ADB CTF Private Sector Geothermal Program: Indonesia & Philippines

1. Country/Region	Indonesia & Philippines	**2. CIF Project ID#**	(CIF AU will assign ID.)
3. Investment Plan (IP) or Dedicated Private Sector Program (DPSP)	☐ IP ☑ DPSP	**4. Public or Private**	☐ Public ☑ Private
5. Project/Program Title	ADB CTF Private Sector Geothermal Program: Indonesia & Philippines		
6. Is this a private sector program composed of sub-projects?	☑ Yes ☐ No		

7. Financial Products, Terms and Amount

	USD (million)
MDB Project Implementation Services (MPIS)	1.5
Senior loan	10
Subordinated debt / mezzanine instruments with income participation	14.5
Convertible grants and contingent recovery grants	4
Total	**30**

8. Implementing MDB(s)	Asian Development Bank
9. National Implementing Agency	N/A
10. MDB Focal Point	Janette Hall Principal Investment Specialist Private Sector Operations Department

11. Brief Description of Project/Program (including objectives and expected outcomes)

The program aims to encourage private sector participation in the development of geothermal power resources in Indonesia and the Philippines using geothermal exploration risk insurance and/or senior or subordinated debt.

12. Consistency with CTF investment criteria

(1) Potential GHG	375,000 tCO_2e p.a. See page 14 for more information
(2) Cost-effectiveness	\$4 per tCO_2e. See page 14 for more information
(3) Demonstration potential at scale	Using conservative figures, ADB estimates the CTF-attributable market transformation to be roughly 600 MW of new capacity. See page 14 for more information.
(4) Development impact	CTF's intervention into Indonesia and the Philippines is expected to lower barriers to entry and assist in the financing of geothermal power projects by partially displacing the elevated costs associated with early mover risks faced by the private sector. See page 14 for more information.
(5) Implementation potential	Implementation potential is high; ADB is currently at various stages of discussion with private sector sponsors in Indonesia and the Philippines. See page 15 for more information.
(6) Additional costs and risk premium	The grant element of CTF financing is needed to cover the identifiable additional cost of geothermal drilling, exploration and power generation, and to address identified perceptions of risk and other barriers. See page 15 for more information.

Additional CTF investment criteria for private sector projects/ programs	
(7) Financial sustainability	The financial sustainability of individual projects undergoes a step-change increase following the successful demonstration of commercial geothermal power resources at a project site. Once resources are proven, sponsors can generally raise commercial debt for well tested project finance structures with bankable PPAs. See page 15 for more information.
(8) Effective utilization of concessional finance	There is a strong case for the use of concessional finance for geothermal drilling, exploration and power generation due to the typically low levels of government support in Indonesia and the Philippines, and high potential to unlock significant private sector investment in large power projects capable of supplying base load power. See page 16 for more information.
(9) Mitigation of market distortions	Due to the absence of private sector led development of geothermal resources in Indonesia and the Philippines, there are unlikely to be negative market distortions from this program. See page 17 for more information.
(10) Risks	Main risks include the discovery of commercial grade geothermal resources, implementation risk associated with the high level of project complexity, regulatory risk, particularly relating to permits and licensing, legal risk, political risks, offtaker/market risk (particularly in the Philippines due to the merchant power market), and environmental hazards. See page 17 for more information.

13. For DPSP projects/programs in non-CTF countries, explain consistency with FIP, PPCR, or SREP Investment Criteria and/or national energy policy and strategy.

Due largely to limitations in public sector financing, the governments of Indonesia and the Philippines have been actively encouraging private sector development of geothermal power projects. Both governments have outlined ambitious road maps for development, outlined in section F of this proposal.

14. Stakeholder Engagement

Potential recipients of CTF and ADB financing have conducted initial stakeholder engagement regarding the development of their concessions. There is significant stakeholder engagement in both countries, conducted prior the government awarding of concessions or service contracts.

15. Gender Considerations

There are no specific gender elements to this program aside from job creation and increases in the reliability of power supplies.

16. Indicators and Targets

Project/Program Timeline	
Expected start date of implementation	December 2016
Expected end date of implementation	December 2019
Expected investment lifetime in years (for estimating lifetime targets)	20
Core Indicators	**Targets**
GHG emissions reduced or avoided over lifetime (tonnes of CO_2-eq)	7.5 million
Annual GHG emissions reduced or avoided (tonnes of CO_2-eq/year)	375,000
Installed capacity of renewable energy (MW)	90

17. Co-financing

		Amount (million USD)
• ADB		30
• Private Sector / bilateral		90
Total		120

18. Expected Date of MDB Approval

Expected date of ADB approval of first transaction: December 2016

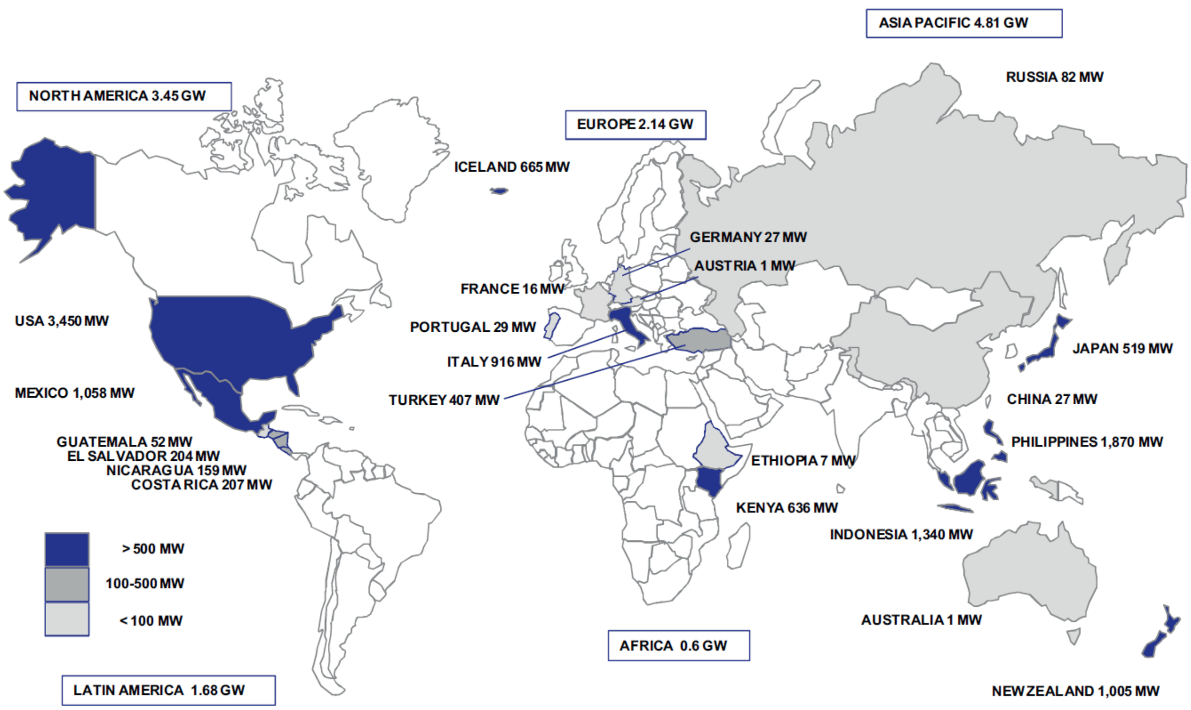
DETAILED DESCRIPTION OF PROGRAM

A. Regional, Country and Sector Context

1. Indonesia and the Philippines are part of a small group of countries endowed with plentiful natural geothermal resources. The geothermal power sectors in both countries had early successes in the 1970s and 1980s, supported by government-led and government-financed projects. This helped to overcome many of the barriers to entry including the high risks and high costs associated with geothermal drilling and exploration. Much of this early development work has resulted in Indonesia and the Philippines now being the second and third largest geothermal power producers in the world after the USA. However, both countries are now facing significant hurdles expanding their geothermal programs as governments are no longer in a position to support the sector as heavily, and many are looking to the private sector to raise capital and implement projects.

2. As shown in Figure 1 below, the USA has installed geothermal capacity of 3,450 MW, followed by the Philippines with 1,850 MW, and Indonesia with 1,340 MW. Notable other geothermal power producers around the world include Mexico (1,058 MW), New Zealand (1,005 MW), Iceland (665 MW), Kenya (636 MW), Japan (519 MW) and Turkey (407 MW).

Figure 1 - Installed Geothermal Power Generation Capacity Worldwide, 2015 (12.6 GWe)[1]



i. Geothermal Power in Indonesia

3. Indonesia's geothermal resources are located along volcanic chains in Sumatra, Java, Bali and the islands in the eastern part of Indonesia. Whilst resource estimates vary, the Government of Indonesia

[1] Bertani, R., 2016. Geothermal power generation in the world 2010–2014 update report. Geothermics 60 (2016) 31–43.

estimates the country's geothermal potential at up to 28,000 MWe, comprising of 312 geothermal potential locations (see Appendix 2). Currently, geothermal power generation fields totaling 1,340 MWe operate in 10 locations[2].

