Evaluation of feed-in tariff-schemes in African countries

M Meyer-Renschhausen
Energy Management Programme, Department of Economics, Hochschule Darmstadt, University of Applied Sciences

Abstract
Almost all African countries are planning to increase their power supply capacities and to diversify the resource base of the electricity sector. In sharp contrast to the ambitious objectives, grid connected power plants, based on renewable energies, are very rare except large scale hydropower in African countries. The small number of renewable energy (RE)-plants in Africa shows that a quick diffusion of these technologies cannot be expected from the dynamic of market forces alone. Political support is necessary. By now, feed-in tariffs (FIT) is the most prominent economic instrument promoting renewable energy technologies in the power sector. They are applied in more than 50 countries, among them several African countries like Algeria, Kenya, Uganda, Ghana and Tanzania. The objective of the paper is to investigate the outcome and effectiveness of African FIT-schemes. It is assumed that most of the FIT-schemes in Africa are poorly working because of unfavourable institutional design, insufficient level of FIT rates or obstacles in the process of implementation. Deficiencies in the design of FIT-schemes and the implementation process can be explained by conflicting policy targets like affordable power prices and grid stability but also with an unclear allocation of property rights that can lead to time-consuming negotiations of Power Purchase Agreements.

Keywords: renewable energies; instruments to promote renewable energies; Feed-In Tariffs; grid-access; institutions;

1. Introduction

Almost all African countries are planning to increase their power supply capacities and to diversify the resource base of the electricity sector. According to official programs and planning (National Resource Plans, White papers etc.) modern renewable energy technologies, especially solar power plants, shall play an important role to meet these targets. In sharp contrast to these ambitious objectives, grid connected power plants, based on renewable energies except large scale hydro power, are very rare in African countries. In the absence of solid figures it is estimated that in 2012 the total number of RE power plants in Africa is less than 1000, compared to 1.1 million in Germany. Furthermore, it is suggested that the total capacity of grid connected solar power plants in Africa is less than 20 MW, compared to say about 25 000 MW in Germany.

The small number of RE-plants in Africa shows that a quick diffusion of these technologies cannot be expected from the dynamics of market forces alone. Political support is necessary.

For promoting renewable energies in the electricity industry, several instruments are available such as subsidies, quotas, tendering and feed-in tariffs. As theoretical discussion shows, each instrument has specific strengths and weaknesses, depending on the targets of energy policy. If it comes to promoting the technological development of a bundle of different renewable technologies, FITs are the most appropriate instrument. On the other hand, if energy policy targets to increase the share of renewable energies in the power sector at least cost quota systems or tendering seem to be more appropriate. Thirdly, if the major policy objective is mitigation of greenhouse gases, the promotion of specific renewable energy technologies might be reasonable. Finally, if job creation is the dominant target, subsidies for specific renewable energy technologies might be superior to other approaches. In the real world, policies have several objectives and thus, a mix of different instruments is applied simultaneously or the FIT-scheme is modified to make it compatible with other policy targets, especially the target of affordable power prices.

By now, the FIT is the most prominent econom-

ic instrument to promote renewable energy technologies in the power sector. FITs were first applied in industrialized countries like Germany and Spain, but by now are applied in more than 50 countries, among them several developing countries. Even several African countries like Algeria, Kenya, Uganda and Tanzania have introduced them; other countries like Ghana, Botswana and Namibia are considering doing so. In 2011, South Africa prematurely abandoned FITs for a competitive bidding process, despite having introduced favourable FIT rates.[1] The outcome and effectiveness of African FIT schemes is not systematically investigated, yet.

The paper aims to describe and evaluate FIT schemes of a number of African countries. It is assumed that most of the FIT schemes in Africa are poorly working because of unfavourable institutional design, insufficient level of FIT rates or obstacles in the process of implementation. Further it is assumed that these design and implementation deficits don't occur accidentally, but are expressing conflicting policy targets like affordable power prices and stability of the power grid.

The paper is organized as follows: In section 2 the criteria that can be used to evaluate FIT-schemes is discussed. Section 3 presents the features of the FIT-systems in relevant African countries and evaluates them according to the criteria discussed in section 2. Section 4 summarizes the relevant results.

2. Criteria for the evaluation of FIT-schemes

FITs were introduced first by industrialized countries to meet a broad bundle of political targets like:

- developing new renewable energy technologies and bringing down the cost of green power generation,
- increasing the share of green power in the electricity market,
- contributing to the mitigation of GHG, and
- creating new job opportunities, especially in rural areas.

To meet these objectives, a FIT scheme must be designed in a way, that it is attracting national and international investors. That means the tariff must be high enough to cover the generation cost of a given technology, including a sufficient rate of return and supplements for technology and country risks.

From investors' perspective, the ideal FIT scheme shows the following design elements:

- it includes a broad bundle of green technologies;
- the tariffs is based on cost of generation;
- the tariffs are differentiated by technology;
- the tariffs are differentiated by size or application for each technology;
- the tariffs are differentiated by resource intensity for wind energy and solar;
- the tariff is provided for a number of years, sufficient to recover all costs;
- the tariff is indexed by inflation;
- there are no program caps; and
- there are no project size caps (minimum or maximum project size).

