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Utilities Regulatory Authority of Vanuatu

Utilities Regulatory Authority

Luganville Tariff Setting Framework

FRAMEWORK PAPER

JULY 2010

1 Preface

The Utilities Regulatory Authority (the URA) is Vanuatu's economic regulator of electricity and water services throughout Vanuatu. The Government of Vanuatu established the Utilities Regulatory Authority on 11 February 2008 under the *Utilities Regulatory Authority Act No. 11 of 2007* (the Act).

The URA is responsible for the regulation of certain services in the electricity and water sectors. Our role differs in each regulated industry but generally involves regulating prices, service standards, and market conduct and consumer protection. We also investigate and advise the Government on regulatory matters that affect Vanuatu's regulated utilities.

The Act states that our primary objective is to regulate these utilities to ensure the provision of safe, reliable and affordable regulated services and maximise access to regulated services throughout Vanuatu.

The power supply concession in Luganville commenced on 23 January 1990 and will expire on 31 December, 2010. A tender process is currently underway and is expected to be completed prior to the expiration of the Luganville concession.

The Act empowers the URA to set the maximum level of tariff for the Luganville concession.

The Luganville Electricity Tariff Setting Framework Paper July 2010 provides guidance to establishing the level and structure of consumer tariffs for the expiring concession in Luganville.

Further, the paper sets out the objectives, methodology and timeline for establishing the new tariff.

Johnson Naviti
Chairperson

2 How to respond to this paper

Stakeholders are invited to comment on the issues set out in this paper. Responses and information received will be considered in the formulation of a Draft Determination and final advice provided to the relevant Ministers

Submissions are due on 30 July 2010 and can be emailed to tmael@vanuatu.gov.vu or mailed to:

Luganville Electricity Tariff Setting Framework
Utilities Regulatory Authority
PMB 9093
Port Vila, VANUATU

Submissions may also be made in person at the Office of the Utilities Regulatory Authority located on the ground floor of the VNPF Building, Port Vila, Vanuatu.

Submissions will be made available on the Authority's website in accordance with the Authority's website policy. Any material that is confidential should be clearly marked as such.

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3 Introduction

3.1 Background

The *Utilities Regulatory Authority Act Number 11 of 2007 (*the **Act***)* establishes the Utilities Regulatory Authority (URA) of Vanuatu. The URA is a body corporate with perpetual succession, acting independently from the Government. The URA's Commission consists of three Commissioners, a Chairperson and two part time Commissioners of which one is the Chief Executive Officer of the Authority.

The Act empowers the URA to regulate certain utilities, in particular, the provision of electricity and water services in Vanuatu.

The URA's core functions with respect to the existing water and electricity utility include:

- Monitoring and enforcing existing concession contracts which include checking monthly price adjustments made by the utility, monitoring service standards and technical performance, reviewing yearly financial reports and auditing operating report processes;
- Renegotiating tariffs with the utility in accordance with the relevant concession contracts;
- Manage consumer complaints by assisting consumers resolve grievances and/or complaints with the utilities;
- Advise Government on utility-related matters as requested; and
- Communicating with the Government, utilities, customers and the general public in order to provide information about matters or updates relating to utilities.

The **Act** empowers the URA to exercise the functions and powers of the Government relating to the setting of electricity tariffs. Based on the methodology used in the recent URA Final Decision paper on the all concessions tariff this document sets out the methodology the URA will use to use in setting a tariff for the Luganville concession.

As part of the Luganville electricity tariff setting, the methodology set out by the URA will also provide for the establishment of a tariff equalization mechanism to enable uniform tariffs to be maintained across the electricity concession areas in Vanuatu.

Therefore, the URA proposes to:

- review the current costs to develop an estimate of the efficient cost of electricity service in Luganville and the associated revenue requirement for the utility;
- review the structure of equalised tariffs across concession areas;
- review the tariff adjustment formulae and recommend a method of indexation that ensures the viability of the operator, a fair price for consumers, and expectations of Government;
- develop a view as to the reasonableness of service standards for electricity specified in the concession contracts, and the possible cost implications of any changes to the service standards,

to inform its decision on whether to request changes in service standards in conjunction with any tariff setting;

- develop, in consultation with stakeholder, an approach and methodology for conducting tariff setting now and in the future – to specify principles and guidelines, and the process and financial model needed for reviewing tariffs; and

- develop, in consultation with stakeholders, the information needed for electricity tariff setting, including accounting and technical definitions.

3.2 Electricity tariff setting regulatory framework

Under Division 3 section18 (1) of the Act, the URA is empowered to determine the maximum price which may be charged in relation to any aspect of a regulated service throughout Vanuatu.

In determining the maximum price under section 18(1) the URA must have regard to the price of similar services in any comparable location.

Further, the URA is empowered to do all things that are necessary or convenient to be done for or in connection with the performance of its functions.

The maximum price determined under subsection (1) will be effective on the day on which the determination is published in the Gazette.

3.3 Electricity tariff setting process

In developing its approach and methodology, the URA will carry out the following process and steps as part of the Luganville electricity tariff setting review:

- **Establish the methodology** for the tariff calculation and highlight issues relevant to the Luganville concession. The URA will established the method to be used to calculate the level of the tariff in consultation with stakeholders through this Framework Paper;

- **Submissions from Stakeholders**. The URA will seek stakeholder submissions on any of the issues raised in this document prior to and during the Luganville tendering process;

- **URA's Luganville Electricity Tariff Draft Decision Paper**. The URA will incorporate feedback to this document and publish a draft tariff decision for the Luganville concession in early August. It will indicate the assumptions that the URA believed are appropriate for the setting of the tariff, the tariff level, structure of an equalisation mechanism and indexation formula.

- **Consultation**. Luganville Electricity Tariff Draft Determination will be made available to the public and all interested stakeholders. The URA will invite submissions on this paper and respond to them in their Final Determination.

- **Asset Audit and Valuation**. As part of the tariff review process the URA will commission an audit of all the assets of the Luganville concession. The Audit results will be used to determine the appropriateness of replacement provisions, to allow costing of the insurance cover required in the concession agreement and identify all government owned assets.

- **URA's Luganville Electricity Tariff Determination.** The URA proposes to publish its Tariff Determination in two stages. Following consultation on the URA's Luganville Electricity Tariff Draft Decision Paper, the URA will publish its decision on the Luganville Electricity Tariff Determination Stage 1 in August 2010. This tariff, tariff structure, equalisation mechanism and indexation formula will be published by the URA.

  The URA proposes to expeditiously assess the investment plans submitted by the tenderers and in consultation with the successful bidder make its determination on the regulated asset base, depreciation and resulting reasonable return.

The URA will publish its Luganville Electricity Tariff Final Determination which will take effect upon gazettal and applied to the new Luganville concession agreement.

3.4 Purpose of this paper

The purpose of this paper is to seek stakeholder comment on the method of setting a tariff in Luganville, the indexation formula and the Price Equalization Mechanism.

The paper seeks comment on the following specific issues:

- The URA's proposed overall approach and methodology in conducting the tariff setting outlined in this paper;
- The extent to which performance standards are adequate and /or need to be better enforced. The current level of service across the concession area and / or current service standards and levels of reliability.
- The URA's proposed approach on setting the tariff in two stages.
- The URA's proposed approach to approving investment plans and incorporating depreciation and a return on investment in the tariff and how the second stage tariff will be set.
- The URA's proposed approach on how the base tariff will be indexed.
- The URA's proposed approach on how uniform tariffs will be applied and the resulting Price Equalisation Mechanism.

The URA has set out specific issues on which stakeholders are invited to comment. However, stakeholders should make any other comments that they wish that may not be covered by the issues raised in this consultation paper.

3.5 Structure of this paper

This paper sets out the URA's proposed approach and methodology for the Luganville electricity concession tariff setting and determination.

