

Assessment report on qualification and certification frameworks and needs

PROJECT TITLE: “Development of regional solar energy qualification frameworks and curricula in ECOWAS, EAC and the Pacific Community”

PROJECT REFERENCE: Structuring of an International Network of Solar Technology and Application Resource Centres (UNIDO Project ID: 190370)



Report prepared by:

Executive Summary (EN)

The United Nations Industrial Development Organization (UNIDO) and the International Solar Alliance (ISA) have initiated the "Structuring of an International Network of Solar Technology and Application Resource Centres" project. The primary goal is to enhance qualification and certification frameworks for solar energy product and service markets, with a specific focus on least developed countries (LDCs) and small island developing states (SIDS). The initial phase of the project targets the Economic Community of West African States (ECOWAS), the East African Community (EAC), and the Pacific Community (SPC)/Pacific Islands Forum (PIF) regions.

The purpose of a Baseline Assessment outlined in this report is to evaluate the existing landscape of solar skills, certification, and QF in the target regions. It involves a multifaceted approach, including the examination of existing standards, regional capacities, and needs. The assessment aims to provide a foundation for subsequent phases of the initiative, enabling the development of tailored qualification and certification frameworks for each economic region.

The assessment methodology is comprehensive and collaborative, involving desk research, online surveys and interviews with key stakeholders, as well as the harmonisation of findings. Key findings from the assessment vary by region: SPC has a strong regional framework but faces challenges in standardisation and collaboration among countries, whereas some leading countries in EAC could serve as a basis for a stronger regional framework, and the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) is taking a leading role as the regional organisation striving to harmonise national frameworks in ECOWAS. The challenge lies in achieving alignment of solar qualification frameworks, bridging the gap between the established regional frameworks and the existing national regulations, all while fostering synergies that harnesses the strengths of both frameworks.

In SPC, key actions to reinforce training and capacity building on solar PV include upgrading the existing regional qualification framework by developing training courses to level 5 (diploma level) incorporating the SEI-API 4 skill set courses and training of trainers to deliver the qualification. There is also a need to develop a system for certifying the skills of solar PV installers and other sustainable energy professionals and to expand the training curricula to include solar thermal training.

In EAC specific attention will be given to common accreditation and quality assurance of solar PV and solar thermal training curriculums at the higher education level through collaboration with the Inter-University Council for East Africa (IUCEA) based on the East African Qualifications Framework for Higher Education (EAQFHE), East African Community (EAC) Secretariat, East African Centre for Renewable Energy and Efficiency (EACREEE), and responsible Ministries in the EAC. Emphasis may also be placed on integrating EAC countries that are less advanced in their training frameworks.

ECOWAS is comparatively advanced in regional training and certification. ECREEE has established a scheme for certifying the skills of solar PV installers and other sustainable energy professionals: the Regional Certification Scheme for Sustainable Energy Skills programme. The scheme initially focuses on certifying installers of simple off-grid PV systems but will gradually cover installers of more complex off-grid and on-grid PV systems, as well as other renewable energy and energy efficiency professionals for the exams, and other training institutions organise the certification exams. Emphasis in this assignment will be given to

improve training frameworks on PV further (e.g. on solar PV mini-grids), as well as solar thermal training, which is less advanced. Lastly, ECOWAS works closely with countries to ensure alignment of national systems with the regional system, which also makes it an essential priority.

The common themes that unite these regions are the constraints posed by limited resources, the pressing need for heightened awareness, the imperative of inclusivity encompassing youth and women, the necessity of adapting national policies to the evolving solar energy landscape, and the critical importance of forging enhanced collaboration among stakeholders.

In the context of the assessment, significant challenges have come to the forefront. These span from resource limitations to a lack of awareness, obstacles pertaining to inclusivity, diverging policies, and insufficient collaboration between several stakeholders in the regions. As a result, proposed measures encompass resource mobilisation, awareness campaigns, inclusivity initiatives, the harmonisation of divergent policies, and the establishment of cooperative frameworks. Together, these actions represent a comprehensive strategy aimed at fostering sustainable change and advancing the cause of solar energy development in the three regions.

Overall, the document provides insights into the challenges and initiatives related to solar energy qualification and certification frameworks in the regions, and underscores the importance of standardisation, collaboration, and capacity building in the solar energy sector to support sustainable development and climate goals.

Résumé exécutif (FR)

L'Organisation des Nations Unies pour le développement industriel (ONUDI) et l'Alliance solaire internationale (ISA) ont lancé le projet "Structuration d'un réseau international de centres de ressources pour la technologie et les applications solaires". L'objectif principal est d'améliorer les cadres de qualification et de certification pour les marchés de produits et de services liés à l'énergie solaire, en mettant l'accent sur les pays les moins avancés (PMA) et les petits États insulaires en développement (PEID). La phase initiale du projet vise la Communauté économique des États de l'Afrique de l'Ouest (CEDEAO), la Communauté de l'Afrique de l'Est (CAE) et les régions de la Communauté du Pacifique (CPS)/Forum des îles du Pacifique (FIP). L'objectif de l'évaluation de base décrite dans le rapport est d'évaluer en profondeur le paysage existant des compétences solaires, de la certification et des cadres de qualification dans les régions cibles. Elle implique une approche à multiples facettes, y compris l'examen des normes existantes, des capacités régionales et des besoins. L'évaluation vise à fournir une base pour les phases ultérieures de l'initiative, permettant le développement de cadres de qualification et de certification adaptés à chaque communauté économique.

La méthodologie d'évaluation est complète et collaborative, impliquant des recherches documentaires, des enquêtes en ligne et des entretiens avec les principales parties prenantes, ainsi que l'harmonisation des résultats. Les principales conclusions de l'évaluation varient d'une région à l'autre : La CPS dispose d'un cadre régional solide mais est confrontée à des défis en matière de normalisation et de collaboration entre les pays, tandis que certains pays leaders de la CAE pourraient servir de base à un cadre régional plus solide, et que le Centre de la CEDEAO pour les énergies renouvelables et l'efficacité énergétique (ECREEE) joue un rôle de premier plan en tant qu'organisation régionale s'efforçant d'harmoniser les cadres nationaux au sein de la CEDEAO. Le véritable défi consiste à aligner de manière transparente les cadres de qualification relatifs au solaire, en comblant le fossé entre le cadre régional établi et les réglementations nationales existantes, tout en favorisant une synergie puissante qui exploite les points forts des deux cadres.

Dans la CPS, les actions clés visant à renforcer la formation et les capacités en matière de solaire PV comprennent la mise à niveau du cadre de qualification régional existant en développant des cours de formation au niveau 5 (niveau du diplôme) incorporant les cours de l'ensemble de compétences SEI-API 4 et la formation des formateurs pour délivrer la qualification. Il est également nécessaire de développer un système de certification des compétences des installateurs de panneaux solaires PV et autres professionnels de l'énergie durable et d'étendre les programmes de formation pour inclure une formation en solaire thermique.

Dans la CAE, une attention particulière sera accordée à l'accréditation commune et à l'assurance qualité des programmes de formation à l'énergie solaire photovoltaïque et à l'énergie solaire thermique au niveau de l'enseignement supérieur, en collaboration avec le Conseil Interuniversitaire pour l'Afrique de l'Est (IUCEA), sur la base du Cadre de Qualifications pour l'Enseignement Supérieur en Afrique de l'Est (EAQFHE), le secrétariat de la Communauté de l'Afrique de l'Est (CAE), le Centre est-africain pour les énergies renouvelables et l'efficacité énergétique (EACREEE) et les ministères compétents de la CAE. L'accent peut également être mis sur l'intégration des pays de la CAE qui sont moins avancés dans leurs cadres de formation.

La CEDEAO est relativement avancée en matière de formation et de certification régionales. L'ECREEE a mis en place un système de certification des compétences des installateurs de panneaux solaires photovoltaïques et d'autres professionnels de l'énergie durable : le programme régional de certification des compétences en matière d'énergie durable. Le programme se concentre initialement sur la certification des installateurs de

systèmes photovoltaïques simples hors réseau, mais il couvrira progressivement les installateurs de systèmes photovoltaïques plus complexes hors réseau et sur réseau, ainsi que d'autres professionnels des énergies renouvelables et de l'efficacité énergétique. Dans le cadre de cette mission, l'accent sera mis sur l'amélioration des cadres de formation sur le photovoltaïque (par exemple sur les mini-réseaux solaires photovoltaïques), ainsi que sur la formation au solaire thermique, qui est moins avancée. Enfin, la CEDEAO travaille en étroite collaboration avec les pays pour assurer un alignement des dispositifs nationaux avec le système régional ; ce qui en fait également une priorité essentielle.

Dans le contexte de l'évaluation dans les régions évaluées, une série de défis importants ont été mis en évidence. Ces défis vont de la limitation des ressources au manque de sensibilisation, en passant par des obstacles liés à l'inclusion, des politiques divergentes et un manque notable de collaboration entre les différentes parties prenantes de la région. En réponse à ces défis complexes, les mesures proposées englobent des efforts de mobilisation des ressources, l'orchestration de campagnes de sensibilisation, des initiatives d'inclusion, l'harmonisation de politiques divergentes et la mise en place de cadres de coopération. Ensemble, ces actions représentent une stratégie globale visant à favoriser un changement durable et à faire avancer la cause du développement de l'énergie solaire dans ces régions.

Dans l'ensemble, le document donne un aperçu des défis et des initiatives liés aux cadres de qualification et de certification de l'énergie solaire dans les régions. Il souligne l'importance de la normalisation, de la collaboration et du renforcement des capacités dans le secteur de l'énergie solaire pour soutenir le développement durable et les objectifs climatiques.

Abbreviations

ACER - Australian Council for Educational Research
ACQF - African Continental Qualifications Framework
BTVET - Business, Technical, Vocational Education, and Training
CAMES - African and Malagasy Council for Higher Education
CBA - Competence-Based Assessment
CFEE - Certificat de fin d'études élémentaires
DECPC - Department of Examinations, Professional Competitions, and Certifications
DFPT - Department of Vocational and Technical Training
DIT - Directorate of Industrial Training
EAQFHE - East African Qualifications Framework for Higher Education
EAC - East African Community
EACAT - Credit Accumulation and Transfer system
EACREEE - East African Centre of Excellence for Renewable Energy and Efficiency
ECOWAS - Economic Community of West African States
ECREEE – ECOWAS Centre for Renewable Energy and Energy Efficiency
EPRA - Energy and Petroleum Regulatory Authority
EQAP - Educational Quality and Assessment Program
GSES - Global Sustainable Energy Solutions
GN-SEC - Global Network of Regional Sustainable Energy Centres
GNQF - Gambia National Qualifications Framework
IUCEA - Inter-University Council for East Africa
ISA - International Solar Alliance
IRENA - International Renewable Energy Agency
LMD - Licence-Master-Doctorat
LDC - Least Developed Countries
MoBSE - Ministry of Basic and Secondary Education
MoHERST - Ministry of Higher Education, Research, Science and Technology
NACTE - National Council for Technical Education
NEQMAP - Network on Education Quality Monitoring in the Asia-Pacific
NUC - National Universities Commission
NVA - National Vocation Awards
NZQA - New Zealand Qualifications Authority
PCREEE - Pacific Centre for Renewable Energy and Energy Efficiency
PICTs - Pacific Island Countries and Territories
PIF - Pacific Islands Forum
PPA - Pacific Power Association
PQAF - Pacific Quality Assurance Framework
PQF - Pacific Qualifications Framework
PRQS - Pacific Register of Qualifications and Standards
PV – Photovoltaics
QF – Qualification Frameworks
RQF - Regional Qualification Frameworks
RTTI - Rwandan TVET Trainer Institute

SEIAPI - Sustainable Energy Industry Association of the Pacific Islands
SHC - Solar Heating and Cooling
SHIP - Solar Heat Industrial Processes
SIDS - Small Island Developing States
SITESA - Solomon Islands Tertiary Education and Skills Authority
SPC - The Pacific Community
SQF - Samoa Qualification Framework
SWC - Solar Workforce Certification
UVQF - Uganda Vocational Qualifications Framework
UHEQF - Uganda Higher Education Qualifications Framework
UNIDO - United Nations Industrial Development Organization
UNESCO - United Nations Educational, Scientific and Cultural Organization
USP - University of the South Pacific
UVQF - Uganda Vocational Qualifications Framework
VQF - Vanuatu Qualifications Framework
WAEC - West African Examinations Council
WAEMU - West African Economic and Monetary Union
WDA - Workforce Development Authority
TVET - Technical and Vocational Education and Training

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1. Introduction

Product and service quality standards in the solar field are fundamental prerequisites for the long-term sustainability of solar markets and investments. They also underpin the trust of consumers, suppliers, and financiers. Such standards directly affect the quality infrastructure, and thus contribute for an effective and inclusive energy transition. A well-structured qualification framework has the potential to create local solar jobs, generate income, and empower domestic companies to participate in global or regional value chains of solar manufacturing and servicing¹.

