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Barriers to medium scale renewable electricity generation in Indonesia

Policy Brief

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Abstract

Small and medium size renewable energy generators can have large benefits for Indonesia, but have not seen significant growth in the last years, despite incentives from the government in the form of feed-in tariffs for specific technologies. This briefing, the second in a series of three, describes the barriers for renewable energy independent power producers (IPPs) in Indonesia, categorised as capacity and skills; financial and other market barriers. The previous briefing focused on the benefits of smaller scale renewable energy projects. The final paper proposes policy interventions and support that could overcome existing barriers and create a more active sector.

This policy brief draws on analysis of the sector, study of available literature and the regulatory framework, and interviews with project developers. It presents a case study to show that under the current feed-in tariff design, the risks faced by independent power producers are substantial and the expected returns need to be high for any prospective project. The third briefing in this series will explore how to enhance technical capacity, provide financial assistance to project developers and commercial banks, and discuss possibilities for reducing regulatory uncertainty.

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Introduction and summary

The Indonesian energy system is facing a number of long-term challenges. Demand for electricity in the coming years is expected to grow at 8 percent annually; the current energy mix leaves Indonesia vulnerable to the price of imported oil, and the country has committed to substantially reducing its greenhouse gas emissions in the coming 15 years. The National Energy Policy passed in 2014 aims increase the share of new and renewable energy (RE) in primary energy consumption from 6 percent in 2012 to up to 23 percent in 2025 (Gol, 2014).

Indonesia's renewable energy strategy will require substantial investments from the private sector to achieve these targets (PLN, 2015; Pertamina, 2014). Small-scale renewable electricity projects (defined as less than 10 MW) are expected to play a key role in this expansion. Smaller-scale schemes are well-suited to a country where 250 million people live across a few thousand islands, as they can provide distributed power using local renewable resources. Such schemes can also help to displace the estimated 35,000 off-grid generator sets in the country (Differ 2012), which have historically been very expensive for the government to support¹. Roughly 3 GW of small-scale renewable energy projects are in the pipeline, meaning that these are in various stages of development or preparation, but there is a large risk that these will not be realised. Few Independent Power Producers (IPPs) have been successful in building their renewable energy power plants. An existing feed-in tariff (FiT) for smaller-scale projects and complementary fiscal measures provide a strong pull for the market. However, the small-scale renewable energy sector has shown limited growth in response to these policies, even though the resources available for renewable energy in Indonesia are extensive.

This briefing note introduces the challenges to expanding the small to medium scale renewables sector in Indonesia, categorized across three aspects: capacity and skills, financial barriers, and other market barriers. The findings are drawn from the experiences of the MitigationMomentum project, which worked to design of policy measures to stimulate these small scale facilities. As part of the project, extensive discussions and interviews with a variety of stakeholders were held, as well as supporting analyses to understand barriers to successful project implementation. The following summarises the findings discussed in this brief:

Capacity, skills and data

- Project developers: For newer or smaller project developers the process of securing the required technical expertise for specific tasks is clearly an issue. As a result nearly all projects experience time and cost overruns, which in some cases are significant and can critically impact on cash flows and liquidity.
- Financial institutions: They have limited experience in financing RE projects or projects with similar characteristics. There is very limited capacity to accurately assess RE business proposals and financial viability of proposed schemes.
- Public agencies: feed-in tariffs are not transparently set or regularly updated in a structured way. There is very limited public data on resource availability that project developers have access to, and it is often found to be inaccurate or outdated.

¹ Through the subsidy on diesel, which in 2014 totalled 18 bln USD (this includes diesel use for transport)

Finance

The majority of IPPs have difficulties securing appropriate debt financing (i.e. borrowing money without giving up ownership, for example through bank loans). In addition to the technical and capacity issues outlined above, this is for the following reasons:

- Indonesian banks are willing to finance micro-hydropower (MHP) projects, but currently apply the same procedures and requirements as for conventional projects. This means that there is no 'project financing' available from commercial banks, and directly accessible collateral of 100% or more of the project value is required, loan tenors (i.e. time until a loan is due) are relatively short, and interest rates are not fixed.
- Financial Internal Rates of Return (IRR) exceeding 20% as are considered attractive but with costs overruns experienced by many of the projects financed, the actual IRR levels drop below this figure.
- The relatively stringent lending conditions applied by the banks means that obtaining a loan is only possible for companies with strong financial support from larger parent or partner companies.
- Bank loans, if secured, cannot be used for project preparation activities (including feasibility studies) and land acquisition, which means that significant up-front equity (i.e. own money) is required by developers.
- Feed-in tariffs are not structurally adjusted between years². Until recently most FiTs were paid in Indonesian Rupiah (IDR), while cost of initial preparation and equipment is incurred in US dollars (USD) or another foreign currency. Note that as of early 2016 feed-in tariffs for hydropower and solar are defined in USD.

Other market barriers

- Once operational, offtake of power by PLN³ can be unreliable and periods of grid down time or low grid voltage may not permit a feasible connection from the plant to the grid.
- Foreign ownership restrictions for small scale power generation are a strong disincentive to international investment in the sector.
- The administrative processes for permitting and approvals are sometimes overly cumbersome and time consuming.
- Land acquisition can be complex and unpredictable, particularly where it involves individuals rather than formal institutions (such as government).