Section 4	presents the URA's proposed rationale for the tariff review and methodology for undertaking a two stage tariff setting process.
Section 5	sets out the URA's proposed approach to assessing the service standards for electricity services in Luganville.
Section 6	describes the URA's position on assumptions used to set the level of the tariff for Luganville concession.
Section 7	outlines the URA's proposed tariff equalization mechanism.
Section 8	gives the URA's proposed tariff structure to be applied to the Luganville concession.
Section 9	describes the URA's position on a indexation formula.
Section 10	presents the URA's position on the methods used for fuel procurement and the price paid.
Section 11	describes the URA's approach and methodology in relation to the promotion of renewable energy.
Appendix A	provides an indicative timeline for completing the tariff setting and review.
Appendix B	sets out the forecast generation data for the Sarakata Hydroelectric power station.

4 Tariff Setting Methodology

In undertaking this tariff review, the URA's objective is to build a methodology for establishing tariffs that meets standards for good regulatory practice.

This methodology will include clarifying the process for resetting tariffs in the future and establish an appropriate financial model to be used for tariff resets.

The URA will develop the methodology in consultation with key stakeholders in a manner that takes into account the need for openness and transparency, while also being reasonably efficient.

4.1 Rationale and Objective

The rationale for the tariff review is to assess the appropriateness of tariffs, both in terms of their level and their indexation method. The URA aims to find the right balance between the interests of the consumers of Vanuatu, of the utility, and of the Government. In short,

- consumers should not pay more than necessary to receive electricity service of a given standard;
- the utility should be able to charge tariffs in such a manner that it can cover all its costs, and this includes operating, maintenance and investment costs; and finally,
- the government need to keep the long-term growth and economic development of Vanuatu in view and thus requires present tariffs to support improvements and future investments in electricity supply.

The methodology the URA proposes, to assess whether tariffs are appropriate to balance the concerns of all stakeholders takes the following form:

- the costs of the utility are reviewed in order to determine what the minimum revenue requirement is for electricity supply to operate in a commercially viable manner;
- the cost information gathered by the URA in relation to its recent Electricity Tariff Review Final Decision May 2010, as to what level of expenses have been associated with the provision of services in Luganville will be considered;
- the appropriateness of costs is intimately linked to the quality and reliability of service that consumers request, and the level of safety that is imposed. Service standards are therefore reviewed for their appropriateness at the same time as company costs;
- in order to determine whether the medium to long term growth and development concerns are addressed, a forward-looking assessment of consumer demand (commercial and residential) and future network investments will be undertaken.
- Investment plans of the successful bidder will also be reviewed in stage two and a reasonable return given on approved investments.

Given all elements above, required revenues to cover present and future costs of electricity supply will be assessed by the URA. The instrument to assess the revenues will be a financial and economic model tailored to Vanuatu based on the model used in its Electricity Tariff Review Final Decision May 2010.

Required revenues indicate the total amount of money the utility is anticipated to need to meet its cost obligations for operations, maintenance and forward-looking investment and it also needs to include a compensation for investors who have put their capital at disposal for the construction of the network.

Regular tariff adjustments mechanism (indexation) will be undertaken once the tariff levels are determined. The review will also assess different possibilities for this mechanism.

The URA proposes to use the methodology set out in this tariff review to establish a transparent framework for future tariff adjustments and periodic reviews.

4.2 Two Stage Tariff Setting Process

Given that the initial level of planned investment and insurance costs are unknown, a two stage tariff setting process will be used. An initial tariff will be set assuming a regulated asset base of zero as all government assets will be taken over free of charge by the winning bidder. This will be the tariff that is used for the Luganville tender final bid.

The URA will review the investment plans, and will set the final tariff, which will cover depreciation and reasonable return on capital required for the investment plan. If the plan is not carried out as scheduled then the excessive tariff paid will be clawed back with interest at the next tariff review.

As insurance costs are dependent on an asset audit and valuation yet to be completed the cost of insurance as required by the concession agreement will also be included at the second stage. The winning bidder will be required to supply three competitive quotes for the required insurance.

Stakeholders are invited to comment on URA's proposed approach and methodology in conducting the tariff setting review as outlined in this section particularly the two stage tariff setting process.

4.3 Building blocks methodology

The building blocks approach has been applied by regulators in many different countries, including Australia, New Zealand, and other Pacific Island Countries such as Tonga. This approach gives the service provider a reasonable amount of certainty that it can stay profitable, while also giving the provider an incentive to improve performance. The provider has this incentive because the tariff is locked-in for the regulatory period (five years) based on forecast efficient costs and forecasted demand —if the provider can reduce costs below forecasts or increase demand, then it can keep the difference. After five years (in normal circumstances) the tariff will be reviewed again, taking into account the efficiency gains made by the provider.

The building blocks approach consists of setting a price cap on tariffs so that over the regulatory period, the service provider's forecast revenue is equal to the provider's forecast reasonable operating costs plus a forecast reasonable return on capital.

This approach is outlined in

Figure: 6.1.

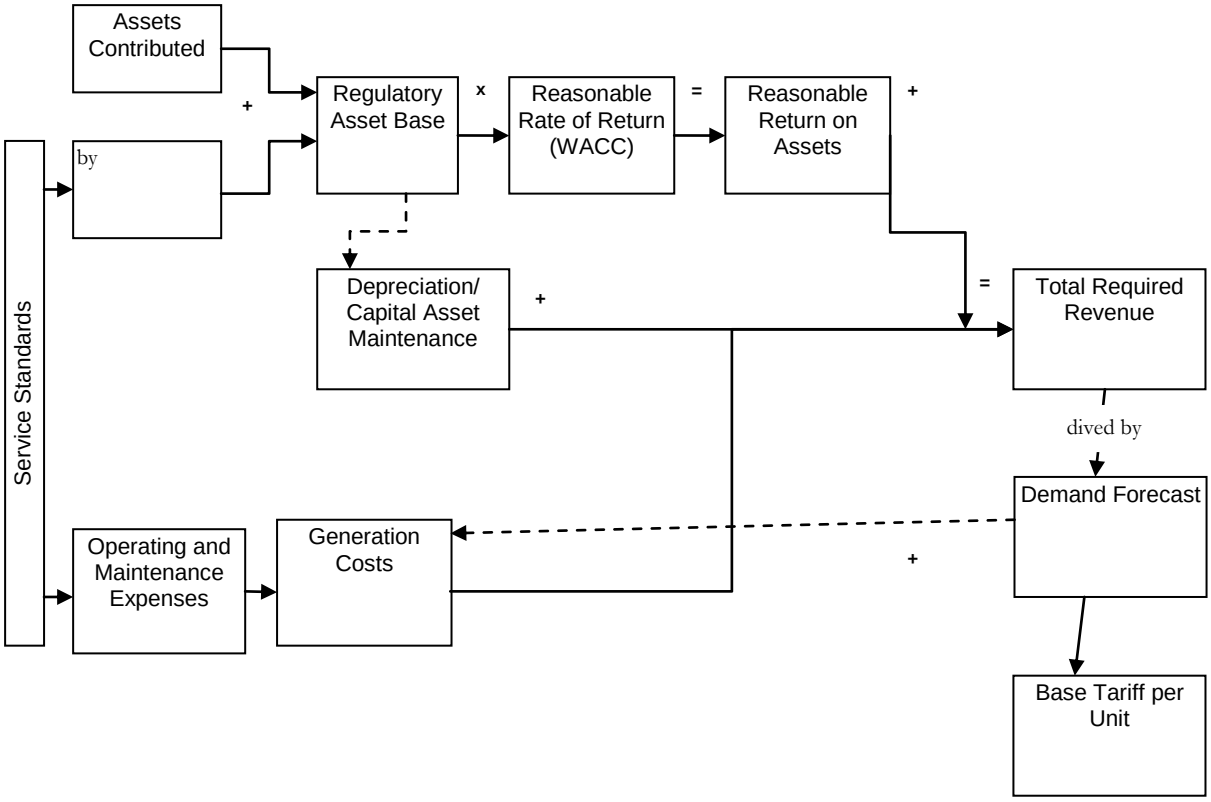

Figure: 6.1. The building blocks approach to setting the price controls

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The building blocks approach can be characterised by three steps:

Step 1 Determining Service Levels

The first step to determining the price controls is to decide upon the service outcomes that the concessionaire is required to deliver over the period. These outcomes will reflect the service standards that are set as part of this tariff review as well as legislative and functional obligations that the concessionaire must meet in accordance with concession requirements. In setting these service outcomes, it is also necessary to consider anticipated future peak demand and customer numbers.