In the context of developing countries, the assurance of product quality becomes paramount. It's a challenge that spans all components and stretches throughout the value chain of solar photovoltaic (PV) and solar heating and cooling (SHC) systems. In particular LDCs and SIDS face unique challenges. These regions often grapple with a lack of qualification, know-how, and experience regarding quality installations.

Installation faults cause more than 50% of global serious defects in PV plants. These faults, often stemming from seemingly minor errors such as loose screws or incorrectly inserted connectors², can devastate plant performance and financial returns. Even the installation of SHC systems, though essential for harnessing solar thermal energy, demands a solid knowledge base, and can result in a complete system failure if incorrectly executed.

To address these challenges, there is a pressing need to invest in reliable and specialised qualification and certification schemes. These schemes should target various enablers of the solar value chains, including consumers. The availability of training institutes and curricula that meet the specific needs of the solar energy market and adhere to minimum standards is integral to national quality infrastructure.

However, particularly in LDCs and SIDS, the qualification frameworks (QF) for PV and SHC are often underdeveloped, and institutions offering quality curricula and training tailored to the diverse needs of experts along the solar energy value chain are lacking. It is not uncommon for experts to travel to other countries or regional universities to receive academic training on renewable energy solutions. This fragmentation in the field of solar energy qualification leads to duplication of efforts or, worse, critical gaps in expertise.

Recognising these challenges, there is a strong case for addressing the issue of solar energy qualification regionally in a harmonised manner. The European Union provides a compelling example of how harmonised regional qualification frameworks (RQF) can foster cross-border solar energy learning, business collaboration, and quality services. These frameworks contribute to the comparability, quality, and transparency of qualifications, making it easier to recognise diplomas and certificates across borders.

A harmonisation approach appears in most regional economic communities in Africa. These communities have begun to address the challenges by harmonising qualification and certification standards regionally. Key qualification bodies in these regions include the African Continental Qualifications Framework (ACQF), which encompasses the EAC and the ECOWAS. Similarly, the Pacific Qualifications Framework (PQF) covers the SPC.

¹ International Network of Solar Technology and Application Resource Centres (STAR C) | Global Network of Regional Sustainable Energy Centres (GN-SEC). <https://www.gn-sec.net/pt-pt/node/12432>

² International Network of Solar Technology and Application Resource Centres (STAR C) | Global Network of Regional Sustainable Energy Centres (GN-SEC). <https://www.gn-sec.net/pt-pt/node/12432c>

In parallel with the qualification framework, multiple certification schemes have been established in these regions to create a certified solar workforce. These schemes aim to accelerate solar energy deployment by setting regional standards for solar developers, installers, and technicians. While such certification programmes have been planned and, in some cases, rolled out in ECOWAS, EAC, and SPC regions, there is limited information available regarding their outcomes, sustainability, and continuity.

The harmonisation of certification schemes of both solar products and services is crucial because it directly impacts the development of regional solar skills. It ensures that high-quality training is delivered to professionals capable of preparing, implementing, operating, and maintaining solar energy systems. International organisations such as the International Electrotechnical Commission (IEC), International Energy Agency (IEA) and the International Organization for Standardization (ISO) have worked extensively to develop internationally acceptable certification standards for solar products. This certification primarily addresses how solar product testing should be conducted. Conversely, studies have shown that a lack of solar skills accounts for approximately fifty per cent of defects in PV and SHC systems worldwide, emphasising the urgent need for advanced training and certification in the field.

2. STAR-C project brief

To tackle these multifaceted challenges, UNIDO and the ISA have embarked on the "Structuring of an International Network of Solar Technology and Application Resource Centres" project, funded by the Government of France. The overarching objective of this project is to create a robust network of institutional capacities within ISA Member States. These capacities will enhance the qualification and certification frameworks of solar energy product and service markets, with a particular focus on addressing the needs of LDCs and SIDS.

In its initial phase, the STAR C project will concentrate its efforts on three crucial regions:

- the Economic Community of West African States (ECOWAS),
- the East African Community (EAC), and
- the Pacific Community (SPC)/Pacific Island Forum (PIF).

To maximise its impact and create economies of scale, STAR C has adopted a regional approach. This approach aims to harmonise solar qualification frameworks across borders, fostering collaboration and synergy among neighbouring nations.

Previous interventions by UNIDO in the realm of quality infrastructure and qualification programmes within these regions have already demonstrated the advantages of regional approaches. UNIDO has actively supported several economic communities, including ECOWAS, EAC, and SPC, in the establishment of qualification frameworks (QF) and certification policies. These efforts have also involved the development of solar skills within the regional energy Centres under the Global Network of Regional Sustainable Energy Centres (GN-SEC) programme. The STAR C project is an integral part of UNIDO's south-south and triangular activities within the GN-SEC platform. Importantly, the project will build upon the institutional infrastructure and lessons learned from previous interventions.

The STAR C project recognises the importance of collaboration and partnerships and will forge strong partnerships with the GN-SEC Centres and regional qualification framework bodies, along with their national focal institutions, such as energy ministries and national standardisation bodies. Organisations like ECREEE

in Cabo Verde, the East African Centre of Excellence for Renewable Energy and Efficiency (EACREEE) in Uganda, and the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) in Tonga have already engaged to some extent in regional solar qualification and certification programmes involving training institutions and ministries within their respective regions.

As part of its mandate, the STAR C project will seek international advisory support to develop regional certification and qualification frameworks. These frameworks will strengthen the regional integration and mobility of solar professionals within the regions.

The transition to renewable energy sources has become an imperative global pursuit, driven by the urgent need to mitigate climate change and secure sustainable energy solutions. Within this context, solar energy has emerged as a pivotal component of the renewable energy landscape. Harnessing the power of the sun offers a clean and abundant source of electricity and thermal energy, with the potential to revolutionise energy systems worldwide.

Recognising the significance of solar energy, the UNIDO has embarked on a comprehensive initiative to advance solar energy skills, certification, and QF. This initiative is designed to foster a harmonised approach to solar energy development across three distinct regions: ECOWAS, EAC, and SPC/ and (PIF).

2.1. Scope of the Baseline Assessment

The Baseline Assessment outlined in this document serves as the foundation upon which the broader UNIDO and ISA initiative will be built. Its overall objective is to thoroughly evaluate these regions' existing landscape of solar skills, certification, and QF. This comprehensive assessment encompasses a multifaceted analysis, encompassing not only the examination of existing legislation and standards but also the assessment of regional capacities and needs.

The Baseline Assessment explored the regulatory frameworks in place, examining how well they align with the dynamic needs of each region's evolving solar market. It will scrutinise the current standards, capacities, and certification processes to identify areas for improvement.

The uniqueness of each region, including varying maturity levels of their solar markets and distinct climate conditions, was considered. This ensures that the recommendations and frameworks developed are tailored to each region's specific challenges and opportunities.

Informed by the findings of this Baseline Assessment, the subsequent phases of the initiative will be guided with precision. Three essential documents will be developed outlining solar qualification and certification frameworks for each economic community (ECOWAS, EAC, and SPC/PIF). These frameworks will provide actionable recommendations, strategies for capacity enhancement, and concrete PV/SHC (Solar Heating and Cooling) standards suitable for regional adoption and subsequent implementation at the national level.

Moreover, curricula and modules for solar PV and SHC training tailored to each region's specific conditions and needs will be designed to recognise the significance of education and training in the field of solar energy. User-friendly guidelines for effective dissemination and utilisation will accompany these training materials.

In summary, this Baseline Assessment marks the inception of a comprehensive journey toward advancing solar energy development in three diverse regions. It is the first milestone towards fostering a harmonised,

sustainable, and inclusive solar energy landscape that aligns with the global imperative to combat climate change and promote renewable energy solutions.

2.2. Objectives of the Baseline Assessment

A multifaceted approach will be undertaken to achieve the UNIDO initiative's overarching objectives. This approach involves a series of comprehensive actions and assessments, including:

1. **Comprehensive Evaluation of Existing Certification and Qualification Frameworks:** Conduct an exhaustive assessment of the current certification and qualification systems within the ECOWAS, EAC, and SPC regions, examining their structures, processes, and effectiveness.
2. **Thorough Identification of Gaps and Shortcomings:** Systematically identify and analyse gaps, weaknesses, and areas requiring improvement within the existing certification and QF. This includes pinpointing deficiencies in standards, regulatory processes, and implementation mechanisms.
3. **In-Depth Review of International Best Practices:** Delve into international best practices in solar energy certification and qualification. Analyse how these global standards and approaches can be adapted and effectively implemented within the unique contexts of the ECOWAS, EAC, and SPC regions.
4. **Engagement with Key Stakeholders:** Engage in a comprehensive outreach effort to gather insights and perspectives from key stakeholders. This involves conducting surveys, interviews, and consultations with various actors in the solar energy sector, including governmental bodies, industry experts, academic institutions, and certification authorities.
5. **Provision of Detailed Recommendations and Strategic Plans:** Develop and present well-defined and actionable recommendations and strategies to enhance the existing certification and QF. These recommendations should address identified gaps and weaknesses while aligning with each region's specific needs and circumstances.
6. **Identification of Key Players and Resource Mapping:** Identify and map out key players and resources within the ECOWAS, EAC, and SPC regions that contribute to developing solar energy skills. This includes identifying relevant institutions such as universities, training centres, research institutes, and other entities that play a crucial role in skill-building and capacity development within the solar energy sector.

3. Methodology

The methodology employed for this Baseline Assessment is based on multiple sources, ensuring a comprehensive assessment of solar qualification and certification frameworks across the ECOWAS, EAC, and SPC regions. The approach combines data sources from desk research and stakeholder consultation, that are harmonised to create a robust foundation for the development of regional frameworks.

It begins with desk research (see 3.1), followed by a comprehensive stakeholder consultation with the support of local partners and key organisations (see 3.2) to complement the desk research and address potential gaps. Lastly, results from both data collection methods are harmonised to ensure a well-informed and comprehensive assessment of the solar frameworks across the three targeted regions.

3.1. Desk research

An initial desk research was conducted to collect and study existing information, documents, and resources. This phase laid the groundwork for providing valuable context and insights into the existing solar energy landscape in the target regions.

The materials collected during the desk research phase were subject to a structured and systematic analysis. This analysis involved categorising, synthesising, and cross-referencing information to identify key themes, trends, challenges, and opportunities within the solar energy sector in each region. Evidence from this phase was the basis for next assessment phases, ensuring that the methodology was rooted in a robust foundation of consolidated knowledge and insights. The desk research conducted was based on various sources, which can be clustered as follows:

- **Previous Studies and Baseline Assessments**, such as the AEE Intec baseline assessment, which served as a valuable source of information and provided insights, challenges, and opportunities within the solar energy sector in the target regions, as well as a clear understanding of the evolution of qualification and certification frameworks over time.
- **Publications and Technical Documents** related to continental, regional, national qualification, and certification frameworks. These documents encompassed various materials, including policy papers, industry standards, and technical guidelines. They provided a comprehensive overview of each region's regulatory and technical aspects of solar energy.
- **National and Regional Evaluations** were systematically reviewed. These evaluations provided insights into the performance and effectiveness of qualification and certification frameworks in place, highlighting areas that required attention and improvement.
- **Standards and Policies** linked to off-grid and thermal solar were analysed to understand the regulatory environment governing the solar energy sector. This included a detailed examination of legal frameworks, accreditation processes, and compliance requirements.
- **Overview of International Bodies.** Information and insights from international, continental, and regional bodies, including ISA, ECREEE, EACREEE, PCREEE, and ACQF, were accessed.

3.2. Stakeholder consultation

The Stakeholder Consultation was carried out by means of an online survey, followed by an online one-to-one interviews in case clarification was needed.

Following the survey's creation, extensive stakeholder engagement was initiated across the ECOWAS, EAC, and SPC regions. This phase involved the following key steps:

- The survey was distributed to various stakeholders within the solar energy sector. These stakeholders included governmental bodies, qualification and certification authorities, regional training institutions, academia, regulators, customs agencies, standards bodies, private sector entities, and solar industry associations. A designated waiting period was observed to allow stakeholders sufficient time to respond comprehensively to the survey. This ensured a rich and diverse dataset for analysis.
- An in-depth analysis was carried out upon collecting survey responses to distil valuable insights and trends. This phase involved systematically examining the data to identify common themes,

areas of concern, and opportunities for improvement within each region's qualification and certification frameworks.

- In some instances, where survey responses left gaps or required further elaboration, structured interviews were conducted with key stakeholders. These interviews provided deeper insights, clarified responses, and gathered additional context. They were particularly instrumental in capturing nuanced information.

The overall objectives were the following:

A. Assess Awareness: To gauge the awareness status surrounding existing "Solar Workforce Certification" (both PV and thermal) and the related solar training opportunities.

