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The case for small and medium scale renewable energy investments in Indonesia

Policy Brief

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Abstract

Small and medium scale renewable energy generation can have large economic, strategic, environmental and development benefits for Indonesia. This briefing, the first in a series of three, describes the rationale for expanding this type of power generation. The second briefing focuses on the barriers currently preventing small and medium scale renewable energy development. The final paper proposes policy interventions and support that could overcome these barriers and create a more active sector.

This briefing note makes the case for additional interventions to incentivise and support smaller scale renewable energy projects, focused around the five key areas: capacity expansion and diversification, Subsidy reduction and state budget stability, electrification of remote areas, climate change mitigation, and social and environmental benefits.

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Introduction and summary

Indonesia faces multiple large challenges in its electricity system. Economic growth and increasing energy access is projected to increase power demand by roughly 8% annually in the period 2015-2025, and significant capacity additions will be needed for production to keep up with demand (PLN, 2015). Indonesia also needs new capacity to reduce its dependence on oil based (diesel) power generation, to reduce exposure to future fuel import costs and the large electricity subsidy that is currently provided.[1] Furthermore, Indonesia has communicated international ambitions with regard to reducing greenhouse gas emissions and increasing the share of new and renewable energy technologies (GoI, 2014; 2015). These developments require large investments in new generation capacity in the coming years, with potentially important consequences for the state budget. Independent power producers (IPPs), producing power from renewable sources, can make important contributions to resolving each of these challenges.

1. **Capacity expansion and diversification;** a key objective of the Government of Indonesia is to reduce dependence on oil by expanding the use of gas and renewable energy resources. Small-scale renewables developed by private intendent power producers (IPPs) can add significant capacity to the grid and help shift towards domestic renewable sources of energy.
2. **Subsidy reduction and state budgets;** In the majority of provinces, the power provided by IPPs can reduce subsidy costs for electricity, because the tariffs paid for small scale renewable energy are substantially lower than current generation costs. IPPs also alleviate the pressure on state budgets and the national utility PLN. Historically most investments in the power system have been made by the Indonesian government, through the state-owned utility PLN[2] and its subsidiaries.
3. **Distributed power and electrification;** technologies for renewable electricity production such as solar PV, mini hydro, and biomass conversion are suitable for providing energy access in remote and rural areas. Such technologies can also provide power in provinces without local fossil fuel resources (transport in small volumes is costly) or where their small power needs would make fossil based generation impractical or expensive.
4. **Climate change mitigation;** renewable energy technologies help to reduce greenhouse gas emissions in line with the Government of Indonesia's policy objectives and its intended nationally determined contribution (INDC) submitted to the Paris climate negotiations in 2015.
5. **Social and environmental benefits;** renewable energy installations can offer other social and environmental benefits to communities such as job creation and reducing air pollution.

While there are many benefits of smaller scale renewable IPPs to Indonesia, successfully stimulating the sector over the coming years remains a huge task. Figure 1 illustrates the current installed capacities of four key technologies for smaller scale power generation: small hydro, biomass, solar photovoltaic (PV), and wind. The figure also shows the capacities of these technologies that are forecast to be installed by 2024 according to the most recent public medium-term investment plan (RUPTL) of PLN, as well as an estimate from the National Energy Council (DEN) of what capacity is needed to meet the National Energy Policy (KEN) that was enacted in 2014. What is not shown, but should be understood, is that growth in these technologies of the last 5 years has been comparatively slow and well below the pace that will be required to meet future ambitions for these technologies.

[1] See the webpage of the Global Subsidies Initiative for excellent updates and reflection on changing subsidies in Indonesia https://www.iisd.org/gsi/countries/indonesia
[2] Two aspects play a role here: capital requirements for investments and the subsidy requirements to compensate PLN for selling electricity below generating costs.

