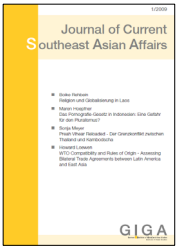

Journal of Current Southeast Asian Affairs

Winters, Matthew S. and Matthew Cawvey (2015),
Governance Obstacles to Geothermal Energy Development in Indonesia, in:
Journal of Current Southeast Asian Affairs, 34, 1, 27–56.

URN: http://nbn-resolving.org/urn/resolver.pl?urn:nbn:de:gbv:18-4-8404

ISSN: 1868-4882 (online), ISSN: 1868-1034 (print)

The online version of this article can be found at:
<www.CurrentSoutheastAsianAffairs.org>

Published by
GIGA German Institute of Global and Area Studies, Institute of Asian Studies and Hamburg University Press.

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Governance Obstacles to Geothermal Energy Development in Indonesia

Matthew S. Winters and Matthew Cawvey

Abstract: Despite having 40 per cent of the world's potential for geothermal power production, Indonesia exploits less than five per cent of its own geothermal resources. We explore the reasons behind this lagging development of geothermal power and highlight four obstacles: (1) delays caused by the suboptimal decentralisation of permitting procedures to local governments that have few incentives to support geothermal exploitation; (2) rent-seeking behaviour originating in the point-source nature of geothermal resources; (3) the opacity of central government decision making; and (4) a historically deleterious national fuel subsidy policy that disincentivised geothermal investment. We situate our arguments against the existing literature and three shadow case studies from other Pacific countries that have substantial geothermal resources. We conclude by arguing for a more centralised geothermal governance structure.

■ Manuscript received 23 November 2014; accepted 23 March 2015

Keywords: Indonesia, renewable energy, decentralisation, governance

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Introduction

With the so-called Pacific Ring of Fire running through its major islands and responsible for its collection of volatile volcanoes and high risk of earthquakes, Indonesia is home to a remarkable concentration of geothermal energy. This energy can be used for electricity production by channelling superheated underground reservoirs to power steam turbines. According to some estimates, if all of Indonesia's 28,500 megawatts (MW) of geothermal potential could be harnessed and appropriately distributed, this would be more than enough to supply the entire country's electricity needs (Brown 2006: 200). Fuller geothermal exploitation would reduce Indonesia's reliance on fossil fuels and address an energy poverty crisis that is observable in the fact that almost one-third of the country's 225 million inhabitants lack reliable access to electricity (WWF 2012: 31).

However, geothermal energy remains remarkably underexploited in Indonesia. Although the country's installed capacity of 1,300 MW is the third largest in the world (after the United States at 3,400 MW and the Philippines at 1,900 MW), this only represents 4.7 per cent of Indonesia's total potential (Matek 2013: Figure 5). National commitments to the exploitation of renewable energy resources have been made at the highest level: in 2006, then-President Susilo Bambang Yudhoyono issued Presidential Regulation No. 5/2006 on National Energy Policy, which required that 5 per cent of domestic energy demand be met with geothermal power by 2020 and another 5 per cent with other forms of renewable energy. In 2011, the national energy plan was updated, targeting 25 per cent of the national energy mix to be based on renewable energy by 2025 (Sukarna 2012) and calling for installed geothermal capacity to double from its 2012 levels by 2016 and then double again by 2025 (Brophy et al. 2011; Ibrahim, Simandjuntak, and Jarman 2012). If these goals are achieved, the use of geothermal energy in place of fossil fuel-based power plants will equate to the largest carbon emissions reduction project in the world (Sukarna 2012).

Unfortunately, the evidence on the ground suggests that these targets are overly ambitious (Crosetti 2010); one member of the National Energy Council described them as "unrealistic" (interview 18). As of mid-2013, some 30 geothermal projects appeared to have stalled, including 11 that were launched before a 2003 change in the regulatory regime (Azwar 2013; Matek 2013).

We highlight four factors that have hindered development in Indonesia's geothermal sector.[1] First, the decentralisation of the permitting and tendering processes for geothermal power plants has created delays by locating decision making authority in local governments that lack incentives to promote exploitation. Second, the point-source nature of geothermal resources, combined with the localised regulation of the sector, creates incentives for rent-seeking acquisition of geothermal working areas by actors that do not intend to develop them. Third, the lack of clarity in the national policy-making process has created significant uncertainty that disincentivises investment. Finally, geothermal exploitation has historically been made less attractive by massive fuel subsidies that have generally distorted energy markets in the country. Although these subsidies have been reformed, a persistent diesel subsidy may continue to challenge renewable energy exploitation.

We proceed by reviewing recent literature on the development of geothermal and other forms of renewable energy, and then provide an overview of the geothermal energy sector in Indonesia. We then describe our research methodology and discuss the four obstacles to Indonesia's utilisation of its geothermal resource, which we observed during two months of field research. We provide shadow case studies from three other Pacific countries in order to determine the extent to which they have experienced, avoided or overcome similar problems in the exploitation of their sizeable geothermal resources. In the concluding section, we summarise our findings and argue that a recentralisation of authority over geothermal energy would be a positive development.

1 Acknowledgments: This research was funded by a grant from the Interdisciplinary Innovation Initiative at the University of Illinois for a project on "Economic Development, Climate Change, and the Transition to Renewable Energy." The co-investigators on that project were Brian Dill, Ashwini Chhatre, Kathy Baylis and Matthew Winters. Thanks to Matt Busch and Berly Martawardaya for help in arranging meetings in Jakarta. Thanks to Primus Lake, Ajis Adang Djaha, Gunadi Tjahjono, and Clemens Kolo from Universitas Nusa Cendana for supporting the research in Nusa Tenggara Timur and to Sukri Tamma for connecting us with that research team. Previous versions of this paper have been presented at the 2014 Midwest Political Science Association Annual Meeting and the 2014 Midwest Conference on Asian Affairs. Valerie Ferrin provided excellent research assistance. Rob Alexander and three anonymous reviewers provided useful comments.