B. Identify Gaps and Needs: To pinpoint gaps and requirements within the current solar training opportunities available to solar developers, installers, and technicians.

C. Evaluate the Certification Framework: To evaluate the "Solar Workforce Certification" framework (PV and thermal) to identify gaps and areas in need of improvement.

The specific objectives, which have driven the survey's structure, are the following:

Section A: Awareness of Solar Workforce Certification and Training

- Assess the necessity of introducing "Solar Workforce Certification" if it is not mandatory.
- Evaluate the sufficiency and integration of current "Solar Workforce Certifications."
- Identify gaps and areas for improvement in the "Solar Workforce Certification" system.
- Assess the coordination among various sectoral stakeholders in the solar industry.
- Determine the availability of communication and marketing tools for collaboration and information sharing among stakeholders and technicians.
- Identify collaborations or partnerships between sectoral stakeholders in developing and updating the qualification framework.

Section B: Solar Training Courses

- Evaluate the quality of solar training courses based on respondents' opinions.
- Identify suggestions for enhancing the quality of solar training courses.
- Identify key obstacles in providing high-quality training services.
- Assess the level of consideration for Solar Thermal in the solar training sector.
- Identify emerging trends and technologies that should be incorporated into future training programmes.
- Determine the availability of monitoring and evaluation tools or platforms to track impacts.

Section C: Solar Workforce Certification

- Evaluate the quality of the "Solar Workforce Certification" framework based on respondents' opinions.
- Identify suggestions for improving the "Solar Workforce Certification" framework.
- Identify key obstacles in enhancing the "Solar Workforce Certification" framework.

- Determine the need for increased focus on Solar Thermal in the solar certification sector.
- Assess the perception of the importance and impact of "Solar Workforce Certification" in the solar sector.
- Determine the availability of monitoring tools or platforms to update sectoral stakeholders and practitioners on the current "Solar Workforce Certification" framework and certified individuals.

3.3. Harmonisation of results

The insights and findings from the desk research and the stakeholder consultation were harmonised to provide a reference baseline for the project. This comprehensive approach allowed for cross-referencing and validation of information, ensuring that the assessment was grounded in a solid foundation of primary and secondary data.

4. Certification and Qualification Frameworks in the ECOWAS, EAC and SPC

As the adoption of PV and SHC technologies continues to expand across these regions, the importance of standardised certification and QF cannot be overstated. These frameworks are critical tools to ensure solar energy systems' quality, safety, and performance, building trust among consumers, investors, and policymakers. However, the effectiveness of these frameworks varies widely among countries and regions, often resulting in inefficiencies, market uncertainties, and safety concerns.

4.1. Pacific Community

In the Pacific Island Countries and Territories, numerous solar training courses have been developed. The SPC managed EU-PacTVET project, developed regional qualifications on sustainable energy Certificate Level 1 – Level 4 and registered at the Education Quality and Accreditation Board. In addition, these are being introduced into a number of training institutes. The PCREEE in collaboration with the Tonga National Qualification and Accreditation Board (TNQAB) have successfully adopted the SE qualification L1-L4 and registered them as a national qualification under the Tonga Qualification Framework (TQF). These National Certificates on Sustainable Energy (NCSE) L1 to L4 are currently being delivered in the Tonga Institute of Science of Technology (TIST) and other technical institutions has expressed their interest to deliver the qualifications.

These regional Sustainable Energy certificate courses provide a lifeline, and pathways early in the students' studies and are suitable to prepare people to enter the industry and/or pursue higher and more specialised qualifications. There is, however, an increasing demand from the industry for short specialised hands-on courses to upskill their existing technicians and also the new technicians they continue to employ.

SEIAPI therefore introduced the following shorter design and install skillset-based courses:

- Grid-Connected PV Systems - Design & Install
- Grid-Connected PV Systems with Battery Storage - Design & Install
- Stand Alone Power Systems (off-grid) - Design & Install
- Hybrid PV / Fuel Generator Systems - Design & Install

These are currently being offered online for the Pacific region via USP Pacific TAFE (Suva, Fiji) and face-to-face in Solomon Islands.

These four skillset courses are based on training unit standards that are listed on the Pacific Register of Qualifications and Standards (PRQS). However, for the courses to be conducted in Pacific Island countries that have their own Quality Training Framework, the training unit standards need to be accredited within that country's qualifications board. Note, the EU-PacTVET certificate courses are also listed on the PRQS and accredited in some of the Pacific Island Countries.

Though people doing the above skillset courses obtain the skills to design and install, they do not obtain a recognised qualification. Nevertheless, they can apply for the relevant accreditation (certification) in the Pacific Power Association (PPA) /SEIAPI technician accreditation program (<https://www.seiapi.com/seiapi-ppa-accreditation/>) that was launched in 2012.

Level 5 in Design and Installation of PV, hybrid and battery systems (diploma in design and installation of PV systems)

Mr Geoff Stapleton from SEIAPI/GSES, Mr Solomone Fifita and Mr Paea Tau'aika from PCREEE met in Tonga on Thursday 5th October 2023 to discuss what this project could do to build on the work already being undertaken in the Pacific.

The outcome was the need for a regional level 5 training programme, following up on the level 4 skillset already developed in the existing PacTVET program. The level 5 (Diploma level) would comprise the four skillset courses introduced by SEIAPI and advance Generic Courses from level 4 to make up the total required credits for diploma level. This would then allow the graduated students from certificate level 4 to take the full Diploma level or for those within the industry) to still undertake the individual skillsets. Since the training unit standards for the 4 skillsets are already registered on the PRQS, the next step would then be to get them recognised as a level 5 diploma within the Pacific Qualifications Framework.

Tonga's law requires all electrical works to be undertaken by licensed electricians so this should also apply to grid connected PV systems and possibly off grid systems where inverters are providing AC power. To deliberate on how the level 5 could lead to a specialised license in Tonga, Mr Stapleton and Mr Tau'aika met with the Head of the Faculty of Science and Technology (formerly the Tonga Institute of Science and Technology) from Tonga National University and the head electrical trainer.

In Tonga, they conduct the PCREEE-supported certificate levels 1, 2, 3 and 4 in electrical and level 4 is what is required to become a qualified electrician. The University liked the idea of the proposed Diploma because the qualified electricians could then have a pathway to obtain a license and even pursue a degree. What is required now is to have the training to be accredited by EQAP before being accredited by the Tonga National Qualifications and Accreditation Board. Training of Trainers for level 5 is a must to assist the technical institutions before they can deliver the qualification.

Proposed Project Activities for Pacific Region

- Investigate with the SPC Educational Quality and Assessment Programme (EQAP) team on what is involved with having the relevant training unit standards as a Diploma available to those who have already completed Certificate 4 in Sustainable Energy.

- Complete the application paperwork to have the relevant training unit standards based on the 4 skillsets accredited by the Tonga National Qualifications and Accreditation Board.
- Provide a training of trainers on level 5 for technical institutions before they deliver the programme. The training of trainers will focus on design and installation of PV, including hybrid and battery systems (diploma in design and installation of PV Systems),

Please refer to the below for additional details on the existing programs in the region.

4.1.1. Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE)

PCREEE was established by the Pacific Ministers of Energy and Transport as regional SEforALL centre of excellence operating under the umbrella of the Framework for Action on Energy Security in the Pacific (FAESP). Through regional methodologies and tools, the centre assists PICTs to address existing barriers and strengthen drivers for sustainable energy markets, industries and innovation. PCREEE is co-hosted by the Pacific Community (SPC) and the Government of Tonga. The centre represents an innovative fusion of regional and international efforts and capabilities. Its design leverages a network of intra and extra regional partnerships, serving as a “hub” for knowledge and technical expertise on matters related to sustainable energy project development and implementation. UNIDO provides technical services and mentoring throughout the first operational phase of the centre.

4.1.2. Educational Quality and Assessment Program (EQAP)

SPC’s EQAP is mandated to develop education quality in the Pacific. EQAP efforts are dedicated to literacy and numeracy, assessment, curriculum development, qualifications accreditation, and research. EQAP works with 15 Pacific countries’ education ministries to provide technical support or hands-on groundwork contributions. EQAP collaborates closely with the Australian Council for Educational Research (ACER), New Zealand Qualifications Authority (NZQA), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). EQAP is a member and represents the Pacific in the Steering Group of the Network on Education Quality Monitoring in the Asia-Pacific (NEQMAP).

The EQAP is financially supported by Australia and New Zealand through a collaborative funding arrangement known as a programmatic funding partnership grant, established jointly in 2018 and spans varying time frames. It’s important to note that it refers to contributions made by development partners at the organisational level. In practice, New Zealand and Australia extend adaptable financial support to the EQAP programme, which enhances the overall budget of EQAP, instead of being designated for activities in advance.

EQAP is a regional programme benefitting the Pacific Island Countries and Territories (PICTs) by supporting the quality of regional and national education in two ways:

- By supporting SPC member countries’ efforts to strengthen their education systems.
- By providing education services where the necessary systems, processes, and capabilities are absent.

EQAP’s accreditation and quality assurance services are a good example, assisting members who do not have national qualifications and accreditation bodies. Only six member countries have their federal agency.

EQAP provides an assembly of goods and services that continue to expand in response to member needs. When organised according to divisional outcomes, they are categorised into the following nine focus areas:

1. Education data, quality, and system management
2. Education policy
3. Large scale assessments
4. Teacher competencies
5. Role in Pacific Regional Framework
6. Information technologies for education
7. Education research
8. Curricula and assessments
9. Qualifications and accreditations

4.1.3. Pacific Qualifications Framework (PQF)

The PQF aims to facilitate the realisation of a good quality education and training system in the Pacific region. It is a meta-framework or a reference framework. The PQF aims to establish comparability and to facilitate recognition of qualifications across Pacific countries' education and training systems, as well as with other regional or international frameworks.

The PQF also serves as a national qualification framework for those Pacific countries that may not have the capacity to develop a national qualifications framework. The PQF level descriptors can be applied to complete qualifications and components of qualifications. Adopting international practice, the PQF is distinguished by two key characteristics. The first is that it is outcomes-based. Each framework level describes in broad terms the progressive complexity of knowledge, skills, and competence from one level to the next higher level. This enhances understanding of what knowledge, skills and competencies learners have acquired. The second characteristic is that it is credit-based, where one credit represents the time, an average learner takes to achieve the learning outcomes of a unit of study. One credit is approximately equivalent to ten notional hours of learning. One year of full-time study is generally equal to 120 credits.

The structure of the Pacific Qualifications Framework is comprehensive and recognises achievements from school, higher education, technical and vocational education and training, and non-formal learning.

The PQF has ten levels that range from a basic certificate at Level 1 to a doctorate at Level 10:

- a. Level 10: Doctoral degree
- b. Level 9: Master's degree
- c. Level 8: Bachelor with Honours; Post-Graduate Diploma; Post-Graduate Certificate
- d. Level 7: Bachelor's degree; Graduate Diploma; Graduate Certificate
- e. Level 6: Advanced Diploma; Associate degree; Diploma
- f. Level 5: Diploma
- g. Levels 1 to 4: Certificates

4.1.4. Pacific Quality Assurance Framework (PQAF)

The Pacific Quality Assurance Framework (PQAF) is the PICTs' response to the call for a 'quality assurance framework for the region'. The PQAF addresses quality standards for accrediting agencies, all forms of education and training institutions (such as technical and vocational, tertiary, and non-tertiary, and field-

specific forms, such as theological education and maritime training), programmes, and units of learning or programme components.

The PQAF, stemming from the Australian Agency for International Development Project under the Australian Aid Programme for the development of the Pacific Register of Qualifications and Standards (PRQS), has seen significant efforts invested in its creation and implementation. However, various factors, such as an absence of long-term funding commitments, inadequate institutional support, and challenges in integrating the framework into broader policies, have raised concerns about its long-term viability, necessitating a critical re-evaluation of the strategies and resources allocated to ensure its continued effectiveness and impact.

PQAF supports Pacific education systems in the quality assurance, validation and accreditation of their higher education programmes and institutions. Its qualifications team helps accrediting agencies, including national qualifications authorities, to develop, accredit and register their national qualifications onto the PRQS. These services, of quality assurance and maintenance of the register (PRQS), support labour and learner mobility as they uphold the credibility of regional qualifications and provide for easier comparability of qualifications.

To support countries, training institutions and other stakeholders in adopting the above frameworks PQAF has developed the following toolkit and guidelines:

- Delivery of Regional Qualifications- A Toolkit
- Guidelines for Development and Accreditation of Regional Qualifications
- Guidelines for the Development and Accreditation of Provider Qualifications
- Guidelines for the Development and Accreditation of Units of Learning

4.1.5. Harmonisation of national standards in the Pacific region

The PQAF stands as a significant milestone in the journey towards dismantling national barriers and nurturing regional cooperation. Training centres in the Pacific bring to the table a wealth of diverse technical expertise, a strong sense of belonging, and the unique ability to tailor their programmes to the specific needs and contexts of their respective regions.