The result of these barriers is that projects have often been slow to be developed, to reach financing, and to get constructed, and even when operational the performance is often sub-optimal. The challenges in expanding the growth of small scale IPPs can be seen in Figure 1 showing market data for small hydro power plants (collected in North Sumatra in 2012 and again in 2015). Only one project had become operational in 2015 from the 6 that were under construction in 2012. Only 4 new projects were under construction despite a seemingly robust pipeline of developers with proposals.

² Regular adjustment is good practice found in feed-in schemes across the world. Although the tariff stays fixed within a project over its lifetime, the offered tariffs for new projects change over time to reflect changes in inflation or lending conditions.

³ PLN (Perusahaan Listrik Negara) is the government-owned utility with a monopoly on electricity distribution.

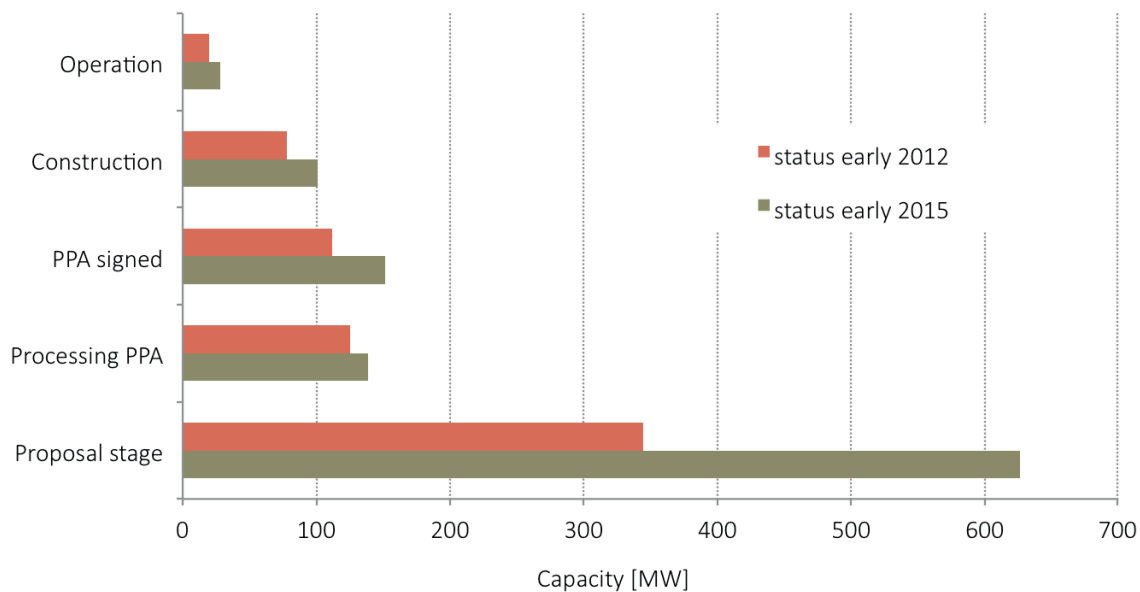


Figure 1: Status of small and medium scale renewable energy IPPs in North Sumatra in early 2012 and early 2015 (source: authors)

In addition to describing the above barriers in more detail, this briefing examines the impact of financing costs on the cost of small-scale renewable electricity generation in Indonesia by looking at a case study of small hydropower. Small hydropower is the most well advanced technology in the country, has seen the most active tariff support from the government of Indonesia in terms of semi-regular revisions, and has the largest targeted capacity according to the public utility PLN (over 1.5 GW in the coming ten years alone).

We make an analysis of investor returns under different assumptions, given the known FiT conditions, and conclude that macro-economic factors, combined with a relatively inflexible FiT design, have made most small-scale hydropower projects financially infeasible over much of 2014 and 2015. The next, and final, briefing in this series shows that financing terms offered by Indonesian commercial banks effectively act to increase FiTs by more than 15% versus ASEAN benchmarks and that government intervention would be economically rational.

Background and context

Renewable energy incentives

The primary policy that has driven the emergence of small-scale renewable energy IPPs in Indonesia is a feed-in tariff for various technologies which has been available since 2009. It offers IPPs of less than 10 MW capacity a guaranteed price of power for a period of up to 20 years. For any individual technology, the tariffs are scaled depending on the location. This is premised on differentiated value to society and greater project developer costs for providing power in less economically developed areas of Indonesia⁴. The differentiation also reflects the higher marginal production cost for producing electricity in remote areas for the public utility.

If we consider a specific technology, such as small hydropower, we see that tariffs have been substantially revised on a number of occasions, most recently to include a move to define tariffs in US dollars (Table 1). As shown later, revisions such as that done in 2014 have been driven by deteriorating macroeconomic conditions that had made many projects unviable. The scheme was changed in 2014 to include a new phased payment approach that offers a high tariff for the first 9 years of operation (slightly longer than the typical period of loans to these projects) followed by a decrease in tariff of approximately 30% after that time (HHP 2014).