Step 2: Determining the revenue required

Having determined the outcomes that must be delivered, the revenue requirements are then determined that are sufficient to enable the concessionaire to deliver these outcomes efficiently. The building blocks approach involves building up the concessionaire's revenue from key components that reflect their operating and maintenance costs and financing requirements, the concessionaires' financing costs (return on and of capital) are built up with reference to the rolled forward value of their regulatory asset bases and the capital expenditure that they must undertake. The return on the regulated asset base will take place at stage two of the tariff setting process as described in Section 4.2.

Step 3: Translating the revenue requirement into a price control

Having determined the revenue required, it is then translated into unit prices using forecasts of energy consumption and customer numbers across the various customer categories. This is then translated into specific tariff which in accordance with an indexation mechanism specifies how prices will be adjusted monthly.

5 Service Standards

The service standard review task will focus on a review of and an assessment of current service obligations and reliability performance standards for electricity services in line with that conducted in the URA's Electricity Tariff Review Final Decision May 2010, with reference to the URA's published 'Electricity Reliability Standards" May 2010.

As part of this task the URA will assess, if necessary, whether any adjustments to the current service standards are required. For example, it may not be economic for all concessions to have the same level of reliability.

In undertaking this service standard review, the URA will use the data obtained for its Electricity Tariff Review Final Decision May 2010.

5.1 Performance Measures

As part of the recent Electricity Tariff Review Final Decision May 2010 the URA undertook a an assessment of the performance of the current utility against a number of other Pacific and Caribbean utilities, the URA will use the results of this process in setting the standards for the Luganville concession.

Key indicators that have been benchmarked include the following:

- System Average Interruption Duration Index (SAIDI)[1]
- Complaints per 1,000 customers
- Customer average interruption duration index (CAIDI)[2]

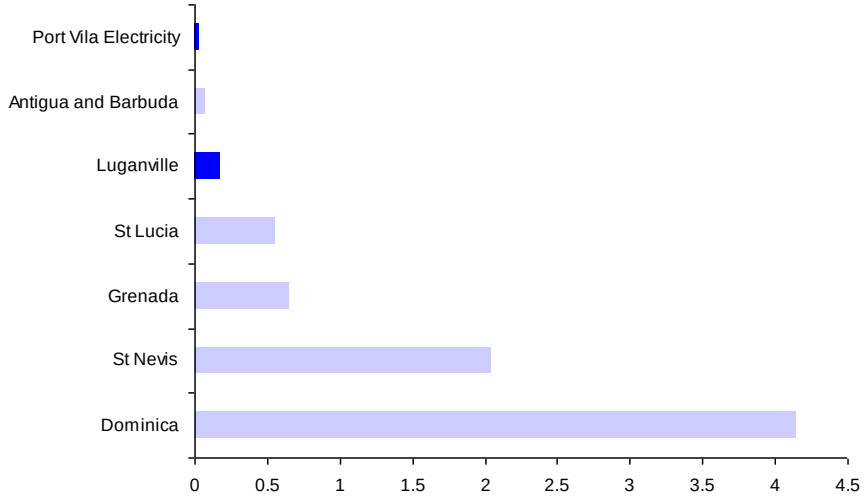
5.1.1 System average interruption duration index (SAIDI)

The system average interruption duration index (SAIDI) is the total minutes, on average, that a customer could expect to be without electricity in a year due to supply interruptions. In the URA's Electricity Tariff Review Final Decision May 2010, the utility's current performance on this benchmark when compared to international data is very good, as shown in Figure 5.1.1.

Figure 5.1.1: System Average Interruption Duration Index (SAIDI) (Hours per customer per year)

[1] System Average Interruption Duration Index, which is the total minutes, on average, that a customer could expect to be without electricity in a year due to interruptions (of duration equal to or longer than one minute)

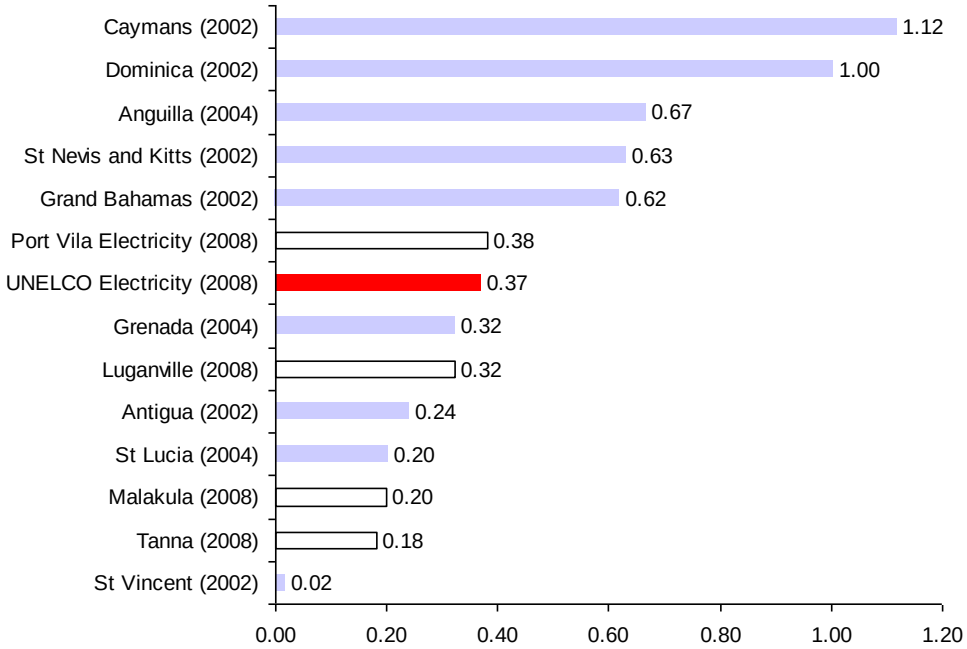
[2] Customer Average Interruption Duration Index, which is the average time taken for supply to be restored to a customer when an interruption (of duration equal to or longer than one minute) occurs.



5.1.2 Peak load per kVA of transformer

The capacity of transformers on a utility's network relative to the load on its network affects the performance of the network and provides an indication of the amount of investment in the network that has been undertaken. An indicator that describes this, peak load per kilovolt-ampere (kVA) of transformer capacity is shown in Figure 5.2.1. A high ratio indicates that there is less capacity relative to load, which will result in poorer network performance. A low ratio can indicate over investment in the network. In the Electricity Tariff Review Final Decision May 2010 the utility's average performance across the four concession areas sits in the middle of the range.

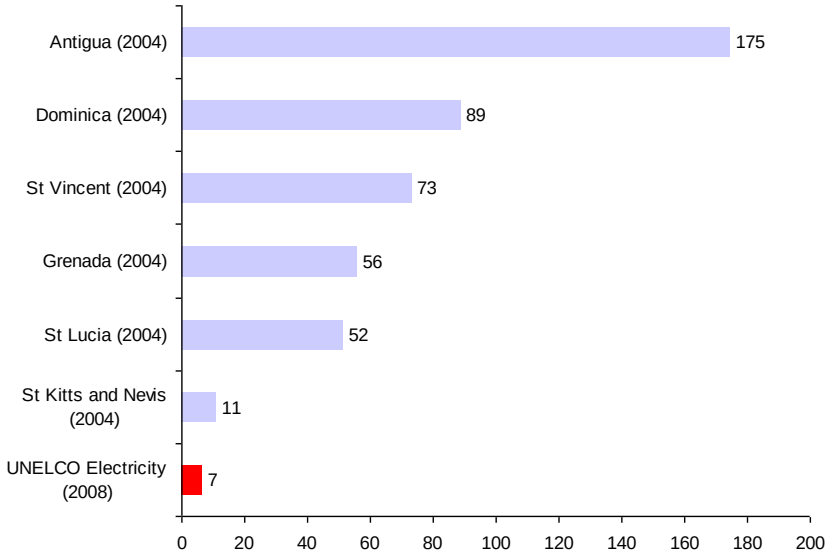
Figure 5.2.1: Peak load per kVA of Transformer (MW/kVA)



5.1.3 Number of complaints per thousand customers

Based on the data available to the URA in its Electricity Tariff Review Final Decision May 2010, very low levels of complaints per thousand customers have been achieved when compared to other utilities in island countries. It is not clear if the very low level of reported complaints is due to an exceptionally low number of complaints or difficulties with the utility's complaints recording and reporting system. No separate breakdown for Luganville was available.