4. Since the mid-1980s, Indonesia's state-owned oil company, Pertamina, and its subsidiary PT Pertamina Geothermal Energy (PGE) have been developing geothermal power projects in collaboration with oil major companies such as Chevron. Pertamina currently owns over 90% of Indonesia's installed capacity and has been awarded the authority to develop 15 additional fields[3]. However, a shortage of capital, increasing drilling and exploration costs and the need to renegotiate the terms on some concessions has limited the implementation of these projects. Several have been under development since the late 1990s, and have struggled to gain support from financiers, leading to stagnation in the industry. This accumulation of partially developed projects present opportunities for sources of concessional finance to unlock the sector and have a highly catalytic impact.

5. Indonesia has short-medium term development plans for the year 2025 to increase geothermal power generation to 6,000 MW_e (corresponding to 5% of the power needs of the country)[4]. The cost of exploration for half of this target (3,000 MW_e) is estimated at $2.8 billion[5]. With little of this likely to come from Pertamina or government support, the burden of raising these funds will likely fall on the private sector. Furthermore, assuming exploration is successful for 3,000-4,000 MW_e of new capacity, the total financing requirement may be in the range of $10-13.5 billion[6]. The Government of Indonesia estimates the 2013 cost of an additional 4,925 MW_e at $14.8 billion (see Appendix 2 for a list of projects and cost estimates).

6. Over the past decade, the Indonesian government has made several moves to encourage geothermal power development and private sector involvement including:

a) The 2009 introduction of the Electricity Law (30/2009), which ended PLN's legal monopoly over Indonesia's power generation, transmission and distribution, and created the legal basis for the private sector to enter each stage of the power sector;
b) The 2013 introduction of the Geothermal Law (Law 27/2003), increasing the transparency and competitiveness of tendering processes (but also delaying development by shifting the authority to control geothermal fields to central and local governments);
c) The 2012 introduction of a geothermal feed-in tariff (FIT) policy; and
d) The 2012 establishment a $200 million Geothermal Fund Facility (GFF) to mitigate resource risks. Whilst this was seen as a positive step, GFF resources remain undisbursed to date; the original GFF design was required loans to be fully collateralized by sponsor's balance sheets, which failed to adequately address the high exploration risk issues, in part due to concerns relating to moral hazard and misuse of the facility[7]).

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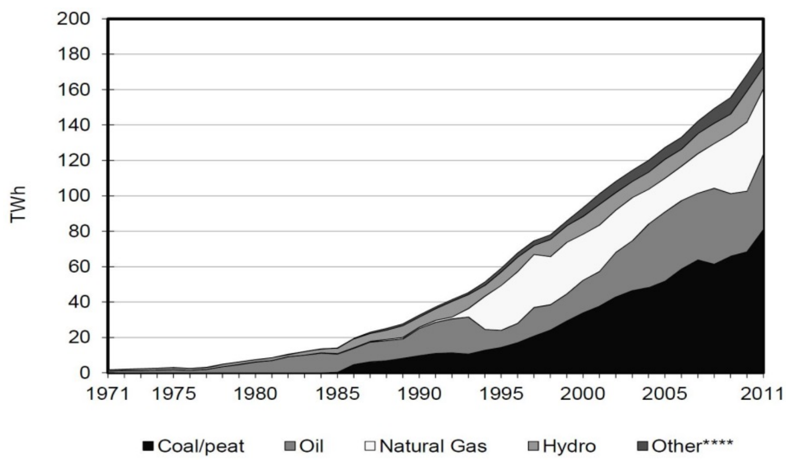
[2] Dara-jat (260 MWe), Dieng (60 MWe), Kamojang (200 MWe), Gunung Salak (377 MWe), Sibayak (11 MWe), Lahendong (87 MWe), Wayang Windu (227 MWe), Ulu Belu–South Sumatra (110 MWe), Ulumbu–Flores (5 MWe) and Mataloko (2.5 MWe)
[3] Tharakan, P., 2015. Summary Of Indonesia's Energy Sector Assessment. ADB Papers On Indonesia No. 09 December 2015, Jakarta.
[4] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.
[5] Ibid.
[6] Ibid.
[7] Climate Investment Funds, 2015. Indonesia - Investment Plan (Revised). Endorsed by the Trust Fund Committee on May 27, 2015, Washington DC.

7. However, progress in the last few years has been slow. In the period 2010–2013, new capacity of 135 MW_e was added. Nineteen concessions have been issued to private companies as of 2013, but barriers to entry including the high cost and risk of drilling and exploration are preventing further development for many projects[8]. Currently, several projects (440 MW_e) are at an advanced construction including the Sarulla and Rantau Dedap projects, partially financed by the CTF country program for Indonesia, but significant scale up is needed to reach Indonesia's 6,000 MW_e (5%) target.

8. In 2013, Indonesia's total power generating capacity (including captive and off-grid generation) was approximately 44,000 MW[9]. Roughly 84% of this capacity was owned by PLN and the rest procured by PLN from contracted Independent Power Producers (IPPs). In 2013, Indonesia generated electricity predominantly from coal (44%), followed by fuel oil (23%), gas power plants (21%), hydropower (7%), and geothermal power (5%)[10]. The graph below shows the history of Indonesia's electricity production since 1971, and the dominance of fossil fired installed capacity.

Figure 2 - Indonesia Electricity Production by Source (1971 - 2011)[11]



***** Includes renewable energy sources such as geothermal*

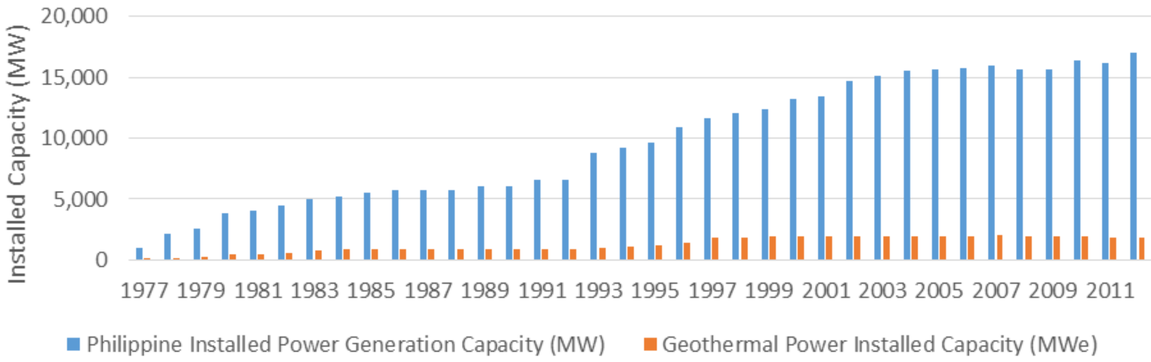
ii. Geothermal Power in the Philippines

9. The Philippines' geothermal resources are located throughout the country, with plants totaling 1,870 MW established in seven locations in Luzon, the Visayas and in Mindanao (see Appendix 3). Utility scale geothermal power production in the Philippines started in the late 1970's, and was predominantly undertaken by the Philippine government owned companies, which were later privatized in the late 1990s. These include the PNOC-Energy Development Corporation (now Energy Development Corporation), the Philippine Geothermal Production Company, Inc. (now Chevron Geothermal Philippines Holding, Inc.), and the National Power Corporation (NPC). Whist this built a solid foundation for the geothermal industry, since privatization there has been almost no new generation capacity added to the country's energy mix.

[8] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.
[9] Tharakan, P., 2015. Summary Of Indonesia's Energy Sector Assessment. ADB Papers On Indonesia No. 09 December 2015, Jakarta.
[10] Ibid.
[11] International Energy Agency, 2013. Energy Balances of Non-OECD Countries. IEA, 2103, Paris.

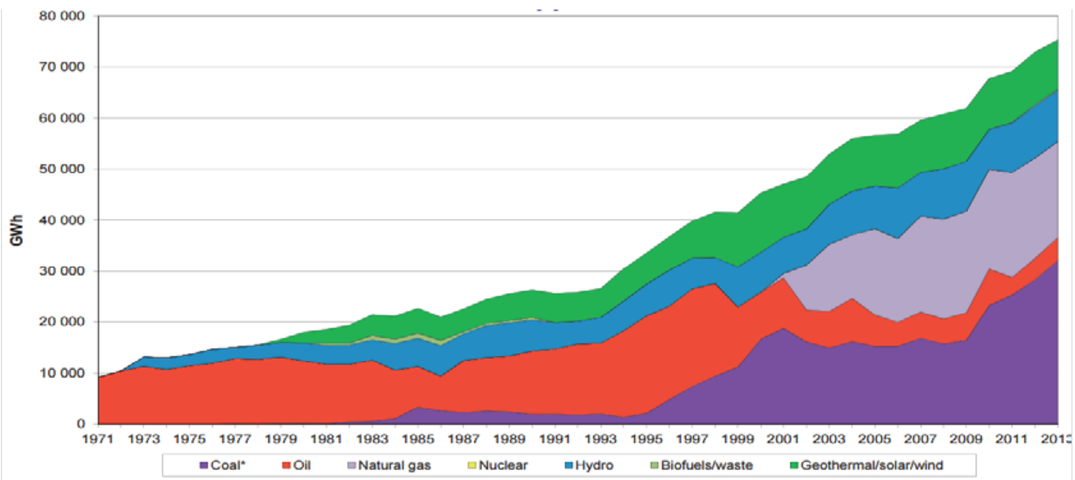
Figure 3 below shows that in the period from 1997 to 2014, there were no new geothermal capacity additions. Since 2014, two relatively small expansion projects (50 MW combined) are being made[12].