Two complementary incentives put in place to encourage renewable energy projects have been considered in the analysis later in this paper (Damuri and Atje 2012; p. 15):

- Accelerated depreciation allowing investments to be depreciated within 2 to 10 years, depending on the type of asset.
- Income tax reductions. Renewable energy projects are eligible for a net income reduction of 5% of the investment value each year, for 6 years.

FiT for medium voltage small-scale hydropower installations ⁵	Year and government regulation
-450 IDR/kWh (equiv. to 5 cents USD/kWh)	2002 PSK Tersebar (equiv. to FiT)
656 to 984 IDR/kWh (equiv. to 6.5 to 9.8 cents USD/kWh)	2009 Regulation No. 31
1,075 to 1,720 IDR/kWh for first 9 years (equiv. to 9.0 to 14.3 cents USD/kWh) 750 to 1,200 IDR/kWh for next 11 years (equiv. to 6.2 to 10 cents USD/kWh)	2014 Regulation No. 22
12 to 19.2 cents USD/kWh for first 9 years; 7.5 to 12 cents USD/kWh for next 11 years	2015 Regulation No. 19

Table 1: Evolution of the base FiT for small-scale hydropower in Indonesia, where 'base' is the FiT paid in Java (source: authors)

⁴ Eg., a hydropower project in the more remote Papua region would receive 1.6 times the FiT paid on the main island of Java.

⁵ Range of values indicates the geographical sensitivity of the FiT

Indonesian banking sector

The Indonesian banking sector is designed as a two-tier banking system with a broad range of commercial banks and rural credit banks. The sector is dominated by ten large commercial banks that together hold 64% of all assets (Bank Indonesia, 2012). Profitability of the sector is high as net interest margins⁶ average approximately 6%, which is the highest among the G20 countries as well all ASEAN countries. This makes Indonesian banks twice as profitable as other ASEAN banks, but it also increases the cost of capital. Despite high interest margins, Indonesian banks can be characterised as highly risk averse and extend little to no long-term credit to clients (Volz et al. 2015).

Some characteristics of Indonesia's financial markets – like a lack of experience and a strong focus on short-term lending and investment – are certainly holding back green investments such as renewable energy. However, it is important to emphasize that green investments are also held back by difficult investment conditions, poor project preparation with corresponding performance risks, and sometimes cumbersome permission procedures (UNEP, 2015). These issues are explored further in the following sections.

⁶ the difference between deposit and lending rates

Capacity, skills and data

Renewable energy generation projects are comparatively new to many private sector parties in Indonesia. While some technologies, such as small hydropower have seen limited private development, others are almost entirely novel in the country. Only after the introduction of feed-in tariffs in 2009 has interest in small scale IPPs grown. Before this introduction the vast majority of small scale projects were designed, engineered, and financed by the public utility PLN. As a result, there is a lack of familiarity with technical and financial aspects of developing and financing small scale renewable energy projects. How this impacts on the sector can be considered by looking at each of the key stakeholders.

Project developers (IPPs)⁷

The technical capacity of the IPPs is found to vary significantly amongst those interviewed. Those supported or sponsored by large established engineering companies did not complain about lack of expertise and stated that procuring the required engineering did not pose a problem for them. For the smaller developers however, for whom the majority were new to the sector, securing the required technical expertise for specific tasks was clearly an issue. All projects without exception had experienced time and cost overruns, which in some cases were significant. This shows a tendency of the developers to underestimate the difficulty and complexity of developing small scale renewable energy projects.

Many of the developers interviewed stated that detailed engineering designs were changed over the course of the construction as a result of onsite conditions encountered (mostly civil components). Sometimes the positioning of civil structures had to be changed due to land acquisitions problems. For small hydro facilities, landslides triggered by excavation works were also a common problem experienced by developers. This shows that the level of detail of feasibility studies is likely lower than it should be, and that subsequent technical due diligence procedures are not given sufficient priority at project preparation stage.

Time overruns are of most concern for developers, because of the effect this has on the project's cash flow and liquidity. Loans from banks are disbursed based on progress in the field and a squeeze on liquidity can result when delays occur while monthly operational costs continue to accrue. Developers reported this as one of the most critical obstacles they faced.

To compound this situation there is a clear lack of awareness of the importance of putting in place proper technical due diligence measures (external consultant) to assess and scrutinize designs at planning stage. The reason for neglecting the step of technical due diligence is more due to lack of awareness rather than economic considerations (the cost of a consultant to carry out this work is largely irrelevant in the context of the overall project cost).

Engineering services for project preparation is almost exclusively procured locally, with few exceptions where international expertise had been mobilized to carry out technical due diligence. Equipment is exclusively imported, predominantly from China and to a lesser extent India and Japan, particularly for larger scale projects. For hydropower schemes below 1 MW there is a tendency to procure locally manufactured equipment. Generators are imported, but there is little data on the reliability of locally developed technology.

⁷ based on Hayton and Nugraha (2013)

Financial institutions

A study on attitudes towards the broader topic of 'green finance' in Indonesia (Volz et al., 2015) provides partial clues as to why finance for renewable energy has been slow to evolve. In that study, almost 70% of banks⁸ interviewed consider green finance a promising business area but only 9% state that their interest in green finance is high enough to consider it as a new area of business. The actual share of green lending in banks' portfolios is found to be negligible and only 6% of banks have a unit that could be considered as responsible for green finance⁹. A survey among 14 Indonesian financial institutions carried out in 2012 posed the question of whether there is "a consensus among financial institutions/commercial banks in your country that there is a need for higher environmental and social standards in lending/investment?" The results were revealing: not a single respondent answered yes (UNEP 2015).

