



NERSA Consultation Paper

Review of Renewable Energy Feed - In Tariffs

March 2011

Review of Renewable Energy Feed-In Tariffs (REFIT)

The National Energy Regulator of South Africa (“NERSA” or ‘the Regulator’), established in terms of the National Energy Regulator Act, 2004 (Act No. 40 of 2004), is the independent regulator of electricity, piped-gas and petroleum pipelines. In carrying out its duties independently and transparently, the Regulator seeks to consult with stakeholders on the review of the tariff levels set in 2009 for Renewable Energy (RE) technologies under the Renewable Energy Feed-In Tariffs (REFIT) programme.

In terms of the Electricity Regulation Act, 2006 (Act no. 4 of 2006) (‘the Act’), the Regulator has a mandate to set electricity tariffs in accordance with section 15 of the Act. In approving the 2009 REFIT tariffs, the Energy Regulator also approved that the REFIT tariffs would be reviewed on an annual basis for the first five (5) years of the REFIT programme and every three (3) years thereafter. This decision was made under the assumption that the REFIT programme would commence immediately after the tariff approvals, but unfortunately due to issues relating to institutional arrangements, the first uptake of REFIT projects is yet to commence. Nonetheless, the Act mandates the Regulator to ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency, effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic regulation. It is therefore in accordance with these provisions of the Act that the Renewable Energy Feed-In tariffs (REFITs) approved in 2009 are reviewed as the financial and economic parameters used in the tariff determination of 2009 have since changed.

In accordance with the provisions of section 35 of the Act, this consultation document, ‘Review of Renewable Energy Feed-In Tariffs’, is being issued for public comment. Electronic copies of the document may be downloaded from the NERSA website at www.nersa.org.za

All stakeholders and the public are invited to submit public written comments on important issues raised in the REFIT Review Consultation Paper.

Closing date for the submission of written comments is **Friday, 22 April 2011**. Written comments and enquiries can be directed to **Dr Andile Gxasheka or Dr Bianka Belinska**.

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TARIFF REVIEW MADE BY THE NATIONAL ENERGY REGULATOR OF SOUTH AFRICA (NERSA) IN LINE WITH THE ELECTRICITY REGULATION ACT, 2006 (Act No. 4 of 2006)

EXPLANATORY MEMORANDUM

The provisions of the Electricity Regulation Act (Electricity Regulation Act No. 4 of 2006 ('the Act')) authorises the Regulator to prepare and pass rules or guidelines for purposes of setting the qualifying principles, technologies and tariffs for supporting renewable energy projects. These tariff guidelines and the Act must be read together when licence applications are submitted for Renewable Energy plants. The Act requires the Regulator to set and approve tariffs that shall 'enable an efficient licensee to recover the full cost of its licensed activities, including a reasonable margin or return'.

All the REFIT technologies previously approved under REFIT phase I and II are considered under this review. The technologies are listed below:

- 1) Landfill gas
- 2) Biomass
- 3) Biogas
- 4) Concentrated Solar Power Trough (with and without storage)
- 5) Concentrated Solar Power Tower (with storage)
- 6) Wind
- 7) Small Hydro
- 8) Photovoltaic (ground mounted and rooftop)

The revised tariffs and rules, once approved, shall repeal both previously-approved REFIT phase I and II tariffs and associated guidelines.

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OBJECTIVES

The Regulator is guided by the following objects of the Act:

- a) *to achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;*
- b) *to ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency, effectiveness and long term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic;*
- c) *to facilitate investment in the electricity supply industry;*
- d) *to facilitate universal access to electricity;*
- e) *to promote the use of diverse energy sources and energy efficiency;*
- f) *to promote competitiveness and customer and end user choice; and*
- g) *to facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public.*

A set of objectives encapsulating these objects of the Act is rearticulated for the purpose of these tariffs. The objectives to be met by these feed in tariffs are:

- a) to develop the qualifying principles and tariffs for renewable energy plants. These tariffs will form a financial supporting mechanism for new investments in the renewable energy generation sector.
- b) the regulation of entry by a buyer and an IPP into a Power Purchase Agreement;
- c) facilitating a fair treatment and the non-discrimination between IPP generators and the buyer;
- d) to outline the methodology to be used in the determination of tariffs which must be imposed by licensees.

GLOSSARY OF TERMS AND DEFINITIONS

BIOGAS

Biogas is defined as the gas that is produced by the decomposition of organic material in the absence of oxygen.