Figure 5.3.1: Number of Complaints per Thousand Customers



Source: UNELCO and audited financial reports (2004) of other utilities

5.2 Service Standards

It would appear that the current utility is providing a reasonably good level of service when compared to comparable industry benchmarks. For the purposes of setting the tariff, it is assumed that any new operator will be able to provide at least the same level of service as is currently being achieved.

Customers have emphasised the importance that they place on a reliable electricity supply, the URA has received little indication that customers value further improvements in average reliability levels.

The utility will be required to report against the following average reliability measures, by network type: annual duration of unplanned interruptions (unplanned SAIDI), annual frequency of unplanned interruptions (unplanned SAIFI), annual duration of planned interruptions (planned SAIDI), annual frequency of planned interruptions (planned SAIFI), and frequency of momentary interruptions (MAIFI).

The URA has issued Electricity Reliability Standards in relation to regulated services. The targeted levels for these reliability measures are provided in these standards. Additionally the URA will publish reports the utilities performance. These reports will include measures of reliability, quality of supply and customer service.

The service standards should be kept under review and should the quality of service begin to fall, the URA will act to adjust or introduce new standards as necessary.

Stakeholders are invited to comment on the extent to which performance standards are appropriate. If not, then what sort of standards should be adopted, and how should they be enforced?

6 Building Block Components

As described above the tariff will be set based on the principle that a fair price for consumers is one where the operator covers the reasonable costs of providing a reasonable level of service and makes a reasonable return. The calculation will be performed using a financial model developed by the URA based on the building block methodology.

The methodology is applied in the following way:

- The first stage Base Tariff (P_0) is set at a level to ensure that the utility covers the reasonable costs of providing electricity at the required level of service.
- The Cost Forecast is based on predictions of the costs associated with providing a forecast level of generation, in order to meet the forecast demand.
- The level of capital invested in electricity is referred to as the Regulated Asset Base (RAB). The second stage tariff is set to ensure the utility earn a reasonable level of return on capital they have invested in this asset base. The reasonable rate of return is estimated as the weighted average cost of capital (WACC).
- The Indexation Formula allows the passing through of some external cost changes, for example fuel, wage, and materials cost inflation. The price calculated each month using the Indexation Formula is referred to as P.
- The Tariff Structure creates the final electricity prices that will be paid by the different groups of customers for fixed monthly fees and per kWh based on the price P.
- A Price Equalisation Mechanism allows uniform tariffs across Vanuatu while earning the Luganville concessionaire a tariff appropriate for that concession's costs.

The methodology has been designed to calculate a price for five calendar years from 2011 to 2015. Each of the elements shown above is described in detail below.

Note: The P defined in the Electricity Tariff Review Final Decision May 2010 differs to the use of P in this document. In this document P refers to the base price received by the concessionaire in Luganville which may be different to the base price charged to consumers in Luganville due to the government's uniform tariff policy.

6.1 Demand Forecast

Energy consumption, peak energy demand and customer numbers are important inputs into the derivation of the new tariff level. Future expenditure requirements are driven partly by expected growth in peak demand and customer numbers while the translation of the revenue requirement into the tariff level relies on forecasts of energy consumption, and customer numbers.

The demand growth forecast set out in the URA's Electricity Tariff Review Final Decision May 2010 was derived based on the Government of Vanuatu's overall GDP forecast for the next five years given the strong historical correlations of GDP growth and electricity consumption growth. This method is applied to kWh and kVA growth forecasts. This same methodology is applied to the Luganville concession for the tariff period 2011 to 2015.

The URA has taken a top-down approach to estimating future electricity demand growth rates. This means that the demand is estimated at an overall level, rather than for individual groups of customers.

The URA notes that electricity demand and GDP growth has been more volatile in Luganville as compared to all concessions thus applying the same growth forecasts as for the all concession models may appear aggressive. Given that the tender process for Luganville requires the growth of connections the URA believes there will be a strong incentive to grow demand in Luganville beyond what there is in other concession areas. Thus demand will be forecasted as per the Electricity Tariff Review Final Decision May 2010.

It is also noted that given the level of electricity supplied by the Sarakata hydroelectric power station that the Luganville base tariff is less sensitive to demand growth forecasts than the all concessions tariff.

6.1.1 Detailed Methodology

The planned tariff financial model will follow the following methodology:

- It takes monthly historical demand in each customer group for both kWh and kVA
- It applies a demand growth rate to the previous years total demand for both kWh and kVA
- It calculates the proportion of the total years demand in kWh and kWh that falls in each month (using 2009 as a base year)
- It applies the month proportions (2009) to the total demand forecasts to give the monthly demand in each customer group
- kWh and KVA are represented in terms of P (via the new tariff structure) and combined for a total demand in P
- This is summed into annual demand

Stakeholders are invited to comment on URA's proposed approach and methodology in forecasting demand as outlined in this section.

6.2 Generation Forecast

The Generation Forecast predicts how power will be generated to meet the estimated demand. The Luganville concession has the following generation sources:

Table 6.2.1– Generation sources

Concession area	Generation sources (capacity, megawatts)
Luganville	Luganville diesel (2.9 MW) Sarakata hydro (1.2 MW)

The Sarakata hydroelectric power station consists of 2 x 300kW and 1 x 600kW generators. These are supplemented by diesel generation capacity made up of 2.9MW, located at the Luganville power station. Peak demand is considered to be 1.2MW during the day and 650kW during the night. During periods, when the peak demand exceeds 800kW of load, the demand is supplemented by diesel generation.

The estimated amount of power generated by the Sarakata hydro plant is considered be 5,614,000 kWh per annum from 2010 to 2014 as described in Appendix B.

The cheapest sources are assumed to be used first to meet demand that is the hydroelectric station. The remaining power requirements are assumed to be generated from the fuel-based sources. Fuel efficiency is estimated and the amount of fuel required calculated.The diesel fuel efficiency for the Luganville diesel generators was considered to be 0.286 litres per kWh in the URA's Electricity Tariff Review Final Decision May 2010 this will be reviewed for the draft tariff determination.

Losses are calculated as the difference between the electricity generated (gross energy) and the amount of electricity invoiced to customers based on historical averages.

Peak demand will not be explicitly modelled for this tariff review given the extent of the excess capacity. The use of coconut oil is also not explicitly modelled as none is currently used in Luganville, though the indexation formula will allow for its introduction.

6.2.1 Detailed Methodology

The planned tariff financial model will follow the following methodology for forecasts generation:

- Total energy sold on a monthly basis is taken from demand forecast
- This is grossed up using average system losses to give Total Energy needed to be produced.
- Total Energy to be produced each month is applied first against hydro based on forecast hydro production[3]
- The remaining energy requirements are applied against diesel generation.
- Diesel efficiency is calculated on historical numbers.
- Total litres needed to generate the required kWh is calculated based on this efficiency.
- Total fuel cost per month is calculated assuming Vt 85 / litre (the model is not sensitive to this price as it is adjusted in the indexation formula)
- All these above numbers are summed to a Annual Generation forecast

Stakeholders are invited to comment on URA's proposed approach and methodology in forecasting

[3] See Appendix B for Hydro forecasts

generation as outlined in this section.

6.3 Cost Forecast

The Cost Forecast estimates the reasonable costs of providing electricity services in the concession areas. Fuel costs are calculated on a monthly basis from the Generation Forecast. All other costs are calculated on an annual basis and forecasted over the 5 year concession period. Costs are based on the URA's cost forecasts as part of the Electricity Tariff Review Final Decision May 2010.

