Utilities Regulatory Authority

Final Decision and Commission Order

Case S-0003-15

In the matter of establishing Standards and Rules for Solar Photovoltaic installations in Vanuatu

April 2016

CONTENTS

Foreword

The Utilities Regulatory Authority (URA) Commission is pleased to issue this Final Decision and Order prescribing the standards for safe installation and reliable operations of zero export Solar Photovoltaic (Solar-PV) systems (**Installation**) by electric customers of concessionaires in Efate, Malekula, Tanna and Santo for self-use (S-0003-15). Other members of the public not customers of Unelco in Efate, Malekula, Tanna ot VUI in Santo are not obligated to comply with these standards, however the Commission strongly urges that they do so for their own safety.

Self-generation technology allows customers to reduce the amount of energy consumed from the grid for normal mains-powered appliances. The core operational aspect of such Installation is that it utilizes solar energy when it is available and switches to the network when solar energy is insufficient to meet the electrical energy needs of the end user. Such Installation does not feed any energy back into the grid. It enables the customer to reduce their consumption from the network without constraining their usage. This is no different from a customer reducing his use through energy conservation, smart appliance buying, or switching from electric to gas cooking, all permissible actions.

The Installation empowers customers to manage their electricity expenses through investment in solar generation equipment where economically viable or for environmental concerns. A key component of this empowerment is for customers to be able to use their own generated power when they can and benefit from the reduced consumption from the network.

The sustainability of such Installations in Vanuatu is enhanced with these Solar-PV Installation Standards and ensure the safety of the public and technicians.

The Solar-PV Installation Standards have been drafted and compiled in accordance with the URA framework for issuing Electricity Safety Standards by adopting Australian / New Zealand standards with certain changes where it was considered necessary for Vanuatu. It also incorporates reliability standards to mitigate quality and availability issues that may be experienced by users or that may arise as a result of any installations connected to the grid.

The URA Commission after its deliberations has determined that the recommendations of the URA Staff should be adopted through this Final Decision.

We urge the Government, UNELCO, VUI and all interested persons to support the Decision and its implementation.

Johnson Naviti Matarulapa Marakipule, Chairman

Hasso Bhatia, *PhD*, CEO and Commissioner

John Obed Alilee, Executive Commissioner

Introduction

1 Case Information

Table 1: Case information

Case number	S-0003-15
Sponsor	Utilities Regulatory Authority
In the matter of	In the matter of establishing standards for PV-Solar installations (zero export) in Vanuatu
Case opened	16 December 2015
Date of Final Order	7 April 2016

2 Purpose of this document

This document sets out the Final Decision and Commission Order establishing safety standards regulating installation and operation of zero export Solar Photovoltaic (Solar-PV) systems (**Installation**) by electric customers of Unelco in Efate, Malekula, Tanna and VUI in Santo for self-use. Installation does not feed any energy back into the grid. Other members of the public who are not customers of Unelco or VUI are not obligated to comply with these standards, however the Commission strongly urges that they do so as it is for their own safety and the safety of their Solar-PV installations.

3 The need for the Solar-PV Standards

There is currently no regulation in place governing how electricity customers can safely install and maintain zero export Solar-PV systems in Vanuatu.
The Solar-PV Installation Standards have been drafted and compiled in accordance with the URA framework for issuing Electricity Safety Standards by adopting international standards such as the Australian / New Zealand standards with certain changes to fit the conditions in Vanuatu.

The endorsement of this level and detail of standards is required not just for safety but to allow solar installations to access insurance and financing where it would otherwise not be available, especially given Vanuatu's exposure to natural disasters.

The URA understands that solar installation companies sometimes have their own sets of standards of works applied to their solar installations. These Solar-PV Installation Standard may be somewhat higher set of standards that apply to all Installations done by electric customers of concessionaires in Efate, Malekula, Tanna and Santo for self-use. All other sets of solar standards must work in collaboration or within the scope of these Solar-PV Installation Standards.

4 Renewable energy policy

Renewable energy and solar is a key focus of the Government's energy policy. The National Energy Roadmap

(NERM) describes the following overall vision:

To energize Vanuatu's growth and development through the provision of secure, affordable, widely accessible, high quality, clean energy services for an Educated, Healthy, and Wealthy nation.

