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NAMIBIA ENERGY REGULATORY FRAMEWORK

DEVELOPMENT OF PROCUREMENT MECHANISMS FOR RENEWABLE ENERGY RESOURCES IN NAMIBIA

Draft 2

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Contents

LIST OF FIGURES

LIST OF TABLES

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_Toc260664521GLOSSARY OF TERMS AND ABBREVIATIONS

Avoided cost; the marginal cost of energy acquired by way of construction of plant, finance of a new generation facility or purchase from an alternate supplier.

Debt Service Coverage Ratio (DSCR); describes the net operating income (revenues minus running cost) divided by the debt service value. If the ratio equals one all net income is required for repaying interest and amortisation.

Distributor; legal entity that owns and operates distribution assets, and distributes electricity through such a distribution system. In Namibia, these entities include Regional Electricity Distributors, local authorities, municipalities and private distributors.

Distribution System; electricity network consisting mainly of medium and low voltage distribution infrastructure that is used to deliver electricity to a consumer.

Electricity Act; refers to the Electricity Act of 2007 (Act No. 4, 2007)**.**

Electricity Control Board; refers to the entity created under the Electricity Act to provide for the requirements and conditions for obtaining licences for the provision of electricity; to provide for the powers and obligations of **licensees**; and to provide for incidental matters.

Electricity market; a market in which electricity is traded and which is established, operated and administered in accordance with the established regulations, rules and codes.

Electricity Trading; the wholesale or retail buying and selling of electricity.

Generator; an entity or unit that produces electricity.

Greenhouse gases; gases, primarily carbon dioxide, methane, sulphur hexafluoride 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 global warming. Some greenhouse gases are of anthropogenic origin, e.g. from coal-fired power stations.

Independent Power Producer (IPP); typically limited-liability, investor-owned enterprises that generate electricity either for bulk sale to a utility or for retail sale to industrial or other customers.

Long run marginal cost (LMRC); the cost of providing an additional unit of electrical output over and above any output currently being produced. LMRC includes capital and operational costs.

Net-metering; a two-way flow of electricity between the distribution grid and customers with their own generation. Usually the utility will not pay for excess electricity generated by the customer but the customer pays for the net amount of electricity used.

Off-taker; an entity in the form of distributor, local authority, utility or buyer of electricity from the independent power producer.

Power Purchase Agreement (PPA); a legal contract between a generator of electricity and the buyer of the electric energy. A PPA can be between an IPP and the incumbent generator, system operator, buyer, distribution company or end user.

Quota mechanism; government or regulator mandates a minimum capacity, generation or consumption of electricity to come from RETs. The mandate is on producers, system operator, distributors or customers.

Regional Electricity Distributors (REDs); entities created by the Electricity Act of 2000, mandated to distribute electricity to consumers.

Renewable Energy Sources (RET); sources of energy that are continuously replenished by natural processes, such as solar, wind, biomass, hydro, tidal, wave, ocean current and geothermal energy, and which can be converted into useful energy such as electricity. RET include:

Biomass; living and recently dead bio-organic materials which can be used as fuel or for industrial production. Biomass is found in liquid, solid and gaseous forms, and include wood, ethanol, biodiesel, butanol, biogas, producer gas and landfill gas. Only sustainably harvested biomass material is considered a renewable energy source. A major source of renewable electricity 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 rich gas which, in turn, is combusted to generate heat and electricity (cogeneration). Landfill gas is considered to be a source of biomass.

Geothermal energy; generated from heat stored beneath the earth's surface. Hot rocks in the earth's crust give off heat when pumping water through the natural rock fissures, which can then be used to produce steam for power generation.

Hydropower; derived from the movement of water under gravitational force to drive turbines to generate electricity.

Solar energy; derived from the sun's radiant energy or electromagnetic radiation. Solar energy can be converted directly into electricity through photovoltaic semi-conducting materials, or used in thermal energy applications to produce steam and then generate electricity using steam turbines, or warm water in solar water heaters.

Wave energy; derived through turbines from ocean waves that build up from the wind blowing on the ocean surface; considered pre-commercial.

Tidal energy; derived through turbines from tidal motion generated from the gravitational pull of the moon; considered pre-commercial.

Wind energy; derived from harvesting naturally occurring energy of the wind though turbines or windmills to generate electricity.

Renewable Energy Feed-In Tariff (REFIT); RET generating plants are enabled access and to sell to the grid at a fixed price or fixed premiums added to market tariffs.

Single Buyer Model; an electricity market where all power producers may only sell their electricity through long-term power purchase agreements to a single entity, which is also called the single buyer. The single buyer may also be a coordinating intermediary between generation, transmission and supply entities.

Tendering; RE developers bid for access to funds and/ or power purchase agreements through a competitive bidding process. The tenderer specifies the RE capacity or share of total electricity to be achieved and the maximum price.

Transmission; the conveyance of electricity by means of a transmission system which consists wholly or mainly of high-voltage networks from an energy source or system to a customer such as a distributing entity.

White Paper on Energy Policy; the 1998 policy document of the Ministry of Mines and Energy of the Republic of Namibia.

EXECUTIVE SUMMARY

The paper is organized as follows: Chapter 1 provides background and introductory information on Namibia's Electricity Supply Industry covering the important players and applicable rules and regulations. The Chapter provides an overview of such policies and regulations that apply to renewable energy in Namibia including the important White Paper on Energy Policy of 1998, Cabinet Retreat Paper of 2008 and finally the Electricity Act 4 of 2007. It also outlines the challenges that renewable energy technologies face in being mainstreamed into the grid.

Before analysing market interventions in favour of RETs (like REFIT, quotas or grants), Chapter 2 discusses ways and problems to internalise external cost. It provides the Theory of Meritorics where the government has to provide those goods that meet public needs but which are not revealed by individual preferences and willingness to pay. An evaluation is made of different renewable energy support mechanisms based on the criteria of the instrument being capable to meet a politically defined target (criterion of efficacy) and secondly, the instrument being in the position to meet a target with minimum cost (criterion of efficiency). The four instruments or renewable energy procurement mechanisms analysed include Tendering; Quota; Renewable Energy Feed-in- Tariff (REFIT); Net Metering and Others such as subsidies, investments grants and tax credits.

Chapter 2 continues to review the four renewable energy procurement mechanisms on a theoretical and a practical level and presents best practice approaches. The long Chapter illustrates the relationship between risk and financing cost and discusses how the design of RE procurement can reduce risk and thus reduce financing cost. Recommendations from the review and comparative analysis of the instruments are that Namibia must adopt a regulatory framework consisting of 4 procurement mechanisms, namely; a REFIT for small (less than 500 kW) wind; solid biomass and land fill gas -and small hydro (less than 10 MW); tendering for large concentrating solar power and (greater than 500 kW) wind based technologies. Net Metering is recommended for photovoltaics because of high specific costs. Its inclusion will enable investors who might expect extra services of such plants like independence from the grid and increased supply reliability. Supporting measures like subsidies, soft-loans, grants and tax credits can reduce equity requirements and thus lead to reduced capital. More-so, the supporting measures might help to limit the cost of the REFIT and tendering mechanisms. Instruments like subsidies and soft loans are also ideal to support rural and off-grid electrification. Even if REFIT and tendering schemes can be considered as powerful instruments to promote the deployment of renewable energy technologies, the design of the instruments is crucial.

Chapter 3 gives an overview over the specific costs of different renewable energy technologies (RETs). The costs of the proposed procurement mechanisms are calculated and the impact on the retail power price is analysed. A REFIT is built for small RETS to calculate the specific costs of different RETs and thus the appropriate FIT. Based on a PROGRAM cost calculator (see ANNEX 2) the impacts of different scenarios on the economy and the retail price for residential power consumers are calculated. The scenarios describe different renewable electricity generation capacities (60MW and 160 MW), but also include technologies proposed under tendering.

Namibia has a small consumer market, and as such any significant renewable energy installation will have an impact on electricity tariffs. The impact of the tariff depends on several factors, including the type of technology, e.g. CSP or wind; size of installed capacity and subsequent energy generated; location (in cases of wind and solar whose speed and radiation levels respectively may not be uniform) and the wholesale market price of electricity.

Chapter 4 reiterates the recommendations of Chapter 2 and Chapter 3 giving specific guidelines on how Namibia may implement the recommended instruments by assigning responsibilities and proposing the necessary institutional guidelines. The Chapter also discusses the monitoring, reporting, review and dispute resolution mechanisms. Chapter 5 concludes the whole study.

1. BACKGROUND AND INTRODUCTION

1.1 Background

The Ministry of Mines and Energy of the Republic of Namibia is cognisant that the country's energy regulatory framework and associated energy laws and regulations are fragmented and outdated, and has therefore embarked on a review. In the past 10 years there have been amendments to various energy-related acts, such as the Electricity Act (2000 and 2007), the Petroleum Products and Energy Amendment Acts (2000 and 2003) and the Petroleum (Taxation) Amendment Act (Act 3, 1991). There have also been various developments within the sector demanding that capacities of existing institutions be enhanced to more comprehensively respond to new challenges in the sector, such as the regulation of gas, nuclear energy and renewable energy technologies. These developments may be well assessed through the policy objectives as stated in the White Paper on Energy Policy of 1998 (IPPR, 2009). The Policy objectives are;

- effective governance
- security of supply
- social upliftment
- investment and growth
- economic competitiveness and efficiency, and
- sustainability

Further change of the regulatory framework conditions are anticipated: the Electricity Control Board (ECB) is set to be transformed into an energy regulator; the South West Africa Water and Electricity Corporation Act of 1980 which governs NamPower is likely to be revised completely, and the Act governing the Regional Electricity Distributors (REDs) has been earmarked for review to specifically address the challenges faced by the REDs.

Even though the promotion of renewable energy technologies (RETs) is not mentioned as a special target of energy policies, the White Paper on Energy Policy (1998) points out the potential of RETs contributing to meeting several targets like energy security and sustainability.

The Ministry started promoting the use of renewable energy resources in earnest in 1993 with the launch of the project "Promotion of the Use of Renewable Energy Sources in Namibia", with the support of the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. A solar credit scheme, the Home Power Project, was launched in 1996 with financial support of the United States of America based development organisation, Renewable Energy for African Development (REFAD).

There have been subsequent projects and programmes launched to promote the diffusion of RETs. The Government partnered the Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) to launch the Namibia Renewable Energy Programme (NAMREP) in 2004 to reduce the barriers that prevented the wider adoption of the solar resource. NAMREP was designed to remove technical, financial, social, institutional capacity, public awareness and social acceptability barriers to solar energy use. The Renewable Energy and Energy Efficiency Capacity Building Programme (REEECAP) was launched in 2005 with the objective *"to increase the capacity of the Namibian resource base in selected areas to enable it to contribute to the implementation of the national policies for renewable energy and energy efficiency as stated in the White Paper on Energy (1998) and the Second National Development Plan"* [NDP2, covering 2001-2005]. The Renewable Energy and Energy Efficiency Institute (REEEI) was re-launched at the Polytechnic of Namibia in 2006, following a cooperation agreement between the Polytechnic and MME. The Institute was given the mandate to facilitate and conduct research into renewable energy and energy efficiency and develop materials and standards, reports and disseminate information and materials.

Energy efficiency has also been promoted by MME and implemented through the ECB, NamPower and REEEI. For example, the Demand Side Management Study commissioned by the ECB in 2006 identified seven (7) measures with the potential to yield significant energy efficiency gains in the country. The following demand side management (DSM) measures were adopted by the DSM Steering Committee that includes MME, ECB, NamPower, the REDs, the Manufacturers Association of Namibia and REEEI: compact fluorescent lights (CFL); solar water heaters; time of use tariffs; demand market participation; ripple control of geysers; energy audits; and energy saving awareness campaigns. The measures are at various stages of implementation.

Rural and off-grid electrification are two of the many programmes that MME is driving through the Directorate of Electricity and Directorate of Renewable Energy. The Rural Electrification Distribution Master Plan (REDMP) provides a framework for the planning of electrical distribution infrastructure, network planning, area prioritisation, financing and implementation of grid electrification. With a rural grid electrification penetration rate of only 27 %, Namibia also pursues the electrification of off-grid areas using solar technologies in an initiative guided by the Off-grid Energisation Master Plan (OGEMP). The barriers to rural electrification in Namibia arise from limited financial resources to extend the grid, and low rural population densities that lead to high investment costs and generally low returns on that investment. Although the policy frameworks covering rural electrification and off-grid electrification exist, there is a regulatory vacuum for the latter. This absence of clear regulatory guidelines is a disincentive to investment in and deployment of clean energy technologies for rural Namibia.

It is concluded that Namibia has an inadequate regulatory framework to incentivise the introduction of large-scale renewable energy technologies and energy efficiency. Such a framework would facilitate the levelling of the playing field between conventional and renewable energy technologies, set national generation targets for renewable energy technologies, ensure fair market access and regulated return on investment, specify the quality of supply and associated standards, and create a framework of market support structures and incentives.

1.2 The Namibian Electricity Supply Industry and its Institutions

The Namibian electricity supply industry (ESI) encompasses the entire value chain from power generation to retailing. In the context of this study, the ESI will include electricity generation, transmission, trading and distribution as well as the relevant policy and regulatory institutions. The Namibian ESI institutions include:

1.2.1 MME

MME is the custodian of Namibia's energy and mineral resources. It sets and guides policies related to the sector, including the electricity sector. MME's Energy Directorate aims to ensure adequate, affordable and sustainable energy supply leveraging on the country's natural resources for the nation's socio-economic development. The Directorate enforces the compliance of legal requirements of energy legislation and regulations and researches new and renewable sources of energy. According to its website, the Ministry conducts functions, amongst others, such as:

- Petroleum product import and export control, pricing and price equalization including upstream -and downstream regulation and the administration of the National Energy Fund
- Rural electrification and the administration of the Solar Electrification Revolving Fund

1.2.2 ECB

The ECB is responsible for regulating the electricity industry, and is the statutory regulatory authority established in terms of the Electricity Act, 2000 (Act 2 of 2000). The Act was subsequently repealed by the Electricity Act, 4 of 2007 which expanded the ECB's mandate and core responsibilities. The core responsibility is to regulate electricity generation, transmission, distribution, supply, import and export to/from Namibia, while its mandate includes developing electricity tariff methodologies as well as independently reviewing and approving electricity tariffs. A significant development to power sector reform is the development of the IPP Framework and development of transmission and distribution grid codes and related operating standards for the market players.

1.2.3 NamPower

NamPower is a state-owned utility and is responsible for power generation, transmission, trading and also has distribution functions in select areas. It was renamed NamPower in 1996, from the previous name of South West Africa Water and Electricity Corporation (Pty) Ltd (SWAWEK) which had been created by South Africa's Industrial Development Corporation in 1964. NamPower is a private limited company but wholly owned by Government and still operates under the SWAWEK Act of 1980.

The company has long enjoyed a complete monopoly position within the electricity industry. Recent ESI restructuring efforts have seen NamPower cede some of these responsibilities, such as the distribution of electricity in areas now served by the REDs. NamPower remains the single buyer through its electricity trading unit, and has the responsibility as Namibia's electricity system operator. On generation, the utility operates three power plants, i.e. the 249 MW Ruacana plant (hydro), the 120 MW Van Eck coal-fired plant, and 24 MW heavy fuel-oil-powered Paratus plant.

1.2.4 REDs and Local Authorities

The creation of REDs is in line with the White Paper on Energy Policy (1998), intentioned to restructure Namibia's electricity distribution industry to improve sector efficiency. The restructuring, which is still on-going, will culminate in five licensed REDs companies from the 45 distributors that include NamPower, local authorities and regional councils -and farmers' cooperatives. Although five REDs are envisaged, in 2010 only CENORED, ErongoRED and NORED are operational.

1.2.5 IPPs

The deregulation of the ESI was intended to create a platform for the entry of Independent Power Producers. In 2010, there are eight (8) IPPs that have been conditionally licensed by ECB, intending to generate power from coal, gas, heavy fuel oil, wind, hydro and biomass, refer to Table 1.1. The licensees are at various stages of negotiating power purchase agreements (PPAs) with NamPower as expected in the single buyer market model. As yet, only Bush Energy Namibia has established an operational power plant (250kW fuelled by biomass, inaugurated in September 2010), while none of the other licensees has put up any power generation infrastructure.