However, challenges persist. Despite the establishment of the PQAF, there remains a prevalent reliance on individual national standards, resulting in fragmentation rather than harmonisation. This issue is exacerbated by a lack of awareness among stakeholders about the advantages of harmonisation of national standards as well as the relevance of adopting the PQAF framework. Additionally, inadequate funding presents a formidable hurdle, obstructing the structured and integrated development of frameworks.

Opportunities for improvement exist through investments in capacity-building programmes to enhance understanding and encourage the adoption of harmonised frameworks. Promoting collaboration among training centres and governments can help identify shared needs and facilitate the creation of integrated approaches. Seeking support from international donors and organisations can inject much-needed resources into harmonisation efforts.

Nevertheless, the absence of strong political commitment from governments threatens to impede progress towards harmonisation. Competing national interests and agendas may further hinder the alignment of standards and frameworks, while limited resources could restrict the implementation of harmonisation initiatives and QA processes for accreditation.

In conclusion, while Pacific training centres hold promises in contributing to harmonisation efforts, addressing these weaknesses, and seizing opportunities is imperative for the successful adoption of common accreditation standards and quality assurance mechanisms.

The following table provides details on the government ministry/department that administers education and training in the 15 countries covered under EQAP with details of the contact person, training framework adopted and the qualification accrediting body.

Table 1: List of Countries and their respective education departments

Country	Head of Education	Training Framework	National Qualification Accrediting Agency/International agency
Fiji	Mr Timoci Bure Acting Permanent Secretary for Education Ministry of Education, Heritage and Arts Senikau House Suva, Fiji	Fiji National Qualifications Framework (FNQF)	Fiji Higher Education Commission
Kiribati	Mrs Roreti Eritai Secretary for Education Ministry of Education Bikenibeu, Tarawa Republic of Kiribati	Kiribati has adopted the Pacific Qualifications Framework	None, however, they are working with SPC (PBEQ)
Samoa	Aeau Christopher Hazelman Chief Executive Officer Ministry of Education, Sports & Culture Apia SAMOA	Samoa Qualifications Framework	Samoa Qualifications Authority
Solomon Islands	Dr Franco Rodie Permanent Secretary Ministry of Education and Human Resources Development Honiara, Solomon Islands	Solomon Islands Qualifications Framework	Solomon Islands Tertiary Education and Skills Authority (SITESA)
Tonga	Mr Isikeli 'Oko Chief Executive Officer Ministry of Education and Training Hala Vuna, Nukualofa, TONGA	Tonga Qualifications Framework	Tonga National Qualifications and Accreditation Board (TNQAB)
Tuvalu	Dr Tufoua Panapa Chief Executive Officer Ministry of Education, Youth & Sports, Funafuti TUVALU	Kiribati has adopted the Pacific Qualifications Framework	None, however, they are working with SPC (PBEQ).
Vanuatu	Mr Iati Bergmans Director-General Ministry of Education and Training, Port Vila, VANUATU	Vanuatu Qualifications Framework (VQF)	Vanuatu Qualifications Authority
Tokelau	Ms Elaine Lameta Director of Education, Department of Education, Atafu Tokelau	National Curriculum Policy Framework	Programmes accredited through NZQA
Papua New Guinea	Dr Uke Kombra Secretary for Education Department of Education	PNG National Qualifications	National Higher and Technical Education Board

	GUINEA	Framework (PNGNQF)	
Cook Islands	Ms Danielle Cochrane Secretary for Education Ministry of Education Rarotonga, COOK ISLANDS	Aligned to the New Zealand Qualifications Framework	Programmes accredited through NZQA
Niue	Ms Birtha Togahai Director of Education Department of Education, Alofi NIUE	Aligned to the New Zealand Qualifications Framework	Programmes accredited through NZQA
Republic of Marshall Islands (RMI)	Mr Kanchi Hosia Commissioner of Education Public School System Ministry of Education, Sports and Training Majuro Republic of Marshall Islands 96960	Does not have a National Qualifications Framework. It adopts programmes accredited by the Western Association of Schools and Colleges of the United States. (WASC)	Programmes accredited through Western Association of Schools and Colleges of the United States.
Federated States of Micronesia (FSM)	Mr Wayne Mendiola Assistant Secretary Division of Formal and Non-Formal Education Department of Education, Palik, Pohnpei Federated States of Micronesia 96941	Does not have a National Qualifications Framework. It adopts programmes accredited by the Western Association of Schools and Colleges of the United States. (WASC)	Programmes accredited through Western Association of Schools and Colleges of the United States.
Palau	Hon. Dr Dale Jenkins Minister of Education Ministry of Education Koror, Palau 96940	Does not have a National Qualifications Framework. It adopts programmes accredited by the Western Association of Schools and Colleges of the United States. (WASC)	Programmes accredited through Western Association of Schools and Colleges of the United States.

Nauru	Mrs Darrina Kun Secretary for Education Ministry of Education and Training Government House Yaren Republic of Nauru	Does not have a National Qualifications Framework	Programmes are accredited through Australian Skills Quality Authority (ASQA)
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4.1.6. Country Technical Training Centres

a. Fiji

The accrediting agency in Fiji is the Fiji Higher Education Commission. The technical colleges accredited are listed as follows:

Table 2: Accredited Training Centres in Fiji

No.	Name of College/Institute	Accrediting Agency
1	Australia Pacific Technical College	Fiji Higher Education Commission
2	Centres for Appropriate Technology & Development	Fiji Higher Education Commission
3	Fiji National University (FNU)	Fiji Higher Education Commission
4	Fulton College	Fiji Higher Education Commission
5	Montfort Boys' Town	Fiji Higher Education Commission
6	Sangam Institute of Technology	Fiji Higher Education Commission
7	The University of the South Pacific (USP)	Fiji Higher Education Commission
8	University of Fiji	Fiji Higher Education Commission
9	Vivekananda Technical Centres	Fiji Higher Education Commission

Procedures to get technical training programmes accredited under the Fiji Higher Education Commission

The TVET sector is regulated by the Higher Education Commission (HEC) and guided by the Fiji National Qualifications Framework (FNQF). The HEC is responsible for ensuring the quality of all training and deals with recognition and equivalence of technical qualifications. The HEC registers training institutions, approves courses and accredits training institutions. The quality assurance mechanism allows for accreditation of the providers of training, which ensures that courses delivered at different levels are evaluated for high-quality education and training.

b. Samoa

The accrediting agency in Samoa is Samoa Qualifications Authority. The technical colleges accredited are listed as follows:

Table 3: Accredited Training Centres in Samoa

No.	Name of College/Institute	Accrediting Agency
1	Australia-Pacific Technical College	Samoa Qualifications Authority
2	Don Bosco Technical Centres	Samoa Qualifications Authority
3	National University of Samoa	Samoa Qualifications Authority

4	Uesiliana Vocational Centres	Samoa Qualifications Authority
5	University of the South Pacific-Alafua Campus	Samoa Qualifications Authority

Procedures to get technical training programmes accredited under Samoa Qualification Authority.

Programme Accreditation applications lodged with Samoa Qualifications Authority (SQA) should provide specific evidence of quality systems working at the Post School Education and Training (PSET) provider’s Faculty/Department/Programme level within the area of the application. The focus of Programme Accreditation is on specific evidence of the quality systems of the provider in a defined area – not simply provision of documented systems at the broad organisational level.

In situations where the Provider already holds accreditation for the programme from an overseas agency, the Provider is invited to submit a copy of the latest accreditation or quality audit report from that Agency, as evidence that it is meeting one or more of SQA’s Programme Accreditation criteria. Sufficient evidence must be submitted for SQA requirements that are not covered by the overseas Agency’s Quality Standards.

c. Solomon Islands

The accrediting agency in Solomon Islands is Solomon Islands Tertiary Education and Skills Authority (SITESA). The technical college accredited is listed as follows:

Table 4: Accredited Training Centres in Solomon Islands

No.	Name of College/Institute	Accrediting Agency
1	Solomon Islands National University (SINU)	Solomon Islands Tertiary Education and Skills Authority (SITESA)

Procedures to get technical training programmes accredited under Solomon Islands Tertiary Education and Skills Authority (SITESA)

The following procedure applies:

The Authority may, on application or its own initiative, accredit a tertiary course, or renew the accreditation of a tertiary course. Note—The applicant may, for example, be an industry body, a registered provider, an applicant for registration as a provider, or a public sector body.

In determining whether to accredit or renew the accreditation of a tertiary course and in determining the terms of accreditation, the Authority: (a) must apply the Solomon Islands Qualifications Framework and Quality Standards, taking into account any supporting policies; and (b) may take into account accreditation or recognition of the course or a similar course in a place outside Solomon Islands.

The Authority must give a person who makes an application under this section written notice of its decision on the application and the applicants right to seek review of the decision under this Act. No applications for accreditation may be made until after the date of adoption of the Solomon Islands Qualifications Framework and Quality Standards.

d. Tonga

The accrediting agency in Tonga is Tonga National Qualifications and Accreditation Board. The technical colleges accredited are listed as follows:

Table 5: Accredited Training Centres in Tonga

No.	Name of College/Institute	Accrediting Agency
1	Ahopanilolo Technical Institute	Tonga National Qualifications and Accreditation Board
2	Montfort Technical College	Tonga National Qualifications and Accreditation Board
3	National Centres for Vocational Studies (merged with TIHE)	Tonga National Qualifications and Accreditation Board
4	Pouono Campus of Tupou Tertiary Institute	Tonga National Qualifications and Accreditation Board
5	Tonga Institute of Education	Tonga National Qualifications and Accreditation Board
6	Tonga Institute of Higher Education	Tonga National Qualifications and Accreditation Board
7	Tonga Institute of Science and Technology	Tonga National Qualifications and Accreditation Board
8	Tupou College Technical	Tonga National Qualifications and Accreditation Board
9	Tupou Tertiary Institute	Tonga National Qualifications and Accreditation Board

Procedures to get technical training programmes accredited under Tonga National Qualifications and Accreditation Board

Every Provider seeking accreditation must apply. Such applications should be submitted in electronic format, when possible, and must include the following:

For each Programme:

- A completed Programme Accreditation Application Form.
- A completed Programme Self Evaluation Form.
- A Qualification Registration Form.
- A checklist for the Evaluation of a Qualification.
- Quality management system manual (or equivalent) and other documents referenced in the Programme Self Evaluation Form(s).
- Payment of the approved fees.

e. Vanuatu

The accrediting agency in Vanuatu is the Vanuatu Qualifications Authority. The technical colleges accredited are listed as follows:

Table 6: Accredited Training Centres in Vanuatu

No.	Name of College/Institute	Accrediting Agency
1	Anglican Church of Melanesia Vocational Education Technical School	Vanuatu Qualifications Authority
2	Edwards Institute of Technology	Vanuatu Qualifications Authority
3	Pacific Vocational Training Centres	Vanuatu Qualifications Authority
4	Pektel Rural Training Centre	Vanuatu Qualifications Authority

5	St Michel Technical College	Vanuatu Qualifications Authority
6	Torgil Provincial Institute of Vocational Training	Vanuatu Qualifications Authority
7	Vanuatu Institute of Technology	Vanuatu Qualifications Authority

Procedures to get technical training programmes accredited under Vanuatu Qualifications Authority

Develop the course using the Unit-of-Competency-based or the Component-based Course Accreditation Document Template (whichever is applicable to the course), the Handbook for the Development of PSET Courses and the relevant Training Package if applicable. Complete the Course Accreditation Document following the Course Accreditation Document Template. Carry out Benchmarking and Validation of the new course. Complete the Course Accreditation Application Form QA-AC-CAF1, compile the Portfolio of Evidence, including the Course Accreditation Document and the Validation and Benchmarking results, and complete the Course Accreditation Application Checklist QA-AC-CAC1, to help ensure that all required evidence has been included. Finally, submit the documents to VQA.

f. Papua New Guinea (PNG)

The programme accreditation in PNG is administered by National Higher and Technical Education Board. There are two accrediting agencies in PNG, namely:

- Papua New Guinea Office of Higher Education
- Papua New Guinea National Training Council

Table 7: Accredited Training Centres in Papua New Guinea by the Papua New Guinea Office of Higher Education

No.	Name of College/Institute	Accrediting Agency
1	Don Bosco Technical Institute	Papua New Guinea Office of Higher Education
2	Goroka Technical College	Papua New Guinea Office of Higher Education
3	Madang Technical College	Papua New Guinea Office of Higher Education
4	Mt Hagen Technical College	Papua New Guinea Office of Higher Education
5	National Polytechnic College or Lae Polytechnical	Papua New Guinea Office of Higher Education
6	PNG University of Technology	Papua New Guinea Office of Higher Education
7	Port Moresby Technical College	Papua New Guinea Office of Higher Education
8	University of Goroka	Papua New Guinea Office of Higher Education
9	University of Papua New Guinea	Papua New Guinea Office of Higher Education

