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Urban Energy Technical Note

Feed-in Tariff Policy

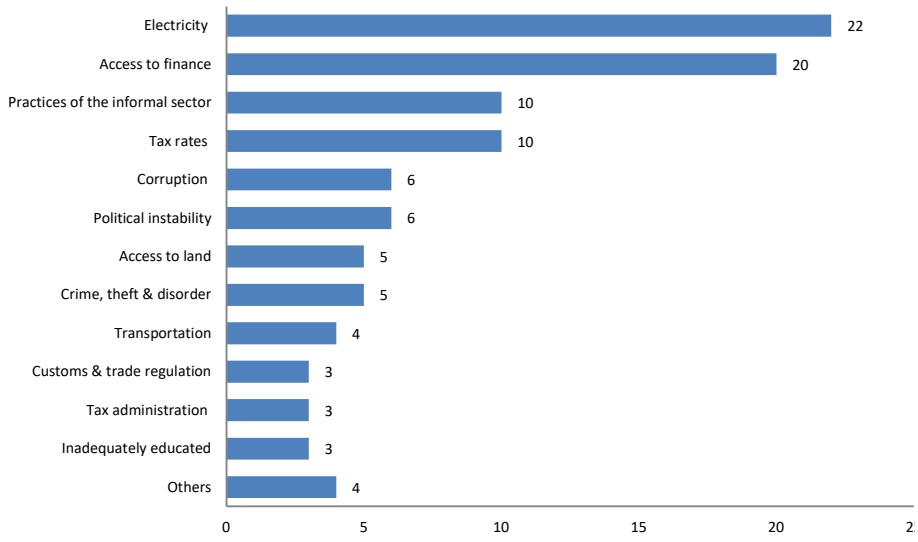
Energy has been described as the missing Millennium Development Goal (MDG), the catalyst without which other goals for issues such as health, education and gender equality cannot be achieved. Studies indicate that access to modern energy services and particularly electricity has a positive effect on local economic development and closely correlates to a country's UN Human Development Index (UNDP, 2012).

According to the World Bank, access to electricity for households in sub-Sahara Africa (SSA) is less than 25%, with the majority relying on traditional biomass and kerosene. Insufficient electricity supply hampers economic development. Indeed, a survey (Fig. 01) of businesses across SSA shows that access to reliable and affordable electricity is their biggest obstacle.

The UN Secretary General Bank Ki Moon said in September 2013 that "Providing sustainable energy for all could be the biggest opportunity of the 21st century". Sustainable energy is the golden thread that connects economic growth, social equity, and a climate and environment that enables the world to thrive.

Renewable energy feed-in tariffs (REFiTs) have been successful in increasing the use of renewable technologies worldwide. As of 2012, 65 countries have implemented some form of a REFiT, driving 64% of global wind installations and 87% of the global photo voltaic installed capacity. While the majority of these installations are found in industrialised countries, particularly Europe, the African continent has significant untapped renewable energy potential.

Fig. 01: **Biggest obstacles facing firms in sub-Sahara Africa**



Several African countries have already introduced the policy including Algeria, Kenya, Mauritius, Rwanda, South Africa (which abandoned its REFiT in favour of a bidding process), Tanzania and Uganda.

What is a Feed-in Tariff?

A feed-in tariff (FiT) is a policy incentive used to encourage the growth of an industry in renewable energy generation by ensuring that those who produce electricity from solar, wind and other renewable sources have a guaranteed market for the electricity they generate, and therefore a return from their investment. FiTs oblige the energy companies (or 'utilities') responsible for operating the national grid to purchase electricity from renewable energy sources at a predetermined price, which is sufficiently attractive to stimulate new investment in the renewables sector. These renewable energy sources may include wind, biomass, small hydro, solar and wave power. FiT are an important policy incentive for promoting renewables since they enhance investor confidence by removing uncertainties regarding the selling price of electricity to the national grid.

