Article

Climate Finance Effectiveness: A Comparative Analysis of Geothermal Development in Indonesia and the Philippines

The Journal of Environment & Development
2022, Vol. 31(2) 139–167

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DOI: 10.1177/10704965211070034
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Abstract

In light of commitments made under the UNFCCC Paris Agreement and Glasgow Climate Pact, trillions of dollars are needed to fund climate mitigation and adaptation in developing countries. However, few studies have investigated the effectiveness of climate finance or how it impacts barriers to renewable energy development in recipient countries. This article contributes to the literature by investigating climate finance effectiveness through comparative case study analysis of its impacts on geothermal development in Indonesia and the Philippines. The article finds that three mechanisms of climate finance—utility modifier, social learning and capacity building—work interdependently in impacting the financial, regulatory, and technical barriers to geothermal development in Indonesia and the Philippines but are individually insufficient to scale the industry; political will and energy shocks play a significant intervening role. This paper raises policy implications for climate finance effectiveness and renewable energy technology deployment in developing countries.

Keywords

climate finance, Indonesia, Philippines, geothermal, domestic politics, renewable energy, technology transfer, effectiveness, global governance

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Introduction

To avoid global climate catastrophe, the climate finance needs are immense. An estimated $1.6 trillion to $3.8 trillion is needed through 2050 for a full energy transformation, and an additional $280 billion to $500 billion is needed annually for adaptation in developing countries (CPI, 2019). In the wake of COP26 Climate Summit in Glasgow, the urgent demands for climate finance increased, yet we still have limited understanding of how effective climate finance is at achieving its aims of fostering sustainable climate mitigation and adaptation in recipient countries. In this context, this article investigates climate finance effectiveness through comparative case study analysis of its impacts on geothermal development in Indonesia and the Philippines.

Located in the Ring of Fire, a seismically active area in the Asia Pacific, Indonesia and the Philippines are the world's two largest producers of geothermal energy after the US, yet they demonstrate different trajectories of geothermal development. Despite Indonesia's superior geothermal reserves (~24 GW), it has only developed approximately 9% of its potential, while the Philippines has developed 44% of its potential capacity (~4 GW) (DOE, 2019; MEMR, 2020). This raises the question of why there are disparities in the advancement of geothermal development and, namely, why the Philippines has developed nearly its full potential of geothermal capacity while Indonesia has not. While the trajectories of geothermal development in these countries diverged over the years, and despite delays in achieving capacity targets, Indonesia surpassed the Philippines in 2017 to become the world's second largest producer of geothermal energy. This advancement is a manifestation of how the government, with the support of international development agencies, has successfully targeted certain barriers that have plagued geothermal development in Indonesia for decades; nevertheless, a significant gap between targets and the reality of renewable installed capacity remains. Meanwhile, the Philippines led in share of geothermal resources developed since the government, supported by international aid, prioritized development in the 1980s–1990s; however, this growth plateaued after primary resources were developed, and the lull has continued ever since.

To address the barriers to and costs of climate change mitigation and adaptation, bilateral and multilateral aid have played an important role in clean energy development; both Indonesia and the Philippines have received substantial amounts of funding earmarked for renewable energy, yet many barriers to deployment remain in both countries. Multilateral development banks committed approximately USD 192.4 billion in global climate finance between 2015 and 2019, and of the 2019 financing commitments, 76% (USD 46.6 million) were earmarked for mitigation (African Development Bank, 2020). This article investigates the ways through which climate finance has addressed barriers to geothermal development in Indonesia and the Philippines from the 1970s to 2020. Using the term "climate finance," this paper examines multilateral, bilateral, and transnational development aid for climate mitigation and adaptation, as well as the complementary funding for capacity building, policy advising, and technical assistance, as it relates to geothermal development specifically.[1] Through comparison of two cases, this research explores the interaction between international organizations, domestic actors, and barriers in the energy sector, providing empirical data that sheds light on the effectiveness of climate finance.

Indonesia and the Philippines were chosen for the comparison because both are archipelagos in Southeast Asia with similar political histories of authoritarian regimes evolved to democracies, recipients of substantial climate finance, targets for decarbonization, but with variation in installed geothermal capacity. Geothermal energy technology is fitting for analysis because both countries have plentiful geothermal resources but face a number of significant barriers to their development, compared to other renewables. These barriers include comparatively high risks and costs of exploration and development, without appropriately matched finance mechanisms; regulatory barriers related to land access and limits on private investment; and technical barriers requiring a highly skilled technical workforce and high-cost technology for exploration and drilling, as well as maintaining older wells to avoid erosion and corrosion.

This article contributes to the growing comparative environmental politics literature that explores policy diffusion and interactions and impacts of international institutions on domestic politics through polycentric or multilevel governance (Jordan et al., 2018; Jörgensen et al., 2015). Studies on the role of transnational networks and subnational actors (Andonova et al., 2017; Bernstein & Hoffmann, 2018; Betsill & Bulkeley, 2004), as well as epistemic communities and advocacy coalitions (Haas, 1989; Keck & Sikkink, 1998) have made important contributions to illuminate how such actors impact policy outcomes beyond the black box of the state (Steinberg & VanDeever, 2012). Furthermore, policy entrepreneurship research has revealed the agency of private actors to effect change (Andonova, 2017; Boasson & Huitema, 2017; Pattberg, 2010).

The existing scholarship on climate finance effectiveness looks at a variety of outcomes as measures of success, from research on the Clean Development Mechanism's (CDM) and Global Environmental Facility's (GEF) ability to address barriers to renewable energy development in developing countries (Castro, 2014; Michaelowa & Jotzo, 2005) to exploring how development aid affects energy transitions and boosts institutional capacity (Heggelund et al., 2005; Marquardt et al., 2016; Stadelmann & Castro, 2014). More specific studies categorizing climate finance effectiveness include recent research by Bhandary et al. (2021). The major contribution of this article is to trace, through empirical comparative case study analysis, how climate finance impacts barriers on the ground in recipient countries.

The main questions leading this research are as follows: *How effectively do international development institutions and climate finance address domestic barriers to geothermal development in Indonesia and the Philippines? What role do domestic politics play in mitigating impacts?* This study presents new data collected through interviews and field research conducted in Indonesia and the Philippines (see Appendix A for full interview list), as well as primary and secondary sources, to explain how climate finance impacts domestic barriers to renewable energy development in recipient countries.

International Development Institutions and Climate Finance

To create an initial framework for analyzing the different mechanisms for development finance to incentivize change, I adapt Young and Levy's (1999) typology of pathways through which regimes affect outcomes and Carbonnier, Brugger, and Krause's (2011) interpretation of this typology for nonbinding agreements as it provides insights into the many ways the international institutions can influence state behavior and national policy, realigning domestic interests.

As Table 1 shows, international development institutions and finance can impact domestic political actors and barriers in different ways. I conceptualize the impacts as occurring through three mechanisms: utility modifier (project development finance), social learning (policy dialogues and norm diffusion), and capacity building (technical assistance, trainings, and workshops). These mechanisms are applied to the case studies of Indonesia and the Philippines and analyzed for how effectively they address each of the barriers to geothermal development.

The utility modifier mechanism can change actors' cost-benefit analysis as new rules or opportunities are introduced. Carbonnier et al. (2011) highlight that regulations are not the only tool of effectiveness: market incentives are also effective tools. This mechanism works on national and subnational levels by modifying the utility of domestic coalitions, as well as of state actors on an international level.