Figure 3 - Philippines Installed Power Generation Capacity (1977 - 2012)[13]



10. Furthermore, Figure 4 below shows that much of the Philippines' growth in power consumption has been satisfied by imported fossil fuels, namely coal and natural gas.

Figure 4 - Philippine Power Generation (1971 - 2012)[14]



11. In a relatively recent push to reduce the reliance on imported fuel and promote the use of geothermal and other sources of renewable energy, the Philippine government introduced the Renewable Energy (RE) Act of 2008. Whilst this did not include a feed in tariff or priority dispatch for geothermal power, this legislation provides a range of incentives for renewable energy power producers including measures to increase private sector involvement.

[12] 20 MWe at Maibarara and 30 MWe at Nasulo

[13] Fronda, A. D., Marasigan, M. C., Lazaro, V. S., 2015. Geothermal Development in the Philippines: The Country Update. Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.

[14] International Energy Agency, 2015. Philippines: electricity generation by fuel. IEA Energy Statistics, OECD/IEA 2015.

12. In tandem, the Philippine Department of Energy has established an ambitious goal of adding an additional 75% (1,465 MW_e) in geothermal power production to the country's power grids by 2030[15]. A total of forty two geothermal service/operating contracts have been awarded since the legislation was passed. However, as mentioned above, only very small capacity additions of 50 MW (3.5% of target) are being made[16]. Significant private sector involvement, combined with innovative solutions to overcome initial drilling and exploration risk, will be needed to come anywhere near the established 1,465 MW_e target.

13. The structure of the Philippine power market also presents unique off-take and merchant market risks for geothermal IPPs. As part of the country's 2001 Electricity Power Industry Reform Act (EPIRA), the government introduced an electricity spot market known as the wholesale electricity spot market (WESM[17]). This facility governs the sale of electricity in hourly blocks from generators (government owned and IPPs) to consumers (distribution utilities or bulk customers) in Luzon and the Visayas where the bulk of the country's population lives[18]. All power available in the system, including power contracted capacity under bilateral arrangements, is offered in the market and is dispatched in the order of bid price, with the market clearing at the price set by the highest bidder to be dispatched.

14. WESM aims to establish a competitive, efficient, transparent and reliable market for electricity. However, it also means that rather than negotiating power purchase agreements (PPAs) with power retailers prior to the construction of projects (usually done in order to attract long-term project financing), project developers must either: (i) finance projects without PPAs and sell power to WESM at spot prices (with uncertainty on price and quantity), or (ii) negotiate bilateral sales contracts with individual off-takers[19], many of which are not 'bankable' (due to the creditworthiness of the off-takers) and not of sufficient duration to support a project financing model. As a result, this market risk / offtaker risk compounds problems for financing geothermal projects in the Philippines.

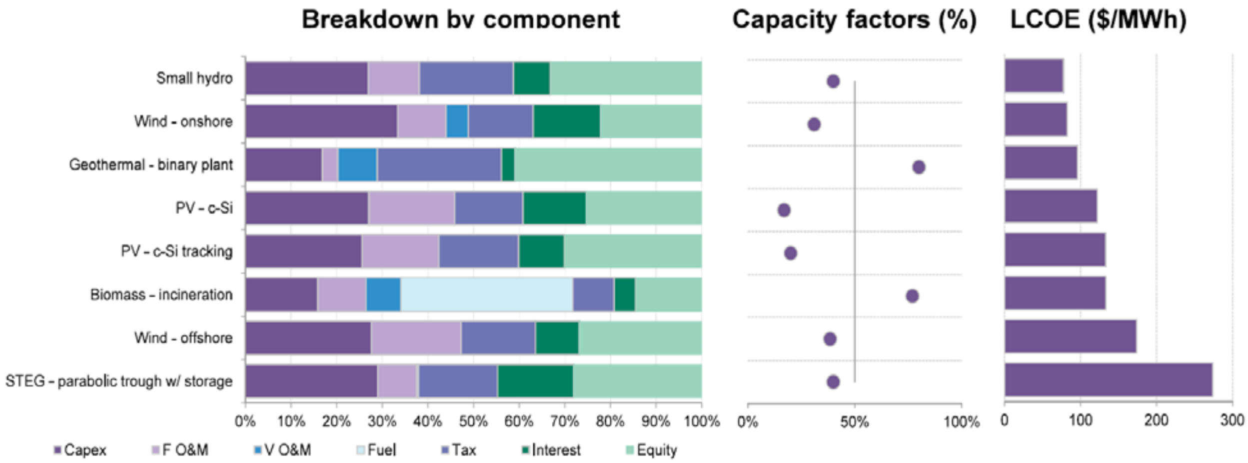
B. Key benefits of geothermal power

15. Geothermal power is a utility scale form of renewable energy generation capable of supplying base load power. When developed on productive geothermal resources in fossil fuel dominated grids, this form of generation can offer attractive economic benefits and significant reductions in greenhouse gas emissions. Indonesia and the Philippines are both heavily reliant on fossil fuel based power generation with relatively high (and volatile) costs of generation, and thus expanding these countries' geothermal resources will provide economic benefits, enable them to transition to lower carbon trajectories and will help to avoid the impacts of climate change.

16. Although capital costs for geothermal power are high, projects typically have large capacities, high availability and long lifetimes. Figure 5 below shows that the life cycle costs per MW are in fact lower than most other renewable energy technologies (second to biomass incineration). Geothermal installations have a high average capacity factor (higher average than other forms of renewable energy), and relatively low levelized cost of energy (ranked third below small hydro and onshore wind).

[15] Fronda, A. D., Marasigan, M. C., Lazaro, V. S., 2015. Geothermal Development in the Philippines: The Country Update. Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.
[16] 20 MWe at Maibarara and 30 MWe at Nasulo
[17] WESM is a gross-offer pool, net-settlements market which enables the trading of electricity as a commodity in 24 one-hour trading periods daily.
[18] Generators outside these areas must negotiate bilateral sales agreements
[19] Individual off-takers are allowed to enter into bilateral contracts for a fixed price and quantity of electricity, but such contracts are structured as "contracts for differences" rather than contracts for electricity supply. Differences between the market clearing price and the contracted price are settled by the contracting parties outside of WESM.

Figure 5 - Comparison of renewable energy economics[20]



C. Barriers to Scale Up

17. The main risks for geothermal power projects are those associated with the initial drilling and exploration phase. Once a site is identified, detailed knowledge is needed on the sub-surface heat resource, geophysics and geochemistry in order to determine where wells should be drilled and to quantify the resource (in terms of MW_e of output for a power plant). The main technical challenge is to determine which locations within the underlying rock strata have high temperatures and high permeability, then steer drilling to intersect with these high-production areas. In Indonesia and the Philippines, geothermal resources are found at depths of up to 2-3km underground.

18. The following figure is a guide to the level of project risk, cumulative cost and bankability of geothermal projects throughout the development and operations phases. As can be seen, the main barriers to project development are in the early phases before test drilling can establish the size and nature of the underlying resource. Once initial risks have been overcome, projects generally adopt the risk profile of conventional thermal power projects, and become more attractive for private sector participation (with notable exceptions such as the merchant power market risk in the Philippines outlined in paras 13 & 14).

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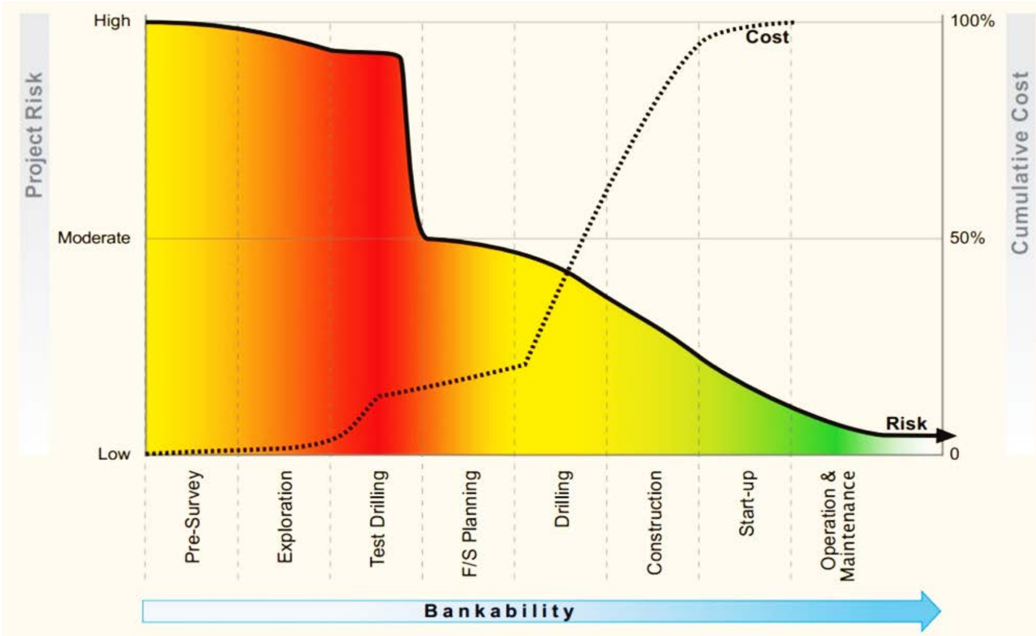
[20] Mills, L., 2015. H2 2015 Global LCOE Outlook: Renewables Increasingly Cost Competitive. Bloomberg New Energy Finance, 29 September 2015.

