Chapter 7

Turning Potential into Power: A Policy Blueprint for Indonesia's Geothermal Transformation

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With some of the planet's richest geothermal resources, Indonesia is a world leader in conventional geothermal deployment—and the nation also has thousands of gigawatts of untapped next-generation geothermal potential. The policies outlined in this chapter can help Indonesia leverage that potential into electricity, direct-use heat, and cooling.

To date, the Ring of Fire nation has deployed almost 3 gigawatts of geothermal electricity—less than 10% of its proven hydrothermal reserves. The country has a stated goal of increasing its geothermal output by 5 gigawatts by 2034 to reach more than 8 gigawatts of power production.[1] By following the policy roadmap outlined in this chapter, however, the nation could deploy 15 gigawatts of firm geothermal electricity and 15 gigawatts thermal of geothermal heat by 2035. This 15 gigawatts electric is a combination of the government's 2034 target and an additional 6 gigawatts electric from next-generation technologies and resources. Those figures could even grow to reach 25 gigawatts electric and 35 gigawatts thermal by 2045.

As shown by the data in the Chapter 3 supplement, "Expanding the Scope: Next-Generation Geothermal Opportunities," the nation's technical geothermal potential runs to 2,160 gigawatts outside of protected areas, making the stated goals ambitious—yet achievable.

In fact, achieving even a fraction of its geothermal potential would strengthen Indonesia's grid resilience, lower peak demand, reduce fuel imports, sharpen industrial competitiveness, expand affordable cooling—and cement Indonesia's role as a global leader in clean, firm energy. This chapter outlines a roadmap for how to achieve these goals by scaling next-generation geothermal power, urban cooling, and industrial heat. By implementing the 10 policy

GEOTHERMAL POLICY RECOMMENDATIONS FOR INDONESIA

UNLEASH INDONESIA'S NEXT-GENERATION GEOTHERMAL POTENTIAL

- Update Geothermal Laws to Clearly Address Next-Generation and Direct-Use Geothermal
- Set National Targets for Geothermal Electricity and Industrial Heat and a Pathway to Get There
- Power Industry and Data Centers with Geothermal Heat and Cooling
- Make Geothermal Cooling Core to Urban Development

MOBILIZE INVESTMENT AND ACCELERATE SCALE

- Fast-Track Permitting, Administrative Coordination, and Other Procedures
- Reduce Financial Risk with Open Data and Expanded Exploration Programs
- Use Collective Procurement to Lower Project Costs
- Standardize Long-Term Geothermal Power Contracts

STRENGTHEN COMMUNITY TRUST AND BENEFITS

- Empower Community Participation and Guarantee Community Benefits by Reforming Geothermal Production Bonuses
- Expand the Geothermal Ecosystem to Unlock Local Jobs

recommendations offered in this chapter, Indonesia could put itself on track to meet its climate targets while also lowering consumer and industrial energy bills, creating more than 650,000 quality jobs, and unlocking billions in private investment.

Grounded in Indonesia's geological strengths and state capacity—and informed by global best practices—this package ensures communities share the benefits, strengthens energy security, and delivers these outcomes with significantly lower environmental risk than fossil fuels or conventional geothermal.

10 RECOMMENDATIONS TO EXPAND GEOTHERMAL DEVELOPMENT IN INDONESIA

Unleash Indonesia's Next-Generation Geothermal Potential

Indonesia is a global leader in conventional geothermal, but an important next step for the country to take is incorporating next-generation geothermal power—as well as geothermal cooling and industrial process heat—into its frameworks.

1. Update geothermal laws to clearly address next-generation and direct-use geothermal.
2. Set national targets for geothermal electricity and industrial heat and a pathway to get there.
3. Power industry and data centers with geothermal heat and cooling.
4. Make geothermal cooling core to urban development.

Mobilize Investment and Accelerate Scale

Creating project finance certainty and unleashing private capital will be key to growing Indonesia's geothermal opportunities.

5. Fast-track permitting, administrative coordination, and other procedures.
6. Reduce financial risk with open data and expanded exploration programs.
7. Use collective procurement to lower project costs.
8. Standardize long-term geothermal power contracts.

Strengthen Community Trust and Benefits

Expand benefits for communities and workers while reducing environmental risks.

9. Empower community participation and guarantee community benefits by reforming geothermal production bonuses.
10. Expand the geothermal ecosystem to unlock local jobs.

Taken together, these measures can provide Indonesia with a decisive pathway: a modern legal foundation that embraces next-generation geothermal and geothermal heating and cooling; a risk-sharing framework that mobilizes private and public capital; market rules that create predictable demand and fair pricing; and safeguards that guarantee communities share directly in the benefits.

INDONESIA'S CURRENT GEOTHERMAL LEGAL FRAMEWORK

Indonesian law used to classify geothermal exploration as mining operations, which subjected power project development to complicated rules and regulations.[2] But the enactment of Geothermal Law No. 21/2014, designed around conventional hydrothermal systems, reclassified the use of geothermal as a non-mining activity and helped streamline geothermal development.[3] The law also distinguished geothermal development for electricity—"indirect use"—from "directly used" geothermal.

While helpful, this change put geothermal electricity licensing in the hands of the central government[4]—and left direct-use geothermal licensing split, inefficiently, between the central and local governments.[5]

Today, developers of geothermal applications require distinct permits depending on the type of installation:

1. Electricity generation requires a Geothermal Business Permit.[6]
2. Under Ministry of Energy and Mineral Resources (MEMR) Regulation 5/2021, direct-use projects instead require a Certificate of Operational Worthiness specific to geothermal direct-use.[7]
3. If a geothermal site is located in a forest area, a developer must also obtain an official Approval for the Use of Forest Areas.[8]

In 2017, legislators introduced more detailed regulations for electricity generation permitting processes via Government Regulation No. 7/2017[9] and MEMR Regulation No. 37/2018.[10,11]

Business licensing in the energy sector is governed by MEMR Regulation No. 5/2021,[12] which links geothermal activities to their respective Indonesian Standard Industrial Classifications (KBLIs) within the national Online Single Submission (OSS) system. This regulation also outlines requirements for operational readiness through the Certificate of Operational Worthiness for geothermal facilities. However, this is the extent of Indonesia's current national regulatory framework for geothermal direct-use projects, as the government has not yet issued a dedicated KBLI or implementing regulation for direct-use activities. Since the enactment of Omnibus Law No. 11/2020 (Job Creation Law),[13] Indonesia's government has expressed its intent to simplify regulations governing direct-use geothermal activities, but it has yet to do so.

CURRENT FRAMEWORK GOVERNING GEOTHERMAL ELECTRIC POWER PLANT DEVELOPMENT

PLN, Indonesia's state-owned national electricity utility, owns and operates the national power grid. The utility controls generation, transmission, distribution, and retail. Private sector participation happens mainly through independent power producers selling power to PLN under Power Purchase Agreements. Direct sales to industrial consumers are allowed under limited conditions. This structure is governed by Electricity Law No. 30/2009 and MEMR Regulation No. 10/2018.

For the geothermal power, Government Regulation No. 7/2017 under the Geothermal Law establishes the framework for indirect use—electricity generation—placing MEMR in charge of Geothermal Working Areas and permits and providing the basis for power sales to PLN. As the government revises Government Regulation No. 7/2017 through 2025 to streamline development,[14] it should ensure that emerging technologies such as advanced geothermal systems and engineered geothermal systems are explicitly incorporated into the updated framework. (See Recommendation 1.)

The Directorate General of New, Renewable Energy and Energy Conservation in MEMR leads the implementation of geothermal policy, pricing, and licensing. MEMR also coordinates financing and policy support with other ministries such as the Ministry of Finance, the Ministry of State-Owned Enterprises, the Ministry of Industry, the Ministry of Investment and Downstream Industry, the Ministry of Environment, and the Ministry of Forestry. Recent reforms include the OSS system for permits and MEMR Regulation No. 11/2024 on domestically made equipment. MEMR also formulated ceiling prices for renewables under Presidential Regulation No. 112/2022, the current geothermal electricity tariff regulation.

PLN indicates that the shift to the current price regime has made it easier to offer more attractive prices to developers and provides a stronger legal basis for Power Purchase Agreement negotiations. However, some geothermal power plant developers have suggested that the current ceiling price still falls short of private sector expectations, particularly in terms of desirable internal rates of return.