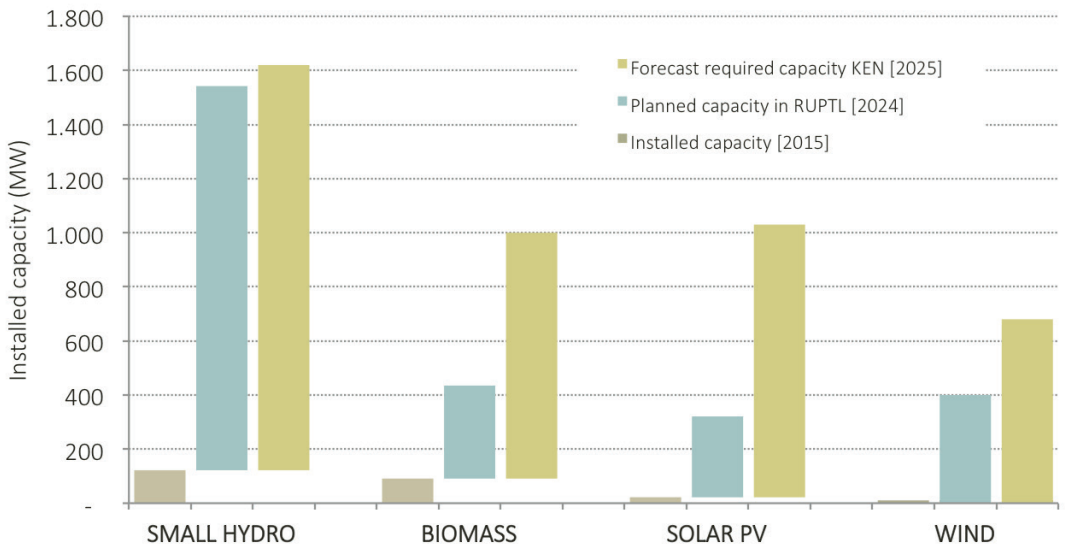

Figure 1: Current, planned and forecast capacities of four small and medium scale renewable energy technologies. Note that current capacities include captive biomass plants and distributed solar (source: authors from PWC 2015; PLN 2015; DEN 2015)

This briefing note makes the case for additional interventions to incentivise and support smaller scale renewable energy projects, focused around the five key areas of benefit listed above. The two upcoming policy briefs will describe the observed barriers in the sector as well as discuss measures to overcome these.

BOX 1: What are IPPS for small and medium scale renewable energy generation?

An independent power producer (IPP) is a non-government producer of electricity. IPPs can be private enterprises (businesses) that produce power as a commercial activity, or collective organizations (e.g. communities) that may engage in energy production for other reasons, such as improved energy access. This brief focuses on IPPs who produce electricity and feed (part of) this into a centralized electricity grid (i.e. grid connected) to be used by consumers elsewhere; in particular those IPPs that are of less than 10 MW in capacity and are therefore eligible for a series of feed-in tariffs that have been announced over recent year. Nonetheless, in rural and more remote parts of Indonesia, off-grid IPPs can also offer significant improvements to the energy system, while noting that these systems would not be eligible for feed-in tariffs in most instances.

Indonesia has one of the world's largest potentials of renewable energy resources. For many regions and technologies only a small fraction (in the order of 1%) of this resource has been exploited (Cameron et al. 2014). The opportunities for small and medium scale facilities up to 10 MW are therefore immense, particularly in regards to hydropower, biomass and solar, each of which could support gigawatts of as yet untapped capacity.

Capacity expansion and diversification

Indonesia experiences rapid growth in demand for electricity to power its economy and the ambition to improve access to electricity to drive development (mainly in remote areas). To these ends, growing the power sector and a continued roll-out of electricity connections, are central objectives of the Indonesian government for the coming years. The Government of Indonesia recently announced plans for 35 GW of capacity expansion by 2019 to cope with electricity shortages, to meet growing demand, and to further reduce oil-based power generation. In addition, annual demand growth is expected to continue at rates approaching 8% in the foreseeable future (Enerdata, 2015; IEA, 2015a).

The cornerstone of Indonesia's planned electricity generation expansion is a significant increase the installed capacity of coal power-fired power stations. This is a continuation of an existing trend, where the contribution of coal plants to electricity generation has increased from roughly 40%, to almost 55% in the last 5 years, corresponding to a significant decrease in the share of gas and oil based generation (see Figure 2). This expansion represents the first step in Indonesia's ambitions for the power sector. The National Energy Council projects that demand for electricity will more than triple by 2030, requiring an additional 150 GW of power generation capacity in the coming 15 years (DEN 2015).

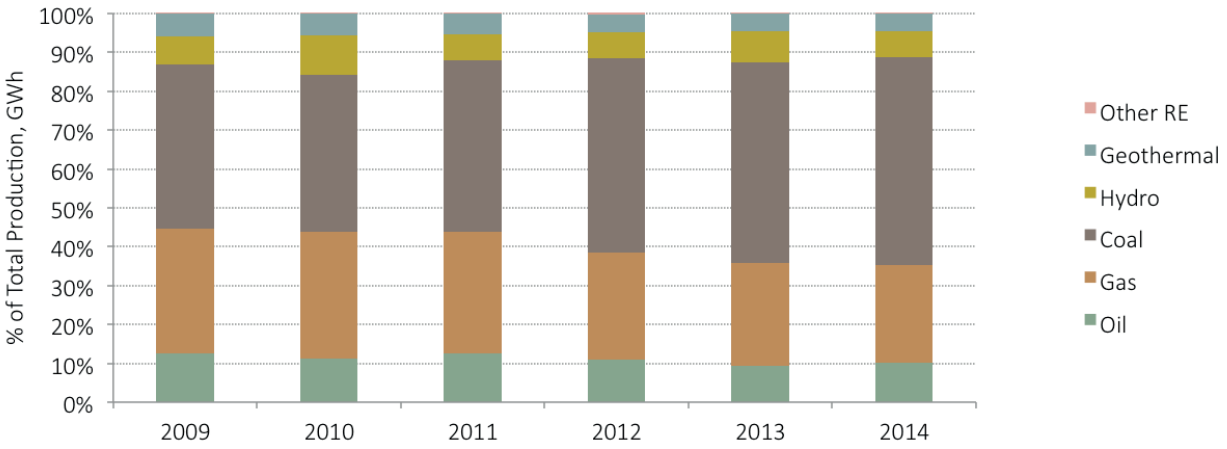

Figure 2: Electricity generation by fuel/source in Indonesia in GWh (source: ESDM 2015)

The National Energy Policy (KEN; enacted in 2014 under regulation 79/2014) requires that the share of renewable energy in the primary energy consumption[3] increases to 23% in 2025 from an estimated 6% today (Figure 3). To reach the targets, the use of gas is expected to more than double, use of coal would triple, and renewables should grow more than eleven-fold within ten years. In the electricity sector, the projections released alongside the KEN suggest that renewables will need to grow to over 35% of electricity[4] provided and coal should contribute slightly less than 50% (DEN, 2015).