The utility will be expected to report detailed cost information by category to the URA on an annual basis.

The Cost Forecast consists of several categories of costs:

- Fuel Costs
- Staff Costs
- Goods and Other Costs
- Depreciation
- Provisions

6.3.1 Fuel Costs

The Generation Forecast described above estimates the amount of diesel and/or copra required to meet the forecast electricity consumption. By assuming the prices of diesel, it is then possible to estimate the cost of fuel. The global price of fuel is highly volatile, so the Indexation Formula described in Section 9 is designed to adjust the price of electricity to allow the utility to cover the reasonable cost of fuel.

The fuel cost no longer include a "Theoretical Diesel Cost" for the fuel equivalent amount of the Sarakata savings as occurred under the previous concession agreement. Hydroelectric generation forecasts are incorporated into the overall generation forecast.

Fuel costs are one of the largest costs in generation of electricity. As the weighted average price for diesel and copra fuel is passed through to electricity customers through the indexation formula, the supply of fuel by a related entity has the potential to create a situation where unfair gains are being retained within the total corporate group. Thus the URA is particularly mindful of the methods used for fuel procurement and the price paid this is discussed further in Section 10.

Stakeholders are invited to comment on URA's proposed approach and methodology in forecasting fuel costs as outlined in this section.

6.3.2 Staff Costs

Staff costs are the wage and salary costs of staff, and the labour related on-costs directly incurred in the provision of electricity. The Indexation Formula is also designed to adjust the price of electricity for changes in general wage levels.

The URA has used data on staff costs used in its Electricity Tariff Review Final Decision May 2010 for the Luganville concession. These are used to forecast staff costs over the proposed tariff period 2011 to 2015.

Stakeholders are invited to comment on URA's proposed approach and methodology in estimating staff costs as outlined in this section.

6.3.3 Goods and Other Costs

These costs included:

- Goods & materials purchased
- Purchases non-stocked (e.g. sub-contracting)
- Taxes

Goods and other purchases includes all other current costs other that fuel and staff costs, incurred in the provision of electricity. The Indexation Formula is also designed to adjust the price of electricity for changes in general goods prices. The utility pays no corporate profit taxes but does pay other duties taxes and levies. Where theses are incurred in the provision of electricity they form part of the utilities costs. The data on costs are taken from Electricity Tariff Review Final Decision May 2010.

Insurance Costs

The new draft concession agreement under Section 19 requires various insurance cover. The cost of this insurance forms part of the utility's costs. The URA proposes to conduct an audit of all Luganville concession assets and the results of this will be available after the tender is decided. The valuation of assets under this audit is required to obtain insurance quotations. Thus the insurance costs will form part of the stage two tariff determination and the winning bidder will be required to supply competitive quotes for the required coverage.

Performance Bond

The new draft concession agreement under Section 14 requires a performance bond of Vt50m. The tariff will cover the estimated costs of financing this bond. This will be calculated using the Weighted Average Cost of Capital times VUV 50M vatu.

Stakeholders are invited to comment on URA's proposed approach and methodology in estimating Goods and Other Costs particularly the cost of obtaining a performance bond and insurance cover.

6.3.4 Depreciation

Given the initial investment in the Regulated Asset Base will be zero. The first stage tariff does not include any depreciation.

Following review of the investment plans by the URA, and if approved the tariff will be increased to cover depreciation and a reasonable return on capital required for the investment plan.

Depreciation of assets purchased by the concessionaire that form part of the RAB will be straight line basis from the time of commissioning to the end of their useful life. The useful life of equipment shall be:

- Civil Works 35 years
- High and low voltage distribution network 35 years
- Transformer stations and individual connections 20 years
- Electrical installations in power stations 15 years
- Medium speed generators (less than 1500rpm) 15 years
- High speed generators (equal or greater than 1500rpm) 8 years

As part of the URA's asset audit an assessment will be made of the depreciation method and appropriate assets life.

Stakeholders are invited to comment on URA's proposed approach and methodology in calculating

depreciation in particular the timeframe of depreciation.

6.3.5 Provisions

The new draft concession agreement under Section 16 requires the concessionaire pay Vt 12 million per year into a Repair and Replacement Fund. This is covered for in the tariff.

Some provisions included in the Electricity Tariff Review Final Decision May 2010 for Luganville concession have been removed such as the provision for termination benefits as all employment contracts will be terminated with ending of the existing concession.

Stakeholders are invited to comment on URA's proposed approach and methodology in calculating provisions.

6.3.6 Costs Not Included in the Tariff

Finances charges such as interest are not included in costs recovered by the tariff as they are covered in the Reasonable Return paid on the Regulated Asset Base.

The concession fee as per Section 13 of the draft concession agreement is not included in the tariff.

Stakeholders are invited to comment on URA's proposed approach and methodology in relation to the costs not included in the tariff.

6.4 Regulated Asset Base (RAB)

The Regulated Asset Base represents the level of investment held by the operator in assets required to provide electricity generation, transmission, distribution and supply.

This is calculated as the Net Book Value of all concessionaire-funded assets in the regulated asset base. It does not include any intangible assets, assets funded by third parties, financial assets or works in progress.

The URA plans to index the RAB valuation for inflation via the Vanuatu CPI. This revaluation of assets means that a real, rather than a nominal, rate of return will be applied to calculate the Reasonable Return.

The initial RAB is set as zero for the first stage tariff setting as the concessionaire has made no initial investment in productive assets. Once the successful bidder has been determined their investment plan will be reviewed by the URA and if approved the tariff will be increased to cover depreciation and reasonable return on capital required for the investment plan.

Stakeholders are invited to comment on URA's proposed approach and methodology in conducting the tariff setting review as outlined in this section.

6.5 Reasonable Return

One of the primary aims of the methodology is to allow for a reasonable return on investment in the concession. This creates the incentive for further investment in expanding the electricity supply. This reasonable return is set to be equal to an estimate of a reasonable cost of capital for the concession. This also incentivises the operator to raise capital efficiently, as there is a financial benefit of minimising capital costs.

The method of estimating a reasonable return is the Weighted Average Cost of Capital (WACC) and is described in sections 3.6.1 and 3.6.2 of the URA's 'Electricity Tariff Review – Tariff Application Report'. The generally accepted method of estimating the WACC is the Capital Asset Pricing Model (CAPM).

Identifying the reasonable value for each of the inputs into the CAPM model poses a challenge in the Vanuatu context; as there is limited data on business risks and thinly or non-traded financial markets. Consequently, the URA has emphasized the need to have primary regard to objective market evidence when estimating the cost of capital, as well as the consistent application of models drawn from finance theory and established regulatory practice.

The objective of this methodology is to arrive at a reasonable Weighted Average Cost of Capital for an efficient and competitive firm operating the Luganville concession as a standalone business. The aim is not to replicate the utilities actual cost of capital and as the business is different in terms of risk to the combined all concession business then the WACC may also differ.

The URA will consider Cost of Capital decisions globally and in neighbouring Pacific countries including further consideration of stakeholder submissions.

6.5.1 Weighted Average Cost of Capital (WACC)

Capital can be raised in two ways: through debt or equity. Both methods have an associated cost – interest payments and dividends respectively. The level of cost for each type of capital is influenced by the perceived riskiness of the investment: the higher the risk, the higher returns that must be offered to sources of capital, resulting in a higher cost of capital. The process of determining a reasonable return estimates the appropriate return for each source of capital. The cost of capital is weighted by their respective contributions to the total capital base.

$$WACC = (R_e \times \%\ of\ capital\ that\ is\ equity) + (R_d \times \%\ of\ captial\ that\ is\ debt)$$

where

R_e = return on equity capital

R_d = return on debt capital

The method of estimating the appropriate returns from each type of capital is the Capital Asset Pricing Model (CAPM), explained below.