Table 1.1: Conditional Generation Licences Issued by ECB

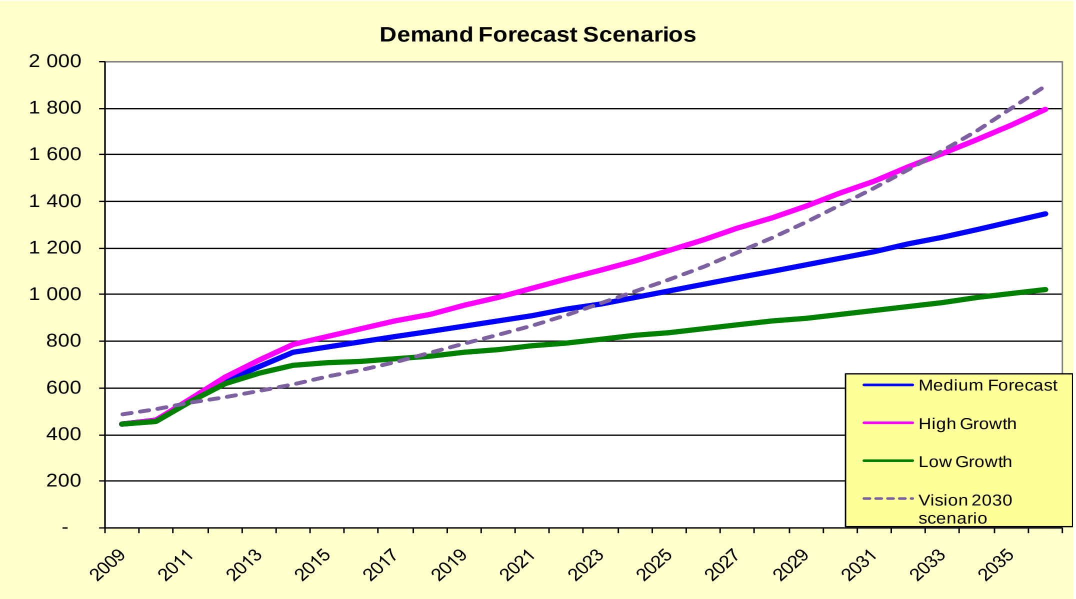
Licensee	Fuel Type	Date Issued	Plant Size (MW)	License Period (yrs)
Aeolus Power Generation	Wind	01-04-07	92	22
BINVIS/ Atlantic Energy Coast	Coal	01-11-07	700	25
Bush Energy Namibia (CBEND)	Solid Biomass	01-05-10	0.250	5
Electrawinds	Wind	01-11-09	50	20
Innowind	Wind	01-03-10	60	20
Namibia International Mining Co. (NIMC)	Diesel /CCGT[5]	01-06-07	210 (68)	20
Vizion Energy Resources	Coal	13-03-08	800 (400)	25
VTB Capital	Hydro	15-07-07	30	20

1.3 Power Supply and Demand

Namibia and the Southern African Power Pool have been experiencing a severe power deficit since the beginning of 2008. Namibia has an installed capacity of 393 MW, while having a peak demand of 443 MW (excluding Zinc Scorpion mine) in 2009 [*NamPower Annual Report, 2009*]. The supply deficit has been filled through imports from Mozambique, South Africa, Zambia and Zimbabwe. The interconnector with South Africa is capable of transmitting up to 600 MW, while the newly constructed High Voltage Direct Current (HVDC) Caprivi Link Interconnector has a capacity of 300 MW and is upgradeable to 600 MW. Electrical energy units into NamPower system in the past three years have been 3,621GWh, 3,719GWh and 3,692GWh in 2007, 2008 and 2009 respectively [*NamPower Annual Report, 2009*]. Four future demand scenarios are shown in Figure 1.1. When taking the limited national electricity supply capacity of 393 MW into consideration, the figure illustrates Namibia's precarious electricity supply situation in 2010.

[5] CCGT stands for Combined Cycle Gas Turbine (Technology)

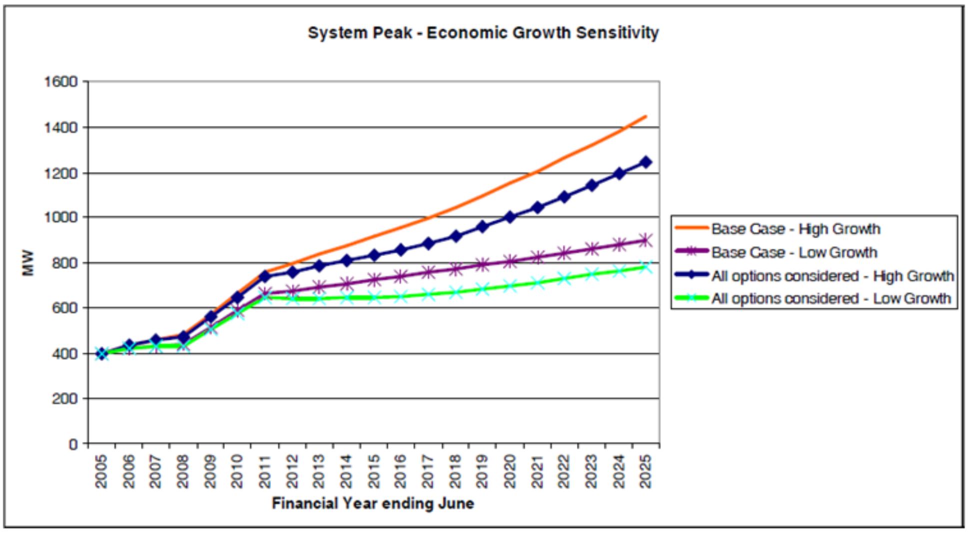
Figure 1.1: Namibia's Peak Load Forecast Scenario



Source: NamPower Presentation at Anixas Ground Breaking Ceremony, 2010.

The REEECAP study of 2008, "Electricity Supply and Demand Management Options for Namibia - A Technical and Economic Evaluation" provides macro-economic scenarios based on different supply and demand options. Figure 1.2 illustrates different demand scenarios for economic growth scenarios with annual economic growth rates of 2% (low growth) and 6% (high growth) per annum [*REEECAP, 2008*].

Figure 1.2: Projected System Peak Demand at Economic Growth of 2% and 6%



Source: REEECAP, 2008.

Namibia is vulnerable to power supply disruptions since its foreign suppliers are also facing a power deficits. Step loads, largely from increased mining activities, will continue to place pressure on national supplies. In order to address the current shortfall, MME through NamPower is contemplating a number of generation options as summarised in Table 1.2.

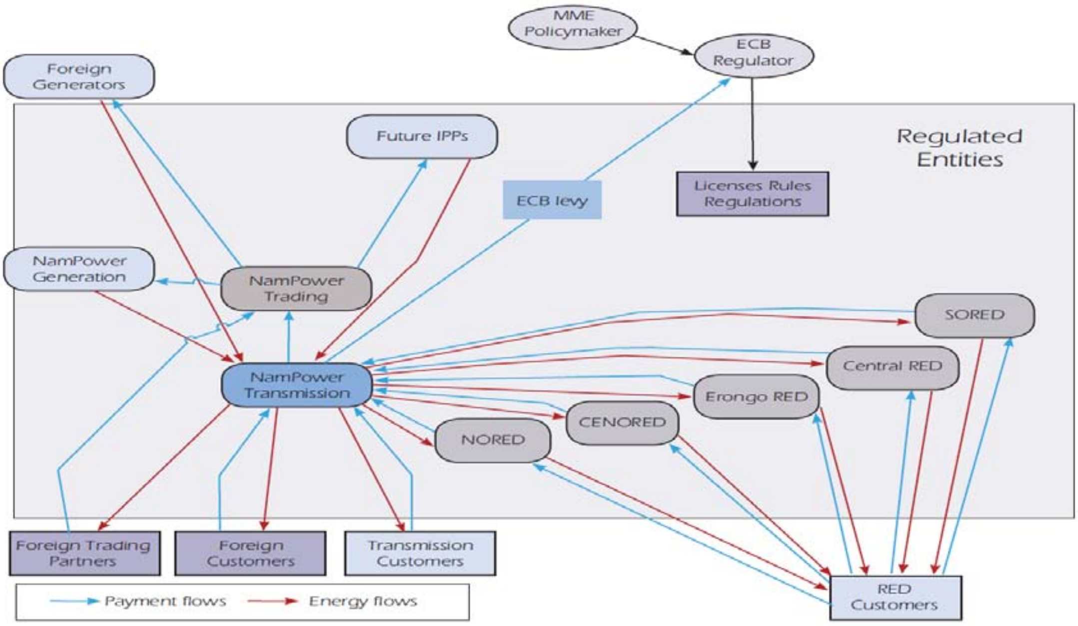
Table 1.2: Planned and Status of Power Generation Projects

Project	Capacity (MW)	Fuel Type	Expected Completion Date	Status
Anixas	22	Diesel	2011	• Work has commenced
Ruacana 4th Unit	92	Hydro	2012	• Project funded from NamPower's balance sheet plus loan from KfW • Work has commenced
Lower Orange river mini hydro power stations	30 - 120	Hydro	2013	• Projects in feasibility stage • Likely development in collaboration with IPPs
Kudu Gas to Power Project (CCGT)	400-800	Gas	2014	• Various options including compressed natural gas are being considered • Payment modalities for gas uncertain • Identification of power off-taker required
Walvis Bay Base Load	200- 500	Coal	2014	• Environmental Impact Assessment (EIA) Study completed • Environmental clearance outstanding • IPP required to build and operate the plant
Baines Hydro Power	360-500	Hydro	2017	• Techno-economic study and EIA started • Project to be built jointly with Angola

1. 4 Namibia's Power Market Model

The current electricity market structure is that of a vertically integrated single buyer whereby NamPower's Electricity Trading Unit buys electricity from suppliers through long-term PPAs. Figure 1.3 illustrates the prevailing market structure in Namibia. The single buyer model in Namibia's open market system compromises NamPower's partiality in negotiating PPAs with IPPs since the Power Trading and Transmission Divisions are an integral part of NamPower.

Figure 1.3: Namibia Single Buyer Model



Source: ECB Annual Report, 2009

Namibia's power market can best be summarised by Lovei (2000) who states that "...the lack of a unified wholesale market price means that the electricity price for small consumers depends on the power purchase contracts signed by their distributors". Lovei goes on to suggest that in order to protect the interests of these consumers, the regulator needs to spell out *procurement rules* or other criteria that distributors must meet before they can pass through electricity purchase costs to captive consumers.

Presently, the ECB contemplates the creation of a modified single buyer market structure. The model will be similar to a wholesale market where there are multiple buyers and sellers of electricity. REDs and other distributors will be able to buy power directly from the IPPs. NamPower's role in a modified single buyer model remains critically important, especially to maintain system balance in real time, and NamPower will also remain the supplier of last resort.

1.5 Cabinet Retreat Recommendations

Of relevance to the Namibian ESI, the Namibian Cabinet Retreat Paper of 2008 makes a series of recommendations with the following observations:

1. The Central RED and Southern RED need to be created. *CENORED and Erongo RED have been requested to assist in management of electricity distribution in the outstanding REDs.*
2. In 2005 Cabinet took a decision that electricity tariffs must reach cost reflectivity by the year 2010/11. *Cost reflectivity means that the utility is allowed by the regulator to recover all allowable costs of supplying electricity which include all operational, administrative and*

customer care costs. Cabinet reiterated this position in 2009. However, based on tariff increases in 2009 and 2010, it is most likely that the 2010/2011 target will not be met. Cabinet extended this target in 2010 to 2011/2012. Tariff cost –reflectivity is essential to attract investments in the electricity sector.

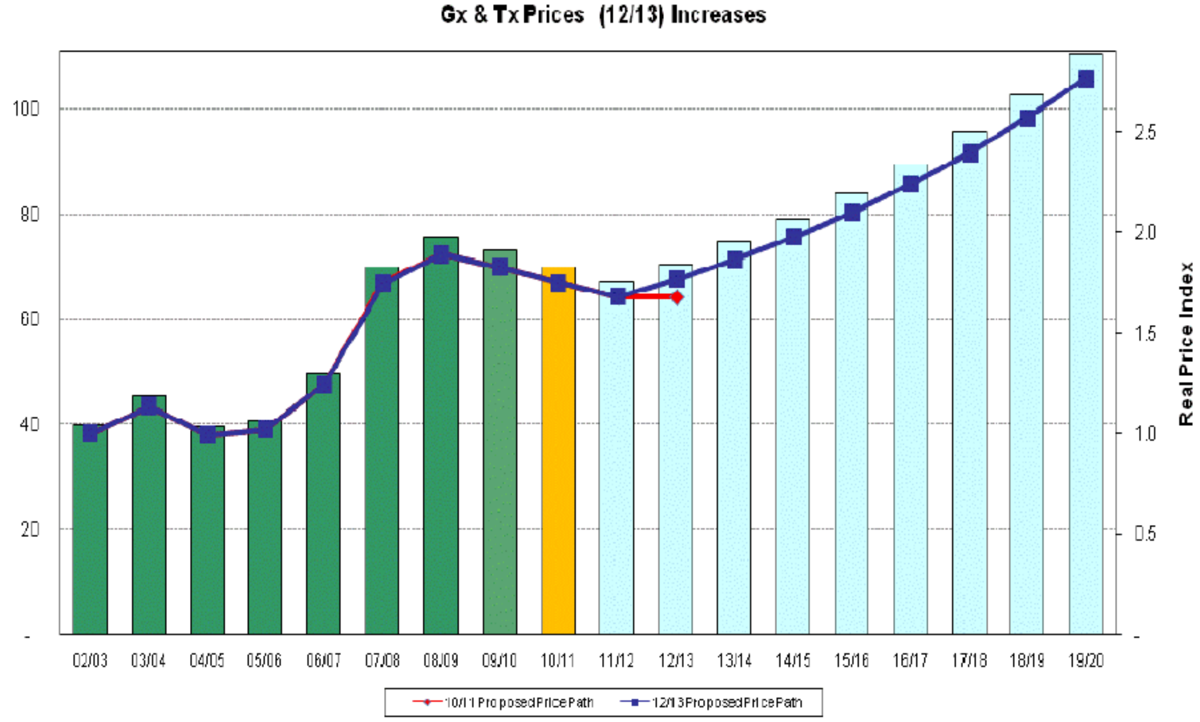
3. The role of private sector investments in the electricity sector is recognized as a complement to NamPower. *IPPs are being invited to take up projects such as the Walvis Bay Thermal Power Plant and the small hydros.*
4. The definition of rural electrification is broadened to include low-income, informal and peri-urban settlements. *These areas have been neglected since they are in undesignated areas and are being considered under the Off-grid Energisation Master Plan.*
5. Fuel is to be levied for infrastructure to help other energy sector entities like NamPower, REDs and Namcor. *The Petroleum Products and Energy Amendment Act, No. 16 of 2003, provides for levies of petroleum products for contribution towards the Energy Fund. The Act empowers the Minister responsible to impose a levy for the benefit of the Fund on any energy source including electricity, nuclear and renewable energy. The Fund may be used for any project or activity in connection with energy as may be prescribed by regulation.*
6. ECB to be transformed into an energy regulator, in line with regional trends and to avoid the unnecessary expense of creating too many new entities with similar functions.
7. The Namibian Government is to engage the government of the Republic of South Africa for support in building small hydro-power plants along the Orange River.
8. Recognition is given to the importance of subsidies to encourage the mainstreaming of renewable energy technologies to the energy supply chain. *The Solar Revolving Fund under OGEMP is designed to subsidise RET.*

1.6 Tariff Cost Reflectivity

It is stated in the Cabinet Directive that electricity tariffs must be cost reflective by 2011/12. The ECB has been granting NamPower tariff increments (e.g. 18% for 2010/2011) to set it on a path to meet that target. For 2010/11 NamPower had requested an increase of 35.16%. REDs and Local authorities are granted varying increases according to the revenue requirements they submit to the ECB. The ECB argues that its pricing methodology takes into consideration the “recovery of cost of supply plus regulated rate of return while keeping prices affordable to consumers” (ECB Press Statement, 2010).

Figure 1.4 illustrates a projection of generation and transmission price increases. It is noted that the actual wholesale price of electricity to re-distributors is 45.62c/kWh (in Namibian currency) for 2010/2011, while the 2008/09 projection proposed a tariff which is almost double that.

Figure 1.4: Generation and Transmission Projected Price Increases.



Source: ECB, 2010

1.7 Challenges Faced by Renewable Energy Resources in Namibia

Namibia is well-endowed with energy resources. Non-renewable energy resources include gas and uranium; however both have their challenges to develop to provide power to the country. The renewable energy resources are in the form of good wind resources, excellent solar radiation, and biomass [*Von Oertzen, 2009*].

However, despite the abundance of various renewable energy sources (RET) in the country, only solar technologies have gained some market access, although their use is limited to off-grid energisation and for domestic water heating. This is despite several licence applications being approved by ECB for wind power development.

The optimum utilisation of RET requires a combination of appropriate policies and a favourable investment framework for the would-be investor. One of the major bottlenecks to the large-scale development of renewable energy projects is with the pricing mechanism for these resources. Countries that have witnessed the large scale development of RETs, such as Germany, Spain, Sri Lanka and China, have introduced procurement mechanisms such as renewable energy feed-in-tariffs (REFITs), often in addition to other procurement mechanisms. South Africa introduced REFITs in March 2009, but they are yet to be implemented. Kenya is implementing feed-in-tariffs for wind, small hydro-power, biomass resource, geothermal, biogas and solar to generate electricity.

The development of procurement mechanisms for the development of renewable energy resources in Namibia is therefore necessary. The present study assesses the following renewable energy technologies: wind, solar, solid biomass including landfill gas and small hydro-power. These resources have received considerable interest from investors, and their development given the right framework conditions seems promising.

Observation:

Namibia's lack of grid based renewable electricity is due to an absence of a specific renewable energy policy and an enabling regulatory framework despite a good overall energy policy. Countries with large scale development of RETs, such as Germany, Spain, Sri Lanka and China, have introduced procurement mechanisms such as REFITs, premiums and other support mechanisms.

2. COMPARATIVE ANALYSIS OF RENEWABLE ENERGY PROCUREMENT MECHANISMS

2.1 Purpose

The section provides a comprehensive comparative analysis of different instruments used to procure RETs globally and their applicability for use in Namibia. The instruments considered in this study are Renewable Energy Feed-in-Tariff (REFIT), Quota, Tendering, Net Metering and others grouped as Tax Incentives or Rebates, Grants and Capital Subsidies. These instruments are used to promote the use of RETs and deliver renewable electricity to the grid. The theoretical analysis is used to make a proposal for the design of RE procurement mechanisms for Namibia. Besides theoretical evaluation practical experiences with different procurement mechanisms made abroad are considered, too.

2.2 Introduction

Namibia's White Paper on Energy Policy emphasises the need of increasing the share of indigenous resources by levelling the playing field between conventional and renewable energy technologies. Creating a level playing field for RETs includes abolishing market and policy failures (such as price ceilings, subsidies for grid-based electrification) [Ministry of Mines and Energy (2005)]. Presently, the most prominent market failure of the Namibian power market is the externalisation of certain costs of fossil fuel power plants operating within the country or abroad. As long as this market failure persists, RETs are systematically discriminated against. Appropriate institutional support is needed to overcome this barrier.

Economic literature suggests two different approaches to overcome market failures and to improve the competitiveness of RETs (Musgrave & Musgrave 1984):

a) internalisation of external cost of fossil fuels based power generation;
b) introduction of special instruments to ensure a greater share of RET in the electricity supply (like quotas, REFIT and others).