The social learning mechanism facilitates a change in behavior by introducing new information and discourses via international forums and policy advising by numerous international actors that can facilitate new perspectives or alternative measures for problem solving domestically (Haas, 1989; Haas & McCabe, 2001; Young & Levy, 1999). Social learning occurs when the cognitive changes emerging from new information and experience provided by international institutions result in the attainment or revision of policy objectives (Clark et al., 2001; Sabatier, 1988).

The capacity building mechanism is the provision of resources directed to building technical and institutional capacity—through training and education. The workshops and trainings provide the opportunity for organizations to work directly with government representatives and stakeholders to build technical knowledge to ensure effective implementation of reforms and to build a technical workforce for geothermal development (Mori, 2010). The capacity building mechanism transmits the knowledge more directly, whereas social learning works through norm or policy diffusion, which can be more passive. As Chayes and Chayes (1993) argue, the lack of compliance with international agreements may be due to government's lack of institutional capacity rather than willful noncompliance.

Renewable Energy Development in Indonesia and the Philippines

The political economic history of Indonesia and the Philippines provides insights into the contemporary state of geothermal energy development in each country. Indonesia

Table 1. Typology of Climate Finance Mechanisms.

		Domestic political interests			Energy shocks
		Policy/technology lock-in	Interest and advocacy group	Corruption/rent-seeking	Energy insecurity
Climate finance mechanisms	Social learning	Learning can promote alternative policies or technologies	Policy advising can promote reforms that change benefits received by interest groups	Institutional reform can help overcome rent-seeking and corruption	Policy and technology alternatives to promote energy security
	Utility modifier	Provides finance for alternative technology development despite lock-in	Financial incentives for interest and advocacy groups - payoffs	Financial incentives for alternative payoff structure	Financial support for alternative technology development
	Capacity building	Capacity building for technical or institutional capacity for new policy or alternative technologies	Capacity building can provide advocacy strategies	Training to provide alternative income / livelihoods	Training in new technology and institutional capacity building

holds 40% of the world's reserves in geothermal energy, far more than the Philippines but it has not tapped its full potential capacity of high-quality, primary resources—whereas the Philippines developed nearly all of its primary resources and half of its capacity potential. The share of reserves developed is an important indicator of progress made towards its full potential and towards meeting government-set targets; the lack of progress may indicate an absence of government will to implement targets or persistent barriers to scaling the industry. As governments move towards increasing security of supply and maintaining baseload power while reducing emissions, abundant geothermal reserves provide capacity to substitute coal for an energy transition.

Figure 1 below which depicts the trends in the development of installed geothermal capacity in Indonesia and the Philippines since mid-1970s. Indonesia lagged behind the Philippines in total installed capacity until recently, and success in the Philippines' development of geothermal energy preceded Indonesia's despite the fact that both countries began exploring geothermal resources in the 1960s and 1970s.

The installed generating capacity shown in Figure 2 below represents the primary energy mix in each country. Historically, Indonesia holds an abundance of fossil fuels while the Philippines does not. Natural resources abundance played a fundamental role in influencing the priority that government leaders of each country placed on energy diversification and renewable energy development, echoing findings from Houle et al. (2015) that material resources affect policy choices.

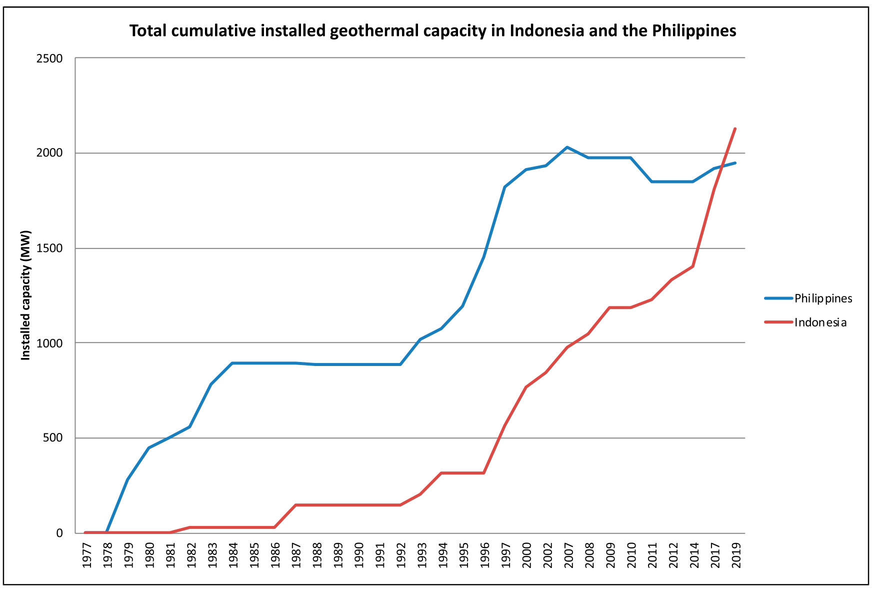

Figure 1. Installed geothermal capacity in Indonesia and the Philippines. Source: DOE (2019), Fronda et al. (2015), International Energy Agency (IEA) (2014), and Ministry of Energy and Mineral Resources MEMR (2019).

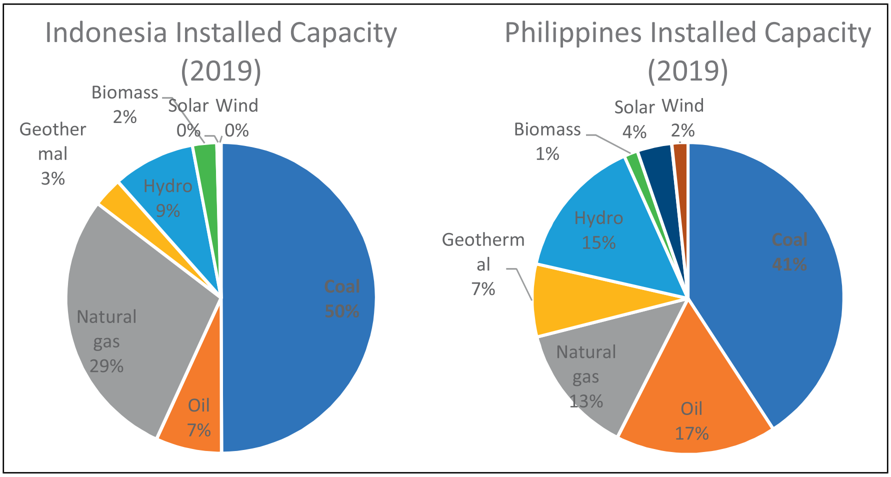

Figure 2. Installed generating capacity in Indonesia and the Philippines. Source: DOE (2019) and MEMR (2019).

Both Ferdinand Marcos and Suharto, former presidents of the Philippines and Indonesia, respectively, exercised their authoritarian control in energy development plans in response to the external shocks and domestic resource availability. This is further exemplified by growth rates in installed capacity for technologies, like geothermal, which can be linked to major energy and economic crises, including the 1973 Oil Crisis and the 1997 Asian Financial Crisis. Endowed with oil resources, Indonesia benefitted greatly from the oil crisis as the increasing prices supported the country's economic growth in the 1970s–1990s. The turning point in Indonesia's energy history arrived when oil reserves dwindled due to poor management and the country shifted from being a net exporter of oil to net importer in 2004; Indonesia formally withdrew from the Organization of the Petroleum Exporting Countries (OPEC) in 2008. As energy insecurity increased, so did Indonesia's plans for energy diversification, as discussed below. The Philippines, in contrast, relied on oil imports to meet its fossil fuel demand and was severely negatively impacted by the 1970s global oil crisis and the domestic 1990s Power Sector Crisis, and further exacerbated by the Asian Financial Crisis in 1997. In response to the rising discontent in the wake of these crises, Marcos first imposed martial law and then redirected government resources to developing geothermal energy to meet energy needs.