Biogas Feedstock is “Renewable” if one of the following conditions applies:

1. The feedstock fulfils the requirements of Renewable Biomass and that can be digested through anaerobic digestion for the purpose of producing biogas;
2. The feedstock is agriculturally derived animal waste or manure; and
3. The feedstock is a biomass residue from wastewater treatment.

BIOMASS

Biomass is “renewable” if it is from recent biogenic origin and one of the following five conditions applies:

1. The biomass is originating from land areas that are forests where:
 - (a) The land area remains a forest; and
 - (b) Sustainable management are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
 - (c) Any national or regional forestry and nature conservation regulations are complied with.

2. The biomass is woody biomass and originates from croplands and/or grasslands where:
 - (a) The land area remains cropland and/or grasslands or is reverted to forest; and
 - (b) Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
 - (c) Any national or regional forestry, agriculture and nature conservation regulations are complied with.
3. If it is biomass residue¹ and the use of that biomass residue in the project activity does not involve a decrease of carbon pools, in particular dead wood, litter or soil organic carbon, on the land areas where the biomass residues are originating from. Where a project involves the collection of dead wood from a forest, which would not be collected in the absence of the project, the extracted biomass cannot be regarded as renewable, since it would result in a decrease of carbon stocks.
4. The biomass is from a non-native and invasive plant that has not been grown specifically for the purposes of biomass fuel production
5. Biomass is traceable, sourced responsibly from local sources.

Otherwise, where none of these conditions applies, the biomass is considered as “non-renewable”. For the avoidance of doubt, fossil fuels or hydrocarbon material derived from fossil fuels is not considered Renewable.

¹ Biomass residue is defined as biomass by-products, residues and waste streams from agriculture, forestry, and related industries. (Please refer to Annex 8 of the report of the twentieth meeting of the Executive Board, see <http://cdm.unfccc.int/EB/Meetings/020/eb20rep.pdf>).

BUYER

Means, in relation to a new generation capacity project, any organ of state in the national sphere of Government designated by the Minister in terms of section 34(1)(c) and (d) of the Act.

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 132 kV or less.

FIT

Feed-In Tariff

FOSSIL FUEL

Means fuel obtained from mineral stocks, regardless of whether it is used in its original form or processed.

GIGAWATT HOUR (GWh)

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

LANDFILL GAS

Landfill gas is defined as gas that is generated by decomposition of organic material within a landfill disposal site.

LEVELISED COST OF ELECTRICITY (LCOE)

The present value of the total cost of building and operating a generating plant over its economic life, converted to equal annual payments. Costs are levelised in real dollars (i.e. adjusted to remove the impact of inflation).

MINISTER

Means the Minister of Energy.

NATURAL GAS

Natural gas is a naturally occurring combustible mixture of hydrocarbon gases and is formed primarily of methane. It is colourless, shapeless, and odourless in its pure form. While natural gas is formed primarily of methane, it can also include ethane, propane, butane and pentane. The composition of natural gas can vary widely.

Unlike other fossil fuels, however, natural gas is clean burning and emits lower levels of potentially harmful by-products into the air. It is used constantly to heat homes, cook food, and also to generate electricity in a gas turbine.

POWER PURCHASE AGREEMENT OR “PPA”

Means an agreement concluded between a generator and the buyer for the sale and purchase of new generation capacity;

PRIMARY RENEWABLE FUEL

Primary renewable fuel is the renewable fuel that a Facility is first and foremost designed to use in order to generate power and be eligible for REFIT tariffs

REFIT

Renewable Energy Feed-In Tariff: means a tariff approved by the Regulator for a renewable energy generator;

RENEWABLE ENERGY (from the 2003 White Paper on 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.

SUPPLEMENTARY FUEL

Supplementary fuel is defined as fuel of non-renewable origin, usually natural gas, LPG or oil, used for the purposes of plant start-up, shutdown, and ignition support. In addition, supplementary fuel in Concentrated Solar Power Plants and biomass plants can be used to maintain boiler and steam production stability, while in biogas plants it can be used to maintain gas engine output.

TRANSMISSION SYSTEM (TS)

The TS consists of all lines and substation equipment where the nominal voltage is above 132 kV. All other equipment operating at lower voltages are either part of the Distribution System or classified as transmission transformation equipment.

