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Assessing the impacts of new IPPs at country level? Case study on Kenya

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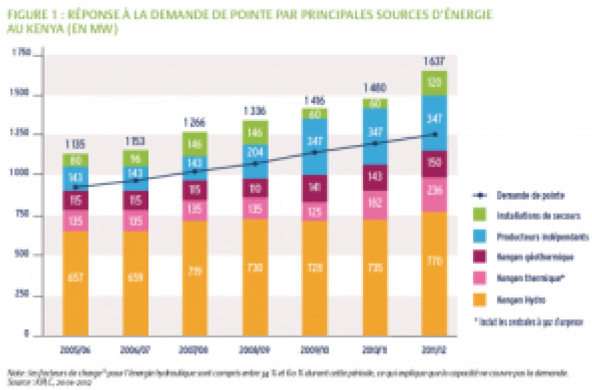
Independent power producer (IPP) investments are making a real contribution to increasing the provision of electricity in Kenya, and in reducing outages. This analysis demonstrates the development potential of IPPs, and provides guidance, particularly the importance of cooperation between public and private bodies, for other developing countries looking to leverage private investment to alleviate shortages and increase the availability of power.

The development impact of new energy generation capacity in a country is proportional to the severity of current power constraints on the economy. For an independent power producer (IPP) to make an impact, it must, where demand exceeds current supply, provide power beyond what public entities could develop, or displace a higher-cost source of energy. Based on these criteria, the case for the positive impact of IPPs on Kenya's energy sector and economy is clear, though within IPP production there is a debate to be had regarding optimal
energy sources.

At a macro level, lack of energy is a frequently cited as a constraint to Kenya's growth: power outages cost the Kenyan economy an estimated 7 % in lost private sector sales revenue, 2 % of total GDP and 1.5 % of GDP growth (Ministry of Energy, 2011). Though generation capacity is not the only source of power problems, insufficient supply (exacerbated by droughts) has led to widespread outages due to load shedding in two of the past four calendar years. Another sign of a power generation bottleneck is that Kenya has not been able to shake its dependence on costly diesel-generated emergency power.

Figure 1 illustrates how increased IPP generation has partially, but not completely, helped displace emergency power from Kenya's generation mix.



Given that the majority of the population is not yet on the grid, and power demand is projected to grow at 6 % a year in the immediate future (ERC, 2013) and over 10 % in the long term (Ministry of Energy, 2011), the state-owned generation company, KenGen, is developing generation capacity as fast as possible within its organizational and capital constraints. In this context, every megawatt (MW) installed by IPPs adds to rather than displaces public investment.

Assessing the impacts of IPPs

Analyzing the impact of a particular IPP project requires multiple methodologies to cover the range of desired outcomes for different stakeholders and at different levels in the economy. The first step, in either an ex-ante or ex-post assessment, is to map these desired outcomes. In ex-post assessments of 2009 investments in Rabai Power, a thermal IPP, and Olkaria III, a geothermal IPP, in Kenya, a team from Dalberg used a "theory-of-change" exercise to map the distinct channels through which each investment was expected to achieve desired outcomes. These outcomes included the diversification of Kenya's power supply, increased private power generation, minimized carbon emissions, returns for investors and income for workers, and positive community/social effects. We defined indicators to measure these outcomes, such as a reduction in the price of energy, increased government revenues and reduced load shedding.

Quantitative and qualitative approaches used to assess each indicator included calculating the change in electricity prices due to lower-cost generation; soliciting ratings of the relative reliability of various power plants from the off-taker, Kenya Power and Lighting Company (KPLC); and interviewing local community members about changes in their lives linked to the new power plant. In this way, the assessment can both compare different IPP projects – for example to identify best practices in engaging the local community – and compare against the case where no new power plant is built at all. The latter scenario also forms the basis for a simple calculation of an economic rate of return (ERR)2.