The political and socioeconomic histories in Indonesia and the Philippines created vested, conflicting interests and subsequent barriers to renewable energy development, particularly relevant to geothermal energy, are summarized in Table 2.

The list of actors and their interests shown in Table 2 is not comprehensive, yet it provides a summary of some of the major institutions and players involved in energy development planning in each country.

Table 2. The Clean Energy Political Economy of Indonesia and the Philippines.

	Indonesia	Philippines
GDP (2019) (per capita) Growth rate	USD 1.1 trillion (USD 4,135.6) 5%	USD 376.8 billion (USD 3,485.1) 6%
Political regime	Democratic since 1999 • Historical authoritarian dictatorship under Suharto and Sukarno	Democratic since 1986 • Historical authoritarian dictatorship under Marcos
Major state actors (domestic institutions and actors)	President Ministry of Energy (MEMR/EBTKE) PLN: SOE electricity utility Pertamina Geothermal (PGE): SOE geothermal producer (63% assets) Geo Dipa Energi: SOE Local governments Local communities and indigenous groups	President Dept of Energy National Power Corporation: SOE electricity utility EDC*: SOE Energy developer until 2007 when privatized DOE Environment Management Bureau National Commission on Indigenous Peoples Local communities and indigenous groups
Major private players	Medco Power, Supreme Energy, Star Energy, Sabang, Jabar Rekin, Wijaya Karya, Sintesa Banten, Spring Energy Sentosa, Sumbawa Timur Mining, Optima Nusantara Energi, Energy Development Corporate, Hitay Energy, ENEL Joint Venture, Ormat	EDC, PGI (Chevron/Unocal), NGAP, Catholic Church
International institutions	KfW, ADB, JICA/JBIC, CTF/CIFs, World Bank, IMF, USAID, UNFCCC CDM, WWF	KfW, ADB, IMF, New Zealand, UNFCCC CDM, WWF

Indonesia's Institutions, Actors, and Interests

The key actors in governing Indonesia's power sector include the regional governments, Ministry of Energy and Mineral Resources (MEMR), the Ministry of Finance, the state-owned electricity utility Perusahaan Listrik Negara (PLN), and independent power producers (IPPs). While PLN must make a profit as a company, it is also legally obligated to provide energy services and infrastructure to the poorest regions and populations under Law 30/2007. The National Development Planning Agency ("BAPPENAS") handles the development planning and is influential in determining the direction of energy policy and aligning it to broader economic plans and regulations as carried out by MEMR (Damuri & Atje, 2012).

The needs and interests of Indonesia's regional and central government, IPPs, and PLN are often misaligned (Budiman et al., 2014). MEMR holds the most central role since it is responsible for developing energy policy, overseeing state-owned enterprises (SOEs), providing data and analyses, energy planning, funding, and regulation (Damuri & Atje, 2012). Under MEMR, the Directorate of Renewable Energy and Energy Conservation (EBTKE) was created in 2010 as a sub-ministerial agency to strengthen oversight of renewable energy and energy efficiency activities.

Geothermal development in Indonesia is dominated by three state-owned geothermal companies: Pertamina Geothermal Energy (PGE), subsidiary of Pertamina Persero, that has been exploring and developing geothermal projects since the 1970s; PLN Gas and Geothermal, a subsidiary of PLN; and Geo Dipa Energi (GDE), whose shares are held by the Ministry of Finance (93%) and PLN (7%) (World Bank, 2019; Yunis, 2015). There are also several private Indonesian and international developers holding geothermal exploration licenses (see Table 1 and Figures 3–6 for breakdown of ownership structure of the industry).

Opposition groups against geothermal development include vested interests in fossil fuels and local and indigenous communities. The deeply embedded subnational political interests in coal, oil, and natural gas and related cronyism, rent seeking, and corruption (including embezzlement of funds from MEMR, extortion, tax fraud, and smuggling) are a major barrier to the renewable energy development (Cahyafitri, 2015; Sukoyo, 2014; Winters & Cawvey, 2015). Local communities, represented by village chiefs, are concerned with environmental and health impacts of geothermal projects—such as safety and pollution—and have pushed back against geothermal projects (WWF, 2012, 2013). While there is legitimacy to these concerns in terms of environmental impacts, fear of new technology is also a contributing factor to spreading misinformation. Indigenous communities are also a source of contestation for geothermal projects: represented by their chiefs, these communities may seek compensation or retribution for allowing access to tribal lands or resettlement.

Philippines' Institutions, Actors, and Interests

In the Philippines, the Department of Energy (DOE) is the government ministry charged with the creation of policies and regulations governing energy development.

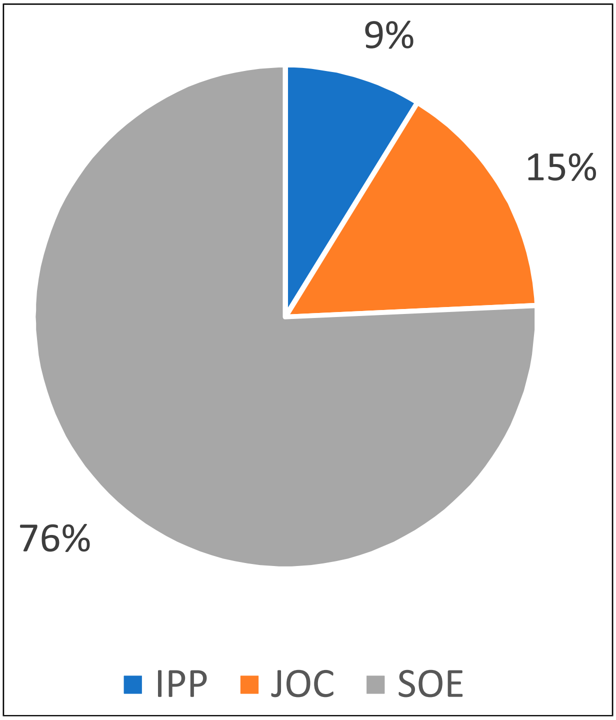

Figure 3. Ownership structure of the Indonesian geothermal assets. Source: Ministry of Energy and Mineral Resources MEMR (2020)

Notwithstanding the DOE's role in energy development, the majority of geothermal resources were developed under the direction of the Ferdinand Marcos regime (1965–1986) and Fidel Ramos (1992–1998) to maintain energy security during the 1973 Oil Crisis and the 1990s Power Sector Crisis. The government's leadership played a large role in expediting geothermal development. Following the confirmation of the first geothermal resources in Tiwi, the government created the Energy Development Corporation (EDC) under the state-owned Philippine National Oil Company (PNOC), in 1976 with the mandate to "explore, delineate and develop indigenous resources in the country" (EDC, 2021). EDC worked with the National Power Corporation (NPC)—the state-owned power and transmission company—under Marcos's direction and was guaranteed offtake for geothermal steam fields and financing to cover exploration and development costs—so offtake risks were removed completely. EDC was privatized and acquired by the Lopez Holdings Corporation in 2007, but nearly all early geothermal development in the Philippines was carried out while EDC was part of PNOC.

One of the major opponents of geothermal development in the Philippines are the indigenous communities, protective of their tribal lands which happen to overlap with some of the most abundant geothermal resources. There is a long history of opposition to development on tribal land, and many geothermal projects have been stalled or canceled due to contested land rights.

