Climate & Development Knowledge Network

INSIDE STORIES on climate compatible development

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Key messages

- Decentralised renewable energy solutions contribute to Tanzania's climate compatible development: they enable economic development by improving access to reliable electricity; lessen vulnerability to fossil fuel price shocks and to drought-related hydropower shortages; and reduce greenhouse gas emissions.
- Tanzania has introduced the Small Power Projects programme as a support mechanism for renewable energy. An appropriate first step for this low-income country, the programme does not cost the national utility or consumers any more than they would pay for conventional power sources.
- Tanzania's renewable energy policy-making and implementation has benefitted from intensive South-South exchanges with Thailand and Sri Lanka.
- Low tariffs and difficult financing conditions currently limit the programme's reach but the programme has enabled Tanzania to build a regulatory framework and gain experience.
- As a next step, the programme could be scaled up if sufficient funds can be secured.

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Achieving development goals with renewable energy: the case of Tanzania

Lack of reliable access to electricity is a significant barrier to economic development and job creation in Tanzania. Currently, only 14% of the population has access to electricity; in rural areas the electrification rate hovers around 2%.[1] Power outages are frequent – especially during droughts, which cripple the hydroelectric power upon which most of the country depends. This brief is about the Small Power Projects (SPP) programme that Tanzania designed – with very limited financial resources – to support renewable energy deployment. These decentralised renewable energy projects are helping Tanzania to address her power challenges while avoiding growth in greenhouse gas emissions.

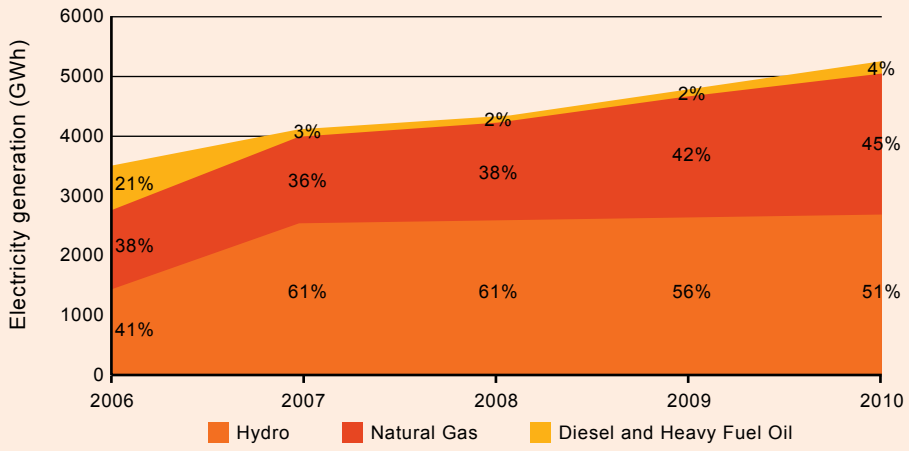
Hydropower is the dominant source of electricity on the country's main grid, increasingly supplemented by fossil fuels, as illustrated in the figure on p2. Some towns in remote regions are served by 13 national utility mini-grids, almost entirely powered by diesel generators.

Tanzania suffered drought-related power crises in 2006, 2007, 2009 and 2011. In 2011, the national utility company TANESCO had to institute rolling blackouts of up to 12 hours, forcing about 50 factories to close down and lay off their employees.[2] In March 2011, the International Monetary Fund reduced its forecast for economic growth in Tanzania from 7.2% to 6%, "largely as a result of widespread weather-induced power shortages".[3] The World Bank estimates that the electricity generation capacity available during the last power crisis was able to meet only 75% of the current demand of grid-connected customers.[4] And yet, these customers represent only a small proportion of Tanzanians who need electricity to fulfil their development needs. Climate change is expected to lead to even more frequent droughts in East Africa, negatively impacting the electricity supply in Tanzania and elsewhere in the region.[5] With electricity demand projected to grow 7.6% per year, this problem will only worsen.[6]

Tanzania is currently exploring several options to address the energy shortage – adding new generation capacity is a key priority. In August 2011, the parliament approved a $742 million emergency power

CDKN helps developing countries to design and deliver climate compatible development. When decision makers in government, business and civil society speak to us about their aims and needs, they often ask about 'best practice' in other countries or, indeed, mistakes to avoid. What are the leading innovations in integrating climate change planning with economic growth strategies and poverty reduction? What are the biggest challenges faced along the way: institutional, financial, political, technical? This paper is one of a series of policy briefs that explore the 'Inside stories on climate compatible development': briefing papers that aim to answer these questions.