Furthermore, access of green power suppliers to the grid – to the transmission grid or to the distribution grid – is crucial. The grid company must be obliged to connect renewable power plants to the grid and to accept the (fluctuating) green power supply with priority. This obligation affects the grid company in many ways (e.g. need for balancing power) and implies a reallocation of property rights in favour of green power suppliers.

Ideally, from a green power supplier's perspective, the grid company[2] is facing the following obligations:

- it has to ensure grid connection within a defined time span;
- it is bearing the cost of grid connection and grid enhancement;
- it has to accept all renewable power supplied without restrictions concerning timing and quantities;
- it has to provide additional balancing power; and
- it has to pay the defined FIT for each kWh supplied even if it is not entitled to pass all cost to the final customers.

Under such a 'green regime' there is no need for power purchase agreements (PPA) between the green power supplier and the grid company. This is the case in Germany where no PPA is required. This regime, while diluting the grid company's property rights, implies the risk of grid disturbances and even of divestments in the grid infrastructure. This disadvantage of a green regime can be avoided if the grid company is financially compensated; meaning that all program costs can be passed to the final costumers.[3]

The ideal FIT scheme, added by an ideal 'green' regime of grid access, is based on two pillars:

- strong public support of green power and acceptance of the people to bear increases of power prices; and
- existence of sufficient grid capacity to connect a significant number of green power producers without the threat of destabilizing the grid.

In developing countries, theses pillars of a well-designed FIT scheme cannot be taken for granted. On the contrary, in most developing countries, power prices for the domestic sector represent a sensible political issue. Often power prices for private households are subsidized to make power affordable. This is true especially for Africa, where the power prices are much higher than in develop-

ing countries in other continents (Eberhard *et al*., 2011). Another critical feature of the African electricity sector is the lack of grid capacity.

As a consequence, it is expected that the FIT scheme and the grid access regime cannot be implemented in a way that may be appropriate for affluent industrialized countries. Instead, modifications are expected, to limit the impacts on power prices and to make the feed-in of green power compatible with the weak grid infrastructure.

To avoid increasing power prices, Governments can apply different strategies, like:

- Program caps to limit the total share of renewable energies in the power sector and thus to limit the additional cost for the customers,
- Technology caps to limit the share of technologies with comparatively high specific cost and high variability like wind energy and
- Minimum sizes to exclude small plants with relatively high specific cost.

Some of these strategies are applied in industrialized countries, too.

Furthermore, different approaches can be distinguished to make the FIT program compatible to the requirements of grid stabilization, like:

- The proposed projects must be in line with the investment priorities of a published Master Plan for the power sector.[4]
- The compatibility of the proposed project with the requirements of grid stabilization is defined by the grid company.
- The conditions of grid access (timing, cost of grid connection and grid enhancements etc.) are left to negotiations between the grid company; and the green power supplier.

In the latter case, it is expected that a Purchase Power Agreement (PPA) will only be signed if both parties agree upon all relevant issues. In this case, all relevant property rights remain in the hands of the grid company. The approach is therefore referred to as the 'grey regime' of grid access. Under such a regime, the grid company is not likely to allow grid access unless if it is meeting its interests e.g. if decentralized green power supply helps to avoid bottlenecks or leads to cost reductions (e.g. by reducing power losses or avoiding power outages). Under the grey regime, serious implementation issues are expected, in spite of favourable FITs. Implementation issues are expected to become even more serious if the grid company is vertically integrated and has its own generation branch. In this case, the grid company does not only defend the profitability of the grid, but tries to avoid 'stranded cost' caused by unused capacities of conventional generation capacities. Again, the implementation issues can be reduced if the regulatory body ensures that the additional cost of the FIT regime can be passed to the final customers.

3. Features of FIT schemes of African countries

In the following section, the features of FIT schemes in a number of African countries are described and analysed. Under consideration are countries with working FIT schemes including more than one type of renewable energy technology.[5] In analysing the FIT schemes, focus is given to the favourable and unfavourable aspects from an international investor's perspective. Favourable are institutions that are increasing incentives for investments in renewable energy plants. Unfavourable are institutions that reduce the scope for investments and increase transaction cost and risks.

Algeria

The Government of Algeria intends to increase the share of renewable energies in the power mix. The first program was passed 2004, but without detailed targets. In the recently published 'Renewable Energy and Energy Efficiency Program' of March 2011 (Ministre de l'Energie et des Mines, 2011) the Government formulates the ambitious objective'… of installing up to 22 000 MW of power generating capacity from renewable sources between 2011 and 2030…and it is expected that about 40% of electricity produced for domestic consumption will be from renewable energy sources by 2030' (Ministre de l'Energie et des Mines, 2011: 4).