Table 3 presents some of the major obstacles and challenges to geothermal energy development.

The next two sections provide a summary of the major barriers to geothermal development, first in Indonesia and then in the Philippines.

Indonesia's Major Barriers

Indonesia is one of the top 10 global carbon emitters (by some calculations the fifth largest), with deforestation and land conversion as the largest contributors to the country's emissions (Climate Action Tracker, 2020; Tacconi & Mutaqin, 2019). While Indonesia aims to have renewables constitute 23% of the energy mix by 2025, as of 2020, due to persistent barriers, only 14% was achieved so far, whereas fossil fuels comprised 86% of primary energy supply (IISD, 2018; MEMR, 2020). Scholars and organizations working on the ground in Indonesia have identified financial, regulatory, and technical barriers to investment in renewable energy technology.

Financial barriers to geothermal development in Indonesia include high risks and costs of exploration and development, high costs of development compared to coal, and a mismatch of financial support for project developers to reduce risks of upstream development (Yasukawa & Anbumozhi, 2018). Typically, the costs of exploration in geothermal-producing countries are borne by the government or SOE instead of the

Table 3. Major Barriers to Geothermal Development in Indonesia and the Philippines.

Case Study	Financial Barriers	Regulatory Barriers	Technical Barriers
Indonesia	-Private sector reluctant to invest -Significant exploration risks without adequate financing support -Issues with PPA and tariffs	-Forestry Law and the 2003 Geothermal Law -Foreign ownership 45 (1>10 MW)/ 95 (<10 MW)	-Historical lack of technical workforce -Limited institutional capacity to implement laws
Philippines	-Tariffs: for example, no feed-in tariff -High costs of development with new technology (lack of quality resources) -Risks of no offtake - Power sector regime (EPIRA)	-Protected areas and ancestral lands -Slow and contradictory permitting leads to project delays -Foreign ownership vs 40/60 clause	-Historical lack of technical workforce -Lower quality resources remaining -Need for newer technology increases costs: for example, expensive binary turbines are needed to extract lower quality geothermal resources

developers. Yet in Indonesia, developers have covered the cost and risks of exploration since the government has historically been averse to supporting high-risk geothermal exploration to avoid taking on a loss if a well should prove unproductive.[2]

The three phases of upstream geothermal development—preliminary survey, exploration drilling, and delineation drilling—are associated with the highest risks, while the downstream phase has the highest costs, but risks are lower (see Table 4 below). The absence of early-stage financing and risk mitigation is one of the largest barriers to Indonesia's geothermal development.

Regulatory barriers to geothermal development in Indonesia have centered around restrictions placed on private investment in the sector and regulations—in particular the forestry and mining laws, which complicate already limited coordination among local and central government (Transparency International, 2020; WWF, 2012; Yasukawa & Anbumozhi, 2018). Following the 1997 Asian Financial Crisis, Suharto issued Presidential Decree No. 39/1997, which halted joint operating contracts (JOCs) involving SOEs and IPPs—a major vehicle for geothermal development— in order to review expenditures for corruption. This law effectively chilled private investments in Indonesia (Kantor et al., 2011). Five years later, the government reopened the sector to private investment with Geothermal Law No. 27/2003, which intended to break up PGE's monopoly of the geothermal industry by opening the tender process for exploration contracts to all bidders, enhance the role of local government, and shift regulatory authority back to MEMR (Suryantoro et al., 2005; World Bank, 2007). However, implementing regulations were not issued until 2007 due to vested interests in oil and gas, stalling private investment for nearly a decade.[3]

Forestry, mining, and geothermal laws were another critical obstacle to the country's geothermal development, and the decentralized authority of the government adds further complications. Geothermal development was legally considered part of the mining sector according to Article 38 (4) of the Forestry Law No. 41/1999, but mining is prohibited in protected and conservation forests (Damuri & Atje, 2012).[4] This prohibition was a bulwark to geothermal development because 57% of geothermal resources are thought to be located in conservation forests (WWF, 2013). Often higher

Table 4. Breakdown of geothermal costs. Source: Tharakan (2015) and World Bank (2019, 2020)

Development stage		Details	Cost (USDmln)
Upstream	First phase	Pre-drilling: geoscientific exploration and baseline environmental studies	1M
	Second phase	Feasibility study, exploration drilling, and well-testing - 25% success rate	25–50M
	Third phase	Delineation drilling and technical feasibility studies	1.26Mper MWor 20–120M
Downstream	Fourth phase	Construction and production drilling	20–200M
		Total	66–370M

quality resources—primary resources with high heat (enthalpy) and steam and low acidity—are located in forested areas.

Technical barriers arise from limited institutional expertise and technical workforce, particularly among Indonesian developers. In Indonesia, local governments play a key role in the implementation of energy policy by issuing permits for exploration and development of renewable energy projects, managing geothermal concession bidding, and setting tariffs; however, there is a gap in technical expertise at the local level to manage tendering contracts, and this is complicated by overlapping jurisdictions, vested interests, and lengthy permitting procedures (EIA, 2015; Fox et al., 2006; Polycarp et al., 2013).[5] There is furthermore a limited domestic technical workforce—few Indonesian developers have managed to break through the tangled barriers to develop projects, while PGE continues to dominate geothermal development, owning 76% of installed capacity compared to 9% owned by IPPs (see Figure 3) (MEMR 2020; Yasukawa & Anbumozhi, 2018).

Philippines' Major Barriers

Historically, the Philippines relied on oil imports to meet its fossil fuel demand until it was severely impacted by the 1970s oil embargo and the 1986 Power Sector Crisis, when blackouts and energy supply shortages plagued the country. Since then, the country has pivoted towards renewables to increase diversification, though it is still a net importer of fossil fuels. The majority of the country's geothermal capacity was developed under the Marcos regime using government resources and SOEs fully dedicated to accelerating geothermal development, removing financial and regulatory barriers in early development. The biggest barrier to early development in the Philippines was the lack of technical workforce. More recently, the diminishing abundance of high-quality primary resources has created new technical and financial barriers: only low-to-medium enthalpy (low heat), high acidity resources remain, which require higher costs to develop associated with binary turbine drilling and special materials to mitigate corrosive effects of acidic fluids (Yasukawa & Anbumozhi, 2018). Since the power sector privatized and operates as a spot market, there is no guarantee of offtake for geothermal electricity generation and utilities are driven by profits and short-term power purchase agreements (PPAs), which puts geothermal at a disadvantage compared to fossil fuels.[6] Project developers argue that a feed-in-tariff may be needed to cover exploration and development costs of these secondary resources.[7]

A major regulatory barrier to private investment in geothermal development in the Philippines is the foreign ownership rule. In renewable energy development, foreign companies are only allowed to hold 40% of the assets and need to "Filipinize" by partnering with local companies that would own the remaining 60%. The capital-intensive nature of geothermal development requires access to capital which favors large multinational developers, rather than local developers who have limited access to equity to cover the high risks and costs of exploration drilling. The constitution outlines natural resources as owned by the people, and therefore, exploitation must be carried out with full supervision of the state, which is why the 40/60 rule is applied. Although full foreign ownership was legalized under Renewable Energy Law No. 9513 in 2002, it still required presidential approval and was not politically feasible until 2020 when the DOE issued a statement condoning this practice in effort to spur further geothermal development.[8]

Another regulatory barrier is the limitation to accessing protected areas or indigenous lands to develop prime geothermal resources overlapping with these territories, stipulated by the 1992 National Integrated Protected Areas System Act (NIPAS). Since many new geothermal resources are in protected areas and ancestral lands, developers often must go through an extensive review process to access these lands or apply to redraw protected areas boundaries.[9]

The financial, regulatory, and technical barriers have slowed and even halted geothermal development progress in both countries. The next sections examine the evolution of interactions between international organizations, domestic political interests, and barriers on the ground in Indonesia and the Philippines, and the subsequent effectiveness of climate finance.

