



Uganda Renewable Energy Feed-in Tariff (REFIT)

Phase 2

Guidelines

Revised 15th November 2012

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1 Introduction

- 1.1 These guidelines are meant to provide clarity and guidance to project developers and investors and key institutional stakeholders, on the key components and operational structure of the Renewable Energy Feed-in Tariff (REFIT).
- 1.2 Under the Renewable Energy Policy (2007), a REFIT was initially established in Uganda which ran from 2007 to 2009. This is referred to from hereon as REFIT Phase 1.
- 1.3 Due to limited uptake by project developers, the REFIT was reviewed in 2010 and a new tariff was developed based on updated levelised costs of production, accompanied by these guidelines. This is referred to from hereon as REFIT Phase 2.
- 1.4 .An interim review of the Phase 2 Guidelines and tariffs was carried out in 2012, culminating in this revision.

2 Objective and Key Principles of the REFIT

Policy Context

- 2.1 The overall aim of the REFIT is to encourage and support greater private sector participation in power generation from renewable energy technologies, through the establishment of an appropriate regulatory framework.
- 2.2 This is in line with the Renewable Energy Policy 2007, whereby Government's policy vision for renewable energy is "To make modern renewable energy a substantial part of the national energy consumption".
- 2.3 The Renewable Energy Policy 2007 defines modern renewable energy as renewable energy resources that are transformed into modern energy services such as electricity, which can be generated from solar energy, wind power, water power, geothermal energy and biomass cogeneration. In addition, it also refers to clean fuels derived from renewable energy resources like biogas, ethanol, methanol, hydrogen or solar water heating as well as biomass utilised in efficient biomass technologies, like improved charcoal stoves and improved firewood stoves.
- 2.4 Renewable energy in the context of the REFIT is defined as electricity which can be generated from energy resources such as water power, wind power, solar energy, geothermal energy, biogas and landfill gas combustion, and biomass cogeneration. A full definition of renewable energy and the relevant technologies is provided in Appendix 3.
- 2.5 The REFIT shall apply to small-scale renewable energy systems, of prescribed priority technologies, up to a Maximum Installed Project Capacity of twenty (20) MW, and greater than 0.5 MW, as defined by the Electricity Act 1999.

Key Principles of Feed-in Tariffs

2.6 Feed-in tariffs (FIT) are an internationally recognised regulatory mechanism used to promote and increase the amount of electricity generated from renewable sources, by providing a fixed tariff based on the levelised cost of production for a guaranteed period of time. FITs have numerous advantages and benefits which include:

- **Improved energy security** – fuel is renewable, accessible, and “indigenous”, enhancing national security.
- **Reduced environmental impacts** – direct environmental impacts as well as externalities associated with conventional electricity production, such as water and air pollution, land use change and biodiversity loss are significantly reduced. Electricity generation from renewables also significantly reduces greenhouse emissions.
- **Economic growth and stimulation** – stimulates the creation of “green” jobs, promotes a competitive manufacturing industry and can allow for revenues to be kept within a country. Additionally, FITs can lead to a decrease in electricity tariffs in the long-term.
- **Diversified electricity supply mix** – FITs can promote production of electricity from a diversified set of technologies. A technology-specific approach to the establishment of tariffs allows for the development and deployment of a wide range of renewable energy technologies.
- **Investment security for developers:** The penetration of renewable energy into the market largely hinges on investment security. With a FIT, the risk premium required by investors can be minimised by the high level of price security in the system. Tariffs provided are high enough to cover investment costs and provide a reasonable rate of return. The long-term certainty provided also stimulates investment in relevant technologies, training and building capacity.
- **Industry competition:** A FIT encourages competition with the tariff gradually reducing as the industry matures. In the long-term, the establishment of a renewables industry drives down the cost of renewable energy power generation due to learning effects and the development of institutional expertise. This increases renewables’ competitiveness with conventional technologies whilst driving down costs for consumers.
- **Reduced Transaction Costs:** A FIT mechanism is characterised by low (to medium) administration and transaction costs, especially when compared to a bidding process. The costs to society of the mechanism are also low and result in a number of ancillary benefits to the electricity sector, to society and to the economy.