Obstacles and Opportunities in the Development of Geothermal Energy

The increasing interest in renewable energy sources over the last decade has been accompanied by a corresponding increase in the academic literature. This research has sought to understand why certain countries, or regions within countries, have been more or less successful at developing policies for and actually exploiting renewable energy. We highlight several of the contributions from this literature in order to establish a framework for the Indonesia case study that follows.

Political science offers the basic insight that it is harder to change any kind of policy when institutions allow the actors that benefit from the status quo to protect their own interest by blocking change and when those actors are more capable of lobbying on behalf of their own interests (Cao 2012; Tsebelis 2002). In a cross-country study, Bayulgen (2014) found that political constraints and the presence of coalition (as opposed to single-party) government are negatively related to the share of electricity production coming from renewable sources. Phillips, Newell and Purohit (2011) argued that vested interests in India have been able to exploit the lack of clarity in the governance of renewable energy at the central-government level to slow development. A number of authors have found that having a sizeable carbon-based-fuel industry hinders the development of renewable energy sources (Aklin and Urpelainen 2013; Bayulgen 2014; Marques, Fuinhas, and Pires Manso 2010).[2] Other authors have found that countries with left-leaning governments (Schaffer and Bernauer 2014) or civil society organisations interested in renewable energy (Jenner, Groba, and Indvik 2013; Lyon and Yin 2010) are more likely to move forward with renewable energy exploitation.

One type of policy that has been singled out as inhibiting renewable energy development (and bringing a host of other macroeconomic ills) is fuel subsidies. Committing significant portions of the state budget to fuel subsidies implies that fewer resources are available for renewable energy investment (Phillips, Newell, and Purohit 2011). It may also create reduced incentives for renewable energy adoption, even among constituents that should not be able to benefit from fuel subsidies but can do so because of black market availability (Bandyopadhyay 2010; Shenoy 2010).

2 However, other researchers have found that countries that are more industrialised (Broz and Maliniak 2010) or that have the most concentrated levels of electricity production from fossil fuels and nuclear energy (Schaffer and Bernauer 2014) are more likely to move toward new use of renewable energy sources.

Scholars have found that where market-distorting fuel subsidies do not exist, higher fuel prices will spur renewable energy development (Aklin and Urpelainen 2013; Bayulgen 2014).

Policy-making with regard to the availability of investment finance might also be particularly relevant for renewable energy exploitation. Bayulgen (2014) found that countries with greater access to investment capital have more non-hydro renewable energy production, while Zhao, Tang, and Wang (2013) showed that countries are more likely to develop renewable resources when they have a substantial amount of domestic credit available.

The literature has also started to collect evidence on the extent to which a centralised or decentralised energy governance structure is better for renewable energy development. With decentralised energy governance, there is a risk that overall renewable energy exploitation might be delayed because of policy variation across subnational units, the low institutional capacity of local governments, rent-seeking by subnational government officials, or resistance by local populations (Babu and Michaelowa 2003; Hamilton 2009; Phillips, Newell, and Purohit 2011). In India, for example, the responsibility for renewable energy policy is shared between the central government and state governments. Differences in institutional and financial capacity among state governments have produced substantial cross-state variation in the amount of renewable energy development (Babu and Michaelowa 2003; Phillips, Newell, and Purohit 2011). Schaffer and Bernauer (2014), on the other hand, found that federal countries are more likely than unitary countries to adopt renewable energy policies, presumably due to greater policy experimentation.

Geothermal Energy in Indonesia

Exploration of geothermal resources for electricity production began in Indonesia in 1974 when President Suharto issued Presidential Decree No. 16/1974. In that year, Pertamina, the national oil company, began drilling exploratory wells at Kamojang in West Java, bringing a small-scale power plant online in 1978 and then a commercial-sized power plant in 1982. Based on a series of presidential decrees issued in 1981, Pertamina possessed the rights to all geothermal resource development in Indonesia and could undertake exploration either on its own or under joint operating contracts with domestic or foreign developers (Brophy et al. 2011; Darma et al. 2010b).

Under this initial regulatory scheme, foreign companies mostly withheld expertise and financing from geothermal projects. In 1991, a new presidential decree allowed foreign companies to play a greater role. Between 1993 and 1998, installed capacity increased by 150 per cent (Darma et al. 2010b)[3] and a number of foreign-based companies entered into energy sales contracts with the national electric company, PLN (Perusahaan Listrik Negara) (Brophy et al. 2011). The 1997–1998 Asian Financial Crisis caused a number of the projects to be delayed or cancelled; with contracts written in US dollars, PLN would not have been able to make contracted payments for electricity supply (Brophy et al. 2011). Nonetheless, installed capacity doubled again between 1998 and 2001, reaching 800 MW by 2003.

In 2003, Law No. 27/2003 significantly changed the regulatory framework for geothermal development. The law removed Pertamina's monopoly on geothermal development and allowed contracts for the exploitation of geothermal working areas to be awarded through competitive bidding. Under the process, pre-qualified bidders compete to offer the lowest price at which they will sell geothermal electricity to PLN; the level of commitment to exploration is also a relevant factor. The winning bidder receives a mining business licence and must then negotiate a power-purchasing agreement (PPA) with PLN. These PPAs have been subject to a changing maximum price. In 2011, Ministry of Energy Regulation No. 2/2011 set a price cap for bids at USD 0.097/kWh. This cap was revised almost immediately in Ministry of Energy Regulation No. 22/2012, which generally raised the tariff ceiling and established variation across provinces and in terms of the voltage of the local transmission system.[4]

In the mid-2000s, the government of Indonesia announced its "fast-track energy programme" to expand electricity access across the country and address persistent energy poverty in outlying areas. The first part of this programme, announced in 2004, downplayed renewable energy in favour of the quick construction of coal-fired power plants. A rapid scale-up of installed capacity – from 26.5 GW in 2004 to 41.0 GW in 2011 – was achieved by constructing standard thermal plants. The second part of the programme emphasised the use of renewable resources

3 Also see the data series "Electricity – total net installed capacity of electric power plants, geothermal" from the United Nations Statistics Division's Energy Statistics Database.