WATT

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

ABBREVIATIONS

AFUC	Allowance for Funds Under Construction
CAPEX	Capital Expenditure
CPI	Consumer Price Index
CDM	Clean Development Mechanism
CO ₂	Carbon Dioxide
CSP	Concentrated Solar Plant
DoE	Department of Energy
FIT	Feed-in Tariffs (REFIT)
FOM	Fixed Operation and Maintenance
GHG	Green House Gases
GW	Giga Watt
GWh	Giga Watt Hour (1000MWh)
HTF	Heat Transfer Fluid
IDC	Interest During Construction
IRP	Integrated Resource Plan
IPP	Independent Power Producer
LCOE	Levelised cost of electricity
MW	Mega Watt
NERSA	National Energy Regulator of South Africa
NCV	Net Calorific Value of fuel
PV	Photovoltaic Plant
PPA	Power Purchase Agreement
RE	Renewable Energy
REFIT	Renewable Energy Feed-In Tariff
RSA	Republic of South Africa
TWh	Terawatt Hour (1000GWh)
VOM	Variable Operation and Maintenance
WACC	Weighted Average Cost of Capital

1. INTRODUCTION AND BACKGROUND

In June 2007, in terms of the Act, the Energy Regulator commissioned a study on the Renewable Energy Feed-In Tariffs (REFITs) to support renewable energies in South Africa. This culminated in the approval of the REFIT Guidelines on 26 March 2009. The major aspects of these guidelines were that:

- a) the Feed-In Tariffs (FITs) would be based on levelised cost of electricity (LCOE), as illustrated in Table 1 below;

Table 1: REFIT Phase I Tariffs – 2009 (R/kWh)

Technology	Unit	REFIT
Wind	R/kWh	1.25
Small hydro	R/kWh	0.94
Landfill gas	R/kWh	0.90
Concentrated Solar Power Trough plant with 6 hours storage	R/kWh	2.10

- b) the LCOE to be used as the methodology to calculate FITs;
- c) the term of the Power Purchase Agreement (PPA) is to be twenty (20) years;
- d) the REFIT is to be reviewed every year for the first five (5) years of implementation and every three (3) years thereafter and the resulting tariffs will apply only to new projects; and
- e) other REFIT-qualifying technologies are to be considered for inclusion in six (6) months' time from 26 March 2009.

Comments and recommendations made during the REFIT Phase 1 approval process, regarding technologies that were excluded, resulted in the Energy Regulator issuing the REFIT Phase II consultation paper on 15 July 2009, with the aim of approving additional REFIT-qualifying technologies.

On 29 October 2009 the Energy Regulator approved:

- a) the REFIT Phase II, based on LCOE, as listed in Table 2;

Table 2: REFIT Phase 2 – 2009 (R/kWh)

Technology	Unit	REFIT
Concentrated Solar Power (CSP) Trough without storage	R/kWh	3.14
Large scale grid connected PV systems (≥ 1 MW)	R/kWh	3.94
Biomass solid	R/kWh	1.18
Biogas	R/kWh	0.96
CSP (Tower) with storage of 6 hrs per day	R/kWh	2.31

- b) that a fifteen per cent (15%) of fossil fuel in the primary energy input be allowed for Concentrated Solar Power (CSP) technologies to start up the plants in the mornings and during cold days; and
- c) that the REFIT PPA together with REFIT Guidelines be revised to be in line with the Electricity Regulations on New Generation Capacity, Government Notice R721 in Government Gazette 32378 ('the Regulations').

2. PURPOSE

In order to be in line with the Regulator decision of 26 March 2009 to *review REFITs every year for the first five-year period of implementation and every three years thereafter and the resulting tariffs to apply only to new projects* the tariffs approved in 2009 must be base dated to 2011 market terms i.e. aligned with the current prevailing financial and economic parameters. This paper is not intended to add new qualifying technologies; new qualifying technologies, if any, will only be considered after the first uptake of the REFIT programme. This consultation process on the tariff review will ensure that all stakeholders [(i.e. Independent Power Producers (IPPs) and end users)] provide comments regarding the tariff level resulting from this review process.

3. REFIT QUALIFYING TECHNOLOGY PRINCIPLES

The following principles for REFIT Phases 1 and 2 that were approved by the Energy Regulator in 2009 will be retained for this review and are listed below:

- 3.1 the LCOE is adopted as the methodology used to review the Feed-In Tariffs (FITs) for the qualifying REFIT technologies. This methodology allows the cost of capital and the operating cost of the project to be recovered over the term of the Power Purchase Agreement (PPA);
- 3.2 the generation term shall be for 20 years;
- 3.3 the REFITs will be reviewed every year for the first five-year period of implementation and every three years thereafter; and the resulting tariffs will apply only to new facilities;
- 3.4 due to the lack of local real-time project data, a reduction rate will currently not be applicable to REFIT. Tariff adjustments providing a tariff line-of-sight will be taken into account in subsequent reviews as and when the local market become established;
- 3.5 the Clean Development Mechanisms (CDM) revenues are excluded from REFITs;
- 3.6 monitoring and verification of compliance with the qualifying principles will be the responsibility of the Energy Regulator as part of the compliance with the generation licence condition; and
- 3.7 a standard technology-specific PPA will be used for REFIT projects and the Energy Regulator will facilitate the conclusion of the PPA in accordance with section 34 of the Act.