Figure 6 - Geothermal project risk, cumulative investment cost and bankability[21]



19. Other obstacles for geothermal power development in Indonesia and the Philippines include:

a) High upfront cost of investment and resultant cost of electricity production;
b) Extensive initial geotechnical work required;
c) High complexity of planning needed for variable timelines and costs (depending on outcomes of drilling and exploration);
d) Long lead times;
e) Regulatory risk and bureaucracy (weak policy coordination between the central and regional governments);
f) Legal certainty (for example regarding asset ownership);
g) Political risks; and
h) Market or off-take risks (as outlined in paras 13 and 14).

D. Unlocking the sector – ways to overcome barriers

i. Exploration Risk Insurance

20. Given that governments in Indonesia and the Philippines are no longer in a position to finance geothermal development, arguably one of the best ways to overcome associated risks for increased private sector development is to encourage the use of financing instruments such as insurance that re-distribute early stage risks among different actors.

21. As described below, geothermal exploration risk insurance covers the costs of drilling a well in the event of unsuccessful exploration, providing protection against the worst case scenario and improved security for investment and planning. The aims of geothermal exploration risk insurance include:

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[21] Vernier, R., Jaudin, F., 2013. EGRIF: a risk insurance for geothermal projects, Geothermal Energy Department Georesources Division – BRGM. GEOELEC Final conference, 5-6 June 2013, Pisa, Italy, GEOELEC National Workshop, 17 October 2013, Paris.

- reducing commercial banks' requirements for sponsors' base and/or contingent equity
- reducing interest rates for commercial loans
- increasing planning reliability and improving budgeting
- lowering investment costs and protecting against lost investments
- broadening the investor base for geothermal projects by lowering risk and improving access

22. The first company to offer geothermal exploration insurance was Munich Re in 2003, with coverage of the Unterhaching project in Germany. Since then, insurance brokers such as Marsh and Willis, and insurance companies like Axa, Gothaer, Swiss Re and R&V have become active in this area. Typically, one insurance company will act as the direct insurer of risk, and insurance brokers will distribute a portion of this risk among other contributing insurance companies[22]. Whilst these are encouraging signs, the uptake of actual policies has not been high, and currently a 10% premium (e.g., $1 million) is required for an insured sum of about $10 million plus an own risk share (deductible) of about $1 million[23]. These high premiums and deductibles, especially in new exploration areas and in emerging markets, are a significant hurdle to uptake.

23. Insurance policies can be designed to cover two components: (i) the cost of drilling for unsuccessful wells, and (ii) the cost of stimulation measures (e.g., well deepening, cold water injection, drilling side tracks, and drilling stimulation wells) to increase the viability of initially unsuccessful wells. The definition of a 'successful well' is an agreed level of thermal or electrical output as measured by a well's steam rate, flow rate, well head pressure and/or other physical variables. These parameters are determined prior to drilling by the insurance provider in close consultation with project developers and detailed analysis of a project's feasibility and initial geological studies. Clear definitions of procedures and best and worst case scenarios are crucial to producing a reliable and transparent policy. The payment of insurance is usually triggered by a failure to achieve the pre-defined level of thermal or electrical output.

24. The insurance cover can be designed in phases with "step-out" features such that if initial drilling results are not as expected, project developers may cancel or adjust the insurance policy. Insurance premiums are usually payable prior to the initial agreed number of wells and upon passing of each "step-out" hurdle. Premiums may be adjusted by the insurance provider if the output of previous wells is marginal and close to the insurance payout trigger. Given the level of technical detail required to formulate an insurance policy of this nature, there are significant third party transaction costs for technical advisors on both sides of such a transaction.

25. As very few reliable standards have been established for geothermal exploration risk insurance, the cooperation between project developer and insurer is of major importance. In preparing the initial assessment, the insurer and the project developers share an alignment of interest to achieve successful well drilling, and project design can be adjusted if needed. Thus, partnering with insurance providers can enhance project design through their knowledge gained from other projects.

26. Despite the history of geothermal power in Indonesia and the Philippines, insurers have yet to provide geothermal risk insurance products in these countries. CTF support for projects utilizing exploration risk insurance is expected to assist in their uptake by demonstrating proof of concept and lowering premiums (or providing first loss to do so) by allowing insurance companies to build a database of information and better quantify the risk profiles of geothermal projects in developing Asia.

[22] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.
[23] Ibid.

ii. Concessional debt

27. In situations where geothermal exploration insurance premiums are prohibitively high, the risk profiles of transactions do not warrant the use of insurance products, and/or the development company wishes to use a different approach to financing, several other concessional financing modalities can assist in catalyzing projects. These include:

a) Long tenor debt, low cost debt with grace period – designed to allow developers flexibility in managing early stage volatility in projects and sufficient time to recover costs over time to service debt. This also gives other financiers confidence that cornerstone financiers are committed to a project over time.

b) Medium term low cost debt – higher risk bearing, early-mid stage financing aims to overcome the main initial financing hurdle in catalyzing projects. After geothermal resources have been proven, private sector participation in financing the downstream power generation project poses few issues unique to geothermal[24], and initial financing can be often be refinanced from follow-on corporate or project financing.

E. Overview of the Proposed Program

i. Background

28. The Dedicated Private Sector Program (DPSP), established under the CTF in 2013, was designed to finance programs or operations that can deliver *scale* (in terms of development results and impact, private sector leverage and investment from CTF financing) and *speed* (faster deployment of CTF resources, more efficient processing procedures), while at the same time maintaining a strong link to country priorities and CTF program objectives. The Dedicated Private Sector Programs have utilized a programmatic approach where MDBs collaboratively identified private sector funding opportunities. Phase I of DPSP was approved in October 2013 ($150 million) and phase II was approved in June 2014 ($358 million). The concept paper for this proposal was endorsed by the CTF Trust Fund Committee at the June 2014 CTF meeting in Jamaica after being evaluated by the MDB committee and nominated for consideration[25].

29. The 2013 $150 million ADB CTF Private Sector Geothermal Energy Program[26] has been instrumental in breaking the hiatus in private sector financing in Indonesia that existed since the Asian financial crisis of the late 1990s. ADB supported two private sector projects through CTF; firstly through long tenor, low cost subordinated debt for the Sarulla Geothermal Power Generation Project[27], and secondly through medium term tenor, higher risk bearing debt for the exploration phase of the Rantau Dedap Geothermal Power Project (Phase I)[28]. A third and final project under this program is currently in processing by ADB and should be approved in late 2016. CTF funds from this proposal, if successful, may be used to augment CTF financing of this third project if needed.

30. Outside of its CTF programs, in 2015 ADB approved a dual-currency project loan and a credit enhancement (in the form of a partial credit guarantee) to support the issuance of the Philippines' first peso-

[24] Post resource discovery, the technology of power generation using geothermal steam is relatively well established, and off-take risks, readiness of the transmission connection, and guarantee of payment from offtakers are common to all IPPs.

[25]http://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/CTF%20CRP%202.%20DPSP%20revised%20decision.pdf

[26] https://www-cif.climateinvestmentfunds.org/projects/private-sector-geothermal-energy-program

[27] http://www.adb.org/projects/42916-014/main

[28] http://www.adb.org/projects/47937-001/main

denominated green project bond (the Tiwi and MakBan Geothermal Power Green Bonds Project[29]). This project marked the issuance of the first certified Climate Bond in Asia and the Pacific, and will support the long-term financing of capital expenditure (including acquisition and plant rehabilitation) and ongoing operations and maintenance at two locations in Luzon, Tiwi and Makiling-Banahaw.

31. These initial interventions in Indonesia and the Philippines have had a demonstration impact and spurred renewed interest from private sector developers. However, there is still scope for additional concessional financing in Indonesia, and the almost thirty-year hiatus of private sector led greenfield geothermal development in the Philippines is yet to be broken. This additional $30 million proposed CTF program is designed to be a follow-on program to ADB's 2013 CTF geothermal program. Whilst much smaller in size than the initial $150 million program, it aims to incrementally build on momentum gained to date, and as mentioned, may participate in the third ADB-CTF geothermal project under development in Indonesia.

ii. Proposed use of CTF funds under this program

32. ADB's Private Sector Operations Department (PSOD) has been working with several private sector geothermal project developers in Indonesia and the Philippines (and with insurance providers and reinsurers based in Europe), and proposes to utilize CTF concessional resources under this program through either of the modalities listed below:

i. **Option 1 – CTF loans with geothermal exploration insurance** – a combination of (i) senior or subordinated debt to pay for costs associated with drilling, exploration, and the development of power projects in the event of successful drilling, and (ii) contingent recovery grants to partially subsidize the cost of insurance premiums for CTF-financed and/or ADB-financed drilling and exploration;

ii. **Option 2 – CTF loans without geothermal exploration insurance** – Senior or subordinated debt to pay for costs associated with drilling, exploration, and the development of power projects in the event of successful drilling;

iii. ADB processing of CTF resources

33. The exact nature of the financing for individual projects will be determined by ADB in line with CTF's private sector guidelines. The specific projects supported by the Program will be subject to full due diligence, as per ADB's procedures for non-sovereign operations, and will need approval from ADB's Management and Board of Directors. The exact terms and conditions of the CTF financing will be determined during ADB's due diligence, and the principal of minimum concessionality will be applied. The table below shows the program's financing plan