As mentioned, the Geothermal Law and related regulations set out the geothermal licensing process for electricity generation. Key stages include (i)

SUMMARY OF GEOTHERMAL DEVELOPMENT SCHEMES AND KEY IMPLEMENTING ENTITIES IN INDONESIA

Preliminary surveys	Working Area (WKP) determination and auction	Granting of Geothermal Permit (IPB)	Exploration and feasibility study	Exploitation
The government/ MEMR, through Badan, Geologi conducts preliminary surveys (SP) and preliminary and exploration surveys (SPE), or may assign: • Research institutions (PSP) • Business entities (PSPE)	**MEMR** conducts the auction of WKP based on the data acquisition scheme: • Open auction: SP, SPE, PSP • Limited auction: PSPE or may assign a state-owned enterprise or public service entity.	**MEMR** grants the IPB to the auction winner (**business entity**) for exploration and exploitation activities, in compliance with relevant environmental regulations, with a total duration of 37 years and the possibility of a 20-year extension.	The **business entity** submits the feasibillity study results to the **MEMR**, conducts geothermal exploration, and enters into a Power Purchase Agreement (PPA).	A **business entity** that develops a geothermal power plant may sell the electricity produced (to public through PLN) and must return the IPB to **the government** after its validity period expires.

Figure 7.1: Summary of geothermal development phases and plans and related key entities. Source: authors.

preliminary surveys; (ii) government auctions of Geothermal Working Areas (WKP) where developers obtain a Geothermal Business Permit (IPB); (iii) exploration and development (up to seven years) covering studies, drilling, and assessments; and (iv) the signing of a Power Purchase Agreement (PPA) with PLN. (See **Figure 7.1**.)

To reach a commercial phase, PLN currently offers three main programs:

1. Independent Power Producers' WKP partnerships, which operate under several possible arrangements:
   - Power Purchase Agreement: The Geothermal Business Permit (IPB) holder develops and operates the power plant independently or jointly with a PLN subsidiary.
   - Special Project Company: The project is developed through a dedicated joint venture entity formed between the geothermal developer and PLN (or its subsidiary).
   - Steam Purchase Agreement: The IPB holder supplies steam to a PLN subsidiary that owns and operates the power plant, as in the Kamojang plant in West Java.
2. PLN-owned and operated WKPs (self-management) in which PLN develops and manages plants, including well operations, directly.
3. Geothermal Exploration and Energy Conversion Agreements, which bring private partners into PLN-owned WKPs. These agreements share the risks and rewards by assigning PLN responsibility for permitting, land acquisition, and site preparation while offering early drilling cost payments to improve project returns.

In addition, the national government has introduced a series of policies to accelerate geothermal power plant development. Key measures include the Government Drilling Scheme (Ministry of Finance Regulation No. 62/2017),[15] which is expected to reduce early-stage risks by financing exploration; the shift from Build-Own-Operate-Transfer (BOOT) to Build-Own-Operate (BOO) (MEMR Regulation No. 4/2020), which should make projects more bankable by allowing developers to retain ownership; and the Carbon Economic Value framework (MEMR Regulation No. 16/2022), which enables revenue via carbon credits. Further support comes from the relaxation of local content requirements (MEMR Regulation No. 11/2024) to improve project bankability. Together, these policies were established to lower costs, share risks, and move stalled projects along.

GEOTHERMAL DIRECT-USE OVERVIEW AND DEVELOPMENT PLANS

In 1999, Pertamina Geothermal Energy and the National Research Institute developed the nation's first direct-use geothermal system—a mushroom-harvesting project in the Kamojang geothermal field in West Java.[16] At the time, Indonesia's geothermal framework, Law No. 27/2003, had only one mention of direct use.[17] Unfortunately, 15 years later, geothermal direct use remains relatively underutilized considering the nation's rich subsurface resources, with Indonesia ranked 74th among 88 surveyed nations in total megawatt thermal use.[18] (See Chapter 4, "Beyond Electricity: Indonesia's Thermal Energy Demand and Direct Use Potential," for more information.)

Even more striking, analysis undertaken by Project InnerSpace suggests that Indonesia has thousands of gigawatts of thermal potential across the whole country. This finding tracks with analysis explained in Chapter 4, "Beyond Electricity: Indonesia's Thermal Energy Demand and Direct Use Potential," that shows geothermal could cost-effectively meet 66.5% of Indonesia's thermal demand by 2030—which would be 44% of the nation's climate goal. What's more, these resources could serve nearly 90% of the country's thermal demand by 2050. The lack of direct-use geothermal in Indonesia today is not surprising: While Law No. 21/2014 lists four categories of potential geothermal direct-use applications to guide developers (tourism, agri-business, industry, and other activities),[19] it prioritized the development of geothermal for *indirect* use—in other words, for electricity generation.[20] Add to that, Government Regulation No. 25/2021 lists 13 obligations for Geothermal Business Permit holders. The development of direct use is 12th on the list.[21]

Although the nation did issue important regulations and guidelines to stimulate local economic growth and drive the national energy transition,[22,23] they are mostly

procedural and do not create the enabling conditions required for large-scale commercial deployment of direct-use geothermal.

Creating conditions that can enable the use of direct-use geothermal would be an impactful step for Indonesia. The policy roadmap outlined in this chapter includes several recommendations that would help Indonesia deploy direct-use geothermal either for urban cooling or industrial heat applications nationwide. Doing so would simultaneously improve air quality and the health of its citizens and help the country reach its climate goals.

POLICY RECOMMENDATIONS

The 10 recommendations in this chapter offer a mix of short-, medium-, and long-term ideas for how Indonesia can unlock more geothermal potential across the country. One of the most important steps Indonesia can take now is to implement Recommendation 1, which would establish a legal framework for next-generation geothermal projects and clarify the use of geothermal for industrial heat and cooling.

Recommendation 1: Update Geothermal Laws to Clearly Address Next-Generation and Direct-Use Geothermal

Who Takes Action: MEMR Directorate General of New, Renewable Energy and Energy Conservation and Directorate General of Mineral and Coal; House of Representatives of the Republic of Indonesia

Geothermal Law No. 21/2014 provides the principal legal foundation for geothermal development, but it was written for conventional hydrothermal systems. Since the law was passed, next-generation technologies—such as engineered geothermal systems and advanced geothermal systems—have emerged that use engineered reservoirs, closed-loop wells, or advanced heat-exchange methods rather than relying on naturally occurring hydrothermal fields. (See Chapter 1, "Geothermal 101: Overview of Technologies and Applications"). Yet Indonesian law still defines geothermal resources largely as underground water and steam, leaving these new technologies outside the nation's legislative scope and creating uncertainty for licensing, investment, and environmental safeguards for next-generation geothermal power projects.

At the same time, Indonesia's energy demand is shifting rapidly toward heat and cooling. Many industrial clusters rely heavily on low- to medium-temperature heat (less than 225°C), and urban cooling demand is projected to rise sharply. Today, geothermal direct-use projects—industrial heat and district-scale cooling—lack a clear statutory basis that treats them as energy infrastructure on par with electricity generation. The government also lacks a clear regulatory framework that manages the use of geothermal brine and excess heat for commercial direct-use purposes. Without such frameworks, developers face ambiguity regarding pricing, incentives, and planning integration.

To address these gaps, Law No. 21/2014 should be amended to define geothermal energy. The current definition is as follows: "Geothermal energy means thermal energy sources as contained in hot water, steam, and rocks along with associated minerals and other gasses that are genetically inseparable in a geothermal system."

To clearly address next-generation and direct-use geothermal, this definition could be changed to the following: "Geothermal energy means thermal energy originating from the Earth's subsurface, regardless of its medium of transfer or method of extraction, including but not limited to naturally occurring steam and hot water, artificially stimulated reservoirs, closed-loop systems, and other advanced geothermal technologies." This definition should explicitly encompass current and future methods of heat harvesting to ensure regulatory clarity, investment certainty, and alignment with global technological progress. In parallel, revisions to Government Regulation No. 7/2017 should integrate these technologies into the licensing and pricing framework for both power and direct-use applications. The amended law should also designate geothermal direct-use systems as "priority infrastructure," granting them eligibility for streamlined permitting, regulated tariffs, and coordinated planning support under Indonesia's national infrastructure policy.[24]

In addition to changing the definition of geothermal and granting direct-use projects priority infrastructure status, the government could take several other concrete next steps to operationalize this recommendation, including the following:

- **Establishing a national tariff framework for geothermal heat and cooling**—benchmarked against displaced fossil fuels—and pairing the framework with a value-added tax (VAT) and customs relief for geothermal cooling systems and components in designated zones, drawing on models from Turkey's geothermal district heating networks[25] and France's Paris Basin regulated tariffs.[26]
- **Introducing standardized heat and cooling supply agreements (HSAs/CSAs)** with indexed pricing, minimum-take obligations, and long-term commitments—modeled on international best practices[27]—to ensure bankability, pricing transparency, and reliable heat delivery.
- **Implementing rights-of-way and connection rules** for thermal loops and buried pipelines, modeled after European district-heating frameworks to enable integration into urban and industrial planning.
- **Funding targeted pilot projects** to jump-start direct-use heating, geothermal cooling, and next-generation power projects, which can help demonstrate viability, build investor confidence, and accelerate deployment.

