On one side are those who hold a strict interpretation of *Tunggu Tubang*, refusing to relinquish inherited land under any circumstances. On the other side are those with a more flexible interpretation, willing to negotiate if compensation allows them to reinvest in new land and preserve heritage continuity. Respecting both positions was crucial: for strict families, infrastructure was relocated to avoid conflict; for flexible families, compensation was structured as land swaps or reinvestment schemes. By recognizing these two schools of thought and adapting accordingly, developers demonstrated cultural sensitivity.

Yet this process cannot be understood without its contextual backdrop. A supportive government at both state and regional levels collaborated with industries, creating a subtle form of soft power. They activated local power structures by consulting elders, involving family members, and engaging trusted networks. Younger generations were invited into discussions, ensuring that decisions reflected both continuity and future aspirations. These strategies embedded negotiations within the community's social fabric, legitimizing outcomes and preventing them from being perceived as imposed from outside.

In sum, reconciliation was achieved not through standard compensation but through a layered process: proven public benefits, collective gains, respect for diverse interpretations of cultural beliefs, and sensitivity to social context. Resistance at the local level was therefore less about rejecting modernization and more about fears of cultural erosion and weakened communal integrity. A key finding is that communities employed reconciliation strategies: they were willing to negotiate when their values were respected and when benefits were framed as serving the wider public good.

Given Indonesia's complex geography and cultural diversity, national-level stakeholders often struggle to fully embrace local realities, leaving community voices underrepresented. The South Sumatra case demonstrates that cultural values, land ownership systems, and religious beliefs directly shape community responses to geothermal energy. While initial impressions may frame geothermal development as a "no-go area," deeper engagement reveals nuanced concerns tied to identity, continuity, and belonging.

5.3 Limitations of the Research

Each chapter has acknowledged certain limitations; nevertheless, there are several constraints that could be underscored:

- a. Constraints of Covid-19 Fieldwork and Limited Sample Size:** Data collection was conducted during the COVID-19 pandemic, which imposed significant logistical and methodological challenges. Travel restrictions and safety measures limited the flexibility of fieldwork, as reaching the affected communities required a nine-hour journey from the provincial capital under constrained conditions. These circumstances reduced opportunities for prolonged engagement, expanding the number of informants and informal interactions with local residents, interactions that might otherwise have enriched the data. Indonesia's geothermal resources are spread across several islands (Pambudi & Ulfa, 2024) – Sumatra, Java, Bali, Maluku, East Nusa Tenggara, and Sulawesi – each home to diverse communities with varying cultural, religious, and socio-economic backgrounds. A larger respondent pool

would have enabled richer comparative analysis across these groups. Although the research engaged key stakeholders, including government agencies, industries, NGOs, scientists, journalists, and local communities, limited participation may have prevented certain nuances, such as generational differences, gendered perspectives, and minority voices, from being fully captured.

- b. Geographic and Project-Specific Focus:** Fieldwork was conducted in a single region and centred on one geothermal project. This narrow scope provided a detailed contextual understanding but inevitably limits the generalizability of the findings. By focusing on one project, the study cannot account for regional variations in acceptance, resistance, or negotiation processes. Broader geographic coverage would be necessary to capture the diversity of socio-cultural responses across the archipelago (Shortall & Kharrazi, 2017).
- c. Timeframe Constraint:** The study reflects stakeholder perceptions and community responses at a specific point in time. Yet geothermal projects unfold over extended periods, progressing from exploration through exploitation to eventual energy production (Liu et al., 2020; Mott MacDonald, 2018). Over time, public debates are dynamic, influenced by shifts in policy, technological advancements, and evolving community experiences (Vargas-Payera et al., 2020a). Attitudes toward geothermal energy may change as projects progress, benefits or risks become more tangible, or new narratives emerge in the media. Because this research is cross-sectional, it cannot account for these temporal shifts. A longitudinal approach would be required to fully understand how acceptance and resistance evolve and how cultural and religious values continue to influence responses across different stages of project implementation.

To address the limitations identified and develop a more comprehensive understanding of geothermal energy implementation in Indonesia, future research could consider Indonesia's diverse socio-cultural contexts and the different stages of project development. These directions will be elaborated further in the following section.

5.4 Future Research

This section provides overarching recommendations for future research that extend beyond the chapter-specific suggestions derived from individual case studies. While earlier chapters offered targeted insights based on their respective analyses, the recommendations presented here aim to integrate those findings into a broader framework.