The economic impact

In Kenya's case, demand estimates and expert interviews suggested that, in the absence of the IPP investments, the missing power would generally be either unserved or provided by diesel-generated emergency power. The implicit cost to Kenya of unserved power has been estimated at around USD

0.84/kilowatt hour (kWh)3 and the cost of diesel-generated emergency power is around USD 0.31/kWh at current fuel prices. While neither of these figures perfectly captures the counterfactual scenarios, they can be used as reference points against which to estimate savings to the economy, based on the actual cost of IPP power. For example, if the 367 gigawatt hours (GWh)4 supplied by Olkaria III at USD 0.09/kWh in 2011 had been provided by diesel generators, consumers would have paid an additional USD 89 million in diesel fuel surcharges – which are passed directly to electricity bills. That means that prices in 2011 would have gone up across the board by USD 0.015/kWh. The government would have made USD 11 million more in fuel-tax revenue, and KPLC would have paid USD 19 million less to the power producer for non-fuel generation costs, which would eventually have been reflected in base tariffs. The net result is that Olkaria III saved the economy USD 59 million over the emergency power alternative.

The Dalberg team represented projected cost savings like these, plus IPP-related tax revenues, as a stream of annual income to the country, excluding any financial returns to the investors, over the 20-year Power Purchase Agreement (PPA) period, and performed an ERR calculation using the total investment cost of the project. The resulting ERR for Rabai Power, a heavy-fuel plant, was 16 % if the alternative was emergency power, not accounting for greater reliability, and 112 % against the cost of unserved power. For Olkaria III, a geothermal plant with higher upfront costs but greater annual savings, the results were 27 % and 89 % respectively. This ERR methodology is not standardised and much of the value of it is in the process of developing the model and observing how returns depend on assumptions such as the dispatch rate or price of oil. But the results also illustrate the significant development returns to investment in a power-constrained setting, and why even higher-cost thermal options appear attractive if the assumption is made that the alternative is unmet demand.

While IPP power may be perceived as more costly than publicly generated power, this is only relevant if there is a choice between the two. In a supply-constrained context such as Kenya, one is not an alternative to the other. KPLC, a separate distribution company, buys power from both the state-owned generator KenGen and IPPs, in both cases through transparent agreements overseen by the Energy Regulatory Commission. Were KPLC able get sufficient supply at a lower price from KenGen, there would no longer be a market for IPPs, but that is unlikely to happen in the foreseeable future and KPLC continues to sign PPAs with both5.

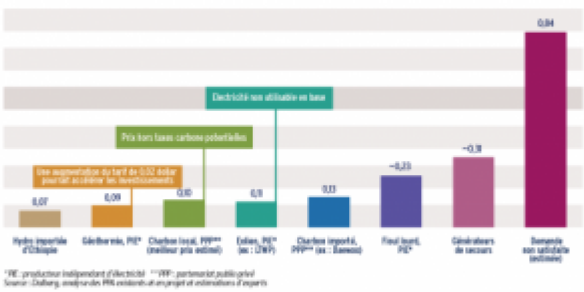
In addition, comprehensively assessing IPP projects in Kenya suggests that they yield a range of positive outcomes at the local and sectorial level, beyond increased power to the grid. For example, a top engineer at KPLC rated the IPPs as systematically the most reliable plants in operation and, given their lower marginal costs, they are often at the top of the dispatch order. IPPs have often been the first to use new technologies in Kenya, including the use of heat capture to power a steam turbine on a thermal plant, well-head generation and a binary isopentane system in geothermal production. Moreover, IPPs have shared technical knowledge with KenGen, which is reflected in KenGen’s own recently constructed power plants including Kipevu III. Lastly, because IPPs are typically funded by development finance institutions (DFIs), which have strict international environmental, social and corporate governance (ESG) standards, they often introduce ESG best practice into the local environment – Rabai Power was cited by community activists as a model for other companies to follow.

Limits

Of course, some IPP investments are more beneficial to the country than others. The economic benefit of building a new heavy fuel oil (HFO) plant has diminished since Rabai was built in 2009. Rabai Power provides power at a higher cost than Olkaria III’s geothermal operations, but the HFO plant met an immediate need to end load shedding on the coast, resulting in high savings against the cost of unserved power. However, now three more HFO plants of similar size will soon come online in Nairobi. It is harder to argue that all three of these are needed to replace unserved power, though they will displace emergency power. The primary advantage of HFO plants is their speed of development, so they are most beneficial where the short-term need is great – in the long term, these plants may be one of the the most costly sources of energy purchased by KPLC.