2.7 The key principles of the Ugandan REFIT include:

- (i) A dynamic mechanism that reflects market, economic and political developments;
- (ii) Integration of administrative and application process with existing regulatory processes to avoid duplication and reduce delays in implementation;
- (iii) Guaranteed purchase price for a fixed duration and a stepped tariff for different priority technologies, ensuring an appropriate return on investment for developers, while at the same time limiting and moderating producer surplus in tariff setting, to prevent excessive returns for developers which could impact negatively on electricity prices;

- (iv) A gradual/ annual tariff reduction for new projects as a result of learning effects and cost reductions (known as tariff degression);
- (v) Guaranteed access to the licensed transmission and distribution grids for qualifying renewable energy generators and an obligation on the System Operator to purchase and discharge the power generated;
- (vi) Burden sharing of the additional cost (or a portion of this) throughout electricity consumers and from international donor organisations;
- (vii) Establishment of maximum annual capacity allocations for specified technologies to limit excessive increases on consumer electricity prices and to limit impacts of intermittent and non-firm power on energy security and power quality;
- (viii) Qualifying renewable energy generators will accept a Standardised Power Purchase Agreement;
- (ix) Application of the REFIT only to projects within the borders of Uganda; and
- (x) The REFIT is aimed at fast-tracking multiple priority renewable energy projects and reducing tariffs for new projects on an annual basis within the limits of the Maximum Installed Project Capacity. Renewable energy projects above the Maximum Installed Project Capacity can be developed through the negotiation of tariffs and Power Purchase Agreements (PPA), on a case by case basis, with either the System Operator or individual buyers.

2.8 It is recognised that in the early stages of the REFIT, certain renewable technologies may cost more than conventional technologies. In the light of this, the Government of Uganda is fully aware of the need to avoid high increases in electricity prices which could have negative socio-economic impacts on the country's poor and on industry. Capacity limits are therefore applied to all REFIT technologies, specifically limiting the uptake of certain high-cost technologies.

2.9 The additional power generation costs resulting from the REFIT may be covered through the following sources:

- Burden sharing by electricity consumers
- Green electricity sales;
- Donor support;
- International climate change funds; and
- Carbon finance.

- 2.10 In order to enhance and stimulate the REFIT during its early stage, various international development partners have developed and committed to support the implementation of the Global Energy Transfer Feed in Tariff (GET FiT) Program in Uganda. The overall objective of the GET FiT is to assist developing countries in pursuing a climate resilient low-carbon development path resulting in economic growth, poverty reduction and climate change mitigation. Among other things, the GET FiT Program provides for a Premium Payment for a limited portfolio of projects, which is a top-up on the current levels of REFIT, to qualifying projects that will have gone through a transparent selection process administered by Government of Uganda in collaboration with the development partners outside the REFIT policy framework.

3 Governance Structure

Electricity Regulatory Authority (ERA)

- 3.1 The REFIT will be managed and implemented by ERA as part of its mandate under the Electricity Act of 1999.
- 3.2 ERA's roles and responsibilities under the REFIT include:
- Establish and review the tariff structure for priority renewable energy technologies;
 - Manage and administer the feed-in tariffs;
 - Develop and review the REFIT guidelines;
 - Monitor, report and review the REFIT as outlined in Section 9;
 - Develop and enforce performance standards, quality standards and codes of conduct for the generation, transmission and distribution of electricity;
 - Prescribe and collect licence fees;
 - Establish and review licensing procedures, receive and process applications for generation licences, issue and review generation licences;
 - Supervise licensed renewable energy generators and verify electricity production from the licensed renewable energy power generators;
 - Develop, manage and review appropriate regulations for grid connection and wheeling of RE electricity;
 - Establish and review technology specific capacity limits to prevent oversubscription of the REFIT;
 - Review and update the REFIT tariff model in line with the monitoring procedures defined in Section 9, including avoided costs of the grid, levelised cost of renewable energy technologies, and the renewable energy scenarios;
 - Mediate disputes between generators, transmitters, distributors and consumers;
 - Establish and act as secretariat for interdepartmental REFIT steering committee to support implementation of the REFIT.