Table 1 - Program financing plan

CTF program	$30 million
ADB co-financing	$30 million
Commercial /bilateral co-financing	$90 million
Total finance mobilized	**$150 million**

34. ADB will administer and manage this CTF program faithfully and will exercise the same duty of care and diligence in the administration and management of the program as it exercises with respect to other third party arrangements utilizing ADB's Non-Sovereign Operations platform. The CTF Trust Fund

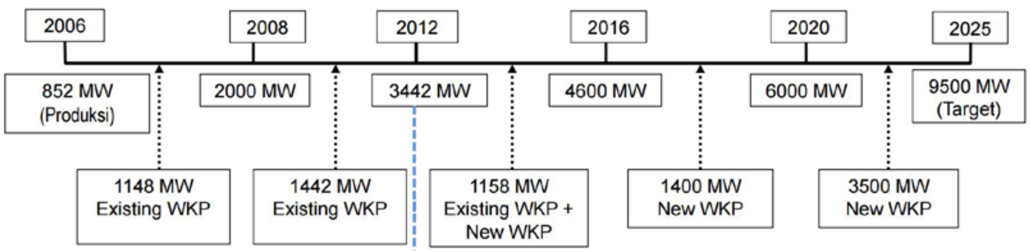
[29] http://www.adb.org/projects/48423-001/main

Committee acknowledges that ADB may deploy CTF funds under this program in higher risk positions compared with ADB financing in accordance with this proposal (i.e., potentially structuring CTF funds with less seniority, less security, longer tenors, longer grace periods and/or with lower pricing than ADB financing).

F. Market Transformation

35. The Government of Indonesia's road map for geothermal development (shown below), outlines the Government's plans to scale up installed capacity to 9,500 MW, which has since been revised downwards to 6,000 MW with project listings for a total of 4,925 MW (Appendix 2).

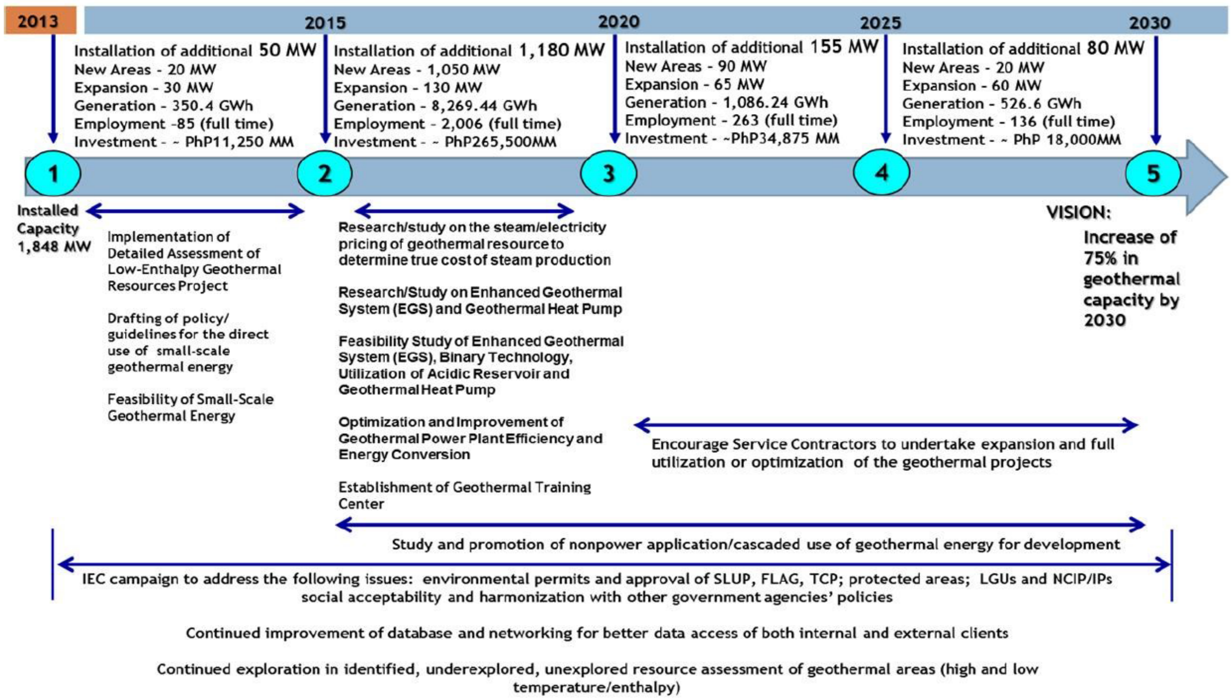
Figure 7 - Indonesia Road Map of Geothermal Development 2006 - 2025[30]



36. Similarly, the Government of the Philippines has published a road map for geothermal project development outlining the estimated addition of 1,465 MW of new capacity up to 2030. Figure 9 below shows the roadmap, and Appendix 3 itemizes the country's projects at "development stage" (producing fields that may be expanded) and 31 projects at "pre-development stage" (exploration stage / not yet developed).

[30] Based on Presidential Decree No. 5/2006, National Energy Policy

Figure 8 - Roadmap for the exploration, development and utilization of geothermal resources in the Philippines (2013-2030)[31]



FIT WITH CTF INVESTMENT CRITERIA

G. Potential GHG Emissions Savings, Potential Replication and Scale up, and Cost Effectiveness

37. CTF funds of $30 million are expected to catalyze investment in roughly 90 MW of new geothermal capacity, resulting in annual GHG emission reductions of 375,000 tCO_2e per year or 7.5 million tCO_2e over a 20-year time frame (see Appendix 4 for calculations). Based on 20-year emission reductions of 7.5 million tCO_2e, and CTF funds of $30 million, the cost effectiveness of CTF financing is roughly $4 per tCO_2e.

38. Using conservative figures, one may assume that the deployment of innovative financing of initial projects proposed for CTF support would help to catalyze roughly 10% of targets for Indonesia and the Philippines. Using a combined target of 6,390 MW (4,925 MW from the Indonesia and 1,465 MW from the Philippines), this equates to a CTF-attributable market transformation of roughly 600 MW of new capacity.

H. Development Impact

39. CTF's intervention into Indonesia and the Philippines is expected to lower barriers to entry and assist in market transformation by partially displacing elevated costs associated with first mover risks. By demonstrating a track record of projects, potential sponsors and financiers, regulators, insurance companies, technical and legal service providers and other stakeholders can become familiar with financing and

[31] Fronda, A. D., Marasigan, M. C., Lazaro, V. S., 2015. Geothermal Development in the Philippines: The Country Update. Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.

developing private sector led geothermal projects. The cost of developing future projects is estimated to fall following the successful demonstration of an initial round of projects.

I. Implementation Potential

40. The project has strong potential for implementation within 12 months of approval. ADB is currently at an advanced stage of discussion with one private sector sponsor in the Philippines, and with one in Indonesia. Private sector interest in working with ADB and CTF on geothermal financing can in large part be attributed to the success of the 2013 CTF program for Indonesia. Demonstration of innovative financing instruments for the Sarulla and Rantau Dedap private sector geothermal projects has spurred considerable interest from developers in Indonesia and the Philippines, and a small additional CTF contribution of $30 million will likely build on this success. If appropriate, CTF financing under this proposal may be combined with the remaining portion of funds from ADB's 2013 CTF geothermal program to support the financing of one project currently under processing by ADB.

J. Additional Costs and Risk Premium

41. The grant element of CTF financing is needed to cover the identifiable additional cost of geothermal drilling, exploration and power generation to address identified perceptions of risk and other non-financial barriers as outlined in section C of this proposal. CTF financing instruments will be priced using the principal of minimal concessionality so as not to over subsidize projects.

K. Financial Sustainability

42. The financial sustainability of individual projects undergoes a step-change increase following the successful demonstration of commercial geothermal power resources, as sponsors can generally raise commercial debt and utilize well tested project finance models. The table below shows that tariffs from geothermal projects in Indonesia can be lower than the cost of new coal-fired power generation indicating strong financial sustainability once projects have proven resources.

