



Chapter 8

Policy and Regulatory Pathways to Catalyse Geothermal in India

Shayak Sengupta, with contributions from Karthik Ganesan, Council on Energy, Environment and Water, and Project InnerSpace

Deploying next-generation geothermal across industrial heat, building cooling, and electricity generation can help India meet soaring energy demand while cutting pollution, strengthening resilience, and creating jobs. India just announced a national geothermal policy framework; this chapter lays out five near- and medium-term actions to implement and expand it. Taken together, these five steps can convert India's large potential into projects while making India less reliant on imported energy.

Like many other parts of the world, India has long used geothermal hot springs for bathing and religious practices, yet its vast geothermal potential remains largely untapped. With energy demands expected to nearly double by 2050 and building stock projected to grow by close to 70% between now and 2047, the country faces soaring heating, ventilation, and air-conditioning (HVAC) needs.^{1,2}

The good news is that India has more than 11,000 gigawatts of direct-use technical potential (with a 100°C cut-off temperature down to 3,500 metres) and more than 1,500 gigawatts of geothermal cooling potential. Additionally, India has the technical potential for roughly 450 gigawatts of electricity generation (down to 5 kilometres) today and technical potential for more than 8,000 gigawatts of

electricity (down to 7 kilometres) as technology improves in the future. In fact, in 2024, the International Energy Agency issued a report stating that India has some of the highest potential for geothermal globally: "India is the third-largest market for next-generation geothermal power capacity by 2050. ... Deploying next-generation geothermal technologies would help India meet growing electricity demand while avoiding the need for additional coal-fired power plants, and it may be a more affordable option that could ... eliminate the need for some solar PV capacity and batteries, creating a more diverse clean energy mix."³

Recognising this potential, India recently adopted a national geothermal policy framework. Now, the country needs rapid implementation, bankable incentives, and



proof-of-concept pilots, as well as clear signals from the government on next steps. This chapter outlines a set of five policy recommendations aimed at exponential acceleration of geothermal energy development in India. These recommendations are grouped by implementation timeline: near term (between one and three years) and medium term (between three and five years). Recommendations touch on the core legal and regulatory foundations for geothermal energy in India, efforts to reduce the high up-front costs and incentivise the supply of geothermal energy, and ways to dramatically scale up customer demand as India continues to urbanise and industrialise.

Together, these recommendations can support India's pursuit of energy independence, economic competitiveness, and climate resilience, helping the country meet its growing energy needs while contributing to its commitment to being net zero by 2070.

Many of the ideas build on India's current successful renewable energy programmes or draw lessons from international geothermal policies adapted for India's unique context. Taking advantage of these opportunities will require close coordination among central and state agencies, industry partners, and local communities.

POLICY RECOMMENDATIONS

Near Term (1-3 Years)

1. The central government could set national geothermal goals in electricity, industrial heat, and building cooling and establish a national geothermal cooling mission.
2. Rapidly operationalise the 2025 National Policy on Geothermal Energy.
3. The Ministry of New and Renewable Energy (MNRE) could advance pilot projects and financial incentives envisioned in the National Policy on Geothermal Energy.

Medium Term (3-5 Years)

4. Central and state governments could adopt demand-pull market-activating reforms.
5. The central government could pass a dedicated geothermal act within the National Renewable Energy Act or as a stand-alone framework for geothermal.

GEOTHERMAL REGULATION AND POLICY IN INDIA

Geothermal regulation and policy in India are in their early and formative stages. In September 2025, MNRE published, for the first time ever, the National Policy on Geothermal Energy to set a framework for geothermal development. We have incorporated many pieces of the geothermal policy into our recommendations. We also developed additional policy refinements and recommendations after reviewing the challenges faced during the development of Indian oil gas and other subsurface resources, as well as incentive structures for other renewable energy sources. The policy recommendations in this chapter aim to help developers of geothermal energy avoid similar obstacles and scale projects significantly faster in order to meet India's national priorities.

India's Current Legal and Regulatory Geothermal Policy Regime

The term *geothermal* seldom appears in Indian statutory law. In fact, it only occurs twice (that we are aware of) in *The Gazette of India*.⁴ The first instance was late in November 1999, when the term *geothermal energy* was formally recognised through the Allocation of Business rules as 10th in a list of subjects for which MNRE has administrative responsibilities.⁵ In the years since, MNRE has taken some steps to develop geothermal, including by drafting a proposed National Policy for Geothermal Energy in 2016.

Allocation of Business

By allocating geothermal resources to MNRE management, the president of India, as directed by the prime minister and cabinet, tasked MNRE with coordinating, developing, and promoting geothermal energy, as well as crafting and administering geothermal programmes. With this authority, MNRE can draft policies, set goals, and establish guidelines and best practices. Consequently, project developers must receive MNRE's consent to undertake projects.



The second official reference to geothermal appeared in a December 2022 amendment to regulations for the Electricity Rules, 2005. In that instance, geothermal was recognised as a possible source of “renewable energy” for electricity generation.⁶ As a result, if India were to develop a geothermal electricity project, the project and resulting electricity would be subject to the updated provisions of the Electricity Act, 2003, and Electricity Rules, 2005.⁷

Outside of MNRE programme requirements, there is no central regulation governing geothermal development. Drilling and subsurface rights are subject to existing oil, gas, mining, and environmental laws and their accompanying regulations in India. As funded by Parliament in the annual budget, MNRE can administer grants and subsidies, fund pilots or demonstrations, and develop plans. MNRE’s policy proposals will broadly guide clearances given by other authorities until the central government stipulates specific regulations. Because the central government governs many of these areas in tandem with state governments, regulations may also vary from state to state.⁸

As such, there is still significant uncertainty as to how any developer can proceed without adopting guidance from MNRE directly or how this guidance would directly affect other general state-level permissions (such as land clearance and groundwater use) and environmental approval.