System Operator

- 3.3 In consultation with the ERA, the System Operator shall publish the REFIT tariffs for priority technologies as approved by the ERA.
- 3.4 Under its mandate as Single Buyer, the System Operator will issue and sign standardised Power Purchase Agreements (PPA) with qualifying renewable energy generators.
- 3.5 Under the PPA, the System Operator shall be obliged to purchase power generated under the REFIT from licensed renewable energy electricity generators subject to fulfilment of all necessary licence conditions.
- 3.6 The System Operator shall be obliged to connect licensed renewable energy electricity plants to the grid.
- 3.7 The System Operator shall be obliged to transmit purchased electricity from renewable energy electricity generators licensed under the REFIT.

Distribution Licence Holders

- 3.8 Holders of valid distribution licences shall be obliged to provide access and connect licensed embedded renewable energy electricity generation plants to the grid in their areas of operation.

4 Qualifying Renewable Energy Generators

- 4.1 Qualifying renewable energy generators shall be defined as:
 - Priority technologies as set out in Appendix 1. Additional technologies can be added in line with the REFIT review process.
 - Projects greater than 0.5 MW installed capacity, in line with the Electricity Act (1999)
 - Projects up to 20 MW installed capacity, in line with the Electricity Act (1999). Projects with an installed capacity greater than 20 MW will be required to negotiate a tariff and PPA with the System Operator, on a case by case basis.
 - Plant including additional capacity resulting from project modernisation, repowering and expansion of existing sites, but excluding existing generation capacity. Additional generating capacity must be ring-fenced
 - Projects connected to the National Grid. Off-grid projects may be included in future developments of the REFIT, although this would require close consultation and collaboration with the Rural Electrification Agency to develop the technical and operational modalities. In particular, this will require the establishment of a mechanism for the monitoring and sale of power to the System Operator as the Single Buyer

- Being located within the territory of the Republic of Uganda.
- 4.2 To avoid projects larger than 20 MW installed capacity splitting in order to take advantage of the REFIT, all projects must have a discrete legal entity. All leases, consents and licences related to the project must be associated with this legal entity and cannot be shared with other projects submitted under the REFIT.
- 4.3 Priority technologies are listed in Appendix 1.
- 4.4 In this revision of the guidelines, the Priority 2 Technologies specified in the 2010 Guidelines, i.e. for which the Levelised Cost of Energy (LCOE) is significantly above the Avoided Cost, are not included in the present list of priority technologies. Due to the high LCOE, this places limitations on total capacity that can be awarded, therefore these technologies will be implemented through a competitive open tendering procurement process.

5 Basis for the Determination of Feed-in Tariffs

- 5.1 The tariffs for each priority technology are determined using a US\$/kWh levelised cost approach, based on the electricity generation costs from the renewable energy sources. This is aimed at providing an after-tax internal rate of return to equity holders equal to an assumed cost of equity capital, in order to provide sufficiently high tariffs on the one hand and avoiding windfall profits on the other hand. The key inputs are based on general investment assumptions and specific assumptions for each of the priority technologies that influence the power generation costs. These include:
- Investment costs for the plant (include material and capital costs);
 - Grid connection costs;
 - Operation and maintenance (O&M) costs;
 - Fuel costs (in the case of biogas and biomass);
 - Interest rates for the invested capital; and
 - Profit margins for the investors.
- 5.2 The tariff shall be set according to the year in which the licence is issued and are provided in Appendix 1.
- 5.3 The tariff will be paid for a guaranteed payment period of 20 years, with O&M costs adjusted on an annual basis for inflation. The O&M weighting of the overall tariff is defined in Appendix 1.
- 5.4 The tariffs shall be adjusted for inflation using the following tariff adjustment formula:

$$FIT_y = [FIT_{y-1} * (1 - w)] + \left[FIT_{y-1} * \frac{PPI_y}{PPI_{y-1}} * w \right]$$

Where

FIT_y is the applicable feed-in tariff in year *y*;

FIT_{y-1} is the applicable feed-in tariff in the previous year;

PPI is Core Producer Price Index for the United States as published by the Bureau of Labour Statistics;

w is the share of O&M in the initial feed-in tariff (i.e. the weight of O&M in the feed-in tariff as defined in Appendix 1) in a given year '*y*'.