- a. Integrating Technical and Socio-Cultural Dimensions:** Future geothermal research must move beyond siloed approaches that treat technical feasibility and social acceptance separately. Technical studies often focus on resource mapping (Renaud et al., 2021), drilling efficiency (Kurevija & Strpić, 2018), reservoir management (Luo et al., 2018), and environmental safeguards (PT. SERD, 2014), while social research emphasizes cultural traditions, religious values, and perceptions of fairness (Manyara & Mading, 2012). Yet in practice, these dimensions are deeply intertwined. For example, noise mitigation technologies or land-use planning cannot be evaluated solely in engineering terms; their success depends on how communities interpret them through cultural and spiritual lenses. Similarly, technical risks such as subsidence or water contamination are perceived differently depending on local beliefs about land and ancestral heritage. By designing interdisciplinary studies that combine geophysical modelling with ethnographic fieldwork and participatory community workshops, researchers can generate insights that are both technically robust and socially legitimate.
- b. Expanding to New Exploration Sites Across Indonesia:** Indonesia's geothermal potential is distributed across multiple islands and provinces, from the Northern tip of Sumatera to the Southern tip of Papua (Indonesia-Investments, 2015; Marry, 2017; Saptadji, 2016), each with distinct socio-cultural and governance contexts. Research that focuses only on established projects risks overlooking the unique challenges of new exploration sites, where community perceptions are still forming. Early-stage studies in these areas can capture how expectations, fears, and narratives emerge before projects become entrenched, allowing for proactive engagement strategies. Comparative, multi-case studies across regions such as Java, Sumatra, Sulawesi, and Flores would highlight how cultural diversity, religious practices, and local governance structures shape acceptance and resistance. This approach would also reveal how historical grievances or "controversy spillover" from other energy projects influence attitudes toward geothermal development in new contexts.
- c. Longitudinal Tracking of Community Attitudes:** Future studies could adopt a longitudinal design to follow communities and stakeholders across the lifespan of geothermal projects. By observing perceptions over time, researchers would be able to trace how debates evolve in response to policy changes, technological developments, and lived experiences (Vargas-Payera et al., 2020b). Such an approach could reveal causal links between benefits (e.g., electricity access, employment) or perceived risks (e.g., environmental and social impacts) and shifts in acceptance or resistance. This would provide valuable insights for adaptive

governance, more effective communication strategies, and proactive conflict mitigation, ensuring that cultural and religious sensitivities remain integrated throughout project implementation.

d. Investigating Stakeholder Interactions and Governance Dynamics: Community acceptance is only one dimension of geothermal development (Bayer et al., 2019; Chavot et al., 2019). The success of projects also depends on how developers, policymakers, NGOs, religious leaders, and media actors interact with local communities and negotiate legitimacy. Future research could examine these multi-level interactions among diverse stakeholders using behavioural system mapping to uncover the dynamics that shape negotiation practices among stakeholders (Bellmann et al., 2025). For instance, government policies that prioritize economic growth may clash with community concerns about cultural integrity, while media narratives can either build trust or fuel resistance. By analysing these governance dynamics, researchers can identify pathways toward more inclusive and culturally sensitive energy policy. This perspective also highlights the importance of institutional acceptance and market frameworks, which often constrain renewable energy deployment as much as community resistance.

5.5 Recommendations for Policy Makers and Geothermal Stakeholders, including Local People

The findings of this study demonstrate that geothermal energy development in South Sumatera is shaped not only by technical and economic considerations but also by cultural legitimacy and religious values. To ensure responsible and sustainable deployment, recommendations for three interconnected groups: policymakers, industry stakeholders, and local communities, are as follows:

- a. Policy Makers.** Policymakers play a critical role in setting the framework for the planning and implementation of geothermal projects. The recommendations are:
 - i. Embed cultural and religious values in energy governance:** Embedding cultural and religious values in energy governance requires Indonesian policymakers to move beyond purely technical and economic frameworks and explicitly integrate local traditions into project planning and regulation. This can be achieved by mandating the mapping of cultural heritage and religious sites in environmental and social impact assessments, such as ensuring sacred forests, ancestral graves, or mosques are protected through buffer zones. Policymakers could also institutionalize consultation

with religious leaders, customary authorities, and community elders so that project guidelines reflect local norms, for instance, aligning compensation schemes with cultural practices such as the *Tunggu Tubang* heritage system in South Sumatra. Finally, training government officials in cultural sensitivity would strengthen their ability to evaluate projects in ways that preserve legitimacy and trust. By embedding these values into governance frameworks, energy policies would not only reduce resistance but also foster long-term acceptance and cooperation.

- ii. **Mandate inclusive participation:** Regulations could require developers to engage communities throughout exploration, construction, and operation. Policymakers can achieve this by obligating developers to establish participatory mechanisms such as community advisory boards, village-level forums, and joint monitoring committees, where local voices directly influence project decisions (Laurian, 2005). For example, community representatives could be included in decision-making about drilling site selection, compensation schemes, or environmental safeguards, ensuring that outcomes reflect local priorities rather than external assumptions. Participation could also be culturally sensitive, for example, by having developers hold informal dialogues in *warung kopi* (local coffee shops) or by collaborating with customary leaders to build trust and legitimacy. Transparent communication channels, such as regular public meetings or accessible information portals, can further empower communities to hold developers accountable.
- iii. **Support interdisciplinary research:** Policymakers could move beyond treating social science as a minor add-on to technically driven projects and instead ensure balanced collaboration across disciplines. Technical research already requires a social science component in research proposals; this is often relegated to a small work package rather than being integrated into the core of project design (PT. Supreme Energy Rantau Dedap (PT. SERD), 2018). Policymakers can address this imbalance by mandating that geothermal research teams include equal representation from engineering, environmental science, and social science, with shared responsibilities in project leadership and reporting. For example, a geothermal exploration project could pair geologists and engineers with anthropologists and sociologists to jointly design community engagement strategies, ensuring that technical plans are informed by cultural insights. Funding schemes could also incentivize interdisciplinary outputs, such as joint publications, integrated impact assessments, or collaborative policy

briefs, rather than siloed reports. Because interdisciplinary teams often face challenges in bridging disciplinary languages and methods, policymakers could further support training programs and workshops that help researchers learn to communicate across fields.

b. Geothermal Stakeholders. Industry actors are on the front lines of implementation and, therefore, must balance technical performance with social responsibility. Here are the recommendations:

- i. **Prioritize community engagement:** Developers could move beyond formal consultations and adopt culturally sensitive practices. Informal dialogues in *warung kopi*, respect for religious norms, and visible presence in community life can build trust more effectively than transactional meetings. For example, a developer might sponsor a community festival or join discussions led by village elders, showing respect for traditions while building trust. Such a visible presence helps communities see developers not as outsiders but as partners, making cooperation more likely than resistance.
- ii. **Respect land ownership traditions:** Compensation schemes must be designed to preserve cultural continuity. For example, enabling heirs to reinvest in land ensures that the *Tunggu Tubang* heritage is maintained rather than eroded. This approach demonstrates respect for local identity while meeting project needs. For instance, instead of one-off payments, compensation could be structured as community development funds or land reinvestment programs, which both meet project needs and safeguard local traditions. This approach signals respect for cultural values and strengthens legitimacy.
- iii. **Ensure equitable benefit distribution:** Employment and compensation opportunities could be fairly shared across the community. Avoiding concentration of benefits among a small group prevents socio-economic polarization and fosters cohesion. Beyond employment, developers could also optimize other local potentials linked to the project location, such as supporting coffee cooperatives if the area has strong commodity production, thereby strengthening local livelihoods. Scholarships for students from affected communities could also be offered, ensuring educational benefits extend across generations. Compensation funds could be distributed through community cooperatives, allowing collective decision-making over how resources are

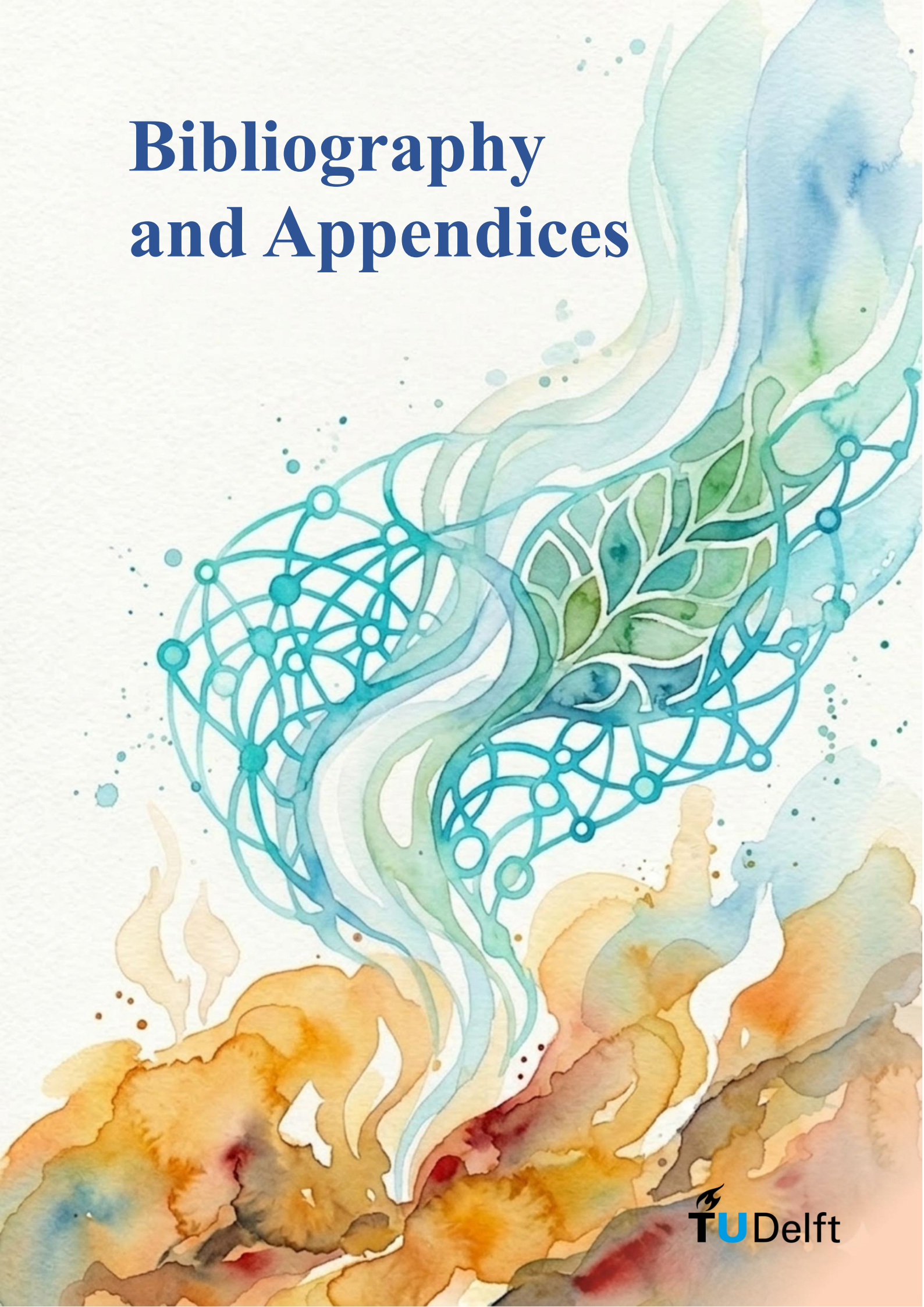
used, while investments in sustainable infrastructure, such as clean water systems or renewable-energy-powered schools, would ensure that benefits are not temporary but embedded in long-term development.

c. Local Communities. Communities are not passive recipients of development but active agents whose strategies of negotiation and adaptation shape project outcomes.