[3] Primary energy consumption measures the total energy demand of a country. It covers consumption of the energy sector itself, losses during transformation (for example, from oil or gas into electricity) and distribution of energy, and the final consumption by end users (Eurostat 2014).

[4] Primary energy consumption comprises power, fuel, and heating/cooling. Increasing biodiesel use beyond 20% is technically difficult for existing vehicles and heating/cooling demand is limited, so much of the 23% will need to come from power generation.

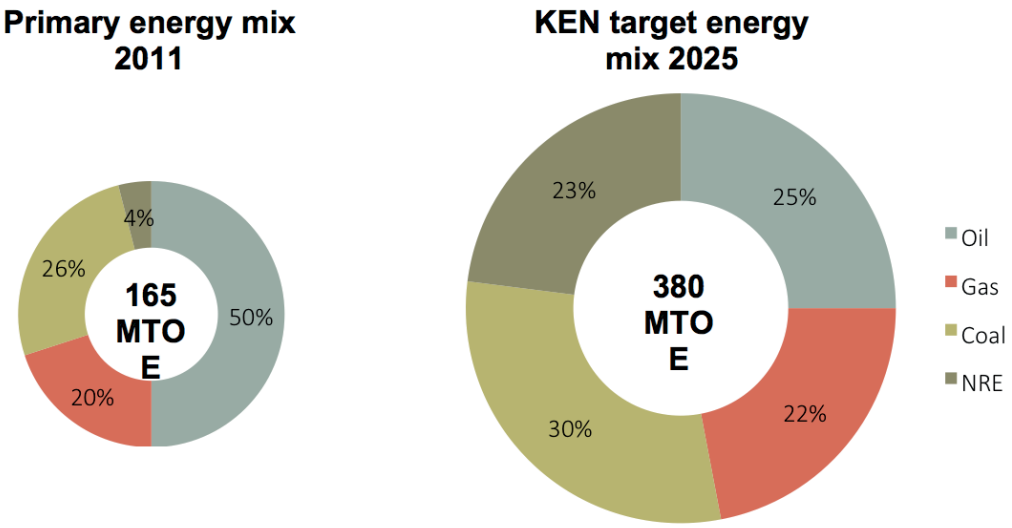

Figure 3: Current and projected primary energy consumption mix; where NRE is 'new and renewable energy' (source: ADB 2015)

However, the short to medium term planned expansion of coal presents some challenges to meeting the KEN. The medium term planning from PLN in their annually revised 'RUPTL' shows that, based on current planned power projects and growth, coal would grow to over 65% of electricity and renewables would contribute roughly 15% (PLN, 2015), far less than the KEN modelling requires. To meet the KEN two things are needed: an enormous increase in renewables over the coming decade plus significantly less coal consumption. Put very simply, for every MW of new coal capacity built in the country, more than 2 MW of renewable generation should be built (Figure 4). Based on planned projects, that ratio will be roughly inverted.

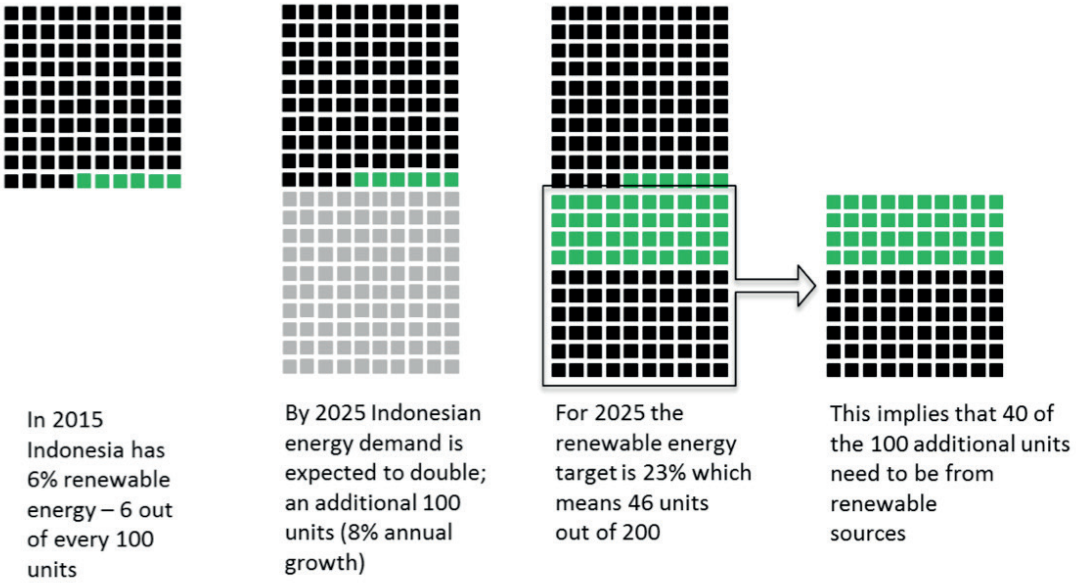

Figure 4: Simple illustration of KEN new and renewable energy expansion requirements (source: Cameron and van Tilburg 2016)