- 5.5 The ERA reserves the right to develop an optional phased tariff structure, allowing a marginal increase during early years (e.g. years 1-7) and a marginal reduction during later years, although retaining the same overall present value. This is aimed at supporting renewable energy generators in financing investments and debt servicing.

6 Technical Regulation

- 6.1 All projects implemented under the REFIT shall be obliged to comply with all relevant technical, legal and regulatory requirements of the Republic of Uganda.
- 6.2 Renewable Energy Power Generators shall be obliged to abide by national standards for connection, operations and reporting as outlined in the Electricity (Primary Grid Code) Regulations of Uganda, 2003 and all amendments thereafter.
- 6.3 The System Operator and Distribution Licence Holders shall be obliged to grant access and connect to the grid, Renewable Energy Power Generators licensed under the REFIT. For distribution licence holders for networks not forming part of the national grid, access and connection will be subject to the proposed supply forming part of existing and future power demand requirements.
- 6.4 The System Operator shall be obliged to immediately and as a matter of priority purchase all the renewable energy electricity generated under the REFIT independent of the power demand.
- 6.5 The Renewable Energy Power Generators shall be responsible for all costs for shallow connection to the grid. Thus, the Renewable Energy Power Generators shall pay for the costs of connecting their plant physically to the nearest point of the electricity distribution grid (at the appropriate voltage level). Any costs for reinforcements of the network shall be borne by either the System Operator or the Licensed Distributors, whichever is applicable.

7 Application and Project Selection Process

- 7.1 All projects coming into the sector will be subject to Section 29 of the Electricity Act.
- 7.2 Application for the REFIT will be processed in conjunction with the standard generation licence application process.
- 7.3 A Performance Bond of US\$ 2,500 (one thousand US dollars) per MW installed capacity is required on submission of an application for the REFIT. This Performance Bond shall be refunded upon Commercial Operation Date (COD). Failure to achieve COD within the specified licence conditions will result in loss of the Performance Bond.
- 7.4 Licenses for projects under the REFIT Phase 2 will be awarded up to the Maximum Technology Capacity Limits defined in Appendix 1 on a first come first served basis.
- 7.5 In addition to existing licensing procedures, projects will be required to demonstrate acceptance of the approved standardised Power Purchase Agreement.
- 7.6 Should the capacity of awarded licences under the REFIT be greater than 80% of the Maximum Technology Capacity Limits for specific technologies, and more than one application for the REFIT has been submitted, ERA may at its discretion, apply any appropriate project selection criteria to the submitted projects.

8 Licensing Conditions, Procedures and Evaluation Criteria for License Applications

- 8.1 Any person who intends to establish a renewable energy power project under the REFIT shall be obliged to fulfil all the requirements and obligations for licensing according to the Electricity Act, 1999, Cap 145.
- 8.2 The licensing procedure for Renewable Energy Power Generators under the REFIT shall be done according to the Electricity Act, 1999.
- 8.3 The Notice of Intended Application (Electricity Act, 1999, Section 30) shall be used by ERA for the initial pre-qualification of all projects. Over and above the current contents, the prescribed form shall be modified to include
- The type of licence required;
 - Generation and sale of electricity under the REFIT as one of the options for type of licence required;
 - 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.
- 8.4 The REFIT tariff is awarded at the time of the award of license. Should the license expire, the tariff shall also expire. Any re-application or extension of the license will require that the prevailing tariff at the time of re-application or extension shall apply.
- 8.5 Existing permit holder shall be required to make a request in writing to apply for the REFIT.
- 8.6 Section 9 (tariff charges and methodology) of the prescribed form for Application for Licence (under Section 34 of the Electricity Act of 1999) shall not be used by ERA for the purposes of evaluating licence applications from persons who intend to generate and sell renewable energy electricity under the REFIT. However, ERA may use the information to review the levelised costs for the qualifying technologies.
- 8.7 Qualified Renewable Energy Power Generators shall be obliged to pay licence fees to ERA charged under Section 120 of the Electricity Act, 1999, as specified in the Schedule to the Electricity (Licence Fees) Regulations, 2003.