4. QUALIFYING PRINCIPLES FOR RENEWABLE ENERGY FEED-IN TARIFFS

- 4.1 Renewable energy project must be based on the following technologies:
- a) Landfill gas
 - b) Biomass
 - c) Biogas
 - d) Concentrated Solar Power (Trough with 6 hrs storage)
 - e) Concentrated Solar Power (Tower with 6 hrs storage)
 - f) Concentrated Solar Power (Trough without storage)
 - g) Wind
 - h) Small Hydro
 - i) Photovoltaic (ground mounted)
- 4.2 The minimum capacity allowed for REFIT projects is 1 MW.
- 4.3 Only REFIT projects located within South Africa will be considered.
- 4.4 REFIT projects will be qualified or selected in accordance with the provisions of the New Generation Capacity regulations.
- 4.5 Only successful REFIT projects selected pursuant to section 4.4 above will apply for a Generation License from the Regulator as required by the Electricity Regulation Act, 2006 (Act No. 4 of 2006).
- 4.6 REFIT includes only new investments in renewable energy power generation from IPPs connected to the National Transmission System or Distribution System and excludes off-grid power generation. Refurbished plants shall not be considered under REFIT.

5. PROPOSED ELIGIBILITY CRITERIA FOR QUALIFYING TECHNOLOGIES

- 5.1 The eligibility criteria for qualifying technologies is summarised in Table 3. As part of the review, minor changes for clarification have been effected to some criteria and such changes are highlighted in the third column of Table 3.
- 5.2 For the CSP technologies, the storage option would be preferred due to the following:
- (a) It offers benefits to the country in relation to reducing power shortages during peak and or intermediate hours.
 - (b) In periods of peak demand, generation costs are generally far higher than prices during off-peak, as in some instances expensive peaking plants are required to operate. It is thus imperative that South Africa, with its most-favourable solar conditions and facing a possible high demand of power in the short term, prioritise the use of storage technology.
- 5.3 A proposed method for monitoring and calculating the maximum fossil fuel input for CSP technologies is outlined in Appendix B. Stakeholders are requested to comment on the methodology.
- 5.4 The proposed methodology for monitoring supplementary fossil fuel/solar energy inputs for CSP will be incorporated as a condition in the generation licence .
- 5.5 The REFITs do not apply to hybrid plants producing electricity from a combination of renewable energy technologies listed in section 4.1 and fossil fuels.
- 5.6 The limit of 15% fossil fuel input of the total solar energy input for CSP should not be treated as in the case of Hybrid Fossil/Solar Power plants, as its sole purpose is for start-ups and warm-ups in cloudy and cold days.

5.7 The REFIT programme only includes power generation from generators connected to the National Transmission System and Distribution System and excludes off-grid renewable energy power generation

5.8 REFIT assumes that all power plants are located in close proximity to the primary energy or fuel source.

Table 3: Qualifying Technologies

RE Technology	2009 position on eligibility for RE power plants	New position on eligibility for RE power plants
Wind	capacity \geq 1 MW	<ul style="list-style-type: none"> • capacity \geq 1 MW • Wind towers located within one site.
Landfill gas	capacity \geq 1 MW	It should be as defined in this document and power plant capacity \geq 1MW

<p>CSP trough with six hours of storage</p>	<ul style="list-style-type: none"> • size of the power plant: ≥ 1 MW; • use of start up/warm up fossil fuel not exceeding 15% of the annual renewable energy production; and • six hours of thermal energy storage (TES) 	<ul style="list-style-type: none"> • capacity of the power plant: ≥ 1 MW; • use of start up/warm up supplementary fuel not exceeding 15% of the primary renewable energy fuel; • six hours of thermal energy storage (TES) to improve the dispatchability of the plant
<p>CSP trough (no storage)</p>	<ul style="list-style-type: none"> • capacity of the power plant: ≥ 1 MW; and use of start up/warm up fossil fuel not exceeding 15% of the annual renewable energy production. 	<ul style="list-style-type: none"> • capacity of the power plant should be ≥ 1 MW; • use of start up/warm up supplementary fuel not exceeding 15% of the primary renewable energy fuel;
<p>CSP tower (central receiver) with six hours storage</p>	<ul style="list-style-type: none"> • capacity of the power plant: ≥ 1 MW; • use of start up/warm up fossil fuel not exceeding 15% of the annual renewable energy production; and • six hours of storage. 	<ul style="list-style-type: none"> • capacity of the power plant should be ≥ 1 MW; • use of start up/warm up of supplementary fuel not exceeding 15% of the primary renewable energy fuel; and • six hours of thermal energy storage.