6.5.2 Capital Asset Pricing Model (CAPM)[4]

The Capital Asset Pricing Model (CAPM) provides an estimate of the required return for risky assets as the sum of the return from risk-free assets and an appropriate risk premium. The calculation is different for debt and equity:

Cost of Equity

$$R_e = r_f + \beta(MRP + CRP)$$

Where

R_e = required return on equity

R_f = the risk free rate of return is the return an investor could reasonably expect if they invested their money in a riskless investment. As the market rarely offers a riskless investment, a proxy for the risk free rate is applied

β = is the scaling factor beta (β) to be applied to the market risk premium, it measures the volatility of the specific assets relative to the entire market. If the assets are more volatile than the market average, then the beta to be applied is greater than one

MRP = The difference between the expected return on a market portfolio and the risk-free rate

[4] See 'URA Electricity Tariff Review Final Decision May 2010' section 4.15 for a detailed description of the inputs into the CAPM model

CRP = Country risk premium refers to an increment in return that would have to be paid for loans and investment projects in a particular country compared to a risk free standard

Cost of Debt

$$R_d = r_f + DRP + \text{CRP}$$

where

R_d = required return on debt

R_f = is the risk free

DRP = the risk that a company defaults on their debt obligations is credit risk

For a detailed description of the inputs into the CAPM model as used in the URA's all concessions final decision see Section 4.15 of the Final Decision Paper.

Stakeholders are invited to comment on URA's proposed approach and methodology in calculating the reasonable return as outlined in this section.

6.6 Base Price

6.6.1 First Stage Base Tariff

The first stage Base Tariff is set at a level where the utility earns revenue from electricity sales equal to the Cost Forecast. It is calculated as an average over five years, assuming constant input prices (fuel, wages, and materials). It is on the basis of this tariff that the final tender bids are received.

The Base Tariff is calculated by:

- Forecasting the Total Demand (kWh and kVA) in terms of P
- Divide Forecast Costs by the forecast Total Demand to give the Base Tariff value of $P_{0.}$

$$P_{0\text{FIRST}} = \frac{Forecasted\ Costs}{Total\ Demand}$$

6.6.2 Second Stage Base Tariff

Given that the initial level of planned investment is unknown the stage one tariff will be set assuming a regulated asset base of zero as all government assets will be taken over free of charge by the winning bidder. This will be the tariff that is used for the Luganville tender process. Following a review of the investment plans by the URA the tariff will be adjusted to cover depreciation and reasonable return on capital required for the approved investment plan.

If the plan is not carried out as scheduled then the excessive tariff paid will be clawed back with interest at the next tariff review.

Insurance costs will also be assessed at this stage and the tariff adjusted accordingly.

The Base Tariff is set at a level where the utility earns revenue from electricity sales equal to the Cost Forecast plus a Reasonable Return. It is calculated as an average over five years, assuming constant input prices (fuel, wages, and materials).

The Base Tariff is calculated by:

- Forecasting the Total Demand (kWh and kVA)
- Applying the WACC to the Regulated Asset Base to give the Reasonable Return
- Adding the Reasonable Return and Costs to give a Total Required Revenue
- Divide Total Required Revenue by the forecast Total Demand to give the Base Tariff value of P_0.

$$P_{0FINAL} = \frac{Forecasted\ Costs + Reasonable\ Return\ on\ Regulated\ Asset\ Base}{Total\ Demand}$$

The Base Tariff is referred to as P_0. This is used in the tariff indexation formula to calculate the price of electricity each month earned by the concessionaire. The monthly calculated price is referred to as P (not to be confused with P_0), and is used with the Tariff Structure to determine the total monthly revenue earned by the utility. The indexation formula is described in the Section 9.

Due to the government's policy of uniform tariffs the P earned by the utility may not be the P charged to consumers.

Stakeholders are invited to comment on URA's proposed approach and methodology in calculating the base tariff as outlined in this section.

7 Tariff Equalisation Mechanism

The Luganville tender process raises the possibility of multiple electricity operators in Vanuatu. Each concession has a different cost base thus a different tariff may be earned by the utility.

It is Vanuatu government policy that uniform tariffs be maintained across all four current concession areas. In order to maintain the uniform electricity tariffs across all of Vanuatu with the possibility of more than one operator, an explicit mechanism is required to balance the revenue across the operators.

7.1.1 Definition of Uniform Tariffs

Uniform tariff does not mean that all customers in the same category must pay the exact same price per kilowatt-hour. Rather the definition applied by the URA is a form that allows individual utilities to discount to specific customers or groups of customers. Uniform tariffs are thus defined as the average price paid be customers across the concessions (P) is the same. If one utility applies discounts below the recommended tariff the discounts comes out of their revenue.

7.1.2 Principles

The following principles have guided the design of this mechanism:

- It must allow for the possibility of multiple operators.
- It must allow for uniform tariffs across all of Vanuatu.
- It must allow all electricity operators to cover their reasonable costs and earn a reasonable return on their investment in the electricity concession.
- It must maintain incentives to increase electricity connections, operate efficiently, and use renewable energy.
- One operator must not be able to influence the results of another operator.

7.2 Automatic subsidy management

In order to automatically balance the tariffs across all of Vanuatu, the adjust price charge to customers due to the equalisation mechanism is as follows

$$P_C = \frac{D_{PV}.P_{PV} + D_L.P_L}{D_{PV} + D_L}$$

Where;

P_C = is the price charged to all customers

P_{PV} = result of pricing formula for Port Vila, Malekula and Tanna

D_{PV} = total demand in Port Vila, Malekula and Tanna (in P)

P_L = result of pricing formula for Luganville

D_L = total demand in Luganville (in P)

In the case where Luganville has a lower utility earned tariff, the mechanism will result in

$$Payment\ to\ mechanism = (P_C - P_L) \times D_L$$

$$Payment\ from\ mechanism = (P_{PV} - P_C) \times D_{PV}$$

P_C is set so that the payments to and from the mechanism are equal.

Given that D_{PV} and D_L are known at month end the equalised price charge to customer can be calculated by the URA prior to the issuing of monthly bills.

7.3 Timing of the equalisation mechanism payments

So as to not adversely impact the cash flow or working capital position of the operator that must pay into the equalisation mechanism, the payment should be required after such a reasonable time as the operator can be expected to have collected the revenue from customers for that month. As such, it is recommended that payment into the equalisation mechanism be required within 35 days of the start of the month for which P is set.

For example:

- Day 1: Start of the month. Pc calculated based on previous month's data.
- Day 10-15: Customer bills sent out using P_c
- Day 30: Customer payments due
- Day 35: Payment into equalisation mechanism due.
- Day 40: Payment out of equalisation mechanism due.

P_{PV} represents the price for Port Vila, Tanna and Malekula, and P_L represents the price for Luganville. Each formula is calculated monthly, and the higher of the two prices is charged to customers across all concessions.

Stakeholders are invited to comment on URA's proposed approach and methodology in calculating the tariff equalisation mechanism.

8 Tariff Structure

As part of the Governments uniform tariff policy and in line with their desire to reduce the electricity costs of low end customers, the URA will apply the same tariff structure for Luganville as applied in the all concessions final decision as shown below.

Customer group	Price per kWh	Monthly fixed charge	Security deposit
Small Domestic Customers	Up to 60 kWh = 0.34 x P 61 to 120 kWh = 1.21 x P Over 120 kWh = 3.00 x P	None	70 x P
Other Low Voltage Customers (Domestic)	1.21 x P	5 x P per subscribed kVA	150 x P per subscribed kVA
Business Licence Holders – Low Voltage	0.87 x P	20 x P per subscribed kVA	150 x P per subscribed kVA
Sports Fields	1.00 x P	None	None
Public Lighting	0.54 x P	None	None
High Voltage Users	0.70 x P	25 x P per subscribed kVA	150 x P per subscribed kVA

Stakeholders are invited to comment on URA's proposed approach and methodology in relation to the tariff structure.

9 Indexation Formula

The purpose of the indexation formula is to allow for fluctuations in certain input prices beyond the utilities control (fuel, wages and materials) to be passed through to electricity customers. The aim, therefore, is to link each component to an index that will reasonably accurately reflect the impact of input price changes on costs.

This allows the utility to collect sufficient revenue to supply electricity services should input prices increase, and allow customers to benefit when input prices fall.