4 The maximum tariff rate is now USD 0.185/kWh for medium-voltage systems in Papua and Maluku, which is nearly double the original ceiling. For high-voltage systems in Sumatra, the tariff ceiling increased only to USD 0.100/kWh.

to continue the expansion of electricity production. However, these resources have not come online as quickly as coal-fired plants, and the government has found itself torn between its stated promise to move away from a fossil-fuel-based economy and its commitment to deliver electricity to the people of Indonesia (interview 03). Given the slow pace of geothermal development, it is quite likely that the government will need to revert to building more coal-fired plants in order to keep pace under the fast-track programme.

Research Methodology

In order to gain insights into the obstacles to and facilitators of renewable energy development in Indonesia, one of the authors undertook two months of field research during the spring of 2013. During the first month, the author interviewed central government officials, international business consultants, domestic industry insiders, and foreign aid agency staff involved with renewable energy development. The purpose of these interviews was to collect impressions from relevant actors about the obstacles to renewable energy development in general, and to Indonesia's exploitation of its geothermal potential in particular.

During the second month, the author travelled to Kupang, the capital of Nusa Tenggara Timur province. Kupang was selected as a relevant field site for the research for three reasons. First, Nusa Tenggara Timur suffers from high levels of energy poverty. In 2008, 75 per cent of the one million households in the province were not served by electrical connections (Dinas Pertambangan dan Energi Provinsi Nusa Tenggara Timur 2011). Expanding electricity generation in the province should clearly be of interest to government officials and the general public there. Second, Nusa Tenggara Timur has substantial geothermal potential of about 1,500 MW (Kementarian Energi dan Sumber Daya Mineral 2011).[5] Third, some geothermal development already has taken place in Nusa Tenggara Timur, with geothermal plants having been built in three different districts on the island of Flores.

In Kupang, the author interviewed provincial officials and representatives of the local PLN office in order to understand how the regulation of geothermal energy was working at the local level. The data gath-

5 This amount is relatively small compared to the potentials of Java (10,000 MW) or Sumatra (13,500 MW). However, given the smaller population density of the islands of Nusa Tenggara Timur, a significant portion of the population's electricity needs could be met through geothermal development.

ered from these interviews was compared to that from the interviews in Jakarta and to other documentary evidence.

Across these interviews, respondents described two categories of problems that they felt hindered the progress of geothermal development. First, respondents said that decentralised regulation was leading to project delays and to rent-seeking. Second, respondents argued that the lack of policy-making clarity at the central government level and the distortionary impacts of fuel subsidies had disincentivised international investors. After describing these findings, we compare Indonesia to Japan, New Zealand, and the Philippines, which vary in their geothermal-relevant policies and in their levels of exploitation. We conclude by describing the ways in which increased centralisation in the geothermal sector could benefit renewable energy development in Indonesia.

Decentralisation and the Delayed Development of Geothermal Energy

Following the downfall of Suharto's authoritarian regime in 1998, the Indonesian legislature passed twin laws decentralising government authority and finances to the district/city level. This "big bang" decentralisation (Hofman and Kaiser 2004) went into effect in 2001, with new laws passed in 2004 to further clarify the rights and responsibilities of the local governments. Contemporary politics in Indonesia are framed by a tug-and-pull between local government units that value discretion and independence and a central government that sees itself as the ultimate guarantor of citizen access to government resources.[6]

As part of the decentralisation process, local governments became the owners of the country's geothermal resources (WWF 2012: 52) and obtained (under Law No. 27/2003) explicit power to tender contracts for geothermal exploitation. The new law was expected to revitalise investment in the sector by empowering local governments to make productive use of the resources under their control. This has not occurred and there has been relatively little investment in exploration since 2003.

Geothermal exploration is very expensive. One study has estimated that 42 per cent of the total capital cost of constructing a geothermal power plant is spent during the exploratory phases (cited in Dapice and Cunningham 2011). For investors to begin exploration, they must feel

6 For more on decentralisation in Indonesia, see Turner et al. 2003; USAID 2006; USAID and Donor Working Group on Decentralization 2009; and Winters 2012.

confident about the likelihood of a profitable project. The evidence below suggests that the decentralised tendering process, rather than giving investors additional access to vital information and new encouragement about their ability to fruitfully invest, has delayed the release of information and hindered the development of confidence.

On one hand, our interview evidence indicates that there are straightforward resource and capacity issues among local governments that lead to delays and low investor confidence in the process. However, the more severe problem – revealed in interview responses and in the secondary literature on Indonesia's political economy – seems to be that local governments lack incentives to improve this situation. In addition, the decentralised tendering process appears to have created new veto players and related opportunities for rent-seeking.

Capacity, Resource, and Incentive Issues among Local Governments

It is something of a cottage industry for central government officials, foreign donors and other observers to blame the shortcomings of public service delivery in Indonesia on the low capacity of local governments. Although the central government has promulgated performance standards and expectations for local service delivery, the extent to which these legal obligations of the local governments are clearly specified and the extent to which the central government can monitor and enforce them are questionable (Buehler 2011).

That said, recent literature on Indonesia shows that local governments provide services when incentives exist (Rosser, Wilson, and Sulistiyanto 2011; Rosser and Joshi 2013; Winters, Karim, and Martawardaya 2014). The 2009 Electricity Law gave new planning powers to the district governments and gave them the right to provide electricity directly to their region (with PLN retaining a right of first refusal for new power generation projects). If local governments believe that geothermal exploitation will bring political rewards, they should utilise these powers. In particular, local governments might facilitate investment by undertaking mapping and exploration tasks necessary for eventual exploitation.

However, there is widespread agreement that local governments are not using these powers, which could be due to a lack of knowledge, resources, or political incentives. Although all three possibilities are relevant, we ultimately believe that district governments lack the political incentives to develop capacity and raise resources for geothermal exploitation.