This then is the first clear argument to expand and support the development of smaller scale renewable energy generation. Indonesia requires a huge expansion in installed capacity and, at the same time, it is clear that the majority of this expansion needs to come from renewable energy sources if the KEN is to be met in 2025, or even to meet the lower levels of renewables forecast in the RUPTL.

Subsidy reduction and state budgets

Electricity prices paid by end-users are regulated under Presidential Decree No.8/2011. There are more than 30 tariff classes organised into six groups: social, household, business, industry, government and special services (PwC, 2013). The average selling price in 2014 was 818 Rp/kWh (approx. 7 US cents/kWh) while the cost of production was 1,297 Rp/kWh (11 US cents). The shortfall is funded through a government subsidy that amounted to approx. US$7.3 billion in 2014, or almost 34% of total operating revenue for the public utility PLN (Figure 5). There is therefore a strong focus from the Government of Indonesia to reduce generation costs and thereby subsidy.

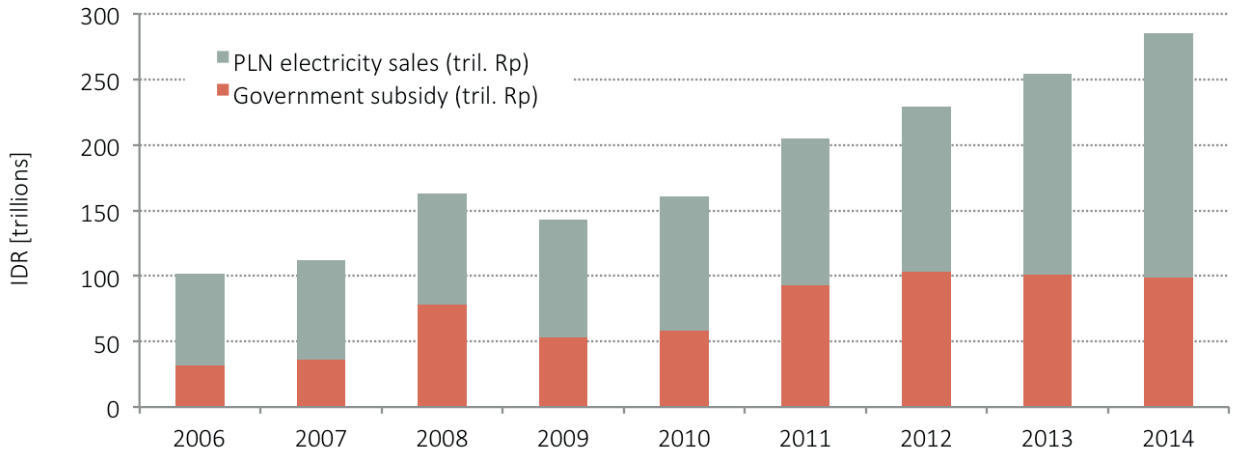

Figure 5: Government electricity subsidy to PLN versus revenue from sales of electricity (source: authors from PLN 2007 to 2015)

Small and medium scale renewable energy generation is found to offer substantial opportunities for subsidy reduction across the majority of regions in Indonesia. Figure 6 shows that for most renewable technologies outside of Java, small scale IPPs would reduce PLN's cost of supply. The feed-in tariffs offered to IPPs for renewables based power generation (fixed for 20 years) also help to hedge against the possibility of higher fuel costs in the future, a trend that may re-exert itself over the coming decades.

As noted earlier, growing the Indonesian power system is a central objective in Indonesia. A key challenge for the sector will be to mobilise investments in power generation, transmission, and distribution to meet the planned growth. The public utility PLN estimates that 130 bln USD of investments are required over the coming ten years (Figure 7) and that it will require over $40 billion in own investments by 2019 to cover its costs for generation, transmission/substations, and distribution, in addition to the USD 43.4 billion expected from the private sector to cover IPP investments. This far exceeds PLN's actual capital expenditure over recent years, and these expenditures have often required sovereign guarantees from the Ministry of Finance (ADB, 2015).