The building blocks described in Section 6 above set the level of the base index price P_0. The base index price P_0 is then used with an indexation formula to calculate the monthly electricity price P that is earned by the concessionaire in Luganville.

9.1 Objectives

The objectives of an indexation formula are:

1. It closely tracks the actually changes in costs faced by the concessionaire.
2. All indexes used need to exist and are be updated regularly.
3. It is independent.
4. The indexes are directly connected to costs in Vanuatu.
5. It is simple and understandable.

The formula in the all concessions Final Decision has been changed given its failure to meet several of these objectives.

9.2 The Formula

The formula indexes two components:

- All variable costs are index to the Vanuatu CPI[5] published by the National Statistics Office. The variable costs means the Staff and Goods and Other Costs described in Section 6.3.
- Fuel costs are linked directly to the fuel price paid.

The CPI is used rather than a PPI index as no PPI index currently exists in Vanuatu.

9.2.1 The Indexation formula

$$P = P_0 \times \left(\left[X_{FUEL} \times \frac{G}{G_0} \times \frac{N}{N_0} \right] + \left[X_{VARIABLE\ COSTS} \times \frac{CPI}{CPI_0} \right] + X_{OTHER} \right)$$

X_{FUEL} = the co efficient for fuel costs described below

G = average fuel price as described below

G_0 = the base value for the price of fuel

N = is the adjustment to fuel indexation to take account of non fuel energy production as described below

N_0 = Is the base value for N, set according to the five-year average forecast level of N

[5] http://www.spc.int/prism/country/vu/stats/P_releases/CPI%20Release%202010Q1.pdf

$X_{VARIABLE\ COSTS}$ = the coefficient for Staff Costs and Goods and Other Costs as described in Section 6.3

CPI = the Vanuatu CPI index. The CPI index will be applied the month following the publishing of any update. This is done on a quarterly basis but there are occasionally delays in publication.

CPI_0= the base value of the CPI index set to the value of the index for the quarter prior to the start of the tariff period.

X_{OTHER} = the co efficient for the remaining costs (fixed)

9.2.2 The fuel price formula

$$G = \frac{G_L L_L + G_{Lc} L_{Lc}}{L_L + (L_{Lc}\, Kpci)}$$

Where:
G_L is the diesel price in Luganville
L_L is the litres used
G_{LC} is the Copra price in Luganville
L_{LC} is the litres of copra used

9.2.3 Renewable Component

As per the all concessions Final Decision paper the renewable component is retained. The fuel component of the formula should be adjusted by the proportion of power generated by fuel (N), where

$$N = Average\ for\ previous\ twelve\ months\ of \left(\frac{Energy\ produced\ by\ diesel\ and\ copra}{Total\ energy\ produced}\right)$$

N_0 is set according to the five-year average forecast level of N. Thus formula for calculating the fuel component of the price is:

$$X_{FUEL} \times \frac{G}{G_0} \times \frac{N}{N_0}$$

9.2.4 Formula Coefficients

The proportion of the tariff that each component represents is referred to as the coefficient of that component. For example, if fuel costs make up 20% of the tariff revenue, then the coefficient of fuel costs (X_{FUEL}) will be 0.20. The coefficients are set based on the forecasts of the different areas of costs, with assumed constant input prices. The assumed constant input price forms the starting value for each index.

For illustrative purposes only the coefficients for Luganville are approximately:

X_{FUEL} = **Fuel coefficient**	**0.27**
$X_{VARIABLE\ COSTS}$ = **Goods + Staff coefficient**	**0.53**
X_{OTHER} = **Fixed coefficient**	**0.20**

Stakeholders are invited to comment on URA's proposed approach and methodology in relation to the indexation formula.

10 Fuel Procurement

Fuel costs are one of the largest costs in the generation of electricity. As the weighted average price for diesel or copra fuel is passed through to electricity customers through the indexation formula, the supply of fuel by a related entity has the potential to create a situation where unfair gains are being retained within the total corporate group. Thus the URA is particularly mindful of the methods used for fuel procurement and the price paid.

URA intends to monitor the Luganville diesel fuel price and its relationship to the Port Vila price and the Singapore fuel price and will request explanations for any anomalies in the price paid and publish the price the utility is paying. The URA may also request to view supply contracts and invoices with all fuel supplier to ensure fuel purchasing is efficient and that any discounts or rebates are passed back through to the tariff.

10.1 Copra purchasing

The URA intends to weigh up its competing objectives on the government policy to promote the coconut industry with its objective of least cost generation. If the cost of using coconut oil were to rise dramatically above the cost of diesel the URA would review its use.

Concerns were raised in the all concession Final Decision over the relatively high cost of coconut oil relative to diesel. UNELCO responded to these concerns by stating:
"Regarding the purchase price of processed coconut oil, UNELCO further confirms that it will make every effort to ensure that the average price remains below or at the most equal to the substitution cost of imported diesel."

Given the cost concerns and potential related party transactions the URA intends to include a copra purchasing clause as per the all concession Final Decision as shown below:

The price of coconut oil for the purposes of Section 2 shall be deemed to be the lesser of:

a) The Actual Price paid by the Concessionaire therefor; or

b) G_L as defined above converted to the equivalent volume of coconut oil in accordance with Kpci

The Actual Price shall be

a) the net price after all deductions, rebates and discounts whatsoever;

b) when the coconut oil is purchased from a person who;

i. has not produced the coconut oil; and

ii. is a person in whom the Concessionaire has a direct or indirect financial interest

the net price after deductions, rebates and discounts whatsoever as paid by that person

c) when the coconut oil is purchased from a person who

i. has produced the coconut oil and;

ii. is a person in whom the Concessionaire has a direct or indirect financial interest

such CIF price as may be reasonably obtained from an alternative supplier.

Stakeholders are invited to comment on URA's proposed approach and methodology in relation to the fuel procurement.

11 Incentives to Promote Renewable Energy

In relation to renewable electricity generation the URA is faced with several competing objectives:

1. To achieve long run least cost generation
2. To reduced the reliance on imported diesel fuel
3. To apply the government's policy of supporting the local copra industry

Renewable electricity supplies, when capital costs and costs of finance are included, may often be more expensive supply sources than diesel. Thus the URA faces objectives that may by conflicting.

Reconciling these competing objectives may be achievable where donor and development bank funding of renewable electricity sources is available. The use of grants, subsidized loans and other mechanism can achieved competitive long run generation costs otherwise not possible. The URA encourages the utility to seek these funding sources and will review each proposal on a project by project basis.

Stakeholders are invited to comment on URA's proposed approach and methodology in relation to the promotion of renewable energy.

Appendix A: Proposed next steps and indicative timeline

As described in Section 3.3 the next steps in the tariff setting process are:

- **Establish the methodology** for the tariff calculation and highlight issues relevant to the Luganville concession. The URA will established the method to be used to calculate the level of the tariff in consultation with stakeholders through this Framework Paper;
- **Submissions from Stakeholders**. The URA will seek stakeholder submissions on any of the issues raised in this document prior to and during the Luganville tendering process;
- **URA's Luganville Electricity Tariff Draft Decision Paper**. The URA will incorporate feedback to this document and publish a draft tariff decision for the Luganville concession in early August. It will indicate the assumptions that the URA believed are appropriate for the setting of the tariff, the tariff level, structure of an equalisation mechanism and indexation formula.
- **Consultation**. Luganville Electricity Tariff Draft Determination will be made available to the public and all interested stakeholders. The URA will invite submissions on this paper and respond to them in their Final Determination.
- **Asset Audit and Valuation**. As part of the tariff review process the URA will commission an audit of all the assets of the Luganville concession. The Audit results will be used to determine the appropriateness of replacement provisions, to allow costing of the insurance cover required in the concession agreement and identify all government owned assets.
- **URA's Luganville Electricity Tariff Determination.** The URA proposes to publish its Tariff Determination in two stages. Following consultation on the URA's Luganville Electricity Tariff Draft Decision Paper, the URA will publish its decision on the Luganville Electricity Tariff Determination Stage 1 in August 2010. This tariff, tariff structure, equalisation mechanism and indexation formula and rate of return on investments will be published by the URA.