<p>Biogas</p>	<ul style="list-style-type: none"> • capacity of the plant \geq 1 MW ; • anaerobic digestion; • water waste; • animal waste or manure; and • any feedstock that can be digested through anaerobic process for the purpose of producing biogas. 	<ul style="list-style-type: none"> • power should be generated from Biogas as defined in this document and can be digested through anaerobic process; • capacity of the plant \geq 1 MW ; and; • typical feedstock includes glycerol from biodiesel production, abattoir waste, wastewater from juicing facilities, wastewater from beverage production facilities, organic waste from food manufacturing, animal waste or manure.
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<p>Biomass Solid</p>	<ul style="list-style-type: none"> • capacity of the plant is ≥ 1 MW; • power plants not utilising mill or industrial waste as feedstock • power generation based on solid fuel (pellets, briquettes) from municipal solid waste. Municipal solid waste excludes the following: medical waste, plastics, • toxic wastes (i.e. chemicals), painted wood, metals, mattresses and carpets – these may produce toxic fumes • 100% forest wood, dedicated food plants, invasive alien plants (i.e. chromolaena) and residues from agriculture; biomass plants that are located in close proximity of the biomass feedstock to be used • It is expected that all trees, except invasive species, that have been cut down for feedstock are replanted later in order for the carbon cycle to be completed. 	<p>It should be Renewable Biomass as defined in this document and capacity of the plant ≥ 1 MW.</p> <p>Only the following categories of feedstock are allowed:</p> <ul style="list-style-type: none"> • forestry trees and residues • agricultural plants i.e. food crop residues • invasive plants; • processed woody materials i.e. pellets and briquettes • woody waste and agricultural waste from municipality <p>The following additional conditions apply to Biomass Solid:</p> <ul style="list-style-type: none"> • industrial waste is NOT allowed • electricity produced NOT coupled to or embedded to any industrial process • medical, toxic and tyre waste are not allowed • forestry trees must be replanted into order to complete the carbon cycle in the atmosphere • all forestry trees and residues to be used for electricity generation will be collected from fields where there is plantation, not from industrial plants
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Hydro	<ul style="list-style-type: none"> • capacity ≥ 1 MW ≤ 10 MW • use water from natural river 	<ul style="list-style-type: none"> • capacity ≥ 1 MW but ≤ 10 MW • use water from natural river
Large scale PV system (ground based)	<ul style="list-style-type: none"> • capacity ≥ 1 MW • ground and rooftop PV system 	<ul style="list-style-type: none"> • capacity ≥ 1 MW • ground based system • fixed array and single axis tracking • any proven PV panel/cell technology • it is up to the IPP to choose PV cell material to be employed

6. REFIT REVIEW FINANCIAL ASSUMPTIONS AND TARIFFS.

6.1 Table 4 shows the financial assumptions used to determine 2009 and 2011 REFITs. Financial parameters that have changed since 2009 include: nominal cost of debt, rate of inflation and exchange rate.

Table 4: REFIT Financial Assumptions

Financial Parameter	Unit	2009	2011
Debt	%	70	70
Equity	%	30	30
Nominal Cost of Debt	%	14.90	9.93 ¹
Inflation	%	8	6 ²
Real Cost of Debt before Tax	%	6.39	3.71
Tax Rate	%	28	28
Real Return on Equity ROE after Tax	%	17	17
Weighted Average Cost of Capital (WACC)After Tax	%	12	9.8

¹ Similar to initial REFIT determination the cost of debt is based on the JIBAR rate as at the end of 2010 plus a risk premium for power generation projects

² Based on the maximum target inflation rate in South Africa.