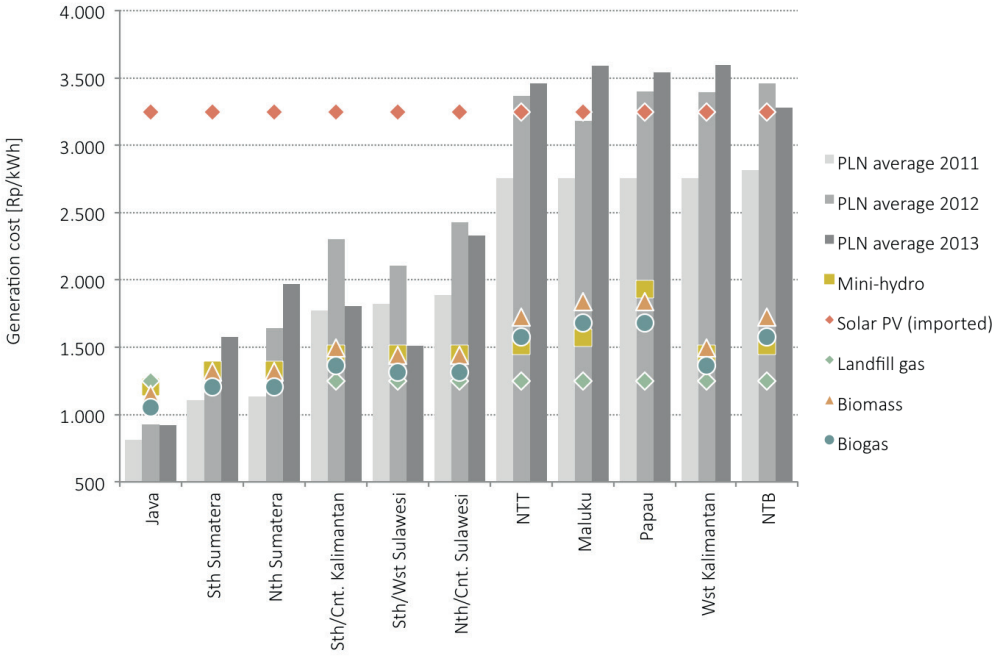

Figure 6: Average PLN generation cost by region versus current small scale renewable energy feed-in tariffs (source: authors from PLN 2012, 2013, 2014; ESDM 2013a, 2013b, 2014, 2015)

It is clear that continuing according to business-as-usual practices will not be enough to meet the enormous financial demands of the energy sector over the medium term. The needs of Indonesia's power system cannot be supplied solely through state or state-owned-enterprise investments. PLN has secured some external funding from the state budget and committed loans, but still estimates that its funding gap over just the next four years is about Rp 392 trillion, or $30.2 billion (ADB, 2015). We calculate that the planned capacity of small scale renewables announced by PLN in their RUTPL could contribute more than USD 2 billion by 2019 if these projects can be realised and developed by IPPs (PLN, 2015). In total over the coming decade, the RUPTL forecasts up to approximately USD 6 billion in small scale renewable energy projects. It will be vital that these are successful, and so far as possible developed by private parties, to reduce the burden on PLN and meet Indonesia's electricity growth targets.

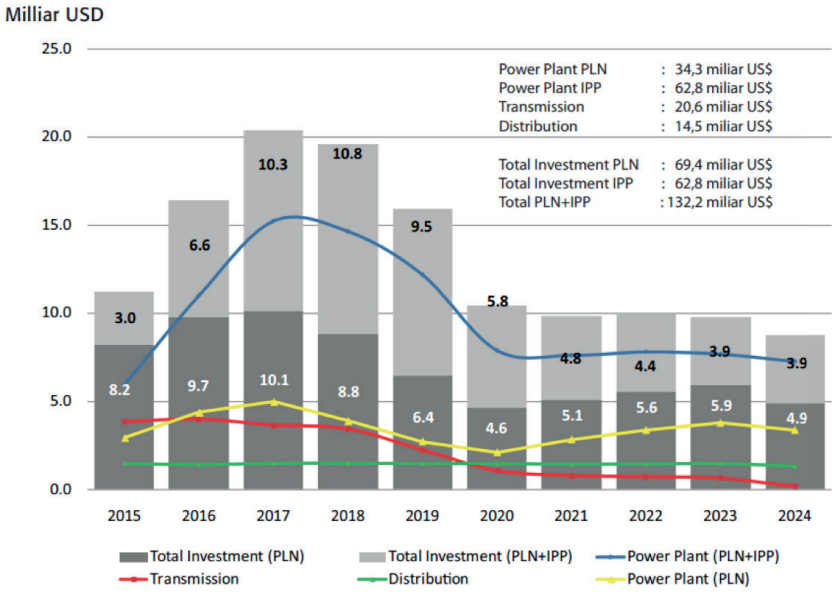

Figure 7: Estimated power sector investment requirement until 2024 – where 'PLN' is investment by the national utility and 'IPP' is investment by private independent power producers (source: PLN 2015)

Distributed power and electrification

Smaller-scale schemes are well suited to a country where more than 200 million people live across almost a 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 support through oil subsidies.

On a national level, electrification ratio reached 80% in 2013, an increase from the previous year's 76%. Despite this increase, this ratio is still below the average of other countries in Asia, which was close to 100% in countries such as Malaysia, Thailand, Vietnam, Singapore and Brunei. By 2022, the country is expected to have approximately 98% electrification ratio across the country, with IPPs taking a significant part of this growth (EY, 2015).