9 Monitoring, Reporting and Review

In addition to existing and on-going monitoring and reporting requirements, the following shall apply:

Electricity Regulatory Authority (ERA)

- 9.1 ERA shall be responsible for overall implementation, monitoring and evaluation of the REFIT.
- 9.2 An Annual Monitoring review shall take place at the end of each financial year and shall comprise:
- Evaluation of uptake in terms of technology, installed capacity and location
 - Assessment of the tariffs and to recommend the need to increase or reduce in line with projected levelised costs of production
- 9.3 A Programme Review shall take place every three years and shall comprise:
- Comprehensive assessment of levelised cost of energy model including key assumptions
 - Assessment of the list of priority technologies to either add or remove technologies
 - Review of capacity limits and adjustment if required
 - Consultation with key stakeholders
- 9.4 Following the initial four years of the REFIT, a pre-defined tariff rate depression may be put in place for certain technologies, determined from international best practice annual depression rates adjusted to local conditions in the Republic of Uganda. These shall not be to provide mandated tariffs, but shall provide an indication of future tariffs and projected reductions. .
- 9.5 ERA shall be obliged to gather and maintain a database and report annually on the following:
- Energy produced and energy purchased under the REFIT per technology band;
 - Financial and economic impacts of the REFIT to the Republic of Uganda;
 - A review and update on the introduction of qualifying technologies on the market;
 - The avoided cost of the grid; and
 - Progress on the implementation of the REFIT
 - Actual generation costs
- 9.6 ERA shall establish and act as Secretariat for an interdepartmental steering committee, including, but not be limited to ERA, the System Operator, Distribution Licence Holders the Ministry of Finance Planning and Economic Development and the Ministry of Energy and Mineral Development. The aim of the steering committee will be to identify and mitigate bottlenecks to renewable energy IPP project development in Uganda and shall meet on a quarterly basis.

System Operator

- 9.7 The System Operator shall be obliged to monitor, verify and report to ERA:
- The total number of licensed and operational Renewable Energy Generators by technology and installed capacity.
 - Electricity production by the licensed Renewable Energy Generators.
 - The cost of energy purchased under the REFIT and all additional costs for implementation of the REFIT.
 - The performance of the licensed generating units against parameters registered.
 - Compliance by licensed Renewable Energy Generators with the Electricity (Primary Grid Code) Regulations of Uganda, 2003.
- 9.8 The System Operator shall provide all the necessary information to support ERA in reviewing and updating the avoided costs for the grid on an annual basis.

Renewable Energy Generators

- 9.9 The Renewable Energy Generators shall be obliged to provide such information to the System Operator as is necessary to facilitate compliance with the Electricity (Primary Grid Code) Regulations of Uganda, 2003.
- 9.10 Renewable Energy Generators shall be required to report to ERA:
- Total up-front and on-going capital investment
 - Generation performance including net maximum capacity generation and the quantity of renewable energy generated and fed on to the grid under the REFIT
 - Plant capacity factor
 - Operation and maintenance costs
 - Fuel costs (if applicable)
- 9.11 Additional generation on existing sites shall be metered separately from existing generation, where applicable or as will be agreed in the PPA.

Appendix 1: Schedule of Tariffs 2012

A1.1 Priority Phase 2 REFIT technologies

The Priority renewable technologies for REFIT in Phase 2 include:

- Small hydro power plant;
- Geothermal power plant;
- Bagasse power generation;
- Landfill gas power plant;
- Biogas;
- Biomass/ Municipal Solid Waste (MSW); and
- Wind

It is noted that these lists of priority technologies may be updated during each REFIT review.

