

Harnessing the Ring of Fire: Political economy of clean energy development finance on geothermal development in Indonesia and the Philippines

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Bilateral and multilateral development finance is playing an increasingly important role in driving clean energy development in emerging economies. Multilateral development banks have financed more than US \$131 billion in climate action between 2011 and 2015; over half of mitigation finance was earmarked for energy related sectors – 30% of which was for renewable energy (approximately US\$39 billion) – according to the 2016 *Joint Report on Multilateral Development Banks' Climate Finance*. Clean energy finance is crucial to spurring renewable energy development in emerging economies to overcome barriers to development. Barriers to clean energy development in emerging economies include a set of financial, knowledge and social barriers. Researchers have analyzed flows in climate finance mechanisms and its impact on renewable energy development, as well as the limitations of project-based sustainable energy financing on energy transitions and energy access. However, few studies have looked at how clean energy finance is accurately matched to the barriers to development and whether it effectively addressed them by fostering renewable energy development. This paper aims to contribute to this literature by investigating the impact of international development assistance for clean energy in addressing barriers to 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 two of the world's largest producers of geothermal energy after the US, yet both countries demonstrate different trajectories of geothermal development. Despite Indonesia's superior geothermal reserves (~29GW) it has only developed 5% of its potential compared to the Philippines, which has developed 56% of potential capacity (~4GW). This puzzle raises the question of why there are disparities in the advancement of geothermal development, and namely why the Philippines is ahead of Indonesia, despite Indonesia's greater resource advantage. Geothermal technology is the technology of focus because it both Indonesia and the Philippines have an abundance in geothermal resources, and developing geothermal technology requires overcoming several difficult barriers to development in comparison to other renewable energy technologies. Both countries have received substantial international development finance for renewable energy development, but many barriers to deployment remain in both countries. This paper investigates the impact of international development assistance for clean energy in addressing barriers to geothermal development in Indonesia and the Philippines.

The main research questions leading this research are: how has clean energy development finance impacted geothermal development in Indonesia and the Philippines? Have the financial mechanisms addressed the major financial barriers to development of geothermal technology? How have domestic political interests impacted the effectiveness of financing? To answer these questions, qualitative analysis is used, namely process tracing and data analysis of clean energy development finance for geothermal energy. The majority of data was collected through primary and secondary data sources, including interviews during field research in Indonesia (2014 & 2015) and the Philippines (2016).

To create an initial framework for analyzing the different effects of development finance, I focus on three mechanisms of impact through which the clean energy development finance can impact outcomes in renewable energy development in developing countries (or recipient countries of development assistance). These mechanisms include: *utility modifier* (financial incentives), *social learning* (institutional knowledge transfer), and *capacity building* (technical training). They are evaluated as they relate to policy implementation and renewable energy development, namely by addressing barriers to geothermal energy development.

The major findings of this research indicate that while clean energy development finance targeted major barriers to geothermal energy development, it was not effective in fully removing the barriers or addressing major domestic political interests in Indonesia. In both cases, political will is a pre-determinant of development finance effectiveness, as opposed to expectations that the clean energy development finance would incentivize renewable energy development. When political will was present, clean energy development finance helped address barriers through financial and technical assistance and capacity building. This research found support for the utility modifier mechanism as the main mechanism through which clean energy development was leveraged in Indonesia and the Philippines. Social learning and capacity building mechanisms were underfunded, particularly in Indonesia, where vested interests remain a barrier to development. Further political economy analysis is needed to overcome these barriers to better improve the targeted effectiveness of development aid. An important policy-relevant insight learned from this research is the challenge of the macro-level approach to international development when the measures of success and effectiveness are determined at a project level; this leads to a micro-level focus as opposed to a systemic approach that incorporates better collaboration and inter-agency coordination to solve macro-level problems.

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