Electricity generation in Tanzania by source, 2006-2010, in gigawatt hours produced



Source: TANESCO

rescue package.[7] The plan endorses short-term contracts with private companies for emergency power purchases. These companies would install gas- or diesel-powered generators and sell the power to the national utility at very high prices. TANESCO is already in an unsustainable financial situation, with its expenses considerably exceeding its revenue. The electricity retail tariffs of around $0.13/kWh don't reflect the cost of generation, and the expensive emergency power that TANESCO purchases at rates up to and above $0.40/kWh further weakens the financial health of the company.

Tanzania extracts some natural gas domestically and has recently awarded licenses to explore additional domestic sources of oil and gas. However, with volatile and rising international fossil fuel prices, fossil fuels – in particular diesel – are unlikely to be viable in the long term. Tanzania could also increase its hydropower capacities, as it is currently only tapping 12% of its hydropower potential.[8] Given the economic insecurity inherent in a dependence on fossil fuels, and the risk of relying on large hydropower alone in times of more frequent droughts, the country's potential for decentralised renewable energy is coming into focus.

The Small Power Projects programme, affordable renewable energy support in a low-income country

Tanzania is aiming to expand renewables as a long-term response to the electricity challenge. The World Bank has, since 2007, played an important role in supporting these efforts through its Tanzania Energy Development and Access Expansion Project. Building on successful examples in other developing countries, World Bank experts suggested a Small Power Projects (SPP) programme to Tanzanian decision-makers in the Ministry of Energy and Mines (MEM), TANESCO and the Electricity and Water Utilities Regulatory Agency (EWURA).

Since 2009, the country has been implementing an SPP programme geared towards the "promotion of private sector participation in the power sector, but also [for] renewable energy scale-up and accelerated electricity access to the Tanzanian population."[9] The SPP programme allows small renewable energy and co-generation facilities of up to 10 MW of capacity to be connected to the grid and to be paid a fixed pre-defined tariff for the power they sell to the utility, under a standardised power purchase agreement.[10] Projects can either be connected to the main grid or to one of the isolated mini-grids. The SPP programme also provides streamlined procedures for approving retail rates for SPP operators that plan to operate their own grids and sell electricity directly to consumers, thereby increasing rural access to electricity. Such projects can also benefit from a grant of $500 for each new household that is connected to a micro-grid, provided by Tanzania's Rural Electrification Agency (REA).

The SPP programme is an example of a feed-in tariff (FIT), a widely used policy tool to promote the deployment of renewable energies. A FIT often leads to additional costs if the guaranteed tariff is above the price of electricity from conventional sources. In most countries, these costs are passed on to consumers through increased electricity bills; other countries cover additional costs out of the public budget. Either option – higher electricity rates or higher public expenditures – would be very difficult to implement in a low-income country such as Tanzania.

Tanzania, therefore, set out to create a FIT mechanism that would not create additional costs for the utility. Most countries pay FITs that reflect the technology-specific generation cost. For example, a higher rate is paid for solar power than for biomass because solar power is more expensive to produce.

A strength of the programme is that it allows local investment in locally available resources by local entrepreneurs.

Mr. Anastas Mbawala
Director of Electricity,
Electricity and Water Utilities Regulatory Agency

In Tanzania, however, rates are based on the cost that the utility would incur to produce the same amount of electricity using conventional sources.

The SPP rates are calculated annually, following a standardised methodology, based on an average of the long-run marginal cost – the cost of providing an additional unit of electricity according to the utility's long-term power plan; and the short-run marginal cost – the budgeted cost per kWh of thermal generation for the next year. As the short-run marginal cost on the micro-grids is based on diesel generation, the micro-grid SPP tariff is significantly higher. Tariffs are adjusted for inflation and a tariff cap and floor ensure predictability; the tariff paid to an SPP generator can never be lower than the rate paid in the first year of the project nor be higher than 1.5 times that amount. In 2012, the rates were set at TZS152.54/kWh (around $0.09) for on-grid projects and TZS480.50/kWh (around $0.28) for micro-grid projects. [11]

While an avoided-cost-based FIT will not incentivise the deployment of more expensive renewable energy technologies, it does help to attract private investment in those technologies that are already competitive at offered prices. In this case, such a tariff can trigger additional investments because it sets a clear framework for investments and guarantees predictable prices.