Since economists prefer to leave the choice of technologies to the market, they normally recommend that the first approach is used.

2.3 Internalisation of External Costs

RETs face several impediments like high investment costs, lack of information by consumers and generators, institutional barriers, and others. Utilities are hesitant to invest in RETs other than conventional hydro-power. The main reason for the dominance of fossil fuels in the power sector is the fact that their specific upfront costs are lower than those of RETs like wind power plants, concentrating power plants (CSP) or PV plants. The later are intermittent and hence difficult to generate electricity reliably.

One important reason for such a cost advantage of fossil fuel power generation is that the market price of electricity generated by fossil fuels does not reflect all the costs related to its generation. Power plants using coal or fuel oils do not have to pay for disposing all pollutants, such as particulate matter and greenhouse gases into the atmosphere. Since the capacity of the atmosphere to absorb and neutralise pollutants is limited, there are harmful feed-backs to all other economic entities, including governments, companies and households.

The disposal of pollutants to the atmosphere indicates the existence of "external costs" and is the "free disposal assumption" held by traditional economic models. The market system on its own does not provide information to the generators about the magnitude of such external costs. And, even if such information was available, no incentive exists to apply it or to consider incorporating external costs in the calculation of power prices.

Since the polluters only pay for the internal costs such as capital costs and fuel costs but not for the external costs, they enjoy cost advantages when compared to other power generators using low emitting technologies like RETs. This is an indication that the conventional fossil fuel based power market is distorted and the government has to intervene and to correct relevant market failures, at least according to welfare economics. Only if all suppliers on the market bear all cost of their activities, the market mechanism can ensure that a given demand (for power) is met by minimum social costs, including internal and external cost.

A correction of the market failure can be achieved by calculating or estimating the external costs, and then attributing these to the polluters. In theory, this can be done by imposing a production tax, such as the so-called Pigouvian tax or emissions tax, where a proper taxation rate is determined by the level of external cost[6]. In this way, conventional fossil fuel power generation become more expensive. As a consequence, economic theory predicts that the demand for such polluting power would decrease, and producers would have incentives to look for cleaner and environmentally cheaper alternatives including the introduction of RETs. Thus, a production tax helps to overcome the market failure and the existing discrimination of RETs.

[6] The optimum rate of a Pigouvian tax is determined by the marginal external cost at the optimum output level.

Unfortunately, an exact calculation of a proper tax rate faces considerable informational barriers that are hard to overcome. Exact information on the quantitative impacts of given pollutants is not available and are also difficult to express in monetary terms since it is not known whether consumer's would be willing to pay for better air quality, and by implication, less global warming.

A specific challenge exists in countries such as Namibia where coal-generated power is not generated locally but imported from neighbouring countries. Here, a Pigouvian or emissions tax cannot be introduced by the state. One option to circumvent this issue is by introducing import tariffs on electricity generated from coal, or introduce specific instruments to increase the share of RET in the local power sector.

2.4 Renewable Energy Technologies as Meritorics

Increasing the share of renewable energy technologies can be done by using a variety of procurement mechanisms or policy instruments, including:

- offering renewable energy feed-in-tariffs
- implementing renewable energy tendering schemes
- introducing a quota system for renewable energy technologies, and
- creating investment grants, tax credits, rebates, etc.

All these strategies are based on the assumption that RETs encompass a bundle of advantages, such as making positive contributions to energy security, technological development and economic growth and reducing greenhouse gas and particulate emissions. Whereas a strategy to internalise external costs is based on welfare economics, the above-mentioned RET procurement mechanisms are not, and are rather based on the Theory of Meritorics founded by Musgrave.

According to the Theory, the government has to provide those goods that meet public needs but which are not revealed by individual preferences and willingness to pay. Since individuals do not fully recognise the benefits of RETs, they are not willing to pay premium prices. Thus, government would have to ensure a proper level of supply. The question, however, is what the appropriate quantity of supply would be. However, it is difficult to define the optimum level of consumption of such goods, and defining the quantity of RET (e.g. in GWh or share of electricity production) remains subject to political decision making.

Therefore, decision criterion is needed to evaluate different RE procurement mechanisms. In economics, government policy instruments should be chosen in a way that political targets are met with minimum social costs. This proposition includes at least two criteria: **firstly,** the instrument must be capable to meet a politically defined target. **Secondly**, the instrument must be effective (criterion of efficacy). Gipe defines that efficacy of procurement mechanisms for renewable generation of electricity "...must, at a minimum, include for:

- access to the grid (interconnection), and
- a price for the electricity produced that contributes to profitability or at least the prospects of profitability" (Gipe, 2006, p. 8)

Since RET are exploiting indigenous resources they contribute to energy security. Thus it can be said that an effective procurement mechanism can be considered as one of improving energy security. The contribution to the target of energy security (although difficult to quantify) must not, therefore, be discussed separately.

The chosen instrument must ensure that the target has minimum costs. The instrument must be efficient (criterion of efficiency). Since efficient solutions (maximization of social welfare) might include different distributional impacts, another criterion is added, which is avoidance of negative distributional impacts. This criterion is met if the consumer surplus is maximised. In practical terms this implies that the instrument should be selected in a way that extra-ordinary profits by producers are avoided (OPTRES 2007, p.50).

Finally, RET procurement mechanisms should contribute to the provision job opportunities. It is well-known that applying RETs promotes employment in several ways: during manufacturing, construction and the procurement of renewable fuels. Namibia's unemployment rates currently stand around 50% with the majority of the unemployed being unskilled and young people.
Thus, theoretical evaluation of the procurement mechanisms is based on the following three criteria:

1. efficacy: does the instrument meet the target
2. efficiency: is the total cost to meet the RET-target minimised
3. avoidance of negative distributional impacts: is consumer surplus maximised as well as creating additional social benefits such as direct and indirect employment creation.

With respect to efficiency two issues have to be addressed:

- First, the criteria of cost minimisation or economic efficiency can be interpreted as static or dynamic. **Static efficiency** is given if the government target is met by minimum cost of using given technologies. **Dynamic efficiency** implies the capability of an instrument to provide incentives to lower the costs which is a precondition for future ambitious targets. Static and dynamic efficiencies have to be considered in evaluating the different procurement mechanisms.

- Secondly, if a country has not formulated quantitative targets for RET (or targets for specific renewable energy types) such as Namibia, but only general energy policy targets like energy security, the evaluation becomes more difficult.

Since meeting policy targets in an efficient way and avoiding unnecessary extra costs for the public is of general economic importance to Namibia, the study will concentrate on these criteria.

The evaluation of RET procurement instruments will use a three-step process:

1. the different RET procurement approaches are presented assuming an ideal type[7] and ideal market conditions (competition) and these are evaluated with respect to the mentioned criteria of efficiency and efficacy.
2. flaws in the design of the procurement mechanisms that can be observed in practice are discussed.
3. some best practice recommendations are then presented.

Observation:

Market failures are addressed by internalising external costs of fossil fuel based generation or by introducing special instruments like REFITs to ensure a greater share of RET in the electricity supply.

Internalising of external costs is almost impossible in Namibia. The special instruments introduced under the Theory of Meritorics must be such that they are efficient, effective and maximise consumer surplus, e.g. job creation.

The nascent renewable energy industry which is still largely confined to solar energy for off-grid electrification and solar warm water preparation employs around ***85 people***[8] on fulltime basis.

2.5 Renewable Energy Procurement Mechanisms

Introducing renewable energy procurement mechanisms in a market economy like Namibia needs careful legitimating because the market as a decision making process is replaced by state planning. Since government decision can be based on poor information and lobbying, replacing the market should be based on sound arguments such as the problem of internalising external cost and the Theory of Meritorics. The instruments or procurement mechanisms used to promote the use of

[7] The ideal type as introduced by Max Weber in this context is describing the typical composition of a support mechanism and should not be mixed with a best practice mechanism.

[8] Based on annual surveys conducted by REEEI

RETs and deliver renewable electricity to the grid in different countries include REFIT, quota, tendering, net metering and others grouped as tax incentives or rebates, grants and capital subsidies (Table 2.1). The utility is obliged to purchase the renewable electricity under the REFIT, quota and tendering. The following sections will describe these instruments in detail evaluating their advantages and disadvantages and their implementation and delivery experiences.

Table 2.1 Instruments for RE generation in selected countries.

Country	REFIT	Quota	Capital subsidies, grants, rebates	Investment excise, other tax credits	Sales tax, energy tax, VAT	Energy production payments, tax	Net metering	Public investment,	Public competitive
Algeria	√								
Argentina			√			√			√
Brazil	√							√	√
China	√		√	√	√			√	√
Guatemala				√	√				
India	☑	☑	√	√	√			√	√
Indonesia	√								
Kenya	√								
Mexico				√			√		
Mauritius	√								
South Africa	√								
Sri Lanka	√								
Thailand	√	√	√				√		

Notes: ☑ = applied in some states

Source: adapted from Ljung, 2007

2.5.1 Tendering

The national government pursues a quantitative target for RET that should be realized by one or several auctions with RET developers being invited to apply to bid for an RE contract. The tendering approach is used by both industrialized (United Kingdom and France) and developing countries (by Peru[9], Argentina[10], Honduras[11], Brazil[12] and Bangladesh[13]).

Typical features of a tendering system are:

- Eligible technologies are defined by the government, but no specific targets for selected technologies;
- All necessary technical information concerning wind-speed, radiation etc. are provided by the government;
- The least cost bidder or the least cost bidders whose capacity is needed to meet the RE target are awarded a contract;
- For defined number of years (15-20 years) the successful bidders will receive a fixed price that is in accordance to their bid;
- A penalty has to be paid in case of withdrawal from the contract or in case of lacking RE generation.

Figure 2.1 illustrates the function of the tendering approach. In this case the government is tendering 30 GWh/year of green power. The bid of each bidder has the size of 10 MW. The light blue columns represent the total annual cost of the different RE suppliers and the dotted line, the market price of electricity in the power market. In the example, the three (3) RE suppliers on the left side are awarded a contract; the fourth supplier, right of the vertical line has not qualified for the tender.

Since the specific production cost of all the RET suppliers are greater than the market price of electricity (P_{el}) the difference has to be covered by the government (tax payers) or the utilities (power consumers). Normally the RET suppliers receive a guaranteed price that is financed by a levy on (domestic) power consumers. In the example (Figure 2.1) the 3 contracted RET power suppliers receive different compensation (A, B, C) according to their specific generation cost, or better according to their bids.

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[9] **http://www.minerandina.com/index.php?option=com_k2&view=item&id=85:arranca-mercado-de-energias-renovables-en-el-peru&Itemid=2&lang=en**

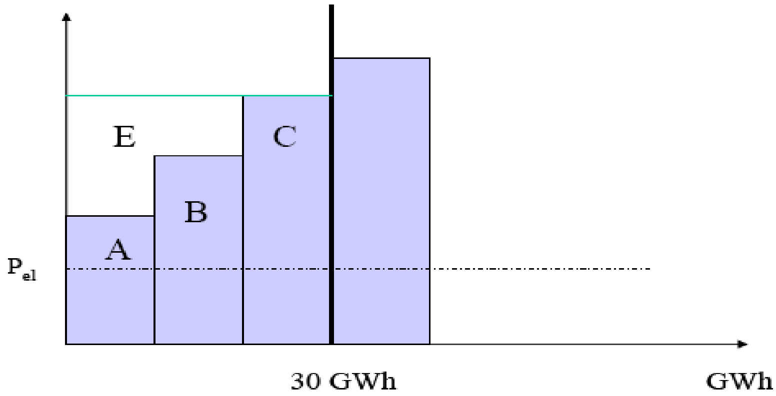
[10] http://www.rechargenews.com/business_area/politics/article201725.ece; http://latamrenewables.com/2010/03/27/argentina-wind-enarsa-renewable-tenders-closing-in/

[11] http://en.centralamericadata.com/en/article/home/Honduras_Bidding_rules_for_Renewable_Energy_Changed

[12] http://www.rechargenews.com/energy/wind/article211126.ece

[13] http://www.energybangla.com/index.php?mod=article&cat=PowerSector&article=2162

Figure 2.1: Tendering



Based on efficacy and efficiency, one can say that the tendering process provides a least cost solution. ***The mechanism thus fulfils the static efficiency criterion.*** The fulfilment of dynamic efficiency criterion through the lowering of production costs and stimulating learning curve effects depends on the design of the tendering scheme. If tenders occur occasionally and the future tendering process is not predictable there are only weak incentives to invest in new production capacities and thus to induce innovations. On the other hand, in the case of long run certainty (annual tenders) investments in the RET industry tend to increase***.*** If only a small share of the contracted capacity is realized the contribution of tendering to extend the share of RE in the electricity sector is not realised. Furthermore, the contribution to increase energy security by expanding indigenous RE is questionable.

Drawbacks associated with tendering (Mendonca, Jacobs, Sovacool, 2009, 175 ff.) include:

- Low participation; since the chance to winning bids is rather small, for example in a small market like Namibia, and the price will be low many potential bidders may decide not to participate. This increases the scope for gaming.
- Lack of information and procedural uncertainty; if relevant information (e.g. wind-speed) is not available the bidders are bidding under uncertainty or have to bear significant upfront costs to gather the needed information. Unclear procedures and the probability of delays in the decision making process are increasing transaction cost and might discourage potential bidders to participate.
- Strategic bidding; if a bidder has information on the (higher) specific cost of competing bidders he has an incentive to strategic bidding. As long as strategic bidding is practiced by

infra-marginal bidders the outcome is efficient, but the consumer surplus is not maximised. If strategic bidding is made by the marginal supplier the outcome becomes inefficient.

- Cancellations; cost overruns result in cancellations. In UK less than 30% of the contracted capacity was installed and the same is true for France.
- Tendering does not allow a continuous growth of RE industry; rather a *Stop- and-Go* development. Since the timing of the next round of tendering is unclear there are no incentives to build production capacities with developers more likely to use imported technology.
- Concentration on least cost technologies may contribute to economic competitiveness and efficiency, but may not fulfil other targets of economic and social policy.
- Definition of sub-categories for different types of technologies (wind, solar) or for different types of bidders (small, large) does not allow the concentration on least cost RETs.

To avoid these flaws best practice recommendations (Ecofys, 2008, p. 40) may include:

- Penalties for non-compliance to help avoid unreasonable low bids;
- Corrections for inflation and prices for key commodities;
- Continuity of calls increasing the predictability of the tendering process and thus avoiding a stop-and-go development;
- Streamlining interacting policies (like special planning) "...to ensure the tendered capacities can actually be realised" (p. 40).

2.5.2 Quota Systems

Quota schemes, sometimes called Renewable Portfolio Standards (RPS) are applied in many industrialized countries like UK, Australia, Canada, Japan and Italy but also in several developing countries like China and India (see Mendonca, Jacobs, Sovacool, 2009, p. 150 ff). In the USA RPS are applied in more than 30 states like Iowa, Minnesota and California. In the case of a quota system, the government mandates a minimum share of power coming from RET which is similar to tendering. The mandate can be placed on generators, distributors or consumers. In the following case it is assumed that the mandate is placed on distributors (utilities). Typical features of a quota system are:

- Eligible technologies are defined by the government, but no specific targets for selected technologies;
- The target increases over time; but there is a final target (MWh) and an end-date;
- The utility decides how to comply, by type of technology and by choosing appropriate developers to deal with;

- Government is allocating Green Certificates for each MWh of RET;
- At the end-date the utility has to prove meeting the obligation. This can be done by bundled certificate or unbundled certificates. Bundled certificates are considered if physical electricity and the certificate are transferred together (this is the case in California). If green power and certificates are traded on different market then the certificates are unbundled. In this case a utility facing relative high cost of RE power production can meet its RE quota by buying certificates on the certificate market;
- A penalty has to be paid in case a utility is lacking certificates.

Discussing the outcomes of a quota system a system of unbundled certificates is considered, where power and certificates are traded on different markets. In this case utilities are free to develop own RET projects like wind farms or CSP plants or to buy the certificates from third parties, like independent green power producers. A RET producer receives two types of income: revenues from selling the green power on the general power market and revenues from selling the certificates on the certificate market.

The green power producers will extend the RET power production as the sum of power price and certificate price are greater or equal to the long-run marginal cost (LRMC) of RET projects. In reality both, the future power price and the future price of green certificates are very difficult to project.

The price on the certificate market is determined by LRMC of the last MW of RE capacity that is necessary to meet the quota, more precisely the sum of all green obligations of all utilities. The "law of one price" holds for both the power market certificate market. RET producers with relatively low cost of supplying green power, so called infra-marginal producers, earn extra profits.

Evaluating the results of a quota system with tradable green certificates the following can be said:

- On a competitive power market each utility will choose the least cost option to meet the obligation. Faced with own low cost RE resources a utility will develop the RET projects and the associate certificates on its own, otherwise, it would buy the green certificates from the certificate market. Thus, the outcome is efficient. Efficiency is given if the marginal cost of producing green power over all utilities is equal;
- Due to the fact that there is **one price** for each MWh of green power, infra-marginal RET producers enjoy extra profits thus failing the consumer surplus maximisation criterion.

The ability of the Quota Scheme to meet the criterion of dynamic efficiency or provide incentives to lower production cost and to induce learning curve effects depends on the design of the quota system. If the persistence of the quota system is uncertain there are no strong incentives to invest in new production capacities incorporating innovative solutions. On the other hand, in the case of long run certainty investments in the industry, the rate of technical progress will increase.

Similar to tendering systems outcomes of quota schemes often differ from the `ideal type´ as describe above (see Mendonca, 2007, p.68 ff.) with the main reasons being market or policy failures. The most relevant market imperfection is missing information on future certificate and power prices. Thus, an investment in RETs today is associated with a high degree of uncertainty concerning future revenues. As a consequence, financing RET projects becomes more expensive.

Research on RE procurement mechanisms focussing on the design and the results of quota schemes make the following best practice recommendations (OPTRES, 2007, p. 129 ff.);

- targets for RE in the electricity sector: political targets to increase the share of RE in the power sector will increase security for investors,
- avoiding maximum prices for RE certificates,
- introducing minimum limits for RE certificates prices,
- introducing generic quotas and no technology-specific quotas,
- issuing of green certificates only to new capacities,
- allowing for banking and borrowing.