Benefits of FiT Policies

FiT have been implemented with impressive results in Japan, Mauritius, Nepal, Sri Lanka and Kenya. They have stimulated interest in renewable energy development in Uganda, South Africa and Tanzania. Led by Germany, Denmark and Spain, a growing number of industrialised countries are aggressively promoting renewables using the FiT model.

FiTs have proved to be effective policy instruments in overcoming key long-term barriers to introducing renewable energy and making it economically viable. They provide guarantees attractive to investors, including access to the grid, long term power purchase agreements and a set price per kilowatt hour (kWh) that covers the costs associated with electricity production.

In summary, key benefits of FiT Policy include:

- If well structured, ensuring that all electricity produced from renewable sources has a guaranteed buyer by obliging grid operators and utilities to purchase the electricity and by giving priority to access the national grid;
- Providing incentives for investors, who are assured of a market and return on their investment;
- Assisting in establishing a secure environment for the financing of renewable energy projects, and promoting market stability for investors in renewable energy electricity generation;
- Accelerating implementation of renewable energy projects.

The following is a checklist that regulators (and anyone with an interest) can refer to when drafting a basic REFiT scheme. A web-based tool (http://www.futurepolicy.org/renewableenergy.html) taking these dimensions into account is also available to help develop draft REFiT policies.

- Choose the eligible technologies based on the resource availability in your country;
- Determine which kind of power production plants shall be eligible;
- Establish a transparent tariff calculation methodology based on the generation costs of each technology;
- Set technology and size specific REFiTs;
- Fix the duration of tariff payment (usually 20 years);
- Create a robust financing mechanism, sharing the additional costs among all electricity consumers;
- Oblige the grid operator to purchase all renewable electricity;
- Grant priority grid access;
- Regulate the cost sharing for grid connection and reinforcement based on the 'shallow' or 'super-shallow' connection charging approach;
- Create effective administrative procedures;
- Set renewable energy targets and mention them explicitly in the REFiT legislation;
- Establish a progress report as the scientific basis for future adjustments.

Feed-in Tariff Policy Models from Selected Countries

a) Mauritius

The policy shift towards renewable energy began in earnest in 2008, with the aim of transforming the country by 2028. The policy aimed at partial energy autonomy from imported fossil fuels by significantly increasing the share of renewables in Mauritius and enhancing energy efficiency. It is paid for through a carbon tax on fossil fuels channelled into the newly created 'Maurice Ile Durable Fund (MIDF).

The programme received strong political support, coinciding as it did with the oil price rising to record levels in 2008. To begin the policy formulation process, a rigorous grid code was drawn up in 2009 detailing the technical requirements for new plants wishing to connect to the national grid. Secondly, a REFiT structure was developed. Taking into account the grid's limited absorption capacity and the low level of available funding for the REFiT through the MIDF, a net-metering scheme with an overall cap of 2MW and a maximum size of 50kW for individual generators was introduced in late 2010.

The net-metering mechanism chosen requires participating households and businesses to use the electricity generated for on-site consumption before selling excess to the grid.

Both the grid code and the REFiT policy were developed with input from the private sector and civil society. The incentives of the Mauritian REFiT are geared towards national, small and household-level producers, rather than external investors looking for profitable projects.

As of September 2012, approximately 20 projects were in operation with more - pre-dominantly solar PV - in the pipeline. The initial cap of 2MW of newly installed capacity was reached within four months, demonstrating strong support and high demand for the scheme. Stakeholders agree that the REFiT has raised awareness among the population of the benefits of renewable energy. The table below shows the FiT.

Technology Size (kWh)	Tariff (US$)
PV <2.5	0.826
2.5 - 10	0.661
10 - 50	0.496
Wind <2.5	0.661
2.5 - 10	0.496
10 - 50	0.330
Hydro <2.5	0.496
2.5 - 10	0.496
10 - 50	0.330

b) South Africa

South Africa is heavily reliant on coal based electricity generation, with about 80% of total installed capacity coming from coal fired power stations. The country is responsible for over 40% of the continent's greenhouse gas emissions and is one of the largest emitters worldwide.