A1.2 2011 REFIT Tariffs and Maximum Technology Capacity Limits (2013-2016)

Table A1: REFIT Phase 2 tariffs, O&M %age, capacity limits and payment period

Technology	Tariff (US\$/kWh)	O&M %age	Cumulative Capacity Limits (MW)				Payment Period (Years)
			2013	2014	2015	2016	
Hydro (9 >= 20 MW)	0.079	7.61%	30	90	135	180	20
Hydro (1 >= 9 MW)	Linear tariff	7.24%	30	75	105	135	20
Hydro (500kW >= 1 MW)	0.109	7.08%	1	2	2.5	5.5	20
Bagasse	0.081	22.65%	30	70	95	120	20
Biomass (MSW)	0.103	16.23%	5	15	25	45	20
Biogas	0.115	19.23%	5	15	25	45	20
Landfill gas	0.089	19.71%	0	10	20	40	20
Geothermal	0.077	4.29%	10	30	50	75	20
Wind	0.124	6.34%	25	75	100	150	20

A1.3 Linear Hydro Tariff 1 to 9 MW

In order to reduce the negative impacts of a stepped tariff, a linear tariff, based on the actual installed capacity, was developed for mid-range hydro projects, 1MW to 8.9 MW. This is described in figure A1 and table A2.

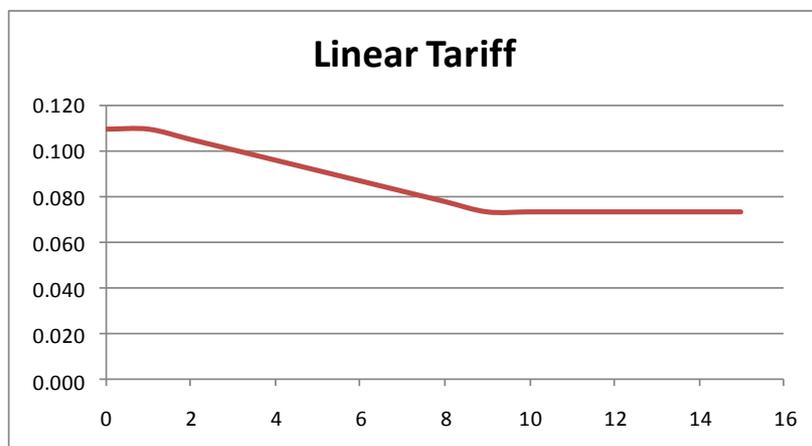


Figure A1: Linear tariff: hydro 1 >= 9MW

Table A2: Linear tariff: hydro 1 >= 9MW

MW	Tariff (USc/kWh)						
1	0.109	3	0.100	5	0.091	7	0.082
1.1	0.109	3.1	0.100	5.1	0.091	7.1	0.082
1.2	0.108	3.2	0.099	5.2	0.090	7.2	0.081
1.3	0.108	3.3	0.099	5.3	0.090	7.3	0.081
1.4	0.107	3.4	0.098	5.4	0.089	7.4	0.080
1.5	0.107	3.5	0.098	5.5	0.089	7.5	0.080
1.6	0.106	3.6	0.097	5.6	0.088	7.6	0.079
1.7	0.106	3.7	0.097	5.7	0.088	7.7	0.079
1.8	0.105	3.8	0.096	5.8	0.087	7.8	0.078
1.9	0.105	3.9	0.096	5.9	0.087	7.9	0.078
2	0.105	4	0.096	6	0.087	8	0.078
2.1	0.104	4.1	0.095	6.1	0.086	8.1	0.077
2.2	0.104	4.2	0.095	6.2	0.086	8.2	0.077
2.3	0.103	4.3	0.094	6.3	0.085	8.3	0.076
2.4	0.103	4.4	0.094	6.4	0.085	8.4	0.076
2.5	0.102	4.5	0.093	6.5	0.084	8.5	0.075
2.6	0.102	4.6	0.093	6.6	0.084	8.6	0.075
2.7	0.101	4.7	0.092	6.7	0.083	8.7	0.074
2.8	0.101	4.8	0.092	6.8	0.083	8.8	0.074
2.9	0.100	4.9	0.091	6.9	0.082	8.9	0.073