What this means, is that Indonesian commercial banks handle renewable energy project proposals essentially as generic requests for project finance. Nevertheless, due to the perceived risk a slightly higher interest rate is applied. Interviewed banks cited the unpredictable nature of renewable energy projects that rely on natural resources as being the main factor increasing the perceived risk from their perspective. For example, for small hydropower, fluctuating stream flows make accurate future revenue calculation and subsequent financial analysis more speculative and therefore more risky in the eyes of the banks. This is a situation that they are not familiar with (Hayton and Nugraha, 2013).

Loan officers have limited experience in financing RE projects or projects with similar characteristics. Their capacity to accurately assess RE business proposals and financial viability of proposed projects is limited. In a recent survey, 69 out of 87 banks mentioned this barrier as very important or important to their decision on financing RE projects. In interviews, bank officials stated that they lack the human resources to deal with technical studies on the potential for energy production, characteristics of locations, the necessary construction works, and particularities of different technologies. In many cases bankers have a limited understanding of RE technologies and are therefore unwilling to approve financing of RE projects (Wolff et al. 2016).

As banks do not possess in-house in-depth technical knowledge, they hire independent technical consultants to carry out technical assessment of project proposals. Similarly, banks hire consultants to verify construction progress on which they decide fund disbursement once a loan has been agreed. Banks reported that expertise is difficult to procure, and costs of expertise is typically financed by the project developer (and this can be significant, especially in the early stages of a project).

Government agencies and PLN

The only direct involvement of the Ministry for Energy and Mineral Resources (ESDM) with the small scale renewable market is through the setting of the FiTs. The rates for the Indonesian FiTs are understood to be established using PLN's 'electricity base price', which is the marginal production cost that would be incurred by PLN to produce electricity at the location of the renewable energy project. The calculated electricity base price is also supplemented with a stipulated return for investors, set by the regulators (Hasan and Wahjosudibjo, 2014). However in practice, there is little public information provided on tariff formation, little transparent stakeholder engagement and no regular or scheduled timeframe for revising existing feed-in tariffs. As a result, large variations¹⁰ in project returns are observed over time (Figure 2), with small hydropower showing returns to investors of anywhere between 7 and 48% over the last five years. Good practice says that more transparency in the calculation methodology and foreseen adjustments of feed-in tariffs can increase investor confidence. Regular reviews of tariffs, for example annually, can allow changing macroeconomic conditions and technology costs to be accounted for.

⁸ Total sample size 68 banks

⁹ and often this in fact refers to the corporate social responsibility (CSR) unit, rather than dedicated green finance

¹⁰ Variations are mainly due to tariff revisions over time, changing lending conditions, and changing exchange rates

Access to accurate resource data represents one of the most problematic aspects of project preparation. Resource figures quoted by ESDM and many other agencies are unreferenced and when traced, often date to very old studies that would now be out of date¹¹. In addition, figures are typically found for aggregate national renewable resources, but not for provincial or local data, which is vital. When local data is available, it tends to conflict with the national figures. For hydropower, this is particularly challenging, because of the difficulty of collecting own data and the possibility of changes to flow rates due to future developments along a river. Although the Government does have gauging stations installed in many rivers, the quality of the data kept by the authorities overall was reported as being poor with many gauging stations in a state of disrepair and therefore not able to provide qualitative data of any use (Hayton and Nugraha, 2013).

Indonesia has seen long periods of underinvestment in infrastructure (ADB, 2015) and IPPs do not have good information on grid strength and availability. Indonesia's underdeveloped and dispersed grid infrastructure (which in reality consists of hundreds of separate grids), spread out resources across a large archipelago, and poor interconnection make the integration of renewable electricity generation a challenge. In general, grid planning and investment by PLN have been insufficient and transmission constraints have emerged related to the geographical mismatch between power supply and demand. In many regions where small scale IPPs are located, the distribution network may require upgrading the local low-voltage grid and local power system operating and balancing procedures may require adjustment in the face of increased capacities for variable power (IEA, 2015). As a result small projects are often unable to export all of the power they could generate, causing them to lose revenue. For more on this see the section on 'other market barriers'.

¹¹ The technical potential for hydropower in Indonesia of 75 GW can be traced back to a JICA study of the 1980s, and although it might be accurate there are no recent figures in the public domain on the economic potential.

Financial barriers

Developers interviewed as part of the MitigationMomentum project, typically not connected to these large players, cited mobilizing finance as the main hurdle they faced in developing their projects (Hayton and Nugraha, 2013). This is confirmed by Wolff et al. (2016) who observe a mismatch between the financial instruments offered by domestic financial institutions and the financing needs of RE project developers; in particular with respect to the availability of adequate debt financing, equity capital, and risk mitigation instruments.