The Algerian government instituted a FIT-scheme by decree, No.04-92 of March 2004 (Décret executive), after power shortages and rationing of electricity in mid-2003. The target of the decree is diversification of electricity generation by using renewable energies and cogeneration. When published in 2004 Algeria was the first African country that had introduced a FIT-scheme. The main features are the following:

- FITs are offered for the following renewable energies used for power generation: wind, waste, hydro and solar (photovoltaic - PV and concentrated solar power - CSP). There are no special prices for specific technologies;
- The FIT – published in law - are not based on cost of generation, but bonuses or premium prices (see Table 1);
- The tariffs are not differentiated by technology, but by energy;
- Tariffs are not differentiated by size or application for each technology;
- Tariffs for wind are not differentiated by windspeed;
- The FIT is offered for a project's lifetime;
- There is no explicit inflation indexing. But since the FIT is based on retail power prices, a general cost increase will lead to increasing tariffs;
- Program caps do not exist; and
- Project size caps do not exist for renewable power plants, but only for cogeneration plants.

The decree does not provide fixed tariffs but defines energy-specific bonuses or premiums that are paid on top of the market price, defined by law No.° 02-01 du 22 Dhou El Kaada 1422 (Articles 88 ff). The market price is identical to the retail price including generation cost, transmission cost, distribution cost, marketing cost and diversification cost. Electricity producers using renewable energies benefit from premiums between 100% and 300% of the market price of electricity, guaranteed for the full lifetime of a project.

Table 1: Premium for renewable energies and cogeneration in Algeria

Renewable energy	*Premium on the market price*
Wind power	300%
Hydro power	100%
Cogeneration	160%
Waste incineration	200%
Solar electricity entirely produced by solar irradiation (PV or CSP without co-generation)	300%
For solar thermal electricity with gas co-generation the bonus is	
for a solar contribution greater than 25%	200%
for a solar contribution of 20% to 25%	180%
for a solar contribution of 15% to 20%	160%
for a solar contribution of 10% to 15%	140%
for a solar contribution of 5% to 10%	100%
for a solar contribution of 0% to 5%	0%

The main institutions of grid access are the following:

- The national grid company Sonelgaz has the obligation to allow third parties the access to the transmission grid;
- The law does not include a 'priority rule' for renewable energies;
- New power plants have to be authorized by the Ministry of Energy or by the national regulator (Commission de regulation de l'electricité et du gaz, CREG). Exceptions exist only for power plants that are producing for the generator's own demand or that are smaller than 25 MW, and
- There is no obligation of the grid company (Sonelgaz) to upgrade the grid infrastructure (Wuppertal Institute for Climate, Environment and Energy, CREAD, 2010).

What are the pros and cons of the Algerian FIT scheme from an investor's perspective?

Positive features are the following:

- FITs are provided for a broad bundle of renewable energies (not for specific technologies);
- FITs are provided for the lifetime of a project;
- No program caps;
- No project capacity caps; and
- Obligation for grid-company to connect green power suppliers.

Unfavourable features of the Algerian FIT scheme that are leading to higher transaction costs or increasing uncertainty are the following:

- Since the FIT is a bonus on the retail price of power, it varies with the power price implying uncertainty in revenue streams for the green energy supplier. Furthermore, subsidies for power stations (subsidies for natural gas) lead to a decrease of retail prices for power and thus reduce the profitability of renewable energy technologies;
- FITs are not differentiated by technology, size and location;
- The Tariff is expressed in national currency not US$ or € implying exchange rate risks for foreign investors;
- There is no obligation for the grid company to feed in green power with priority (no priority rule);
- Unclear rules as to who shall bear the cost of grid connection and grid enhancement; and
- No obligation for the grid company to enhance grid-infrastructure.

In conclusion, one can say that both the design of the tariff and the grid access rules imply serious risks for investors. The FIT is not fixed, but is depending on variable and subsidized power tariffs. The grid access regime can rather be referred to as a `grey regime' than a green regime. A lot of important issues such as cost of grid connection, grid enhancement and the timing of feeding in green power are left to negotiations between the grid company and the green power supplier. Since the grid company has a generation branch it is expected that they will be reluctant to accept the supply of green power from independent power producers.

The Algerian energy policy, characterized by insufficient FITs and regulatory obstacles, obviously attempts to promote renewable energies without increasing power prices and without endangering the financial stability of the national grid company. Authorization of new power plants and lacking provisions to avoid bottlenecks in the grid is protecting the incumbent power generator (Sonelgaz) against stranded cost and the grid company (Sonelgaz) against rising costs. Since these costs have to be passed to final costumers in one way or the other, the provisions help to avoid rising power prices.

Thus, it is no wonder that the outcome of the FIT scheme is poor. There is no indication that any project has been initiated and realized by the FIT-scheme. The ambitious objectives mentioned will hardly be realized with help of the existing FIT-scheme. The recently published 'Renewable Energy

and Energy Efficiency Program' of March 2011 does not even mention the FIT-scheme as a relevant instrument. Instead, the focus is on subsidies to cover the additional cost of (large) renewable power plants. In conclusion, one can say that the Algerian FIT-scheme is not working because of the insufficient level and the variability of tariffs. Since the tariff is insufficient, other issues like obstacles to grid access do not become visible.