MNRE’s National Policy on Geothermal Energy

Although MNRE was given its geothermal authority in 1999, no major actions were taken until 2016, when, in an aspirational effort to help spur geothermal development, MNRE drafted its first proposed regulatory roadmap.

The 2025 policy outlines some of the foundational regulatory concepts that MNRE would use to administer a geothermal programme, including the definition of a geothermal resource and the outlining of various processes, such as leasing, exploration approval, and project development. (See **Figure 8.1** for more details on the new policy.) The roadmap does not address every legislative or regulatory policy necessary to scale geothermal exponentially. This chapter suggests specific items within the new policy that can be moved forward quickly, as well as additional actions India can take to scale geothermal.

HIGHLIGHTS FROM THE 2025 NATIONAL POLICY ON GEOTHERMAL ENERGY
1. Defines <i>geothermal resources</i> and establishes processes for leasing, exploration, approvals, and project development.
2. Establishes a single-window clearance system, with states required to designate nodal agencies for permitting and monitoring.
3. Authorises MNRE to support geothermal power and direct-use pilot projects.
4. Acknowledges high up-front costs and risks and calls for policy mechanisms including incentives, subsidies, and risk-mitigation tools to attract public and private investment.
5. Empowers MNRE and state governments to issue additional guidelines and incentives to make geothermal development sustainable and bankable.
6. Highlights priority areas for development, including high-heat-flow regions such as the Himalayan geothermal belt, Cambay Graben, and the Godavari Rift Valley; industrial clusters such as steel, cement, and food-processing zones; and repurposing opportunities in oil and gas basins such as Cambay and Krishna-Godavari.
7. Promotes diverse applications across electricity generation, industrial process heat, district cooling, agriculture, and ground source heat pumps.
8. Leverages oil and gas drilling expertise, equipment sharing mechanisms, and Directorate General of Hydrocarbons (DGH) data on abandoned and existing oil wells for geothermal development.
9. Advances public-private partnerships and pilot demonstrations to build investor confidence and technical capacity.
10. Aligns geothermal development with India’s 2070 net-zero goal and a broader transition to clean energy.

Figure 8.1: Highlights from the 2025 National Policy on Geothermal Energy. Source: the authors.



OPPORTUNITIES FOR STRENGTHENING INDIA'S GEOTHERMAL POLICY

While the 2025 National Policy on Geothermal Energy is a critical step forward, there are several additional opportunities to further de-risk early projects, diversify the innovation ecosystem, and ensure India's geothermal development is ready for the future.

Start-up and university innovation	The policy supports research and development broadly but does not establish direct funding lines or incubation mechanisms for start-ups and universities, missing a chance to catalyse early innovation.
Detailed project reports (DPRs)	Funding or co-developing DPRs with states could accelerate state-level project pipelines.
Geothermal site listing	Although the policy includes engineered geothermal systems, advanced geothermal systems, and data-sharing provisions, the final policy retains a static list of 381 hot spring sites—which risks keeping the focus on traditional geothermal sources instead of tapping into the vast distributed resource base that could help cater to large population centres as well.
Strengthening NDR data access to enable geothermal development	India's National Data Repository (NDR) has been designed primarily to support petroleum operations, which limits access for geothermal developers. The 2025 National Policy on Geothermal Energy recognises the potential for DGH-managed oil and gas data to be used for geothermal prospective analysis, subject to existing NDR procedures and guidelines. Broadening NDR provisions to include geothermal—and to provide mechanisms for guaranteed access—would support the accelerated development of India's geothermal sector.

Figure 8.2: Four opportunities to strengthen India's current geothermal policy. Source: the authors.

A BRIEF HISTORY OF INDIAN OIL, GAS, AND MINING REGULATION: A BIT OF A JUMBLE

Some existing laws and regulations in India are likely to influence geothermal governance—particularly those governing oil and gas production and non-coal minerals. Some of these rules date back to British colonial rule. Both fossil fuels and non-coal minerals saw increasing nationalisation of industry in the decades immediately after independence in 1947, followed by growing liberalisation and openness to private sector participation.

Since its enactment in 1950 and in subsequent amendments, the Indian Constitution has explicitly outlined the roles of the central and state governments in regulating oil, gas, minerals, and most energy and natural resource-related ancillary topics. In detailed lists, the constitution enumerates (1) powers of the central government, (2) powers of state governments, and (3) subjects where regulation is concurrently shared by both the central and state governments. Powers not explicitly enumerated to either the central or state governments are retained by the central government.⁹ Geothermal is not explicitly enumerated and, therefore, falls to the central government by default.

Per the nation's constitution, the regulation of petroleum in India is the responsibility of the central government.¹⁰ In practice, for oil and gas exploration and production, the central government has adopted regulations that cede authority over land use and oil and gas leases to state governments, particularly for onshore production—but these are also subject to central government approval.^{11,12}

The Indian constitution also outlines that state governments own their non-oil-and-gas mineral resources; however, mining regulation of these minerals is subject to central government approval.¹³ Parliament has asserted extensive central legislative control over these regulations, especially royalties.¹⁴ As for other properties (e.g., land and water), the constitution largely tilts towards regulation by state governments. That said, it also outlines joint central-state jurisdiction over electricity and forests. Environment and pollution, which are not explicitly mentioned, fall under central purview, but in practice, state and central governments share responsibilities.^{15,16} Legal, ownership, and royalty considerations are unpacked in Chapter 7, "Who Owns the Heat?"



