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EXECUTIVE SUMMARY

IGNITING THE RING OF FIRE: A VISION FOR DEVELOPING INDONESIA'S GEOTHERMAL POWER.

Indonesia, Southeast Asia's largest energy producer and consumer, boasts enormous renewable energy potential and still little progress has been made in increasing renewable energy use. However with soaring fossil fuel prices, Indonesia's dependence on fossil fuels to power its economy is no longer economically viable.

Research shows that renewable energy sources can meet up to 35 percent of Indonesia's energy needs by 2035 (Leitmann et al. 2009; Marpaung et al. 2012). Geothermal power in particular can play a key role in shaping Indonesia's low carbon future, with the potential to replace coal-fired power plants as a base load electricity source with virtually no emissions (Mackay 2008). The challenge lies in making this transition within the country's existing institutional structures under which the price of fossil fuels is not only heavily subsidized but also centrally set (Ardiansyah et al. 2012).

Geothermal energy development in Indonesia

The country's total potential geothermal resources and reserves are estimated at 28,994 MWe (megawatts-electrical) with an installed capacity of 1,196 MWe (approximately 4 percent of the total resources and reserves). Of all 276 geothermal areas in Indonesia, a total of 37 can be considered as mining working areas (*WKP* [*Wilayah Kerja Pertambangan*]), with 7,376 MWe of geothermal potential.

Yet to accelerate the development of geothermal energy is somewhat of a herculean task for a developing country like Indonesia. In 2010, a review commissioned by the Ministry of Energy and Mineral Resources (MEMR) argued that it will be difficult to meet the government target of 3,967 MW of geothermal capacity by 2014, and that the most it can hope to deliver is 2,297 MW (Castlerock 2010). Based on our calculations, Indonesia can realistically achieve 1,700 MWe by 2014, 2,750 MWe by 2020 and 4,000 MWe by 2025. The projected figures, based on the current actual installed capacity, means a mere 57 percent increase by 2015 and 129 percent by 2020.

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Positive impacts on energy security, energy poverty and GHG emissions reductions

Energy security

Geothermal energy use can ease Indonesia's high dependency on oil and consequently reduce the burden from heavy fossil fuel and electricity subsidies. According to the Ministry of Finance, energy subsidies in 2012 reached USD 17.7 billion or 168.6 rupiahs, which was 17 percent of total government expenditures. Energy subsidies bring a substantial number of perverse economic impacts; for example, while subsidies are intended to help the poor afford fuel, it is the rich who benefit from it disproportionately (Pallone 2009).

Energy poverty

Indonesia's steady economic growth of more than 6 percent, even during the recent global recession, was accompanied by a 9 percent growth in electricity demand each year (Ministry of Finance 2009; PwC 2011). The country struggles to meet this demand. A significant number of Indonesia's population, primarily those living in rural areas and the outer islands, lack access to electricity.

The government's second-phase crash program, to be implemented between 2009 and 2018, at an estimated cost of USD 21.3 billion (ESDM 2009b), will build 60 percent of new capacity from renewable resources. At least 5,000 MW or 48 percent will be sourced from geothermal energy (Ardiansyah et al. 2012; Girianna 2009), which can help increase access to electricity in the outer islands where most geothermal resources are located (Girianna 2009). It is crucial to note, however, that building geothermal power plants in remote areas requires additional financing to connect electricity production to the main grid (Tanoto & Wijaya 2011).

GHG emissions reductions

Although more than 60 percent of Indonesia's current greenhouse gas (GHG) emissions come from forestry and land-use sectors (Ministry of Environment, 2009), experts predict increased carbon dioxide (CO_2) emissions from electricity generation by 2030, reaching 810 million tonnes of CO_2 equivalent (CO_2e), due to a heavy dependence on coal. This increase of nearly seven times the amount in 2005 (DNPI 2010) will exacerbate climate change impacts to which Indonesia, an archipelagic nation, is already vulnerable to (Ministry of Environment 2009).

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Conversely, several studies illustrate the significant GHG emissions savings from an increase in geothermal installed capacity; for example, Wijaya and Limmeechokchai (2009) show that an increase of 10 GW in geothermal energy capacity by 2025 will result in emission savings of approximately 58 million tonnes of CO_2e. Our report also demonstrates that the energy scenario based on the Government of Indonesia's geothermal targets will achieve an annual reduction of 13.6 million tonnes of CO_2 by 2015 and 17.1 million tonnes of CO_2 by 2020. Alternatively, WWF's Ring of Fire geothermal scenario shows an annual reduction of 13.6 million tones of CO_2 by 2015 and 19.8 million tones of CO_2 by 2020.