  The URA proposes to expeditiously assess the investment plans submitted by the tenderers and in consultation with the successful bidder make its determination on the regulated asset base, depreciation and reasonable return.

  The URA will publish its Luganville Electricity Tariff Final Determination which will take effect upon gazettal and applied to the new Luganville concession agreement.

The following table sets out the URA timeline* for the Luganville electricity tariff setting process.

Publish Luganville Tariff Setting Framework Paper	19 July 2010
Submission on Framework Paper due	28 July 2010
Draft Tariff Determination Stage 1 published	2 August 2010
Submissions on Draft Tariff Determination Stage 1 due	9 August 2010
Tariff Determination Stage 1 published	16 August 2010
Draft Tariff Determination Stage 2 published	12 September 2010
Submission on Draft Tariff Determination Stage 2 due	24 September 2010
Final Tariff Determination published	4 October 2010

*Proposed indicative timeline

Appendix B: Forecast of hydroelectric generation

This document was prepared as part of the all concessions tariff review.

Estimated Production for the Santo Hydro

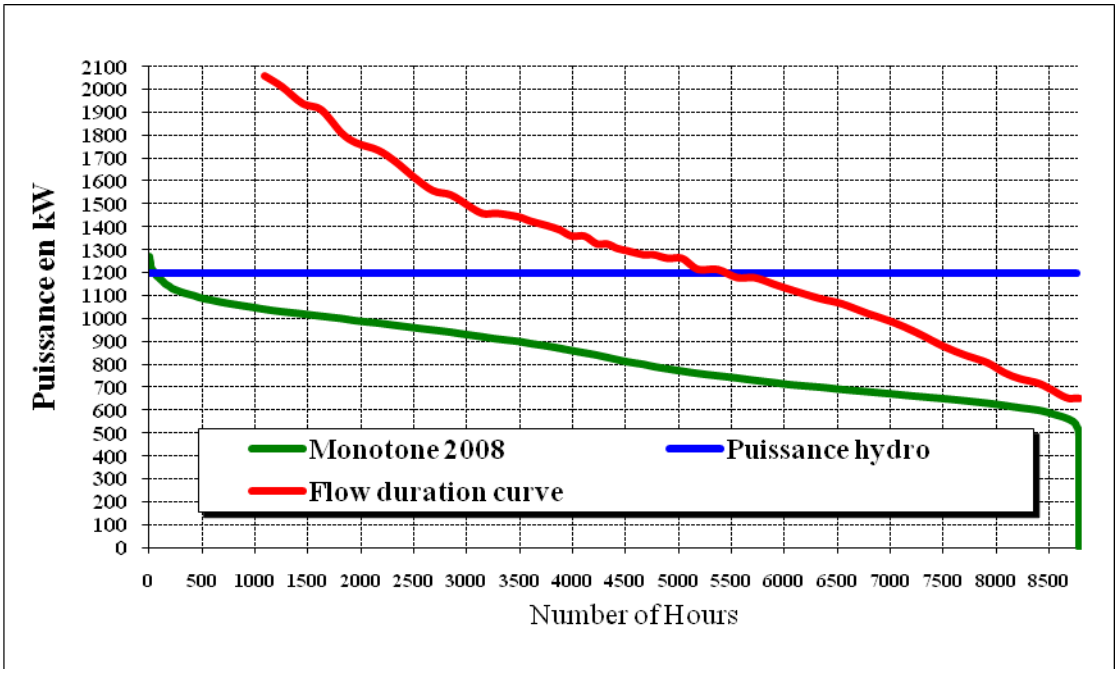
The Santo hydro consists of:
2 x 300 kilowatts asynchronous machine
1 x 600 kilowatts synchronous machine

This is supplemented by diesel generators:
2 x 1000 kW
1 x 750 kW
1 x 400 kW
1 x 250 kW
All Cummins engine output synchronous generators

Peak demand is estimated at:
Maximum during the days = 1200 kilowatts
Minimum during the night = 650 kilowatts

During the day, when the peak exceeds 800 kilowatts of load, the demand is supplemented by the diesel generators. At night, the pattern of consumption does not require the diesel generators.

Method and Assumptions
We use the monotonic load shown below for 2008 to give a possible annual hydro production of 7 000 000 kWh.



This number is calculated by subtracting the diesel production o 200 kW and using the 800 kilowatts of load, which imposes a de facto nominal power of 1000.

We deduce the load curve of total production by the triangle of 4500 hours on 200 kilowatts (see chart): (4500h x 200kw) / 2 = 450 000 kWh.

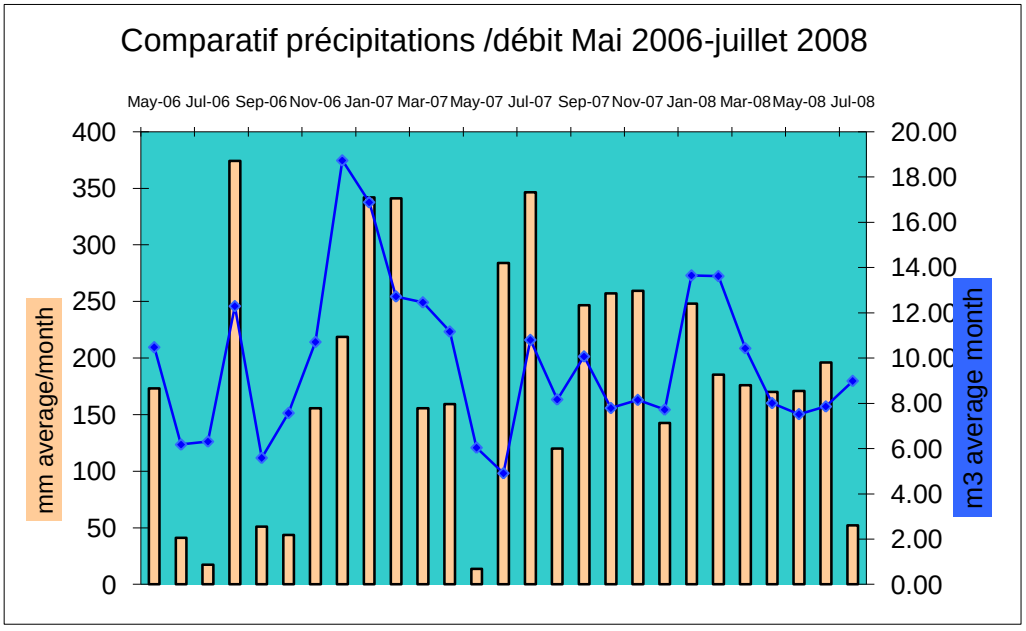
Assumptions

- 1 month full stoppage of the hydro to repair major damage to the step-down transformers, the cell departure and arrival, or the transmission line.

  This will reduce the hydro power supply to zero despite the potential dam capacity being available. Production will be based solely on the diesel generator on the basis of the average power of 900 kilowatts demand for 24hrs x 30days = 648 000 kWh.

- 2 months a year period of low water flow causing a provision of 400 kilowatts a month, 600 kilowatts on the second month. This power demand must be supplied by the diesel generators which as above add 900 kilowatts per half day.

  When the maximum hydro production is 400 kW the following diesel production is required:
  500 kilowatts x 720 h / 2 = 180 000 kWh by diesel generation
  When the maximum hydro production is 600 kW:
  300 kilowatts x 720 h / 2 = 108 000 kWh by diesel generation



With the above assumptions the annual producible hydroelectricity is calculated as:

7 000 000 kWh (theoretical maximum)
- 450 000 kWh *share of annual* diesel
- 648 000 kWh due to major damage
- 288 000 kWh due to rainfall deficit.
= 614 000 kWh production annually by hydroelectric power station.

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You can access the Electricity Tariff Review Framework – Framework Paper by referring to our website www.ura.gov.vu, contacting us by telephone (+678) 24945, fax (+678) 2308, email: tmael@vanuatu.gov.vu or writing to us at Office of Utilities Regulatory Authority, PMB 9093, Port Vila, Vanuatu.