GEOTHERMAL HEAT: A NATIONAL RESOURCE?

India's legal treatment of subsurface resources is fragmented across petroleum, mining, land, and water statutes. Geothermal sits between these frameworks: It is neither a hydrocarbon nor a hard mineral, yet it requires drilling, reservoir management, and long-lived stewardship. To unlock investment while protecting communities and ecosystems, India should recognise subsurface geothermal heat as a national resource held in the public interest, separate from surface ownership. Surface rights, private or communal, would remain intact; what changes is clarity that title to the heat itself does not vest with the surface owner. This idea is included in Recommendation 4, but it could also move forward as part of implementation of the current geothermal framework.

Access would occur through transparent, time-bound licenses or leases with clear duties; environmental safeguards and reinjection; groundwater protection and monitoring; data-sharing and public reporting; restoration and decommissioning; and fair compensation for access corridors and easements. This approach removes present ambiguity; harmonises central and state government roles; and provides a coherent basis for royalties and fees, auctions, or administered pricing. It also aligns geothermal with India's tradition of stewarding strategic subsurface resources for long-term public benefit—while giving developers the certainty they need to finance exploration, industrial heat projects, district cooling, and next-generation systems at scale.

INDIAN ELECTRICITY MARKETS AND REGULATION

In addition to potential impacts from geothermal-specific laws and regulations, the increasing deployment of geothermal energy in India will be influenced by Indian electricity markets and regulations, particularly since the current MNRE roadmaps envision electricity generation geothermal projects.

India's Electricity Market Structure

India's electricity market is among the world's largest systems. The sector and operations are coordinated between the central and state governments. The current structure of the electricity sector in India stems from reforms in the 2003 Electricity Act that spurred private sector participation and the unbundling of generation, transmission, and distribution assets.^{17,18} Power plants are owned by either the central or a state government or the private sector. Distribution companies—or *discoms*—are load-serving entities that purchase the generated power and deliver it to consumers. Most discoms are owned by state governments, but a small number are privately owned.

Long-term contracts between discoms and developers that tender for generating capacity—rather than short-term scheduling and operations—are more likely to influence the uptake of geothermal electricity and capture its clean, firm attributes. (For example, there have been tenders for solar and energy storage projects as well as hybrid solar-wind projects to procure firm renewable power.^{19,20}) For geothermal electricity to be deployed, a project developer must secure a contract for its capacity at a sufficiently attractive price for a discom or large (corporate or industrial) buyer. Moreover, these contracts would likely need to be modelled on India's conventional fossil fuel electricity contract or round-the-clock renewable energy contracts to accurately capture the clean, firm attributes of geothermal energy.²¹ These contracts have various pricing structures (e.g., fixed and variable components or peak and off-peak tariffs) to incentivise uptake.

Regulatory Efforts to Address Weak Distribution Companies

Distribution companies are the key buyers of wholesale electricity in India. However, companies have historically been the weakest link in India's electricity system due to their poor financial health, often characterised by liquidity issues stemming from revenue and cost pressures. On the cost side, many discoms are obligated to pay higher capacity charges for older coal power purchase agreements, as well as for obligations to use renewable energy as "must run" sources. On the revenue side, state government-owned discoms often struggle to collect revenue from consumers because of technical losses,



power theft, and low regulated tariffs that do not cover the actual cost of power (a politically contentious issue). With such poor financial health and offtake risk, discoms continue to hinder investment by renewable energy project developers and their financiers.²² This issue will also apply to geothermal energy.

Given the risk from state discoms, the central government has instituted several instruments and policies to encourage the expansion of renewable energy in India, including offtake guarantees, green open-access policies, and captive power for larger consumers.

The main offtake guarantee in India is provided through central government-owned companies—such as the Solar

Energy Corporation of India (SECI) and NTPC Limited (formerly the National Thermal Power Corporation)—with assets in fossil, hydro, nuclear, and renewable electricity generation. These companies act as intermediaries between private sector renewable energy developers and state government-owned distribution companies. SECI and NTPC enter into power purchase agreements with project developers through competitive tendering and bidding, after signing power sale agreements with the discoms. Through dedicated funds and contracts, these intermediaries reduce the risk of non-payment by discoms to developers. One tool available to these intermediaries is a tripartite agreement between India’s central bank, the Reserve Bank of India (RBI); the central government; and state governments. As a last resort,