- 6.2 The nominal cost of debt for 2009 tariffs was 14.9% and in 2011 it is 9.93%. The inflation rate has dropped from 8% in 2009 down to 6% in 2011.
- 6.3 The assumptions for the cost and performance of the REFIT review are based on the assumptions for the IRP 2010.
- 6.4 The revised REFIT tariffs are for year 2011.
- 6.5 The exchange rate is assumed to be 1US\$=ZAR7.4.
- 6.6 The calculated WACC listed in Table 4 above was used for calculation of the LCOE calculation.
- 6.7 The total project cost in the determined revision of REFITs include provisions of 2% for land costs, 6 to 10% for owner's development costs, 3% for grid integration costs and interest during construction (IDC) or allowance for funds under construction (AFUC). The overnight cost and performance of renewable energy (RE) power plants are based on the assumptions used for the IRP2010, more specifically in the 2010 Electric Power Research Institute (EPRI) Report, they are as follows:
- (a) the reference plant for wind is based on 50 wind turbines of 2 MW each or total plant capacity of 100 MW
 - (b) CSP trough without storage (0 hours storage)
 - (c) CSP trough with six (6) hours of thermal energy storage
 - (d) CSP central tower (or receiver) with 6 hours TES cost and performance
 - (e) Amorphous silicon PV ground mounted with 10 MW of capacity
 - (f) Biomass forestry residue
 - (g) Landfill Gas

- 6.8 The revised tariffs for 2011 and projected consumer price index (CPI) adjustments for 2012 to 2013 are shown in Table 5. The breakdown of LCOE tariffs for capital expenditure (Capex), fixed operation and maintenance (FOM), variable operation and maintenance (VOM) and fuel components of various technologies are listed in Appendix A from Table A1 through to Table A9. The projected CPI adjustments are based on the CPI adjustments applied to the operation, maintenance and fuel portions of 2011 Revised tariffs. The forecasted CPI from South African Bureau of Economic Research (BER) published in December 2010 was used for the REFIT projections for 2012 and 2013. With regard to the capital investment portion it is assumed that the project owners will enter into foreign exchange forward agreement and interest cover. The total hedging and insurance costs are included in the O&M costs. REFITs 2012 and 2013 are indicative projected values and the actual levels should be derived by adjusting REFIT base tariffs of 2011 to the actual inflation of the years 2012 and 2013.
- 6.9 Based on the financial assumptions in Table 4, the reviewed REFITs listed in Table 5 are proposed:

Table 5: 2009 REFIT and 2011 Revised REFIT with projected CPI adjustments for years 2012-2013

YEAR:	REFIT 2009	REFIT 2011	REFIT 2012	REFIT 2013	Percentage Change 2011/2009
TECHNOLOGY	R/kWh	R/kWh	R/kWh	R/kWh	
Wind ≥ 1 MW	1.25	0.938	0.945	0.952	-24.9%
Landfill Gas ≥ 1 MW	0.90	0.539	0.550	0.562	-40.1%
Small Hydro ≥ 1 MW	0.94	0.671	0.675	0.680	-28.6%
CSP trough ≥ 1 MW with 6 storage	2.10	1.836	1.845	1.854	-12.6%
CSP trough ≥ 1 MW without storage	3.14	1.938	1.953	1.967	-38.3%
CSP central receiver (tower) ≥ 1 MW with TES 6 hrs	2.31	1.399	1.408	1.417	-39.4%
Photovoltaic ≥ 1 MW ground mounted	3.94	2.311	2.325	2.338	-41.3%
Biomass solid ≥ 1 MW (direct combustion)	1.18	1.060	1.084	1.108	-10.1%
Biogas ≥ 1 MW	0.96	0.837	0.862	0.887	-12.9%

7. TARIFF INDEXATION

- 7.1 South African CPI as published by South African BER annually, will be used to adjust the REFIT in the PPA for annual economic fluctuations. The adjustment will only be applied to the 'operation and maintenance' and fuel portions of the previous calendar year REFIT. The Capex portion will remain constant for the duration of the PPA.
- 7.2 The formula for annual REFIT CPI adjustment in the PPA will take the following form:

$$\text{REFIT}_{j+1} = \text{Capex}_{2011} + (\text{FOM}_j + \text{VOM}_j + \text{FUEL}_j) \times (1 + \text{RSA_CPI}_j/100) \quad (1)$$

Where:

j	-	calendar year \geq 2011
REFIT _j	-	PPA tariff in year j
CAPEX ₂₀₁₁	-	Capex, R/kWh
FOM	-	Fixed Operation and Maintenance in year j, R/kWh
VOM	-	Variable Operation and Maintenance in year j, R/kWh
RSA_CPI _j	-	Actual South African CPI for year j

8. REFIT POWER PURCHASE AGREEMENT

- 8.1 The Regulator will facilitate the conclusion of the REFIT PPA and the associated commercial agreements necessary for buying and selling power between a REFIT IPP and the Buyer.
- 8.2 REFIT agreements will be approved by the Regulator in the licensing process of the preferred bidders
- 8.3 The term of the PPA is 20 years as agreed in REFIT Phases 1 and 2.