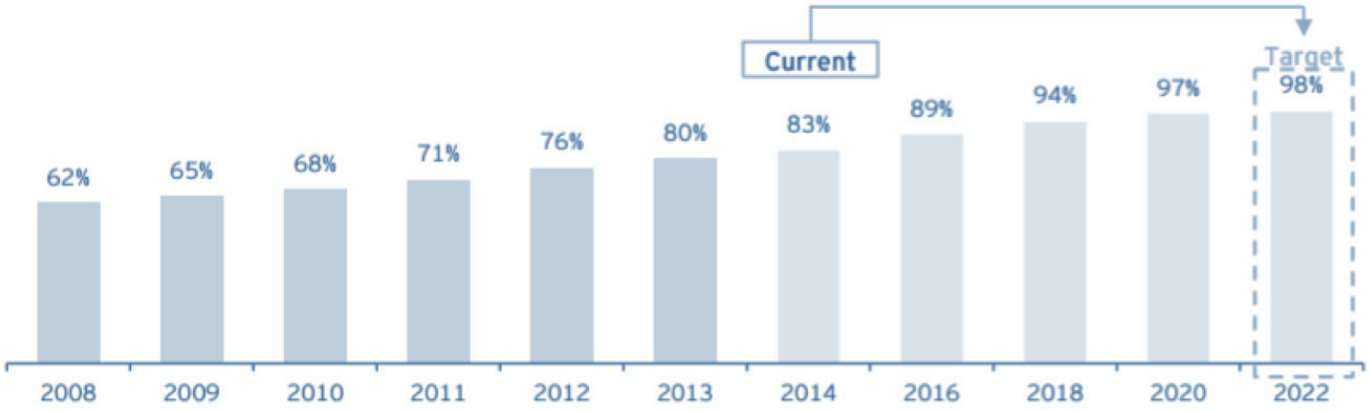

Figure 8: Indonesia's projected electrification ratio (source: EY 2015)

Low calorific value coal will be an important part of the government's electrification strategy. Indonesia has abundant coal reserves, especially of low calorific value (CV) (below 5,100 kcal/kg), which are less attractive to the export market. These coal resources are located mainly in South Sumatra and have typically been utilized for local electricity generation. However, these reserves are unlikely to be effective in providing electrification in many regions of Indonesia for two main reasons. First, Indonesia faces high transportation costs in shipping coal across the country (EY, 2015). While planned transmission infrastructure may help provide additional supply in areas of high demand such as Java, it will not be effective in providing power in more remote regions where electrification is most challenging. Second, the inherent limits in providing coal-based power efficiently at smaller scales means that it will not be useful to establish small coal based generation in many provinces or regions due to the low levels of demand and lack/cost of grid infrastructure. Figure 9 gives a sense of the challenge, where those regions with lowest levels of electrification are also those with few fossil resources and little need for large scale centralised power generation. In those instances, locally available and/or distributed power generation solutions, of the type offered by small scale renewables, can provide huge benefits for communities.