Local governments should also play a central role in geothermal direct-use planning, tailoring implementation to regional industry, community, and tourism needs. Lampung Province's Regional Regulation No. 11/2019 on surface-water use illustrates how provinces can lead by creating a fiscal

CRITICAL MINERAL EXTRACTION FROM GEOTHERMAL BRINES

Indonesian law defines geothermal development and mineral extraction as two different activities.[31] But geothermal exploration, particularly from conventional geothermal systems, can also produce critical minerals such as lithium, silica, and rare earth elements that are dissolved in geothermal brines. These brines have the potential to be a solid source of lithium; they contain concentrations of up to 60 ppm,[32] compared with 0.2 ppm of lithium concentration from seawater. (Silica can also be extracted from geothermal sludge.[33])

Minerals extracted from geothermal fluid can be used for agriculture and the cosmetic industry. In Iceland, several skincare products and supplements, namely MýSilica and GeoSilica, come from the by-product water of geothermal power plants.

In Indonesia, several research initiatives focused on geothermal byproducts for the agriculture sector are underway. Katrili and Sulasih-Sulanjana are fertilizer-booster products developed through collaborations between University of Gadjah Mada and PT Pertamina Geothermal Energy, as well as PT Geo Dipa Energi (Persero).[34] The products use nano-particulate silica to strengthen plants' resistance to pests and improve moisture retention in soil. They have demonstrated promising results, with local farmers reporting larger, more resilient crop yields and improved overall crop stability.

The country's lithium needs are growing. For example, Indonesia is targeting 2 million electric cars and 13 million electric motorcycles by 2030, which could mean it would need hundreds of thousands of tons of lithium in the next five years.[35] Extracting the lithium from geothermal brine is less environmentally impactful than mining it from the Earth.

In updating laws, the government should recognize mineral extraction as a permissible co-activity within geothermal concessions and write regulations specifically to allow mineral extraction from geothermal brines.

Along with legal reforms outlined, the government should also offer streamlined licensing procedures that allow geothermal operators to apply for mineral extraction rights under their existing concession, rather than requiring separate permits. Fiscal incentives such as import duty exemptions for mineral recovery technologies could reduce financial risks for early-stage projects.

and governance framework—defining who pays, how fees are calculated, and how revenue is allocated.[28] A similar model could establish permitting and registration systems for direct-use wells and pipelines; set usage fees or royalties based on heat extracted, application type, and scale; and channel revenues toward community infrastructure, regional industrial parks, and eco-tourism facilities. A national regulation could then replicate and standardize this approach across Java, Sumatra, and other regions with high thermal demand. (See Chapter 4, "Beyond Electricity: Indonesia's Thermal Energy Demand and Direct Use Potential.")

Issuing a higher-order regulation for geothermal direct use and elevating the "encouragement and/or prioritization of direct-use geothermal in WKP" within Government Regulation No. 25/2021[29] would send a clear signal that Indonesia intends to treat industrial heat and building cooling with the same strategic importance as electricity. These actions can create the policy certainty needed for large-scale investment[30] and signal to domestic and international partners that Indonesia intends to unlock new opportunities for industrial competitiveness, national resilience, and green sovereignty.

Recommendation 2: Set National Targets for Geothermal Electricity and Industrial Heat and a Pathway to Get There

Who Takes Action: MEMR Directorate General of New, Renewable Energy and Energy Conservation and Directorate General of Electricity; PLN

Two related steps that Indonesia could take are to (i) set coordinated national targets for firm geothermal electricity and direct-use geothermal heat—complementary pillars that can cut coal use, stabilize the grid, and decarbonize industry; and (ii) introduce a dedicated clean and firm procurement path within PLN's Electricity Supply Business Plan (RUPTL) to ensure a pathway to meet these goals.

Based on the technical potential discussed in this report, we recommend the goal of 15 gigawatts electric and 15 gigawatts thermal heat by 2035, scaling to 25 gigawatts electric and 35 thermal by 2045. These paired goals align procurement, planning, and finance so that power and heat grow together.

To help ensure the country meets these targets, the government could create a clear procurement path inside PLN's RUPTL with multi-year capacity awards dedicated to geothermal and carve-outs for next-generation systems. Although the ceiling prices established under Presidential Regulation No. 112/2022 are higher than the current average electricity supply cost, many developers still view the prices as insufficient to stimulate investment, noting that an internal rate of return of around 14% is often needed for geothermal projects. In addition, geothermal plants should receive capacity credits at or above 90% to reflect their round-the-clock reliability, with bonus payments for high availability.

In line with Indonesia's commitment to phase out coal-fired power plants—most notably MEMR Regulation No. 10/2025 on the Roadmap for Energy Transition in the Electricity Sector,[36] which mandates early retirement of coal plants—geothermal should be recognized as a central pillar of that transition. Repurposing or co-locating next-generation geothermal facilities at existing coal sites can preserve grid stability and infrastructure value while advancing the national phase-out agenda.[37] Multiple coal plants in Indonesia sit on top of high geothermal heat and are early candidates for further investigation. (For more details see Chapter 2, "Powering the Transition: Indonesia's Geothermal Market.")

Recommendation 3: Power Industry and Data Centers with Geothermal Heat and Cooling

Who Takes Action: MEMR Directorate General of New, Renewable Energy and Energy Conservation and Directorate General of Electricity; Ministry of Industry; Ministry of Communication and Digital

Indonesia's biggest and most immediate geothermal opportunity lies in cleanly and efficiently meeting thermal energy demand. In 2023, industrial and process heat demand totaled 2,998,059 terajoules, generating approximately 241 million metric tons of carbon dioxide emissions—almost one-quarter of Indonesia's total energy-related emissions. As explored in Chapter

4, "Beyond Electricity: Indonesia's Thermal Energy Demand and Direct Use Potential," if geothermal and other clean heat solutions decarbonize two-thirds of this thermal demand by 2030, the emissions savings could reach close to 160 million metric tons of carbon dioxide—44% of Indonesia's 2030 reduction pledge in the energy and industrial sectors. The Nationally Determined Contributions have not yet assigned an energy-only quota for Indonesia's 2060 net-zero pathway, but direct-use geothermal could decarbonize 90% of thermal demand by 2060, a nationally significant cut. In other words, geothermal for cooling and for providing industrial heat is a pivotal lever for Indonesia to accomplish its energy goals.

The ideal place to start this work and drive geothermal deployment at scale is in industrial clusters and data centers. Industries such as textiles, food and beverage, pulp and paper, and chemicals all use process heat with temperatures below 250°C—ideal for geothermal. Additionally, Indonesia's rapidly expanding digital economy is driving exponential growth in energy-intensive data centers, which require year-round, highly reliable cooling that can be efficiently supplied through geothermal and mine-water systems.

In addition to the legal and regulatory updates suggested in Recommendation 1, the government could take several other concrete next steps to operationalize this recommendation, including in the following areas:

- **Thermal zoning and mandates:** MEMR and the Ministry of Industry, along with provincial governments, should designate geothermal heat priority zones in major industrial estates and urban districts; secure rights-of-way for piping as mandated under regional land use and infrastructure laws; and require that large new heat users locate in, or connect to, these systems.
- **Financing:** Through the Indonesia Infrastructure Guarantee Fund, PT SMI, and state banks, offer concessional loans and credit guarantees for shared thermal networks and retrofits, including pooled Special Purpose Vehicles at the industrial estate and urban district levels to aggregate credit.
- **Public procurement and project siting:** Require government-backed data centers and industrial parks in development to adopt geothermal-ready design standards and prioritize the integration of geothermal systems when siting a project in order to meet green certification requirements.
- **Replicable pilots:** Fund between three and five flagship industrial clusters (in Java, Sumatra, and Sulawesi) and two or three geothermal-cooled data center campuses, providing standardized HSAs/CSAs, technical and procedural rules that define how end-users connect to a shared network, and monitoring protocols—thus creating a national template that can be replicated.