POLICY RECOMMENDATIONS TO CATALYSE GEOTHERMAL DEVELOPMENT IN INDIA

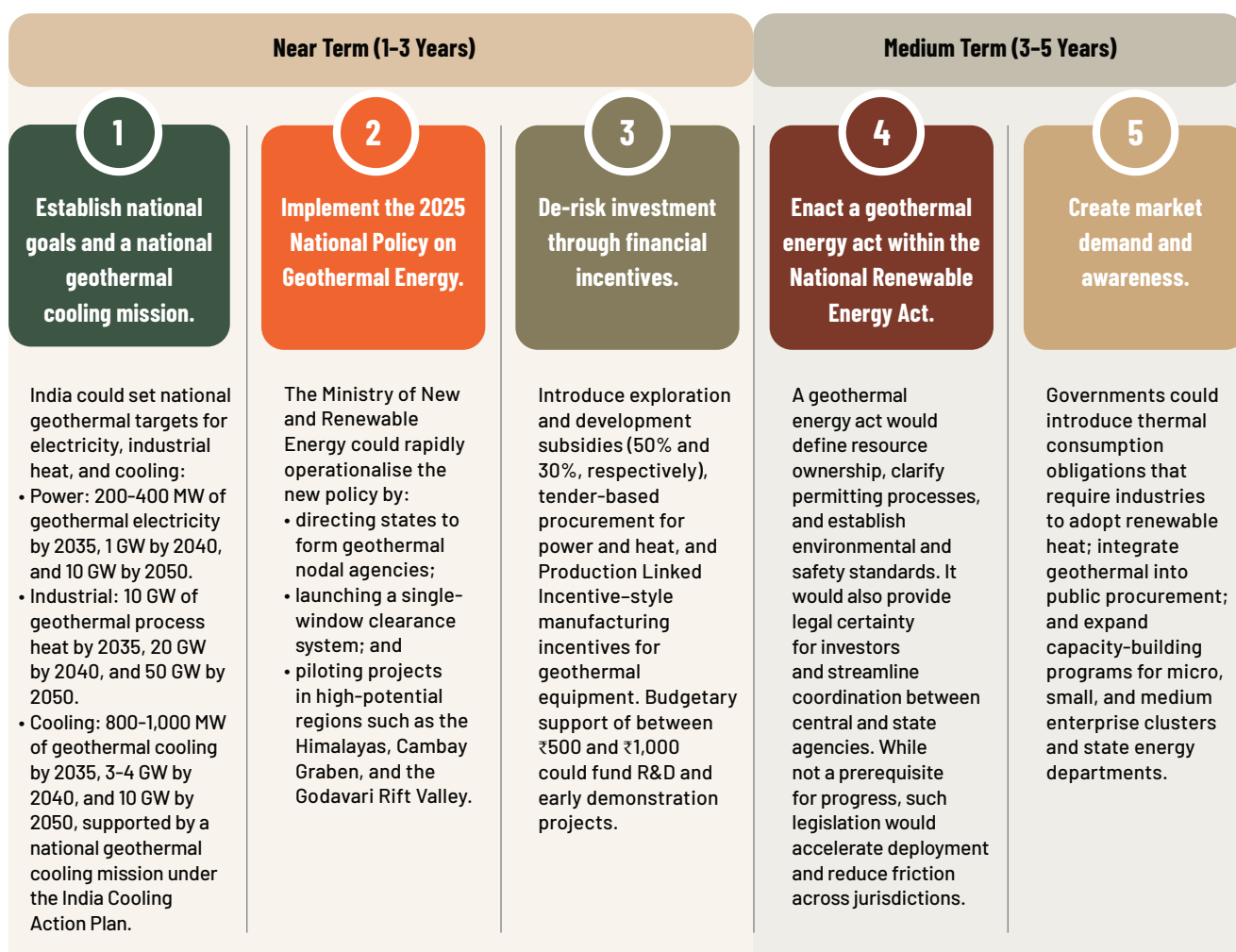


Figure 8.3: Policy recommendations to catalyse geothermal development in India. GW = gigawatts; MW = megawatts. Source: the authors.



the central government may ask RBI to deduct money from a state government's account in case of default or payment delays by the state's discom.²³

Two other instruments to promote renewable energy in India are green open-access and captive power, which enable large power consumers to bypass the need to purchase power from a discom. In open-access power, large power consumers can contract with renewable power producers directly and use the existing power grid to transmit that electricity (and pay fees to the transmission and distribution companies to cover their network costs and cross-subsidies). Likewise, in captive power, a large consumer can also set up their own renewable energy project as a single user or with a group of consumers.²⁴ In both instruments, large commercial and industrial customers may get cheaper, cleaner power depending on project economics and regulated state and central government charges.²⁵ These procedures are governed by the Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022. (Some states have been unsupportive of these policies, as they take away large revenue-generating customers for their discoms, further exacerbating discom financial woes.)

POLICY RECOMMENDATIONS

The remainder of this chapter delves into each of the enumerated policy recommendations, some of which go beyond the 2025 policy and some of which help implement it to ensure continued momentum. As noted earlier, existing laws and regulations governing oil, gas, mining, and electricity will also shape the geothermal sector's regulatory landscape. Related recommendations explore the implications of these existing laws on accelerated geothermal development.

1. Establish national goals and a national geothermal cooling mission.

India's geothermal potential spans power generation, industrial heating, and cooling—three interconnected areas that together can reshape how the country meets its growing energy demand. Expanding geothermal power reduces reliance on fossil fuels and provides clean, steady electricity; using geothermal heat directly in industry cuts costs and emissions from manufacturing; and deploying geothermal cooling can supply cooling to many more

people without needing to add significant new electricity generation while also increasing resiliency, particularly during periods of peak demand. While progress in any one of these areas is valuable, their combined impact is far greater. Setting coordinated goals across each of these sectors allows each to grow and complement the others. Doing so can improve air quality, strengthen grid stability, enhance energy resiliency, and fortify India's long-term energy independence.