Overview of geothermal financing

The landscape of clean energy development finance in Indonesia and the Philippines consists of the multilateral and bilateral development banks and international organizations presented in Table 2. The climate finance for geothermal development between 1980 and 2015 totaled USD 6.7 billion in Indonesia and USD 3 billion in the Philippines, varying from financial assistance, pilot projects, technical assistance, and policy advising to training and workshops to address the diversity of barriers to geothermal development. Figure 4 depicts the overall trends in bilateral and multilateral climate finance for geothermal energy development in Indonesia and the Philippines from 1980–2015, and Figure 5 shows multilateral climate finance contributions between 2015 and 2020.[10]

The discussion of climate finance is increasingly salient considering the UNFCCC COP in Paris and Glasgow. Emissions reduction commitments and climate finance allocations provide a backdrop against which recent geothermal development plans have evolved in Indonesia and the Philippines.

In Indonesia in the early 2000s, international pressure to reduce emissions coincided with the country's exit from OPEC. Through international forums such as the 2007 UNFCCC COP13 in Bali, Indonesia came under increasing international pressure to reduce deforestation and carbon emissions, and leaders felt pressure to appear "progressive."[11] At the 2009 G-20 Summit, then President Susilo Bambang Yudhoyono ("SBY") made the 26/41 Commitment, whereby he pledged a 26% reduction of emissions by 2020 from business-as-usual (BAU) and up to 41% reduction with international support. Indonesia deepened its emissions reduction targets under its Paris Agreement Intended Nationally Determined Contribution (INDC) to 29% emissions reduction by 2030 and up to 41% reduction with international support (UNFCCC, 2015a). At COP26 in Glasgow, Indonesia signed the agreement committing to coal retirements and zero deforestation by 2030 but has since signaled it may not be able to

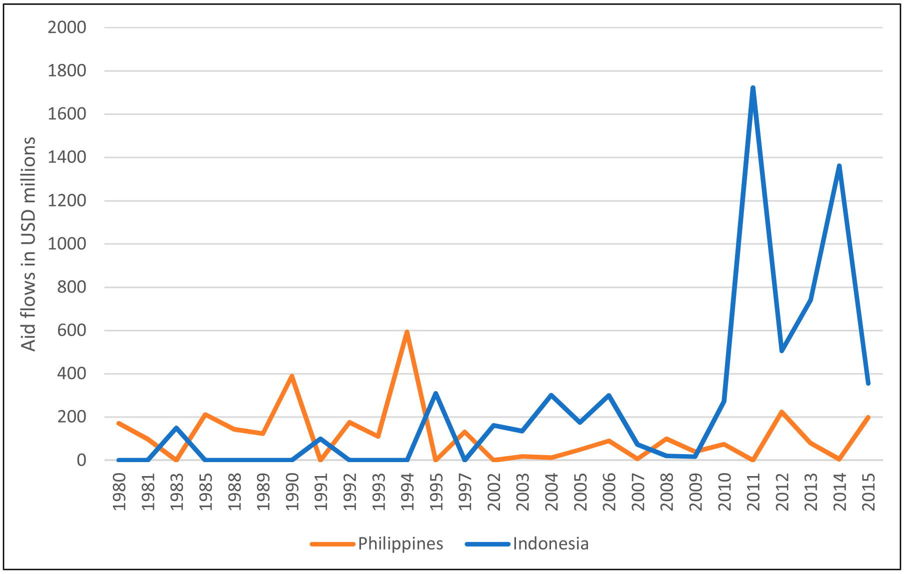

Figure 4. Clean energy development aid to Indonesia and the Philippines, 1980–2015.
Source: Asian Development Bank (2016), Japanese International Cooperation Agency (JICA) (2016), KfW, World Bank, ADBJICA (2015) and UNEP, DTU (2016)

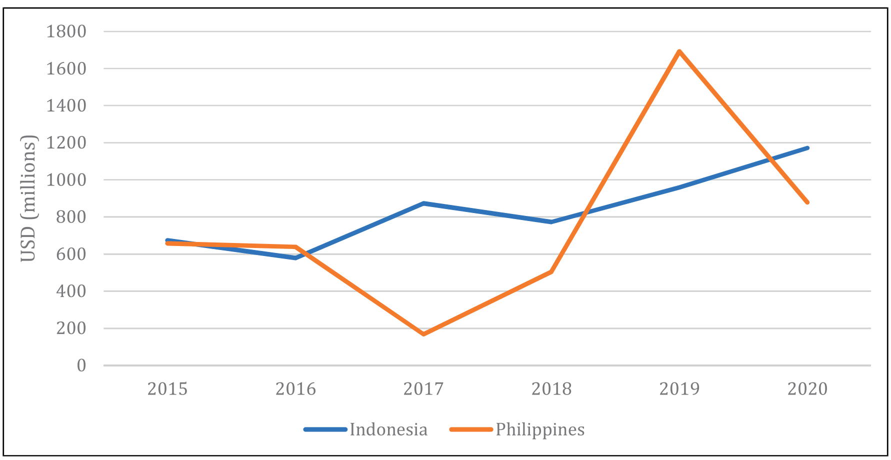

Figure 5. Multilateral climate finance allocated to Indonesia and Philippines, 2015–2020.
Source: African Development Bank (2020)

abide by it (BBC, 2021). The reputational risk of being seen as a laggard at international forums is a motivating factor to appear progressive.[12] Nevertheless, two-level games

(Putnam, 1988) are evident as Indonesia attempts to appease international pressure to reduce emissions and domestic pressures, while signaling a need for international support. The 26/41 commitments made internationally were eventually institutionalized, representing norm diffusion, but progress towards emissions reduction has been slow. The signal to international community to attract climate finance was successful in drawing international support for climate mitigation, including geothermal development, as detailed below.

The Philippines in contrast has prioritized renewable energy as part of its renewable energy mix since the oil crisis in the 1970s but the country's energy mix is still reliant on imported fossil fuels. Most recently under the Paris Agreement, the Philippines committed to 70% emissions reduction by 2030 against BAU (UNFCCC, 2015b), but these targets are conditional on climate finance and technology transfer (Climate Action Tracker, 2018).

The next sections examine how the development finance earmarked for geothermal development addresses major barriers in Indonesia and the Philippines.

Geothermal Financing in Indonesia

Financial and technical barriers. Bilateral and multilateral development finance have targeted financial and technical barriers in the geothermal industry, such as upstream development and technical training. Over the course of nearly 10 years and several iterations of funding mechanisms, development institutions made inroads through policy dialogues with the Government of Indonesia in reframing government funding for exploration as a data gathering exercise, which has helped to overcome the major financial barriers. Each mechanism has attempted to incorporate some level of government funding, matched by international funding, to help reduce investments risks associated with early-stage development.