Table 8: Accredited Training Centres in Papua New Guinea by the Papua New Guinea National Training Council

No.	Name of College/Institute	Accrediting Agency
1	Air Niugini Technical Training School	Papua New Guinea National Training Council
2	Australia Pacific Technical College	Papua New Guinea National Training Council
3	Besenengka Vocational Centres	Papua New Guinea National Training Council
4	Bishop Brother Industrial Training Centres	Papua New Guinea National Training Council
5	Caritas Technical Secondary School	Papua New Guinea National Training Council
6	City College of Technology	Papua New Guinea National Training Council
7	Don Bosco Technical School	Papua New Guinea National Training Council

8	Elirana Electronics Technology School	Papua New Guinea National Training Council
9	Innovative Training Centres	Papua New Guinea National Training Council
10	International Training Institute	Papua New Guinea National Training Council
11	Lae Technical College	Papua New Guinea National Training Council
12	Mega Institute of Technology	Papua New Guinea National Training Council
13	Melanesia Training Institute	Papua New Guinea National Training Council
14	Micro Training Institute	Papua New Guinea National Training Council
15	Oisca Rabaul Eco Technical Training Centres	Papua New Guinea National Training Council
16	PNG Industry Vocational Education and Training Inc	Papua New Guinea National Training Council
17	PNG Institute of Technologies	Papua New Guinea National Training Council
18	PNG Power Training Centres	Papua New Guinea National Training Council
19	Works Institute of Technology	Papua New Guinea National Training Council

Procedures to get technical training programmes accredited under National Higher and Technical Education Board (NHTEB)

These requirements shall be met:

- The Programme is consistent with the Papua New Guinea National Qualifications Framework.
- The Programme is well-designed.
- Programme resourcing and information are adequate.
- Programme teaching and learning are of high quality.
- Admission criteria are appropriate.
- Assessment is appropriate and effective and expected student learning outcomes are achieved.
- Programme monitoring, review, updating and termination are appropriately managed.

g. Other Pacific Countries

Kiribati: There is no national qualification accrediting agency, however, Pacific Board for Educational Quality (PBEQ) granted accreditation as a higher education and training institution to The Kiribati Institute of Technology (KIT).

Table 9: Accredited Training Centres in Kiribati

No.	Name of College/Institute	Accrediting Agency
1	The Kiribati Institute of Technology (KIT)	Pacific Board for Educational Quality (PBEQ)

Tuvalu: Tuvalu has adopted the PQF and the Pacific Quality Assurance Framework (PQAF) for their system. The known training providers in Tuvalu are APTC and USP Tuvalu Campus.

Tokelau: Programmes accredited through NZQA.

Niue: Niue follows the New Zealand Qualifications Framework. The known training provider in Niue is USP Niue Campus.

Cook Islands: Cook Islands follow the New Zealand Qualifications Framework. The known training providers in Cook Islands are Cook Islands Tertiary Training Institute and USP Cook Islands Campus.

Federal States of Micronesia (FSM): FSM runs programmes accredited under Western Association of Schools and Colleges of the United States. The known training provider in FSM is College of Micronesia.

Palau: Palau runs programmes accredited under Western Association of Schools and Colleges of the United States. The known training provider in Palau is Palau Community College.

Marshall Islands: Marshall Islands runs programmes accredited under the Western Association of Schools and Colleges of the United States. The known training provider in RMI is the USP Marshall Islands Campus.

Nauru: The training programmes offered are generally in alignment with the Queensland State of Australia. The known training provider in Nauru is the USP Nauru campus.

4.1.7. Other Pacific Training Programmes

Within the SPC, there exist alternative initiatives dedicated to addressing the framework-related challenges that the PQAF has encountered. Despite the PQAF's commendable efforts to establish a well-defined framework, the prevailing regional dynamics often overshadow a more comprehensive, long-term vision, primarily due to limited financial resources. These alternative projects, although lacking in long-term sustainability, serve as crucial short-term pillars of support for endeavours seeking to bridge the existing gaps. While sustainability remains a significant concern, the immediate impact and assistance provided by these initiatives play a vital role in advancing the broader goals of the SPC.

a. PPA/SEIAPI Accreditation Programme

To support the development of a quality-based sustainable energy industry, the Sustainable Energy Industry Association of the Pacific Islands (SEIAPI) and the Pacific Power Association (PPA) have developed an accreditation scheme for individuals and organisations (business entities). (Note: In countries with quality Training Frameworks, only accredited training centres can certify an individual, that is why the industry-based scheme is called an accreditation scheme).

Initially, the PPA/SEIAPI Technician Certification and Accreditation Programme was launched by SEIAPI in May 2012. Later in April 2014, the Scheme was relaunched as the PPA/SEIAPI Certification/Accreditation Programme whereby individuals can be certified as designers, installation (maintenance) technicians and inspectors (of system installations).

The organisation (or business entity) can be accredited as the supplier of products, systems, and services. However, to be accredited in providing products/services in a specified technology, the organisation needs to have certified designers and installers on their staff or under sub-contract. If there are any Individuals who operate as sole traders within the industry, for example, they might sell and install RE equipment or be an energy efficiency auditor, then they must apply to be both an accredited individual and an accredited organisation.

The programme has two levels of accreditation: provisional and full. An individual will need to successfully complete a training course which has been recognised (and or specified) by PPA/SEIAPI. As the accreditation programme is an industry-based programme, SEIAPI/PPA would verify that the individual is incorporating into their work what they have learnt in such a training course. Therefore, both levels of membership, i.e. (i) the individuals and (ii) the organisations, will initially receive 'provisional' accreditation after successfully completing the training. Full Certification would be provided after they submit evidence that they have applied the training received in their work.

Currently, technologies under which accreditation exists include:

- Grid-connected PV systems
- Stand-alone PV systems (Level 1- Solar Home Systems, Level 2- Stand-alone systems with/without Inverters, Level 3 Hybrid Power systems).

b. EU PacTVET Project

The purpose of the project was to enhance and/or create P-ACPs' (Pacific - African, Caribbean, and Pacific countries) regional and national capacity and technical expertise to respond to climate change adaptation (CCA) and sustainable energy (SE) challenges³.

The PacTVET project was component three (3) within the broader Adapting to Climate Change and Sustainable Energy (ACSE) Programme. The project was built on the recognition that energy security and climate change were major issues hindering the social, environmental, and economic development of Pacific ACP (P-ACP) countries.

The project was implemented by the SPC in partnership with the University of the South Pacific (USP) over a period of 74 months.

c. Sustainable Energy Industry Development Project (SEIDP)

The World Bank provided funding to PPA as the Project Implementation Agency for the Sustainable Energy Industry Development Project (SEIDP). One component of this required provision of consultancy services to provide technical assistance in development of technical guidelines, training unit standards and conducting workshops on the guidelines.

Global Sustainable Energy Solutions (GSES) provided the consultancy services between April 2018 and August 2020. In summary the project:

- Updated and published four (4) existing technical guidelines.
- Developed and published twelve (12) new technical guidelines:
- Developed Nineteen 19 training unit standards that were submitted for approval onto the Pacific Register of Qualifications and Standards).
- Conducted thirty-four (34) 4-day workshops on the guidelines in 13 countries.

4.1.8. Solar Energy Courses in the Pacific region

USP Pacific TAFE

In July 2022, The University of the South Pacific (USP) Pacific TAFE offered the following online courses:

- Grid Connected PV Systems – Design Only, Install Only and Design and Install
- Stand Alone Power Systems (SAPS also known as Off-Grid) - Design Only, Install Only and Design and Install
- Battery Storage Systems for Grid Connected PV System - Design Only, Install Only and Design and Install

³ PACTVET LIAISON CONSULTANCY | National Advisory Board. <https://nab.vu/pactvet-liaison-consultancy>

The stand-alone course covers PV only solar systems and PV-fuel generator hybrid systems. Since signing the agreement there have been more than 60 registrations for the online solar courses (May 2023 update).

SEIAPI is working with GSES and USP Pacific TAFE to determine how the practical courses will be conducted for those undertaking the installation courses. SEIAPI has liaised with GSES and determined that the following 12 short online courses currently available by GSES in Australia will be put online through USP Pacific TAFE by early 2023:

- AS/NZS 5033:2021 Updates – Online Short Course (3 hours)
- Solar Hot Water Systems (3 hours)
- Communications, Monitoring and Control (4 hours)
- Fault Current Analysis for Commercial Solar (2 hours)
- Introduction to PV Systems: Grid-Connected PV Systems (6 hours)
- Operation and Maintenance of PV Systems (3 hours)
- Power Cable Selection for PV Systems (5 hours)
- SketchUp for Solar PV Systems (6 hours)
- Solar Battery System Fundamentals (4 hours)
- Solar Sales Essentials (2 hours)
- Utility Scale Solar Projects (8 hours)
- Solar Power System Fundamentals (20 hours)

Solomon Islands National University (SINU)

The Solomon Islands National University was established in 2013 by the Government of the Solomon Islands to provide quality and affordable education. Solomon Islands National University (SINU) has signed an agreement with GSES, and training is being offered using the GIZ PPA license training material.

College of Micronesia (COM)

The College of Micronesia-FSM is a public community college in the Federated States of Micronesia. It began operation in 1963 as the Micronesian Teacher Education Centre. The college has a state campus in each of the four states with its national campus in the capital city of Palikir, Pohnpei.

The College of Micronesia has signed an agreement with GSES, and training is being offered using the GIZ funded PPA license training material.

Pacific Regional Sustainable Energy Training Centres

SEIAPI has secured private foundation funding to establish a new Pacific Regional Sustainable Energy Training Centres at the USOP Pacific TAFE campus in Suva, Fiji. The building is currently being designed with a tender being released later in 2023 with the aim of opening the new training centres in mid-2024. The centres will initially teach the PV courses for grid and off grid systems but will be expanded to offer courses in:

- Solar water pumping
- Energy efficiency
- Operation and maintenance of systems (grid and off grid)
- Auditor/inspector training
- And any other courses identified as being required by the industry.

Funding has been optioned for the hiring of two new trainers. The long-term objective is that these trainers will be resources to support training being conducted within other training centres.

Funding has also been obtained for providing practical equipment for other in-country training centres as per the SEIAPI training plan (see section 11).

SEIAPI Training Plan-December 2022

The Sustainable Energy Industry Association of the Pacific Islands (SEIAPI) has been promoting the need for solar training for system designers, installers, and maintainers since SEIAPI was established in 2010. The private solar industry companies and the electrical power utilities in the region require a well-trained technical workforce to meet the needs of their customers and to support national energy objectives.

Skills training is often provided as certificate level 1 to 5 courses. These provide a level of training appropriate for those new to the field, often school leavers, to obtain suitable practical training to enter an industry. However, the sustainable energy industry is already established. Private companies, government energy departments and power utilities often need their staff upskilled and/or new staff capable of undertaking specified tasks. To help meet this needed training, countries including Australia, New Zealand and United States provide training for the sustainable energy in the form of skillsets. The skillset typically defines a task that can be performed after a person has successfully completed the training, an example being to design a grid connected PV system.

Over the years, GSES/SEIAPI developed the following training proposals, discussion papers and request for funding:

- Proposal for Development of Solar Training in Papua New Guinea (April 2020)
- Draft Pacific Community (SPC) sustainable energy capacity building project proposal titled *Pacific Sustainable Energy Industry and Technical and Vocational Education and Training* (PSEITVET; (November 2020)
- Draft in-country training requirements for the Pacific Power Association (PPA)/Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) Licensing Roll Out (February 2021)
- Discussion Paper on Development of Solar Training in Papua New Guinea (February 2021)
- Fiji Renewable Energy Training Plan (March 2021)
- Discussion Paper on a Proposed USP-TAFE /GSES Training Agreement (March 2021)
- Proposal to Establish a Solar Training Centres at USP Pacific TAFE in Fiji (October 2021)
- Request for Funding for Establishing: Regional Sustainable Energy Training Centres at USP-Pacific TAFE Suva Fiji (May 2022)

Based on the experience gained in conducting training, undertaking various solar PV related visits to PICs and other countries over the last five years and developing the various reports and proposals. SEIAPI eventually developed a training plan in December 2022⁴.

In summary this plan states that the key activities to establish solar training within existing training centres is to:

⁴ Capacity Building - GSES International. <https://www.gsesinternational.com/consulting/capacity-building/>

- Train the trainers and provide them with ongoing support (one objective of the regional training centres)
- Provide training equipment to in-country training centres so that practical training course can be conducted; and
- Where necessary have the training unit standards registered on the PRQS accredited within the countries that have national training frameworks.