Figure 9 - Tariffs for geothermal projects in Indonesia[32]

	COD	MW	US¢/kWh
Muara Laboh	2017/2018	220	9.40 (PPA)
Sarulla	2017/2018	330	6.79 (PPA)
Rajabasa	2020/2021	220	9.50 (PPA)
Rantau Dedap	2019	220	8.86 (PPA)
Blawan Ijen	2019	110	8.58 (PPA)
Atadei	2016	5	9.50 (PPA)
Ungaran	2019	55	8.09 (PPA)
Sorik Marapi	2019/2020	240	8.10 (tender price)
Suoh Sekincau	2020/2021	220	6.90 (tender price)
Cisolok Cisukarame	2019	50	Rp630 (tender price)
Jaboi	2019	10	Rp1,705 (tender price)
Tangkuban Perahu	2019	110	Rp533.6 (tender price)
Jailolo	2017	10	Rp1,727 (tender price)
Sokoria	2017/2019	5	Rp1,250 (Tender price)

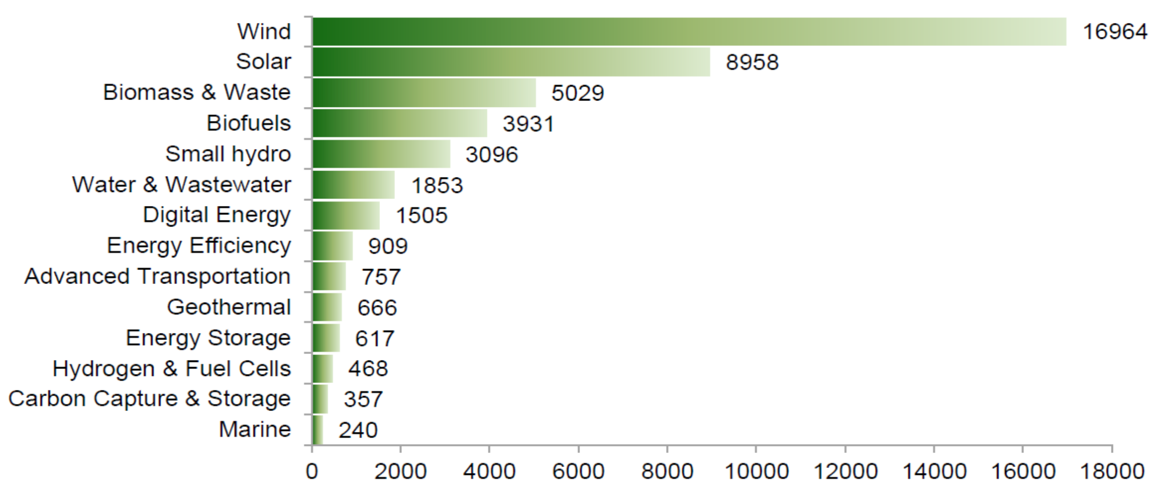
[32] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.

Rawa Dano	2019	110	8.39 (tender price)
Tampomas	2019	45	6.50 (tender price)
Batu Raden	2018/2019	110	9.47 (tender price)
Ngebel/Wilis	2019/2020	165	7.55 (tender price)
Ciremai	2019	110	9.70 (tender price)
Guci	2019	55	9.09 (tender price)
Hu'u Daha	2021	20	9.65 (tender price)
Seulawah Agam	2018	110	6.90 (tender price)
COD = commercial operating date, MW = megawatt, PPA = power purchase agreement, Rp = rupiah			

L. Effective Use of Concessional Finance

43. Whilst there are several key benefits of geothermal power, as outlined in section B of this proposal, the figure below shows that geothermal power is one of the under-represented forms of renewable energy generation in terms of transactions financed. This is in part due to (i) the large scale nature of geothermal transactions as compared with technologies such as solar and wind; and (ii) the limited geographies in which geothermal resources are found. However, it also highlights the fact that much of the focus of concessional (and commercial) financing has been on the scaling up of solar and wind projects. More support is arguably needed for geothermal power (a base load power source that can displace coal) in order to facilitate comparable scale up and replication. As demonstrated by solar and wind technologies, as newer forms of power generation mature, costs generally lessen and the need for concessional financing support diminishes.

Figure 10 - Number of financial transactions by climate-related sector (2000-2012) [33]



44. In addition, the table below shows a comparison of feed in tariffs in various countries. This table illustrates that government support for geothermal in Indonesia is not comparable with other countries, and the applicable feed in tariffs can be as low as 25% of what is received by developers in other countries. In the Philippines there is currently no feed in tariff support for geothermal projects (which must compete in the merchant market for electricity), indicating a strong need for the use of concessional finance. ADB's

[33] Haščič, I. et al. (2015), "Public Interventions and Private Climate Finance Flows: Empirical Evidence from Renewable Energy Financing", OECD Environment Working Papers, No. 80, OECD Publishing. http://dx.doi.org/10.1787/5js6b1r9lfd4-en

scoping for this program indicates a small portion of CTF concessional financing would have strong potential for scale up and market transformation.

Table 2 - Comparison of Feed in Tariffs[34,35]

	Size	Currency/kWh	US¢/kWh
Indonesia			7 - 18.5
Philippines			0.0
Germany		0.25 €	33.7
Japan	<15 MW	27.3 Y	26.6
	>15 MW	42.0 Y	40.9
Italy	<1 MW	0.20 €	27.0
Taipei, China		4.80 NT$	17.0

M. Mitigation of Market Distortions

45. Due to the absence of private sector led development of geothermal resources in the Philippines, there is unlikely to be negative market distortions from a CTF intervention. Similarly in Indonesia, the geothermal market has not been sufficiently developed, especially relative to the thermal power sector, to suffer from significant negative market distortions from the proposed concessional financing program to a handful of private sector demonstration projects.

N. Risks

46. The program's main risks relate to the nature of the underlying geothermal resources. Drilling and exploration is a high risk activity and unlike the oil and gas sector, where successful drilling can result in high margins, sales from power produced from successful geothermal wells is often much smaller in comparison or may have a regulated return. Drilling at depths of up to 3km is expensive, and if drilled wells and stimulation measures are not successful, drilling costs are often largely unrecoverable.

47. Sponsors also face a range of risks typical of geothermal projects including: (i) implementation risk associated with the high level of project complexity, (ii) regulatory risk, particularly relating to permits and licensing, (iii) legal risk, (iv) political risks (v) offtaker/market risk (particularly in the merchant power market of the Philippines), and (vi) environmental hazards.

O. Performance Indicators

48. The performance indicators outlined below are derived from the CTF Results Measurement Framework, and will be tracked according to CTF guidelines at least annually. Please note that other performance targets and indicators quantifying developmental impacts will be included in the formulation of ADB's Project Design and Monitoring Frameworks for individual projects to be supported under this Program.

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[34] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.

[35] Asian Development Bank and The World Bank. 2015. Unlocking Indonesia's Geothermal Potential. © Asian Development Bank and The World Bank. https://openaccess.adb.org; https://openknowledge.worldbank.org. Available under a CC BY 3.0 IGO license.

Table 3 - Program performance indicators (see assumptions in Appendix 4)[36]

Program Performance Indicator	Baseline	Anticipated Results by 2046 (20 years)
GHG emissions avoided	0	375,000 tCO_2e per annum
CTF financial leverage	0	1 : 4
Installed capacity of distributed power sources (MW)	0	Up to 90 MW
Generation from geothermal power sources (MWh/y)	0	590,000 MWh/y
Number of new jobs generated	0	180 direct and indirect jobs

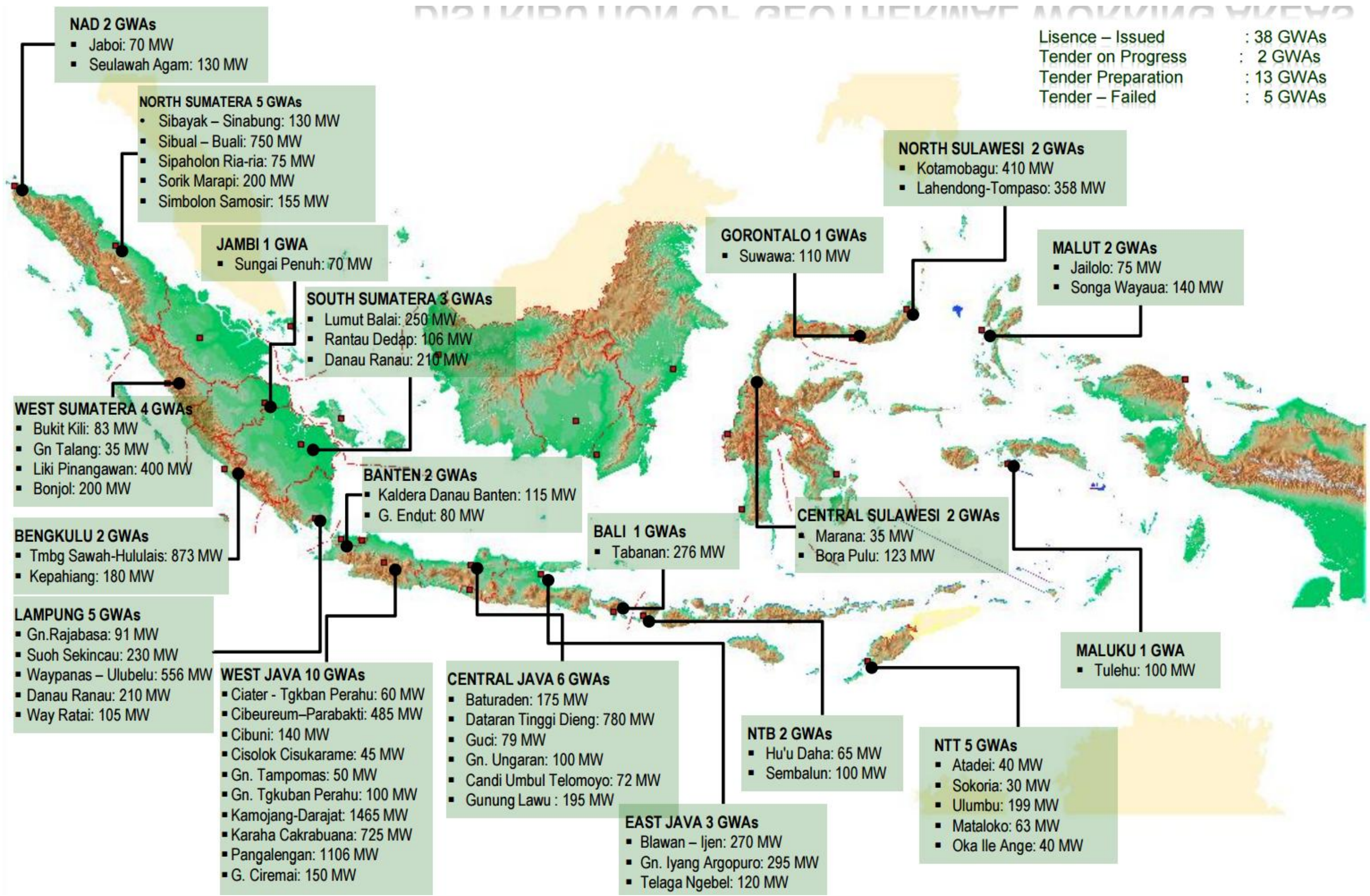
[36] Other performance targets and indicators quantifying developmental impacts will be included in the formulation of ADB's Project Design and Monitoring Frameworks for each individual project to be supported under this program.