By aligning industrial clusters and data centers with geothermal supply, Indonesia can produce the first gigawatts of direct-use heat deployment this decade. As a result, the country would cut fuel imports, stabilize energy costs, and help position itself to achieve up to one-third of its 2030 pledge and a significant share of its 2050–2060 climate goals.

Recommendation 4: Make Geothermal Cooling Core to Urban Development

Who Takes Action: Ministry of Agrarian Affairs and Spatial Planning; Ministry of Public Works; Ministry of Housing and Residential Areas; Ministry of National Development Planning

The International Energy Agency projects that between 2021 and 2030, Indonesia will have added more than 2 billion square meters of new housing. The agency also projects that by 2030, the number of households with air-conditioning units is likely to jump from about 1 in 10 to more than 1 in 3.[41] In parallel, Indonesia's National Cooling Action Plan (I-NCAP) estimates electricity use for cooling will rise from 79 terawatt-hours in 2020 to 183 terawatt-hours in 2030 and about 265 terawatt-hours in 2040.[42] (See Chapter 2, "Powering the Transition: Indonesia's Geothermal Market.") The I-NCAP emphasizes the need for passive and district-scale solutions to reduce cooling-related emissions—an area where geothermal systems could provide continuous, low-carbon cooling with far lower peak electricity requirements.

The Ministry of Agrarian Affairs and Spatial Planning, the Ministry of Public Works and Housing, the Ministry of National Development Planning (Bappenas), MEMR

GEOTHERMAL-POWERED DATA CENTERS: INDONESIA'S PATH TO A GREEN DIGITAL ECONOMY

Co-locating data centers with geothermal resources offers a direct, always-on, and clean source of on-site power. A recent U.S.-based analysis shows this approach can cut the levelized cost of electricity by between 31% and 45% compared with traditional grid-dependent models.[38] With global technology companies racing to secure low-carbon, 24/7 power for data centers, few countries have more potential—and expertise—than Indonesia.

As of August 2024, PLN was serving 128 data center customers with nearly 1 gigawatt of load. Demand is projected to reach 4 gigawatts by 2033.[39] The rapid growth of AI could accelerate that demand by two or three times. With its exceptional subsurface heat resources, Indonesia is uniquely able to meet—and even surpass—this demand. Today, some existing data center activity overlaps with conventional geothermal production, but the fastest-growing digital load centers lie in areas where next-generation geothermal technologies come into play.

The Project InnerSpace GeoMap Beta tool highlights wide zones with favorable geothermal resources that sit directly below Indonesia's emerging data center corridors—Jakarta, Purwakarta, Surabaya, Batam, and Medan.[40] This match can enable off-grid geothermal generation near major fiber and industrial nodes, providing reliable, low-carbon baseload power exactly where it is needed.

Aligning Energy and Digital Growth

- **In Java,** the Jakarta–Purwakarta corridor hosts the country's highest concentration of data centers—and has some of the nation's best subsurface power potential.
- **In Surabaya,** strong geothermal resources can anchor the development of green data centers, while submarine cable interconnections can extend this digital and energy capacity to emerging hubs in South Kalimantan and Makassar.
- **In Sumatra,** geothermal resources align with fiber nodes in Lampung and Medan, creating potential for data center hubs powered by geothermal.
- **In the Riau Islands (Batam),** subsurface heat resources make the islands Indonesia's most strategic location for next-generation geothermal data centers because Singapore, next door, is constrained by land and renewable energy limitations and searching for ways to sustain its position as a global data hub. Next-generation geothermal systems in Batam can deliver reliable baseload power and ultra-low latency for one of Asia's most critical fiber nodes.

This confluence of demand and resources means Indonesia makes one of the world's most compelling cases for geothermal-powered digital infrastructure.

Policy Pathways and Incentives

The Indonesian government can take decisive steps such as the following to accelerate geothermal integration in the data center sector:

- **Mandate geothermal integration:** Electrify 50% of new or expanding data center loads within the next one or two years, aligned with Presidential Regulation No. 112/2022 on renewable tariffs.
- **Leverage geothermal heat for cooling:** Meet 50% of cooling demand via geothermal heat using direct-line (private wire) models, especially in Java and Sumatra.
- **Create fiscal incentives:** Offer tiered tax holidays by capital expenditure or energy load and VAT or import duty exemptions for geothermal and cooling equipment such as drilling tools, Organic Rankine Cycle units, absorption chillers, pumps, heat exchangers, immersion cooling hardware, and more.
- **Support co-location and clustering:** Establish geothermal industrial parks near major load zones, and grant land and building tax reductions for data centers that are situated on top of—or within 20 kilometers of—a geothermal field.
- **Offer flexible off-site incentives:** Extend special PPAs or partial benefits for off-site geothermal power users.

With strong regulatory direction, targeted fiscal incentives, and continued exploration of next-generation geothermal technologies, Indonesia can transform its geothermal endowment into the foundation of Asia's clean, connected future.

(as the energy sector coordinator), and provincial governments could take the following concrete steps to operationalize this recommendation:

- **Designate geothermal cooling zones** in dense districts, industrial clusters, and new developments (including Nusantara), reserving pipe corridors and shared borefield space.
- **Require geothermal-ready design** in municipal standards and large public or commercial projects.
- **Integrate district cooling** into urban master plans and procurement rules, using standardized connection codes, HSAs, and CSAs.

Geothermal cooling should be established as a core design principle of the new capital city to anchor the city's early growth. The Nusantara Capital Authority, in collaboration with the Ministry of Public Works and Housing and Bappenas, should adopt geothermal district-cooling pilots, which would reduce electricity demand during peak hours, lower emissions, and demonstrate a scalable and replicable model for other cities.

By embedding geothermal cooling in planning frameworks, Indonesia can keep cities livable without overloading the grid. If just 10% of Indonesia's projected 2040 cooling demand was