Electricity

Geothermal energy could play a role in India's next phase (post-2030) of clean electricity development to help meet growing power demand. India's energy needs are accelerating, and some projections suggest that the country may need to more than triple its current installed capacity of 468 gigawatts by 2040²⁶—roughly equivalent to adding a grid the size of the European Union's.²⁷ Project InnerSpace analysis suggests that bringing between 200 megawatts and 400 megawatts of geothermal electricity online by 2035 and reaching 1 gigawatt by 2040 and 10 gigawatts by 2050 could significantly contribute to a more diversified and resilient energy mix for India. While ambitious, these levels of deployment could support the development of a stable, low-carbon energy sector. They would also be broadly in line with initiatives pursued in other countries, including Kenya and the United States.^{28,29}

Chapter 2, "Where Is the Heat? Exploring India's Subsurface Geology," highlights that India has total technical potential for roughly 450 gigawatts of electricity generation (down to 5 kilometres) today and technical potential for more than 8,000 gigawatts of electricity (down to 7 kilometres) as technology improves in the future. This finding indicates that, in principle, there is substantial scope for geothermal power to contribute to India's clean energy transition if exploration and development are pursued.

Industrial Direct Use

Geothermal energy could be a promising source of heat for India's industries, all of which are expected to see substantial growth in energy demand and currently lack adequate, credible alternatives to fossil fuels or traditional biomass. For example, the International Energy Agency projects that by 2040, industry will be the single largest source of India's energy consumption.³⁰



In particular, India's low- and medium-enthalpy geothermal resources could be suited for the heat needs of small and medium industries such as textile manufacturing, food processing, pulp and paper production, and pharmaceutical production—all processes that require thermal energy at temperatures between 80°C and 250°C. Geothermal energy could displace the mix of coal, biomass, and (increasingly) natural gas that these industries use for their heat needs.^{31,32,33} As noted at the start of this chapter, the total technical potential for industrial direct-use heating is more than 11,000 gigawatts (with a 100°C cut-off temperature down to 3,500 metres).

With this industrial direct-use energy, the government could aim to bring 10 gigawatts of geothermal process heat online by 2035, more than 20 gigawatts by 2040, and more than 50 gigawatts by 2050.

Building Cooling and a National Geothermal Cooling Mission

In addition to industrial demand, India's building stock will also see growth in energy demand to be the second-largest source by 2040.³⁴ Geothermal energy could help meet the cooling needs of these buildings through district cooling and more efficient ground source heat pumps (GSHPs).

India's cooling energy demand is expected to be the largest source of demand growth in buildings. In 2040, projected increases in electricity consumption just for cooling in India could rival all of Germany's current power consumption. Air-conditioners and space cooling will primarily drive this growth.³⁵ Consequently, the need for more efficient space cooling could mean a greater role for geothermal energy. Chapter 3 notes that India has more than 1,500 gigawatts of total technical cooling potential in India, and 610 gigawatts of this cooling potential can be found in high heat-risk areas that have significant aquifer cooling potential. GSHPs, which can cool buildings by using the ground as a heat sink, are more energy-efficient than conventional air-conditioners, yet they also have higher up-front costs, requiring concerted policy support such as dedicated targets, financing, and building codes.³⁶ For example, the 2024 Energy Conservation and Sustainable Building Code for commercial buildings mentions the use of GSHPs, but this updated code needs to be adopted and enforced by individual states.³⁷

Likewise, establishing district cooling networks paired with geothermal sinks could increase the availability of efficient cooling in buildings and reduce additional loads for the electricity system. District cooling systems pump cold water from a centralised station to multiple buildings for their cooling needs. This station could then use large GSHPs to cool these buildings.³⁸ India's first district cooling network at Gujarat International Finance Tec-City (GIFT City) provides a pilot for similar systems to expand the country but should be coupled with geothermal sinks.³⁹ As outlined in Chapter 4, "Geothermal Cooling Opportunities," India has significant potential for this type of cooling, particularly in regions that are—and will continue to be—impacted by extreme heat events. States ranking in the top 10 for cooling potential include Uttar Pradesh, Gujarat, Tamil Nadu, and Andhra Pradesh.

To that end, India could set a goal of between 800 megawatts and 1,000 megawatts of geothermal heating and cooling by 2035 (thermal output), between 3 gigawatts and 4 gigawatts by 2040, and more than 10 gigawatts by 2050. This goal is crucial: India is projected to nearly double its building stock over the coming decades, adding between 700 million and 900 million square metres in new floor space every year through 2040, with demand for a new air-conditioner every 15 seconds.⁴⁰

These targets are not just a matter of energy efficiency but climate resilience and public health as well. Between 2001 and 2019, India experienced almost 20,000 heat wave-related deaths.⁴¹ By 2036, heat waves and erratic rainfall are expected to affect more than 80% of India's population, with dangerous heat events projected to increase in frequency and severity.⁴² Already, these events are straining power grids, health systems, and vulnerable communities.

In this context, geothermal cooling systems can serve as a form of distributed climate adaptation. In line with these targets, the Government of India could initiate a national geothermal cooling mission as part of the India Cooling Action Plan outlined in 2019. The India Cooling Action Plan envisions significant increases in cooling demand, and the plan's intention to promote non-in-kind cooling technologies aligns with this geothermal cooling mission. A national geothermal cooling mission would incorporate these targets as well as promote district cooling pilot projects in schools, public hospitals, government buildings,



and community centres. Given the limited implementation of the India Cooling Action Plan, there is ample scope to incorporate geothermal energy as a cooling solution.^{43,44}

The Indian Army's Net Zero Energy Building in Jhansi, commissioned in 2025, provides a compelling demonstration of this technology. The facility uses 10 vertical boreholes (120 metres deep) connected to a closed-loop GSHP system, maintaining indoor temperatures at 22°C when outdoor extremes reach 43°C. Supported by rooftop solar photovoltaics, the building functions as an off-grid geothermal-cooled system and serves as a replicable model for cantonment and institutional infrastructure across India.⁴⁵

These targets—for electricity, industrial direct use, and geothermal cooling—are achievable with industrial process heat clusters, a few city-wide thermal energy networks (TENs), and GSHPs in thousands of public and commercial buildings. As discussed in more detail in Policy Recommendation 3, if the central government implements a Production Linked Incentive (PLI) plan for GSHP or TEN equipment, India can significantly ramp up its domestic production of equipment used for geothermal cooling.