Appendix 1 - Email from CTF Trustee confirming cash availability for this Program

To be obtained prior to TFC approval

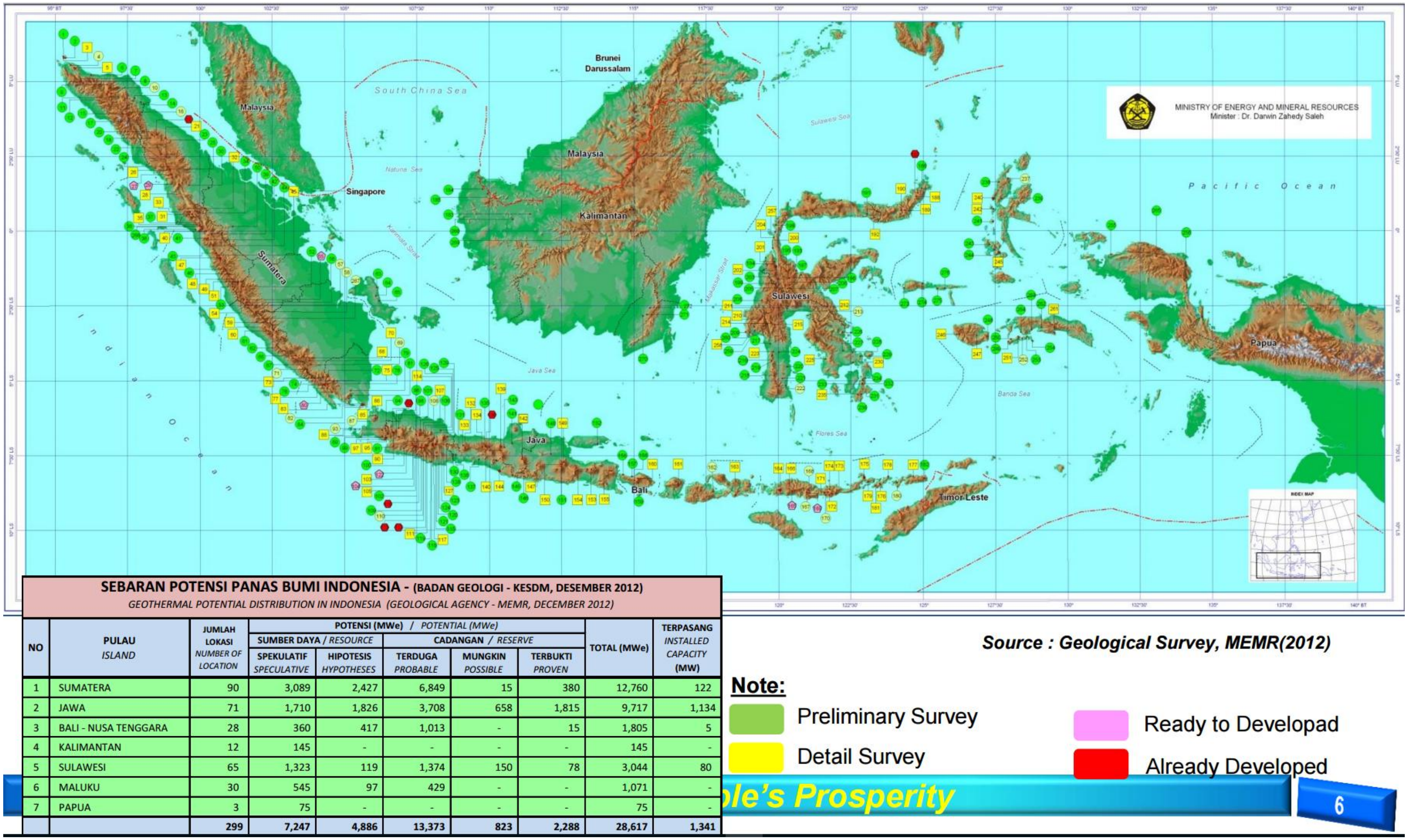
Appendix 2 – Geothermal power production and potential in Indonesia

Figure 11 - Indonesia Geothermal Working Areas (GWAs)[37]



[37] R. Mulyana. 2013. Government's Programs to Accelerate Geothermal Energy. Paper for the Indonesia International Geothermal Convention and Exhibition. Jakarta. June 2013.

Figure 12 - Geothermal Potential of Indonesia[38]



SEBARAN POTENSI PANAS BUMI INDONESIA - (BADAN GEOLOGI - KESDM, DESEMBER 2012)
GEOTHERMAL POTENTIAL DISTRIBUTION IN INDONESIA (GEOLOGICAL AGENCY - MEMR, DECEMBER 2012)

NO	PULAU *ISLAND*	JUMLAH LOKASI *NUMBER OF LOCATION*	POTENSI (MWe) / *POTENTIAL (MWe)*					TOTAL (MWe)	TERPASANG *INSTALLED CAPACITY* (MW)
			SUMBER DAYA / *RESOURCE*		CADANGAN / *RESERVE*				
			SPEKULATIF *SPECULATIVE*	HIPOTESIS *HYPOTHESES*	TERDUGA *PROBABLE*	MUNGKIN *POSSIBLE*	TERBUKTI *PROVEN*		
1	SUMATERA	90	3,089	2,427	6,849	15	380	12,760	122
2	JAWA	71	1,710	1,826	3,708	658	1,815	9,717	1,134
3	BALI - NUSA TENGGARA	28	360	417	1,013	-	15	1,805	5
4	KALIMANTAN	12	145	-	-	-	-	145	-
5	SULAWESI	65	1,323	119	1,374	150	78	3,044	80
6	MALUKU	30	545	97	429	-	-	1,071	-
7	PAPUA	3	75	-	-	-	-	75	-
		299	**7,247**	**4,886**	**13,373**	**823**	**2,288**	**28,617**	**1,341**

[38] R. Mulyana. 2013. Government's Programs to Accelerate Geothermal Energy. Paper for the Indonesia International Geothermal Convention and Exhibition. Jakarta. June 2013.

Figure 13 - Identified Geothermal Work Areas and Required Financing in Indonesia[39]

NO.	GEOTHERMAL POWER PLANT PROJECT	STATUS OF GEOTHERMAL WORK AREA (GWA)	PROVINCE	ESTIMATED CONFIGURATION (MW)	INSTALLED CAPACITY (MW)	REQUIRED FINANCING (US$ M)
A. EXISTING GWA (DEVELOPMENT OF EXISTING CAPACITY)						
1	Kamojang 5 and 6	Existing	West Java	1x30 1x60	90	$270
2	Wayang Windu Unit 3 and 4	Existing	West Java	2x110	220	$660
3	Dieng	Existing	Central Java	1x55 1x60	115	$345
4	Lahendong 5 dan 6	Existing	North Sulawesi	2x20	40	$120
Total A					**465**	**$1,395**
B. EXISTING GWA (NEW DEVELOPMENT)						
5	Sungai Penuh	Existing	Jambi	2x55	110	$330
6	Hululais	Existing	Bengkulu	2x55	110	$330
7	Kotamobagu 1 and 2	Existing	North Sulawesi	2x20	40	$120
8	Kotamobagu 3 and 4	Existing	North Sulawesi	2x20	40	$120
9	Tulehu	Existing	Maluku	2x10	20	$60
10	Iyang Argopuro	Existing	East Java	1x55	55	$165
11	Cibuni	Existing	West Java	1x 10	10	$30
12	Karaha Bodas	Existing	West Java	1x30 2x55	140	$420
13	Patuha	Existing	West Java	3x60	180	$540
14	Tangkuban Perahu II	Existing	West Java	2x30	60	$180
15	Sarulla 1	Existing	North Sumatera	3x110	330	$990
16	Sarulla 2	Existing	North Sumatera	2x55	110	$330
17	Lumut Balai	Existing	South Sumatera	4x55	220	$660
18	Ulubelu 3 and 4	Existing	Lampung	2x55	110	$330
Total B					**1,535**	**$4,605**
C. New GWA						
19	Sembalun	New	West Nusa Tenggara	2x10	20	$60
20	Tangkuban Perahu I	New	West Java	2x55	110	$330
21	Ijen	New	East Java	2x55	110	$330
22	Ngebel	New	East Java	3x55	165	$495
23	Gunung Endut	New	Banten	1 x55	55	$165
24	Rawa Dano	New	Banten	1 x110	110	$330
25	Cisolok-Cisukarame	New	West Java	1 x50	50	$150
26	Tampomas	New	West Java	1 x45	45	$135
27	Gunung Ciremai	New	West Java	2 x 55	110	$330
28	Baturaden	New	Central Java	2x110	220	$660
29	Guci	New	Central Java	1x55	55	$165
30	Ungaran	New	Central Java	1x55	55	$165
31	Seulawah Agam	New	Aceh	1X55	55	$165
32	Jaboi	New	Aceh	2x5	10	$30
33	Umbul Telumoyo	New	Central Java	1x55	55	$165
34	Simbolon Samosir	New	North Sumatera	2x55	110	$330
35	Sipoholon Ria-Ria	New	North Sumatera	1x55	55	$165
36	Sorik Marapi	New	North Sumatera	240 (Total)	240	$720
37	Muaralaboh	New	West Sumatera	2x110	220	$660
38	Bonjol	New	West Sumatera	3x55	165	$495
39	Rantau Dadap	New	South Sumatera	2x110	220	$660
40	Rajabasa	New	Lampung	2x110	220	$660
41	Suoh Sekincau	New	Lampung	4x55	220	$660
42	Wai Ratai	New	Lampung	1x55	55	$165
43	Danau Ranau	New	Lampung	2x55	110	$330
44	Bora	New	Central Sulawesi	1x5	5	$15
45	Marana/Masaingi	New	Central Sulawesi	2x10	20	$60
46	Hu'u	New	West Nusa Tenggara	2x10	20	$60
47	Atadei	New	East Nusa Tenggara	2x2,5	5	$15
48	Sokoria	New	East Nusa Tenggara	3x5	15	$45
49	Mataloko	New	East Nusa Tenggara	1x5	5	$15
50	Jailolo	New	North Maluku	2x5	10	$30
51	Songa Wayaua	New	North Maluku	1x5	5	$15
TOTAL C					**2,925**	**$8,775**
TOTAL (A + B + C)					**4,925**	**$14,775**