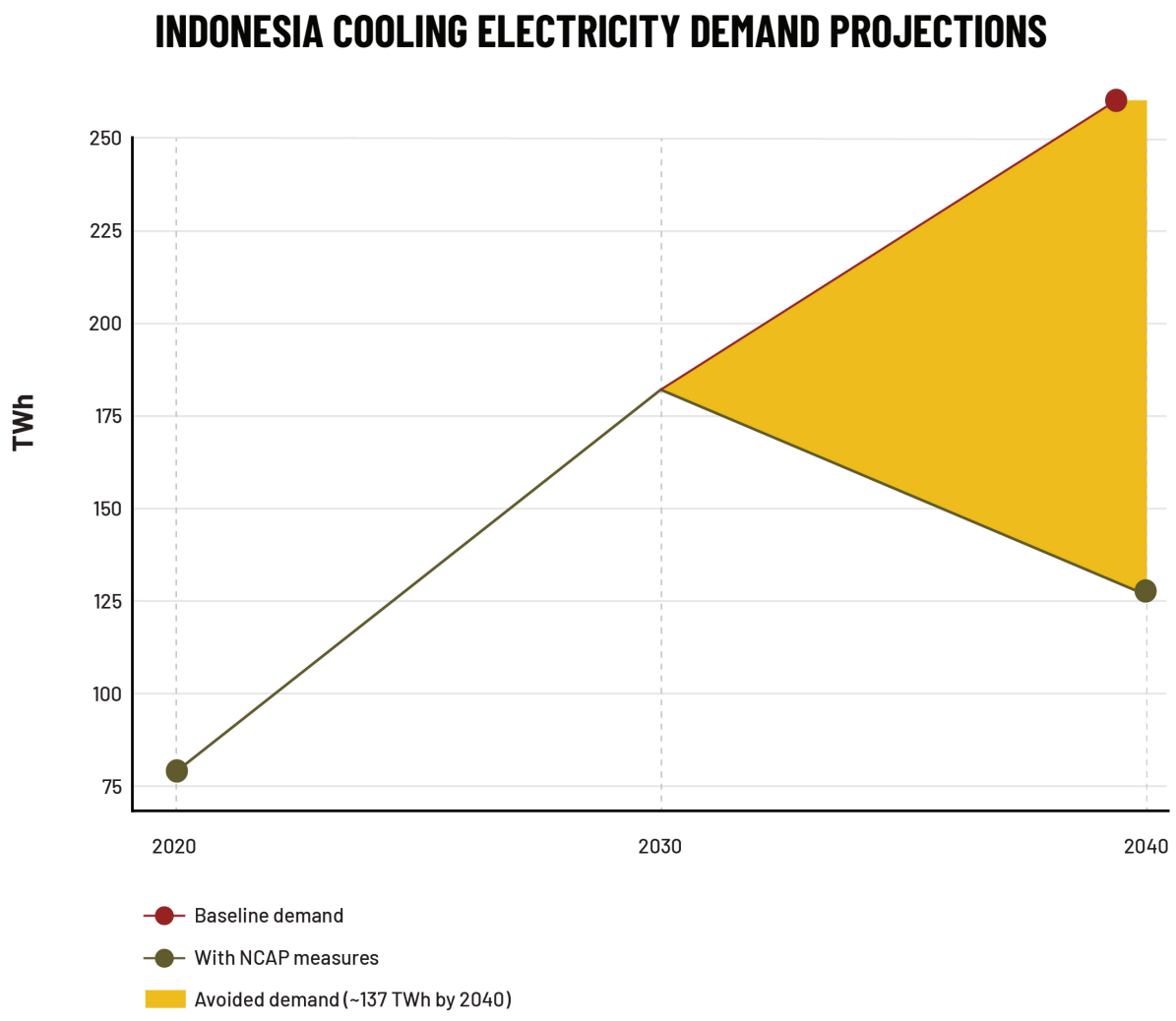

Figure 7.2: Positioning geothermal district cooling as the anchor technology for designated zones can shoulder a meaningful share of the national cooling efficiency wedge. NCAP = National Cooling Action Plan; TWh = terawatt-hours. Source: Adapted from United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) & United Nations Environment Programme (UNEP). (2024, August 6). *Indonesia sets path for climate-friendly cooling with National Cooling Action Plan (I-NCAP).*

met with geothermal instead of conventional air-conditioning, the country could avoid up to 130 terawatt-hours (see **Figure 7.2**) of peak electricity demand and tens of millions of tons of carbon dioxide emissions annually—the equivalent of taking several coal plants offline. This estimate is based on national projections that cooling could contribute more than 100 gigawatts to peak load by 2040,[43] and it assumes a conservative 10% substitution with low-power geothermal cooling systems. (See Chapter 4, "Beyond Electricity: Indonesia's Thermal Energy Demand and Direct Use Potential.")

By treating geothermal cooling as priority urban infrastructure, Indonesia can meet its surging cooling needs without overburdening the power system. Early planning and zoning will reduce costs compared with retrofitting while also ensuring that urban populations remain protected from rising temperatures and risks of heat waves.

Recommendation 5: Fast-Track Permitting, Administrative Coordination, and Other Procedures

Who Takes Action: Ministry of Investment and Downstream Industry; MEMR Directorate General of New, Renewable Energy and Energy Conservation and Directorate General of Electricity

Indonesia has taken an important step with its OSS system that centralizes investment licensing across sectors, but the system functions primarily as a routing platform rather than a true one-stop authority, and geothermal projects still face multi-year delays. The process to obtain important permits such as environmental clearances, forest-use approvals, land rights, and water licenses remains fragmented across agencies and levels of government. Integrating geothermal permitting into a unified, delegated OSS track would streamline investment licensing and turn administrative coordination into a catalyst for faster project delivery.

The government should establish a geothermal-specific fast lane within the OSS system, granting the MEMR a dedicated role as a single coordination point for geothermal licensing in exploration, Working Areas assignments, and production. MEMR would coordinate directly with the Ministry of Environment, the Ministry of Forestry, the Ministry of Agrarian Affairs and Spatial Planning, the Ministry of Public Works and Housing, Ministry of Investment, and provincial and district governments. This process should also acknowledge that some projects have lower risk than others. Smaller projects and projects that involve drilling in already developed areas are less risky than larger projects in forested areas. A tiered approach to approvals would recognize this fact.

To ensure accountability, the law should introduce statutory permit clocks—fixed deadlines for agencies to process applications, with automatic approval if the agency misses a deadline without cause. A 180-day statutory clock for geothermal projects would significantly reduce lead times, boost investor confidence, and align Indonesia's process with international best standards for renewable infrastructure.

In Indonesia's OSS system, geothermal activities currently fall under KBLI 06202 for geothermal exploration and extraction[44] and KBLI 35111 for electricity generation from geothermal sources.[45] KBLIs for direct-use projects fall under the purview of these two overarching classifications, with 16 specific licenses for heat use. However, there is no dedicated KBLI for geothermal direct use that would allow the industry to submit new KBLIs as technologies advance. For example, there is currently no KBLI for permitting ground source heat pumps. Once MEMR issues a regulation establishing the legal basis for direct-use activities—such as by updating MEMR Regulation No. 5/2021,[46] as described in Recommendation 1—it can formally coordinate with the Central Bureau of Statistics to create a new KBLI classification specific to geothermal direct use. This sequence would ensure that the new classification is grounded in a clear regulatory mandate and aligns with Indonesia's national licensing framework. As a result, investors could then register direct-use projects through the OSS system, access licensing pathways, and qualify for sectoral incentives under Indonesia's investment framework.

LICENSING FOR GEOTHERMAL DIRECT USE IN INDONESIA

For all geothermal direct-use projects, licensing is a critical step to ensure regulatory compliance, technical reliability, and operational safety.

In Indonesia, licensing for geothermal direct-use projects is regulated under the Ministry of Energy and Mineral Resources Regulation No. 5 of 2021 on Business Activity Standards and Products in the Implementation of Risk-Based Licensing in the Energy and Mineral Resources Sector.[47] Developers that hold a geothermal permit must obtain certificates that prove operational worthiness for direct-use applications. Submissions for these certificates are routed through the OSS system (**Figure 7.3**) to the Directorate General of New, Renewable Energy and Energy Conservation or the relevant provincial/district energy office.

While these safeguards are important, the licensing process plays a significant role in determining how geothermal development progresses. To support this chapter's vision for expanding direct-use geothermal, the government can strengthen the licensing framework so it is more enabling. This step can include clearer procedures, well-defined institutional roles, and efficient coordination while still maintaining rigorous personnel capabilities and safety and environmental standards.

The government could take several concrete next steps to operationalize this recommendation, including the following:

- **Establish a fast-track Certificate of Operation Worthiness** channel with clear service-level deadlines.
- **Clarify agency roles** via a joint decree and standardized checklist.
- **Adopt tiered approvals** so small and low-risk projects move quickly.
- **Build regional review capacity** and provide developer guidance.
- **Integrate permits** within the OSS system to cut duplicative submissions.

These improvements must be paired with a strong capacity-building program for provincial and district governments to ensure inspectors and local workers have the technical competencies to properly assess, certify, and monitor geothermal direct-use installations.

Recommendation 6: Reduce Financial Risk with Open Data and Expanded Exploration Programs

Who Takes Action: MEMR Directorate General of New, Renewable Energy and Energy Conservation and Geological Agency; Ministry of Finance; PT Sarana Multi Infrastruktur; Indonesia Infrastructure Guarantee Fund; Special Task Force for Upstream Oil and Gas Business Activities

Indonesia already has two key mechanisms to reduce the financial risk of early-stage geothermal development: the Government Drilling Scheme (Ministry of Finance Regulation No. 62/2017)—where the state directly funds and executes drilling before tendering working areas—and the Geothermal Resource Risk Mitigation Project (GREM, P166071), launched in 2018 with support from the World Bank and Climate Investment Funds. GREM became operational in June 2021 and is managed by PT Sarana Multi Infrastruktur (PT SMI), providing contingent financing to private and state-owned developers for exploration drilling. The program's structure allows partial loan forgiveness if wells prove non-viable, which reduces risk and encourages private participation.