As part of this training plan SEIAPI has already started identifying other potential training centres in the region. SEIAPI is currently working with:

- Vanuatu Institute of Technology
- Tonga Institute of Science and Technology
- University of Technology (UNITECH) in Lae, Papua New Guinea
- Port Moresby Technical College (PNG)

In 2023 SEIAPI plans to visit Samoa and Cook Islands to meet with training institutes in those countries.

4.2. EAC Region

The qualification and certification landscape within the EAC region is undeniably unique, distinguished by its geographical diversity, economic dynamics, and cultural richness. Notably, this region stands in sharp contrast to areas like the Pacific, where hundreds of disparate islands are scattered across the vast expanse of the ocean.

In the Pacific, the geographical fragmentation presents an entirely different set of challenges, as each island nation grapples with its distinct qualifications and certification frameworks. Conversely, within the EAC region, the focus often converges on a handful of countries that serve as the epicentres for training, education, and the synthesis of regional needs.

The complexities and unique dynamics stemming from this diversity underscore the challenges and opportunities within this regional context, highlighting the pivotal role of key nations in consolidating educational and training standards across the EAC area.

In the EAC region, a concentration of training centres and resources within select key countries facilitates a centralised and regionally targeted approach to training and education. This focused regional perspective streamlines coordination and optimises resource allocation.

The shared goals and regional integration objectives among EAC member states creates a unifying framework for training centres. This fosters collaboration and synergy, and the presence of these centres in specific countries ensures better resource availability, including faculty expertise and facilities, thereby supporting the development and maintenance of high-quality training programmes.

Nevertheless, while certain countries enjoy concentrated training resources, others within the EAC region may face limited access. This imbalance can result in uneven opportunities for technical training. Additionally, navigating the complexities of coordinating accreditation and harmonisation efforts across countries with varying administrative structures and regulations presents bureaucratic challenges. Balancing the diverse interests and agendas of different member states is particularly delicate when harmonising standards and frameworks.

Despite these challenges, the EAC's unwavering focus on regional integration provides a unique opportunity for training centres to collaborate on common accreditation and Quality Assurance (QA) standards. Leveraging shared objectives enhances the quality of technical training programmes, capitalising on the expertise of select countries to fortify the regional framework. It is essential to ensure that resource disparities among key countries and others do not lead to inequalities in the quality and accessibility of technical training programmes.

Investing in programmes to empower member states with fewer resources can promote equitable access to high-quality technical education. Furthermore, concerted efforts to harmonise policies and regulations related to technical training and education across EAC member states can mitigate bureaucratic obstacles.

Given the vast extent of the area under consideration, a selective approach has been chosen, focusing on specific countries among those involved, considering their cost-effectiveness, resource utilization, and their significant and impactful developments.

4.2.1. East African Centre of Excellence for Renewable Energy and Efficiency (EACREEE)

East African Centre of Excellence for Renewable Energy and Efficiency (EACREEE) plays a key role in promoting renewable energies and energy efficiency in the East African Community (EAC) region. Through its activities in the areas of policy, capacity development, knowledge management, and awareness raising, as well as business and investment promotion, EACREEE aims to create an enabling environment by mitigating existing barriers and in promoting a competitive sustainable energy market, as well as economies of scale in the EAC region. EACREEE will continue to execute regional projects, programmes and activities in the above areas and in addition showing leadership in the coordination and harmonization of donor activities and acting as a regional hub for the SEforALL initiative.

4.2.2. East African Qualifications Framework for Higher Education (EAQFHE)

The EAC comprises Partner States, including Democratic Republic of Congo, South Sudan, Burundi, Kenya, Rwanda, Tanzania, and Uganda. These nations are actively developing their respective national qualifications frameworks (NQF) that are rooted in learning outcomes. Notably, Kenya, Rwanda, and Tanzania have already completed the development of their NQFs and are currently at various stages of implementation. The East African Qualifications Framework for Higher Education (EAQFHE) serves as a pivotal convergence tool for standardising qualification levels across all Partner States within the EAC⁵. It establishes a framework for comparing qualifications attained in one Partner State with those achieved in others, as well as with qualifications from various countries and regions worldwide. This framework significantly enhances the mobility of EAC citizens, fostering not only cross-border movement but also facilitating seamless transitions between different educational institutions and levels. Importantly, it duly recognises knowledge and skills acquired through non-formal education channels as integral components of a formal qualification.

⁵ African Continental Qualifications Framework - 6th peer learning webinar | ETF. <https://www.etf.europa.eu/en/news-and-events/events/african-continental-qualifications-framework-6th-peer-learning-webinar>

Table 10: Qualification Types in the East African Education System

Basic Education Qualifications	
Lower Primary Qualification Types	Upper Primary Qualification Types
<ul style="list-style-type: none"> • Certificate of general basic education 	<ul style="list-style-type: none"> • Certificate of general basic education
	<ul style="list-style-type: none"> • Government/Grade Trade Test (GTT) Cert. I
	<ul style="list-style-type: none"> • GTT II
	<ul style="list-style-type: none"> • GTT III
Lower Secondary Qualification Types	Upper Secondary Qualification Types
<ul style="list-style-type: none"> • Certificate of general basic education 	<ul style="list-style-type: none"> • Certificate of general secondary education
<ul style="list-style-type: none"> • Certificate of vocational basic education 	<ul style="list-style-type: none"> • Certificate of vocational education
<ul style="list-style-type: none"> • Artisan Cert. (Theory and Practice) 	<ul style="list-style-type: none"> • Diploma of vocational secondary education
<ul style="list-style-type: none"> • Artisan Cert. (Practice) 	
Higher Education Qualifications	
Undergraduate Qualification Types	Postgraduate Qualification Types
<ul style="list-style-type: none"> • Certificate 	<ul style="list-style-type: none"> • Postgraduate Certificate
<ul style="list-style-type: none"> • Diploma 	<ul style="list-style-type: none"> • Postgraduate Diploma
<ul style="list-style-type: none"> • Advanced Diploma 	<ul style="list-style-type: none"> • Master’s Degree
<ul style="list-style-type: none"> • Bachelor’s degree 	<ul style="list-style-type: none"> • Doctorate Degree
	<ul style="list-style-type: none"> • Post-Doctoral

The education and training sector across the EAC Partner States, as illustrated in the above table, can be broadly categorised into various segments, including basic education, industrial/technical training (encompassing vocational training), professional training, and higher education. To ensure harmonisation across these diverse systems, the EAQFHE has identified cycles and levels predicated on the proficiency levels attained. The first and second cycles pertain to Early Childhood Development Education and Primary School programmes, while the third and fourth cycles encompass Secondary, Postsecondary, Technical, and Vocational Training programmes. Lastly, the fifth cycle aligns with Undergraduate and Postgraduate programmes.

Table 11: Higher Education Structure in East Africa

Admission from	Cycle V
Cycle IV	Sub-cycle 1 (Level 6)
<ul style="list-style-type: none"> Tech. Diploma 	<ul style="list-style-type: none"> Bachelors Degree 360 credits
<ul style="list-style-type: none"> Craft Certificate 	<ul style="list-style-type: none"> Professional Diploma min 300 credits
<ul style="list-style-type: none"> Non tech. Diploma 	<ul style="list-style-type: none"> Advanced Diploma 240 min credits
<ul style="list-style-type: none"> Certificate of general secondary education 	<ul style="list-style-type: none"> Diploma 120 min credits
<ul style="list-style-type: none"> Certificate of vocational education 	
<ul style="list-style-type: none"> Diploma of vocational secondary education 	
Learning	Qualifications that signify completion of Cycle V subcycle 1 are awarded to learners who:
Outcomes	<ul style="list-style-type: none"> have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, while supported by advanced learning, includes some aspects that will be informed by knowledge of the forefront of their field of study;
	<ul style="list-style-type: none"> can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study;

In delineating the structure of higher education in East Africa, these cycles are described in a hierarchical fashion, emphasising learning outcomes, as delineated in the above table. It is important to note that each subsequent cycle within higher education presupposes the acquisition of additional learning outcomes built upon the foundations of the preceding cycle.

Qualifications Type Specifications serve as essential guidelines that shape the development and accreditation of educational and training qualifications. These specifications primarily cater to accrediting bodies within each education and training sector, tasked with accrediting qualifications across East Africa. Moreover, qualification developers in each education and training sector within the EAC Partner States also rely on these specifications.

These specifications extend their utility to authorised issuing organisations, industry and professional associations, licensing and regulatory bodies, learners, graduates, and employers. The overarching goal of each qualification type is to formally acknowledge individuals as possessing the necessary knowledge, skills,

and values for various avenues such as further education, employment, and active civic engagement. Additionally, these specifications help ascertain the extent of learning required to attain these competencies.

The measurement of learning volume is articulated through credit points. This credit point system quantifies the amount of learning expected at different qualification levels. For example, in the case of undergraduate qualifications, an average of sixty credit points represents the minimum expected learning achieved by students during one academic year of study. This same credit point system is applicable to regulations governing significant components of study, including thesis requirements, general studies in undergraduate programmes, and equivalent credits for formal instruction, laboratory work, or fieldwork.

The EAC Higher Education system employs a standardised Credit Accumulation and Transfer system (EACAT) to evaluate and acknowledge the learning achievements and performance of higher education learners across the EAC and collaborating countries. EACAT credits are utilised for monitoring, recording, and rewarding educational accomplishments, promoting mobility between programmes and institutions. However, not all earned credits may necessarily contribute to a specific programme or award, as individual programmes are unique and determined by each institution.

Institutions possess the authority to determine which credits they will accept for accumulation or transfer based on their educational mission and the learner's interests. Regulatory bodies and professional organisations may also impose additional requirements beyond credit accumulation. EACAT credits, equivalent to 1,500 - 1,800 hours of study, foster transferability and progression across the community.

The acceptance of credit transfer is contingent on the alignment of prior learning with the intended programme of study and programme availability. Credit recognition denotes eligibility for consideration but not automatic admission.

Credit transfer from one institution or programme to another is typically time-bound, with credits considered valid for up to five years. Institutions granting awards must own a substantial proportion of the total core credits required for graduation.

Assessment and award processes are outlined by individual institutions and specify credit requirements for progression and qualification attainment. Institutions also determine policies related to failure compensation, re-sits, reassessment opportunities, and their impact on credit awards.

Credits serve as a pivotal tool for both recognising prior learning and accrediting work-based learning experiences. Institutions leverage credit level and volume to determine the recognition of acquired knowledge and skills within specific programmes.

These credits establish a robust and standardised system for the assessment and validation of individuals' knowledge, skills, and competence within the PV and SHC sectors. This standardisation plays a crucial role in ensuring that certified professionals consistently meet high-quality benchmarks, thereby instilling confidence throughout the industry. Certification bodies, employers, and customers rely on credit-based systems to effectively assess an individual's proficiency in PV and SHC technologies, a critical factor for ensuring safety, quality, and optimal system performance.

The ongoing endeavour is to harmonise the credit system regionally. This harmonisation effort seeks to establish a unified and universally recognised credit framework, allowing professionals who have earned credits from reputable certification and qualification programmes to seamlessly work across international

borders. By creating a framework that recognises and accepts the same credit system and harmonises credit standards from well-established programmes, this initiative facilitates global mobility for certified individuals. It fosters a more cohesive and interconnected global workforce, promoting the widespread adoption of PV and SHC technologies and contributing to the transition to sustainable energy sources.

4.2.3. IUCEA

The Inter-University Council for East Africa (IUCEA) is an inter-governmental organisation of the EAC enacted by the IUCEA Act 2009. Its mandate is to coordinate higher education in the Community and to advise the EAC Partner States on all matters relating to higher education. In dispensing its mandate, its core focus revolves around three areas: quality of higher education, research, networking, and collaboration between member universities and beyond.

To achieve this, IUCEA is required to establish a regional harmonised higher education system and facilitate the maintenance of internationally comparable education standards in East Africa to promote the region's competitiveness in higher education⁶.

Over the past years, IUCEA in partnership with the national councils and commissions for higher education has facilitated the development of a functional Regional Quality Assurance System for East Africa. IUCEA has also facilitated the development of an East African Qualifications Framework for Higher Education (EAQFHE), which is a generic instrument for anchoring national qualifications frameworks for the purpose of harmonisation and synchronisation of education and training systems and for comparing the qualifications attained in the EAC.

Cognisant of its mandate and considering the above-mentioned developments in the higher education system, IUCEA has now embarked on a process of developing a regional accreditation programme to help in the harmonisation of quality education and promote mobility of students, staff and skills. Prior to a programme being submitted, it should have been accredited by the National Commission/Council or any other accrediting body using prescribed quality assurance standards and guidelines. The regional accreditation of programmes comes with many benefits including access to potential development partners' funding and ensuring ease of comparability, transfer of credits and ultimately student mobility and recognition of qualifications. To guide the accreditation process, IUCEA has developed standards, guidelines, procedures, processes, norms and assessment tools which were approved by its Governing Board, the Executive Committee.