To meet the increasing electricity demand, the Department of Energy (DoE) has also developed a new long term 'Integrated Resource Plan 2010-30 for Electricity', mandating an additional 17,800MW from renewables by 2030 (including 8,400MW from wind, 8,400MW from solar PV and 1,000MW from concentrated solar power [CSP]).

As of 2011, the national policy goal was to achieve a 10% share of total installed capacity for wind and PV technologies by 2020, and 20% by 2030. According to the Electricity Regulation on New Generation Capacity, 30% of the additional generation capacity was to be implemented by independent power producers and municipalities.

In 2007, the National Energy Regulator of South Africa (NERSA) produced an initial REFiT study. After two years of multi- stakeholder consultations, the South African government officially introduced the country's feed-in tariff policy. However, before the REFiT could really take off, the government repealed its decision and instead introduced a public bidding process to promote renewable energy.

The initial abrupt shift away from a REFiT policy sent confusing signals regarding planning and stability of renewable energy policy in South Africa, resulting in uncertainty for investors.

In the first phase of bidding for 3,750MW of renewable energy expected to come online by 2016, the government received more than 400 applications. Of these, 28 bidders and 1,400MW were approved followed by a further 19 projects totalling 1,000MW in phase two, spread among wind (mainly off-shore), solar PV, CSP and small hydro.

c) Sri Lanka

Colonial planters used micro- and mini-hydro plants on tea and rubber plantations in Sri Lanka in the late 1800s and early 1900s, with some 500 plants reported to be functioning at the turn of the century. The grid of the Ceylon Electricity Board (CEB) was extended to the plantations in the 1960s and low prices were offered to factories to encourage them to consume more electricity for their operations, thereby making it more economical to purchase electricity from the grid as opposed to running their own power systems. This resulted in the closing down of most of the micro-hydro plants on the estates. In the 1980s, an increase in grid electricity prices (a result of increased fuel prices) created interest in reviving some of these plants. Some 60 plants were rehabilitated and began operating in tea estates to reduce electricity bills. These were found to be attractive investments as the costs of rehabilitation were much lower than those of building brand new power installations, and returns on investment from the reduced electricity bills were relatively high.

In 1996, as part of a programme of liberalisation in the power sector by the Sri Lankan government, the CEB allowed grid-connection of private small hydro plants (<10 MW) and issued a standard Power Purchase Agreement (PPA) starting in 1997, and revised annually. The FiT on the PPA was determined by the avoided cost of fuel at the CEB thermal plants and tied to the international price of petroleum fuel. The tariff offered to developers in 2005 was around 6 US cents per kWh for the dry season and 5.3 US cents in the wet season.

Returns on investment were found to be attractive, with typical payback periods around 3 - 4 years or less. As a result, a significant amount of investment in small hydropower ensued. The table below illustrates Sri Lankan FiT.

Technology	Tariff (US Cents)
Mini-hydro	11.54
Mini-hydro (local)	11.79
Wind	17.19
Wind (local)	17.67
Biomass	18.32
Agric. & Indus. waste	12.86
Municipal waste	19.49
Waste heat recovery	5.88
Other renewables	18.32

d) Kenya

Kenya's REFiT was first implemented in 2008 by the Ministry of Energy (MoE) after a four year process. The World Bank was keen to identify ways to promote renewable energy, and following initial pre-feasibility and feasibility studies in 2004, small hydro, wind and biomass were all identified as promising new resources. The MoE, Energy Regulatory Commission (ERC), Kenya Power Company [KPC] (state utility), Kenya Electricity Generation Company (KenGen) were all involved in the development of the REFiT policy.

Development of REFiT was driven by: the need to promote the uptake of renewable energy and increase power generation; the need to promote smaller electricity projects and; the desire of authorities to open up the energy market and shift more power generation to the private sector.

The second draft published in 2010 added biogas, geothermal and solar PV as eligible technologies. Moreover, the tariffs for wind and biomass were adjusted upwards. These tariffs are not fixed but negotiated for each project. KPC negotiates according to the actual costs for the project development and the rate of return for investors. Regardless of technology, all tariffs are limited by one common maximum tariff ceiling, which cannot be exceeded.