As noted above, banks don't treat renewable energy proposals different from conventional asset finance. This means that there is no provision of 'project financing' as it might be experienced elsewhere; i.e. loan structures that rely primarily on the project's cash flow for repayment, with the project's assets and rights held as collateral, but not the non-related assets of the investors contributing equity. Project finance is an essential tool for the energy sector in markets across the globe, as private developers can fund major projects off balance sheet and without large constraints on their collateral. To qualify for receiving a loan Indonesian banks use relatively stringent criteria: borrowers must be able to provide collateral with a value at least equal to the loan amount in the form of firm assets such as property or cash deposits (even more strict requirements are known to exist). Amongst interviewed banks, all reported that investments in their small-scale renewables portfolio were experiencing time and cost overruns, some of these significant. As a result, one bank had imposed an additional requirement on lenders, to make 20 - 30% of the total borrowed amount available in a deposit account with the bank as a form of additional guarantee. The end result is that these collateral requirements often disqualify small-scale developers from participating in the sector and make it significantly more difficult for established players to justify additional renewables projects.

The final lending conditions provided by the banks are therefore similar to conventional commercial lending practices for projects rather than specific project finance conditions, barring the additional debt premium (typically stated as 1 to 2%) applied for renewable energy investments. Table 2 illustrates typical lending terms to small hydropower projects - the only technology with substantial experience - based on feedback from the project developers interviewed.

Name	Reported values
Interest rate	12 - 13% (variable)
Loan term	5 - 7 years
Grace period	1 - 2 years
Maximum loan to equity ratio	70 : 30
Cash sweep	Not common

Table 2: Reported debt terms for small hydropower projects in Indonesia (Hayton and Nugraha 2013)

In conclusion, whilst banks are willing to participate in the sector, the companies able to secure loans under the current conditions are largely limited to those who would anyway be able to mobilise the capital from their own assets (balance sheet) and use it as equity if truly required. Smaller firms with limited financial resources would struggle to secure finance from a commercial bank under current lending conditions, which introduces a barrier to entrance for suitable actors and inhibit sector growth. Moreover, the negative experiences of time and cost overruns observed to date will make it even more difficult for fledgling companies (i.e. without lending history) in the future (Hayton and Nugraha, 2013). It is also important to note that the interest rates applied are variable over the life of the loan, something that adds additional risk for project developers, particularly given the variability of

interest rates in the country. In addition, the static definition of most FiTs in Indonesian rupiah in previous years has also created challenges over time. These issues are briefly explored in the following section.

Changing macroeconomic conditions

Two key characteristics of the Indonesian FiT play an important role in determining viability of projects. First, the fact that it is not adjusted between years to account for changes in inflation or lending conditions. Second, is that, until recently, most FiTs have been paid in Indonesian Rupiah, while most of the initial equipment and cost is incurred in US dollars or another international currency.

The first factor means that project developers are exposed to the risk of changing local conditions, as higher rates of inflation reduce real returns over time and changing debt payments must be met by project revenues. The second factor means that planned or potential projects can become non-viable due to exchange rate changes¹².

Figure 2 illustrates how changing interest rates and exchange rates had substantially reduced returns from hydropower projects from early 2013 until late 2014. That change to the FiT in 2014 had an obvious and direct impact on returns, making the considered nominal project attractive. At the same time, the most recent change to the FiT in 2015 with a payment pegged in US dollars has increased expected returns to very high levels. To understand something of the rationale behind this large increase in FiTs, it is important to realise that most projects will not achieve their design assumptions. The evidence suggests that the vast majority of projects in Indonesia are optimistic in their calculations and financial plans.

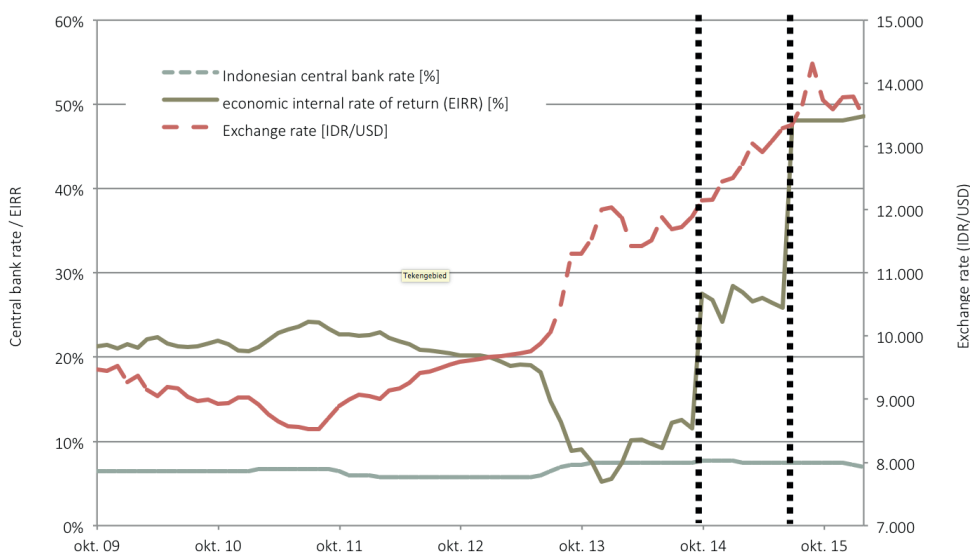


Figure 2: Indonesian central bank interest rates [left axis], IDR exchange rate [left axis] and resulting economic internal rate of return (EIRR) [right axis] for a nominal small hydropower project from Oct 2009 to Feb 2016 (source: authors based on data from OANDA¹³ and BI 2015)

The following section takes the case study of a nominal small hydropower project and introduces uncertainty into the design assumptions to observe the impact on expected returns. It also contrasts the ‘brute force’ approach of very high FiTs with other possible interventions that could improve project design and lending rates.