In practice, Tanzania's FIT approach is not more expensive than conventional fossil fuel expansion. Compared with short-term capacity expansion, the utility even saves money. The tariff is based in part on the cost of additional generation in the *long run*, so its costs are lower than those of immediate emergency electricity procurement for the national grid or additional diesel generation on the micro-grids. At the same time, the tariffs are high enough for some renewable energy projects using waste biomass and potentially small hydro to be profitable.

Barriers to successful implementation

There have been three main barriers to successful implementation of the SPP programme:

Scepticism and lack of experience among practitioners. A number of people need to act to make renewable energy projects a reality, including project developers, banks and utility engineers. Tanzania has little experience with renewable energy projects and there was doubt as to whether such projects would be feasible, reliable and financially viable. Interacting with electricity experts and practitioners from Thailand and Sri Lanka helped address this barrier. The programme enjoyed strong support from regulators at EWURA and some high-level support from TANESCO. Lower level engineers in the utility were more sceptical, but the creation of an SPP cell helped to overcome their resistance. The SPP cell is a unit within the utility responsible for signing contracts with the SPP developers and connecting them to the grid that is staffed by TANESCO employees, who are convinced of the programme's merits.

Complicated regulatory requirements. Concerns, such as technical requirements and conflicts over land ownership and water rights, must be kept in mind when developing renewable energy projects. Approval processes can get complicated, often involving several agencies. The SPP programme addressed this by defining a transparent and streamlined approval process. In

Tanzanian engineers and policy-makers visit a small power producer in Thailand. Photo: Chris Greacen.

Box 1: Saving money and emissions with decentralised renewable energy

Model calculations by TANESCO show the direct savings that the SPP programme could deliver in remote mini-grids. In two of the mini-grids, SPP hydro projects are planned and could come online in 2014, completely replacing diesel generation. These include a 6 MW hydro project in Songea (where the peak demand is currently around 5 MW) and a 1 MW hydro project in Mbinga (current peak demand 0.8 MW). At 2011 prices, the savings to the utility can be estimated as follows:

- The average generation cost for the two diesel-powered stations is TZS 676/kWh, while the feed-in tariff for the mini-grid is TZS 380/kWh. TANESCO will save TZS 296/kWh.
- Monthly energy generated and distributed to customers in the two mini-grids is around 1,919,379 kWh.
- Annual savings for the utility are 12x1,919,379xTZS 296 = TZS 6,817,634,208. This is the equivalent of over $4 million.

In addition, 7.2 million litres of fossil fuel imports would be saved, and over 19,000 tonnes of CO_2 emissions would be avoided.

addition, the SPP cell also serves as a one-stop shop for all those interested in developing SPP projects.

Financing conditions. Financing renewable energy projects in Tanzania is difficult due to high interest rates, short pay back periods and high equity requirements (around 40% of the project cost). In 2010, the World Bank approved a credit line that will address some of these problems, for example, by providing 15-year loans. Lack of experience in the banking sector is also a problem. Banks are unused to project financing and don't focus on the viability of a project but rather on the financial situation of the company developing the project. The World Bank is also leading efforts are to build capacity in the banking sector. Although there are signs that banks are now willing to finance renewable energy start-ups, financing, combined with the low SPP rates, remains the most significant barrier to success.

South–South exchange

A South–South exchange has played an important role in developing the Tanzanian SPP programme and in building support for its implementation. In 2009 and 2010, the World Bank financed study tours to bring Tanzanian delegations to Thailand and Sri Lanka, where FITs for small power producers have been in use since 1992 and 1998, respectively. The delegations included regulators, ministry officials, utility engineers, and potential project developers and financers. These exchanges helped to answer many questions and, informed by the Thai and Sri Lankan models, Tanzania was able to rapidly develop SPP regulations that are appropriate in a developing country context. The exchange continued beyond the study tours; for example, experts from the Thai utility have helped TANESCO set up the SPP cell, establishing a long-term channel for learning.