- i. **Strengthen collective negotiation capacity and build renewable energy literacy:** Local communities could establish councils or forums that represent diverse voices, including elders, women, youth, and minority groups, to ensure that negotiations with external actors are unified and inclusive. At the same time, collaboration with NGOs, schools, and universities can help translate abstract concepts such as “renewable energy” and “climate change” into locally relevant narratives. By combining stronger collective representation with greater awareness of energy and sustainability issues, communities can both safeguard cultural traditions and enhance their bargaining position in national energy debates, ensuring their perspectives are respected in decision-making.
- ii. **Engage proactively in monitoring and dialogue:** Communities could participate in ongoing oversight of projects, tracking environmental and social impacts, and providing feedback to developers and policymakers. This proactive role strengthens accountability and ensures that concerns remain visible.

In conclusion, Indonesia’s geothermal future cannot be secured solely through technical innovation or economic optimism. In a nation defined by extraordinary cultural diversity and religious pluralism, energy transition is a profoundly social process. Traditions, beliefs, and spiritual landscapes are not peripheral; they are central to how communities interpret risk, legitimacy, and progress. Ignoring these dimensions risks perpetuating conflict and eroding trust; embracing them, however, opens pathways to inclusive, context-sensitive governance. The key lesson for future endeavours is clear: sustainable geothermal development in Indonesia requires governance frameworks and communication strategies that embed local traditions, respect cultural identities, and create participatory spaces for negotiation.

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Appendix A Mapping of Frames

Frames	Set of Arguments	N=927
<i>Energy security</i>	The country needs energy (73), geothermal energy supports the country's needs (46), this technology needs infrastructure (32), and geothermal energy is a potential resource in Indonesia (167)	318
<i>Economy</i>	Cooperation among stakeholders to explore geothermal energy (53), the development provides employment (24), it needs incentive from the government to develop (10), it can increase income (31), it needs investment (102), it needs financial support (6), and price adjustment among stakeholders (53)	279
<i>Legislation</i>	The regulation of legal admission and finance (110), arguments against the law, (6) and other political issues (27)	143
<i>Environment</i>	The resources' locations are situated in protected areas (27) and geothermal energy is environmentally friendly (67)	94
<i>Knowledge</i>	Information dissemination about geothermal energy (24) and research to develop the technology (30)	54
<i>Social issues</i>	Cultural issues related to geothermal development (10) and other social arguments (29)	39

Appendix B The Tones of the Frames

Energy and Security Frame (N = 318)

Positive (N = 251)	1. Indonesia has an abundant supply – 40% of world geothermal energy; 2. Geothermal energy is the most potential renewable energy to support the country needs; 3. Geothermal energy is a local energy that provides regional electricity needs; 4. The industries prioritize a safe working environment for the workers.
Negative (N = 67)	1. Geothermal energy is an uncertain energy resource; 2. The development of geothermal energy is insignificant – less than 5%; 3. The slow pace of infrastructure construction due to the remote location; 4. The exploration location is high-risk – mostly located in volcanic areas.

Economy Frame (N= 279)

- Positive (N = 195)**
1. The development of geothermal energy can increase state-, regional- and local- revenue;
 2. The industries execute certain community development programs to increase the local income;
 3. The exploration of geothermal energy can absorb the local workforce;
 4. The government promotes the developing of the energy by issuing the Subsidiary Loan Agreement;
 5. Good cooperation with several foreign investors e.g. Turkey, Japan, New Zealand, etc.

- Negative (N = 84)**
1. The exploration of geothermal energy is a high-cost production;
 2. The exploration of geothermal energy is a high -risk investment;
 3. The industries need skilled and qualified workforces but the numbers are limited;
 4. Incentives and fiscal support from the government are not sufficient to support the development;
 5. No competitive selling price – PLN (State Electricity Enterprise) is the only buyer allowed.

Legislation Frame (N = 143)

- Positive (N = 76)**
1. Some regulations related to the development of geothermal energy are issued, e.g. those related to price adjustment, exploration permits in the protected area, investments, etc.;
The development of geothermal energy involves many stakeholders.

- Negative (N = 67)**
1. Management of geothermal energy exploration is centralized, which neglects the authority of local and regional government;
 2. Exploration permits in certain protected areas remain difficult to obtain;
 3. Some actors used political issues to influence local people to resist the projects.

Environmental Frame (N = 94)

- Positive (N = 63)**
1. Geothermal energy is green energy – No carbon emission is produced;
 2. The usage of geothermal energy can reduce the greenhouse effect;
 3. The technology used during production is environment-friendly;
 4. To keep energy production sustainable, the balance of nature is well maintained.

- Negative (N = 31)**
1. The location of exploration is situated in a protected area;
 2. Besides the noise pollution, the drilling process will reduce the water supply;
 3. The forest will be barren during the exploration e.g. to build the infrastructure, and thus, production will reduce the variety of flora and fauna;
 4. Animals living in the forests will be threatened, due to the reduction of their ecosystem.

Knowledge Frame (N = 54)

- Positive (N = 39)**
1. The dissemination of information to the public is encouraged;
 2. Collaborative research with foreign actors is welcomed.
 3. Research centres for geothermal energy in some universities in Indonesia are established.
- Negative (N = 15)**
1. Information assessed by the public is limited and not transparent;
 2. Data availability is not sufficient.

