SECTION A:	QUALIFICATION DETAILS																
QUALIFICATION DEVELOPER (S)	Construction Industry Trust Fund																
TITLE	Certificate IV In Solar Photovoltaic Electrician														NCQF LEVEL	4	
FIELD	Manufacturing, Engineering, and Technology			SUB-FIELD	Solar Photovoltaic										CREDIT VALUE	66	
New Qualification			✓	Review of Existing Qualification													
SUB-FRAMEWORK	General Education			TVET								✓	Higher Education				
QUALIFICATION TYPE	Certificate	I		II		III		IV	✓	V		Diploma		Bachelor			
	Bachelor Honours			Post Graduate Certificate								Post Graduate Diploma					
	Masters									Doctorate/ PhD							

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale

Government has identified high unemployment and poverty amongst youth as a national security risk, hence the need to train this section of the population in productive and income generating skills.

Despite the country continuing to receive investments, these investments are biased towards capital intensive ventures. This situation has the inherent risk of unemployment continuing to surge, and the government, through its vital development policy paper, National Development Plan 11 (NDP 11), has identified areas of potential high employment uptake such as agriculture, services, and manufacturing and has made a commitment to give these sectors extensive support with a view to making meaningful contribution the growth of the economy.

Another policy document that makes mention of skills development as a vehicle towards inclusivity and provision of opportunities for all, is the Vision 2036 document under the of Human and Social Development (Pillar 2) which states that" Botswana society will be knowledgeable with relevant quality education that is outcome based, with emphasis on technical and vocational skills as well as academic competencies."

Solar Photovoltaic Electrician is one such sector with a high potential for employment uptake, as it is applicable in most of the government's strategies towards renewable energy and green technology development. Green

Technology, as an emerging sector with high potential for contribution to GDP calls for the upskilling of the workforce in this sector as this would provide professionalism to this sector.

The 2016 report on Top Occupations of the future listed Solar System Technicians in the Mining, Minerals, Energy, and Water Resources, as one of the occupations that are in demand (HRDC, 2016).

This qualification provides qualifying learners with the underlying solar photovoltaic knowledge, skills and values in order to become competent practitioners in the renewable energy sector; be employed or self-employed within the industry and pursue further learning in specific areas of renewable energy engineering.

Purpose

The qualification equips the candidates to:

- Comply with safety, health, environment and risk management procedures.
- Apply fundamentals of electrical power in a photovoltaic system.
- Apply photovoltaic system concepts and technologies.
- Install solar photovoltaic systems components.
- Perform solar home system sizing.
- Install solar water pumping in a photovoltaic system.
- Commission, and maintain completed PV system installations.

ENTRY REQUIREMENTS (including access and inclusion)

- Minimum entry of NCQF Level III or equivalent.
- There shall be access through RPL and CAT in line with the National RPL and CAT policies.

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SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES) ***Upon completion of this qualification, candidates will:***	***ASSESSMENT CRITERIA***
1. Apply the principles of Occupational Health and Safety in the Work Environment.	1.1 Identify hazards in the workplace. 1.2 Assess possible risks in the workplace. 1.3 Practice Good Housekeeping. 1.4 Wear Appropriate Personal Protective Equipment.
2. Demonstrate knowledge of Entrepreneurial principles in the workplace.	2.1 Plan for given work assignments. 2.2 Solve problems creatively in the workplace. 2.3 Mobilise people and resources to execute tasks. 2.4 Create value through implementation of innovative ideas.
3. Apply photovoltaic system concepts and technologies.	3.1 Apply principles of electricity and solar energy in a solar PV Systems. 3.2 Draw and interpreted electrical circuit diagrams and symbols used in PV systems. 3.3 Apply principles of solar energy in a photovoltaic system. 3.4 Reduce or enhance the amount of solar energy collected by a PV array. 3.5 Measure solar power and solar energy using correct instruments and procedures. 3.6 Use equipment and software tools to evaluate the solar window obstructions and shading at given locations.
4. Size Solar PV System.	4.1 Apply principles of solar home systems. 4.2 Calculate the resulting effect on AC Power and Energy production.