2. Implement the 2025 National Policy on Geothermal Energy.

India's geothermal sector has waited decades for a clear framework. While not a substitute for statutory legislation, MNRE's National Policy on Geothermal Energy offers a foundational framework for the development of all types of geothermal, including for power, cooling, and direct-use heat. With this policy now in place, MNRE can move quickly to turn it into practice by prioritizing governance and administration. The policy establishes a single-window clearance system, defines geothermal resources, and empowers MNRE and state governments to issue additional guidelines. These elements are important, as they give clarity to developers, investors, and state authorities—and therefore help organise a credible market. To ensure early success and credibility, MNRE could take the following steps:

- Direct states to establish geothermal nodal agencies within 6 to 12 months to serve as one-stop shops for land, water, forest, and environmental permits. MNRE can issue model structures and staffing guidance to ensure consistency nationwide.
- Publish national clearance guidelines with firm timelines (e.g., 90 days for exploration permits, 120 days for development approvals) to reduce uncertainty and provide predictability for investors.
- Launch a national digital clearance portal integrated with existing resource data repositories to allow developers to track applications and reduce duplicative processes.

Additionally, MNRE could prioritise early rollouts in high-potential regions such as the Himalayan geothermal belt, Cambay Graben, and Godavari Rift Valley. Demonstrating proof-of-concept in these areas will build confidence among developers and investors and provide a replicable model for nationwide adoption.

It is also important to note that this report finds far more geothermal potential in the country than was identified in the policy. As mentioned, India has the technical potential for roughly 450 gigawatts of electricity generation (down to 5 kilometres) today and technical potential for more than 8,000 gigawatts of electricity (down to 7 kilometres) as technology improves in the future; more than 1,500 gigawatts of geothermal technical potential for cooling; and more than 11,000 gigawatts of potential for direct-use heat for industrial processes. The size of this opportunity should be an incentive for MNRE to move more quickly to tap into it.

3. De-risk investment through financial incentives.

The adoption of MNRE's policy was critical and authorised the ministry to support geothermal power and direct-use pilot projects and create policy mechanisms (including incentives, subsidies, and risk-mitigation tools) to address high up-front costs. To further support geothermal growth, MNRE might explore measures such as the following:

- **Establish a 50% exploration subsidy and 30% development subsidy, aligning geothermal with international best practices and India's proven solar support model.** Covering approximately 50% of exploration costs follows international



best practices—such as exploration risk-mitigation facilities in Indonesia,⁴⁶ Turkey,⁴⁷ and Kenya⁴⁸—by reducing early-stage financial risk and addressing the highest-uncertainty phase where investors are most reluctant.⁴⁹

A subsidy of around 30% of plant development costs would mirror the level of support that India already extends to solar projects under schemes such as Central Financial Assistance. Applying this proven model to geothermal will level the playing field for a resource that has higher up-front costs but delivers always-on, firm power and heat once operational. Together, these subsidies would not only reduce the financial burden on early projects but also attract private capital, accelerate pilot deployments, and signal the government's commitment to making geothermal a mainstream part of India's energy transition. MNRE could also empower state nodal agencies to issue additional guidelines and incentives that reflect local conditions while maintaining alignment with central policy.

- **Launch tenders for direct-use geothermal applications.** MNRE could launch a pilot tender to showcase an example of direct-use geothermal. The organisation could also seek, from Parliament, full funding in the budget for a dedicated tender no later than 2027. These competitive solicitations would offer long-term offtake agreements or viability gap funding. MNRE has used similar mechanisms to support early-stage deployment of emerging technologies such as floating solar, biomass gasification, offshore wind, and, most recently, green hydrogen.^{50,51,52,53}

These efforts were often launched before statutory mandates or large budget lines existed, leveraging modest funding under R&D, technology innovation, or public-private partnership programs. A similar approach can be applied to geothermal—especially for electricity generation in high-potential areas, industrial process heat in key clusters, and district cooling-scale or public GSHP systems in urban buildings.

Industrial process heat, district energy systems, and GSHPs would benefit from capital subsidies

modelled on existing MNRE programmes such as PM-KUSUM (Prime Minister's Farmer Energy Security and Upliftment Mission) for agricultural solar⁵⁴ or PM Muft Bijli Yojana (Prime Minister's Free Electricity Scheme) for rooftop solar. These could be targeted toward public infrastructure, industrial clusters, and commercial building retrofits in high-density areas. Because many of these systems reduce demand on the grid and avoid fossil fuel use, they already qualify under Bureau of Energy Efficiency (BEE)-administered building efficiency programmes and the Energy Conservation Building Code.⁵⁵

As noted in Chapters 3 and 4, pilot projects could include industrial heat in Cambay's manufacturing clusters and district cooling systems in heat-stressed cities near the deep sedimentary basins—especially the Indus, West Bengal, Cambay, and Cauvery basins—where aquifer cooling potential is high and can be integrated into urban resilience strategies, energy-efficient infrastructure, and sustainable groundwater management. These visible, replicable pilots would demonstrate geothermal's versatility beyond power generation.