So far, only two projects are operating under the REFiT: a 920kW small hydro plant owned by the Kenya Tea Development Authority (KTDA) and a 5MW geothermal well head generator operated by KenGen. However, following the 2010 revision of the policy, tariffs are not attractive for small scale hydro, biomass and wind power projects and there are currently around 60 approved projects in the pipeline. The table below illustrates Kenya's FiT rates.

Technology	Firm	Non-firm
Biogas	0.08	0.06
Biomass	0.08	0.06
Geothermal (normal)	0.08	
Small hydro 0.5-1.0	0.12	0.10
1 - 5	0.10	0.08
5 - 10	0.08	0.06
PV	0.20	0.10
Wind (normal)	0.12	

e) Germany

Germany is widely considered to be the country that is the most successful at rapidly transitioning toward renewable energy systems through FiT. Using FiT,

Germany currently generates about 31% of its power (and up to 74% on very windy, very sunny days). The backbone of the transition is solar photo voltaic (PV) and onshore wind power.

According to the Renewable Energy Sources Act (EEG), electricity produced from solar energy is bought at a statutorily fixed price for a period of 20 years. The solar electricity is normally all fed into the grid, as the remuneration is higher than the price paid for using electricity from the grid. In this case, the energy received from the grid and that which is fed into it are registered and calculated separately using two meters.

The EEG obliges grid operators to buy electricity produced by solar PV systems at a stipulated minimum price. The rates of remuneration correspond with the year the system was commissioned. They are paid for a duration of 20 years and fixed for the entire period. Different rates of remuneration apply according to the type and size of the system. Bioenergy and small hydroelectric power plants contribute regularly to the mix with off-shore wind farms to be brought on board in the near future.

As a result of the REFiT, power outages in Germany have decreased (to 15.3 minutes in 2013) as the renewable content of its power supply has increased since 2006. An essential characteristic of Germany's transition to renewable energy is that nearly 70% of its generation capacity is by farmers, small- and medium-size businesses, cooperatives, green investment funds and community-owned utilities.

This kind of small-scale, distributed production is what makes the disparate patchwork supply function as well as it does. It has numerous advantages, including the involvement of millions of citizens in the transition. This has given them a stake in the transition from coal electricity generation, which is one reason that upward of 85% of Germans consistently support clean technologies. Moreover, the shift to citizen-owned energy has overcome the big utilities that for so long opposed migration from fossil fuels.

The German REFiT legislation has recently been instrumental in creating a global best practice. Latest figures indicate that approximately 214,000 people are now employed in the renewable energy sector.

Lessons Learnt for Policy Makers

Based on the REFiTs models presented in this technical note, lessons learnt for consideration by policy makers in developing countries can be summarized thus:

FiT policies and investor confidence: FiT policies appear to be crucial for ensuring investor confidence. This is because comprehensive FiTs policies guarantee:

- A market for all energy generated;
- Pre-determined electricity pricing;
- and,
- Long term Power Purchase Agreements (PPAs).

Long-term commitment is necessary from both the private and public sector: This was a key factor in the development of biomass co-generation in Mauritius. In Kenya, long-term commitment by the Government is demonstrated by the stipulation of long-term power purchase agreements – a minimum of 15 years.

Increased income generation opportunities: Renewable energy programmes or projects that provide opportunities for income generation have in most cases been successful. This is demonstrated by biomass-based cogeneration in Mauritius and small hydro development in Sri Lanka.

Preference should be given to specialised renewable energy projects with specific focus on a single option. This was true in the case of co-generation in sugar industry in Mauritius and mini -hydro plants in the tea sector in Sri Lanka.

Building renewable energy industries around existing networks reduces the cost of setting up a whole new network and facilitates accelerated scale-up. This was the case with small hydro-power development in Sri Lanka and co-generation in Mauritius, where renewable development was built on the thriving sugar cane and tea sectors respectively. Co-generation development in Kenya also appears to follow this principle.

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