¹² No currency swap is commercially available for Indonesian Rupiah, certainly not at the scale of these projects. The only way to hedge is to find a second investment with opposite currency exposure, and then package the two. This is not a very practical option.

¹³ www.oanda.com

Other market barriers

Foreign direct investment (FDI) is an important driver behind ownership of IPPs and their ability to invest in renewable power capacity. On the whole, FDI has played an important role in the development of most East Asian economies. Indonesia, however, is an exception and FDI inflows have been significantly lower than in most other countries of the region: 60.6 trillion IDR in 2013, accounting for only 0.88% of GDP over the period 1981-2013. This is much lower than the average share of 2.81% of GDP for all developing East Asian and Pacific countries. Even if only the years 2004-2013 are considered, Indonesia's average FDI-to-GDP-ratio of 1.9% is considerably lower than that of Thailand (3.2%), Malaysia (3.6%), China (4.2%), Vietnam (5.9%), or all developing East Asia and Pacific countries (3.9%) (UNEP, 2015).

No.	Business Fields	KBLI	PR 39/2014
ENERGY AND MINERAL RESOURCES			
1.	Power Plant: - Power Plant < 1 MW	35101	100% Local Capital (DDI)
	- Power Plant > 10 MW	35101	Foreign Capital Ownership Maximum 95% (Maximum 100% for the purpose of Public Private Partnership/KPS during concession period)
2.	Power Plant Transmission	35102	Foreign Capital Ownership Maximum 95% (Maximum 100% for the purpose of Public Private Partnership/KPS during concession period)
3.	Electricity Distribution	35103	Foreign Capital Ownership Maximum 95% (Maximum 100% for the purpose of Public Private Partnership/KPS during concession period)
4.	Small-scale Power Plant (1-10 MW)	35101	Foreign Capital Ownership Maximum 49%
5.	Construction and Installation of Electric Power: - Installation of Electric Power Utilization	43211	100% Local Capital (DDI)
6.	Biomass Pellet Producing Industry for Energy	16295	Partnership
7.	Electric Power Installation Examination and Testing	71204	100% Local Capital (DDI)

Figure 3: Foreign ownership restrictions for power generation based on presidential regulation 39/2014 (source: Indriani, 2016)

The Indonesian government generally encourages FDI, however, for certain industries foreign ownership is restricted to between 45% to 95% if on an "Investment Negative List" (Figure 3). For small scale IPPs (i.e. of less than 10 MW capacity), the limit on foreign ownership is 49%. This has reportedly discouraged investment in these smaller facilities (UNEP 2015).

The government's role in private sector energy projects includes issuing the necessary approvals and permits for the various project elements. ESDM issue the energy generation permit (IUKU) upon completion of the project. Meanwhile district government is responsible for issuing the appropriate business license, land use permit and approving the environmental impact management & mitigation plan. District authorities also assist in facilitating land acquisition with local communities. The general consensus from the IPPs was that local governments were constructive and supportive of their initiatives and whilst the administrative process was sometimes overly cumbersome and time consuming, overall they did not perceive this as being a major obstacle. Moreover recent streamlining measures implemented at district government level whereby a "single window" permit issuing authority handles multiple permit requests was noted as having a significant effect on easing the administrative burden (Hayton and Nugraha 2013). That being said, the experiences of project developers can vary greatly between provinces and districts. In addition, some investors also complained that permissions are often given to local brokers with no experience in project development, who either do not develop the resources in a timely way or try to on-sell the rights at a high price.

Once operational, the most common problem experienced is the limited availability of the PLN grid to receive the power generated. Small and medium size renewable power is very suitable for providing secure energy access in remote locations, but it is exactly this type of location where the PLN grid tends to experience problems and the frequency of grid down time is at its highest. Moreover, even when the PLN grid is operating, IPPs may have difficulties selling their power and frequent tripping as a result of unstable grid voltage remains a common occurrence. One developer reported their average monthly down time as a result of restricted grid access was 20%. Regarding administrative issues, feedback from all operational IPPs was that the meter reading and payment procedure applied from PLN was satisfactory. There were no serious complaints that PLN deliberately delayed payments or attempted to avoid their financial obligations (Hayton and Nugraha 2013).

The most complex technical aspect of project preparation is that of land acquisition particularly where it involves individuals rather than formal institutions (such as government). Once again the situation encountered by IPPs can vary enormously from one region to another where location specific cultural and economic factors come into play. Where land is state owned, local government are entitled to issue long-term lease concessions to developers. These are usually for 20-25 years and extendable at the end of the lease term. Where plans encroach into areas of protected forest, approval from the respective ministry is required prior to concessions being awarded. One IPP had even successfully negotiated permission to construct a project within a National Park area highlighting the fact that given the right approach is adopted, obtaining the necessary permits etc. can be achieved even in difficult environments. Although often lengthy, land acquisition procedures and costs via government authorities are at least relatively predictable (Hayton and Nugraha 2013).