Starting in 2011, Kreditantstalt fur Wiederaufbau (KfW) (Germany's Credit Institute for Reconstruction), Asian Development Bank (ADB), and Japanese International Cooperation Agency (JICA) worked with the country's government to design a revolving fund to finance geothermal projects—the Geothermal Fund Facility (GFF).[13] The ADB expressed interest in matching the government's contribution to the Fund under the condition that the government would take on the risk of exploration; however, the government was still averse to financing high-risk geothermal exploration since it could not take a "loss" (Polycarp et al., 2013). While the ADB and JICA worked with the government to demonstrate the benefit of government support for exploration as a gain in terms of geological data, the government did not make major contributions to the GFF.[14]

Moving ahead to 2019, the World Bank's Geothermal Resource Risk Mitigation Project (GREM) creates an innovative financing tool aimed to reduce the risks associated with exploration drilling. GREM aims to provide an innovative financing mechanism for upstream development through a Risk Sharing Facility (RSF), as well as capacity building and technical assistance to MEMR and PLN to improve licensing and power offtake agreements (World Bank, 2019). GREM is expected to result in 1 GW of new geothermal capacity by 2029, leveraging USD 4 billion in investments in steam production drilling and power plant construction. The unique aspect of the RSF is the use of equity and debt in a Special Purpose Vehicle (SPV), whereby if the project proves valuable, then the equity investors can share in profits, but if the wells are dry, then SPV is valued at USD 0 but risks are pooled.[15] The RSF also helps develop a database on risks and losses to be used by banks for pricing loans (World Bank, 2019). The RSF reframes a loss as a gain by contributing immense value to the geothermal industry and the banking industry, which should alleviate the concerns of the government. Since 25% of wells will likely be productive, the GREM facility would self-fund through the successful projects that also cover the losses of the other 75% of exploration, providing a long-term solution for exploration financing.

Aside from funding to remove financial barriers of exploration drilling, technical barriers have been targeted by development agencies, such as KfW, JICA, New Zealand, ADB, and the World Bank, to support the development of Indonesia's geothermal industry including soft loans and mobilizing finance for the exploration of commercial sites for pilot projects, providing technical training and capacity building to local government officials responsible for tendering contracts for geothermal development, improve data collection, and support for policy reform implementation (Polycarp et al., 2013).[16] One example is KfW's Geothermal Program launched in 2010 with EUR 7.7 million (USD 10.3 million) in soft loans to PLN and Pertamina for funding to rehabilitate the Kamojang geothermal project, support exploration financing for geothermal power plants in Flores and Aceh, and assist with the tendering process to remedy benefit sharing issues with Seulawah Agam geothermal project (Downing, 2011).[17] Another example is funding in the GREM mechanism earmarked for technical assistance and capacity building, which focused on building local technical capacity to establish an effective exploration and tendering program to reduce regulatory risks long-term, and to strengthen capacity to carry out drilling, well completion, and write resource assessment reports (World Bank, 2019).

Regulatory barriers and social learning

The regulatory barriers related to competition and land access have been resolved through successive iterations of the Geothermal Law. Political barriers to the implementation of the 2003 Geothermal Law were in part resolved by domestic energy shocks as well as political leadership. A sustainability-minded politician, Irwan Prayitno—now Governor of West Sumatra and previously Head of the House's Commission VIII for Energy, Mineral Resources, Environment, Science, and Technology (1999–2004)—pushed the Geothermal Law through Parliament while he was Chair to counterbalance the Oil and Gas Law (Law No. 22/2001), which favored oil and gas development.[18] In the wake of Indonesia's 2008 energy crisis, Parliament prompted the government to issue a mandate to enact the original 2003 Geothermal Law as a possible solution to the energy crisis. The implementing regulations thereby removed the major barrier to private investment.

The other major regulatory barrier was the definition of geothermal development as a form of mining, which was prohibited in forested areas where most high-quality geothermal resources are located. Industry stakeholders such as the Indonesian National Geothermal Association (INAGA) and private companies, as well as international actors, including the ADB, World Bank, United States Agency for International Development (USAID), and World Wildlife Foundation (WWF), lobbied for reform of the 2003 Geothermal Law to redefine geothermal development, but it took over 10 years of policy dialogues between development agencies, the government, and industry stakeholders to result in change. Ultimately, social learning changed perceptions.[19] In a major shift of domestic political interests in favor of geothermal development, the new Geothermal Law was adopted in 2014, declassifying geothermal development as mining and allowing for exploration and drilling in forested areas (Cahyafitri, 2015).

The complex interactions of energy shocks, political leadership changes, and ongoing policy dialogues and financing from development banks have helped to target and ameliorate regulatory, financial and technical barriers in Indonesia. The multiple attempts to overcome these barriers demonstrate evolution of the government's problem-solving approaches and shifting interests. The next section details how climate finance addressed similar barriers existing in the Philippines but to different outcomes.

Geothermal financing in the Philippines

Addressing financial and technical barriers. Under the Marcos regime and in the wake of energy shocks in the 1970s, the Government of the Philippines invested primarily in geothermal development to meet capacity needs, dedicating SOEs to the cause but with significant technical cooperation from bilateral donors. New Zealand provided bilateral financial and technical assistance and technology transfer for exploration and development of the Philippines' first geothermal sites, which helped to build up technical expertise of the Philippines' SOEs and reduce technical barriers. Between 1973 and 1985 the Philippines received a total of NZD 21.5 million (roughly the same amount in USD at the time) as a New Zealand government grant for geothermal exploration, and the private New Zealand consulting company, Kingston Reynolds Thom and Allardice (KRTA), was appointed to carry out the technical assistance for the aid agreement, in conjunction with the NPC and PNOC, and later PNOC-EDC (Hochstein, 2005).[20]

During this period, geothermal development operated under the 1972 Presidential Decree 87, known as the Oil Exploration and Development Act, which upheld the sovereignty of the producer-country over the natural resources (Velasco, 2006). Under this structure, the Philippines quickly developed 446 MW of installed geothermal capacity by 1980. By 1983, the country became the second largest geothermal producer in the world with the commissioning of Tongonan Unit 1 and Palinpinon Unit 1, each with 112.5 MW installed capacity—both owned by PNOC-EDC.[21]

In the 1990s, development finance helped facilitate economic and regulatory reform, incentivizing private investment (Bacon, 2019). The Ramos regime prioritized economic liberalization and institutional reforms, including private investment and requests for development aid in geothermal and power capacity development to respond to the power sector crisis. Development agencies directly funded projects developing installed capacity to meet energy demands, in addition to a sizeable tranche of funding for policy advising (social learning mechanism). Development funding targeted policy advising and institutional capacity building to strengthen regulatory capacity for pricing and policy implementation, particularly for geothermal field development and power sector and transmission and distribution development.

The creation of the Build Operate Transfer (BOT) Scheme under Republic Act 6957 in 1990 and the Presidential Decree 45/1991 temporarily removed the financial and regulatory barriers to private investment and catalyzing the development of an additional 1 GW of geothermal installed capacity between 1996 and 2000 (World Bank, 2007; Yasukawa & Anbumozhi, 2018). The BOT Scheme allowed for a contractual agreement between a private developer and the government (joint operating contract or JOC) to construct, finance, operate, and maintain a facility for a maximum term (up to 50 years), after which the facility is transferred to the government. However, in the aftermath the Asian Financial Crisis, foreign investment was curtailed, and development stalled. As shown in Figure 6, the ownership of geothermal assets in the Philippines is dominated by SOEs, which own 67% of total operating assets.