Other economic gains

Apart from geothermal energy's positive economic impacts on energy security, energy poverty and GHG emissions savings, tapping the country's geothermal potential also brings additional government revenue and employment. In the case of Indonesia, geothermal energy development can generate one million jobs – significantly more than other types of power generation. In our report, we calculate increased employment, based on various energy scenarios, to reach anywhere from 37,000-206,000 by 2015 and 61,000-325,000 by 2020. Another important economic gain of geothermal energy development is its potential to attract further financial investment.

Risks and costs of geothermal energy development

One of the key risks in geothermal energy development is associated with the electricity market. Until recently, Indonesia's geothermal resources have been underutilized partly due to pricing disagreements between the PLN, the state-owned electricity company, and the government. Even when geothermal licenses were granted, developers delayed exploration; waiting for power-purchasing agreements with the PLN, which were in turn on hold in anticipation of the government's pricing approval.

As a temporary measure to resolve tariff discrepancies, the PLN introduced in January 2011 an 18 percent tariff hike ceiling, in line with the MEMR's Regulation No. 7 of 2010. However price increases will not eliminate all risks associated with the electricity market. (Castano, 2011) reported that some investors remain concerned about the ability of debt-ridden PLN to pay higher tariffs as state coffers are already burdened with subsidies for the energy sector.

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Another immediate risk is related to the costs of exploration. In geothermal energy development, a drilling project exploring a single location can easily swallow EUR 15-20 million (KfW 2011), which does not take into account costs associated with the risk of non-discovery (KfW 2011). It can then take another ten years to develop a geothermal power plant to the level of commercial operation, with project financing available only in the latter phase of the process (PwC 2011). The fact that geothermal development requires significant up-front equity is a key issue for investors (PwC 2011).

Yet more fundamental to increasing geothermal energy capacity is the problem of limited grid capacity. Nationally, only 65 percent of the country's territory is connected to the grid, most of it in the more developed western islands; while only 45 percent of eastern Indonesia is connected (Jakarta Post, June 2012). Indonesia is currently trying to expand its infrastructure (i.e. transmission systems) with support from the World Bank with a loan of USD 225 million (World Bank 2010a). Without overhauling the grid system, geothermal energy development is likely to remain sub-optimal.

And finally, ignoring the social and environmental impacts can significantly increase the economic costs of geothermal energy development, and may even lead to costly project delays.

Policy and institutional barriers

While Indonesia's government appears to have thrown its full support behind geothermal energy development, a few of its energy policies continue to foster a reliance on fossil fuels. In particular, its policies on energy pricing and subsidies send conflicting signals– subsidies distort the electricity market price, making fossil fuels appear cheaper and therefore preferable to geothermal energy. To accelerate geothermal energy development, comprehensive economic incentives need to be in place, which include further reforming energy tariffs so they reflect true market prices.

It is this lack of clarity around the country's energy policy framework and institutional arrangements (including the bureaucracy, the legal system and tendering process) that discourage investment in the industry. The involvement of different ministerial institutions and agencies in the Indonesian energy sector, for example, creates a significant challenge in terms of coordination.

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Another source of confusion, which translates to risk, is the division of power between central and local governments. With decentralization, regional governments play a critical role as the official owners of the steam resource, whereas the central government plays an equally pivotal part providing expertise and underwriting the power purchase agreements (De Wilde 2010). While fine in theory, decentralization seems to have only raised transaction costs. As one Jakarta-based development economist describes it, 'the state bureaucracy has a genius for producing more obstacles or disincentives' (Lacey 2010).

Encouraging provincial and district governments to develop geothermal energy is an enormous challenge, as most have little expertise and a limited understanding of energy scenarios and energy development. Developing WKPs is likely to be one of the bigger challenges in realizing geothermal energy development, as the tendering process requires interest, ownership and strong capacity at the local level.

Geothermal energy and forest conservation

Geothermal energy development in Indonesia is unique in the sense that much of the development is likely to take place in the country's remaining important forest areas; up to 42 percent of potential geothermal resources or more than 12 GW are located in protected forest areas (MEMR 2011) and are subject to the recently enacted law on pristine forests, which include stricter conditions under which licenses are issued (Girianna 2009; Satriastanti 2011; *The Jakarta Post* 2011).

With the recent slew of policies supporting fast-tracking geothermal energy development in forest areas, there is an urgency to institute a set of sustainability benchmarks that will mitigate associated impacts and risks, and ensure that geothermal energy development is sustainable.

Financing geothermal energy development

In the wake of the global recession, the past years witnessed a slump in investments in renewable energy. Recent developments suggest however a renewed interest in the sector. There has also been a noticeable increase in public investment in sustainable energy companies, amounting to USD 14.1 billion in 2009, as governments resorted to "green stimulus" to keep their economies afloat (UNEP & New Energy Finance 2010); such interest spell an opportunity for building innovative

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public-private partnerships to support geothermal energy development in Indonesia, particularly for early stage financing.