	4.3 Apply requirements for charge control in battery-based PV systems. 4.4 Size and configure the PV array, battery subsystem, and other equipment to meet the electrical load. 4.5 Apply labelling requirements for electrical equipment in PV systems. 4.6 Conducted load assessment according to industry specifications. 4.7 Use the sunshine hours method according to industry specifications.
5. Install photovoltaic system components.	5.1 Perform a site survey and test soil for installation designs. 5.2 Draw a simple one-line diagram for interactive and standalone PV systems. 5.3 Install Photovoltaic system components according to industry specifications. 5.4 Integrate Photovoltaic systems components according to industry specifications. 5.5 Configure PV modules to match the voltage, current and power output for interfacing. 5.6 Install and secured PV arrays on the ground, building rooftops or other structures. 5.7 Install solar water pump and apply pumping techniques. 5.8 Complete Installation reports and documentations according to industry standards.
6. Pre-Commission and maintain renewable energy systems	6.1 Apply safety requirements for operating PV systems. 6.2 Monitor performance parameters in PV systems. 6.3 Use electrical test equipment to test components for functionality and safety.

	6.4 Carry out pre-commission procedures of completed solar photovoltaic systems installations. 6.5 Compete pre-commission documentations according to standards.
7. Maintain Solar photovoltaic systems.	7.1 Apply requirements for maintaining PV arrays and systems components. 7.2 Develop a simple maintenance plan for a given PV system. 7.3 Measure DC and AC voltages, currents and power levels, solar energy, operating temperatures and other data. 7.4 Troubleshoot problem and take corrective actions from the system, subsystem to the component level. 7.5 Carry out maintenance procedures of solar photovoltaic systems. 7.6 Compete maintenance documentations according to standards.

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SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total (Per** Subject/ Course/ Module/ Units)*
		Level [ ]	***Level [4]***	***Level [5]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	*Safety, Health And Environmental*		*3*		*3*
	Engineering Drawings and Symbols		*3*		*3*
	Working At Heights		*3*		*3*
	Entrepreneurial Principles		*3*		*3*
CORE COMPONENT *Subjects/Courses / Modules/Units*	*Electrical Principles*		*3*		*3*
	Renewable Energy		*3*		*3*
	Photovoltaic Technology		*3*		*3*
	Photovoltaic Systems Component		*4*		*4*
	Photovoltaic Water Pumping		*4*		*4*
	Size Photovoltaic Systems		*15*		*15*
	Photovoltaic System Pre-Commissioning		*5*		*5*
	PV System Troubleshooting		*5*		*5*
	Photovoltaic Systems Maintenance		*3*		*3*
	Tools And Equipment In Photovoltaic Systems		*4*		*4*
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses / Modules/Units*	*Photovoltaic Hybrid System*			*5*	*5*
	Stand-Alone Renewable Energy System			*5*	*5*
	Grid-Connect Renewable Energy System			*5*	*5*
	TOTAL				***66***

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
4	***61***
5	***5***
TOTAL CREDITS	***66***

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

The qualification consists of Fundamental and Core Components.

To be awarded the Qualification learners are required to obtain a minimum of **66** credits as detailed below.

Fundamental Components:

The Fundamental components consist of foundational knowledge which is generic to any qualification to the value of **12** credits, all of which are compulsory.

Core Components:

The core components consist of modules containing applied knowledge and practical skills to the value of **49** credits which are compulsory.

Elective Components

Leaners are to elect one module **(5 credits)** to meet the required minimum of **66** credits.

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ASSESSMENT ARRANGEMENTS

All assessments leading/contributing to the award of credits, or a qualification shall be based on learning outcomes and/or sub-outcomes.

Formative Assessment

Formative or continuous assessment would be conducted to inform teaching and learning and establish the learner's level of readiness for progression to the next learning unit or module.

Formative assessment shall constitute 60% of the Final Mark.

Summative Assessment

Internal summative assessments shall be carried out in accordance all applicable examination rules, and the weighting of the assessment shall constitute 40% of the Final Mark.