Ghana

The Ghanaian FIT scheme is still at an early stage of implementation. The objective of the 'Renewable Energy Bill', that was passed 2011, is to support the development, utilization and efficient management of renewable energy sources. '…Government faces the challenge to increase renewable energy in the national energy mix in a sustainable manner. Its goal is to increase the proportion of renewable energy, particularly solar, wind, mini hydro and waste-to-energy in the national energy supply mix and to contribute to the mitigation of climate change. ' (Republic of Ghana: Renewable Energy Bill, 2011:1).

The main features of the Ghanaian FIT-scheme are the following:

- FITs are offered for a great number of renewable energies used for power generation: wind, hydro, solar (PV and CSP), biomass, bio-fuel, landfill and sewage gas, municipal solid waste, industrial waste, geothermal energy, ocean energy, other energy sources (as designated by the Minister). The tariffs will be expressed in US$;
- In principal, the FIT is based on cost of generation, but other aspects like impact on power prices have to be considered as well. The tariff level is not published in law, but shall be published by the Public Utility Regulation Commission. Experts expect the FIT for PV to range between USD 0.20 and 0.25 per kWh;
- The tariffs shall consider the technology under consideration;
- The law does not make statements whether the tariff shall be differentiated by size;
- Tariffs shall consider the location of renewable power generation;
- The FIT is guaranteed for 10 years. 'The feed-in-tariff rate fixed for electricity from renewable energy sources shall be guaranteed for a period of ten years and subsequently be subject to review every two years' (§28 (Wuppertal Institute for Climate, Environment and Energy, CREAD, 2010).
- There is no explicit inflation indexing; it can be considered after ten years;
- A program cap does not exist; and
- Project size caps do not exist, neither minimum sizes nor maximum sizes

Implicitly, caps concerning the maximum aggregate plant capacity for a single technology or for all renewable energy technologies can come into the picture, since Renewable Energy Law is combining the FIT-scheme with another instrument, a renewable energy purchase obligation for distribution companies. Distribution companies as well as so called bulk customers have to cover a specified percentage of their energy demand by renewable energies.

The main institutions of grid access are the following:

- Grid companies have the obligation to connect renewable energy generators to the transmission or distribution grid;
- The law includes a purchase obligation but no explicit 'priority rule' for renewable energies. The PPA has to be in accordance to guidelines published by the Regulation Board;
- Renewable power generators need to be licensed. The license can be refused for many reasons like technical data, national security, public safety, food security, health and environmental safety; and
- The law does not include any regulations as to who is going to bear the cost of grid connection and grid enhancements.

What are the pros and cons of the Ghanaian FIT scheme from an investor's perspective?

Positive features are the following:

- FITs are provided for a comprehensive bundle of renewable energies (not for specific technologies);
- FIT will be expressed in US$;
- The tariff shall consider the type of technology and the location of renewable power plants;
- There are no program caps;
- There are no project capacity caps, neither minimum caps, nor maximum caps;
- Obligation on grid companies to connect green power suppliers and to purchase the power;

Unfavourable features of the Ghanaian FIT scheme that are leading to higher transaction costs or increasing uncertainty are the following:

- The FITs – though not yet published - are guaranteed for 10 years only. The tariff level after ten years is subject of future policy decision making;
- The FIT is not strictly based on cost of generation, but other aspects like impact on power prices may be considered as well;
- There is no explicit inflation indexing - it can be considered after ten years;
- There is no obligation for the grid company to feed in green power with priority (no priority rule);
- Unclear rules on who shall bear the cost of grid connection and grid enhancement;

- Renewable power generators need to be licensed. The license can be refused for many reasons; and
- There is no obligation for the grid company to enhance grid-infrastructure.

It can therefore be concluded that the Ghanaian FIT scheme shows some favourable design elements like FITs expressed in US$ and the lack of program and capacity caps. At the same time there are, however, several unfavourable features that lead to uncertainty and may jeopardize profitability and bankability. It is still too early for a final conclusion since neither the tariffs nor the guidelines for PPA have been published. Furthermore, experiences concerning the process of licensing are lacking. In general it can be said that if the licenses are not granted according to a standardized process with defined timing, it may imply detrimental impacts on the process of project implementation. Publishing of guidelines can help to speed up the process of negotiation, if they clarify the (property) rights of the green energy supplier.

The fact, that the tariffs are not yet published indicates the relevance of target conflicts, promoting renewable energy in the power sector without increasing the power price level. If the tariff will be too low, not the FIT-scheme, the Renewable Power Purchase obligation will be effective. In this case, the FIT-scheme will be replaced by a quota-system.

Kenya

To increase the electricity supply and to diversify the electricity energy sources, the Government of Kenya introduced a REFIT scheme in 2008. The general objectives of the REFIT system are both, macroeconomic (income and employment generation) and energy economic (contribution to supply and diversification of electricity generation sources [6, p.3]. The Kenyan FIT-scheme was revised 2010. Besides higher tariffs for wind and biogas the revised version includes tariffs for biomass, geothermal and solar resources (Ministry of Energy, 2010).