9. STAKEHOLDERS INPUTS REQUESTED

Stakeholders are requested to provide comments on the following:

- (a) Financial assumptions used for the calculation of the REFIT.
- (b) REFITs and qualifying principles.
- (c) Any other comments or proposals to the Regulator related to this Review of Renewable Energy Feed-In Tariffs Consultation Paper.

10. REFIT REVIEW

The revised tariffs will apply to new REFIT IPP projects to be commissioned after the promulgation of the revised tariffs.

11. REPEAL

The revised REFITs for year 2011 will repeal the REFIT Phases 1 and 2 tariffs and guidelines that were approved in 2009.

12. NERSA PROCESS FOR APPROVAL

Table 6 below shows the timelines, activities and approvals that will be followed by the Regulator in approving the review of the tariffs.

Table 6: Timelines for approval of REFIT Review Tariffs.

TIMELINES FOR APPROVAL OF RENEWABLE ENERGY FEED-IN TARIFF	
ITEM/ACTIVITY	ACTUAL/TARGET DATE
1.Publication of NERSA consultation paper and invitation for written public comments	22 March 2011
2. Advertisement of Public Hearing in newspapers	18 April 2011
3.Deadline for submitting written public comments to the Regulator on REFIT Review Consultation paper	22 April 2011
4.Closing date for registering to attend and/or present at the Public Hearing: on Review of REFIT	02 May 2011
5. Public Hearing on Review REFIT	05 May 2011
6. Regulator approval of Reviewed REFIT	26 May 2011

Stakeholders are invited to comment on the NERSA's Review of REFIT consultation paper and the comments on qualifying principles of technologies should be sent to the following: Dr Andile Gxasheka or Dr Bianka Belinska at 526 Vermeulen Street, Kulawula House, Arcadia, Pretoria or PO Box 40343, Arcadia 0007 Pretoria, or email at refitreview2011@nersa.org.za. The consultation documents will be available on the NERSA Web site: www.nersa.org.za. The deadline for submission of comments is 22 April 2011.

APPENDIX A: LCOE

Table A1: Wind technology LCOE breakdown and projected CPI adjustments.

WIND			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.27	0.27	0.27
Levelised Capex, R/kWh	0.8204	0.8204	0.8204
Levelised FOM, R/kWh	0.1180	0.1247	0.1313
Levelised fuel, R/KWh	0.0000	0.0000	0.0000
Levelised VOM, R/kWh	0.0000	0.0000	0.0000
LCOE, \$/kWh	0.9384	0.9451	0.9517

Table A2: Landfill LCOE breakdown and projected CPI adjustments.

LFG			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.8	0.8	0.8
Levelised Capex, R/kWh	0.3368	0.3368	0.3368
Levelised FOM, R/kWh	0.0709	0.0750	0.0789
Levelised fuel, R/KWh	0.1111	0.1174	0.1236
Levelised VOM, R/kWh	0.0199	0.0211	0.0222
LCOE, R/kWh	0.5387	0.5502	0.5615

TABLE A3: Small Hydro LCOE breakdown and projected CPI adjustments.

SMALL HYDRO			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.5	0.5	0.5
Levelised Capex, R/kWh	0.5910	0.5910	0.5910
Levelised FOM, R/kWh	0.0662	0.0700	0.0737
Levelised fuel, R/KWh	0.0058	0.0062	0.0065
Levelised VOM, R/kWh	0.0078	0.0083	0.0087
LCOE, R/kWh	0.6709	0.6754	0.6799

TABLE A4: CSP Trough without storage LCOE breakdown and projected CPI adjustments.

CSP Trough no Storage			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.25	0.25	0.25
Levelised Capex, R/kWh	1.6786	1.6786	1.6786
Levelised FOM, R/kWh	0.2566	0.2713	0.2856
Levelised fuel, R/KWh	0.0027	0.0029	0.0030
Levelised VOM, R/kWh	0.0000	0.0000	0.0000
LCOE, R/kWh	1.9379	1.9527	1.9672

TABLE A5: CSP Trough with six(6) hrs storage LCOE breakdown and projected CPI adjustments.