Comparing tendering and the quota system, it can be said that in both cases the least cost RETs will be chosen; thus, the outcome is efficient. But one important difference in the case of the quota system is the market price of certificates which is determined by the marginal producer. In conclusion, from the theoretic consideration one can say that both alternatives are equal from the perspective of economic welfare. In both cases the sum of producer and consumer surplus is maximised. But considering the distribution impacts both options are different. The tendering process implies a higher consumer surplus and lower power prices (including the levy or green certificate component).

2.5.3 Renewable Energy Feed-in-Tariffs (REFITs)

REFIT systems are applied in many industrialized countries as well as few of developing countries (see Table 2.1). The main feature of REFIT systems is the provision of cost covering prices for electricity produced by RE plants and fed into the grid. Since the costs of different RETs are different, the guarantee prices are of different levels. Additional to cost covering prices the grid operators face a purchase obligation to buy up all RE power produced. Normally, a REFIT system is not combined with a quantitative target for the RE development. Among developing countries some apply REFIT system to just one or two types of RETs.

Very similar to REFIT schemes are **premium prices** for RET electricity that are provided in several countries like the Netherlands, Norway, Denmark, and Spain and in the Canadian province of Ontario (ECOFY, 2009, p.34). In this case the RET power generator receives two types of revenues: the market price of electricity and a fixed premium per kWh. Compared to a REFIT scheme the premium system offers an opportunity of a higher return in case of increasing prices on the power market. On the other hand the premium system involves higher risks, since the power price might drop.

Furthermore, a combination of REFIT system and premium prices is possible. In Spain the RE producers can choose every year what support system they like to use. In the following section we concentrate on REFIT systems.

2.5.3.1 Typical Design and effects of REFIT Systems

In practice REFIT systems are designed in manifold ways. The features of the `ideal type´ are:

1. The REFIT is designed as a cost covering tariff that is provided for a sufficient duration of the system, say 15-20 years.

2. Since the cost of different technologies differs, technology specific tariffs are offered. Thus, high producer surplus can be avoided.

3. Since the cost of RETs differ by size, location and fuel type the technology specific tariffs are often stepped in accordance to

    a) local conditions (wind, hydro, PV)

    b) size (PV, hydro, biogas plants)

    c) fuel (solid bio-waste, biogas, energy crops)

4. Degression: Since the costs of RETs are often decreasing by time, the tariff for new plants is revised periodically (e.g. 5% per annum)

5. Since the cost and revenues of RE plants cannot be anticipated correctly in advance, it can be prudent to start with a “generous tariff” that will be revised after some years, say 3 years.

6. Inflation-Indexation: Inflation reduces the real value of revenues. If running costs and capital costs are increasing with the rate of inflation the economic performance of RE projects

might become endangered. Existing plants become uneconomic, new plants will face serious financing problems since loans are often inflation-indexed.

7. Purchase obligation: Besides cost covering tariffs the purchase obligation of the grid owner is the “second most important ingredient for all FIT schemes” (Mendonca, Jacobs, Savacool, 2009, p.29). It obliges the nearest grid company to buy all renewable electricity independent of power demand.

Since the tariff is strictly oriented to the specific cost of the respective technology (including an acceptable return to equity), there is an incentive to invest, but no extra profits will occur. Different tariffs exist for different local conditions (e.g. wind-speed or radiation) or types of technology which prevents windfall profits.

Since the FIT is offered for a defined period, long enough to recover all cost, the investment is almost riskless for the investor. Thus, a strong demand can be expected. As a consequence, the political target to increase the share of RE in the power sector will be met. The mechanism is effective.

On the other hand, if cost covering FITs are provided for all types of RETs the outcome will be inefficient. Static inefficiency is given, if the expansion of RE is not concentrating on the least cost RETs but includes high cost options too. In such a case electricity consumers (or tax payers) will face a serious burden. This holds especially for developing countries where the people spend a relatively high share of their income on electricity.

Evaluating the dynamic efficiency of the REFIT scheme shows a different picture. Once a FIT is defined for several years the RET suppliers have strong incentives to lower the cost and to improve the quality to increase profits and to extend the market share. The REFIT scheme will give permanent incentives to promote technical progress to induce learning curve effects. Similar to tendering and quota the dynamic efficiency depends on the design of the scheme. If the duration of the REFIT were uncertain there would be no incentives to invest in new production capacities and innovative solutions.

Some elements of “bad design” (Mendonca, Jacobs, Savacool, 2009, p. 57 ff) for REFIT are:

- Low tariff level, leading to lacking incentives for investments in RETs;
- Unnecessarily high tariff level, leading to windfall profits and unnecessary high burden to electricity customers or tax payers;

- Flat rate level: If one tariff for all types of RETs is provided only a few RETs will be supported (if the tariff is low) or significant windfall profit will be realized by producers applying low cost RETs;

- Lack of clear rules on who has to bear the cost of grid connection and grid reinforcement (the producer of RE or the grid company);

- Exemptions from purchase obligation;

- Bad financing mechanism: The extra cost of RE is not financed by a top-up on electricity bill, but by the general budget or a by special funds. In such a case the stability of the REFIT system will depend on tax incomes and becomes subject to political debates;

- Bad tariff calculation schemes like ‘avoided costs’ (which may be interpreted differently) from conventional power production or ‘avoided external cost’. In the first case the tariff will be too low to provide a significant incentive, in the second case the outcome depends on many assumptions and political considerations. While ‘avoided costs’ of conventional energy generation in a given market can still be calculated relatively objectively, the estimate of the ‘avoided external costs’ is based on a large number of assumptions.

- Capacity caps: They tend to limit the expansion of RE in the electricity sector. Furthermore, they lead to ‘stop-and-go’ cycles with strong demand before the cap is reached and collapsing demand when the cap is reached. In general it can be observed that ‘stop-and-go’ dynamics are not suitable to promote a RET industry.

- Legal status: The REFIT system is not established by law but by ministerial orders.

Formulating some best practice recommendations one can say an effective REFIT system should;

- provide technology specific tariffs covering the cost of the respective RET (including the cost of grid connection),

- provide size specific tariffs to avoid over subsidization,

- grant the FIT for a duration of 15 – 20 years,

- include a compensation for inflation,

- include a clearly defined purchase obligations of the off-taker without exemptions,

- have an effective administrative structure (limited number of involved authorities),

- have clearly defined rules concerning the allocation of grid connection and grid reinforcement cost,

- be backed-up by a national grid reinforcement plan.

2.5.4 Net Metering

The mechanism allows a consumer to connect small RETs to the grid through bi-directional or smart meters. The consumer is offsetting electric energy provided by the utility by own generation. The RET power plant is usually designed to prioritise on-site electricity demand. Excess energy may be sold at the retail rate. In periods of excess demand electricity is bought from the utility. “In this way, the consumer uses the utility as a battery. The utility stores the energy until a producer needs it. This is the essence of net metering” (Gipe, 2009, p. 97). “Net” in this context means, that the consumers pay for the amount of energy consumed after deducting the amount of kWh generated by the own plant.

Net Metering schemes are applied in USA, Canada, Australia and Denmark. In the USA all states have net metering schemes with special rules (see Wikipedia, keyword “Net Metering”).

Elements of an ‘ideal’ Net Metering Scheme:

- Definition of eligible facilities;
- The interconnection of facilities is limited to the consumers property to offset his consumption;

- Utilities buy up all excess demand at retail rate;

- The amount of electric energy fed into the grid and compensated by the retail rate is restricted to the annual electricity consumption. If more energy is generated than used within a billing period (year) it is billed zero.

Net Metering is effective where small scale RETs are available with specific generation cost smaller than the retail rate. The mechanism is undesirable in cases with RETs with specific cost higher than the retail price.

The procurement mechanism is inefficient, since the plant size is limited by the on-site consumption. Thus, RET generators cannot make use of economies of scale. Furthermore, since interconnection is limited on the consumer's property, low cost opportunities of green power generation (e.g. remote areas with high wind speed) cannot be used.

In practice the efficacy of Net Metering programmes is reduced by several restrictions (Gipe, 2009, p. 99 ff.):

- Monthly balance of account (instead of annual balance);
- Price of RE fed into the grid often is considerably lower than the retail price (no price symmetry);
- Not all utilities (public, private) are obliged to provide Net Metering services;
- The size of the single facility is limited normally to own demand;
- The size of the total programme is limited (total amount of generating capacity or percentage of utility's total load);

In conclusion, it can be said that Net Metering can provide some incentives to apply low cost RETs but it cannot be considered as a policy for a rapid deployment of a significant amount of RET. This holds especially if the retail prices are artificially low (lacking internalization of external cost, subsidization of retail prices).

2.5.5 Subsidies, investment grants and tax credits

Another approach to increase the share of RET in the electricity sector is providing investment grants, low-interest loans or tax credits to investors (see ECOFYS, p. 40 ff.). These instruments are applied in many countries (see Table 2.1). In some countries investment grants are provided as main support instrument (Finland), but in most countries as secondary instrument supporting other instruments like REFIT or quota systems.

Subsidies, soft-loans and tax exemptions (like accelerated depreciation schemes or tax credits) play an important role to reduce the capital cost of RETs. As mentioned earlier, the criterion of efficacy can only be met, if the instrument includes measures for a) the access to the grid and b) a price for the electricity produced that contributes to profitability. Since subsidies and soft-loans are not intended to fully bridge the gap between the power price and the specific cost of RETs, they are incapable to meet the criterion of efficacy. If they are not designed to meet a defined target they cannot be directly compared to the other instruments mentioned before and may be applied differently from country to country.

2.6 Summary of RETs procurement mechanisms

It can be concluded that each of the RET procurement mechanism considered so far has its specific strengths and drawbacks drawn from its design characteristics and intended purpose. Tendering schemes and quota systems are suitable to meet politically defined targets for RET. Furthermore, both support schemes tend to provide efficient solutions: they give incentives to investors to apply least cost RETs. In the case of quota systems the efficient outcome is depending on a competitive market for RET certificates.

REFIT systems on the other hand typically support a broad range of RETs with different specific cost. By setting minimum prices REFIT schemes provide investors with incentives to demand for RETs, but they are not designed to meet specific targets. REFITs are instruments of "industry policy" rather than instruments of "energy policy". As instruments of industry policy are not aiming at quantitative objectives, its effectiveness has to be judged against other criteria like deployment and diffusion of new technologies and development of a new industry. It also provides an opportunity for committed citizens to participate in the energy production.

Since REFIT systems are designed to promote different types of RETs they do not focus on least cost solutions. Since the outcome is not meeting the criterion of static efficiency, the burden for the power consumers tends to be higher than in the case of tendering and quota systems.

Table 2.2: Summary of Comparison of RETs Procurement Mechanism

Mechanism	Contract	Compensation	Other aspects	Efficacy & Energy security	Static efficiency	Dynamic efficiency	Impact of electricity cost to customers	Impact on employment
Tendering	Least cost RET supplier sells to utility; gets long-term contract	Price as bid; fixed in contract	Penalty in case of withdrawal	Very positive	Very positive	Negative	Very positive	Positive
Quota system with green certificates	Least cost RET suppliers sell to power market; No long-term contracts	Variable Pool power price and variable price of green certificates.	Level of risk for RE producers is very high	Very positive	Positive	Negative	Positive	Positive
REFIT	All RE-producers feed power into grid with no long term contract	Cost covering tariff; Tariff is technology specific; Usually fixed by law/regulation	Purchase obligation; priority rule given to utility	Depends on tariff	Negative	Very positive	Negative	Positive
Premium Prices (e.g. Spain)	All RE producers feed power into grid with no long –term contract	Power pool price and premium	Purchase obligation; priority rule given to utility	Depends on tariff	Negative	Very positive	Negative	Positive
Subsidies, investment grants & tax reductions	Very variable	Grants or rebates which are usually not usually cost covering	Depends on the design and application	Negative	Negative	Positive	Negative	Positive

2.7 The cost of renewable energy electricity

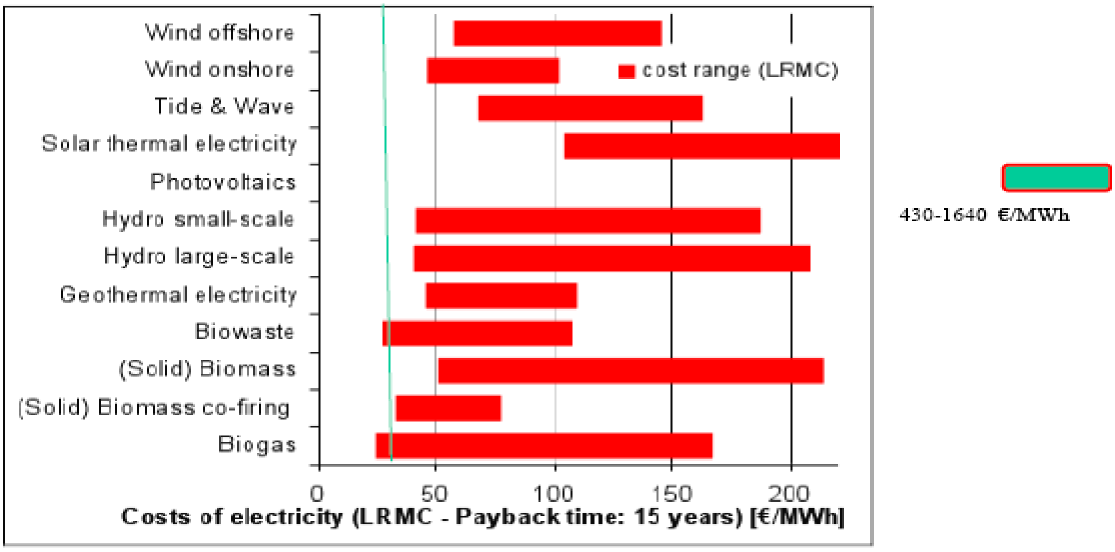
This section presents the parameters that provide input to the costing of RETs. European data is used first before making reference to Namibian estimates. European data is readily available and widely used.

Designing an effective and efficient programme to support the diffusion of RETs in the electricity industry must be based on data on the relevant RET like solar radiation, wind speed, biomass quantity, hydro power potential etc. Furthermore, information of the specific generation cost of different RETs is important.

Available data show that Namibia has considerable renewable resources. To date, hydro-power is the most relevant indigenous renewable energy for power production (249 MW from Ruacana). Nevertheless, it is possible to double or triple the capacity of hydro-power generation by constructing new dams along Kunene River or in the lower Orange River (see von Oertzen, p. 5 f).

Data on the specific power generation costs of RETs in Namibia are hard to find. To provide an indication of the specific costs of different RETs, of the minimum cost and the cost ranges, the present study uses European data. **Figure 2.2** illustrates 2006 LRMC data of different RETs in the European Union. The red bars represent the range of specific costs of different RETs, the LRMC, assuming an economic life time of 15 years. The vertical green line indicates the Namibian wholesale market price of electricity.

Figure 2.2: Long Run Marginal Cost of different RET for power generation



Source: OPTRES 2007, p.10

Considering the specific costs of new plants (LRMC), the following observations can be made:

- Specific costs (€/MWh) are very different between RETs (some are close to the market price of electricity such as biomass and biogas whilst others such as solar thermal and photovoltaics are significantly higher);
- The cost of given RETs varies in a broad range. Major reasons for the cost variations are the plant size, the variation of wind-speed and radiation, fuel cost (in the case of biomass etc.). Other aspects like financing cost are equally relevant;
- Using wastes (from forest industry, agriculture or landfill gas) is the least cost option, followed by hydro and onshore wind;
- RETs based on solar energy show the highest specific cost, especially photovoltaics (PV). (But, in the long run the relative prices of different RETs can change. In the past the strong promotion of RET technologies in industrialized countries has reduced cost significantly, in industrialized and developing countries.)

Even if the European cost data may not be entirely representative for developing countries like Namibia, they however, indicate that a least cost strategy should be based on landfill gas, agricultural wastes, hydro and wind power. In any case Namibia has a limited manufacturing base, meaning that all RETs will still be imported from Europe and other developed countries.

Specific costs of new plants in developing countries are often higher than in industrialized countries, mainly due to higher transport costs, taxes, missing infrastructure and higher (administrative) risks. Also, country-specific risk levels are affecting financing cost (UNEP, 2004). Section 2.8 discusses how the financing cost can be reduced by an intelligent design of RE procurement.

Research conducted on the costs of RETs largely focuses on the cost dynamics (experience curve effect), and the associated experience-curve effects that can be observed (Neij, 2008; NEEDS 2006). The most impressive learning rate exists in the case of PV (see Table 2.3). Here, a doubling of capacity induces a decrease of specific investment cost by 20%. Evaluating US figures, Wiser et al. observe a decline in specific investment cost ($/KWp), mainly caused by a drop of module prices[14], and observe that the decline was more evident for smaller system sizes (Wiser et. al. 2009, p. 12 ff.).

In the case of wind energy the costs were decreasing significantly until 2003 and then rising significantly (Wiser, Bolinger 2009). Similar observation of increasing specific cost for wind power

[14] About 50% of investment cost are non-module cost (installation, inverter, grid-connection)

plants were made in Germany (Staiß, Schmidt, Musiol, 2007, p. 228 ff.)[15]. In the case of other RETs the experience curve effects were comparatively small.