The main features of the Kenyan FIT-scheme are the following:

- FITs are offered for the following renewable energies used for power generation: wind, biomass, small hydro, biogas, geothermal, solar (PV and CSP);
- The tariffs are expressed in US$;
- The calculation of the FITs is principally based on the generation cost of renewable power plants; but other factors like avoided cost and international FIT-levels will be considered too;
- The FITs of the Kenyan scheme are not minimum tariffs that must be paid by the Grid Company, but maximum tariffs that must not be exceeded. The supplier and the grid company may agree upon lower tariffs (Ministry of Energy, 2010);
- Different tariffs are offered for firm and non-firm power (electricity from sources with fluctuating supply);
- Tariffs are not differentiated by plant-size, except for hydro (see Table 2);
- Tariffs for wind, solar etc. are not differentiated by location;
- The FIT is offered for a period of 20 years;
- There is no inflation indexing;
- A general program cap does not exist, but caps for every technology; and
- There are defined project size caps – minimum and maximum caps – for each technology (Table 3).

In the case of solar power, there is one FIT provided for both, solar PV and Concentrating Solar Power (CSP). For both technologies, the minimum size is 500 kW. Thus, in case of PV there is a focus on large ground based plants and not on small (top-of-roof) plants. 'Small scale solar PV does not meet expressed policy goals of rapidly scaling up power availability with low cost electricity' (GTZ, 2009:16).

The main features of grid access are the following:

- Grid companies have the obligation to connect renewable energy generators to the transmission or distribution grid;
- The law includes a purchase obligation with explicit 'priority rule' for renewable energies. 'Power Producers and grid system operators may agree by contract to digress from the priority of purchases, if the plant can thus be better integrated into the grid system. The parties shall seek approval for such variations from the Energy Regulatory Commission' (Ministry of Energy, 2010:13);
- Renewable power projects need to be approved in a complex procedure. Firstly, a Letter of Interest (LOI) has to be submitted and approved. Once it is approved, a 'detailed proposal' must be submitted. 'Investors whose EOIs are approved will be required to carry out detailed feasibility studies including environmental and social impact assessments and submit detailed proposals. Detailed proposals should be considered as the business plans of the investors and should therefore be detailed enough and be presented in a bankable format' (Ministry of Energy, 2010.6);
- The law clearly defines that cost of grid connection and grid enhancement has to be paid by the grid company and shall be transferred to final customers; and
- The cost of the FIT-scheme cannot completely be transferred to the final customers. About one third of the program cost has to be borne by the

Table 2: Feed-in-tariffs in Kenya

Technology type	*Plant capacity (MW)*	*Maximum firm power tariff (US$/kWh) at the interconnectio point*	*Maximum non-firm power tariff (US$/kWh) at the nterconnection point*
Geothermal	up to 70	0.085	
Wind	0.5–100	0.12	0.12
Biomass	0.5–100	0.08	0.06
Small Hydro	0.5–0.99	0.12	0.10
	1–5.0	0.10	0.08
	5.1–10	0.08	0.06
Biogas	0.5–40	0.08	0.06
Solar	0.5–10	0.20	0.10

Table 3: Capacity caps for firm and non-firm generation

Technology type	*Plant capacity (MW)*	*Cap for firm capacity (MW)*	*Cap for non-firm capacity (MW)*
Geothermal	up to 70	700	
Wind	0.5–100	300	
Biomass	0.5–100	200	50
Small Hydro	0.5–0.99 1.00–5.0 5.1–10.0	150	50
Biogas	0.5–40	100	50
Solar	0.5–10	100	50

grid operator. The grid operator is entitled to '…recover from the electricity consumer 70% of the portion of the Feed-in-Tariff except for solar which will be 85%, or as maybe directed by the Energy Regulatory Commission…' (Ministry of Energy, 2010:12).

What are the pros and cons of the Kenyan FIT scheme from an investor's perspective?

Positive features are the following:

- FITs are provided for a comprehensive bundle of renewable energies (not for specific technologies);
- FIT are expressed in US$;
- Attractive level of FIT for wind and firm solar;
- The tariff is offered for a period of 20 years;
- A general program cap does not exist; generous caps exist for every single technology;
- There are defined project size caps – minimum and maximum caps – for each technology (Table 3);
- Grid companies have the obligation to connect renewable energy generators to the transmission or distribution grid;
- The law includes a purchase obligation with explicit 'priority rule' for renewable energies; and
- Costs of grid connection and grid enhancement have to be paid by the grid company and shall be transferred to final customers.

Unfavourable features of the Kenyan FIT scheme that are leading to higher transaction costs or increasing uncertainty are the following:

- The FITs are maximum prices not minimum prices. The grid company may try negotiating lower prices;
- Very low tariffs for non-firm electricity make investments in PV technologies extremely unattractive;
- The FIT is not only based on generation cost of renewable power plants, but other aspects like avoided cost and international FIT levels have to be considered as well;
- The grid company is not entitled to recover all cost of the FIT scheme. Incomplete recovering of the cost may reduce its capability to follow other economic objectives like grid stabilization and rural electrification.
- There is no explicit inflation indexing; and
- Renewable power projects need to be approved in a complex process.