Indonesia's energy sector has only recently become a lucrative destination for foreign investment, as it was previously dominated by state owned companies. In 1985, limited private sector participation in the form of independent power producers was allowed in the electricity sector. However PLN remains a monolith, continuing its role as the single biggest buyer, distributor and price negotiator in the market (PwC 2011).

Recognizing the significant investment risks associated with geothermal energy development, in particular during the preliminary phases, the Indonesian government, in collaboration with international partners, implemented the following key measures:

- **Access to government guarantees** – In 2011, the Finance Ministry issued a decree, stipulating government guarantees for geothermal projects that are part of the second phase crash programme, and have reached the construction phase. The Finance Ministry later revised the decree to extend the guarantee during the exploration phase, as the risks associated with exploration are significantly higher than power plant construction and steam field operation. However, the revision, which was issued in August 2011, demanded that project developers secure financing within 48 months after the guarantee was issued or they risk losing it (*Bisnis Indonesia* 2011).

- **Improved reliability of geothermal resource data** – The surveys and advanced explorations are run solely by the Energy ministry's geological agency. The scope and accuracy of the exploration data determine the level of risk that private entities take on once they have won an auction for a working area. However private developers and investors continue to question the quality of surface exploration data.

- **The Indonesian "Fit Fund" and the geothermal exploration mitigation facility**– The 'Fit Fund', developed by BAPPENAS and international partners (i.e. development banks) in 2010-2011, is designed to support geothermal energy

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projects that have won tenders but cannot continue development, as they require a tariff above US 9.7 cents/kWH (Beukering 2012). The Fit Fund pays the difference between the price required by geothermal developers and the current electricity price.

In 2011, the government established a USD 128 million fund, which local governments can access to finance exploration drilling (Castlerock 2010). However, with this model, the risks now lie with the local governments, who will have to repay 100 percent of the loan.

The role of carbon financing

Carbon financing is a useful tool to boost the creditworthiness of a project and helps it to obtain the necessary financing, particularly during the early stage development. It monetizes the advanced sale of emission reductions and either boosts project return, raising the IRR (internal rate of return) to attract investment or enhances project equity value for equity or debt investment (NREL 2011). Carbon finance potentially provides a source of funds that can be utilized to bridge the incremental costs associated with geothermal development in Indonesia and an important option to consider as part of a comprehensive pricing policy.

In its current form, the Clean Development Mechanism is contributing to the gigatonnes gap by providing carbon credits to undeserving projects, thereby flooding the carbon markets with dubious credits and causing carbon prices to plunge to levels that are inadequate to effect a shift to low carbon energy.

Recommendations

To realize and accelerate the development of geothermal energy, this report recommends the following policy, institutional, economic and financial measures:

- Substantive institutional reforms are key issues. Not merely creating a new institution to tackle coordination issue but most important thing is to provide a clear mandate to which institution that leads the process of geothermal energy acceleration.

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- Investments in capacity building at the regional government levels (i.e. provincial, district authorities) and for key proponents of geothermal energy development (e.g. developers) in managing geothermal resources are important, particularly for the energy planning and tendering process.

- Reduce if not completely eliminate subsidies for fossil fuels and provide sufficient capital to support sustainable geothermal energy development.

- To accelerate geothermal energy development, overall economic incentives system needs to be improved, which includes further reforming energy prices so that they reflect true market prices. Geothermal energy prices should be bankable to improve its access to fund and consider project risk, which will be different in each location.

- Reduce exploration and other early stage development risks by improving completeness and reliability of exploration data and implementing risk-mitigation measures.

- Stimulate commercial financial institutions to support renewable energy including geothermal and also formulate financial instruments that can reduce resource risk and accelerate Indonesia's geothermal energy development.

- Expanding the grid is urgent and critical. Without overhauling the grid system, geothermal energy development is likely to be sub-optimal. In addition to the improvement of the existing grid, the need of local communities to have an access to electricity requires to be seriously addressed.

- With explicit policy support for accelerating geothermal energy development in forest areas, it is imperative that measures are taken so that lands acquired for geothermal energy use are not high conservation value forests or sensitive ecosystems, and that the impacts and risks on forests are mitigated. WWF's Ring of Fire project is currently building, in collaboration with key Indonesian stakeholders, sustainability standards designed to manage environmental and socio-cultural impacts and ensure the sustainability of geothermal energy development.

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- The proponents of geothermal energy development (e.g. investors, developers and the government) should anticipate and mitigate the social and environmental impacts of geothermal projects, as these can significantly increase the economic costs of development, and may even lead to costly delays.

- In particular, the development of different strategies is needed to lower the transaction costs of Indonesia's decentralised governance arrangements around energy investment and regulation. To reduce transaction costs should not be confused as an argument for deregulation, but should rather be seen as a call for the removal of uncertainties around regulatory decisions already taken and their replacement by efficient executive motors of implementation.