To date, GREM has advanced several prospects—including Toka Tindung (Klabat-Wineru), Wapsalit, and Hu'u Daha—to the due diligence and financing stages, and a memorandum of understanding with Ormat Technologies was signed in September 2025. However, no publicly documented GREM-financed wells have yet been drilled,[48] underscoring both the promise of the program and the urgency of accelerating its

NAVIGATING THE CERTIFICATE ISSUANCE PROCESS

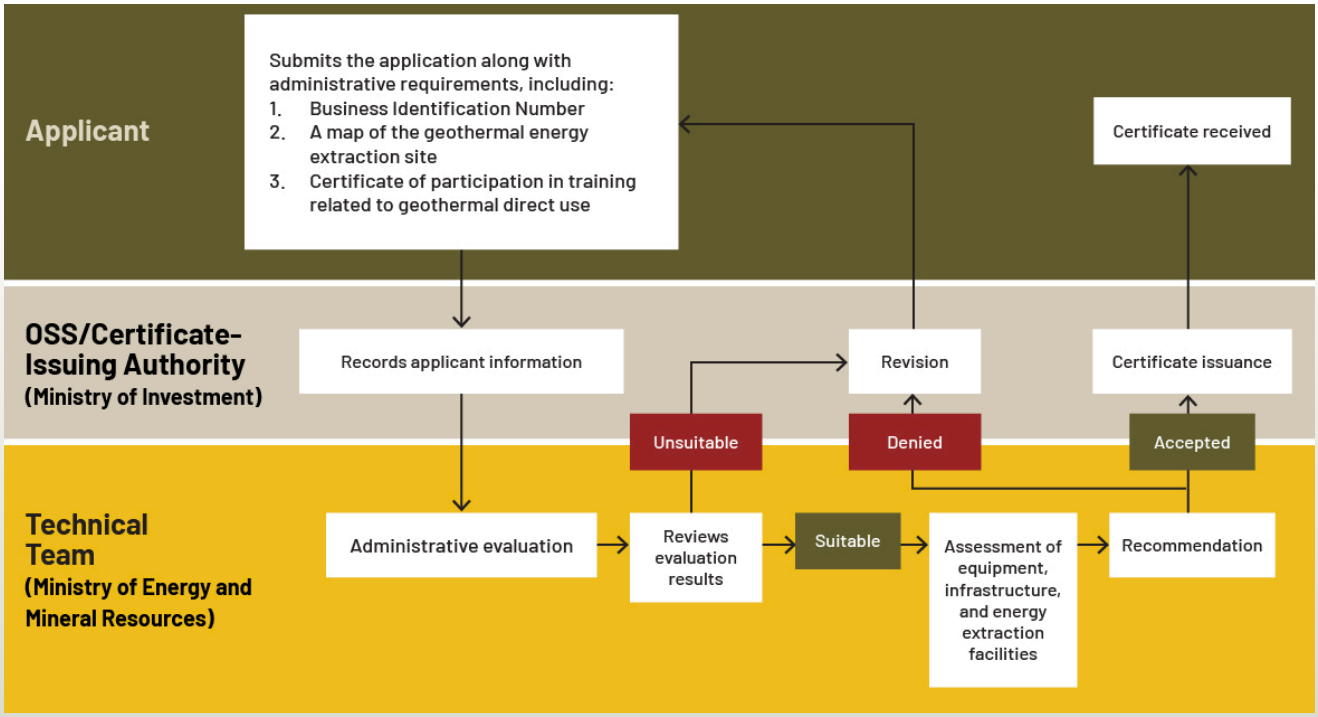

Figure 7.3: Process diagram outlining the stages of and responsible authorities involved in issuing the Certificate of Operational Worthiness for geothermal direct-use installations. OSS = Online Single Submission. Source: Audit Board of Indonesia. (2021). *Regulation of the Minister of Energy and Mineral Resources number 5 of 2021 concerning standards for business activities and products in the implementation of risk-based business licensing in the energy and mineral resources sector*. Government of Indonesia; Al Asy'ari, M. R., Adityatama, D. W., Brilian, V. A., Erichatama, N., & Purba, D. (2024). Beyond electricity: Geothermal direct use business models and potential applications in Indonesia. In *Proceedings, 49th Workshop on Geothermal Reservoir Engineering.* Stanford, CA, United States.

implementation. By expanding existing mechanisms rather than creating duplicative structures, Indonesia can leverage multilateral capital, strengthen PT SMI's role as a financial intermediary, and accelerate private sector participation.

Today, geothermal information in Indonesia is still compartmentalized—spread across multiple agencies, research institutions, and state entities with varying data standards and access rules. Confidentiality provisions and overlapping ownership between MEMR, the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas), and universities further complicate information-sharing and make coordination essential for a unified national database. Establishing consistent governance and interoperability standards will ensure that publicly funded exploration contributes to an open, cumulative knowledge system that benefits both investors and researchers. (See Chapter 5, "Deploying the Workforce of the Future: The Role of Indonesia's Oil and Gas Workforce and Institutions.")

MEMR, through its Data and Information Center, should establish a centralized geothermal data and sample repository linked to a national thermal atlas. The repository should be supported by modern APIs and digital platforms for seamless data integration, mapping, and analysis, and it should store both digital data sets and physical core and fluid samples accessible to government, academia, and industry. Developers that fail to comply with these reporting requirements should be ineligible for future exploration rights to ensure transparency and public benefit.

At the same time, Indonesia should expand public–private partnership (PPP) models for geothermal exploration and early development. With this approach, public entities would finance and execute initial drilling, while proven wells would be transferred to private developers for build-out under transparent tendering. Such models would lower entry barriers, distribute risks equitably, and speed up resource assessment. Comparable frameworks in Kenya, where the Geothermal Development Company leads government-backed exploration, and in the United States with the Frontier Observatory for Research in Geothermal Exploration (FORGE) program[49] show how blended public and private investment can rapidly scale geothermal capacity (see **Figure 7.4**).

Formally integrating geothermal into Indonesia's National PPP Strategy would enable projects to access viability gap funds, project-preparation facilities, and credit guarantees through PT SMI, the Indonesia Infrastructure Guarantee Fund, and state banks.

In addition, the government can take several concrete next steps to operationalize this recommendation, including the following:

- **Scale and accelerate GREM's developer-led window** to finance early exploration and feasibility work.
- **Extend eligibility** to direct-use and next-generation geothermal projects, including industrial heat, district cooling, and agricultural applications.
- **Mandate standardized data reporting,** requiring geological, geophysical, and geochemical results to be submitted in a common format and released publicly after a confidentiality period of between three and five years to ensure that state-supported drilling expands the national geothermal knowledge base.

By coupling open-data policies with expanded risk-sharing and PPP-based exploration programs, Indonesia can move from isolated project preparation to dozens of wells drilled each year by the late 2020s. This result would, in turn, create the exploration pipeline required for sustained growth across all types of geothermal. These reforms would reduce investor risk, expand scientific knowledge, and establish Indonesia as a regional leader in transparent and innovation-driven geothermal development.

GEOTHERMAL SECTOR GOVERNANCE ACROSS FOUR COUNTRIES

Aspect	Kenya	Turkiye	United States	Indonesia
Market structure	Liberalized, single buyer with open Independent Power Producer (IPP) access	Liberalized generation, state-controlled grid	Mixed: deregulated and regulated by state	Single-buyer (PLN)
Public sector role	Geothermal Development Company (GDC) funds exploration	Directorate of Mineral Research and Exploration (MTA) initial role, now private-led	Incentives + grants (federal & state)	Gov. drilling, limited PPPs
Private sector role	Post-exploration entry	Private-led via feed-in tariffs	Dominant, competitive	IPPs under PLN contracts
PPP usage	Build-Own-Operate-Transfer (BOOT), Build-Own-Operate (BOO), Build-Own-Transfer (BOT) widely used	Limited PPPs, some BOO	No formal PPPs, private financing + aid	Institutional PPPs, no geothermal focus

Figure 7.4: A comparative analysis of geothermal developments across four countries. PPP = public-private partnership. Source: Modified from Sutama, C. S., Ashat, A., Nur, S., & Alkano, D. (2024). Comparative analysis of geothermal PPPs: International insights and Indonesia's cases. In *Proceedings, the 10th Indonesia International Geothermal Convention and Exhibition (IIGCE) 2024*. Jakarta, Indonesia.

COLLABORATIONS, PILOT PROJECTS, AND DATA COLLECTION

The government could establish a pilot program in collaboration with Indonesian universities, state-owned enterprises, and global technology providers for geothermal innovation. This initiative would focus on reusing depleted or marginal oil and gas fields as test beds for next-generation geothermal concepts, including engineered and advanced geothermal systems, closed-loop designs, and superhot rock exploration. By building where there are existing wells, pads, and pipelines, and with existing seismic data, such a program could reduce costs and shorten timelines while demonstrating new approaches under Indonesia's geological conditions.

The program could be structured around competitive grants and concessional finance for university–industry consortia, encouraging partnerships that combine academic research, local operators, and international service companies. Flagship pilot clusters to test power generation and direct-use applications could be launched in regions with direct connections to industrial parks or data centers such as Sumatra, Java, and Kalimantan. These clusters would also serve as field laboratories for training Indonesian engineers, students, and regulators, building a skilled workforce for the next generation of geothermal development.