The Roadmap includes aggressive targets of 40% renewable energy generation by 2015 and 65% by 2020. Given the priority of renewable energy as a Government policy, these Solar-PV Installation Standards are important to encourage and achieve the renewable targets with safety and reliability.

5 Legal overview

The legislation governing the generation of electricity by the public for self-use is governed by the Electricity Supply Act CAP 65 as amended and the Utilities Regulatory Authority Act 11 of 2007 as amended.

Pursuant to the provisions of the Electricity Supply Act CAP 65 (**ESA**), a person who is not a concessionaire is permitted to generate electricity for his or her own use in any dwelling house, store, workshop or any other premises owned or occupied by that person (Sections 1B(1) and 4(2) of the ESA).

Under the Utilities Regulatory Authority Act (**URA Act**) the URA is mandated to ensure the provision of safe, reliable and affordable regulated services, maximize access to regulated services throughout Vanuatu and promote the long term interests of consumers (Section 2 of the URA Act).
The URA Act specifically empowers the URA to issue safety standards and reliability standards in relation to the safety and reliability of a regulated service in any place (Sections 14(1) and 17(1) of the URA Act). When determining whether to issue safety or reliability standards, the URA must have regard to the cost and convenience of compliance with the standards and nature and magnitude/importance of risk/issue addressed (Sections 14(3) and 17(3) of the URA Act). Pursuant to Section 12(2) of the URA Act, the URA must exercise its functions in a way that considers the interests of, and impact on, consumers and utility businesses as well as Government policy.

Electricity customers of UNELCO in Port Vila, Malekula and Tanna (pursuant to concession contracts) are required to inform UNELCO of operation of such installation a month in advance and to observe the safety guidelines.. This has been provided for in the Standard.

1 The Standards and Applicability

These Standards regulate the installation and operation of Solar-PV (zero export) systems (**Installation**) by electric customers of a regulated electricity utility in Vanuatu for self-use pursuant to the Electricity Supply Act. Such Installation does not feed any energy back into the grid.

Other members of the public (not customers of an electricity utility) are not obligated to comply with these Standards, however, the Commission strongly urges that they do so as it is for their own safety and safety of the persons around the installations.

Suppliers and installers are urged to comply with and adhere to the Standards, however the ultimate responsibility rests upon the user and installer on a given premises.

These standards apply primarily to Solar-PV installations commissioned after the gazettal date of this Standard. However, pre-existing Solar-PV installations shall also make effort to upgrade their installations to meet these standards.

2 Objective

The objective of this Standard is to:

(a) Improve the safety and performance of all solar photovoltaic power (zero export) systems installed and operated in Vanuatu;

(b) Encourage adoption of current technology and safety features available for design, installation and operation of solar photovoltaic power (zero export) systems;

(c) As an empowerment tool to domestic customers, to consider solar roof top systems to manage their energy costs; and

(d) Increase confidence in the design and installation work of all solar photovoltaic installations, thus increasing the ability to access insurance and finance.

3 Contravention of the Standards

Where the URA finds (itself or having it been brought to its attention by a third person) there is a potential of non-compliance, the URA may undertake safety inspections (Section 16 of the URA Act).

In the event of non-compliance with the Standards, the URA may issue safety orders (Section 15 of the URA Act), issue infringement notices (Section 25 of the URA Act) and levy penalty on such contravening person in accordance with the URA Act.

4 Notification to Utility

(a) An electricity consumer (within a concession area) setting up an Installation in compliance with these Standards (and not exporting power to the grid), is required to notify the utility at least one month prior to commencement of generation by sending the commissioning notice in the form set out in Annexe I. The electricity consumer must ensure that the notice is submitted to the utility by registered letter with acknowledgement of receipt or by a suitable method.

(b) No agreement or approval is required to be obtained from the utility for zero export Solar-PV installations designed and installed in accordance with this Standard.

5 Notification to URA

For information collection purposes only a copy of the commissioning notice shall be provided to the URA one week prior to the commissioning date.

6 Independent Expert Signoff

(a) All Solar-PV installations must be performed by qualified and licensed electricians.

(b) Solar-PV installations (zero export) larger than 4kWp single phase or 10kWp three-phase, shall require independent sign off from an expert recognized and accredited organization specializing in design, construction and installation of Solar-PV systems.