4.2.4. Uganda

In Uganda, the process of competence-based assessment, qualification, and certification within the field of solar trade is diligently overseen by two key authorities: the *Directorate of Industrial Training (DIT) under the Ministry of Education and Sports*, and the *Electricity Regulatory Authority (ERA)*. These efforts are deeply rooted in a comprehensive framework that not only governs solar trade but also spans the entire spectrum of education and qualifications.

At the heart of this framework lies the *National Qualifications Framework (NQF)*, a dynamic structure that extends its reach from early childhood education to the highest echelons of doctoral study. Within this

⁶ Inter-University Council for East Africa | ASCL Country Portal - Information about African countries. <https://countryportal.ascleiden.nl/content/inter-university-council-east-africa>

expansive framework, the *Uganda Higher Education Qualifications Framework (UHEQF)* serves as a distinguished subset, commencing at level four (see Table 12) and offering a unique perspective on the intricate web of higher education qualifications.

The UHEQF is more than just a regulatory document; it is a normative instrument thoughtfully designed to elucidate the intricate relationships among various higher education qualifications. It accomplishes this through the articulation of a common language, facilitating the comparability of qualifications. For learners, this translates into a powerful tool for making well-informed decisions about the educational pathways they wish to embark upon.

One of the notable strengths of this framework is its capacity to guide learners in charting their own progression pathways aligned with their chosen careers. This feature is instrumental in fostering a sense of direction and purpose, ultimately empowering individuals to pursue their educational and professional aspirations with clarity.

Moreover, the framework is not an isolated creation; it stands as a product of rigorous benchmarking against the best practices regionally and internationally. This careful alignment ensures that Uganda's education and training standards remain competitive and relevant on the global stage.

The architecture of this framework is underpinned by a credit system, allowing for the quantification of the volume of learning undertaken by students. Furthermore, it hinges on the articulation of precise learning outcomes which provide a clear description of what learners are expected to comprehend or demonstrate at each stage of their educational journey. In essence, it paves the way for transparency and accountability, offering stakeholders a means to assess the quality and rigor of educational programmes.

Structured into different levels, the framework beautifully captures the essence of learning as it unfolds, marking an increasing complexity of learning achievements. With each ascending level, it bestows greater responsibilities and autonomy upon the learners, reflecting their growth and maturation as knowledge seekers.

Crucially, the framework goes beyond mere structure; it embodies a mechanism for naming and interpreting higher education qualifications. This means that qualifications are not merely certificates but concrete manifestations of a well-structured, internationally comparable education.

Table 12: Levels of Uganda's National Qualifications Framework

Levels	Education levels	Typical Qualifications at the level
Level 1	Primary Education	Primary Leaving Certificate
Level 2	Secondary Education	Uganda Certificate of Education (UCE or simply O-level)
Level 3		Uganda Advanced Certificate of Education (A or simply A-level)
Level 4	Higher Education	Higher Education Certificate, University Foundation Programme
Level 5		Ordinary Diploma
Level 6		Advanced/Higher Diploma

Level 7		Bachelors
Level 8		Master's Degree/Post Graduate Certificate/Diploma
Level 9		Doctorate

d. The Directorate of Industrial Training (DIT)

Within the landscape of Ugandan education and vocational training, the DIT stands as a starting point of quality assurance, recognised both nationally and internationally. As an integral component of the Ugandan Ministry of Education and Sports, DIT carries a mandate with the intent to transcend geographical boundaries, encompassing nationally, regionally, and globally acknowledged quality assurance services for Business, Technical, Vocational Education and Training (BTVE). DIT's mandate is firmly rooted in the realm of skills quality assurance. Empowered by the BTVE Act of 2008, this directorate is tasked with a multifaceted mission that extends across several critical domains, distributed among 2 departments:

1 Assessment & Certification Department

DIT plays a central role in the development of occupational standards, ensuring that the skills and competencies demanded by various industries are well-defined and benchmarked.

- **Regulation of Work-Based Training Schemes:** The directorate regulates work-based training schemes, aligning them with industry needs and best practices to foster a skilled workforce.
- **Expansion and Implementation of the Uganda Vocational Qualifications Framework (UVQF):** DIT actively expands and enhances the application of the Uganda Vocational Qualifications Framework, providing individuals with recognised qualifications that resonate within the Ugandan and international job markets.
- **Accreditation of Assessment Centres:** Recognising the critical role of assessment Centres in skills development, DIT accredits these Centres, ensuring they meet the highest standards of quality and efficacy.
- **Assessment and awarding of Uganda Vocational Qualifications:** DIT conducts assessments aligned with predefined occupational competencies, subsequently awarding Uganda Vocational Qualifications, thereby validating the skills and knowledge of individuals across various trades.
- **Promotion of Entrepreneurial Values:** DIT places a strong emphasis on the cultivation of entrepreneurial values and skills within competence-based education and training, preparing individuals not only to excel in their chosen fields but also to navigate the entrepreneurial landscape effectively.
- **Implementation of Vocational Qualifications:** The directorate oversees the implementation of vocational qualifications within the BTVE sub-sector, ensuring their integration and relevance in the broader educational framework.

2 Qualifications Standards Department

This department is entrusted with the crucial task of developing occupational standards, crafting training modules, and compiling and distributing assessment and training packages tailored to the diverse needs of occupational sectors. With a rich repository of 120 occupational profiles, training modules for 80 distinct occupations, assessment instrument banks for 83 occupations, and comprehensive assessment and training

packages for 80 different occupational areas, this department underpins the quality and relevance of skills development in Uganda.

In essence, the Directorate of Industrial Training serves as a linchpin in Uganda's pursuit of skills excellence, ensuring that its workforce is equipped with the competencies demanded by a dynamic and competitive job market. Through meticulous standardisation, accreditation, and assessment, DIT nurtures a skilled labour force that propels Uganda towards greater economic prosperity and sustainable development.

Uganda Vocational Qualification Framework (UVQF)

The Uganda Vocational Qualifications Framework (UVQF) is an integral component of the DIT's multifaceted quality assurance roles. DIT's responsibilities encompass the development of occupational standards, the creation of assessment and training packages (ATPs), the accreditation of assessment centres, the certification of assessors, and the execution of competence-based assessments, culminating in the certification of successful candidates.

This section is not merely a regulatory provision; it serves as the bedrock upon which the UVQF is built. It clarifies the UVQF's fundamental nature as a mechanism that defines occupational and assessment standards within the dynamic realm of the workforce. It also outlines the core function of awarding vocational qualifications to learners who demonstrate mastery of the established standards, irrespective of whether their education and training pathways follow formal or non-formal channels.

The UVQF stands out with a notable emphasis on inclusivity, making it an accessible platform for learners, irrespective of their training duration, educational background, assessment method, gender, or any special needs they may have. This inclusive ethos underscores a steadfast commitment to ensuring equitable access to skills validation. It also serves as a compelling starting point for promoting greater gender diversity in the sector.

Building upon this inclusive foundation, the framework can take progressive steps by implementing policies and practices that guarantee universal access to resources, opportunities, and benefits. This encompasses the equitable distribution of funding, scholarships, and training opportunities, ensuring that every aspiring learner has a fair chance to participate and excel.

Moreover, this approach could serve as an exemplary model for countries across the region and beyond. By developing targeted programmes designed to empower women in the sector, the framework can provide essential training, mentorship, and networking avenues that enable women to advance in their careers. These programmes should be comprehensive, addressing both the technical skills necessary for proficiency in the field and the leadership development needed for success.

Under the competent stewardship of DIT, learners undergo Competence-Based Assessment (CBA), leading to the attainment of various qualifications. These qualifications reflect a spectrum of proficiency, ranging from modular transcripts that acknowledge partial qualifications to national certificates, diplomas, and specialised certificates, each conferred based on the level of competence achieved:

- **Modular transcript** (partial qualification after undertaking modular assessment in each occupation)
- **Worker's PAS (PAS=Practically Acquired Skills)**, it is a partial qualification, especially for apprenticeship individuals in the informal sector.
- **UVQF level 1:** National certificate for individuals who merit in performing the full occupational skills but under supervision.

- **UVQF level 2:** National certificate for individuals who merit in performing the full occupational skills under moderate supervision.
- **UVQF level 3:** National certificate for individuals who merit in performing the full occupational skills at supervisory level.
- **UVQF level 4:** National diploma for individuals who merit in performing the full occupational skills at technician level. I
- **UVQF level 3-CVTI:** Certificate in Vocational Training Instruction “(Offered to BTVET instructors after 9 months CBET Programme conducted at Nakawa VTI)
- **UVQF level 4-DVTI:** Diploma in Vocational Training Instruction (offered to BTVET Instructors alter 9 months CBET Programme conducted at NakawaVT1)
- **UVQF level 5-DTIM:** Diploma in Training Institution Management (Offered to BTVET Principals and Head Teachers alter 9 months CBET Programme conducted at NakawaVT1) UVQF awards.

In 2009, DIT ushered in a transformative era by commencing the issuance of UVQF qualification certificates and transcripts. This marked the gradual phasing out of trade test certificates, symbolising a significant shift in the BTVET subsector's approach to skills validation. Employers are urged to take heed of these reforms, confident in the knowledge that UVQF-labelled certificates attest to an individual's ability to perform occupational tasks at the level of competence indicated on the qualification certificate. Under Section 21 of the BTVET Act 2008, DIT is entrusted with the mandate to award certificates and diplomas for business, technical, or vocational education and training conducted under the UVQF. These certificates and diplomas hold not only national but also labour market recognition, reinforcing the value of UVQF qualifications.

The UVQF extends a welcoming hand to students who excel at community polytechnics, vocational schools, and both public and private training centres. It serves as a bridge to the next level of learning, offering opportunities for advancement.

Moreover, this inclusivity extends to individuals who have demonstrated their competence through evidence-based assessments, regardless of their background. Even those who have acquired skills through the informal sector find a pathway to reintegrate into the formal system. The UVQF is the vanguard, paving the way for the National Qualification Framework (NQF), which promises to democratise education and training, enabling learners of all backgrounds to access tertiary and university-level education.

The Ministry of Education and Sports, guided by its comprehensive ten-year BTVET (Business, Technical, Vocational Education, and Training) strategic plan, demonstrates unwavering dedication to the "Skilling Uganda" initiative. This visionary plan prioritises practical skills training, with a central aim of addressing the pressing issue of youth unemployment. In today's dynamic labour market, competence, as assessed through practical performance, stands as the principal currency. Employers increasingly seek individuals who not only possess the requisite skills but also exhibit a firm commitment to enhancing productivity within a fiercely competitive environment.

Indeed, this forward-thinking approach, although functional primarily in its intentions, can serve as a catalyst and inspiration for regional frameworks. The idea of offering a valuable blueprint for focusing on the youth population, a segment often overlooked, yet one that, when effectively harnessed, can play a pivotal role in national and regional development. By channelling efforts toward empowering and equipping youth with practical skills and fostering a commitment to productivity, each nation in the region can unlock a wealth of

untapped potential. This, in turn, has the potential to be a transformative force, propelling regional growth and development to new heights.

In this intricate educational landscape, the interconnections between the UVQF, BTVET training, and the Uganda Higher Education Qualifications Framework (UHEQF) are prominently highlighted within the framework document. These linkages serve as a roadmap, guiding learners through a continuum of education and skills development, ultimately leading to a more prosperous and empowered workforce.

e. The Electricity Regulatory Authority (ERA)

The Electricity Regulatory Authority (ERA) operates under the purview of Section 10 of the Electricity Act 1999, encompassing a crucial mandate amongst its various functions. This mandate revolves around the regulation of individuals and entities engaged in electrical installation works within a wide spectrum of premises, including residences, offices, commercial establishments, industrial facilities, schools, and healthcare institutions. The primary objective underpinning this regulatory role is to ensure the safety of electricity consumers across diverse settings.

In strict accordance with the provisions set forth in the Electricity Act of 1999 and the Electricity (Installation Permits) Regulations SI No 19 of 2003, the performance of electrical installation works is subject to stringent requirements. Specifically, such works can only be undertaken by individuals possessing the requisite electrical worker's permit duly issued by the ERA.