Table 2.3: Estimates of Global Energy Production Capacity Growth

	Learning rate (%) (Neij 2008)	Data period	Annual Capacity Growth (%)	Doubling time (years)	Doubling per 20 years	Source
Solar PV	20	2001-2008	42,1	1,6	12,1	Global Solar Photovoltaic Market Report. (2009), **www.thesynergyst.com**
Wind	15	2000-2009	26,8	2,6	7,7	**www.wwindea.org/home/index.php**
Biofuel	5	1978-2008	25,3	2,7	7,3	Renewables Global Status Report 2009. **www.ren21.net**
Hydro	2,5	1978-2008	2,3	29,8	0,7	BP Statistical Review of World Energy 2009, **http://www.bp.com/statisticalreview**
Geo-thermal	2,5	1980-2008	3,5	20,0	1,0	Bertani 2005. World Geothermal power generation in the period 2001-2005.Geothermics 34: 65-69.
Oil/ diesel	2,5	1978-2008	0,8	88,0	0,1	BP Statistical Review of World Energy 2009, **http://www.bp.com/statisticalreview**
Gas CT/CC	4,0	1978-2008	2,8	24,7	0,8	BP Statistical Review of World Energy 2009, **http://www.bp.com/statisticalreview**

Source: Deichmann et. al. 2010, p. 29

2.8 Risks and financing cost

This section explores the effect that policies have on the risk level and associated costs of RET projects. A special focus is put on the issue of how different RET procurement mechanisms are affecting risks and therefore the cost of financing RET projects.

Generally, risks associated with RETs are quite similar to risks associated with other large energy projects and infrastructure projects. They can be classified by different ways such as commercial and non-commercial, to name but two (KfW 2005). For RET projects, the most relevant risks are assumed to be: performance, macroeconomic (currency devaluation, inflation, etc), energy demand, environmental, political and regulatory.

[15] The main reasons mentioned are stronger demand for plants, increasing prices of raw materials like steel, copper and concrete, and higher financing cost.

Boettcher (2009) distinguishes endogenous (project-specific, such as project management, technical performance) and exogenous risks (such as regulatory, macro-economic environment, resource, etc). Whereas endogenous risks can be managed by the project company using financial risk instruments (insurances, weather derivates etc.), the exogenous risks cannot. The latter are not insurable since they are not accurately quantified according to likelihood and severity of losses (UNEP, SEFI (2004, p.15)). The UNEP study emphasizes the differences between large scale projects and small scale projects with respect to the availability of financial risk management instruments.

Since lenders are risk averse, high risk levels will be translated in financial parameters like;

- debt term (share of equity, duration of loan),
- interest rate,
- and debt service coverage rate (DSCR)[16],

Therefore, the higher the risk level, the higher the share of equity, the shorter the duration of loans, the higher the interest rate and the DSCR.

Another approach to classify the risks of RET projects is to consider the different stages of the project cycle. Risks occur on all stages of the project cycle, starting from project development, construction, along operation until decommissioning.

Policies can play an important role to reduce the risk level and thus capital cost. This is true for all stages of the RET project cycle (see ECOFYS, 2008, p. 10 ff; Boettcher, 2009, p.73 ff.).

[16] The Debt Service Coverage Ratio (DSCR) describes the net operating income (revenues minus running cost) divided by the debt service value. If the ratio equals one all net income is required for repaying interest and amortization.

Table 2.4: Risks of RETs and Role of Policies

Risks at Project Development Stage	Role of Policies
- acquisition of permits not successful - grid connection not possible or too expensive - electricity purchase conditions not acceptable	Policy can help to reduce risks by - creating a stable and reliable policy framework, e.g. by long-term targets - creating a supportive legislation and a facilitating bureaucracy (facilitating rules of approval of projects and defined purchase obligation)
Risk on the Construction Stage	**Role of Policies**
- construction risk (time and cost overruns) - Counterparty risk	On this stage the role of policy to reduce risk is limited
Risk on the Operation Stage	**Role of Policies**
- Performance risk: - underperformance of installation, poor O&M, theft - Resource risk: Variable variability of resource; disturbances in logistics of biomass supply - Market risk: Changing prices on the power market, the market for green power and/or the market for green certificates - Regulatory risk	- Policy can help to reduce risks by optimizing - the design of RE support policies (long-term targets) - the design of the RET support scheme - the stability of policy context (no abrupt changes of the RET support policy) - inflation and exchange rates - role of transmission system operator - role of regulator

Source: ECOFYS, 2008,

In an unregulated power market without any procurement mechanism, the RET power generators would face significant market risk. This holds true for vertically unbundled markets and is more severe in the case of vertical integration of power generation and transmission. In this case discrimination against independent (RE) power producers is another serious issue.

In case of an unbundled power market the RET power generator typically sells the power on the wholesale market where the price is determined by demand and supply. During periods of high load the price will be determined by the marginal cost of peak load power stations (fuel oil, natural gas), during periods of low demand the marginal cost of base load power stations (hydro, hard coal) will be price determining. The RET power generator (with marginal cost close to zero) is facing the risk that the competitive market price is not sufficient to cover his average cost (price risk).

In the case of physical bottlenecks in transmission another risk occurs. RET power generation is separated by a bottleneck from power consumption and cannot be sold. Furthermore, in case of vertically integrated structure the incumbent power generator has incentives to discriminate against the RET power generators to ensure a high usage of own generation capacities.

RET procurement mechanisms are designed to reduce some of these risks. Thus, they help to reduce capital cost. Table 2.5 shows which risks are affected by the different support schemes. The REFIT scheme combined with a tough purchase obligation completely eliminates the price risk. The grid company has to buy up all RET power supplied at the cost covering price.

In case of a premium price the RET power supplier receives a premium on top of the market price of power. In case of dropping power market prices the sum of market price and premium might be insufficient to cover the specific cost and to cover the dept. Thus, some price risk exists.

In case of a quota system with unbundled certificates the revenues of the RET power supplier consist of the market price of electricity plus the price of green certificates. In the event of abundant conventional and green power production the market price of electricity and the price of certificates will drop. Thus, the RET power production faces a double risk.

In the case of tendering the successful bidder is awarded a contract guaranteeing a cost covering price. Thus, the price risk is eliminated.

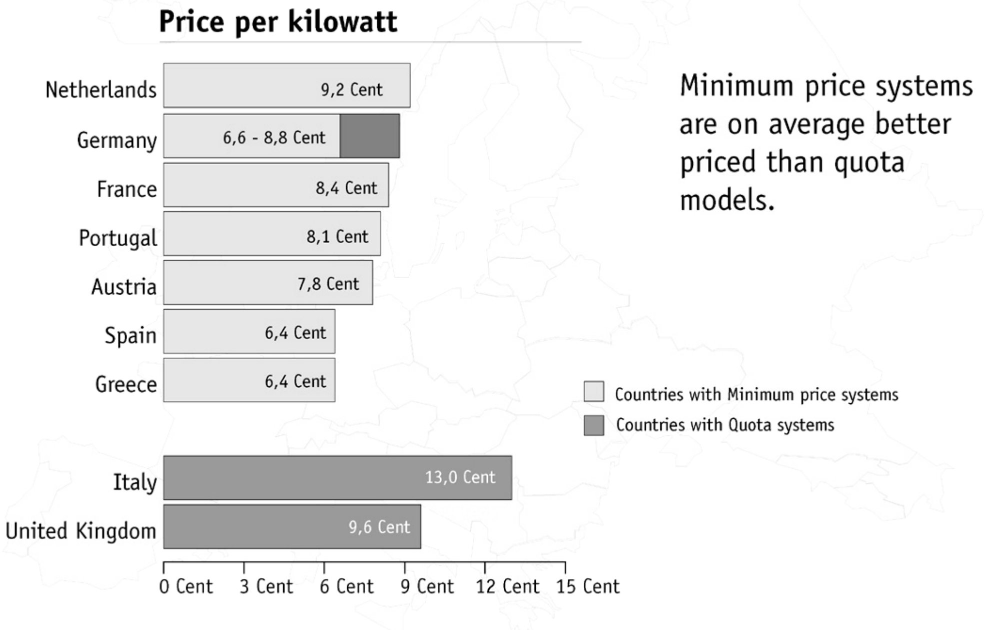
Table 2.5: Risk Profile of Selected RET Projects

Support mechanism	**Power price risk**	**Green certificate price risk**
REFIT combined with purchase obligation	None	None
Premium	Yes	None
Quota System	Yes	Yes
Tender	None	none

Source: ECOFYS, 2008, p. 35; own assessment

Summing up the theoretical considerations one can say that REFIT and tendering schemes are most appropriate to reduce price risks and hence to reduce financing cost.

Figure 2.3: Prices (in Euros) for Wind Energy in Countries with REFIT and Quota Schemes



Source: BWE, 2005

Butler and Neuhoff emphasize that switching from tendering (Non-Fossil Fuel Obligation, NFFO) to a quota system (Renewable Obligation Certificates, ROC) in the UK has increased uncertainty and financing problems: "by contrast, obtaining finance is perceived to be more difficult under the ROC where payments are not guaranteed. Although the price paid under the latter is currently higher than under the NFFO, there is concern amongst investors that the policy will not be continued over the long term" (Butler, Neuhoff 2004, p. 22.).

The ECOFYS study (p.130) which conducts a comparative assessment of all support instruments for different countries from a project financing perspective concludes that the "15 to 20 year support provided or negotiable in Germany, France, California and Quebec sets the standard favourably for the applied economic lifetime of a project, whereas the 10 year premium support in the Netherlands and the inherent uncertainties in the UK obligation scheme result in lower applied economic lifetimes (e.g. 15 year) and higher liveliest cost of electricity" (ECOFYS, 2008, p. 104 f).

In conclusion it can be argued, regardless of the fact that there is no riskless procurement mechanism, the choice of procurement mechanism plays an important role to reduce the risk and capital cost of RET projects. As discussed earlier, each procurement mechanism consists of different measures and can be designed in various ways. The working of a REFIT system for example depends on numerous design elements (like duration of support and compensation for inflation) and other supporting measures like purchase obligation and grid connection rules. Furthermore, risks occur on all stages of the project cycle. The best design of a REFIT system does not take into account, if there are serious obstacles on the development stage, e.g. if it is difficult to obtain a planning permission or during construction (RET support policy is not linked with spatial planning).

In the same way a quota scheme, showing a higher level of risk can be improved by supporting measures like soft-loans, stand-by guarantees, minimum prices for certificates etc.

Discussion:

Tendering, Quota, REFIT, Premiums, Net metering and subsidies are instruments used to promote the use RETs and deliver renewable electricity to the grid. Different countries use different instruments to achieve specific objectives. The instruments will depend on a number of factors, namely local resource base, financial and economic resources, RE target, the prevailing and adopted power sector and market model.

2.9 Recommendations for RET procurement mechanisms in Namibia

In the White Paper on energy policies (1998) the Government of Namibia has defined its energy policy targets, including improving security of supply, sustainability, social upliftment, investment and growth, economic competitiveness and efficiency.

RETs can contribute to meet these targets, especially the target of security of supply. Several barriers, however, have to be overcome (see Nexant 2010, p. 16 ff.). Currently, the power price does not reflect the scarcity of resources. To provide a level playing field and to make use of the advantages that RETs offer, effective and efficient procurement mechanisms have to be introduced.

Section 2.4 introduced several procurement mechanisms, including tendering, quota schemes and REFIT systems. It was shown that these mechanisms are suitable to meet defined targets and that differences exist with respect to static and dynamic efficiency. Efficiency is important, since all procurement mechanisms will increase the actual price that consumers will have to pay, or the tax portion allocated by government to pay subsidies.

To discuss the suitability of these procurement mechanisms for Namibia, aspects such as the simplicity and transparency of implementing such mechanisms, the size of the power market with regards to administrative challenges, and national developmental objectives as set in national developmental plans (Vision 2030 and National Development III) will have to be taken into account.

It is recommended that REFITs are applied to small (less than 5MW) wind; solid biomass including land fill gas and small hydro. Tendering is proposed for large (greater than 5MW) CSP and wind based technologies. Any installation above these specified capacities is considered large.

Caps are recommended on capacity of renewable energy technologies to be procured.

Rational for Threshold and Cap

REFIT is proposed to be applied at distribution level. Some of the distribution grids are not strong enough to manage intermittent renewables and balancing resources would be required. Small and gradual introduction of RETs to the grid is therefore proposed. The 5MW threshold allows small business to participate in RE development.

RETs will have an immediate but declining financial burden to consumers and technical challenges to grid operators. It is therefore very important that caps are instituted on the different RETs based on both cost and technical. Chapter 3 provides a clear analysis of the impact of different RETs and their capacities on the final tariff costs.

2.9.1 Tendering for CSP and Large RETs

It is an effective approach to provide a defined amount of RET power. It is efficient since the price of RET power is revealed in a competitive process. Furthermore, designed as pay-as bid auction it minimizes the burden for power consumers or tax payers. Tendering is already a widespread procurement process in the electricity industry of Namibia. **It is recommended for RET with capacity above 5MW. CSP is exclusively recommended for tendering. The mechanism must be administered by the Ministry of Mines and Energy and technical support provided by ECB.**

Rationale: Large RET power plants and large CSP projects typically feed power into the transmission grid. Tendering is an effective approach to provide a defined amount of RET power at defined location. Tendering can help "to prepare for the integration of additional renewable resources commensurate with the expansion of Namibia's system" (Nexant, 2010, p.19). In this sense the tendering approach or Request for Proposal (RFP) is superior to a REFIT scheme where the location of feed-in is determined by decentralized RET power producers. "Given the relatively small size of Namibia's system, and the importance of ensuring that the renewable generation resources brought into the system have adequate balancing resources for integration, the RFP approach gives the country more control over the process than would be the case with a Feed-In Tariff". (Nexant, 2010, p.19)

The tendering process is efficient since the price of RET power is revealed in a competitive process. Designed as pay-as bid auction, it minimizes the burden for power consumers or tax payers.

2.9.2 REFIT for Small RETs

A REFIT system significantly reduces the market risks (price risk) and thus provides incentives for investors to look for opportunities. It is an ideal instrument to mobilize small and decentralized resources. A REFIT can provide an opportunity for building economic opportunities in rural areas and ensure sustainability. **The REFIT is recommended for small hydro, solid biomass including landfill gas and wind (less than 5 MW). The ECB will administer the REFIT which will be applied at distribution level and implemented by REDs and local government authorities since electricity from small installations is expected to be fed into the grid at distribution level.**

Potential developers in REFIT must have planning permission and a grid connection offer for their projects and they will then be able to be fully licensed and contracted up to the notified fixed prices.

The REFIT scheme should include a purchase obligation for Regional Electricity Distributors (RED) and any other electricity distributor in Namibia -and a priority rule.

Rationale: A simple and transparent REFIT scheme provides a permanent incentive for decentralized economic units (households, firms, eventually REDs) to look for opportunities of applying RETs. Concentrating on small scale plants the electricity will be fed into the distribution grid. The location of feed-in will be determined by the decentralized power generators. For the sake of simplicity and transparency the RET generator should bear the cost of grid connection, but not the cost of grid reinforcement. Furthermore, the provision of a permanent incentive to apply small scale RETs will promote the deployment of an indigenous RET industry. Small-scale producers cannot compete against bigger developers in a tendering process.

2.9.3 Net metering for PV

Installed capacities for PV are not expected to be large and are all assumed to be roof top installations at this moment. The rationale for the exclusion of PV facilities from the REFIT scheme is the high costs of this RET (factor 3 – 4 compared to other RETs- see Chapter 3 for cost indications). It is therefore recommended to introduce Net Metering for PV.

Rationale: Net metering typically provides incentives for electricity consumers to apply RETs with specific cost lower than the retail price (about NAM $ 1). For RETs with high specific cost like PV plants (NAM$ 2 – 3) the incentive for investing in PV is small. But investors might expect extra services of PV plants like independence from the grid and increased supply reliability.

2.9.4 Other support measures like soft loans, grants, tax breaks, etc.:

Some of these measures have been applied in Namibia for off-grid electrification and have spurred growth in solar home systems. The measures are recommended to be combined with others like tendering, REFIT and net metering. Namibia is still struggling with low electrification rates and RETs are viewed as appropriate and alternative energy resources to provide energy in off-grid and rural communities in line with OGEMP. Soft loans and grants have been used to support RETs under the ongoing MME's Solar Revolving Fund and the just concluded Namibia Renewable Energy Programme (September 2010).

Rationale: Supporting measures like soft-loans, grants and stand-by guarantees can reduce equity requirements. Leading to reduced capital costs supporting measures might help to limit the cost of the REFIT scheme and tendering. The instruments are also ideal to support rural and off-grid electrification.

2.10 Conclusions

Renewable energy sources can play an important role to meet Namibia's energy policy targets. Since market penetration of RET is hampered by many barriers, effective and efficient procurement mechanisms are necessary to stimulate their increased uptake. After evaluating the pros and cons of different procurement mechanisms, a scheme consisting of 4 procurement mechanism instruments is recommended, namely a REFIT scheme and a tendering process are suggested as "main" instruments, Net Metering for PV, and soft loans as supporting instruments which must continue to reinforced to support rural and off-grid electrification. REFITs are proposed for small (less than 5MW) wind; solid biomass and land fill gas hydro. Tendering is proposed for large (greater than 5MW) RETs. Even if REFIT and tendering schemes can be considered as powerful instruments to promote the deployment of RET, the design of the instruments is crucial.

As discussed earlier, each procurement mechanism consists of different measures and can be designed in various ways. The design of the specific procurement mechanisms recommended in this section is discussed in a Chapter 4.

Discussion:

Namibia has a small electricity market but is endowed with abundant renewable energy resources. Affordability of electricity services must be considered. RETs benefits must be maximised to address challenges such as employment creation, rural upliftment, industrial competitiveness, energy security, and sustainable development. RET procurement mechanisms adopted must be catalysts to address these challenges.

3. ESTIMATING THE COSTS OF THE PROCURMENT MECHANISMS

3.1 Purpose

The purpose of this chapter is to calculate the costs of the proposed procurement mechanisms and the impact on the retail power price. A REFIT is calculated for small RETS which are then applied to different RET generation capacities. The overall impact on different mixes and levels of RET is calculated.

3.2 Introduction

The costs and benefits of different power supply scenarios, including different forms of renewable energies, have been recently analysed by REEECAP (2008). The outcome of the study was that a balanced power generation strategy including a measured share of RETs will show the highest benefit-cost-ratio (BCR).