The more complex and unpredictable land acquisition arrangements are usually where privately owned land is involved. Private landowners often attempt to maximise their return by demanding unrealistic and irrational sums for land if they know it has a strategic value for the developer. This happens even where land is non-productive and of relatively low value (Hayton and Nugraha 2013).

Impacts of barriers – a case study

In this section we explore what the existing incentives and financing conditions mean for project developers, as well as how changing macro-economic conditions and project risks can impact returns. This is illustrated by looking at a fictional small hydropower project being developed in mid-2015. As seen in Figure 2, similar projects at that time had high returns on investment, even on Java where the minimum feed-in tariff is offered. Yet the feed-in tariff, and therefore returns, were substantially increased late that year. The analysis in this chapter hints at why this might have taken place - i.e. to guarantee high returns despite project risks - but also that other interventions, such as reducing project risk and improving financing terms might have been more economically efficient. That theme is taken up in the next brief in this series.

Small-scale hydropower IPPs

As noted, investors in renewable energy in Indonesia are often firms with limited or no track record in renewable energy, but with a drive to expand their business into new sectors. Given the high debt rates in the country, it can be expected that these investors are looking for substantial returns before a project becomes attractive. A figure often heard is that equity IRRs should be more than 20% to attract investors; however, as we shall see, even substantially higher figures can be risky if the underlying design and assumptions are flawed¹⁴.

The starting point for the analysis of small-hydropower projects in Indonesia is to consider a nominal 1 MW project in mid-2015 that receives the base FiT, which was introduced in 2014. Based on averages of six different real projects the performance and investment characteristics of such a facility are summarised in Table 3.

Aspect	Value	Comments
Total investment cost	1,500 USD/kW	
Capacity factor	70%	
Total O&M costs	5% of initial investment / year	Assumed to be adjusted according to current inflation rates

Table 3: Nominal performance and investment characteristics of small-scale hydropower in Indonesia (Hayton 2013)

Together with the previous assumptions on debt terms (Table 2), the revised 2014 FiT and the available fiscal incentives such as accelerated depreciation, a nominal project is found to be attractive with an EIRR of roughly 27%¹⁵ (Figure 4). It is important to note, that it is only the 2014 change in FiT that makes this type of return possible, and in the next section we consider the recent history that led to this increase.

Project risk and expected returns

As noted earlier, the experiences with small hydropower in Indonesia to date have shown that developers consistently over estimate their achievable capacity factors (whether by intent or because of poor flow data) and nearly always under estimate system costs. These two factors alone can greatly impact the final return that a project will see. In addition, many projects in remote areas (as hydropower projects often are) are connected to weaker electricity grids and are unable to export their full capacity for sale. This directly reduces project revenues and is largely out of the hands of the developer.

¹⁴ As a finance expert put it colloquially "poor design can still mess up a project that looks good on paper"

¹⁵ even though equity returns in later years are largely absorbed by O&M costs that are assumed to be indexed with current consumer inflation rates in the absence of more accurate data

To simulate these impacts on the previously considered nominal project, a basic Monte Carlo analysis was made for the four factors in Table 4 using Palisade’s @Risk software¹⁶. The results in Figure 5 show how easily any optimism in key project assumptions can impact on final returns. The available data is insufficient to confirm the assumed distributions in Table 3. Yet the analysis gives a sense of how banks, who have previously observed large divergences in project outcomes versus design, are likely to view any new project. Certainly, the high levels of technical risk that banks have been exposed to from initial projects now contributes to their unwillingness to lend. Only by improving project designs and assumptions, as well as demonstrating success in a future generation of hydropower projects, can this risk perception be reduced.

Simulated barrier	Varied factor	Probability distribution ¹⁷
Technical	Project cost	Varied between 1,500 and 1,800 USD/kW
Technical	Capacity factor	Varied between 70 and 55%
Financial	Variable interest rate	Between 0 to 2% additional interest rate experienced
Operational	Project uptime (proxy for grid constraints reducing electricity exports)	Varied between 100 and 80%