[39] R. Mulyana. 2013. Government's Programs to Accelerate Geothermal Energy. Paper for the Indonesia International Geothermal Convention and Exhibition. Jakarta. June 2013.

Appendix 3 - Geothermal power production and potential in the Philippines

Figure 14 - Geothermal service/operating contracts in "Development Stage" (producing fields)[40]

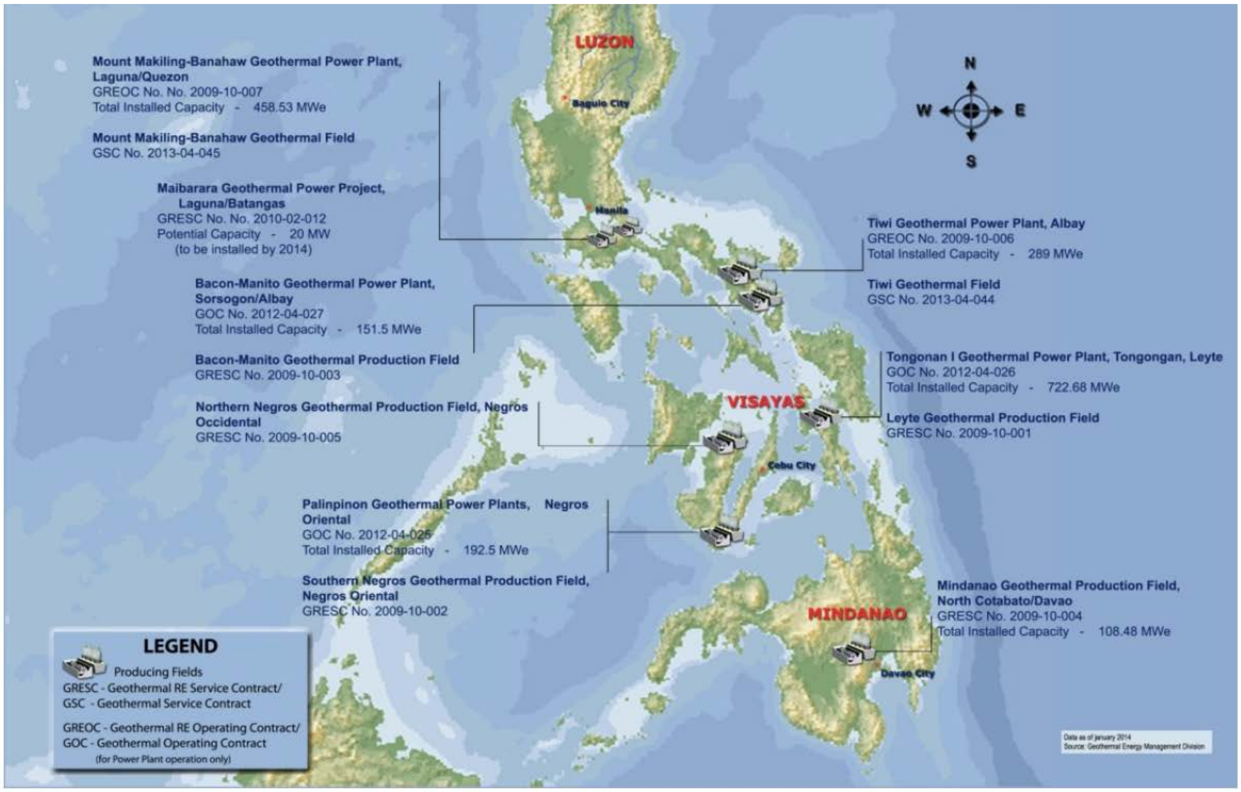
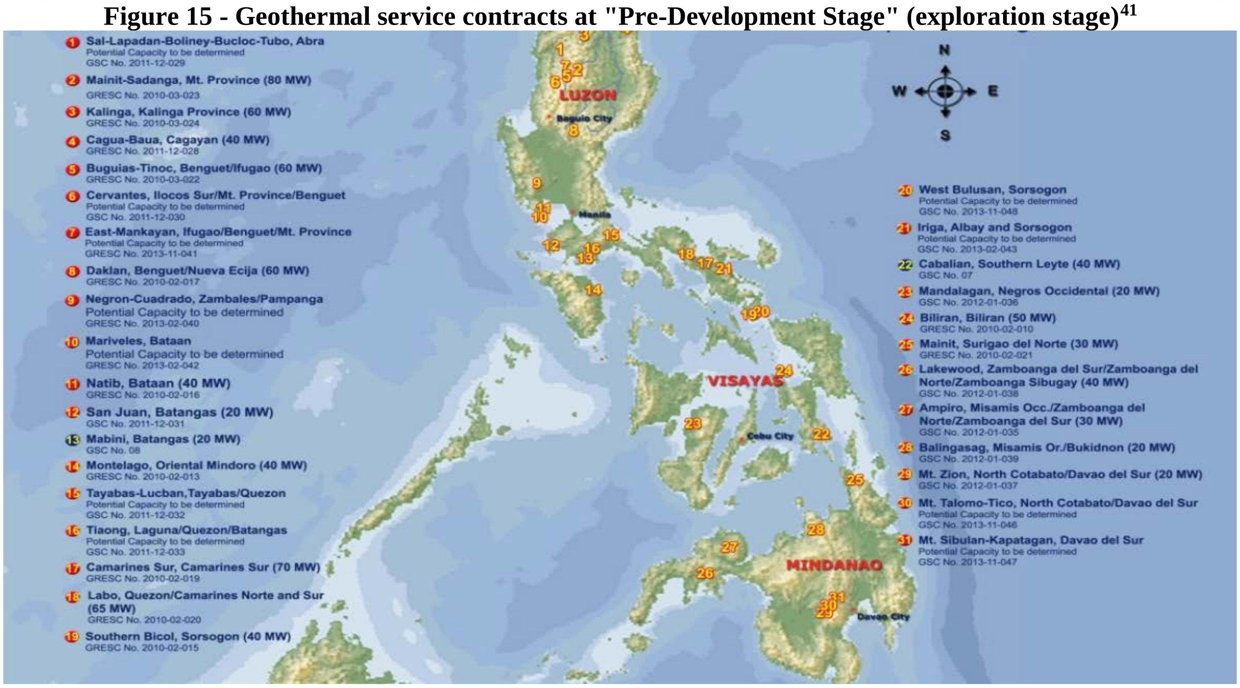


Figure 15 - Geothermal service contracts at "Pre-Development Stage" (exploration stage)[41]



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[40] Fronda, A. D., Marasigan, M. C., Lazaro, V. S., 2015. Geothermal Development in the Philippines: The Country Update. Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.
[41] Fronda, A. D., Marasigan, M. C., Lazaro, V. S., 2015. Geothermal Development in the Philippines: The Country Update. Proceedings World Geothermal Congress 2015, Melbourne, Australia, 19-25 April 2015.

Appendix 4 – Emission Reduction Calculations

CTF financing	$ 30	million
Drilling cost per well (av.)	$ 7	million
Number of wells (est.)	4.3	wells
Capacity per well (est. av.)	7	MW
Installed capacity (including co-financing)	90	MW
Capacity factor	75%	
Power generation	591,000	MWh p.a.
Grid emission factor[1]		
- Indonesia	0.7577	tCO_2e / MWh
- Philippines	0.5109	tCO_2e / MWh
- Average	0.6343	tCO_2e / MWh
Emission reductions (annual)	375,000	tCO_2e p.a.
Project lifetime	20	years
Emission reductions (lifetime)	7,500,000	tCO_2e
Notes: [(1)] *Kuriyama, A. 2016. IGES List Of Grid Emission Factor, Data and Tools. March 2016.*		