CSP Trough 6 Hours Storage			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.4	0.4	0.4
Levelised Capex, R/kWh	1.6725	1.6725	1.6725
Levelised FOM, R/kWh	0.1604	0.1695	0.1785
Levelised fuel, R/KWh	0.0027	0.0029	0.0030
Levelised VOM, R/kWh	0.0000	0.0000	0.0000
LCOE, R/kWh	1.8356	1.8449	1.8541

TABLE A6: CSP Tower with six (6) hrs storage LCOE breakdown and projected CPI adjustments.

CSP Tower with 6 Hours Storage			
Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.4	0.4	0.4
Levelised Capex, R/kWh	1.2409	1.2409	1.2409
Levelised FOM, R/kWh	0.1558	0.1647	0.1734
Levelised fuel, R/KWh	0.0027	0.0029	0.0030
Levelised VOM, R/kWh	0.0000	0.0000	0.0000
LCOE, R/kWh	1.3995	1.4085	1.4174

TABLE A7: PV ground mounted LCOE breakdown and projected CPI adjustments.

Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.18	0.18	0.18
Levelised Capex, R/kWh	2.0745	2.0745	2.0745
Levelised FOM, R/kWh	0.2366	0.2501	0.2633
Levelised fuel, R/kWh	0.0000	0.0000	0.0000
Levelised VOM, R/kWh	0.0000	0.0000	0.0000
LCOE, R/kWh	2.3111	2.3246	2.3378

TABLE A8: Biomass solid without storage LCOE breakdown and projected CPI adjustments.

Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.8	0.8	0.8
Levelised Capex, R/kWh	0.6387	0.6387	0.6387
Levelised FOM, R/kWh	0.1387	0.1466	0.1544
Levelised fuel, R/kWh	0.0311	0.0329	0.0346
Levelised VOM, R/kWh	0.2518	0.2661	0.2803
LCOE, R/kWh	1.0603	1.0843	1.1079

TABLE A9: Biogas LCOE breakdown and projected CPI adjustments.

Year	2011	2012	2013
CPI BER Dec 2010, %		5.7	5.3
Capacity Factor	0.8	0.8	0.8
Levelised Capex, R/kWh	0.3908	0.3908	0.3908
Levelised FOM, R/kWh	0.1795	0.1897	0.1998
Levelised fuel, R/kWh	0.1298	0.1372	0.1445
Levelised VOM, R/kWh	0.1365	0.1443	0.1519
LCOE, R/kWh	0.8366	0.8620	0.8869

APPENDIX B: SUPPLEMENTARY FUEL

The following methodology for determination of the primary renewable energy fuel eligible for REFIT has been adopted from a proposal tabled by Mott MacDonald. The proportion of the Total Net Generated Energy that should be eligible for the CSP tariff (ϵ_{CSP}) for a defined payment period should be calculated as follows:

$$\epsilon_{CSP} = \frac{\text{Solar Energy (GJ)}}{\text{Solar Energy (GJ)} + \text{Supplementary Energy (GJ)}} \leq 0.15 \quad (2)$$

Where:

Supplementary Energy is the measured total use of Supplementary Energy over the period. The Supplementary Energy must be measured by recognised international or SA standard methods for mass flow or weight measurement along with similar recognised standard methods for determining the average calorific value of the supplementary fuel used during the defined payment period. The plant must have installed appropriate instruments and systems to allow a totalised mass of Supplementary fuel used in a period to be measured and logged each payment period. The sampling frequency of the supplementary fuel for calorific value must be sufficient to give a representative average of the period's supplementary fuel consumed. Supplementary energy should be calculated over the defined payment period as follows:

$$\text{Supplementary Energy (GJ)} = \text{Total Supplementary Fuel Used (Tonnes)} \times \text{Average NCV} \quad (3)$$

Where: NCV is the Net Calorific Value of fuel in *GJ/tonne* units.

Solar Energy is calculated by measurement of the average solar field heat transfer fluid (HTF) enthalpy increase and the total heat transfer fluid mass flow both measured over the defined payment period using the following formula:

$$\text{Solar Energy (GJ)} = \text{Total HTF Flow (Tonnes)} \times \text{Average Enthalpy Rise (GJ/Tonne)} \quad (4)$$

An agreed method for measuring the average solar field enthalpy rise and HTF flow shall be made between the Buyer and Seller, based on recognised international standards for flow measurement, temperature and pressure measurement and recognised enthalpy tables for the solar field HTF.

The amount of electricity eligible for the CSP Tariff is then defined as follows:

$$\text{CSP Eligible Electricity} = \varepsilon_{\text{CSP}} \times \text{Total Net Generated Energy} \quad (5)$$

END