Investment by IPPs does not guarantee the optimal mix of energy sources. Providers respond to incentives, especially those reflected in feed-in tariffs, which are set by the government. Leaders in the private sector in Kenya have suggested that the current feed-in tariffs are geared too much in favour of investment in thermal power and not enough in geothermal power. Given the superiority of geothermal as an energy source – it is renewable, has near-zero carbon emissions, extremely reliable (unlike hydro), can be used for baseload power (unlike wind), and has low operating costs –, experts are suggesting that the feed-in tariff for geothermal be increased by USD 0.02/kWh or more to accelerate development by IPPs. This would come at a cost to consumers, but if it spurs faster development of geothermal power sources, the increase could easily be compensated for by savings over the cost of thermal power currently produced by both KenGen and IPPs (*Figure 2*).

FIGURE 2 : COÛT DE L'ÉLECTRICITÉ AU KENYA, PAR TYPE DE SOURCES (EN DOLLAR/KWH)



Both IPPs and public generators require complementary public investment in transmission infrastructure, and sometimes in pre-development efforts such as geothermal exploration. Kenya has established two government-owned entities for these purposes: KETRACO to build transmission lines and the Geothermal Development Corporation (GDC) to explore steam vents for KenGen and geothermal IPPs. There have, however, been delays in execution of both activities that have hindered IPP investment or reduced its benefits. For example, a new transmission line between Mombasa and Nairobi to transfer power from thermal stations on the coast was to have been completed by 2011 but now looks more likely to be completed in 2014. In the meantime, there is an estimated 100 MW of unused capacity available on the coast from such plants as Kipevu II and III and Rabai, which is still at 50% utilization, pushing down the ERR, even as KPLC continues to pay for emergency power in Nairobi. In geothermal, development of some plants has been delayed for years waiting for GDC – which has suffered from a lack of sufficient funding – to prove the steam. For IPP investment to reach its full potential, Kenya will need to build the capacity of both of these institutions.

Optimizing investment

Nonetheless, Kenya's IPP sector is already one of the most robust in Africa, thanks in part to the commitment of DFIs to funding projects even when other investors would not. Where the public generator is unable to meet demand, the higher returns required by private investors can easily be offset by greater production efficiency, more reliable operations, and the transfer of new knowledge and technologies. Today, as there is considerable investment momentum in the sector, including local providers of capital, not all developers require DFI finance. Some investors are also willing to forgo letters of comfort, given KPLC's perfect record of payment to IPPs and adherence to cost-reflective tariffs. With more than 20 % of power now coming from IPPs, Kenya's experience shows that it is possible to leverage the private sector to achieve national power goals.

This experience holds a number of lessons for optimizing future IPP investment. First, the development case for IPP investment should be based on clearly defined economic benefits rather than viewing IPPs as a credible alternative-case scenario. Then, the necessary analysis should be undertaken by the public authorities and validated by the private operator. In Kenya's case, both the Ministry of Energy and KPLC have agreed on the urgent need for new capacity, though the targeted mix of sources should be adjusted as the capacity evolves. Second, it became apparent that separating public generation from distribution helps enable IPP investment by creating an entity whose goal is to obtain reliable electricity at a good price while remaining agnostic about the source, and can establish a credible off-taker relationship with IPPs. Lastly, it is clear that complementary public infrastructure investment, including the development of a grid, can be just as critical as attractive tariffs and a strong policy environment to attracting and utilizing IPP generation.

Footnotes

[1] The load factor is defined as the ratio of average energy demand (load) to the maximum demand (peak load) during a period.
[2] Interest rate at which the cost and benefits of a project, discounted over its life, are equal. In this case benefits refers to economy-wide cost savings and excludes financial returns for the investor.
[3] This cost is cited in Kenya's Least Cost Power Development Plan 2011, and has also been quoted by the World Bank. It is derived from an earlier study estimating the implicit cost of energy not supplied owing to generating capacity deficiencies and/or shortages in basic energy supplies.
4 This is 6% of the total power produced in Kenya that year, but the estimated savings are greater than 6% of total power costs because the alternative is three times the cost per kWh.
5 Note that KenGen is publicly listed with 30% private shareholding, so it must also generate a return for its shareholders.

References / ERC, 2013. Updated Retail Tariffs Application. KPLC. Report 7 February 2013. // **KPLC, 2006-2012.** Annual reports from 2006 to 2012. // Ministry of Energy, 2011. Updated Least Cost Power Development Plan – study period 2011-2031, Nairobi, Kenya, March.