It is widely acknowledged that Indonesian local governments lack the technical knowledge required to estimate rates of return or to otherwise provide useful information to potential investors (interviews 11, 14, 17). Specifically, foreign investors have complained that the tenders submitted since the promulgation of Law No. 23/2003 have been poorly designed and sometimes altered after their initial issue (Wahjosoedibjo and Hasan 2012; Hasan and Wahjosudibjo 2014). One donor agency representative said that some tender documents were only one page in length (interview 14). In Nusa Tenggara Timur, provincial officials appeared under-informed about geothermal exploitation. The head of the Provincial Planning and Development Agency (Bappeda) reported that the provincial government was interested in exploiting geothermal resources, but he said it was PLN and not the provincial government that would help facilitate projects. He saw the provincial government's role as communicating with the community about projects (interview 20). Similarly, a local NGO based in Kupang said that they had put pressure on the local government to develop geothermal resources, only to be told that the National Energy Plan called for the development of coal-fired plants first (interview 26). Within the provincial PLN, officials said that initiatives for geothermal development come from the centre and that the provincial PLN implements plans that were produced in Jakarta (interview 23).

Local governments that lack the capacity to undertake initial exploration could allocate resources in their budgets to help potential investors accomplish this task. However, they have not yet done so (de Wilde, 2010). Understanding the high costs and uncertainty of exploration, the Ministry of Finance created a Geothermal Fund Facility (GFF) (in Regulation No. 3/2012) to help local governments undertake preliminary exploration and prepare tender documents. Initially, the fund was not structured to help subsidise full exploration costs, but since this was a major concern for potential investors, the fund was subsequently extended to include them (WWF 2012: 18).

However, local governments have only used the fund in limited ways, and foreign investment consultants have complained that the fund has not been disbursing (interviews 2, 3, 5, 11, 15, 16). One environmental consultant described the fund as structurally constrained from its inception, since it is administered by the Ministry of Finance's Government Investment Center (Pusat Investasi Pemerintah), which is not allowed to make a loss on investments. It therefore usually lends to local governments for purposes where repayment is relatively certain (for example, building infrastructure such as schools and hospitals) (interview

5). Since geothermal exploration may come at a loss, the barriers to using fund resources are prohibitive, and potential investors argue that the government needs to create an explicit risk fund (interview 11).

Why is it that there are not greater incentives for local governments to pay the upfront costs on their own? The major problem seems to be that local governments cannot necessarily expect to receive political rewards for geothermal exploitation. Compared to interventions in the health and education sectors, it will take more time for geothermal power plants to come online, and current governments may not be able to claim credit. More to the point, power produced by geothermal plants may serve distant communities more than local communities, which is an even greater obstacle to credit claiming.[7] Given that a local government may only create a single geothermal tender, it is being asked to develop capacity that will probably be useful for only a single project (interview 11).

The GFF is meant to offset this problem, but the fund is not structured in a way that incentivises borrowing from local governments. If exploration fails, the local government is completely responsible for the loan; if exploration succeeds, the benefits to local officials per se may be minimal. Insofar as the resources are coming from the central government anyway, making the local governments borrow in order to support investors adds an unnecessary layer of complication. One respondent asserted that it is much easier for local governments to simply be passive and complain about PLN's poor service provision (interview 11).

Most citizen and civil society activity related to renewable energy has involved local communities 'opposing' renewable energy development. In Bali, a geothermal plant was criticised for dishonouring sacred mountains and forests (WWF 2012: 55). On Flores, an earthquake subsequent to the construction of a geothermal plant was blamed on the fact that the correct ceremony had not been performed prior to construction (interviews 19, 26). Although the reactions of local communities to geothermal development would need to be considered regardless of whether the local or central government was in control of the resources, the sen-

7 One of the constraints to geothermal development is the lack of electrical grid connectivity in Indonesia. Only 65 per cent of Indonesian territory is connected to an electrical grid, and geothermal resources are often located in remote areas, which means that additional financing is required in order to connect the power plant to the grid (WWF 2012). One industry insider noted that development of grid infrastructure must be coordinated across local governments, which introduces additional coordination costs and therefore additional uncertainty for investors (interview 9).

sitivity of local governments to voters within their constituencies may empower community activists that seek to stop geothermal development.

Given these challenges, one foreign investment consultant described the need to convince local government leaders of the potential political benefits of renewable energy. He described making contacts with district heads through party operatives in Jakarta and having those party elites describe to the district heads the benefits of improved electricity provision. He argued that it is only through the persuasive powers of informal political networks that renewable energy projects can come to fruition (interview 4).

Ultimately, few local governments have embraced their new powers to take the initiative regarding geothermal development, preferring to rely on centralised planning and management. The fact that local officials are pushing responsibility back to the central government level suggests that the decentralised system is not serving its purpose of allowing local governments to be more in control of or more innovative with the management of their geothermal resources. Whereas the central government might press ahead with a local geothermal project in the pursuit of broader regional or national public good, Indonesia's local governments do not appear to have an incentive structure that will lead them to do similarly.

Point-Source Natural Resources and Rent-Seeking

Geothermal reserves are point-source in the sense that there is one area in which they can be exploited, and they cannot be easily reproduced elsewhere. The literature on the natural resource curse has emphasised that point-source natural resources may be particularly deleterious to efficient economic decision making and good governance because of the large rents that can be obtained by controlling access to the point of exploitation (Le Billon 2001, 2007). Some of the problems surrounding geothermal exploitation in Indonesia suggest exactly the type of rent-seeking that is common with point-source resources. We start this subsection by discussing the possibility that companies that have no intent of actually exploiting geothermal resources win tenders and then squat on the sites. We then look at the possibility that local officials delay permitting processes in order to obtain rents or protect special interests.

The decentralised geothermal tendering process increases the probability that companies that never intend to exploit a resource will try to obtain exploitation rights and then sell them to sincerely interested parties. As described above, Law No. 27/2003 specifies that geothermal working area tenders should go to the company that offers to supply

electricity at the lowest price. The ultimate power-purchasing agreement, however, is not part of the tender document. This allows companies to bid a low price and gain rights to a geothermal resource, but then draw out the negotiation of the PPA in order to sell the exploitation rights at a profit to another developer (de Wilde 2010). One investment consultant claimed that this practice was rife in the 2000s, with district executives awarding licences to their friends and family members to later sell at profit (interview 4).

Insofar as it exists, this rent-seeking behaviour likely is facilitated by the lack of capacity among local governments to adjudicate bids for geothermal exploitation. Even well-intentioned officials are likely to assess bids only along the price dimension and not the quality dimension (interviews 11, 13). Therefore, insincere bidders can submit low-cost bids, obtain rights to a resource, and then fail to develop it.