Appendix 2: Glossary of Terms

AVOIDED COST

Avoided Cost is the marginal cost for the same amount of energy acquired through another means such as the construction, finance and operation of new efficient generation facility at baseload conditions, or purchase from an alternate supplier. This may also include the cost of infrastructure upgrades.

CAPACITY LIMIT

The capacity limit is a cap on the total amount of newly installed generation capacity for particular renewable energy technology.

COGENERATION

Cogeneration is the simultaneous generation of electricity and useful thermal energy (heat) at a single plant. This occurs either through the use of thermal energy during electricity generation or via the use of waste energy for electricity during heating processes. Cogeneration is also referred to as combined heat and power (CHP). In a Ugandan context, cogeneration can also refer to the production of electricity as a by product of an industrial process, without the need for a combined heat and power system to necessarily be in place.

CONNECT

Connect means the making and maintaining of contact between the electrical systems of two persons such as may allow the supply of electricity between those systems.

DISTRIBUTION

Distribution refers to the conveyance of electricity through a Distribution System.

DISTRIBUTION SYSTEM

An electricity network consisting of assets operated at a nominal voltage of 33 kV or less. However it is noted that some lines at 33kV are also regarded as transmission lines.

DISTRIBUTOR

A Distributor is a legal entity that owns or operates/distributes electricity through a Distribution System.

EMBEDDED GENERATING UNIT

An embedded generating unit means a generating unit which is connected to a distribution system

EMBEDDED GENERATOR

An embedded generator means a generator whose embedded generating units are connected to a distribution system

GIGA WATT HOUR (GWh)

An energy unit in which electricity consumption is measured: 1 GWh = 3,600 GJ (Gigajoule) (Joule, unit of energy).

GREENHOUSE GAS

Gases primarily carbon dioxide, methane, and nitrous oxide in the earth's lower atmosphere that trap heat, thus causing an increase in the earth's temperature and leading towards the phenomenon of climate change.

INDEPENDENT POWER PRODUCER (IPP)

IPPs are defined as typically limited-liability, investor owned enterprises that generate electricity either for bulk sale to an electric utility or for retail sale to industrial or other customers with certain conditions.

LEVELISED ENERGY COST OF ENERGY (LCOE)

The levelised energy cost is the price at which electricity must be generated from a specific source to break even. It is an economic assessment of the cost of the energy-generating system including all the costs over its lifetime: initial investment, operations and maintenance, cost of fuel, cost of capital, and is very useful in calculating the costs of generation from different sources

MAXIMUM INSTALLED PROJECT CAPACITY

Maximum Installed Project Capacity is the maximum size of installed generation plant.

PRODUCER SURPLUS

Producer surplus is the difference between the total income derived from the sale of a product and the costs involved in its production. In the context of REFIT, this refers to the potential surplus as a result of differences in the cost of production due to the varying sizes and scales of technology adopted. For small scale projects, producer surplus will be low, for larger scale projects producer surplus will be higher. The potential for a producer surplus is balanced against the need to develop a non-complex and simple to implement mechanism.

REFIT

Renewable Energy Feed-In Tariff: a mechanism to promote the deployment of renewable energy that places an obligation on specific entities to purchase the output from qualifying renewable energy generators at pre-determined prices.

RENEWABLE ENERGY

Renewable energy harnesses naturally occurring non-depletable sources of energy, such as solar, wind, biomass, hydro, tidal, wave, ocean current and geothermal, to produce electricity, gaseous and liquid fuels, heat or a combination of these energy types.

Solar energy can be used to generate electricity; heat water; and to heat, cool and light buildings. For example, photovoltaic systems capture the energy in sunlight and convert it directly into electricity. Alternatively, sunlight can be collected and focused with mirrors to create a high intensity heat source that can be used to generate electricity by means of a steam turbine or heat engine.