Evaluating the Kenyan FIT-scheme we see both institutional design elements that promote investments in renewable power projects, as well as detrimental rules. With regard to the grid access rules the Kenyan FIT scheme shows a lot of favourable features and thus tends to be a green regime. On the other hand, the design of the FIT scheme itself shows several features that lead to increased uncer-

tainties and may impede investments.

The target conflict between promoting renewable energies and stability of power prices leads to some interesting modification of the FIT-scheme: The FIT-tariff is a maximum tariff, not a guaranteed tariff. The tariff itself is subject to negotiations between the grid company and the investor. This feature impedes project planning and bankability, since future revenues are subject to uncertainty.[6] Since the grid company may not pass all FIT cost to the final consumers, but only 70% (85%) it has a strong incentive to negotiate the tariff and to avoid all kind of projects that lead to significant profit reductions.

Possible target conflicts between increasing the share of renewable energies and grid stability can lead to exception from the priority role. Even if the Regulator has to approve any exception the investor is facing another source of insecurity that may impede implementation and increase financing cost. The question on how far these design elements of the Kenyan FIT-scheme may lead to serious impediments for green power projects depends very much on the behaviour of the Regulator and the Ministry of Energy.

Kenya is the only African country where data on the impacts of the FIT-scheme is available. By spring 2011, the FIT policy has elicited 49 expressions of interest (EOI) from potential investors, most of them for wind power plants (23) and hydro power projects (19) (Republic of Kenya, 2011). The received proposals include a capacity of about 1 500 MW, of which 1 311 MW were approved, most of them being wind power. If all these projects were implemented the Kenyan generation capacity would be doubled. But by now, only for 2 projects have had their PPAs have been signed so far. The other projects are undertaking feasibility studies (Republic of Kenya, 2011). Since the agreement on PPA is subject to negotiations, it is too early to judge the Kenyan FIT-scheme as a success story. Despite the fact that the design of the Kenyan FIT- scheme does include several exceptions from best practice recommendations, it can be considered as one of the most promising schemes in Africa. Since the South-African FIT-scheme has been abandoned in 2011, Kenya has the model role for implementation of FIT-schemes in Africa.

Uganda

Uganda was among the first African countries to introduce a FIT-scheme. In 2007, the Government got a mandate for feed-in tariffs through by the nation's 2007 Renewable Energy Policy. 'The overall objective of the Renewable Energy Policy is to diversify the energy supply sources and technologies in the country. In particular, the policy goal is to increase the use of modern new renewable energy from the current 4% to 61% of the total energy consumption by the year 2017' [9, p.7]. The FIT-scheme is a relevant instrument to realize this target by attracting international investments into the power sector (Electricity Regulatory Authority, 2011/2).

The main features of the Ugandan FIT-scheme are the following:

- FIT are offered for the following renewable energies used for power generation: Hydro, biogases, biomass, biogas, landfill gas, geothermal, wind and PV solar (PV and CSP);
- The FITs are based on levelised cost of generation;
- The tariffs are not differentiated by technology, but by energy;
- Except from hydro, the tariffs are not differentiated by plant-size;
- Tariffs for wind are not differentiated by windspeed;
- There is an explicit inflation indexing for the variable cost;
- The FIT is offered for 20 years;
- Program caps exist for each technology; and
- Project size caps exist (20 MW); in the case of greater projects the feed-in price is subject to negotiations.

The Uganda FIT programme explicitly distinguishes Priority 1 and Priority 2 projects. Technol-

Table 4: Received and approved proposals under the Kenyan FIT scheme

Received proposals					*Approved proposals*	
	Technology type	*No.*	*Capacity (MW)*	*% of total*	*No.*	*Capacity (MW)*
1	Wind	2	1 118	74	20	1 008
2	Biomass		164	11	4	164
3	Hydro	4	111	7	16	81
4	Geothermal	19	70	5	0	0
5	Biogas	1	40	3	1	40
6	Cogeneration	1	18	1	1	18
		49	1 521	100	42	1 311

ogies that fall under Priority 1 technologies are those '…for which the Levelised Cost is below or close to the Avoided Cost', whereas technologies with levelised cost '…significantly above the Avoided Cost' are referred to as Priority 2 projects' (ERA, 2011:5). In case of Priority 2, the annual allowable installed capacities are limited. Currently, all technologies listed in Table 4 are Priority 1 technologies. The only Priority 2 technology is solar PV.

The selection of Priority 1 and Priority 2 projects is based on different rules. Whereas the former '…will be awarded up to the Maximum Technology Capacity Limits on a first come first served basis' the latter will be awarded up to the Maximum Technology Capacity Limits of Table 4 '...through an annual open bidding process' (ERA, 2011:8), based on the following criteria:

- Initial pre-qualification;
- Acceptance of the approved standardized power purchase agreement;
- Contribution to grid stabilization and mitigation of transmission losses;
- Promotion of local economic development and employment creation;
- Viable network integration requirements;
- Ability and capacity to raise finance; and
- Short-commissioning time

The Uganda FIT-scheme includes detailed rules of grid access:

- Both the national grid operator as well as distribution grid companies are obliged to connect green power generators to the transmission or distribution grid;
- The grid operator has to buy all green power supplied without consideration of the power demand (priority rule);
- Renewable energy generators need to be licensed; and
- Cost of grid connection shall be borne by the renewable power supplier; whereas cost of grid enhancement has to be borne by the grid company (Electricity Regulatory Authority, 2011/2).