All assessment shall be carried out by BQA registered and accredited Assessors.

MODERATION ARRANGEMENTS

There shall be internal and external moderation carried out by BQA registered and accredited Moderators.

RECOGNITION OF PRIOR LEARNING

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework.

CREDIT ACCUMULATION AND TRANSFER

Candidates would be allowed to accumulate enough credits that would warrant them the award of the qualification. This would include transfers of credits from previous learnings.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways

Horizontal Articulation:

Graduates of this qualification may consider pursuing to other qualifications on the same levels in the field of landscaping such as:

- Certificate IV in Solar thermal Hot Water Systems
- Certificate IV in Renewable Energy Systems

Vertical Articulation:

Learners may progress to higher level in the same field such as

- Certificate V in Solar Photovoltaic Electrician
- Certificate V in Solar Thermal Hot Water Systems

Employment Pathways

Learners who attain this qualification will have competencies and attributes to work as:

- Solar Photovoltaic Electrician
- Solar PV Installer
- Maintenance Electrician – Solar PV

QUALIFICATION AWARD AND CERTIFICATION

To be awarded the qualification the candidate must have met the following requirements:

- All exit level outcomes met.
- Minimum **66** credit requirements.

Certification:

Upon completion of the qualification the candidate will be awarded a **Certificate IV in Solar Photovoltaic Electrician.**

REGIONAL AND INTERNATIONAL COMPARABILITY

Benchmarking has been done against qualifications registered neighbouring countries within the region like **South Africa** and beyond to appreciate what is typical of this level and type of qualification out there, in relation to graduate profiling, scope and depth of content, to ascertain regional and international comparability and articulation of the proposed qualification. The outcome of this process are highlighted below.

The following Similarities and Differences of the qualifications examined were observed.

Similarities

All the qualifications studied bear similar attributes with this proposed qualification, especially with regard to the content and scope of the exit level Outcomes. In all the qualifications, emphasis is on the requisite skills to install solar PV systems and be able to do maintenance work on installed systems. The qualifications in Kenya and the United States of America are also used as entry points towards attainment of professional accreditation or examinations.

Since the qualification is skills based, assessment is integrated, and competencies are achieved through the design and development of assessment activities that make use of a variety of assessment methods and tools that measure not only the learner's knowledge and ability to perform practical tasks and activities within a familiar context, but which also challenge learners to demonstrate their ability to deal with problem situations that might or can arise in the workplace from time and which require learners' to demonstrate their ability to adapt their performance to meet the requirements of changed circumstances and to reflect on what they are doing and why.

Differences

While all the four qualifications contain similar core Solar PV modules and outcomes, there are slight variations when it comes to the peripheral outcomes. The South African qualification from South African Renewable Energy Technology Centre (SARETEC) have included Mechanics, hydraulics and actuators, while the New Zealand one from The Industry Training Organisation have incorporated the setting up and use of data logging for a renewable energy generation systems.

Another difference is the disparity of credit and duration between the qualifications. The South African qualification has 344 credits, the New Zealand 50-60, while the qualifications of Tanzania have not specified the credits, but a duration of 6 months, and Australian one denotes its length in hours of between 90 and 110.

Comparability and Articulation

The proposed qualification generally compares well with the qualifications studied since the exit outcomes cover similar scope and depth and are aligned to exit-level descriptors typical of this level and as done within the region and beyond as well as competencies required for employment as a Solar PV Electrician.

The proposed qualification has also included fundamentals that include communication skills, entrepreneurship, and occupational health and safety to ensure that there is provision for development of attributes, thus offering the learners with a window of opportunity for self-employment.

What sets this proposed qualification apart from those examined is that whilst most of them expects learners to be able design solar PV Systems, the proposed qualification main focus is on installation and maintenance. With the main focus being on skills development, the only underpinning knowledge provided is the one that would enable the learner to apply fundamental principles in the installation and maintenance process.

REVIEW PERIOD

The qualifications shall be reviewed after 5 years.

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