More recently, the Philippines has struggled to develop its remaining secondary resources due to dwindling quality of reserves and increasing costs of development, representing newer technical and financial barriers. Nevertheless, the DOE set ambitious targets to develop the remaining resources despite mounting technical barriers:

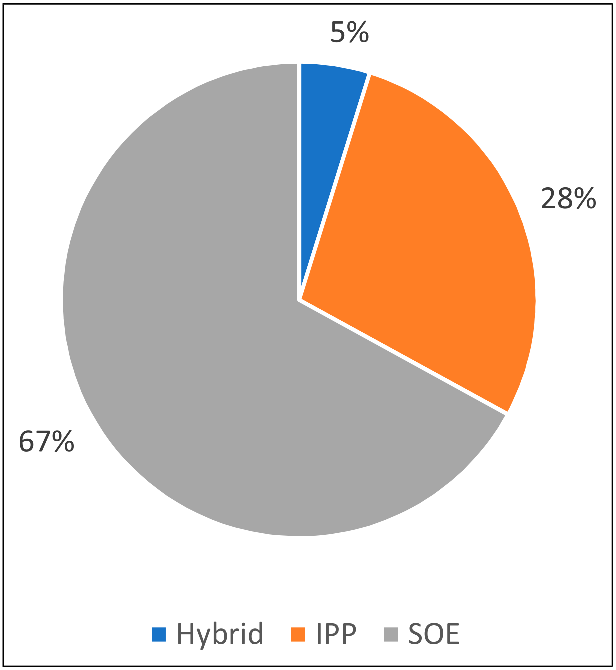

Figure 6. Ownership Structure of Philippines Geothermal Assets. Source: DOE (2021)

a total of 1495 MW by 2030 in added capacity (cumulating to a total installed capacity of 3,461 MW by 2030) (DOE, 2010). In a push to reach geothermal targets, the DOE took steps to attract private investment, including issuing a statement encouraging foreign ownership in effort to spur further geothermal development,[22] launching new exploration surveys and auctions, including low enthalpy working areas mainly for secondary resources, and renewing a MOU with the Government of New Zealand for technical cooperation for geothermal (Velasco, 2021).[23]

In order for foreign investors to participate in large-scale geothermal exploration, they need to meet certain conditions, including the USD 50 million minimum investment (DOE, 2020). As a result, the geothermal industry began pushing for a risk mitigation and government co-investment in drilling to reduce the risks associated with the exploration phase of development. The National Geothermal Association of the Philippines (NGAP) is promoting new legislation in 2021 that proposes a Geothermal Exploration Risk Mitigation Mechanism, which would provide cost sharing with the government to reduce exploration risks (NGAP, 2021), as similar to the World Bank's GREM in Indonesia. If drilling is successful, the developer would repay the government for their loan, but if the project is unsuccessful, the government's portion is considered a grant. This mechanism aims to catalyze the deployment of 700 MW over the next 15 years.[24]

Regulatory barriers

International and transnational actors have also targeted and addressed specific regulatory barriers to geothermal development in the Philippines, including the 2002 Renewable Energy Law.

In the late 1980s, an institutionalized transnational advocacy network called the Renewable Energy Commission—consisting of civil society, government and private actors, including WWF, Greenpeace, Aboitiz, Vestas, EDC, Chevron, and a variety of renewable energy companies, and the Philippine Catholic Church, worked together to advocate for support of the Renewable Energy Law, which provided a range of incentives for renewable energy investors, including tax credits and exemptions, feed-in-tariff for intermittent, and emerging renewable technologies and financing.[25] Importantly, the law also provided for 100% ownership of geothermal assets by a foreign company (pending the president's approval), which addresses one of the regulatory barriers to geothermal development. The network pooled resources to lobby for the law's passage, conducted public media campaigns and collected over 400,000 signatures in petition for renewable energy. After overcoming vested fossil fuel and coal industries, the Renewable Energy Commission succeeded in passing the new Renewable Energy Law in 2002 (RA 9513). This coalition successfully fostered cognitive shifts on part of policymakers to support renewable energy policy adoption, demonstrating social learning. Nevertheless, it still remains to be seen if the recent declaration by the DOE on foreign investments, as mentioned above, will resolve the foreign ownership issue (DOE, 2020).

Impacts of the Climate Finance Mechanisms

By exploring the various forms of climate finance and its domestic impacts on the geothermal industry, this article conceptualizes effects on domestic actors and barriers as utility modifier mechanism, social learning, and capacity building on barriers to geothermal development in Indonesia and the Philippines. The case studies reveal that the *utility modifier mechanism* is an important factor in encouraging private sector investments by reducing financial risks and promoting an investor-friendly environment through necessary economic and regulatory reforms. However, the utility modifier mechanism rarely alone is a sufficient mechanism to create lasting change, nor does it fully remove the barriers needed to catalyze geothermal deployment at scale. Financial aid for projects is often coupled with policy advising (social learning), as well as technical assistance to build technical capacity or expertise (capacity building), which is key to ensuring necessary regulatory reforms are implemented and there is local capacity to carry out geothermal project development and tendering.

These intersecting dynamics are exemplified in Indonesia, where the World Bank played a role in filling gaps for exploration and drilling in upstream development through joint government funding and development aid by shifting government attitudes toward providing funding for the exploration phase drilling was crucial to helping overcome one of the largest barriers to geothermal development. Social learning and policy diffusion played a key role to complement financial support by working with the Government of Indonesia to reframe public funding for exploration as fruitful even in the case of unproductive wells through the gained data. The long-term solution of the RSF under the GREM should reduce risks for private investors, thereby addressing a major financial barrier to early-stage geothermal development. The funding provided for the GREM is coupled with training to institutions that carry out tendering and permitting to fulfill the capacity building mechanism. These three mechanisms worked in concert to address entrenched barriers and propagate sustainable change in the industry.

The *social learning mechanism* was found to be key in influencing normative change and problem solving deep within government bureaucracies, which affected the overall trajectory of geothermal development and broader energy transition in both Indonesia and the Philippines. As explained by a senior energy expert at the World Bank, the dialogue with the government is a long process that involves working at different levels of government—the ministry and presidential level as well as at the local administrative level—by educating the technocrats and implementers of policy.[26] The iterative process involves a back-and-forth between the World Bank and government ministries, the former providing guidance and the latter negotiating for options that are more economically and politically viable with domestic constituents. In Indonesia, repeated international forums like COP-13 in Bali and the G-20 Summit in 2009 mounted international pressure and diffused norms surrounding carbon emissions reductions and were instrumental in driving forward emissions reduction commitments under SBY, though the government continues to fall behind on its goals and energy development plans, reflecting possible domestic barriers.

The *capacity building mechanism* was evident in both case studies whereby development institutions provide funding for training and institutional capacity building to

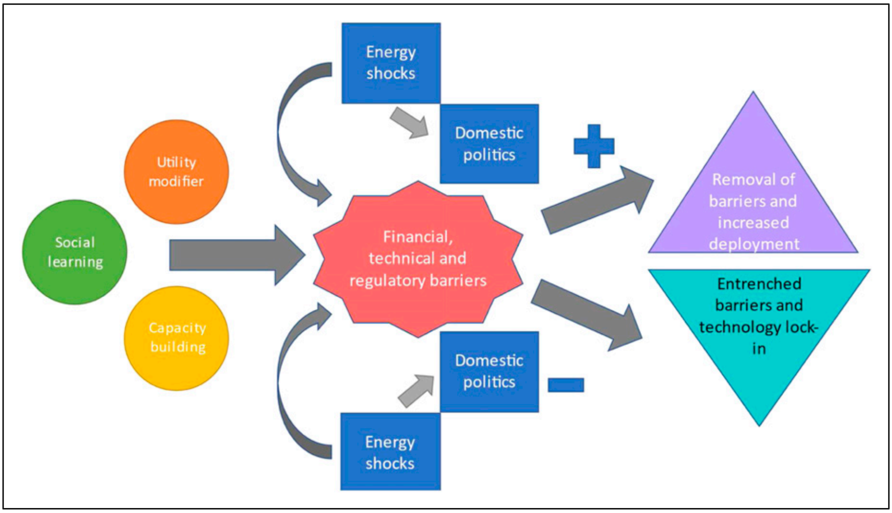

Figure 7. Interactive effects between climate finance and domestic political barriers.

develop technical and institutional capacity, such as training agencies with technical expertise or ensuring that the ministries can successfully implement policies and programs. The capacity building mechanism was exemplified in the Philippines when the Marcos regime prioritized geothermal development, but the country had limited local technical expertise. New Zealand responded by providing bilateral technical assistance aimed to help the government develop its technical capacity and it continues to play a role in 2021 as the country attempts to develop secondary resources with new technology.