The physical location of geothermal resources in protected forest areas also has created the potential for rent-seeking behaviour. As described above, Law No. 27/2003 identified geothermal energy development as a mining activity. Under the terms of Law No. 41/1999 on Forestry, this disallowed geothermal development (as a mining activity) within protected forests and conservation areas. However, over 40 per cent of identified geothermal resources are located in such areas. The mining classification was regarded as a misclassification since geothermal power production is significantly less destructive than mining (interview 3). This situation was corrected with Presidential Regulation No. 28/2011 and a memorandum of understanding between the Ministry of Energy and the Ministry of Forestry. Under these documents, the Ministry of Forestry was given permitting power to allow geothermal development (WWF 2012: 58).

This made the Ministry of Forestry the key veto player for local governments and investors interested in geothermal development (WWF 2012: 60, 63), and several interviewees alleged widespread corruption within the Ministry of Forestry (interviews 4, 7, 12). Similarly, based on interviews with Chevron officials, Dapice and Cunningham argued, "[I]t appeared that obstacles might be placed in [Chevron's] way as a negotiating tactic to extract better terms" (Dapice and Cunningham 2011: 12). Forest laws, originally intended to stop the expansion of palm oil plantations, have instead stunted the development of geothermal power sources (Sovacool 2010). One long-time Indonesian political observer suggested that being tough on geothermal development was a way for the Ministry of Forestry to appear to be doing its job while it continues to assist the timber companies that are its true patrons (interview 12).

Another informant was more sanguine, noting that the Ministry of Forestry has a mandate to protect forest land, which faces many risks in Indonesia, and that it should be allowed to fulfil this mandate (interview 7).

Beyond simple rent-seeking for profit, decentralisation also creates opportunities for local governments to obstruct renewable energy development in the service of political clients. With reference to the "diesel fuel mafia" (described in more depth below), one foreign investment consultant claimed that diesel suppliers put pressure on local leaders to delay permitting and licensing processes for renewable energy projects in order to keep rural areas dependent on diesel gen-sets for electricity generation (interview 2).

Whether because of rent-seeking or obstructionism, the decentralisation of permitting processes to local governments and local offices of the Ministry of Forestry has led to significant complaints about project delays and increased project expenses within the geothermal sector. One foreign investment consultant claimed that rent-seeking by local governments makes power plants between two and three times more expensive to bring online than they should be (interview 6).

A Disincentivised Investment Environment

Although there are Indonesian investors interested in renewable energy investment, they have largely been unable to obtain project financing from domestic banks. According to a large number of interviewed sources, domestic investors either cannot afford the relevant feasibility studies or the banking sector is not prepared to lend based only on project designs (interviews 1, 2, 3, 4, 16). Given the high levels of exploratory and capital investment needed for geothermal exploitation, international investment is usually essential.

However, international investors face numerous barriers to understanding their prospects for profit in Indonesia. Many of these difficulties of estimating return on investment are linked to the confusing and overlapping governance structures in the renewable energy sector. One foreign investment consultant said that an investor would have to be ready to interact with PLN, the Ministry of Energy, and the Ministry of Finance at the central, provincial and local levels in order to bring about a project of any size (interview 4). Although local governments are the recognised owners of geothermal resources, they legally have joint responsibility with the national Ministry of Energy to develop the resource and monitor its exploitation (WWF 2012: 61).

More to the point, investors have difficulty estimating the extent to which national policy will remain in place and difficulty understanding who drives policy change. In this section, we lay out apparent uncertainty in the geothermal sector related to the national policy-making process and also describe the distortionary impacts that the country's fuel subsidies have historically had on the energy sector.

Who Sets National Renewable Energy Policy?

There are a number of ways in which potential geothermal investors must confront questions of policy permanence and stability. The most prominent of these is in terms of pricing. As described above, even developers with geothermal licenses do not begin exploration until they have obtained a power-purchasing agreement with PLN. PPAs have been delayed because of uncertainty surrounding the overall price scheme in the sector. The initial maximum tariff that could be paid for geothermal power was established at USD 0.097/kWh in 2009. The goal was to reinvigorate negotiations between PLN and independent power producers in order to move geothermal resources closer to development. However, the price ceiling was lower than the tariffs in the United States, which range from USD 0.10–0.12, and in the Philippines, which are set at USD 0.148 (WWF 2012: fn. 23). Because of the tariff's uninspiring value, it was increased almost immediately and allowed to vary by province and type of transmission system (Ministry of Energy Regulation No. 22/2012). The Ministry of Energy also gave PLN the ability to seek approval to negotiate contracts that exceed the price ceiling (Hasan and Wahjosudibjo 2014). In June 2014, the tariffs were revised yet again in order to account for inflation over time (Baker & McKenzie 2014). The rapid revision to the price ceiling and the possibility that the price ceiling is not a hard ceiling both caused uncertainty for potential investors: the rules of the game appear to be a moving target.

The price ceiling, sometimes described as a feed-in tariff (FIT), is not actually a FIT but rather a maximum allowable tariff. The other renewable energy sectors have true FITs, whereby an additional payment beyond what would be paid for electricity from coal-fired plants is added to the tariff rates. The Ministry of Energy is responsible for producing these FITs. However, any FIT must also be accepted by PLN, which will pay the tariff to the power producer, and by the Ministry of Finance, which is concerned with the national budgetary implications of the tariffs. One industry consultant reported having asked many questions about the policy process through which FITs are developed, but finding few answers. He said that the key conversations seem to be between the

Ministry of Finance and PLN; yet it is the Ministry of Energy that issues the FITs (interview 7). One government insider agreed that the lines of responsibility for the FITs were unclear, saying that the Ministry of Energy produces the FITs, yet PLN gets blamed for them, and that it is ultimately unclear who is leading the process (interview 8). Officials within the Ministry of Finance expressed frustration with the Ministry of Energy leadership, stating that if the Ministry of Energy would coordinate with the Ministry of Finance in the first place, it would be unnecessary to reissue FITs (interview 15).[8]

Without a true FIT in geothermal, the National Planning and Development Agency (BAPPENAS) has developed a "Fit Fund" in collaboration with international donors that is designed to provide a supplemental tariff when geothermal developers feel that they cannot proceed with a project because of low tariff levels. While this is certainly an attractive addition to cost-benefit calculations for potential investors, the fund also adds yet another central government player into the mix and may also be a tenuous source of funding, making projects reliant on the fund less attractive.