Data Collection and Sharing

All pilot projects should be subject to open-data requirements, with performance results and subsurface information made public within a fixed period to accelerate replication. Fiscal incentives and cost-sharing from industry—potentially financed through carbon pricing revenues or existing innovation funds—would help take the risk out of early-stage investment while anchoring long-term private sector participation. By 2028, such a program should aim to deliver at least five advanced geothermal pilot wells, validated techno-economic data for scaling, and a cohort of Indonesian professionals with hands-on expertise. Together, these outcomes would establish Indonesia as a regional leader in adapting advanced geothermal technologies to tropical and oil field settings.

Recommendation 7: Use Collective Procurement to Lower Project Costs

Who Takes Action: MEMR Directorate General of New, Renewable Energy and Energy Conservation; Ministry of Finance; National Public Procurement Agency

The government could support geothermal developers by conducting collective (or joint) procurement, especially in the early stages of exploration when costs and risks are significant (see **Figure 7.5**). This action can reduce the overall cost of a project by securing lower prices on key components such as generators, turbines, and drilling equipment.

Such support can be vital in Indonesia. Indonesia's geothermal resources are often located in remote areas with limited infrastructure, which increases the complexity and cost of a geothermal project. In some cases, developers have to create their own infrastructure, including roads and bridges, which can lead to high drilling costs; today, a typical well between 2,000 meters and 2,500 meters deep can cost between US$4 and $6 million in Indonesia.[50]

To bring costs down and make the market more viable for developers, the government should create a dedicated "geothermal procurement coordination unit." Under MEMR, such a unit would facilitate a centralized tender for drilling services to be used at multiple WKPs in the same province or island. The unit could also create a prequalified supplier database that includes contractors and other service providers with proper experience.

The unit would also ensure that procurement procedures align with regulatory requirements and industry best practices. It could offer incentives such as subsidies or tax benefits for joint collective procurement initiatives. The unit should also set clear guidelines to prevent anti-competitive practices.

Local governments play vital roles in collective procurement, and the unit would be responsible for working with governments on mobilization routes and permits. Alongside reducing cost, this approach can also minimize idle periods between projects for contractors.

GEOTHERMAL PROJECT RISKS, COSTS, AND HISTORIC FUNDING SOURCES

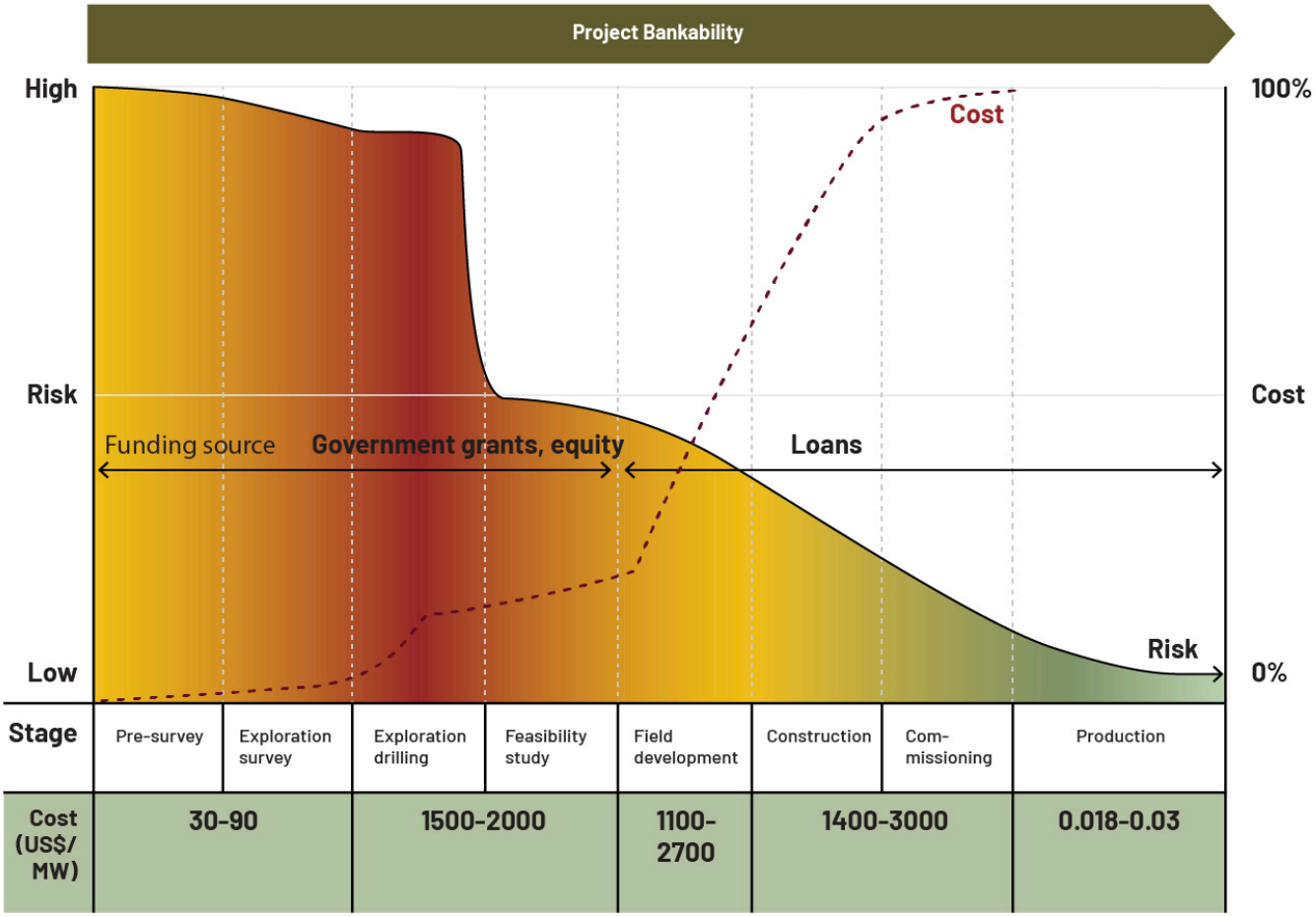

Figure 7.5: Geothermal project risk, costs, and funding sources. Source: Modified from Fridriksson, T., Matek, B., Albertsson, A., & Bertani, R. (2016). *Comparative analysis of approaches to geothermal resource risk mitigation: A global survey*. Energy Sector Management Assistance Program (ESMAP), World Bank; Purwanto, E. H. (2019). *Assessment of exploration strategies, results and costs of geothermal fields in Indonesia*. United Nations University Geothermal Training Programme.

Recommendation 8: Standardize Long-Term Geothermal Power Contracts

Who Takes Action: MEMR Directorate General of Electricity; PLN; Ministry of Finance Directorate General of Financing and Risk Management

Today, even when tariffs are adjusted, developers remain reluctant to commit capital due to risks that others in a contract will fail to meet their obligations. PLN is currently the sole purchaser of electricity in Indonesia, and its financial condition has limited its ability to sign bankable PPAs. Revising the pricing mechanism can help, but without confidence that there are secure offtakers, investors remain hesitant.

To remedy this situation, the government should require that all PLN geothermal PPAs be structured as bankable, long-term contracts with provisions related to curtailment, termination, and payment obligations aligned with international norms. To reduce counterparty risk, PPAs for high-capital expenditure geothermal projects should be backed by a sovereign guarantee. This guarantee would significantly reduce financing costs, improve credit ratings for projects, and unlock the scale of investment required for Indonesia's geothermal potential.

Recommendation 9: Empower Community Participation and Guarantee Community Benefits by Reforming Geothermal Production Bonuses

Who Takes Action: Ministry of Finance Directorate General of Treasury, Directorate General of Financing and Risk Management, and Fiscal Policy Agency; MEMR Directorate General of New, Renewable Energy and Energy Conservation; Ministry of Home Affairs

Indonesia already shares most geothermal revenue with host regions—80% of Revenue Sharing Funds (DBH) flows to regional governments and 20% to the central government.[51] While this sharing supports decentralization, it lacks transparency and tangible local outcomes. Once transferred, revenues often disappear into general budgets, leaving communities with visible infrastructure but no clear fiscal dividend—fueling distrust and resistance. (See Chapter 6, "Common Ground: Building Trust and Transparency in Indonesia's Energy Transition," for further context.) This perception is heightened in areas such as Wapsalit,[52] Mount Talang,[53] Tampomas,[54] and Tangkuban Perahu,[55] where poor consultation, weak benefit-sharing, and environmental concerns have sparked opposition and delayed projects.[56]

To rebuild trust, Indonesia should consolidate geothermal revenues through a unified geothermal production bonus (BPPB) mechanism—an instrument within the Non-Tax State Revenue system (PNBP)—bringing together DBH, PNBP, and voluntary developer contributions. Jointly managed by the Ministry of Finance and MEMR, this enhanced BPPB mechanism would serve as the central vehicle for delivering local benefits. It should finance tangible outcomes such as schools, clinics, training centers, geothermal cooling networks, and industrial-heat pilots—ensuring communities see and feel the dividends of hosting geothermal projects. Access to BPPB-supported benefits should be contingent on verified compliance with corporate social responsibility (CSR) commitments; free, prior, and informed consent (FPIC) protocols; and the Certificate of Operational Worthiness. All operations should be published on a public dashboard that is maintained by MEMR and Bappenas and shows audited revenue flows and approved projects.