This analysis further reveals the intervening role of *political will* as a necessary condition for raising the salience of geothermal technology as a principal solution to energy capacity needs; *energy shocks* also play an intervening role in determining overall impact and success in outcomes of the development finance in removing barriers. See Figure 7 for a visual depiction of these dynamics.

Political will on part of the government to prioritize geothermal technology in energy plans, carry out regulatory reforms, invest state resources—whether co-financing with development banks and the private sector as in the case of Indonesia or utilizing SOEs to carry out exploration and drilling as in the case of the Philippines—played a fundamental role in removing barriers to geothermal development. When energy shocks created capacity constraints, high energy prices and energy insecurity, this led to outcomes of investment in renewables as a part of the overall energy portfolio—as seen in the Philippines after the power sector crisis and Indonesia after the shift from net exporter to net importer—both governments prioritized geothermal energy development. These enabling factors explain the variable outcomes in geothermal development in both countries in terms of the share of primary geothermal resources developed and the variance in onset of growth in installed capacity (see Figure 1). Therefore, while the three mechanisms of climate finance work interdependently in impacting the financial, regulatory, and technical barriers to geothermal development in Indonesia and the Philippines, political will and energy shocks play a significant intervening role.

Lastly, while liberalization policies played an important role in allowing for private entities to invest in and develop geothermal projects—such as the BOT Scheme in the Philippines and JOCs in Indonesia—these reforms were mitigated by the government response to the Asian Financial Crisis when private investments were halted. Despite reforms and efforts to attract foreign investment and foster domestic industries, a limited number of companies have managed to develop and own geothermal assets. As shown in Figures 3–6, SOEs dominate the industry and own the majority of operating assets. This trend may change in light of the newly created risk mitigation mechanism in Indonesia and the Philippines, as well as the opening of foreign ownership rules in the Philippines.

Conclusion

This paper contributes to growing research on climate finance effectiveness by examining the impacts of climate finance on domestic barriers to renewable energy development in recipient countries. This paper seeks to answer how effectively international development agencies and climate finance addressed domestic barriers to geothermal development in Indonesia and the Philippines, and how domestic politics mitigate impacts. The main findings are that the utility modifier mechanism—or development project finance—is the most prominent form of aid but is it not a sufficient mechanism to fully remove the barriers needed to catalyze private investment in geothermal deployment in a self-sustaining way. Project finance (utility modifier) is often intertwined with policy diffusion (social learning) and trainings (capacity building), which more effectively removes barriers to geothermal development. These findings have important policy implications for climate finance and development aid more broadly: to be most effective, climate finance should include a comprehensive package addressing major regulatory, financial, and technical barriers by combining policy advising and technical capacity building with project-based financial aid.

My findings demonstrate that political willingness to prioritize renewable energy development is a necessary condition for development aid effectiveness, and energy shocks influence political will. These intervening variables play a significant role in the effectiveness of climate finance mechanisms. The paper finds that policy dialogues over years and even decades between international institutions, transnational actors, government ministries and industry incrementally led to social learning to ameliorate important regulatory barriers like government funding of exploration drilling in Indonesia or foreign ownership in the Philippines.

While much progress has been made in terms of removing barriers to geothermal development in Indonesia and the Philippines, some barriers still remain. The financial barriers in the Philippines are unresolved and may benefit from the proposed risk sharing mechanism or a feed-in-tariff, but further fiscal support for exploration drilling is needed. In Indonesia, the financial barriers are likely resolved with the GREM, but remain untested—only time will tell if this mechanism reduces the financial risks to sufficiently attract private investments. Further technical trainings through vocational programs would benefit developing domestic technical expertise in the local geothermal industry (Yasukawa & Anbumozhi, 2018).

As both countries work towards their emissions reduction goals under the Paris Agreement and Glasgow Climate Pact, geothermal development should be prioritized for capacity development in energy planning, but political willingness and commitment to prioritizing geothermal development is crucial to meeting these targets, even with increased levels of climate finance. Underlining the broader energy security benefits of continued development of geothermal capacity may increase the salience of these issues with government stakeholders.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The author acknowledges the support of the SNF Postdoctoral. Mobility (P2GEP1_175034) and Doc. Mobility (P1GEP1_165424) Fellowships in making this research possible.

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Notes

1. While a portion of the aid being studied in these case studies pre-dates the term “climate finance,” which was adopted more recently under the UNFCCC discourse, the overarching aim of these diverse funds is aligned with the definitions of climate finance. For a reference and history of climate finance within the UNFCCC, see: https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance.
2. MEMR interview, 2020; Supreme Energy interview, 2014; World Bank interview, 2020.
3. Supreme Energy interview, 2014.
4. Pertamina interview, 2015; Supreme Energy interview, 2014.
5. KfW interview, 2014.
6. KPMG interview, 2016; ADB interview, 2016.
7. KPMG interview, 2016.
8. DOE interview, 2020.
9. EDC interview, 2016.
10. Climate finance depicted is not geothermal-specific.
11. UNDP interview, 2014
12. World Bank interview 2020.
13. World Bank interview 2020.
14. ADB interview, 2015.

15. World Bank interview, 2020.
16. KfW interview, 2014, 2015.
17. WWF interview, 2015.
18. Supreme Energy interview, 2014.
19. INAGA interview, 2014; Supreme Energy interview, 2014; WWF interview, 2015.
20. Chevron interview, 2016.
21. See: http://www.energy.com.ph/about-edc/milestones/.
22. DOE interview, 2020.
23. Full foreign ownership was legalized under Renewable Energy Law No. 9513 in 2002 but requires presidential approval, although it was not politically feasible until the 2020 DOE statement.
24. Legislation still pending at the time of submission.
25. WWF interview, 2016.
26. World Bank interview, 2020.

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Appendix A: Interview List

Interview	Place	Date
ADB, Philippines	Manila, Philippines	3/1/2016
ADB, Indonesia	Phone interview	8/22/2015
Chevron	Virtual	10/7/2016
Department of Energy, Philippines (DOE)	Virtual	11/13/2020
KfW	Jakarta, Indonesia	8/22/2014
EDC	Manila, Philippines	3/1/2016
Indonesia Geothermal Association (INAGA)	Jakarta, Indonesia	8/20/2014 and 8/6/2015
KfW	Jakarta, Indonesia	8/3/2015
KPMG	Manila, Philippines	4/7/2016
MEMR	Jakarta, Indonesia	11/4/2020
Pertamina Geothermal	Jakarta, Indonesia	8/2/2015
Supreme Energy	Jakarta, Indonesia	8/21/2014
UNDP	Jakarta, Indonesia	8/5/2014
World Bank	Virtual	10/13/2020
WWF, Indonesia	Jakarta, Indonesia	8/5/2014 and 7/28/2015
WWF, Philippines	Manila, Philippines	3/8/2016

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