Given the multiple central government actors, even the legal basis for geothermal exploration and exploitation is less than certain. As described above, the unfortunate categorisation of geothermal power generation as a mining activity in Law No. 27/2003 was corrected through a presidential regulation and a memorandum of understanding between the Ministry of Energy and the Ministry of Forestry. However, such corrections do not have the same force as a law, so there remains a risk that geothermal exploitation might be subject to the changing whims of new ministers that will revise the regulations. For instance, an industry report on the June 2014 geothermal tariff revision concluded by saying that it is unclear whether "the Government will be willing to proceed with tenders" under the regulation in the absence of amendments to the Geothermal Law (Baker & McKenzie 2014: 5).

Given overlapping institutional authority and the need for interministerial coordination (and coordination with a key state-owned utility), as well as the lack of permanence in sectoral regulations, substantial uncertainty surrounds the pricing and regulatory structure going forward

8 According to one source who works with a donor technical assistance programme in the renewable energy sector, a similar lack of policymaking clarity was also problematic in the hydro sector. The FIT for hydropower had little effect on development because it was issued without appropriate external consultations. This apparently led the Ministry of Energy to be more consultative in advance of producing biomass and biogas FITs (interview 16).

in the geothermal sector. This level of uncertainty will inhibit investment unless the expected gains are sufficiently large, which does not seem to be the case given the observable evidence of delayed investment. One Chevron executive summed up the situation succinctly as follows:

> There needs to be a stable legal and regulatory regime, which allows for long-term development rights, open markets created by long-term contracts and long-term prices with certainty of payment (*United Press International* 2010; quoted in WWF 2012).

Fuel Subsidies and Distortion of the Renewable Energy Market

For several years prior to 2015, Indonesia suffered from large economic distortions caused by massive consumer fuel subsidies. In 2012, energy subsidies in Indonesia had reached USD 17.7 billion, accounting for 17 per cent of total government expenditures (WWF 2012: 14). These fuel subsidies were undoubtedly removing money from the budget that might otherwise have been used for FITs and other renewable energy investment incentives (interview 15). Under President Joko Widodo, Indonesia revised the fuel subsidy policy in January 2015, completely eliminating subsidies on gasoline and keeping only a minimal subsidy on diesel (which is used for public transportation) (Diela 2015).

While the overall elimination of subsidies will definitely open new doors for renewable energy development, the diesel subsidy may still pose a risk to renewable energy development. Slightly more than half of rural off-grid power is generated by diesel gen-sets (Differ Group 2012). Although PLN should not be purchasing diesel at subsidised prices, there are indications that its regional offices purchase cheap fuel for use in electricity production (Braithwaite 2012), and there is certainly a black market through which they can do so (interviews 12, 13). This black market may actually create actors with an interest in maintaining the diesel subsidy. A large number of informants – both foreign investors and government officials – referred to a "mafia" of diesel fuel importers who favour the status quo: the subsidies maintain high fuel demand, bringing rents to those who hold import licenses and giving them an incentive to fight to keep the subsidies (interview 4). Local suppliers are likely to continue holding on to their contracts to provide diesel fuel, since they have the infrastructure in place to deliver it.

Given the low global market prices of petroleum, the Indonesian government acted at an opportune moment to remove fuel subsidies. For the moment, however, this could mean that there is less mobilisation

in favour of new renewable resources. When global fuel prices begin to rise again, this may catalyse local government pressure on the central government to help support new renewable energy development (interview 8). Given the long-term high costs of diesel fuel, PLN is likely to remain in a position where it can reduce its overall costs by moving away from diesel gen-sets and toward renewable energy (interview 3).[9]

Geothermal Energy Development in Comparative Perspective

In the two previous sections, we identified four potential obstacles to geothermal development in Indonesia. In this section, we discuss the experiences of three other Pacific countries – Japan, New Zealand, and the Philippines – and the extent to which these obstacles may generalise to other countries. Although each of these countries possesses substantial geothermal potential,[10] these states have differed in their policies and installed capacities over time. The experiences of these three countries bear key similarities and differences with the history of geothermal policy and exploitation in Indonesia, and the comparisons bolster our multifaceted explanation for what would improve geothermal development in Indonesia.

The Philippines

The Philippines possesses substantial geothermal resources, with estimates between 3,500 and 8,620 MW of potential installed capacity (Gawell, Reed, and Wright 1999).[11] Between 1990 and 2010, geothermal exploitation in the Philippines more than doubled, from 891 to 1,904 MW of installed capacity (Earth Policy Institute 2011). The current amount of exploitation – at 22.1 per cent of geothermal potential – is

9 One industry insider insisted that for some parts of Indonesia, there simply are no alternatives to diesel gen-sets (interview 13).

10 Among countries with geothermal resources, Gawell, Reed, and Wright (1999) rank each of these countries, along with Indonesia, in the top 25 per cent worldwide in terms of potential geothermal energy.

11 Jennejohn, Blodgett, and Gawell (2009) described the Gawell, Reed, and Wright (1999) study as utilising "fairly conservative assumptions about the resource base and technology," so the real geothermal potential in the Philippines may be much greater. Indeed, Gawell, Reed, and Wright (1999) estimated that Indonesia possesses a maximum potential of 15,650 MW, much less than the estimate of 28,500 MW mentioned above.

much greater than in Indonesia, which, based on the estimates from Gawell, Reed, and Wright (1999), increased from 0.9 per cent to 7.6 per cent of total potential over the same 20-year period. On the other hand, the growth in installed capacity in the Philippines stagnated after 2000, while Indonesia's grew steadily during the 2000s.