Social Frame (N = 39)

- Positive (N = 16)**
1. Local people empowerment through community development programs and Corporate Social Responsibility for the affected people are encouraged by the industries;
 2. The project will not disturb the social life of local people;
 3. The industries maintain a good relationship with the neighbourhood;
- Negative (N = 23)**
1. The project neglects the spiritual relationship between local people and the location of the resources;
 2. There will be a gap between local people and the workers in terms of social and cultural life.
-

Appendix C Sources of Geothermal Energy Frames

Actors	Pros		Cons		Total	Total Pros		Total Cons		Total
	N	%	N	%		N	%	N	%	%
<i>National</i>					195	131	27.2	64	13.3	40.5
The Ministry of ESDM (Energy and Mineral Resources)	69	65.7	36	34.3	105					
DPR (The House of Representatives)	28	70	12	30	40					
President/Vice President	13	65	7	35	20					
The Ministry of Environment and Forestry	8	61.5	5	38.5	13					
The Ministry of Finance	5	83.3	1	16.7	6					
The Ministry of Foreign Affairs	4	100	-	-	4					
The Ministry of Research, Technology and Higher Education	1	33.3	2	66.7	3					
BAPPENAS (State Minister for Chairperson of the National Development Planning Agency)	1	100	-	-	1					

BNPB (National Disaster Management Authority)	1	100	-	-	1					
BPPT (Agency for the Assessment and Application of Technology)	-	-	1	100	1					
Coordinating Ministry for Maritime and Investments	1	100	-	-	1					
<i>Regional Government</i>					28	18	3.7	10	2.1	5.8
Governor	8	72.7	3	27.3	11					
ESDM	6	85.7	1	14.3	7					
DPRD	0	0	6	100	6					
BP3MD (The Coordinating Board for Regional Capital Investment, Planning and Promotion)	4	100	-	-	4					
<i>Local Government</i>					20	12	2.5	8	1.7	4.2
Regent	8	61.5	5	38.5	13					
ESDM	4	57.1	3	42.9	7					
<i>Industries</i>					164	123	25.5	41	8.5	34
State-owned enterprises										
PGE - Pertamina Geothermal Energy	50	69.4	22	30.6	72					
PLN (State Electricity Enterprise)	21	72.4	8	27.6	29					
GeoDipa	4	66.7	2	33.3	6					
Private	48	82.6	9	17.4	80					
<i>NGOs and associations</i>	14	38.5	22	61.5	36	14	2.9	22	4.6	7.5
<i>Scientists</i>	17	53.1	15	46.9	32	17	3.5	15	3.1	6.6
<i>Local People</i>	1	14.3	6	85.7	7	1	0.2	6	1.2	1.4
TOTAL					482	316	65.6	166	34.4	100

Appendix D Category of Irrelevant Articles

Category of irrelevance	Amount	Examples
In-pictures article (A short description article with mainly some picture content)	7	Series of pictures followed by “A subsidiary of PT Pertamina (Persero)in the field of geothermal energy development, PT Pertamina Geothermal; Energy (PGE) seeks to increase its production by working on various new geothermal development infrastructure from its working area.” https://republika.co.id/berita/inpicture/nasional-inpicture/nzek69375/produksi-energi-panas-bumi-pt-pgearea-ulubelu-4
General information on renewable energy	19	“Hadi Purnomo, a Commission 7 Indonesian House Representatives member, wants every stakeholder to discuss renewable energy seriously. He advised the House Representatives and the stakeholders to hold an FGD about renewable energy development.” https://www.republika.co.id/berita/dpr-ri/berita-dpr-ri/17/06/07/or5m87368-dpr-ingin-diskusi-dengan-stakeholder-tentang-energibaru
Unrelated topic	10	“Mustadi (52), a coffee farmer from Lahat regency, was killed by a tiger in a protected forest area in Rekimai village, between Lahat and Muara Enim regency, Sout Sumatera.” https://regional.kompas.com/read/2019/12/14/17430151/disaksikan-istri-petani-kopi-di-lahattewas-diterkam-harimau

Appendix E The Respondents

Respondents	Backgrounds	N	Label
Local Officials	Head of the Affected Villages	5	H1
			H2
			H3
			H4
			H5
Indigenous respondents	Affected directly by the project	8	In1
			In2
			In3
			In4
			In5
			In6
			In7
Urban indigenous respondents	Local people who live in the urban area	2	In 8
			U1
			U2

Appendix F Mapping of Interview Results

Constructs	Statements	Themes
Knowledge	Geothermal energy is electricity.	Knowledge
	Geothermal energy is assumed to be similar to coal mining	Knowledge
	Geothermal energy is heat/steam from the earth's subsurface.	Knowledge
	A geothermal project was being developed in their region.	Knowledge
Benefits	Employment opportunities raised economic status (house renovations, motorcycles, furniture).	Economy
	A rotational hiring system among villages to reduce tensions.	Economy
	There was compensation for noise pollution, structural damage, and land acquisition.	Economy
	Geothermal energy was expected to provide electricity for the community.	Quality of life
	People talked about the easier access between villages, thanks to the roads and bridges built by the company.	Quality of life