In principle, the REEECAP study includes a significant proportion of the data needed to evaluate a RE procurement programme. The reason, why the present study cannot simply refer to the REEECAP study is fourfold:

- the study is based on the assumption of a drastic increase of power demand of Namibia leading to a huge demand of additional supply- which might still hold true based on rapid mining growth largely in the Erongo Region
- the expansion of RETs is based on comparatively large units (e.g. 1 MW in the case of PV),
- some relevant RETs are not considered (landfill gas, biogas, small hydro), and
- the assumed specific costs of some RETs seem low taking current price developments into account.

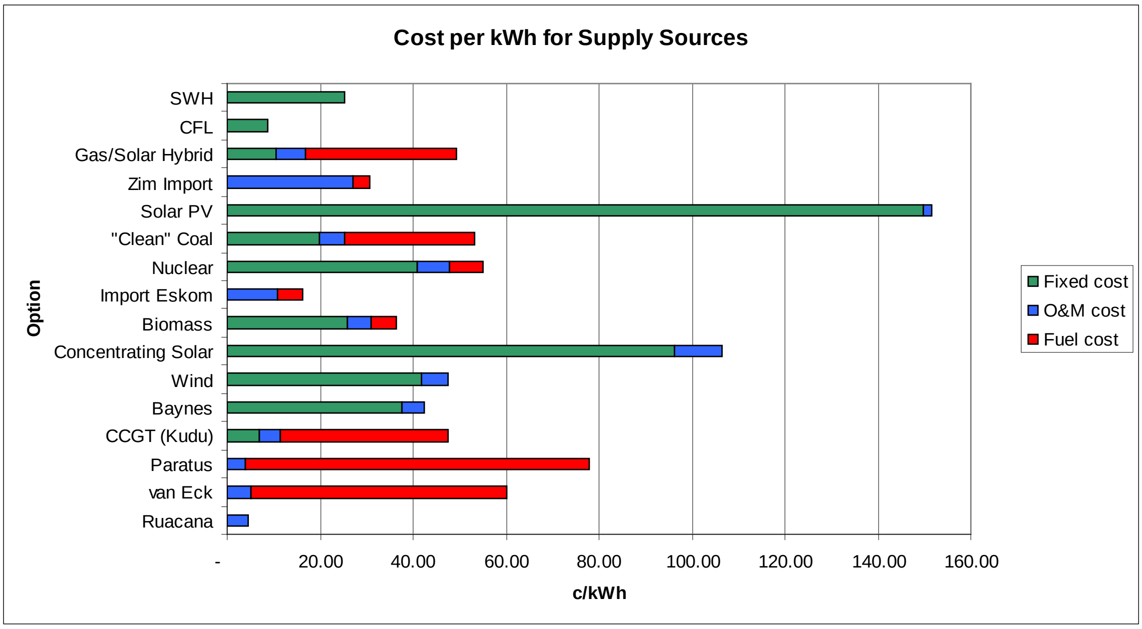
Thus a careful consideration of all available cost data of RETs is required. This is presented in Section 3.2.1. To include more recent data and local conditions, a tariff calculator is developed in Section 3.3. To estimate the cost of the renewable energy procurement mechanisms a reference case including a given mix of RETs is defined.

3.2.1 Availability of RET Cost Data

The Terms of Reference specify that the present study is to focus on procurement mechanisms including for the following RETs: wind, CSP, landfill gas, small hydro, PV and solid biomass.

Detailed cost data for generation of electricity by wind, CSP, PV and solid biomass in Namibia have been presented by REEECAP and are shown in Figure 3.1 below.

Figure 3.1: **Estimated base tariffs for generating options**



Source: REEECAP (2008), p. 53

REEECAP cost data for RETs could be used for designing a REFIT scheme, or more generally, for designing of a RET procurement mechanism for Namibia and for calculating the cost of it. However, for reasons mentioned in Section 3.2, they will not be used

Table 3.1: Estimated Generator Capacities and Step Sizes.

	CCGT	Baynes	Wind	Concentrating Solar	Biomass	Nuclear	"Clean" Coal	Solar PV
Minimum Size MW	400.00	360.00	30.00	50.00	0.50	165.00	175.00	1.00
Step Size MW	400.00	90.00	2.00	50.00	0.50	165.00	175.00	1.00
Probable Limit MW	800.00	540.00	60.00	300.00	60.00	330.00	700.00	100.00
Limiting Factor	Gas reserve	Water resource	Grid stability	Cost & Storage	Grid capacity	Cost	Coal Transport	Cost & Storage

Source: REEECAP (2008), p. 54

REEECAP makes suggestions to different levels of generating capacities as power supply options; however, their probable upper limits in installed capacity are some of the limiting factors (see Table 3.1)

A comprehensive approach to use RETs in Namibia should include a mix of both small and large generating units, even if the generation cost might be slightly higher, because there are some RETs that may not be feasible to exploit at either large or small scale but are competitive in one form against the other.

Table 3.2: Specific Costs of Selected RETs According to National and International Studies

	REEECAP (2008)	Germany (BMU) (2007)	EU (2008) 2007 data	EU (2008) Projection 2010	NERSA (2010)	Tariff Calculator (preliminary)
Wind	0.44	0.7 – 0.852)	0.55 – 1.10	0.50 – 0.90	1.25	1.655
Solar PV	1.5	4.80 – 5.50	5.20 – 8.80	2,70 – 4.60	3.94	3.941
CSP	1.0	-	1.70 – 2.50	1.10 - 1.60	3.14	4.241.
Small Hydro	-	0.97 (<500 kW) 0.67 (<5000 kW)	0.60 – 1.85	0.55 – 1.60	0.94	3.365.
Solid Biomass	0.38	1.4 – 2.201)	0.80 – 1.95	0.85 - 2.00	1.18	1.669.
Landfill	-	0.64 (2 MW) – 1.50 (0.25 MW)	-	-	0.90	0.762.

Notes: 1) Smaller Plants (< 10MW) with cogeneration of heat

2) Wind speed of 6.5 m/sec

Table 3.2 presents international cost data. Costs expressed in EUR/kWh were converted to Nam$/kWh, assuming an exchange rate of EUR/Nam$ of 1:10. The national and international cost data on RETs for power generation show a wide range. REEECAP data are the most optimistic while the NERSA cost figures are the highest from the comparison illustrate in Table 3.2. The preliminary cost data of the REFIT calculator for Namibia, included in the last column, are explained below.

3.3 Determining the Cost Elements and REFIT Calculator

To get a realistic picture of the cost of RETs in Namibia local data of investment cost and financing cost have to be considered. On the other hand, since the data (capital cost, inflation rates, interest rates etc.) change regularly a flexible cost calculator is desirable. It should include all relevant cost elements.

The FIT calculator presented is quite simple, but it includes all relevant data. It is interconnected to the PROGRAM-cost-calculator that is outlined in section 3.4. The PROGRAM-cost calculator provides information on the additional cost the economy and the power consumers have to bear if RETs are used instead of expanding the traditional power mix. The section below explains the working and the outcome of the FIT calculator.

The FIT calculator consists of 4 parts in tabular form. In the first part the weighted average capital cost (WACC) is calculated (using specific ECB definitions). The second table includes cells for the relevant investment parameters (specific investment cost, hours of full load, economic lifetime etc.) that may be completed by ECB to calculate the specific cost for the first year of operation. The running costs have to be expressed as percentage of the investment cost. Fuel cost – relevant in the case of solid biomass and landfill gas – has to be inserted as cost per MWh electricity.

In the second part all costs are expressed as annual costs. In the bottom line the total annual costs are divided by the annual amount of kWh. As a result specific costs (Nam/kWh) are obtained. A FIT, typically designed as a cost covering tariff, has to be oriented to the specific cost[17].

The third section develops the specific costs (the FIT) where the running costs are increased with a given rate. This inflation rate can be filled in the cell between Part 2 and 3. Escalating the running cost by an assumed constant rate indicates the future development of the FIT. This figure is needed to calculate the future Program Cost in the PROGRAM calculator.

Since the rate of inflation is varying from year to year, the FIT provided to the investors has to consider the metered or expected inflation rate of a given year. The idea of adapting the FIT is that in a country with a significant rate of inflation, the FIT cannot be determined once and then left unchanged for the economic lifetime of the project. The risk would be too great for both, the investor and the electricity consumer.

3.3.1 FIT Calculator for Namibia

The following tables show the construction and the working of the FIT calculator. The relevant assumptions have to be filled in the yellow boxes. The figures should be replaced by the actual figures. T he outcome in terms of specific cost (Nam$/kWh) or cost covering tariffs is included in the light red boxes.

The yellow boxes include preliminary figures of relevant parameters that can be changed	
The light brown boxes show intermediate figures resulting from assumptions above	
The red boxes show the cost covering feed-in tariff for future years (adapted to inflation)	

Table 3.3.1 shows how the weighted average cost of capital (WACC) is calculated. In general it is based on the ECB methodology for calculation the WACC for investments in generation. In accordance to the current ECB guidelines for generators we assume post tax cost of equity of 19.62 % (equal to a pre tax cost of equity of 30.19 %).

[17] According to economic theory competition ensures that the market price is oriented to the cost. Thus, a FIT should be oriented to the specific cost. In case of new investments the specific cost are calculated by dividing the annual cost by the energy output (kWh). The annual costs imply a sector specific return on equity. In a competitive environment the net present value (NPV) is zero.

Table 3.3.1: Key parameters of WACC calculation

Key Parameters for WACC calculation						
Parameters	**Solar PV**	**Wind**	**CSP**	**Small Hydro**	**Solid Biomass**	**Landfill Gas**
Weight of Dept	70.00%	70.00%	70.00%	70.00%	70.00%	70.00%
Weight of Equity	30.00%	30.00%	30.00%	30.00%	30.00%	30.00%
Corporate Tax Rate	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Risk free rate of investment	9.05%	9.05%	9.05%	9.05%	9.05%	9.05%
Dept premium	2.30%	2.30%	2.30%	2.30%	2.30%	2.30%
Equity beta	1.762	1.762	1.762	1.762	1.762	1.762
Equity risk premium	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Cost of dept	11.35%	11.35%	11.35%	11.35%	11.35%	11.35%
Cost of equity - after tax	19.62%	19.62%	19.62%	19.62%	19.62%	19.62%
Cost of equity - nominal before tax	30.19%	30.19%	30.19%	30.19%	30.19%	30.19%

Table 3.3.2: Key parameters for calculating the annual cost

Investment parameters	**Solar PV**	**Wind**	**CSP**	**Small Hydro**	**Solid Biomass**	**Landfill Gas**
WACC according to table above - cost of equity before tax	17.00%	17.00%	17.00%	17.00%	17.00%	17.00%
Economic Lifetime/years of operation (n)	20	20	20	40	20	20
Specific Investment Cost (Nam$/kWp)	35,000	15,000	60,000	80,000[18]	30,000	20,000
Power (kW) typical size	35	1,500	10,000	5,000	500	500
Annual Electricity production (kWh/KW)	1,800	2,200	4,000	5,000	7,000	7,000
Annual Insurance Cost as % of initial investment cost	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Annual Administration & Management costs % of initial investment cost	1.00%	3.00%	3.00%	3.00%	4.00%	3.00%
Annual O&M of Investment Cost as % of initial investment cost	1.00%	3.00%	7.00%	0.50%	5.00%	4.00%
Fuel Cost (Nam$/MWh)	0	0	0	0	500	40

[18] Specific costs for small hydros are relatively high because of the sound environmental measures that have to be adopted in the ecologically sensitive basin of the Lower Orange river.

Observation:

Various specialists like consultants and power producers in Namibia and abroad were consulted on the relevant investment parameters like specific investment cost, hours of full load, economic lifetime of projects etc. In the most cases, only wide ranges of figures were named. This is no wonder, since apart from solar PV, no reference projects exist in Namibia. ***Thus, the cost figures have to be considered as best available estimates.*** If a range of cost figures was mentioned by the experts, conservative estimations were then used. This helps to avoid a situation where the REFIT scheme will fail to start because of too optimistic (or too low) cost figures. Once the REFIT scheme has initiated the first projects the estimated cost figures can be replaced by real cost figures of Namibian RET projects.

Table 3.3.3: Calculation of annual cost and specific cost for the first year (Nam$)

Calculation of Annual Cost (Nam$)						
Parameters	**Solar PV**	**Wind**	**CSP**	**Small Hydro**	**Solid Biomass**	**Landfill Gas**
Investment Cost	1,225,000	22,500,000	600,000,000	400,000,000	15,000,000	10,000,000
Annual Investment Cost	217,685	3,998,300	106,621,339	68,132,795	2,665,533	1,777,022
Insurance cost/y	6,125	112,500	3,000,000	2,000,000	75,000	50,000
Administration cost/y	12,250	675,000	18,000,000	12,000,000	600,000	300,000
O&M cost/y	12,250	675,000	42,000,000	2,000,000	750,000	400,000
Fuel cost/y	0	0	0	0	1,750,000	140,000
Annual Running Cost	30,625	1,462,500	63,000,000	16,000,000	3,175,000	890,000
Annual Cost	248,310	5,460,800	169,621,339	84,132,795	5,840,533	2,667,022
Annual Cost/kWh of the Year 1 = REFIT for the 1. year	**3.941**	**1.655**	**4,241**	**3.365**	**1.669**	**0.762**

As shown by table 3.3.3 solar PV and CSP show the highest specific cost, whereas landfill gas and solid biomass show comparatively low specific cost. These figures are in line with international cost figures.

Table 3.3.4: Calculation of future FIT considering escalation of running cost by rate of inflation

Inflation-Rate	**6.29%**	(Rate to escalate the running cost)				
Development of the FIT with compensation of inflation (Nam$/kWh)						
Year	**Solar PV**	**Wind**	**CSP**	**Small Hydro**	**Solid Biomass**	**Landfill Gas**
1	3.941	1.655	4.241	3.365	1.669	0.762
2	3.972	1.683	4.340	3.406	1.726	0.778
3	4.005	1.712	4.445	3.448	1.786	0.795
4	4.039	1.744	4.557	3.494	1.851	0.813
5	4.076	1.777	4.676	3.542	1.919	0.832
6	4.115	1.813	4.802	3.594	1.992	0.853
7	4.156	1.851	4.937	3.648	2.070	0.874
8	4.200	1.891	5.079	3.706	2.152	0.897
9	4.247	1.934	5.231	3.768	2.239	0.922
10	4.297	1.979	5.393	3.833	2.332	0.948
11	4.350	2.027	5.564	3.903	2.431	0.976
12	4.406	2.079	5.747	3.977	2.536	1.005
13	4.466	2.133	5.940	4.056	2.648	1.036
14	4.530	2.191	6.146	4.140	2.766	1.070
15	4,597	2,253	6.365	4.229	2.893	1.105
16	4.669	2.318	6.598	4.323	3.027	1.143
17	4.745	2.388	6.845	4.424	3.169	1.183
18	4.827	2.462	7.108	4.531	3.320	1.225
19	4.913	2.540	7.388	4.644	3.481	1.270
20	5.004	2.624	7.685	4.765	3.652	1.318

Table 3.3.4 shows that the specific cost will increase as the running cost are increasing by the expected rate of inflation. To provide a cost covering FIT the tariff has to be adapted year by year. In Table 3.3.4 a constant inflation rate is assumed. In reality the inflation rate will vary from one year to the other. Thus, Table 3.3.4 rather serves for illustrative purposes than working as a tool to calculate future tariff levels.

3.4 Program Cost Calculator

In this section the construction and the working of the Program Cost calculator are presented. The Program Cost calculator takes the power customers' point of view. Thus, the Program Costs are defined as the additional cost to the power consumers if RETs instead of a traditional power mix is used[19]. The power consumers' point of view is different from the economic point of view. From the economic point of view the additional costs have to be balanced by the additional benefits like

[19] It is assumed that all RET program cost are born by the final electricity customers.

improved job opportunities and less pollution. Dividing the Program Costs by the power consumption (kWh) information on the additional cost per kWh is obtained. As a rough approximation one can say that the wholesale power price and also the price for final customers will increase by this amount. In reality, the increase to final power prices will be higher since local surcharges are charged on top of the wholesale prices (including the REFIT supplement).

Calculating the Program Costs requires a lot of additional information. Besides information on the specific cost of the single RETs information on the quantities that are produced by each RET is needed. This is on top of information on the total power consumption and the wholesale price. These data values have to be filled into the upper section of the Program Cost calculator.

Table 3.4.1: Parameters for calculating the Program Cost

NamPower Wholesale price 2010 (Nam$/MWh)	456
National Power Consumption (MWh)	3,600,000
Final Consumer Price 2010 (Nam$/kWh)	1.15
Expected Increase of Annual Power consumption (%)	5.00%
Expected Increase of Power Price for Final Customers (%)	8.00%

In general, one can say that the greater the amount of renewable electricity the higher the Program Cost. Some support mechanisms like tendering are capping the capacity or amount of renewable electricity while others do not. Thus, the amount of renewable electricity depends on design of the support scheme. The following conditions are considered;

- Tendering: the additional capacity or the amount of electricity generated in the Namibian system is defined.
- REFIT with cap: additional capacity or the amount of electricity is defined
- REFIT without cap: If a FIT without a cap is provided the renewable electricity suppliers are behaving as price takers extending the supply until the marginal cost are identical to the true FIT. If precise information on the marginal cost of renewable electricity production is lacking the amount of renewable electricity generation can only be estimated[20].

[20] Germany provides a good example for this case. Due to decreasing prices of PV modules, in 2009 and 2010 the amount of additional PV capacity was much higher than expected. As a consequence a new provision was introduced: The FIT will be extraordinarily decreased if the expansion of the capacity is surmounting defined thresholds (e.g. 1500 MW/year).