In contrast to the decentralisation in Indonesia, geothermal development in the Philippines is guided by central government officials, since the constitution gives primary responsibility for exploration and development of natural resources to the national government (Peñarroyo 2010). Furthermore, the constitution provides three methods by which the state may promote the utilisation of natural resources: (1) direct involvement, (2) cooperative efforts with the Filipino private sector, and (3) presidential agreements with foreign corporations (Peñarroyo 2010). The state has utilised the first and third options for the development of geothermal energy. As of mid-2005, the government was operating both the plant and steam-field for three of the country's eight geothermal facilities, and foreign companies were involved in either the plant or steam-field operation for the other five (Dolor 2006: Table 1). The greater exploitation of geothermal potential in the Philippines may be due in part to the multiple options available within the centralised governance structure.

Of particular relevance to geothermal development in the Philippines is the Philippine National Oil Company Energy Development Corporation (PNOC EDC), a geothermal development company. As a state agency, PNOC EDC conducted most of the country's geothermal resource assessments during the 1970s and 1980s (Peñarroyo 2010). Centralisation of information promoted geothermal development through a build-operate-transfer (BOT) model in which PNOC EDC assumed responsibility for the risky exploratory phases of projects, while private companies undertook plant construction and initial operation. After 10 years, the private contractor would transfer the plant to PNOC EDC (Gehringer and Loksha 2012). More than one-third of the country's installed capacity was developed through BOT contracts with a small set of private companies (Dolor 2006: Table 2). Compared to the decentralisation of information and the lack of risk-financing mechanisms in Indonesia, PNOC EDC promoted geothermal development in the Philippines by centralising information and assuming initial risk.

In addition to governance structure, fossil fuel prices may have contributed to the cross-country differences in geothermal development. As noted above, subsidies in Indonesia historically decreased the attractiveness of geothermal exploitation by suppressing the price of fossil fuels. Fuel prices in the Philippines have been almost twice as high as those in

Indonesia in recent years (Bakhtyar et al. 2013). These higher prices provide a stronger incentive to the energy industry in the Philippines to generate electricity from non-carbon-based sources.

Japan

While it has a much higher level of economic development,[12] Japan is similar to Indonesia and the Philippines in that it possesses substantial geothermal potential: conservative estimates range from 860 to 3,640 MW (Gawell, Reed, and Wright 1999). Geothermal exploitation in Japan remains well below these levels, but installed capacity more than doubled from 214.6 MW in 1990 to 536 MW in 2010 (Earth Policy Institute 2011). If we assume a potential capacity of 3,640 MW, Japan's utilised potential in 2010 stood at 14.7 per cent, which is lower than the Philippines' 22.1 per cent but higher than Indonesia's 7.6 per cent. As with the Philippines, exploitation has been stagnant since 2000.

As in Indonesia and in contrast to the Philippines, a decentralised permitting process appears to have hindered geothermal development in Japan. Potential developers in Japan must secure a permit from local governments that are primarily responsive to local stakeholders' concerns (Kubota et al. 2013). In particular, geothermal resources in Japan tend to be located at hot springs, so a developer must persuade the managers of hot spring inns that the project will preserve the natural resource that sustains their businesses (Kubota et al. 2013).

Other obstacles to geothermal development in Japan bear less resemblance to the problems in Indonesia. In contrast to the uncertainties associated with Indonesia's price ceiling, Japan enacted a renewable portfolio standard system for various energy resources in 2003, including geothermal (Sugino and Akeno 2010). However, the policy supported only a single plant technology that has not been widely adopted in Japan (Nishio and Asano 2006; Sugino and Akeno 2010: Table 2). Furthermore, the Japanese government partially liberalised the electricity market in 2000 in order to minimise costs for developers. This move reduced the attractiveness of geothermal projects due to the higher level of risk and lower level of profits compared to energy produced from fossil fuels (Sugino and Akeno 2010).

12 Japan's 2013 GDP per capita was USD 37,433 (in constant 2005 dollars), compared to USD 1,810 for Indonesia and USD 1,581 for the Philippines (World Development Indicators).

New Zealand

New Zealand's potential geothermal capacity is similar to that of Japan, with conservative estimates ranging from 1,000 to 3,500 MW (Gawell, Reed, and Wright 1999). New Zealand successfully increased its installed capacity almost three-fold, from 283.2 MW in 1990 to 762 MW in 2010 (Earth Policy Institute 2011). Assuming a potential capacity of 3,500 MW, the exploitation rate in 2010 stood at 21.8 per cent, which is comparable to the Philippines' 22.1 per cent. The difference between New Zealand and the previous two case studies is the sustained growth over time, with noticeable improvements of 151 MW in installed capacity between 1995 and 2000 and 327 MW between 2005 and 2010. With a relatively high exploitation rate and continued growth in installed capacity, New Zealand is perhaps the most successful case that we have studied.

Unlike the centralised approach in the Philippines, New Zealand devolved most of its environmental authority to regional and territorial councils in the 1991 Resource Management Act (RMA) (Dickie and Luketina 2005). This could raise concerns that local officials in New Zealand, as in Indonesia, might not be inclined to develop expertise in geothermal energy. Two factors appear to alleviate this concern. First, unlike Indonesia, where geothermal plants are located in provinces throughout the islands of Java, Sulawesi, Sumatra, and Nusa Tenggara Timur (Darma et al. 2010a: Figure 3), New Zealand's geothermal resources are concentrated in two regions: Waikato (with nearly 80 per cent) (Dickie and Luketina 2005; Harvey et al. 2010) and the Bay of Plenty (Harvey et al. 2010). Furthermore, central government oversight minimises the probability that problems will arise under the decentralised governance structure. Several channels exist for correcting or preventing local government ineffectiveness. The RMA requires regional councils to address nationally important matters in their policies, plans and decision making (Dickie and Luketina 2005). Furthermore, the RMA enables project developers who encounter resistance from local officials to turn to the Minister of the Environment to process their applications.

Robust geothermal development in New Zealand may also be attributable to recent fossil fuel developments. One such factor is climate change policy. During the 2000s, the government developed a carbon credit trading scheme in response to the Kyoto Protocol, which "encourag[es] low emissions technologies such as geothermal energy" (Harvey et al. 2010: 6). The second factor is the expected depletion of the Maui gas field (Harvey et al. 2010), which provided 76.8 per cent of New Zealand's gross gas production in 1990, but only 24.3 per cent in 2010

(New Zealand Ministry of Business, Innovation and Employment 2014). Geothermal reservoirs provide an alternative to such non-renewable resources as natural gas. Indonesia could be "cursed" by the presence of large coal reserves in Kalimantan that continue to facilitate the baseline attractiveness of thermal power plants.