Wind energy uses the naturally occurring energy of the wind either directly as in windmills or to generate electricity, and can be used, for example, to charge batteries or pump water.

Large modern wind turbines operate together in 'wind farms' to produce electricity for utilities. Small turbines are used to meet localised energy needs.

Biomass energy (from organic matter) can be used to provide heat, make liquid fuels, gas and to generate electricity. Fuel-wood is the largest source of biomass energy, generally derived from trees. However, fuel-wood is used unsustainably when new trees are not planted to replace ones that are used. Fuel-wood derived unsustainably cannot be properly defined as renewable. However, as is practised in many parts of the world, when fuel-wood is planted and harvested sustainably, it is renewable. Other types of biomass include plants, residues from agriculture, food production, animal feed production or forestry, and organic components in municipal and industrial wastes. A major source of renewable electricity in many parts of the world derives from agricultural and animal waste, either through direct combustion, or through the production of biogas (anaerobic digestion of agricultural or animal wastes) to generate methane which, in turn, is combusted to generate electricity (and often heat and electricity – i.e. cogeneration). Landfill gas is considered to be a biomass source.

Bio-fuels in liquid form can be produced from the conversion of biomass and used, for example, for transportation. The two most common bio-fuels are ethanol and bio-diesel. Fermenting any biomass that is rich in carbohydrate, such as maize, makes ethanol. Bio-diesel is made using vegetable oils, animal fats and algae.

Hydropower uses the movement of water under gravitational force to drive turbines to generate electricity.

Wave power, tidal power and ocean currents can be used to drive turbines to generate electricity. Technologies to harness these forms of power are presently being developed to the stage of commercialisation.

Geothermal activity in the earth's crust derives from the hot core of the earth. Examples are the natural geysers and hot water sources employed for power generation and space heating or using deep hot dry rock as heat exchangers by pumping water through the natural rock fissures to produce steam for power generation.

TARIFF DEGRESSION

Tariff degression is a fundamental principle in establishing feed-in tariffs used to keep tariffs in line with evolving cost realities through decreases in the payment level, at either specific points in time, or as capacity targets are reached. Tariff degression can be established transparently ahead of time, over several years, according to fixed annual percentage declines, or according to a responsive formula that allows the rate of degression to respond to the rate of market growth. The first approach is the one considered for the Uganda REFIT Phase 2. The reduction potential of electricity generation costs for renewable energy technologies is based on a number of factors that include the following economies of scale, learning process, technical progress, and rationalisation.

TRANSMISSION SYSTEM (TS)

The TS consists of all lines and substation equipment where the nominal voltage is above 33kV. All other equipment operating at lower voltages are either part of the Distribution System or classified as transmission transformation equipment. However it is noted that in some instances, lines at 33kV are regarded as transmission lines.

WATT

1 Joule per second of energy consumption or dissipation (1 MW = 1,000,000 W).

Appendix 3: Acronyms and Abbreviations

CSP	Concentrating Solar Power
EPC	Engineering Procurement Construction
ERA	Electricity Regulatory Authority
GOU	Government of Uganda
GWh	GigaWatt Hours
HV	High Voltage
IPP	Independent Power Producer
kV	Kilovolt
LCOE	Levelised Cost of Energy
MEMD	Ministry of Energy and Minerals Development
MW	Megawatt
NDP	National Development Plan
NEMA	National Environment Management Authority
O&M	Operation and Maintenance
PPA	Power Purchase Agreement
PPI	Producer Price Index
PV	Photovoltaic(s)
RE	Renewable Energy
REA	Rural Electrification Agency
REFIT	Renewable Energy Feed-In Tariff
RES-E	Electricity from Renewable Energy Sources
RET	Renewable Energy Technologies
UEB	Uganda Electricity Board
UEDCL	Uganda Electricity Distribution Company Limited
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited
UShs	Uganda Shilling
WACC	Weighted Average Cost of Capital