Risks	Social jealousy between employed and unemployed villagers.	Economy
	The exploration would disturb the environment, similar to coal mining.	Environment
	a structural imbalance between labour demand and community expectations.	Economy
	Compensation was only distributed during the early stages and was later discontinued.	Economy
	Locals argued that exploration would have the same environmental impact as coal mining.	Environment
	The project would increase pollution, deplete groundwater, harm coffee plantations, and cause deforestation.	Environment
	Dust and noise from construction reduced coffee productivity (flowers infertile).	Environment
	Cause adverse effects on the local environment and the natural imbalance that disrupts wildlife	Environment
	Negotiations with elders and religious leaders to facilitate a smooth implementation.	Environment
	Farming identity threatened when locals prefer company jobs (Tunggu Tubang concern).	Economy
Cultural-religious issues	Tunggu Tubang's inheritance tradition complicated land acquisition; ancestral land is not easily traded.	Quality of Life
	Religious values of Islam are assumed to conflict with outsiders' values.	Quality of Life
	The presence of external skilled workers was assumed to introduce lifestyles and practices that conflicted with local traditions and religious values.	Quality of Life
	Trading the land for any purpose was considered a violation of cultural values.	Quality of life
	The issue of compensation raised was not only due to the monetary restitution given to the locals, but it also encompassed the cultural considerations associated with land ownership.	Quality of life

Appendix G Recruitment flyer for NGOs

 ecadin_id 





Call for Non-governmental Organizations

*to participate in a research aimed to
investigate how stakeholders perceive and
frame **geothermal energy** in Indonesia*

Anita Trisiah
Ph.D. Candidate in Multi Actor Systems, Delft University of Technology
the Netherlands

tiny.cc/Geothermal_AT

 ecadin.org   [energyacademyindonesia](https://energyacademyindonesia.org)   [Energy Academy Indonesia](https://EnergyAcademyIndonesia.org)  info@ecadin.org  [@_Ecadin](https://twitter.com/_Ecadin)

 152    

 Liked by [lily_suherlina_ahmad](#) and others
ecadin_id Thanks in advance!
February 25, 2021 · See translation

SURVEI PENELITIAN

Dengan hormat,

Saya Anita Trisiah, dosen UIN Raden Fatah Palembang. Saat ini saya sedang menempuh studi S3 di TU Delft, Belanda. Adapun riset yang sedang saya lakukan berkaitan dengan aspek sosial pengembangan teknologi energi panas bumi sebagai potensi sumber energi terbarukan di Indonesia.

Sebagai tahap awal riset ini, saya melakukan survei berupa penyebaran kuesioner pada stakeholder terkait. Salah satunya adalah Pemerintah, yang memiliki peran dalam pengembangan energi terbarukan termasuk energi panas bumi. Berkaitan dengan hal tersebut, saya mengharapkan partisipasi Bapak/Ibu pada survei yang antara lain bertujuan untuk mengetahui bagaimana persepsi para stakeholder terhadap pengembangan energi panas bumi, faktor apa saja yang mempengaruhi persepsi tersebut, dan lain sebagainya.

Survei ini terdiri dari empat bagian dan waktu yang Bapak/Ibu perlukan untuk menyelesaikan survei ini sekitar 20 menit.

Partisipasi Bapak /Ibu sepenuhnya bersifat sukarela. Jika merasa tidak berkenan, maka Bapak/Ibu diperbolehkan tidak melanjutkan mengisi survei ini. Jawaban yang diberikan akan dianalisis secara anonim dan tidak akan dikaitkan dengan Bapak/Ibu secara pribadi.

Jika memiliki pertanyaan lebih lanjut, silakan menghubungi peneliti:

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Bagian I: Identitas Responden

Instansi tempat bekerja	
Level	
Jabatan/posisi	
Bidang keahlian	☐ teknologi ☐ sosial ☐ ekonomi ☐ kebijakan ☐ hukum ☐ Lainnya
Pendidikan terakhir	☐ S1 ☐ S2 ☐ S3 ☐ Lainnya

Bagian II: Pengetahuan mengenai potensi dan energi terbarukan

Pernyataan	Skala				
	1 Sangat tidak tahu	2 Tidak tahu	3 Netral	4 Tahu	5 Sangat tahu
4. Indonesia memiliki cadangan energi fosil yang cukup untuk memenuhi kebutuhan energi listrik nasional.					
5. Indonesia membutuhkan energi terbarukan untuk memenuhi kebutuhan akses listrik nasional.					
6. Indonesia memiliki potensi yang besar dalam pengembangan energi terbarukan.					
7. Energi panas bumi memiliki potensi yang besar untuk dikembangkan di Indonesia.					
8. Indonesia memiliki tingkat produksi energi panas bumi yang tinggi.					
9. Ada penolakan yang besar terhadap eksplorasi energi panas bumi di beberapa daerah di Indonesia.					

Bacalah teks berikut untuk menjawab pertanyaan di bagian selanjutnya.

Energi Panas Bumi di Indonesia – Keuntungan dan Kerugiannya

Energi panas bumi adalah energi yang berasal dari panas yang berada di dasar bumi. Secara alamiah, panas tersebut dapat mencapai permukaan bumi dan membentuk sumber air panas. Atau dengan cara lain, panas bumi dapat dibor dan dialirkan ke permukaan bumi untuk menghasilkan energi bersih.

Data menunjukkan bahwa Indonesia memiliki 40% cadangan panas bumi dunia. Hal ini disebabkan karena Indonesia merupakan negara kepulauan di daerah ‘cincin api’, sebuah daerah luas yang berada cekungan Samudera Pasifik dengan mayoritas gunung berapi. Di satu sisi, hal ini beresiko pada terjadinya banyak gempa bumi dan letusan gunung berapi. Namun di sisi lain, karakteristik geologi ini menjadi potensi pasokan energi panas bumi yang sangat menguntungkan Indonesia.