(c) The owner of a Solar-PV system shall ensure that any point of connectivity of the system to the utility network has been inspected and tested by a certified electrician with local utility knowledge.

7 Minimum Standards

7.1 Appliacble Standard for Installation of photovoltaic (PV) array

7.1.1 Source

Standard: AS/NZS 5033: Installation and safety requirements of photovoltaic (PV) arrays.

7.1.2 Description

This standard sets out general installation and safety requirements for photovoltaic (PV) arrays, including direct current (DC) array wiring, electrical protection devices, switching and earthing up to but not including energy storage devices, power conversion equipment or loads.

7.1.3 Application

All Solar-PV installations, either domestic or commercial, shall be done in accordance with AS/NZS 5033 standard.

7.1.4 Amendments for Vanuatu

In addition to Section 6 of the AS/NZ 5033, signage shall also be written in Bislama as shown in Annexe II.

7.2 Applicable Standard for Stand Alone Power System – Safety

7.2.1 Source

Standard: AS/NZS 4509.1: Stand-alone power systems-Safety and Installations.

7.2.2 Description

This Standard sets out safety and installation requirements for stand-alone power systems used for the supply of extra-low voltage (ELV) and/or low voltage (LV) electric power to a single load, or an electrical installation in a single residence or building, or a group of residences or buildings and associated items with switchboards to AS/NZS 3000 requirements.

This Standard covers:

(a) Equipment up to, and including, the output of the stand-alone power system (i.e. the point of supply-see the definition in Clause 1.4.12 of the AS/NZS 4509.1 Standard,); and

(b) direct connection of a stand-alone power system to -

  (1) a single load (e.g. a water pump);

  (2) a single electrical installation (e.g. a residence); or

  (3) a group of independent electrical installations (e.g. a number of separate residences and/or buildings)

This Standard includes minimum rating and over-current protection requirements for the consumer mains and earthing arrangements.

System maintenance matters are also included in Appendix A of the AS/NZ 4509.1 standard.

7.2.3 Application

Stand-alone power systems and the connection to an electrical installation shall be in accordance with AS/NZS 3000, except as varied herein and with the applicable additional requirements of this Standard.

Where applicable, all solar photovoltaic installations are to be installed and maintained in accordance with this standard.

7.2.4 Amendments for Vanuatu

In Addition to sections on signage in AS/NZS 4509.1, signage will also be in Bislama as shown in Annexe II.

7.3 Applicable Standard for Stand Alone Power Systems – Design

7.3.1 Source

Standard: AS/NZS 4509.2 Stand-alone power systems-System Design.

7.3.2 Description

This standard sets out requirements and guidance for the design of stand-alone power systems with energy storage at extra-low voltage used for the supply of extra-low and low voltage electric power in a domestic situation. Equipment up to the system output terminals is covered. The principles in this standard are applicable to other systems including commercial and industrial applications.

7.3.3 Application:

All solar photovoltaic installations shall be designed in accordance with this standard.

7.3.4 Amendments for Vanuatu:

Subject to Rule 7.4, systems are required to be re-inspected after serious natural disasters (e.g. hurricanes, earthquakes etc).

7.4 Applicable Standard for Structural Design actions – Structural Design

7.4.1 Source

Standard: AS/NZS 1170 Structural design actions.

7.4.2 Description

This standard provides the procedure for structural design. It includes design procedures, reference to design actions (other parts of the series), combinations of actions, detailing for robustness, methods of analysis and methods for confirmation of a limit states design.

7.4.3 Application

All solar installations are to be installed in line with these two standards where applicable.

7.4.4 Amendments for Vanuatu

None required.

7.5 Applicable Standard for Structural Design actions – Structural Design for Wind Actions

7.5.1 Source

Standard: AS/NZS 1170.2 Part 2: Structural Designs-Wind actions.

7.5.2 Description

This Standard sets out procedures for determining wind speeds and resulting wind actions to be used in the structural design of structures subjected to wind actions other than those caused by tornadoes.

The Standard covers structures within the following criteria:

(a) Buildings less than or equal to 200 m high.
(b) Structures with roof spans less than 100 m.
(c) Structures other than offshore structures, bridges and transmission towers.