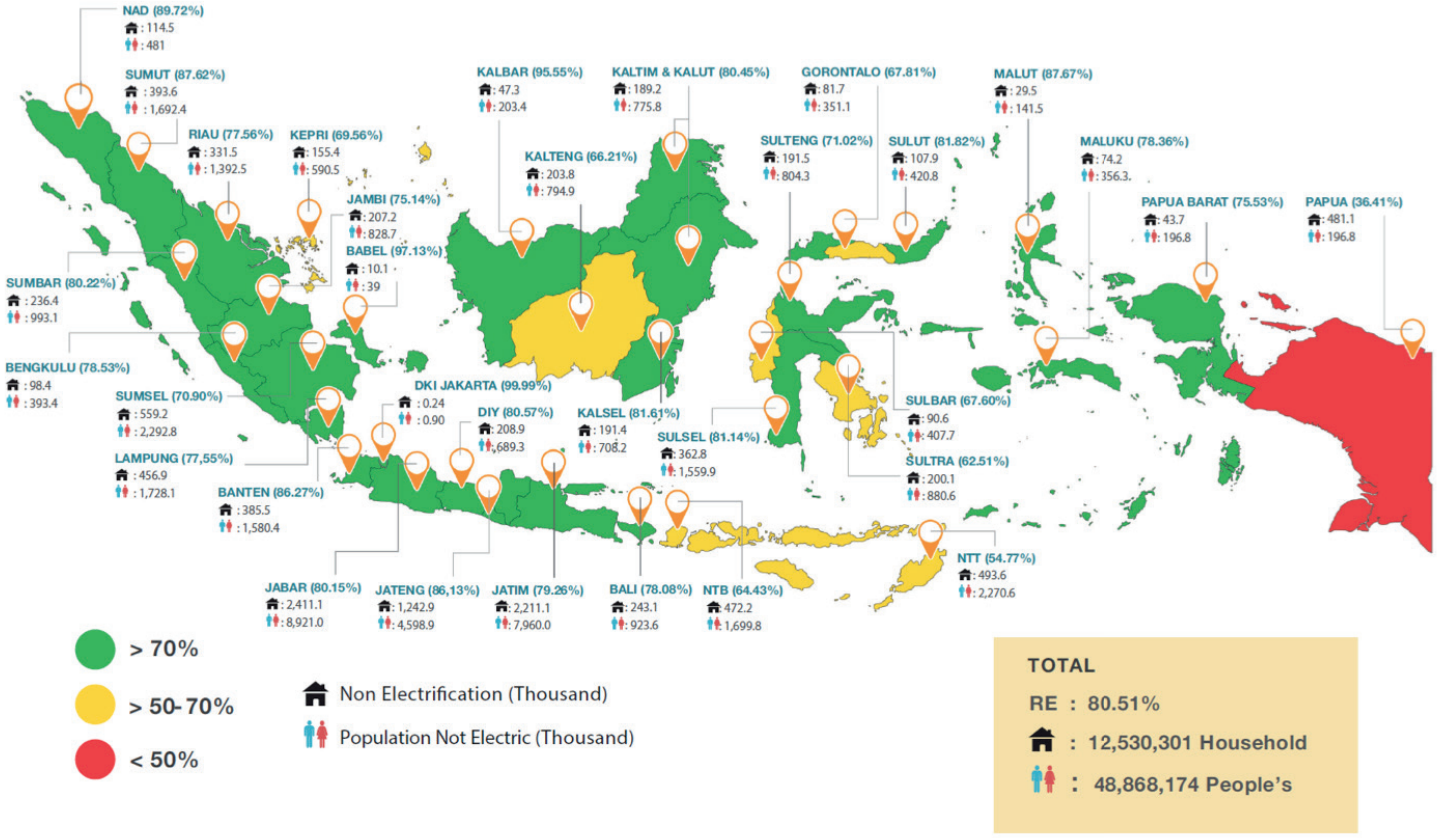

Figure 9: Electrification ratio across Indonesian provinces in 2013 (source: DEN 2014)

Climate change mitigation

In 2009 Indonesia announced that it aimed to reduce its GHG emissions by 26% relative to business as usual levels by 2020, and possibly up to 41% with international support. This ambition was further elaborated in the National Action Plan for Mitigation (RAN-GRK). The RAN-GRK allocated the majority of emission reductions to the land-use sector, but included some relatively limited activities around renewables and energy efficiency. In September 2015, the government of Indonesia published its INDC, in which it announced the intention to reduce GHG emissions by 29% relative to business as usual in 2030 unconditionally, and possibly up to 41% with international support (GoI, 2015).

That INDC reiterates Indonesia's commitment to meeting the KEN target of 23% of primary demand from renewables and in supporting documents the National Ministry of Planning (Bappenas) provides more details regarding the energy sector (Bappenas, 2015). In that report a fair and ambitious scenario are described corresponding to the unconditional and conditional pledges in the INDC. For the energy sector these fair and ambitious scenarios translate to reductions in emissions versus business of usual levels of 254 MtCO2e (17.6%) and 472 MtCO2-eq (32.7%) respectively (Figure 10).

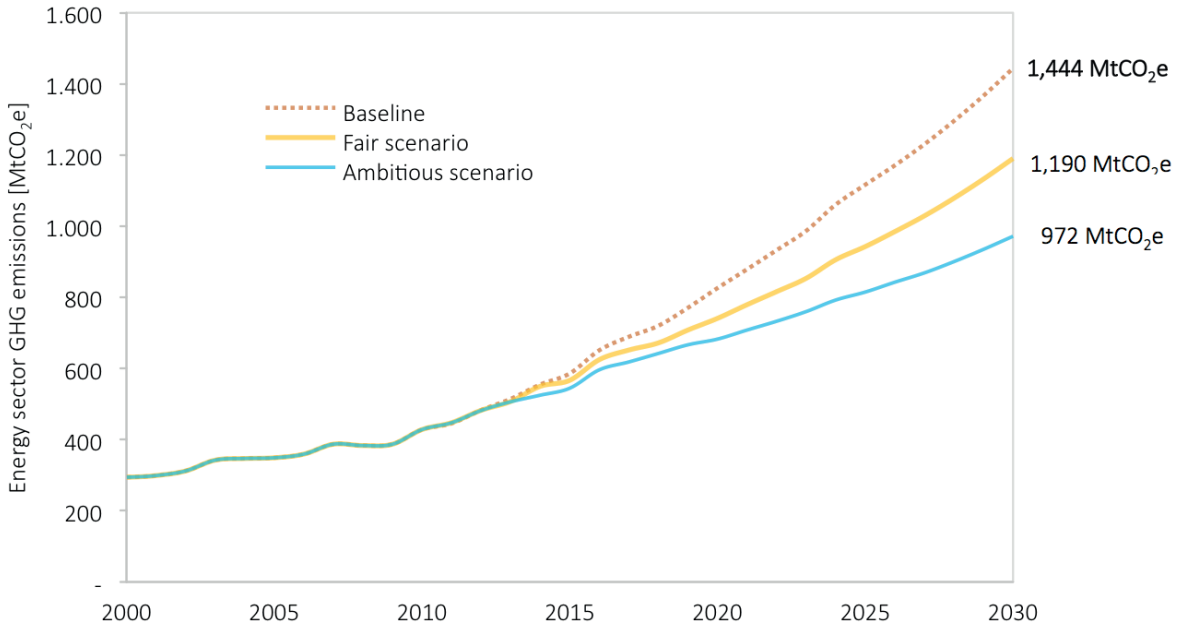

Figure 10: Emission scenarios for the Indonesian energy sector from the INDC (source: Bappenas 2015)