This approach can build on local leadership. Lampung Province's Regional Regulation No. 11/2019[57] on surface-water use (outlined in Recommendation 1) offers a strong precedent—creating a transparent, community-driven system for managing natural resources. A similar geothermal model could define permitting, usage fees, and revenue allocation frameworks at the provincial level, then be scaled nationally.

To strengthen implementation, MEMR and the Ministry of Home Affairs should convert CSR from a voluntary practice into a mandatory, verifiable obligation. Indicators such as local job creation, community procurement, and delivery of social assets should be independently verified and publicly disclosed. Developers that fail to meet obligations should face enforceable penalties.

An independent geothermal governance body should be established to oversee BPPB revenue collection, allocation, and spending, which can ensure transparent formulas for distributing royalties and PNBP among national, regional, and local stakeholders. This governance function could be administered through PT SMI—a trusted state-owned financial intermediary—to provide fiduciary integrity and accountability. It should also support pilot projects for geothermal cooling and industrial heat and earmark a portion of revenue for domestic equipment manufacturing—helping Indonesia build a strong national supply chain.

Geothermal projects must respect rights of Indigenous and *adat* communities. MEMR should make FPIC a procedural requirement for developments affecting customary land, while developers should work with local universities and environmental agencies to co-produce social baselines, monitor environmental and social impacts, and maintain accessible grievance systems with pathways to mediation. Local governments should lead participatory planning, nominating community representatives to serve on advisory panels that guide BPPB-supported investment and disbursement.

Finally, local content must extend beyond procurement to people. Educational and training centers in geothermal regions should equip local residents with skills in construction, operations, and

safety—enabling long-term employment and deeper community integration.

These reforms align with Indonesia's legal architecture: together, Law No. 33/2004 on fiscal balance[58] and Law No. 21/2014 on geothermal energy provide authority for fiscal and sectoral coordination. Development should also comply with Environmental Law No. 32/2009[59] and the Ministry of Environment's implementing regulations on Environmental Impact Assessment (EIA) and post-operation restoration.

A reformed BPPB mechanism consolidated with DBH, PNBP, and developer contributions could unify scattered obligations into a single, transparent system—linking every rupiah to tangible outcomes and showing how Indonesia's geothermal wealth can power a model of green sovereignty that uplifts host communities.

Recommendation 10: Expand the Geothermal Ecosystem to Unlock Local Jobs

Who Takes Action: Ministry of Manpower; Ministry of Education, Culture, Research, and Technology; MEMR Center for Human Resource Development; National Research and Innovation Agency

Several regions in Indonesia reject the development of geothermal. In part, this rejection may be due to a lack of information about the benefits of the energy source for the public. Increasing public awareness about geothermal's economic and climate benefits can foster social acceptance and public support. To address the knowledge gap, the government should initiate geothermal educational programs for energy workers and the public into broader national energy policies.

This action could involve establishing dedicated funds for training programs, promoting geothermal-related research and innovation, and including geothermal energy and direct use topics in school curricula. These educational efforts can also align with national energy targets.

Through the Center for Human Resource Development, MEMR should collaborate with universities on educational events such as Geothermal Goes to Campus, an initiative timplemented at several universities in Indonesia, including Sepuluh Nopember Institute of Technology,[62] Diponegoro University,[63] and the University of North Sumatra.[64] Such events can foster students' interest in exploring geothermal energy development in Indonesia.

PRIORITIZE DEVELOPMENT IN LOWER-RISK ZONES

On the islands of Sumatra, Java, Sulawesi, and Maluku, Indonesia's significant geothermal potential often overlaps with ecologically sensitive areas.[60] To minimize environmental and biodiversity impacts, the government should prioritize development in non-forest use zones, which contain about 38% of the nation's conventional geothermal capacity. These areas typically offer easier road access, favorable geology, and lower investment costs, enabling faster and less disruptive development.

Geothermal projects in forest areas—often remote and mountainous—can require up to 10 kilometers of road per 100 megawatts of capacity,[61] increasing the risk of environmental harm to forests, wildlife, and water sources. Developers should avoid such sites where possible. If development in forest areas is necessary, MEMR and the Ministry of Forestry must enforce strict safeguards: promoting directional drilling from outside forest boundaries, minimizing land clearing, limiting road size, and integrating fauna crossings and erosion controls. Developers should also be required to train personnel on biodiversity protection and regulatory compliance.

Ultimately, Indonesia must ensure geothermal development does not increase pressure on forest ecosystems. Expanding the legal definition of geothermal to include low-impact applications—such as direct use for cooling and industrial heat—can shift development toward less sensitive, non-forested zones. This approach aligns environmental stewardship with energy goals, enabling sustainable growth without sacrificing biodiversity.

To address a broader audience, MEMR should collaborate with nongovernmental organizations or universities to give free webinars on geothermal topics. Several organizations have given geothermal webinars on various topics, including Indonesia's Center for Renewable Energy Studies; the Institute for Essential Services Reform (IESR) conducted a webinar about the social and economic benefits of geothermal energy.[65]

According to the *Specialized Workforce for Indonesia's Transition (SWIFT) Roadmap 2025–2060*, the need for labor in the geothermal sector will increase by 130,000 workers by 2060,[66] but if the country strives to produce 25 gigawatts electric and 35 gigawatts thermal, the direct and indirect workforce requirements could be more than 650,000 by 2045.

It is important to highlight the distinction of adding direct-use and thermal heat applications into this equation. After a conventional geothermal energy plant is up and running, the number of on-site jobs needed is relatively limited, which is why geothermal graduates have historically faced challenges with securing long-term work in the sector. But emerging commercial opportunities—such as direct-use applications, geothermal cooling networks, geothermal mineral extraction, and green hydrogen production—can generate substantially more workforce demand and create new value chains that diversify geothermal-related employment. If Indonesia successfully captures these wider geothermal-based opportunities, workforce needs could increase significantly across drilling services, industrial heat networks, district cooling, mineral recovery, and hydrogen production—making capacity-building efforts more relevant and impactful.

As explained in Chapter 5, "Deploying the Workforce of the Future: The Role of Indonesia's Oil and Gas Workforce and Institutions," the government needs to develop a comprehensive occupational map to help institutions get ready to prepare a skilled geothermal workforce. This map would identify current skills, workforce distribution, and future labor market requirements. It would also identify existing capacities and gaps so the government can plan relevant policies and training programs.

To coordinate this workforce agenda, the government should establish an Energy Workforce Transition Task Force authorized by presidential instruction and led by MEMR's Human Resources Development Agency. This task force would align forecasting, training, and certification across ministries, ensuring geothermal and energy-transition skills develop in a unified, industry-ready pathway. See Chapter 5, "Deploying the Workforce of the Future: The Role of Indonesia's Oil and Gas Workforce and Institutions," for more.

An established occupational map can guide policy initiatives, including vocational training, curriculum development, and certification programs. It would also promote strong links between educational institutions, industry demand, and government development plans. The map should also involve the oil and gas industry because there are so many translatable workforce skills and competencies across the two energy industries—up to 80% of the workforce effort required in the geothermal industry involves skills that are common in the oil and gas industry.[67]

CONCLUSION

If Indonesia achieved even a fraction of its geothermal potential, it would strengthen the nation's grid resilience, lower peak demand, reduce fuel imports, sharpen industrial competitiveness, and expand affordable cooling. By implementing the recommendations offered in this chapter, Indonesia could put itself on track to meet its climate targets while lowering the long-term costs of energy and creating hundreds of thousands of jobs.

The very first place to start: simply updating geothermal laws to clearly address next-generation and direct-use geothermal, as laid out in the first policy recommendation in this chapter.

Grounded in Indonesia's geological strengths and state capacity—and informed by global best practices—the set of recommendations offered in this chapter could cement Indonesia as a global leader in geothermal energy.

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