7.5.3 Application:

All solar installations are to be installed in line with these two standards where applicable.

7.5.4 Amendments for Vanuatu:

Given the risk of cyclones in Vanuatu the below additional standards apply:

(a) Panel racking must be installed to manufacturing installation guidelines.
(b) Installers must inform customer in writing of the limits to wind loading of all installations.
(c) Racking should be inspected at least every 5 years and following any serious storm events.

7.6 Applicable Standard for Solar-PV installation electrical wiring

7.6.1 Source

Standard: AS/NZS 3000 Electrical installations.

7.6.2 Description

This standard sets out requirements for the design, construction and verification of electrical installations, including the selection and installation of electrical equipment forming part of such electrical installations.

These requirements are intended to protect persons, livestock, and property from electric shock, fire and physical injury hazards that may arise from an electrical installation that is used with reasonable care and with due regard to the intended purpose of the electrical installation.

In addition, guidance is provided so that the electrical installation will function correctly for the purpose intended.

7.6.3 Application

All solar photovoltaic installations shall be installed in line with this standard where applicable.

7.6.4 Amendments for Vanuatu:

None required.

7.7 Applicable Standard for Cable Selection for Solar-PV Installation

7.7.1 Source

Standard: AS/NZS 3008. Electrical installations—Selection of cables
Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions.

7.7.2 Description

This Standard sets out a method for cable selection for those types of electrical cables and methods of installation that are in common use at working voltages up to and including 0.6/1 kV at 50 Hz a.c. Three criteria are given for cable selection, as follows:

(a) Current-carrying capacity
(b) Voltage drop
(c) Short-circuit temperature rise

This Standard provides sustained current-carrying capacities and voltage drop values for those types of electrical cable and installation practices in common use in Australia. A significant amount of explanatory material is also provided on the application of rating factors that arise from the particular installation conditions of a single circuit or groups of circuits. Also, provided in Section 5 is information on cable selection based on short-circuit temperature limits.

7.7.3 Application:

Cables for solar photovoltaic installations shall be selected in line with this standard where applicable.

7.7.4 Amendments for Vanuatu:

Not required

7.8 Applicable Standard for Installation requirement for Grid connected Solar-PV

7.8.1 Source

Standard: AS 4777.1 - Grid connection of energy systems via inverters.

7.8.2 Description

AS 4777.1 Specifies requirements for the installation of inverter energy systems with ratings up to 10 kVA for single-phase systems, or 30 kVA for three-phase systems, onto the low-voltage electricity distribution network (grid).

7.8.3 Application

Where applicable, a solar photovoltaic installations shall be connected to a utility grid in line with this standard.

Section 5.2 of AS 4777.1 requires special attention for safe connectivity of inverters and grid protection devices to the electricity grid in Vanuatu.

7.8.4 Amendments for Vanuatu:

Where applicable, signage as required by Section 5.5 shall also be in Bislama subject to Annexe II.

Annexe I. Month Notice of System Commissioning

A notice in this form must be provided to the electric utility serving the area,
Date of Notice:
Date of planned commissioning:
Address of Installation:
Brief Description of installation:
PV module manufacturer and model number:
Number of modules in series in a string:
Number of strings in parallel in PV array:
Inverter manufacturer and model number:
Number of inverters:

Accredited installers name:
Accreditation number:
Organization accredited to:
I verify that the above system has been installed to all relevant standards
Signed: Date:

Accredited Designers name:

Licensed electrician's name:
Electricians license number:
Signed: Date:

Annexe II. Signage Required in Bislama

	Denja: D.C Voltej long ples ia i save kilim yu
DO NOT WITHDRAW FUSE UNDER LOAD	No mas karemaot fius taem elektrisiti hemi on i stap
PV ARRAY DC ISOLATOR	Swij blong ofem ol sola panel
	Denja: Ikat fulap sola pawa sos long ples ia. Blong yu shatem daon ikwipmen ia, yu mas offem evri swij blong ol sola isolatas.
DO NOT SWITCH OFF POWER SUPPLY	Yu no mas offem powa saplae
	Denja: Electriciti long ples ia i save kilim yu. Yu no save kam insaed