Conclusions

With substantial geothermal resources, Indonesia has the potential to transition away from carbon-based fuels and toward renewable energy sources. Based on a review of the existing literature, two months of field research, and three shadow case comparisons, we have explored why geothermal energy remains underexploited in Indonesia. We have highlighted several problems related to governance in the sector that make it difficult for projects to come to fruition and that create investment-reducing uncertainty.

First, we have discussed how decentralisation has introduced inefficiencies into the sector. Local governments lack both the technical and financial resources to encourage and oversee the tender of geothermal working areas. Decentralisation has led to an increase in the number of permits required for exploitation, which may facilitate local government rent-seeking and the protection of vested interests. As point-source natural resources, geothermal reserves are particularly susceptible to rent-seeking behaviour. These findings from Indonesia mirror some of those reported elsewhere in the renewable energy literature about India (Babu and Michaelowa 2003; Phillips, Newell, and Purohit 2011). In the shadow case studies, centralisation seems to have facilitated geothermal exploitation in the Philippines, while decentralisation has stalled exploitation in Japan. In New Zealand, a decentralised governance framework has been less problematic because of central government oversight and the concentration of geothermal resources in only two regions. Without some recentralisation, low government capacity and rent-seeking may continue to hinder geothermal exploitation in Indonesia.

Second, the national policymaking process in the sector is unclear, such that potential investors have a hard time calculating the likely return on their investment. The resultant uncertainty disincentivises investment. The central government's attempt to subsidise initial exploration costs has not been widely utilised. As previous literature has found, the unavailability of investment capital can easily hinder the development of renewable energy (Bayulgen 2014; Zhao, Tang, and Wang 2013). Indone-

sia might be able to better incentivise investment through clearer delineation of policy-making powers at the central government level.

Finally, fuel subsidies have historically hindered geothermal exploitation in Indonesia by constraining the central government budget in a way that has prevented investment in infrastructure and investment incentives. Although the government of Joko Widodo has eliminated many of the subsidies, the remaining diesel subsidy may potentially prolong the use of diesel gen-sets in certain areas of the country. These findings again echo some of the findings from the literature on India (Bandyopadhyay 2010; Phillips, Newell, and Purohit 2011; Shenoy 2010). The shadow case studies also reveal the role that fossil fuel policy plays in geothermal development. In countries where prices for petrol and diesel are relatively high (such as the Philippines), geothermal resources have become a more attractive alternative. The experience of New Zealand also indicates that carbon trading could increase the financial benefits of geothermal projects and thereby facilitate the expansion of geothermal installed capacity. Thus, integrating Indonesia into a global carbon market could accelerate the utilisation of this country's geothermal resources, although this is unlikely to be the case during the present period of low global petroleum prices.

In sum, our findings suggest that policy innovations could expand investment in the geothermal sector in Indonesia. By removing diesel subsidies, recentralising authority and clarifying the lines of responsibility at the national level, the Indonesian government could promote geothermal exploitation through the effective and consistent implementation of policies such as feed-in-tariffs, carbon-trading schemes, or government-funded exploration of the risky exploratory phases of a project. Prospective investors may respond to such policies by expressing greater interest in developing the extensive geothermal potential in Indonesia.

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Appendix: Interview Respondents

Respondents are identified by their position, the location of the interview, and the date of the interview. The interviews are listed in chronological order.

	Position; Location; Date
01	Consultant, USAID; Jakarta; 9 February 2013
02	Executive officer, renewable energy development and consulting firm; Jakarta; 11 February 2013
03	Staff, Environment Office, USAID; Jakarta; 12 February 2013
04	Executive officer, renewable energy development and consulting firm; Jakarta; 14 February 2013
05	Management consultant, international management consulting corporation; Jakarta; 15 February 2013
06	Independent business consultant; Jakarta; 15 February 2013
07	Strategic planning consultant, hydropower developer; Jakarta; 18 February 2013
08	Staff, Investment Planning and Risk Management Directorate, Pertamina; Jakarta; 18 February 2013
09	Executive officer, renewable energy civil society organization; Jakarta; 18 February 2013
10	Director, political civil society organisation; Jakarta; 18 February 2013
11	Project manager, KfW (German Development Bank); Jakarta; 20 February 2013
12	Journalist, English-language newsletter; Jakarta; 25 February 2013
13	Executive officer, large energy-related corporation listed on the Indonesia Stock Exchange; Jakarta; 26 February 2013
14	Project manager, GIZ (German Development Agency); Jakarta; 27 February 2013
15	Officials, Center for Climate Change Financing and Multilateral Policy, Ministry of Finance; Jakarta; 28 February 2013
16	Director and staff, USAID-funded renewable energy project; Jakarta; 1 March 2013
17	Faculty member, Department of Political Science, Gadjah Mada University; Yogyakarta; 17 March 2013
18	Member, National Energy Council, Indonesia; Yogyakarta; 18 March 2013
19	Faculty, Department of Electrical Engineering, Nusa Cendana University; Kupang; 24 March 2013

	Position; Location; Date
20	Official, Provincial Planning and Development Agency (Bappeda), Nusa Tenggara Timur Province; Kupang; 25 March 2013
21	Official, Geothermal Section, Bureau of Petroleum and Geothermal Energy, Department of Mining and Energy, Nusa Tenggara Timur Province; Kupang; 26 March 2013
22	Official, Electrification Section, Bureau of Electricity and Energy Utilization, Department of Mining and Energy, Nusa Tenggara Timur Province; Kupang; 26 March 2013
23	Staff, Kupang Office, National Electric Company (Perusahaan Listrik Negara); Kupang; 26 March 2013
24	Official, Regional Planning and Development Agency (Bappeda), Kabupaten Rote Ndao; Kupang; 26 March 2013
25	Official, Regional Planning and Development Agency (Bappeda), Kabupaten Kupang; Kupang; 27 March 2013
26	Staff members, institution-strengthening civil society organisation; Kupang; 28 March 2013