Table 4: Assumed project risks

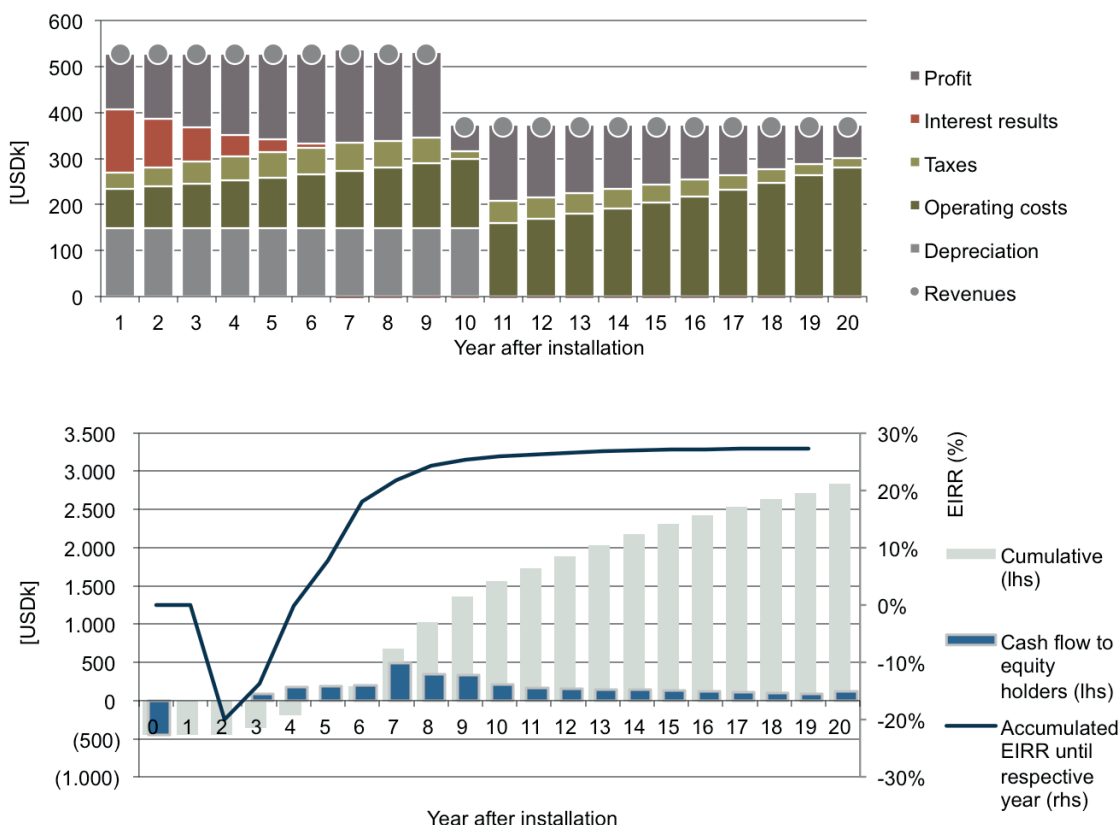


Figure 4: Cost structure (top) and cash flows to equity investors (bottom) for a nominal 1 MW hydropower plant in Java, Indonesia in mid-2015 (source: authors)

¹⁶ <http://www.palisade.com/risk/>

¹⁷ Each factor was modelled as a simple linear distribution, with the nominal figure most likely and the other bound with a probability of zero. Realistically, it is assumed that developers are always optimistic in their assumptions, with only downside risk present.

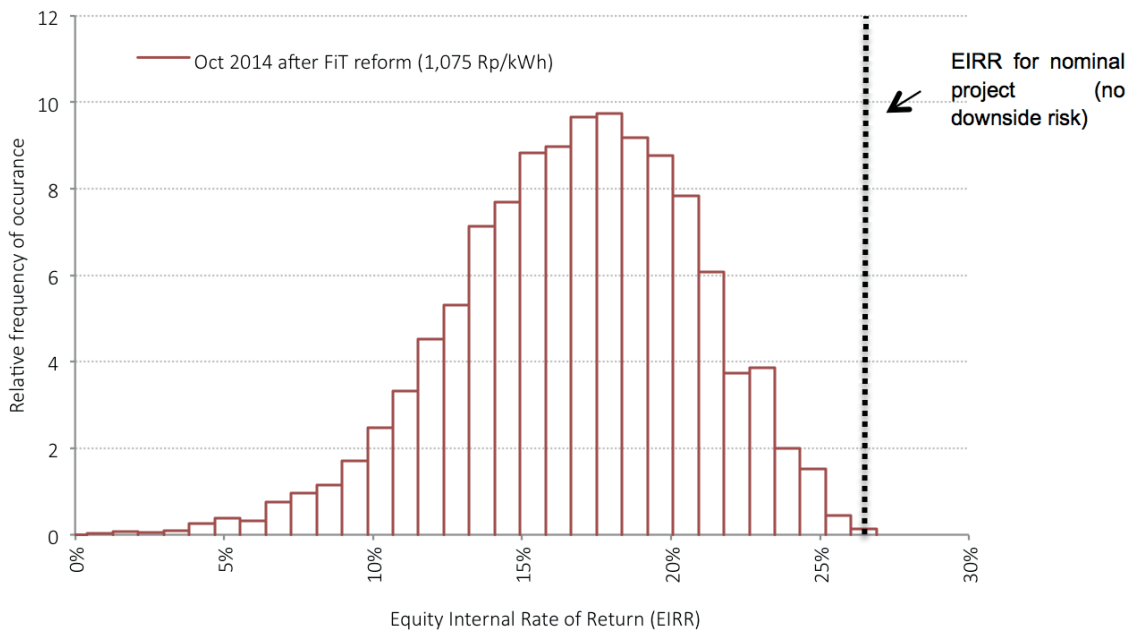


Figure 5: Expected equity IRR based on uncertainty in project costs, capacity factor and uptime (source: authors)

The next briefing expands on what can be done to overcome the observed barriers and improve the viability of projects, as well as the economic efficiency of such approaches compared to simply raising the feed in tariff as done in late 2015.

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