In terms of renewables, the fair scenario assumes that PLN's RUPTL is implemented as planned, to reach a mix of 16% renewable electricity in 2024. As noted earlier (Figure 1), reaching those levels will require a huge and rapid expansion of smaller scale renewable energy facilities over the coming ten years. The ambitious INDC scenario increases the proposed share of renewable electricity to 28.5% in 2025, yet as explained in Section 1, this would still be below the levels that are expected to be needed to meet the KEN. This is because of the huge of oil in transport and other fossil fuels in industry, which means that the relatively share of renewables in the electricity mix must be very high to meet an overall primary share of 23%. In any case it is clear, smaller scale renewables will have a key role to play in meeting either of the INDC scenarios and prompt action must be taken if the sector is to reach those targets.

Social and environmental benefits

Renewable energy IPPs can have important benefits for ordinary Indonesians, beyond the strategic aims of the government around energy diversification, climate change and subsidy reform. Through its National Development Policy on Natural Resources and Environment (RPJMN), the GoI has been looking towards the diversification of the Indonesian energy mix as a means to ensure the sustainability and quantity of energy supply. In particular, the increased utilization of RE resources and energy efficiency as mechanisms for supporting low-carbon economic and social development.

A recent study by NewClimate Institute on the impacts of mitigation actions in relation to INDC pledges (Höhne et al., 2015) outlines three aspects that are particularly relevant for renewable energy expansion:

- **Poverty alleviation:** the strong correlation between poverty and a lack of access to modern energy is shown by the fact that countries, in which a large share of the population is living on an income of less than 2 USD per day, tend to have low electrification rates and heavily rely on traditional biomass as a source of energy. Providing reliable access to modern forms of energy is essential for the provision of services such as clean water, sanitation and health care and provides the basis for sustainable development through the provision of reliable and efficient lighting, heating, cooking, mechanical power, transport and telecommunication services.
- **Air quality and health improvements:** GHG emissions and air pollutant emissions often derive from the same sources, such as power plants, factories and cars. Hence, mitigation measures that reduce the use of fossil fuels typically have a large potential to also cut emissions of pollutants, which have a variety of detrimental impacts on health and ecosystem effects at various scales.
- **Job creation**: the International Labour Organization, states that there is sufficient evidence to show that climate change action does not need to threaten current jobs, but can, on the contrary, lead to more and decent jobs, poverty reduction and social inclusion. There is a wealth of research into this topic for renewable generation (Figure 11).

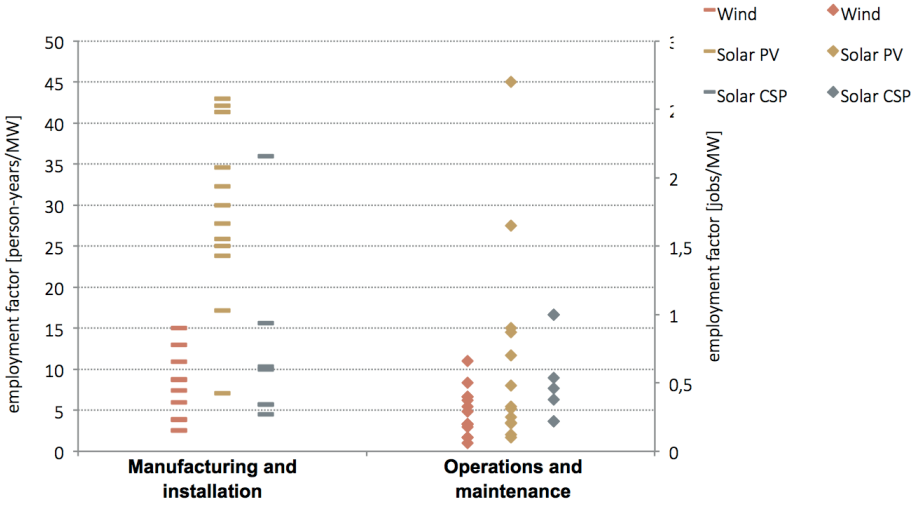

Figure 11: Employment factors for the renewable energy sector from various studies for three technologies (source: Cameron and van der Zwaan 2015)

Taking the example of job creation and employment, we estimate that the capacity expansion plans for smaller scale renewables in the RUPTL could lead to the creation of roughly 3,000 permanent jobs over the coming 10 years in manufacturing and installation, and 1,000 full-time jobs in operations and maintenance by 2025 – assuming median employment factors found in existing studies.

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