The Program Costs include the cost of RETs that are supported by REFIT, but even indicates the cost for RETs that go under tendering. In the case on net metering no additional cost for the power consumers is assumed. Concerning the calculation of the REFIT and tendering Program Cost we have to emphasise one important difference: In the REFIT case the price is decreed by government, whereas in the case of tendering the price is determined by competition. If the government succeeds to define the FIT in an “as-if-competition manner” [21]and if the tendering process is working properly, theoretically the outcome of both processes could be identical. In reality neither the government has perfect information on the cost of the RETs nor is the tendering process working perfectly (incomplete information on site specific cost drivers, market power, strategic behaviour). Being aware of these issues, the cost calculated by the REFIT calculator can be taken as an approximation to the cost of the tendering process.

Unlike in other African countries (see Table 3.6), the Government of the Republic of Namibia has not yet defined a quantitative target for the expansion of RETs in the electricity sector (neither capacity targets nor output targets).

Table 3.4.2: Share of Electricity from RE in African Countries, existing in 2008 and Targets

Country	Existing Share	Future target
Algeria	9.9%	10% by 2010
Cameroon	-	50% by 2015 & 80% by 2020
Cape Verde	-	50% by 2020
Egypt	-	20% by 2020
Ghana	-	10% by 2020
Libya	-	10% by 2020 & 30% by 2030
Madagascar	-	75% by 2020
Mauritius	37%	65% by 2028
Morocco	-	20% by 2012
Niger	-	10% by 2020
Nigeria	-	7% by 2025
Rwanda	-	90% by 2012
South Africa	<1%	4% by 2013 & 13% by 2020

Source: REN 21; Renewables 2010, global Status Report, 2010, p. 59

Thus, estimating the Program Cost for Namibia requires reasonable assumptions on the quantities supplied. This includes assumptions on

- the total RET capacity (or electricity output)

[21] To adapt the FIT to perfectly the cost of different RETs of different sizes and at different locations a great number of different tariffs have to be offered.

- the contribution of single RET to meet the target

These capacity assumptions have to be filled into the first row of the second part of the PROGRAM calculator. For the sake of simplicity, Program Costs of 3 scenarios are considered:

1. consisting of 60 MW assuming 10 MW for each of the 6 suggested RETs (wind, CSP, solid biomass, small hydro, land fill gas and PV). All supported by a REFIT scheme. It is assumed that no other support instrument exists[22].
2. consisting of 60 MW assuming 3 technologies suggested for a REFIT scheme (5 MW of landfill gas, 15 MW of solid biomass, 40 MW of small hydro).
3. consisting of Program 2 and additional 100 MW of wind and CSP power plants (50 MW each)

To calculate the Program Cost of the scenarios, the amount of electrical energy (MWh) produced by each of the technologies included is considered. This amount is calculated by multiplying the capacity (MW) by the average hours of full (h).

Empirical evidence shows that the hours of full load per annum differ significantly among the technologies in question, ranging from 1800 hours in the case of PV up to 7700 hours in the case of landfill gas and solid biomass.

The third part of the Program Cost calculator shows how the Program Costs and the power price of final customers will develop if the FIT is increasing and in the same time the power consumption and the wholesale power market price are increasing.

In the following paragraph we shortly describe the 3 scenarios

- the total Program Cost and it's dynamics
- the relevance of the different RETs with respect to the Program Cost
- the dynamics of power price to the final customers

Scenario 1:

In Scenario I, assuming 10 MW of each RET, the Program Cost is about Nam$ 400 million in the first year increasing to more than Nam$ 900 million in the 20th year. Scenario I help to see what technology is driving the Program Cost. The most important contributions to the Program Cost result from CSP and small hydro. The lowest contributions stem from landfill gas and wind power.

[22] Theoretically the additional cost of a REFIT scheme and tendering can be identical, provided the government has perfect information on the market price of RETs when designing the REFIT scheme.

Table 3.4.3: Program Cost of Scenario I

Investment parameters	Solar PV	Wind	CSP	Small Hydro	Solid Biomass	Landfill Gas
Capacity (MW)	10	10	10	10	10	10
Hours of full load	1,800	2,200	4,000	5,000	7,000	7,000
RES Power generation (MWh/y)	18,000	22,000	40,000	50,000	70000	70000
Revenues of RES producers (Nam$)	70,945,781	36,405,335	169,621,339	168,265,589	116,810,669	53,340,446
Market value of RE power (Nam$)	8,208,000	10,032,000	18,240,000	22,800,000	31,920,000	31,920,000
Program Cost per Renewable Energy (Nam$)	62,737,781	26,373,335	151,381,339	145,465,589	84,890,669	21,420,446

As solar PV shows only comparatively low hours of full load, the electricity generation is low and thus the contribution to the total Program Cost.

Since the Program Costs have to be borne by the final customers the power price is increasing. In Year 1 it increases by about Nam$ 0.14. In the 20th year the increment is less than Nam$ 0.05, even if the FIT is rising continuously. The explanation for this outcome is the assumed increase of the national power consumption and the rise of the wholesale power price. The higher the increase of total power consumption and the wholesale power price the smaller is the increase of the power price for final customers.

Table 3.4.4: Program Cost and Change of Power Price for Final Customers in Scenario I

Program Cost (Nam$)/year	Increase of Final Consumer Price (Nam$/kWh)	Increase of Final Consumer Price (%)
492.269.159	0,1367	11,89%
498.366.079	0,1282	11,15%
504.925.908	0,1202	10,46%
511.981.732	0,1129	9,82%
519.568.921	0,1061	9,22%
527.725.273	0,0998	8,68%
536.491.187	0,0939	8,17%
545.909.828	0,0885	7,69%
556.027.323	0,0834	7,26%
566.892.949	0,0788	6,85%
578.559.351	0,0744	6,47%
591.082.765	0,0704	6,12%
604.523.256	0,0667	5,80%
618.944.976	0,0632	5,50%
634.416.435	0,0600	5,22%
651.010.793	0,0570	4,96%
668.806.168	0,0542	4,72%
687.885.964	0,0516	4,49%
708.339.226	0,0492	4,28%
730.261.014	0,0470	4,09%

Scenario I allow to study the impacts of net metering for solar PV, too. If we assume that PV is not going under REFIT (0 capacity) but under net metering (10 MW) the Program Cost are reduced by about Nam$ 60 million in the first year and the increase of the power price for final customers is Nam$ 0.12 instead of Nam$ 0.14 (in the first year).

Scenario II

In Scenario II the program consists of 60MW (40 MW small hydro, 15 MW biomass, 5 MW landfill gas), supported by REFIT. Here, the Program Cost are about Nam$ 720 million in the first year increasing to almost Nam$ 1 billion in the 20th year. Thus, the costs are higher than in Scenario I. The reasons for that are twofold. One reason is the high share of small hydro that is characterized by high specific investment cost. The second reason is the fact that the RE power generation (340,000 MWh/y) is much greater than in Scenario I (273,000 MWh/y) due to the high hours of full load of the RETs included.

Table 3.4.5: Program Cost of Scenario II

Investment parameters	**Solar PV**	**Wind**	**CSP**	**Small Hydro**	**Solid Biomass**	**Landfill Gas**
Capacity (MW)	0	0	0	40	15	5
Hours of full load	1,800	2,200	4,000	5,000	7,000	7,000
RES Power generation (MWh/y)	0	0	0	200,000	105000	35000
Revenues of RES producers (Nam$)	0	0	0	673,062,357	175,216,004	26,670,223
Market value of RE power (Nam$)	0	0	0	91,200,000	47,880,000	15,960,000
Program Cost per Renewable Energy (Nam$)	0	0	0	581,862,357	127,336,004	10,710,223

Since the Program Costs have to be borne by the final power customers the power price is increasing. In the first year it increases by Nam$ 0.20. In the 20th year the increment is only about Nam$ 0.064, even if the FIT is rising continuously. The explanation for this outcome is the assumed increase of the national power consumption and the wholesale power price. Again, the higher the increase of the total power consumption and the wholesale power price, the smaller the increase of the power price to the final customers.

Table 3.4.6: Program Cost and Change of Power Price for Final Customers in Scenario II

Program Cost (Nam$)/year	Increase of Final Consumer Price (Nam$/kWh)	Increase of Final Consumer Price (%)
719.908.584	0,2000	17,39%
726.758.819	0,1869	16,25%
734.139.934	0,1748	15,20%
742.090.323	0,1636	14,23%
750.651.042	0,1533	13,33%
759.865.994	0,1437	12,49%
769.782.117	0,1347	11,72%
780.449.594	0,1265	11,00%
791.922.066	0,1188	10,33%
804.256.868	0,1118	9,72%
817.515.275	0,1052	9,15%
831.762.770	0,0991	8,62%
847.069.323	0,0934	8,13%
863.509.694	0,0882	7,67%
881.163.752	0,0833	7,25%
900.116.816	0,0788	6,85%
920.460.022	0,0746	6,49%
942.290.711	0,0707	6,15%
965.712.839	0,0671	5,84%
990.837.422	0,0638	5,55%

Scenario III

Scenario III consists of 60MW (small hydro, biomass, landfill gas) supported by the REFIT scheme and additional 100 MW of capacity that go under tendering (50 MW wind and 50 MW CSP). Due to the higher capacity (>125% compared to scenario I and II) the Program Cost is much higher than scenario I and II. The cost is about Nam$ 1.3 billion in the first year, increasing to more than Nam$ 2.5 billion in the 20th year.

Table 3.4.7: Program Cost of Scenario III

Investment parameters	Solar PV	Wind	CSP	Small Hydro	Solid Biomass	Landfill Gas
Capacity (MW)	0	50	50	40	15	5
Hours of full load	1,800	2,200	4,000	5,000	7,000	7,000
RES Power generation (MWh/y)	0	110,000	200,000	200,000	105000	35000
Revenues of RES producers (Nam$)	0	182,026,673	848,106,693	673,062,357	175,216,004	26,670,223
Market value of RE power (Nam$)	0	50,160,000	91,200,000	91,200,000	47,880,000	15,960,000
Program Cost per Renewable Energy (Nam$)	0	131,866,673	756,906,693	581,862,357	127,336,004	10,710,223

Since the Program Costs have to be borne by the final power customers the power price is increasing. In the first year it increases by about Nam$ 0.45. In the 20th year the increment is only about Nam$ 0.16, even if the FIT is rising continuously. The explanation for this outcome is the assumed increase of the national power consumption and the wholesale power price.

Table 3.4.8: Program Cost and Change of Power Price for Final Customers in Scenario III

Program Cost (Nam$)/year	Increase of Final Consumer Price (Nam$/kWh)	Increase of Final Consumer Price (%)
1.608.681.950	0,4469	38,86%
1.631.344.060	0,4196	36,49%
1.655.622.795	0,3943	34,29%
1.681.629.399	0,3708	32,24%
1.709.482.592	0,3490	30,35%
1.739.309.064	0,3288	28,59%
1.771.243.998	0,3101	26,96%
1.805.431.637	0,2926	25,45%
1.842.025.875	0,2764	24,04%
1.881.190.898	0,2614	22,73%
1.923.101.857	0,2474	21,52%
1.967.945.596	0,2344	20,39%
2.015.921.414	0,2224	19,34%
2.067.241.891	0,2111	18,36%
2.122.133.754	0,2007	17,45%
2.180.838.809	0,1910	16,61%
2.243.614.932	0,1819	15,82%
2.310.737.119	0,1735	15,09%
2.382.498.608	0,1656	14,40%
2.459.212.079	0,1583	13,76%

3.5 Conclusions

In conclusion, one can say that different program designs result in different impacts on the power price for final consumers. The smallest price impact is shown by scenario I that is comprised of all 6 RETs. The price impact can be lowered if solar PV is taken out of the REFIT program and goes under net metering.

In the case of Scenario II, the impact on the power price for final customers is slightly higher than in Scenario I. This is resulting from the high share of small hydro with comparatively high specific cost, but also from the higher electricity generation (>25 % compared to Scenario I). The RE power mix of Scenario II has some other positive impacts. First, the RETs included in Scenario II are base load power stations. The need for back up capacities for balancing a fluctuating supply, are lower than in case of Scenario I and III. Moreover, RETs based on solid biomass and landfill gas are based on less sophisticated technologies that can be easier to manufacture in Namibia. Thus, the impact on economic growth and labour opportunities will be higher.

Scenario III shows the strongest impacts on the price for final power consumers. This impact is fairly independent of whether CSP and wind are going under REFIT or tendering. The main reason for the stronger price impact is the significant higher RET capacity and RE power generation.

All calculations are based on very rough cost estimations. More solid national cost figures will be available once investments in the RETs have been done. Thus, starting the program helps to develop the market for RETs and thus to improve the data base and to better fine-tune the instruments. Solid national RET cost data will only be available if the market for RETs becomes more mature.

A comprehensive approach to use RETs in Namibia should include a mix of both small and large generating units, even if the generation cost might be slightly higher, because there are some RETs that may not be feasible to exploit at either large or small scale but are competitive in one form against the other

4. DESIGNING SUITABLE PROCUREMENT MECHANISMS FOR NAMIBIA

The procurement mechanisms recommended in this study have been elaborated in consultation with key ESI stakeholders. Namibia has a small consumer market, and as such any significant renewable energy installation will have an impact on electricity tariffs. The impact of the tariff depends on several factors, including the type of technology, e.g. CSP or wind; size of installed capacity and subsequent energy generated; location (in cases of wind and solar whose speed and radiation levels respectively may not be uniform) and the wholesale market price of electricity. The retail electricity tariff is also subjected to surcharges by the local authorities.

The study recommends that a combination of 4 procurement mechanisms, namely; tendering, REFIT, net-metering and fiscal support measures be implemented to procure renewable electricity in Namibia as outlined in Chapter 2 and 3. The mechanisms must be subject to review for improvement after 3 years of implementation. It is expected that Namibia a few projects that would have been initiated will provide Namibian cost figures.

The Electricity Act (2007) does not explicitly provide for the recommended mechanism or any support for renewable electricity generation, save for Section 43 which states that the Minister responsible for energy may make regulations in relation to "instalment and implementation of renewable energy technologies, the use thereof (including the placing of obligations on persons with regard thereto) and the provision of electricity therefrom". Although this regulation is not the best and ideal regulation to facilitate the wide diffusion of RET, it is however advisable to ride on this Act to lay the foundation for the future of grid in feed RETs.

It is therefore recommended that the proposed RET procurement mechanisms be implemented as a regulation as provided for by Section 43 of the Electricity Act (2007) as this will not delay the process. The ECB must facilitate the development and promulgation of the requisite regulations for the procurement of RETs. Although a law is ideal and necessary if the procurement instruments are to be effective, this route has long time scales since wider consultation and consensus has to be reached in the legislature. Necessary regulations must be adopted while the legislative route is being pursued.

The rest of this Chapter will outline the specific guidelines on how Namibia may implement the recommended instruments by assigning responsibilities and proposing institutional guidelines.

4.1 Summary of recommendations for RE procurement mechanisms

The recommended mechanisms and the applicable technologies are:

1. Tendering to be applied for solar (CSP) and large wind based generation systems, i.e. for CSP and RETs greater than 5MW in installed capacity;
2. REFIT for small wind, small hydro and biomass including landfill gas;
3. Net-metering for photovoltaics; and
4. Other support measures like soft loans, grants, tax breaks, etc to support all the above instruments and continue promoting rural and off-grid electrification.

The reasons for these recommendations are given **Section 2.9** while **the** REFIT tariffs are summarised in Table 3.5.

4.2 Best Practice Recommendations

The failure of renewable energy programmes may not only be attributed to the lack of appropriate policies and low tariffs, but are often due to poorly designed procedures and process that govern their implementation. The following will outline some of the simple design recommendations based the analysis of different literature as discussed in Chapter 2 and practices elsewhere. These best practices facilitate fair market access and return on investment for renewable energy.

- MME, through the Minister must proclaim regulations to govern the RET procurement and the regulations are administered by the ECB.
- The regulatory framework must absolve ECB from licensing generators of small power plants. Such generators must however seek generation permits from the respective power off-taker.
- The regulatory framework must be simple, comprehensible and transparent but fulfilling all applicable regulations.
- Interconnection of the recommended RETs to the grid must be provided for in the respective Transmission and Distribution Grid Codes.
- In the case of REFIT, the framework must provide a platform for power producers to sell while obligating the regional electricity distributors, local authorities and NamPower to buy on a priority basis all RETs generated electricity at a pre-determined fixed tariff for the given period of time.
- The framework must differentiate the **amount paid to producers by technology.** Technologies that Namibia wants to develop further because of other socio-economic benefits get relatively higher payment to encourage wide installations and innovation.

- Compensation to producers varies by **geographic location** and system size. This is done to encourage decentralised development and encourage smaller-scale projects.
- Compensation for inflation must be incorporated
- All projects implemented under each procurement mechanism must comply with all other relevant technical, legal and regulatory requirements of the Republic of Namibia.

4.3 Designing a Tendering Mechanism

The tendering mechanism must be administered by MME with technical support from a committee comprising the ECB and other ESI members. MME is in a neutral position to administer the tender process for large scale RETS. Tendering has the advantage that cost competitive RETs will be deployed. The mechanism also gives the administrator control over the whole process.

Tendering should be implemented on condition that the Government has knowledge of the availability of the resources i.e. solar and wind. The Government must invest in resource assessments to possess that knowledge base.

4.4 Designing a REFIT Mechanism

The REFIT must basically fulfil two main objectives of price and access.

- The off-taker, i.e. RED, local authority or NamPower is obligated to purchase renewable electricity. They are obliged to connect renewable energy generated electricity from eligible technology to their grid network.
- The renewable energy electricity price is set at a level and for a period long enough to guarantee a fair return on investment.
- The off-taker will grant a generation permit to the RE generator. The permit must be a "standard contract" to ensure a fast and non bureaucratic start of RE generation.
- The off-taker must ensure that the authorised power plant meets safety and technical quality standards as prescribed by the appropriate Grid Code.
- The RE developer must bear the cost of grid connection.
- The off-taker must bear the cost of grid enhancement.

4.5 Designing a Net-metering Mechanism

Net-metering is one of the simplest means of promoting direct consumer investment in renewable energy. Consumers will have to install bi-directional or advance metering equipment as guided by standards set by ECB's Distribution Grid Code.