Literatur juga menunjukkan bahwa panas bumi memiliki manfaat dan risiko yang berkaitan dengan beberapa hal, antara lain: energi dan keamanan, ekonomi, politik dan hukum, lingkungan, pengetahuan dan informasi, serta masalah sosial. Adapun contoh dari manfaat dan risiko tersebut tercantum pada tabel berikut:

Hal yang berkaitan	Manfaat	Resiko
<i>Energi dan keamanan</i>	Energi panas bumi menyediakan akses energi listrik untuk Indonesia	Kemungkinan terjadinya kebocoran gas beracun dapat berakibat fatal.
<i>Ekonomi</i>	Perkembangan energi panas bumi dapat meningkatkan pendapatan di tingkat nasional, daerah dan lokal	Eksplorasi panas bumi memerlukan investasi yang sangat besar
<i>Politik dan hukum</i>	Kolaborasi yang dilakukan dengan stakeholder internasional menjadikan Indonesia mengglobal	Isu mengenai energi panas bumi seringkali disalahgunakan oleh oknum tertentu untuk kepentingan politik.
<i>Lingkungan</i>	Energi panas bumi ramah lingkungan.	Eksplorasi panas bumi menimbulkan polusi suara.
<i>Pengetahuan</i>	Riset ilmiah memajukan perkembangan energy panas bumi.	Terbatasnya pengetahuan dan informasi tentang panas bumi dapat menyebabkan terjadinya penolakan.
<i>Sosial</i>	Proyek panas bumi dapat membantu pemberdayaan masyarakat lokal.	Beberapa daerah eksplorasi panas bumi dianggap suci berkenaan dengan kepercayaan dan budaya lokal.

Bagian III: Persepsi terhadap manfaat dan resiko panas bumi

Jawablah pertanyaan berikut yang anda anggap sesuai.

14. Pada skala rendah, sedang dan tinggi, menurut pendapat anda bagaimana tingkat manfaat dari energi panas bumi sebagai sumber energi terbarukan untuk dikembangkan di Indonesia?				
Isu	Manfaat	Skala	Resiko	Skala
Energi dan keamanan	Energi panas bumi menyediakan akses energi listrik untuk Indonesia	☐ tinggi ☐ sedang ☐ rendah	Kemungkinan terjadinya kebocoran gas beracun dapat berakibat fatal.	☐ tinggi ☐ sedang ☐ rendah
Ekonomi	Perkembangan energi panas bumi dapat meningkatkan pendapatan di tingkat nasional, daerah dan lokal	☐ tinggi ☐ sedang ☐ rendah	Eksplorasi panas bumi memerlukan investasi yang sangat besar	☐ tinggi ☐ sedang ☐ rendah
Politik dan hukum	Kolaborasi yang dilakukan dengan stakeholder internasional menjadikan Indonesia mengglobal	☐ tinggi ☐ sedang ☐ rendah	Isu mengenai energi panas bumi seringkali disalahgunakan oleh oknum tertentu untuk kepentingan politik.	☐ tinggi ☐ sedang ☐ rendah
Lingkungan	Energi panas bumi ramah lingkungan.	☐ tinggi ☐ sedang ☐ rendah	Eksplorasi panas bumi menimbulkan polusi suara.	☐ tinggi ☐ sedang ☐ rendah

Pengetahuan	Riset ilmiah memajukan perkembangan energy panas bumi.	☐ tinggi ☐ sedang ☐ rendah	Terbatasnya pengetahuan dan informasi tentang panas bumi dapat menyebabkan terjadinya penolakan.	☐ tinggi ☐ sedang ☐ rendah
Sosial	Proyek panas bumi dapat membantu pemberdayaan masyarakat lokal.	☐ tinggi ☐ sedang ☐ rendah	Beberapa daerah eksplorasi panas bumi dianggap suci berkenaan dengan kepercayaan dan budaya lokal.	☐ tinggi ☐ sedang ☐ rendah

Bagian IV: Framing tentang energi panas bumi

Jawablah pertanyaan berikut yang anda anggap sesuai.

15. Jika anda berbicara atau menginformasikan tentang energi panas bumi, bagaimana kemungkinan anda menggunakan hal di bawah ini pada informasi yang anda sampaikan?					
Isu	Skala				
	1 Hampir tidak mungkin	2 Sedikit mungkin	3 Mungkin	4 Lebih mungkin	5 Sangat mungkin
Energi dan keamanan					
Ekonomi					
Politik dan hukum					
Lingkungan					
Pengetahuan					
Sosial					