MAIN SWITCH INVERTER SUPPLY	Bifala Swij blong Inveta Sapplae
WARNING DUAL SUPPLY ISOLATE BOTH NORMAL AND SOLAR SUPPLIES BEFORE WORKING ON THIS SWITCHBOARD	Denja: I gat 2 pawa saplae long ples ia. Yu mas offem normal pawa mo sola pawa fastaem bifo yu statem wok long swijbod ia.
	Sola panel (I stap wea?) .....
SOLAR ARRAY *(specify location)* _____ **Short Circuit Current** *(specify)* _____ **A** **Open Circuit Voltage** *(specify)* _____ **V**	**Shot Seket Karen** (hamas?) ..... **Open Seket Volteg** (hamas?) .....
INVERTER LOCATION _____	Ples we Inveta i stap long hem .....
	Sola Sistem

Annexe III. Summary of Solar-PV Standards

Applicable Standard
AS/NZS 5033 Installation of photovoltaic (PV) arrays
AS/NZS 4509.1 Stand-alone power systems – Safety
AS/NZS 4509.2 Stand-alone power systems – Design
AS/NZS 1170 Structural design actions AS/NZS 1170.2 Part 2: Wind actions
AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 3008 Electrical installations—Selection of cables AS/NZS 3008.1.1 Part 1.1: Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions AS/NZS 3008.1.2 Part 1.2: Cables for alternating voltages up to and including 0.6/1 kV—Typical New Zealand installation conditions
AS 4777.1 Grid connection of energy systems via inverters. AS 4777.2 Part 2: Inverter requirements AS 4777.3 Part 3: Grid protection requirements

Detailed information about joint Australian/New Zealand Standards can be found by visiting www.standards.com.au or Standards New Zealand web site at www.standards.co.nz.

Responses to submission

The utilities namely VUI and UNELCO were provided with copies of the proposed zero export Solar PV Installation Standards (**Standards**) on 29th February 2016 to review and provide feedback by 14th March 2016.

1 VUI responses

VUI responded to the URA proposed Standards on the 14th March 2016 highlighting that "*We have no comments*".

2 UNELCO response

In its response, UNELCO provided the following comments.
"UNELCO is not in a position to comment thouroughly on the Proposed Standards until such time when the impact of this project on the stability of the grid and on the fairness and equity between all UNELCO customers has been addressed as a first step."

2.1 URA response

Installations built in accordance to the Proposed Standards shall not export any electricity back into the grid and therefore shall have minimal impact on the grid stability.

The impact of zero export Solar PV installations on the fairness and equity between all UNELCO customers is a matter that the URA is willing to discuss with UNELCO in the future as both gain experience with zero export Solar PV installations.

Findings:

The Commission finds that:

- It has necessary to issue these Solar-PV Installation Standards to enable consumers and public to safely exercise their right under the Electricity Supply Act of generating electricity for self-use through zero export Solar-PV systems. Further, the Standards assist the Government in achieving the aims set out under the National Energy Roadmap in respect of renewable energy (solar).
- The URA Commission has the power to issue and require the implementation and adherence to the Standards pursuant to the URA Act.
- The Standards are in conformance of Section 3 of the URA Act.

The Commission therefore orders that:

1. The Solar-PV Installation Standards set out under the section titled 'The Rules' (together with Annexes I and II) are adopted.
2. **Gazettal:** The Order shall be submitted for Gazettal. The URA staff shall inform utility (UNELCO and VUI) and the public once the Order is gazetted.
3. **Dissemination of information:** Within 10 days of being informed of gazettal, utility shall display on its website the Solar-PV Installation Standards and make available in their office(s) copies which shall be provided to customers, free of charge.
4. **Effective Date:** The Order comes into effect on the date of gazettal.

Execution Page

CEO and Commissioner

Hasso C. Bhatia, PhD

Date 7/4/16

Chairman

Johnson Naviti Matarulapa Marakipule

Date 07/04/16

Executive Commissioner

John Obed Alilee

Date 7/4/16

Seal of the Utilities Regulatory Authority

Utilities Regulatory Authority
Vanuatu

You can access the S-0003-15 Final Decision, April 2016 on our website www.ura.gov.vu, or by contacting us by telephone (+678) 23335, email: breuben@ura.gov.vu or regular mail at S-0003-15, Utilities Regulatory Authority, PMB 9093, Port Vila, Vanuatu.