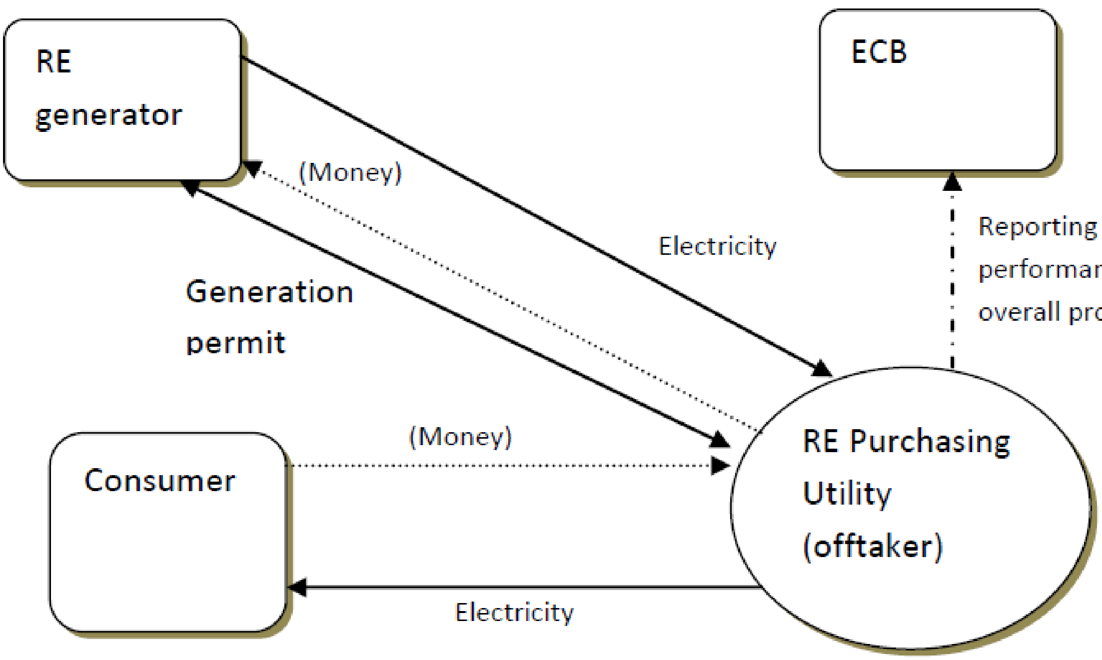
The net-metering model proposed will include the following provisions:

- It will apply to all roof top PV systems and to all consumer classes.
- Excess kWh credits are carried over to the consumer's next monthly bill indefinitely.
- The off-taker will grant a generation permit to the RE generator

4.6 Monitoring, Reporting and Review

The regulations governing the RET procurement mechanism are developed by MME and the resulting regulatory framework is administered by the ECB. Figure 4.1 illustrates the proposed procurement structure for RETs under REFIT. In the case of Net-Metering mechanism, no money will flow between the RE generator and off-taker who is the RE Purchasing Utility. ECB, as the administrator and regulator of the procurement mechanism, should continuously monitor and regularly review the process to ensure that it captures developments in the energy market. These developments could include the development of a renewable energy policy, the National Integrated Resource Plan and climate change discussions and protocols. The off-taker (distributor or NamPower) will be responsible for handling the day to day operations of the REFIT and Net-metering in terms of purchasing power, monitoring the performance of RE Generators and where applicable pass through the cost to consumers.

Figure 4.1: RE Procurement Structure and Process under REFIT



MME should not only continue administering the other support mechanisms like soft loans and grants but must widen the scope of these instruments to support the REFIT, net metering and tendering.

4.7 Sustainability

As the market evolves the Government is encouraged to devise mechanisms of financing the procurement of RETs sustainably. This may mean transforming the National Energy Fund to cover RETs rather than petroleum industry alone. The Petroleum Products and Energy Amendment Act, No. 16 of 2003 which governs the Energy Fund already empowers the "Minister responsible to impose a levy for the benefit of the fund on any energy source including electricity, nuclear and renewable energy". A regulation may need to be passed to allow RE financing benefiting from the Fund. This will cushion the off-taker and the consumer from direct tariff hikes but at the same time spurring the growth of the RE industry.

MME must explore and encourage the use carbon of financing as a top up financing and generate additional revenues that can be used to cover the additional cost of RE.

4.8 Resolution of Disputes and Remedies

The resolution of disputes, resolution and remedies are defined as per the Electricity Act (2007).

- Minister of Mines and Energy is recommended to promulgate regulations that provide for the four RET procurement mechanisms.
- Renewable electricity generators feeding into the distribution network will not need to be licensed by the ECB but must get a permit to develop and supply electricity to the respective off-taker at distribution level
- Renewable electricity generators must be licensed by the ECB
- A regulation may need to be passed to allow RE financing benefiting from the National Energy Fund. This will cushion the off-taker and the consumer from direct tariff hikes.
- Carbon financing must be explored to top up financing and generate additional income

5. CONCLUSION

Namibia's lack of grid based renewable electricity is largely due to an absence of a specific renewable energy policy and an enabling regulatory framework to address market failures despite a good overall energy policy. Countries with large scale development of RETs, such as Germany, Spain, Sri Lanka and China, have introduced procurement mechanisms such REFTs, premiums and other support mechanism.

Market failures are addressed by internalising external costs of fossil fuel based generation or by introducing special instruments like REFITs to ensure a greater share of RET in the electricity supply. Internalising external costs is almost impossible in Namibia because part of the fossil fuel based electricity is imported and also the fact that the country is under no obligation to reduce and/or avoid carbon emissions. The special instruments introduced under the Theory of Meritorics must be such that they are efficient, effective and maximise consumer surplus, e.g. job creation.

Tendering, Quota, REFIT, Premiums, Net metering and subsidies are instruments used to promote the use RETs and deliver renewable electricity to the grid. Different countries use different instruments to achieve specific objectives. The instruments will depend on a number of factors, namely local resource base, financial and economic resources, RE target, the prevailing and adopted power sector and market model.

Namibia has a small electricity market but is endowed with abundant renewable energy resources. Affordability of electricity services must be considered. RETs benefits must be maximised to address challenges such as employment creation, rural upliftment, industrial competitiveness, energy security, and sustainable development. RET procurement mechanisms adopted must be catalysts to address these challenges. The nascent renewable energy industry which is still largely confined to solar energy for off-grid electrification and solar warm water preparation currently employs around 85 people on fulltime basis.

In order to come up with appropriate figures for calculating the costs of introducing different procurement instruments, various specialists like consultants and power producers in Namibia and abroad were consulted on the relevant investment parameters like specific investment cost, hours of full load, economic lifetime of projects etc. In most cases, only wide ranges of figures were provided. This is no wonder, since apart from solar PV, no reference projects exist in Namibia. Conservative estimations were then used. This helps to avoid a situation where the REFIT scheme will fail to start because of too optimistic (or too low) cost figures. Once the REFIT scheme has initiated the first projects the estimated cost figures can be replaced by real cost figures of Namibian RET projects.

The study concludes by suggesting the following RET procurement mechanisms:

1. Tendering to be applied for solar (CSP) and large RET based generation systems, i.e. for CSP and RETs greater than 5MW in installed capacity;
2. REFIT for small (less than 5MW) wind, small hydro and biomass including landfill gas;
3. Net-metering for photovoltaics; and
4. Other support measures like soft loans, grants, tax breaks, etc to support all the above instruments and continue promoting rural and off-grid electrification.

A comprehensive approach to use RETs in Namibia should include a mix of both small and large generating units.

Minister of Mines and Energy is therefore recommended to promulgate regulations that provide for the four RET procurement mechanisms. Under the new regulatory framework, renewable electricity generators feeding into the distribution network will not need to be licensed by the ECB but must get a permit to develop and supply electricity to the respective off-taker at distribution level. Renewable electricity generator feeding into the transmission network, however, must be licensed by the ECB.

In order to cushion the off-taker and the consumer from direct tariff hikes but at the same time spurring the growth of the RE industry, a regulation may need to be passed to allow RE financing benefiting from the National Energy Fund. MME is encouraged to explore and support the use carbon financing as a top up financing and generate additional revenues that can be used to cover the additional cost of RETs.

6. REFERENCES:

Bannon John. 2007. *NamPower: Ten years and Beyond*. United Kingdom

Baumol, W.; Oates, W. (1998): The Theory of Environmental Policy. Second Edition. Cambridge University Press

Boettcher, J. (2009): Finanzierung von Erneuerbaren Energien-Vorhaben. München

Butler, L, Neuhoff, K. (2004): Comparison of Feed in Tariffs, Quota and Auction Mechanisms to support Wind Power Development

Commission of the European Communities. (2008): Energy Sources, Production Costs and Performance of Technologies for Power Generation, Heating and Transport. Commission Staff Working Document. Brussels

Deichmann, U.; Meisner, C.; Siobhan, M.; Wheeler, D. (2010): The Economics of Renewable Energy Expansion in Rural Sub-Saharan Africa. The World Bank. Policy Research Working Paper 5193

Ecofys (2008): Policy instruments to reduce financing cost in RE technology projects. David de Jager and Max Rathmann, Utrecht 2008

German Wind Energy Association (BWE) (2005): Minimum price system compared to the quota model – which system is more efficient? **http://www.wind-works.org/FeedLaws/Germany/BWE%20Minimum%20price%20system%20compared%20with%20the%20Background_Systeme_eng.pdf**

Gipe, P. (2006): Renewable Energy Policy Mechanisms. **http://www.wind-works.org/FeedLaws/RenewableEnergyPolicyMechanismsbyPaulGipe.pdf**

Gipe, P. (2009): Wind Energy Basics. A Guide to Home and Community Scale Wind Energy Systems. 2nd edition

International Energy Agency: The Electricity Access Database **http://www.iea.org/weo/database_electricity/electricity_access_database.htm**

Kreditanstalt für Wiederaufbau (KFW) (2005): Financing Renewable Energy. Instruments, Strategies, Practice Approaches.

Lovei Laszlo. 2000. *The Single Buyer Model.* World Bank Group. Note Number 225. Washington, DC 20433.

Ljung P. (2007). Energy sector reform: strategies for growth, equity and sustainability. Sida Studies No. 20. Stockholm.

Mendonca, M. (2007): Feed-in Tariffs. Accelerating the Deployment of Renewable Energy. London (Earthscan)

Mendonca, M. Jacobs, D., B. Sovacool (2009): Powering the Green Economy. London (Earthscan)

Ministry of Mines and Energy (1998): White Paper on the Energy Policy of Namibia

Ministry of Mines and Energy (2004): Hydropower Master Plan. . **http://www.mme.gov.na/energy/hydro-power-masterplan.htm**

Ministry of Mines and Energy (2005): Barrier Removal to Namibian Renewable Energy Programme (NAMREP) **http://www.mme.gov.na/energy/pdf/SWH%20Study%20Report%20FINAL.pdf**

Musgrave, R.A.; Musgrave, P. (1984): Public finance in theory and practice. McGraw Hill

NEEDS (2006): Cost development – an analysis based on experience curves. **http://www.needs-project.org/docs/results/RS1a/Deliverable%20D%203%203%20-%20RS%201a%20%283%29.pdf**

Neij, L. (2008). Cost development of future technologies for power generation – A study based on experience curves and complementary bottom-up assessment. Energy Policy, 36 (6), p. 2200-2211

Nexant (2010): Synthesis Paper. Policy Options for Developing Wind and other Renewable Energy Resources in Namibia, Prepared by Edward Hoyt, Charles Zimmermann and Bernard Speckman, Nexant, Inc., Draft

OPTRES (2007): Assessment and optimization of renewable energy support schemes in the European electricity market. Final Report.

REEECAP (2008b), Electricity Supply and Demand Management Options for Namibia - A Technical and Economic Evaluation, Emcon Consulting Group, as part of the REEECAP Project, The Renewable Energy and Energy Efficiency Institute

Staiß, F.; Schmidt, M.; Musiol, F. (2007): Vorbereitung und Begleitung der Erstellung des Erfahrungsberichtes gemäß §20 EEG. Forschungsbericht im Auftrag des BMU

UNEP, SEFI (2004): Financial Risk Management Instruments for Renewable energy Projects. Summary document

UNEP, SEFI (2007): Renewable Power, Policy, and the Cost of Capital. Improving Capital Market Efficiency to Support Renewable Power Generation Projects.

UNEP, GEF (2008): Financial Risk Management Instruments for Renewable energy Projects. Project Status Note, March 2008

von Oertzen, D. (2008): Namibian National Issues Report on the Key Sector of Energy with focus on Mitigation. **http://www.undp.org/climatechange/docs/Namibia/Namibian%20national%20issues%20report%20on%20key%20sector%20of%20energy.pdf**

von Oertzen, D. (2009), Green Energy in Namibia, Electricity Control Board of Namibia, May 2009

Wiser, R.; Bolinger, M. (2009): 2008 Wind Technologies Market Report. Berkeley

Wiser, R. et. al. (2009): Tracking the Sun II. The Installed Cost of Photovoltaics in the U.S. from 1998 – 2008. Berkeley

Websites

Electricity Control Board, **http://www.ecb.org.na**

Ministry of Mines and Energy, **http://www.mme.gov.na/directe.htm**

World Future Council **http://www.futurepolicy.org/2573.html**

ANNEX 1: TERMS OF REFERENCE

TERMS OF REFERENCE

DEVELOP A PROCUREMENT MECHANISM FOR RENEWABLE ENERGY RESOURCES IN NAMIBIA

1 Introduction

The Namibian Electricity Supply Industry (ESI) is undergoing fundamental changes in terms of its institutional, regulatory and commercial framework. The Electricity Act (Act 4 of 2007) recognises the existence of the Electricity Control Board (ECB) as an independent regulatory authority created to control, regulate and promote the Namibian ESI. The Electricity Control Board has the sole mandate to approve electricity tariffs in Namibia and in this regard has developed tariff methodologies for generation, transmission and distribution.

Namibia's economic growth and the reduction of poverty in the country depend on the expansion of the country's electricity supplies. Load growth in recent years has been robust, almost 10 percent for 2006-2007, and while there was a slowdown in growth in 2009, it is expected that the steady recovery of the global economy will lead to accelerating consumption and demand growth over the next several years. Meanwhile, Namibia's ability to secure supplies in South Africa and elsewhere is diminishing because of the region's rapid growth and perennial shortages. This means that Namibia must bring new capacity on line quickly and continue to add to installed capacity in the medium- to long-term. The ECB has recently embarked on several studies that focus on the use of different energy sources to ensure sufficient generation capacity and energy for the future.

All recently completed studies, have recommended that Namibia should make use of competitive contracting system to ensure the most competitive tariff. However, this is not the practice and as new investors and developers approach the ECB the need for a tariff methodology for renewable energy resources is becoming imminent.

The ECB has therefore decided to engage a consultant/s to develop a framework and tariff methodology to ensure that sustainable, transparent and fair tariff methodology be developed for renewable energy resources in Namibia.

2 Objectives

To obtain the services of a consultant/s, with appropriate and relevant financial & economic, business, renewable energy and tariff expertise, who shall develop a framework and tariff methodology to ensure that the renewable energy resources to be developed in Namibia will be paid a fair, transparent and sustainable tariff that adheres to the overall national objectives as outlined in the Energy White Paper of 1998.

3 Scope of Services

3.1 The consultant shall develop a comparative analysis of the different renewable energy procurement mechanisms and methodologies available highlighting the advantages and disadvantages and make a recommendation to the ECB management on the appropriate and preferred methodology.

3.2 Using the methodology as recommended in 3.1 the consultant shall develop a model to calculate the tariff for the following renewable energies in Namibia:

- Solar (Concentrated and PV)
- Wind
- Biomass including land fill gas.
- Small Hydro

3.3 At least one national workshop shall be held to discuss the results with the industry and other stakeholders and another workshop with selected key stakeholders to discuss the preliminary results of the study.

3.4 The consultant shall be responsible for all recordings of all proceedings and minutes of meetings.

3.5 The consultant shall make available a final report to the ECB as well as an Excell Spread sheet with the tariff calculations.

4 Background information

Contracted consultant/s to consider the following in carrying out its services:

4.1 Electricity Act 4, 2007

4.2 National Tariff Study 2001

4.3 The Energy White Paper, 1998

4.4 The IPP Framework, 2007

4.5 The Draft Synthesis Paper on Renewable Energy Policy, 2010

5. Reporting

5.1 The ECB will appoint a representative to co-ordinate the project with the consultant.

5.2 The ECB or consultant may request additional ad-hoc meetings on specific issues if required.

5.3 The consultant shall be responsible for record keeping of all proceedings and minutes of meetings. All documents should be submitted to the ECB for approval before going out to other stakeholders.

5.4 All reports, minutes, presentations, models (including calculations & source codes and studies conducted shall be made available to the ECB in full electronic media. PDF or any other encoded files will not be accepted.

5.5 Copyright of all reports, minutes, presentations, models and studies shall vest in the ECB.

6 Duration

The project is envisaged to last three (3) month from once the order/contract has been placed.

7 Proposals to be submitted

Proposals provided should at least contain:

7.1 The proposed key human resources (project team), qualifications and experience.

7.2 The proposed work plan (including time frames) to be implemented to cover the scope of services.

7.3 Contract price quoted in Namibian Dollar (N$) or South African Rand (R)

7.4 Inclusive of all taxes.

7.5 Inclusive of professional fees, transportation cost, accommodation and subsistence cost and administration fees (including logistical arrangements for meetings/ workshops, venues and catering)

7.6 A written undertaking not to engage in collusive tendering or other restrictive practice.

8 General

8.1 The ECB reserves the right to reduce the scope of this project and to increase the scope subject to negotiations with the successful tenderer.

8.2 Enquiries should be directed to Mrs Helene Vosloo at **leens@ecb.org.na** or telephone number (061) 374 313 or fax number (061) 374 305

ANNEX 2: REFIT CALCULATOR