First Successes and Next Steps

As discussed above, the three main barriers have been to some extent addressed. As a consequence, the first power purchase agreements under the SPP programme have been signed. Five renewable power plants – with a total capacity of 28.3 MW – are now operational, including projects powered by wood waste, coconut husks, micro-hydropower and bagasse from sugar processing plants. An additional ten projects with a capacity of over 60 MW are in the pipeline.[12]

The SPP programme has enabled Tanzania to begin using distributed renewable energy in electricity generation, even in times of an ongoing electricity crisis. The additional capacity will help to make Tanzania's energy supply on the main grid more reliable, as the projects will be located close to the load centres and will avoid transmission losses. So far, only one contract for a project on an isolated micro-grid has been signed but if more of those projects were developed, they could make an important contribution to rural electrification.

Nevertheless, many observers note that renewable energy deployment under the programme has been slower than expected and that higher rates and better lending conditions will be needed to develop

"The main success of the SPP programme is that it accelerates rural electrification, since most of the SPP are located in rural areas."

Mr. Charles Shayo
Head of the Small Power Projects cell, TANESCO

more projects. An analysis of the projects that are currently being realised shows that only large companies, with strong balance sheets and free waste biomass at their disposal, were able to develop viable projects. The recent devaluation of the Tanzanian Shilling has increased the costs of buying imported equipment and this has led to serious questions as to whether further micro-hydro projects will be built.

The current tariff (particularly for main-grid-connected SPPs) is too low to develop renewable projects beyond the small set of projects described above. This is particularly true for the more expensive technologies, such as solar and wind. International support for the banking sector is being deployed to improve financing conditions, but more could be done to encourage greater equity. Tanzania might also consider adjusting its tariff-setting methodology to take account of recent currency devaluations or to give more weight to the short-term avoided cost. This would result in higher rates, enabling the construction of more projects.

Experience from other countries shows that differentiated tariffs, based on the generation cost of different technologies, allow the development of more diverse projects. Tanzania is considering adopting such technology-based rates in its SPP programme but is likely to need international financial support to do so. International climate finance could play an important role here, creating the market and the enabling conditions to attract private sector investment. A renewable energy policy that defines targets and ways to reach them would help Tanzania make the next steps in renewable energy deployment.

Key lessons and implications

- FITS that are based on avoided costs and focused on small projects can be an affordable and effective tool for low-income countries to improve reliable delivery of energy services, while reducing emissions and diversifying energy mix. Avoided-cost-based FITs create the basis upon which a more ambitious approach with higher tariffs could be used to increase deployment.
- Technology-based tariffs are more likely than avoided-cost-based tariffs to achieve rapid scale-up of a more diverse set of renewable energy technologies. However, these are an additional cost. For low-income countries with limited financial resources, their introduction is likely to require international financial assistance, for example through international public climate finance.
- Simply providing a payment mechanism with a guaranteed rate is not enough to encourage renewable energy. Issues such as scepticism among existing players, lack of experience and capacity, land and water rights and financing conditions need to be addressed simultaneously.
- South–South exchanges between policy-makers and practitioners can encourage the spread of successful approaches by building on the experiences of developing countries with established renewable energy policies.
- Countries must plan early for the impacts of climate change in order to have enough time to develop long-term sustainable, climate compatible development solutions. As Tanzania's reliance on fossil fuel powered emergency generation demonstrates, it is difficult to change course in the midst of a crisis, when quick fixes are needed.

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2. Ng'wanakilala, F., 2011.
3. International Monetary Fund, 2011.
4. The utility had to institute load shedding for up to 213 MW of the current peak demand of 846 MW. World Bank, 2011, p.2.
5. Karekezi, S. et al., 2009.
6. Ibid.
7. Ng'wanakilala, F., 2011
8. Nkawame, M., 2011.
9. EWURA, Public Notice, 2010.
10. The size cap only limits the generating capacity that can be fed into the grid. Projects can be larger than 10 MW if the generation beyond 10 MW is for on-site consumption.
11. A detailed description of the tariff-setting methodology and current calculations are available from EWURA's SPP site at http://www.ewura.com/sppselectricity.html. Throughout this brief, an exchange rate of USD1=TZS1700 has been used.
12. Mbawala, A., 2012, pp. 11-12.

About CDKN

The Climate and Development Knowledge Network (CDKN) aims to help decision-makers in developing countries design and deliver climate compatible development. We do this by providing demand-led research and technical assistance, and channelling the best available knowledge on climate change and development to support policy processes at the country level.

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