Green power generators who intend to sell power under the REFIT scheme need to be licensed. They have to submit a Notice of Application that serves the regulator (ERA) for the initial pre-qualification of the projects. The Notice shall include information about the following aspects:

- 'Contribution of the project to grid stabilisation and reduction in network losses;
- Acceptance of the standardised Power Purchase Agreement;
- Impacts on socio-economics to include economic development, employment creation and contribution to national developmental goals and objectives;
- An indication of the location and technical specifications of the interconnection point with the grid;
- Technical and financial requirements for network integration' (Electricity Regulatory Authority, 2011/2:9).

What are the pros and cons of the Ugandan FIT scheme from an investor's perspective?

Positive features are the following:

- FITs are provided for a comprehensive bundle of renewable energies (not for specific technologies);
- FITs are expressed in US$;
- Attractive level of FITs for most technologies, especially for wind and solar PV;
- The tariff is offered for a period of 20 years;
- Explicit inflation indexing for the variable cost;
- Grid companies have the obligation to connect renewable energy generators to the transmission or distribution grid;
- Purchase obligation with explicit 'priority rule' for renewable energies; and

Table 5: Feed-in-Tariffs up to a maximum capacity of twenty megawatts (20MW)

Technology	*Tariff (US$/kWh)*	*O&M percentage (US$/kWh)*	*2011 (MW)*	*2012 (MW)*	*2013 (MW)*	*2014 (MW)*	*Payment period (Years)*
Hydro (9>><=20 MW)	0.073	7.61	45	90	135	180	20
Hydro (1 >< = 8MW)	Linear tariff	7.24	15	30	60	90	20
Hydro (500kW>><=1 MW)	0.109	7.08	1	15	2	5	20
Biogases	0.081	22.65	20	50	75	100	20
Biomass	0.103	16.23	10	20	30	50	20
Biogas	0.115	19.23	10	20	30	50	20
Landfill gas	0.089	19.71	10	20	30	50	20
Geothermal	0.077	4.29	10	30	50	75	20
Solar PV	0.362	5.03	2	3	5	7.5	20
Wind	0.124	6.34	50	75	100	150	20

- Cost of grid enhancement has to be borne by the grid company.

An unfavourable institutions feature of the Ugandan FIT scheme that may lead to higher transaction cost or increasing uncertainty are the following:

- Cost of grid connection shall being be borne by the green power supplier;
- Low cumulative capacity limits, especially for solar PV; and
- Renewable power generators need to provide comprehensive information on project financing, and project impacts need to be approved by the Regulator.

As mentioned, the Government of Uganda has defined ambitious targets to increase the share of modern renewable energies from 4% to 61% in 2017. The FIT-program shall play an important role to increase the share of green power in the power sector by attracting international investments.

The Ugandan FIT scheme can be considered as one of the most sophisticated schemes among all African countries. Due to the challenging pre-qualification process, there are some doubts whether the 61% target will be met. Up to now, there is no data available on how many projects have been approved under the FIT scheme.

4. Conclusions

The main objective of FIT-programs in African countries is to increase and diversify the power supply, preferably financed by international investors. At the same time, significant increases of power prices shall be avoided. To attract international investors the FITs are generally based on the specific cost of the renewable energy technologies and often expressed in US$. But there are exceptions like Algeria where premiums on the power market price are offered.

To avoid increasing power prices, Governments of African countries with FIT-schemes apply a broad bundle of different strategies. Here, one can distinguish explicit and implicit approaches. Explicit approaches are institutions that are explicitly designed to limit the program cost. They are clear-cut and must be obeyed by the stakeholders like project developers, grid companies and Government authorities. Implicit approaches involve features that are not clear-cut. The outcome is subject to negotiations between the stakeholders.

Explicit approaches that are practiced by the countries under consideration are the following:

- Program caps to limit the total share of renewable energies in the power sector and thus to limit the additional cost for the customers;
- Technology caps to limit the share of technologies with comparatively high specific cost, sometimes called Priority 1 and Priority 2 technologies;
- Minimum sizes to exclude small plants with relatively high specific cost;
- Different tariffs for firm power (non-fluctuating power) and non-firm power. Higher tariffs for firm power supply are economically justified since firm power doesn't involve an increase of balancing power.

Examples of implicit approaches are:

- Tariffs are not only based on the cost of renewable power technologies, but have to consider other aspects, too (like impacts on power prices);
- Tariffs are maximum prices, not minimum prices;
- PPAs are subject to negotiations between green power producer and grid company;
- Unclear rules concerning grid extensions and grid enhancement;
- Requirement of licensing or approval of renewable energy producers or projects.