-Terima kasih atas perhatian anda-

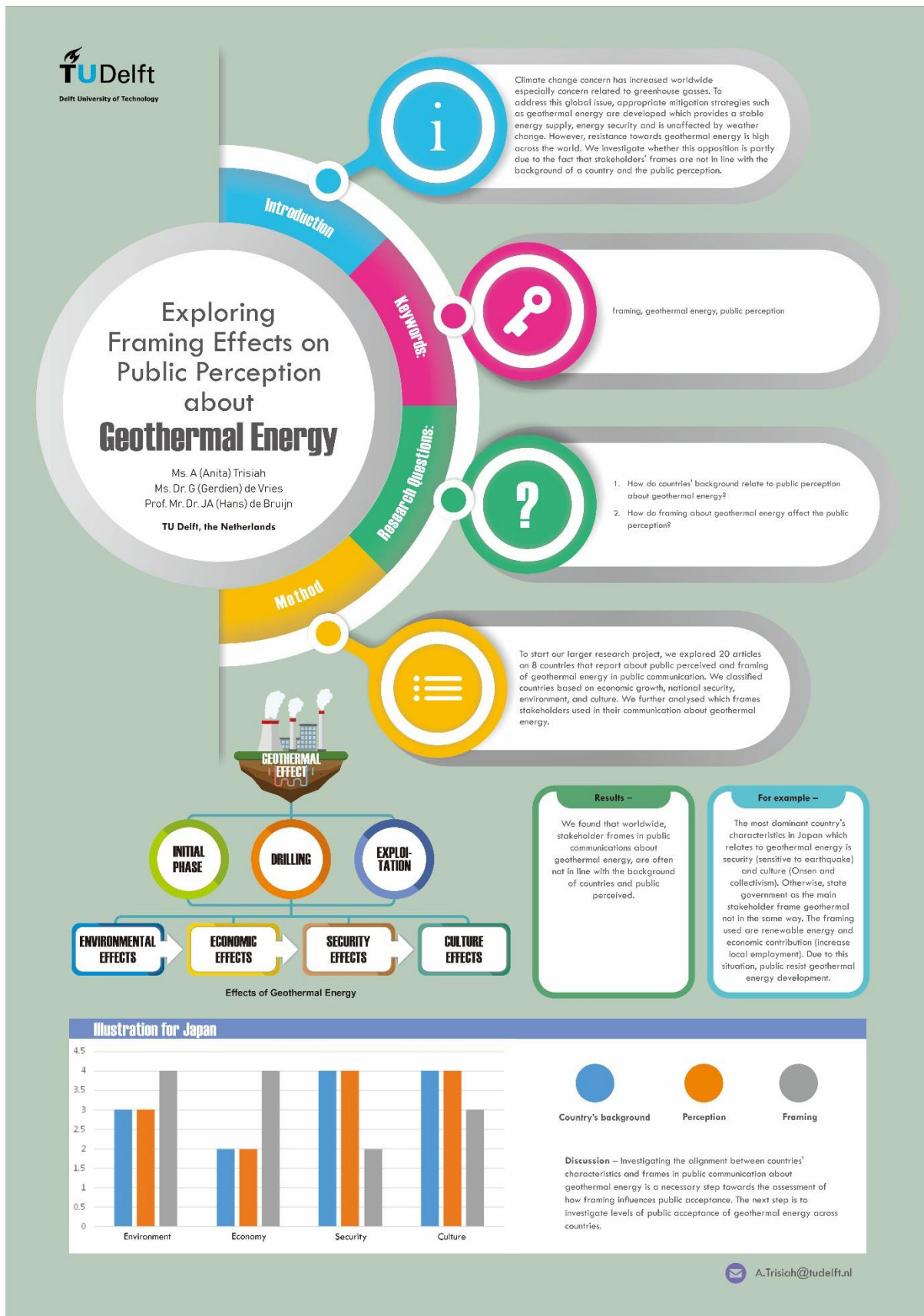
Jawaban anda sudah tersimpan dan akan diproses secara anonim. Jika anda memiliki komentar, pertanyaan atau jika anda ingin mengetahui hasil dari analisis survei ini, silahkan menghubungi peneliti:

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Anita Trisiah was born in Palembang on September 24, 1982. She earned her Bachelor's degree in English Education (S.Pd.) from Universitas Sriwijaya in 2001, followed by a Master of Science in Managerial Communication from Universiti Utara Malaysia in 2007. After graduating from her Master's in 2009, she worked in academia, joining Universitas Bina Darma Palembang as a lecturer in Communication Studies. Since 2011, she has been part of the Faculty of

Dakwah and Communication at Universitas Islam Negeri (UIN) Raden Fatah Palembang, where she teaches, supervises students, and conducts research in communication.

Over the years, Anita has taken on a variety of academic and leadership roles. She contributed to the Quality Assurance Unit at Universitas Bina Darma (2009–2010), served as Secretary (2013–2015) and later Head (2015–2018) of the Communication and Islamic Broadcasting Study Program at UIN Raden Fatah, and was a member of the Task Force for International Cooperation (2020–2024). Since 2024, she has been leading the Center for Ranking and Internationalization, under the Quality Assurance Unit at UIN Raden Fatah, Palembang.

From 2018, Anita has been pursuing her doctoral studies in Organization and Governance at the Multi-Actor Systems Department, Faculty of Technology, Policy and Management, Delft University of Technology, supported by a scholarship from the Indonesian Ministry of Religious Affairs. During her PhD journey, her academic engagement extends internationally. She has reviewed manuscripts for leading journals such as *Environmental Communication* and *Energy Research & Social Science*, has been invited to serve as a guest lecturer, and supervised a Master's student.

Anita's research interests lie at the intersection of communication, energy governance, and cultural-religious values. Her doctoral research at TU Delft reflects this commitment, exploring how cultural-religious values shape community acceptance of geothermal energy projects in Indonesia and how these insights can inform more just and sustainable energy transitions.

List of Publications

1. **Trisiah, Anita**, Gerdien de Vries and Hans de Bruijn (2022). Framing geothermal energy in Indonesia: A media analysis in a country with huge potential. *Environmental Communication*, 16(7), 993-1001. <https://doi.org/10.1080/17524032.2022.2144403>
2. **Trisiah, Anita** and Gerdien de Vries (2026). Local Perception and Frames of Geothermal Energy: The Relevance of Cultural and Religious Values. *Geothermal Energy Journal*. <https://doi.org/10.1186/s40517-026-00381-w>
3. **Trisiah, Anita**, Gerdien de Vries and Hans de Bruijn (2026). Understanding Stakeholders' Frames and Perceptions of Geothermal Energy in Indonesia: What are the Priorities? *Sustainable Futures Journal* (under review).