- **Promote technology localisation and supply chain development.** MNRE could adapt India's successful PLI-style model to support domestic manufacturing of geothermal components (e.g., drilling rigs, heat exchangers, GSHP units), lowering costs while building industrial capacity.
- **Fully fund the government's Renewable Energy Research and Technology Development (RE-RTD) Programme.** This programme is critical to de-risking exploration, identifying viable zones, and supporting demonstration-scale drilling.

It is also vital that Parliament pair policy approval for a geothermal plan with a dedicated line item in MNRE's annual budget. A capital allocation of between ₹500 and ₹1,000⁵⁶ (US\$60 million–\$120 million) over five years could support early-stage resource mapping, public-private demonstrations, risk-sharing instruments, and institutional capacity building, which would in turn activate geothermal's long-dormant mandate and position it alongside wind, solar, and hydrogen in India's renewable strategy.



OTHER RENEWABLE ENERGY POLICY TEMPLATES

Several other policies and programmes specific to incentivising clean energy in India are worth highlighting, as they could serve as models for how to stimulate growth for geothermal power through financial incentives, specifically the following:

- Solar parks and ultra mega projects that receive land, transmission, and permitting support from MNRE.⁵⁷
- National Wind Solar Hybrid Policy, which promotes co-located wind and solar to improve grid stability.⁵⁸
- Waived inter-state transmission charges for wind and solar projects commissioned by specific deadlines, therefore reducing the costs of that energy (though this incentive is expected to end soon).
- Generation-based incentives that are paid per kilowatt-hour generated for projects feeding into the grid.⁵⁹

Finally, while it requires parliamentary action, MNRE could recommend geothermal be incorporated into India's tax and market incentive structures. Accelerated depreciation provisions helped catalyse early wind and solar growth.⁶⁰ The same could apply to geothermal heat systems and power plants, particularly in sectors with heavy thermal energy demand.

MNRE has a proven playbook for nurturing early-stage energy technologies. By adapting existing instruments to geothermal's distinct technical and market profile, India can accelerate deployment of this underutilised resource while staying consistent with financial and institutional models that have successfully scaled other renewables.

4. Enact a geothermal energy act within the National Renewable Energy Act.

While India currently defines and regulates renewable energy, including geothermal energy, through the Electricity Act, 2003, and amendments to the Electricity Rules, 2005, additional legislation and statutory authorities are helpful to scale geothermal in the country.

This legislation could be incorporated into a Renewable Energy Act, or it could be stand-alone legislation focused just on geothermal. No matter what form this act takes, the reasons for why this is needed and the language and provisions are detailed in this section.

Geothermal more closely resembles oil, gas, and mining than it does solar or wind. Geothermal development must navigate risks such as subsurface drilling with its attendant safety and environmental issues, resource management and conservation, and intricate land and mineral rights issues.

Consequently, the nascent geothermal energy sector in India will greatly benefit from robust legal infrastructure to ensure safe and sustainable development and transparent scaling. A well-structured geothermal act in India might borrow elements from India's Oilfields Act for drilling and subsurface rights; the Electricity Act for generation, transmission, and grid integration; the Environment Act for environmental safeguards and permitting; and possibly the Mines and Minerals Act for land access and royalties regulations.

5. Create market demand and awareness.

While MNRE-led tenders, grants, and subsidies will help increase supply by pushing pilot projects into the market, these are not enough to drive widespread commercial deployment. In parallel, the central government could create demand-pull incentives for geothermal energy, which could include (a) mandating clean thermal consumption obligations for large energy-intensive industries; (b) raising awareness of geothermal technologies among energy efficiency measures for micro, small, and medium enterprises (MSMEs); and (c) public procurement of geothermal technologies.

a. Mandate clean thermal consumption obligations for large industries.

BEE could mandate large energy-intensive, heat-consuming industries to procure some thermal energy from clean, renewable sources. These TCOs could be an expanded or modified version of renewable consumption obligations (RCOs) that BEE has notified as of August 2025 for designated consumers: electricity distribution companies (discoms), open



access, and captive power users.⁶¹ However, TCOs would differ from RCO regulations by first mandating use of clean heat as opposed to only electricity, which would capture industrial energy derived from direct fuel combustion. Moreover, the TCOs would expand the list of designated consumers to large industrial energy users. BEE can issue TCO regulations for a wider set of industries through the ordinary rulemaking

process since the 2022 Energy Conservation Act Amendments explicitly give the central government broad authority to regulate and mandate fossil and non-fossil energy use by industries.⁶² While the TCOs could start modestly, they have the potential to cover approximately 80% of industrial energy use in India that comes from direct combustion of coal, gas, oil, and biomass.⁶³

Topics to Cover in a Geothermal Act

Regardless of whether a geothermal act is issued on its own or as part of the Renewable Energy Act, it would benefit from covering these topics:

- **Resource classification:** a durable, technology-agnostic definition of geothermal resources.
- **Institutional authority:** clearly empowering licensing and regulatory bodies, with appellate procedures for geothermal. This could be MNRE or the Ministry of Petroleum and Natural Gas for well drilling and development and the Central Electricity Regulatory Commission and state electricity regulatory commissions for electricity development.
- **Inter-ministerial coordination:** requirement of coordination covering new and renewable energy, mines, environment, petroleum and natural gas, and others to ensure consistent and cohesive governance.
- **Permitting timelines:** mandate for time-bound approvals (with clear standards and procedures); single-window systems; and streamlined clearances across land, water, power, and environment.
- **Coordination with states:** clear delineation of union vs. state roles, especially where land and groundwater are state subjects under the constitution
- **Incentives:** building on MNRE’s programmatic incentives, creation of clear provisions allowing central and state governments to promote geothermal with statutory financial incentives.
- **Licensing and exploration:** a framework for issuing exploration and production licenses and leases, including who has authority to grant them and how public vs. private enterprises will participate.
- **R&D:** a sandbox approach to support R&D and early-stage projects, allowing innovative technologies and methods to be tested under controlled, flexible regulatory conditions.
- **Drilling and well safety:** technical standards for drilling, well integrity, and reservoir management (akin to the Oilfields Act).
- **Grid integration:** rights and responsibilities of geothermal plants under the Electricity Act (e.g., deemed open access, tariff mechanisms).
- **Direct-use rights:** legal support for industrial heating and cooling, district energy, GSHPs—especially in urban and industrial clusters.
- **Environmental compliance:** specific environmental assessment norms such as tailored assessment triggers; thermal discharge limits; continuous seismic monitoring; promotion of safe fluid and waste management, life cycle assessments, land restoration plans, and noise barriers; protection of sensitive areas; and strategies to to minimise risks (see Chapter 9).
- **Dispute resolution:** mechanisms to resolve conflicts over access to heat, which also consider existing mechanisms for water rights and land.
- **Data and transparency:** requirements for resource data reporting, drilling logs, production rates, possibly modelled on requirements for oil and gas.
- **Guarantee National Data Repository (NDR) rules to include geothermal data use:** updates to NDR rules to guarantee geothermal developers use oil and gas seismic and well data, accelerating project development.
- **Subsurface access:** property rights regime for accessing land and ownership of subsurface heat on private, central, state, or tribal lands, including recognising subsurface heat as a national resource and developing a national policy that defines geothermal energy’s legal status and sets out clear regulatory and licensing guidelines, as noted in Chapter 7.
- **Local and community stakeholder rights:** enabling of inclusive regulation and benefit-sharing mechanisms, particularly in “scheduled areas” and around religious or sacred geothermal sites.



Aligning TCOs with Existing Energy Efficiency and Emissions Regulations

Thermal consumption obligations (TCOs) could align with India's energy efficiency cap-and-trade programme for the industrial sector Perform, Achieve, and Trade (PAT) scheme. This programme aims to promote increased energy efficiency in designated large, energy-intensive sectors such as steel, cement, and chemicals. Facilities must comply with stipulated energy-intensity targets by either making necessary investments or trading energy-saving certificates.^{64,65} Notably, the scheme incentivises renewable energy by not counting its use against a facility's required energy intensity target. While PAT increased energy efficiency awareness and established an energy auditing and compliance infrastructure across large industrial units, the scheme lacked effectiveness due to insufficiently stringent targets, an abundance of energy-saving certificates, and lax enforcement.^{66,67} There are plans to extend the programme to include greenhouse gas emissions through the Indian Carbon Credit Trading Scheme.^{68,69,70} Consequently, energy and emissions intensity targets should account for any decreases from adopting TCOs for large industries.

b. Integrate geothermal technologies into MSMEs' energy efficiency efforts.

BEE could spread geothermal technology awareness in its knowledge-sharing and pilot project efforts for MSMEs. While TCOs would cover large industries to increase the uptake of geothermal energy, existing energy efficiency regulations do not cover MSME industries due to their size, heterogeneity, and economic informality. MSME industries face a number of challenges in adopting energy efficiency and renewable energy, including lack of awareness, access to finance, technical expertise, and energy data.^{71,72} Nonetheless, given India's low- and medium-enthalpy geothermal resource base, MSMEs could benefit from geothermal energy. For example, SAMEEKSHA (Small and Medium Enterprises Energy Efficiency Knowledge Sharing) is a

central repository for BEE to share knowledge about various energy efficiency technologies, yet it lacks any information on geothermal technologies.

c. Leverage public procurement to de-risk adoption.

The central government could procure geothermal energy through its own contracts, buildings, and construction. As previously mentioned in this chapter, the Indian Army recently inaugurated its first geothermal-powered building in Jhansi, Uttar Pradesh.^{73,74} This project delivers space cooling with 120 metre deep geothermal systems. Innovative projects like this one show that the central government has the ability to invest in demand generation for geothermal technologies. By doing so in construction of office buildings, hospitals, and other public areas, learnings from adoption can be applied to other sectors, which can also reduce risk for the private sector.

CONCLUSION

India stands at a critical inflexion point in its energy journey. With one of the world's fastest-growing populations and economies, the nation is facing an unprecedented surge in energy demand across electricity, industrial heating, and cooling. Meeting this demand sustainably, affordably, and reliably will require tapping into every viable domestic energy resource. Geothermal energy, long underutilised in India, is uniquely positioned to play a transformative role in helping India achieve its national goals.

The policies outlined in this chapter are designed to turn that vision into reality. By implementing the five recommendations outlined, India can establish a robust foundation for geothermal market growth. These reforms will enable the development of new projects across the country, helping meet growing energy demand while uplifting communities.

In short, geothermal energy is not just a technical opportunity—it is a nation-building one as well. With the right policies in place, India can become a global leader in geothermal innovation, delivering clean heat and power to its people while driving long-term economic and environmental gains. The path is ready. The time is now.



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