From an investor's point of view, explicit and implicit rules of program cost control will be judged differently. Explicit rules are limiting program cost by regulating (limiting) the number and size of projects. Especially, project size caps do not increase the project risk and affect bankability. On the other hand, if implicit rules like negotiable PPA or tariffs are applied, the transaction cost will be rising and the outcome of the process becomes uncertain. In this case, the bankability of renewable energy projects is jeopardized, since banks unlikely finance projects whose cost and timing is uncertain. Thus, implicit rules of reducing program cost tend to impede the attraction of international investors and thus jeopardize the success of a FIT-program. South Africa represents an example that a highly attractive FIT scheme can become completely ineffective when all relevant issues are left to negotiations between green power suppliers and a grid company.

As mentioned earlier, each instrument to promote renewable energy in the power sector has its specific strengths and weaknesses, depending on the targets of energy policy. Whereas, FITs are most appropriate to develop new renewable energy technologies and to bring down the cost, quota systems and competitive bidding seem to be superior to increase the share of renewable energies at least cost. Since stable power prices are of high political priority all over Africa, there is no wonder that several African countries with FIT schemes have introduced elements of quotas or tendering:

- Ghana has introduced renewable energy purchase obligations for distributers and bulk consumers;
- Uganda has introduced an annual open bidding

process for Priority 2 projects (projects with comparatively high generation cost).

In 2011, South Africa has replaced its FIT scheme with a comprehensive competitive bidding process. The tendering approach enables the country to expand the share of renewable energies in the power sector at relatively low cost and in accordance to the National Resource Plan. The success of the first bidding rounds shows that South Africa is likely to avoid the implementation deficits of the FIT scheme and to harmonize the conflicting targets of expanding the share of renewables, affordable power prices and grid stability. Namibia seems to be the next country that is about to modify its FIT plans in favour of competitive bidding for bigger projects: All projects greater than 5 MW shall go under tendering.[7]

Notes

1. This was due to possible conflict with the relevant state procurement Act
2. System operation is assumed to be a function of the grid company.
3. Another issue is 'stranded cost' of incumbent power producer
4. Typically, the Master Plan combines political objectives for the future dynamic of the power system with economic considerations of the grid company and power generators
5. The FIT scheme of Mauritius includes only one technology
6. In the 'detailed proposal' the investor has to publish a business plan including information on project financing. As long as future revenues are questionable banks will hesitate to make clear statements on the share of debt that is acceptable to them
7. Namibia is introducing three schemes, FIT for small renewables, less the 5W, tendering for large scale (greater than MW) and net –metering for roof top PV. Currently, Namibia plans a tender of 30 MW solar PV (3 projects of 10 MW in different parts of the country)

References

Décret exécutif n° 04-92 du 4 Safar 1425 correspondant au 25 mars 2004 relatif aux coûts de diversification de la production d'électricité. Journal officiell de la Republic Algerienne N° 19, 7 Safar 1425, 28 mars 2004, p. 10 ff; www.mem-algeria.org/francais/index.php?page=237.

Eberhard, A. *et al,* (2011). Africa's Power Infrastructure. Investment, Integration, Efficiency. World Bank, Washington D.C.

Electricity Regulatory Authority, Uganda (2011/2). Renewable Energy Feed-in Tariff (REFIT), Phase 2; Approved Guidelines for 2011-2012; www.era.or.ug/Pdf/Approved_Uganda%20REFIT%20Guidelines%20V4%20%282%29.pdf.

Gipe, P. (2010). Grading North American Feed-in Tariffs. www.wind works.org/FeedLaws/USA/Grading%20N.Am.%20FITs%20Report.pdf.

Government of Uganda (2007). The Renewable Energy Policy for Uganda, www.rea.or.ug/userfiles/RENEWABLE%20ENERGY%20POLIC9-11-07.pdf.

GTZ (2009). Target Market Analysis – Kenya's Solar Energy Market. Berlin, Germany. www.renewablesb2b.com/data/ahk_usa/publications/files/gtz2010-en-targetmarketanalysis-solar-kenya.pdf

Ministre de l'Energie et des Mines (2011). 'Renewable Energy and Energy Efficiency Program'. www.mem-algeria.org/francais/index.php?page=enr.

Ministry of Energy, Kenya (2010). Feed-in-Tariff for Renewable Energy Resource Generated electricity. Guide for Investors.2nd edition.

Ministry of Energy, Kenya (2011). Feed-in Tariffs Policy on Wind, Biomass, Small-Hydro, Geothermal, Biogas and Solar Resource Generated Electricity. 2nd edition 2010; www.energy.go.ke/wp-content/uploads/2010/08/feed%20in%20tarriffs.pdf.

Republic of Ghana: Renewable Energy Bill 2011; www.energymin.gov.gh/upsdocs/Renewable%20Energy%20Bill,%202011.pdf.

Republic of Kenya: Scaling-Up Renewable Energy Program (SREP) - Investment Plan for Kenya. Draft, May.2011; www.energy.go.ke/wp-content/uploads/2010/08/Updated%20%20SREP%20Draft%20Investment%20Plan-May%202011.pdf.

Wuppertal Institute for Climate, Environment and Energy, CREAD (2010). Algeria - A Future Supplier of Electricity from Renewable Energies for Europe? Wuppertal; www.wupperinst.org/uploads/tx_wiprojekt/Algeria_final_report.pdf.