Key Highlights of the Electrical Installation Permit Framework:

- **Installation Personnel:** To engage in electrical installation activities, an individual must hold a valid permit issued by the Installations Permits Committee. This requirement applies equally to persons employed by companies or firms, regardless of the possessing entity's permit status.
- **Technical Qualifications:** Individuals seeking permits must meet specific technical qualifications, which serve as a benchmark for competence. These qualifications include, among others, a University Degree in the relevant field, Higher Technician's Diploma, Ordinary Technician's Diploma, Master Craftsman's Certificate, Craftsman's Certificate, Intermediate Certificate, or any other recognised technical qualification deemed suitable by the Committee. The type of qualification held determines the class of permit issued by the Installations Permits Committee.
- **Types of Permits:** The Installations Permits Committee has the authority to issue various classes of permits, each corresponding to different categories of electrical installation work. These classes are categorised as:
 - **CLASS A:** Authorises the undertaking of all classes of electrical installation work.
 - **CLASS B:** Permits the execution of electrical installation work of medium value or complexity, encompassing heavy low voltage and simple high voltage connections up to 11 kV.
 - **CLASS C:** Pertains to electrical installation work of smaller scale and value, including projects such as installations in multi-storied flats, complex residential structures, and commercial buildings, as well as the installation of light plants up to 415 volts.
 - **CLASS D:** Reserved for specialised classes of electrical installation work, including the installation of residential premises with a maximum of five bedrooms and equipment repairs up to 240 volts.

- **CLASS Z:** Covers specialised fields such as switch gear installation, centralised cooling and refrigeration, generator set installation, solar systems, and electrical installation systems and designs.
- **Permit Renewal and Validity:** Permits issued under the Electricity (Installation Permits) Regulations of 2003 are eligible for renewal; however, they are non-transferable and expire on December 31st of the year in which they were initially issued.
- **Application Process:** Individuals or representatives of companies and organisations must submit permit applications in writing or electronically to the Installations Permits Committee. The Committee then issues permits in a prescribed format, subject to specific conditions it deems necessary.
- **Company Requirements:** Companies or organisations applying for permits must employ personnel qualified to be issued with CLASS A or B permits.
- **Display of Permits:** All individuals possessing permits must prominently display them at their usual places of business to affirm their compliance with the regulatory framework.

It is noteworthy that while ERA certification aligns with the DIT qualifications in terms of skill sets, the nomenclature may vary, highlighting the importance of recognising and understanding the equivalence of qualifications in these regulatory bodies.

4.2.5. Kenya

The Energy and Petroleum Regulatory Authority (EPRA) assumes a central role within Kenya's dynamic energy sector. This regulatory body is entrusted with the comprehensive oversight and regulation of various dimensions of the nation's energy landscape, encompassing electricity, petroleum, and renewable energy. Its multifaceted mandate extends to ensuring the safe and efficient generation, distribution, and utilisation of electrical energy. Moreover, EPRA diligently supervises petroleum operations and actively promotes the adoption of renewable energy sources to drive sustainability.

In the realm of renewable energy, EPRA shoulders the responsibility of leading the planning, development, and execution of structures aimed at advancing and regulating renewable energy sources and energy efficiency. This multifaceted endeavour encompasses research, the formulation of standards and regulations, rigorous compliance oversight, and active enforcement. Among its numerous responsibilities, EPRA collates and maintains vital data related to renewable energy and energy efficiency, designs comprehensive national plans, and initiates the development of essential standards and codes of practice. The authority also plays a pivotal role in advising the Commission, internal stakeholders, and external parties on intricate technical and regulatory matters pertaining to renewable energy and energy efficiency.

Furthermore, in the realm of personnel licensing, EPRA implements a tiered system comprising three distinct levels. This system accommodates applicants with diverse educational backgrounds, ranging from primary education qualifications through secondary education, certificates, diplomas, and up to bachelor's degrees. This inclusive approach ensures that individuals at varying stages of their education and careers can contribute meaningfully to Kenya's energy sector, aligning with EPRA's commitment to fostering inclusivity and expertise within the industry.

Table 13: Levels of Kenya’s EPRA Qualifications Framework

S.No	Category	Education (Academy)	
1	Basic T1	Primary Leaving Certificate	Primary Leaving Certificate
2	Intermediate T2	KCPE, Electrical Govt. trade test 2 and Basic Solar Training	Verifiable two years solar installation experience
		KCSE, Certificate in Electrical or Electronic and Intermediate Solar Training	Verifiable four years solar installation experience
		KCSE, Diploma in Electrical or Electronic and Intermediate Solar Training	Verifiable two years solar installation experience
3	Advanced	BSc. Electrical Engineering or relevant degree Or Higher National diploma	One year solar installation experience
		KCSE, Diploma in Electrical or Electronics and Intermediate Solar Training	Verifiable Four years solar installation experience
		BSc. Electrical Engineering or relevant degree Or Higher National diploma	Two years solar installation experience

To undertake the certification process, one is required to have some basic electrical background and have taken some form of training in solar technologies from a recognised training centre.

The educational landscape grapples with a multitude of persistent challenges, with capacity development taking centre-stage as a pressing concern. This concern primarily revolves around the acquisition of essential tools and equipment necessary to facilitate effective learning, a fundamental aspect crucial for elevating the overall quality of education.

First and foremost, a noteworthy obstacle is the deficiency in proper infrastructure within numerous educational institutions, particularly in practical training related to solar technologies. This deficiency encompasses the absence of workshops, laboratories, and demonstration facilities, all of which are indispensable for hands-on learning experiences.

Furthermore, geographical disparities compound the challenge, making it arduous for individuals in remote and underserved areas to access accredited training centres. This geographical divide creates a substantial hindrance, limiting the educational opportunities available to a considerable portion of potential learners.

Adding to these complexities, the financial aspect emerges as a real barrier. Many training programmes impose significant costs, including tuition fees and the procurement of necessary materials. These financial burdens can be prohibitive for individuals, further exacerbating the existing barriers to entry.

Addressing these multifaceted challenges is imperative to ensure that quality solar technology education becomes accessible to a broader spectrum of learners. It necessitates a comprehensive and collaborative effort involving educational institutions, governmental support, industry stakeholders, and advocacy groups

to bridge gaps in infrastructure, reduce geographical disparities, and alleviate financial burdens, ultimately fostering a more inclusive and accessible educational landscape for aspiring solar technology professionals.

Additionally, it's worth noting that the educational system has predominantly operated in a centralised manner. However, there are ongoing efforts to decentralise educational initiatives, with the aim of extending access and opportunities to individuals across the entire country. This decentralisation is poised to democratise education and ensure a more equitable distribution of resources and opportunities. Indeed, adopting a hybrid approach that combines decentralisation with strategic coordination and oversight can be a valuable and effective way to address the challenges associated with centralised educational systems and promote equitable access to education. This approach empowers local communities to play a more active role in shaping their educational programmes while maintaining essential quality standards and resource distribution through centralised coordination. It strikes a balance between autonomy and accountability, ensuring that education remains responsive to local needs while upholding overall educational quality.

Furthermore, a noticeable gender disparity exists within technical fields, with a disproportionately low representation of women⁷. To rectify this imbalance, concerted efforts are underway, such as those led by SE4ALL, which are designed to empower women and encourage their active participation in technical disciplines. Such initiatives hold the potential to foster greater diversity and inclusivity within these fields, ultimately enriching the educational landscape.

4.2.6. Tanzania

The National Council for Technical Education (NACTE) operates as a statutory body established under the National Council for Technical Education Act, 1997 (Act No. 9 of 1997), providing a robust legal framework for the coordination and enhancement of technical education and training in the country. This framework ensures that technical institutions produce graduates of exceptional quality who can effectively adapt to evolving global needs and technological advancements.

NACTE's jurisdiction encompasses all tertiary education and training institutions, excluding universities and their affiliated colleges. These institutions offer a spectrum of courses ranging from technician to semi-professional and professional levels, leading to the conferment of certificates, diplomas, degrees, and related qualifications.

The council's multifaceted mandate, derived from Cap. 129, can be summarised into three primary functions:

- **Regulatory Function:** NACTE establishes the regulatory architecture for technical education and training, culminating in the assurance of high-quality qualifications.
- **Quality Assurance Function:** It collaborates with technical institutions to elevate and sustain the quality of education they deliver. This entails ensuring that educational programmes align with labour market requirements and overseeing compliance with the regulatory framework.
- **Advisory Function:** NACTE serves as an advisory body, offering guidance to both the government and technical institutions regarding the strategic development of technical and vocational education and training. This council enables informed decision-making in policymaking processes.

⁷ Inter-University Council for East Africa | ASCL Country Portal - Information about African countries. <https://countryportal.ascleiden.nl/content/inter-university-council-east-africa>

These functions are intrinsically interconnected, collectively forming the core responsibilities of NACTE. This comprehensive approach ensures the delivery of quality-assured technical education and training throughout the nation.

In pursuit of its mission, NACTE has introduced National Technical Awards (NTA) within the technical education and training landscape. These awards are competency-based, affirming that recipients possess the knowledge and skills necessary within their respective occupational sectors. The seven NTA levels correspond with the National Vocation Awards (NVA) under the VETA system, creating a comprehensive ten-level framework for Technical and Vocational Education and Training (TVET) qualifications. Each NTA level corresponds to a distinct competency level, further enhancing the credibility and value of TVET qualifications in the country.

Table 14: Levels of the NTA⁸

NTA Level	Minimum Overall Credits	Minimum Credits from current Level	Award	Competence Level descriptors
NTA Level 4	120	120	Basic Technician Certificate	Apply knowledge and skills at routine level
NTA Level 5	120	120	Technician Certificate	Apply knowledge and skills in a range of activities, some of which are non-routine and be able to assume some operational responsibilities
NTA Level 6	240	120	Ordinary Diploma	Apply knowledge and skills in broad range of work activities, most of which are non-routine
NTA Level 7	360	360	Higher Diploma	Apply knowledge, skills and understanding in a range of complex technical activities, high degree of personal responsibility and some responsibility for the work of other
NTA Level 8	480	120	Bachelor's degree	Apply knowledge, skills and understanding in wide and unpredictable variety of contexts with substantial personal responsibility, responsibility for the work of others and responsibility for the allocation of resources, policy, planning, execution, and evaluation
NTA Level 9	180	150	Master's degree	The holder of the qualification will be able to display mastery of a complex and specialised area of knowledge and skills, employing knowledge and understanding to conduct research or advanced technical or professional activity, able to work autonomously and in complex and unpredictable situations

⁸ TVET Qualifications Framework. <https://www.esis.ac.tz/tvet-qualifications-framework/>

NTA Level 10	540	360	Doctorate	The holder of the qualification will be able to apply knowledge and understanding and do advanced research resulting into significant and original contributions to a specialised field, demonstrate a command of methodological issues and engaging in critical dialogue with peers, able to work autonomously and in complex and unpredictable situations.
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4.2.7. Rwanda

In Rwanda, the Rwanda Utilities Regulatory Authority (RURA) holds the responsibility for overseeing licensing in various domains. Within the Technical and Vocational Education and Training (TVET) sector, the landscape comprises a diverse array of public and private institutions. These include Vocational Technical Centres (VTCs), Technical Secondary Schools (TSSs), and Polytechnics, each offering distinct levels of certification spanning from level 1 to level 7.

Initially, the oversight and implementation of vocational and technical training were consolidated under the Workforce Development Authority (WDA). However, a strategic decision was made in 2015 to bifurcate WDA's responsibilities to prevent any potential conflicts of interest. Consequently, two entities were established under the Ministry of Education (MINEDUC) to manage the TVET system effectively: the Workforce Development Authority (WDA) and Rwanda Polytechnic (RP).

WDA's primary role revolves around setting training standards, accrediting both public and private VTCs, ensuring the quality of assessments, and meticulously collecting data on internal and external TVET outcomes. Its overarching objective is to ensure strict compliance with these established standards.

Conversely, Rwanda Polytechnic (RP) focuses on the development and implementation of curricula and assessments within vocational centres and colleges (ranging from levels 3 to 5, equivalent to 10 to 12 years of schooling), as well as in the eight Integrated Polytechnic Regional Colleges (IPRCs) (spanning levels 3 to 7, equivalent to up to 14 years of schooling or 2 years of university studies). RP also plays a pivotal role in training educators in the competency-based training (CBT) approach and provides technical expertise through the Rwandan TVET Trainer Institute (RTTI).

Specifically, within the realm of solar technologies, RURA has established a comprehensive regulatory framework governing solar PV systems. This framework aims to facilitate the efficient, effective, sustainable, and organised development and operation of solar PV system services in Rwanda. Certificates and permits within this domain are categorised into two main classes:

- "Class A" permit authorises its holder to engage in solar PV system installation work for small, off-grid systems (a solar PV system incorporating a single module or multiple modules up to 100 Wp).
- "Class B" permit enables its holder to undertake solar PV system installation work for advanced systems, including grid-connected and hybrid setups.

These classes are further delineated to cater to various aspects of solar technology deployment, ensuring adherence to specific standards and requirements.

Table 15: Qualification for licensing in Rwanda for solar PV technician

Category	Minimum academic education	Professional experience
Class A	A2 in Electricity or similar domain Basic Solar Training	Two years of solar installation experience
Class B	A2 in Electrical Technology or similar domain Intermediate Solar Training	Four years of solar equipment Installation experience
A1 in Electrical Technology or similar domain Intermediate Solar Training	Two years of solar equipment installation experience	
BSc. Electrical Technology or solar domain Intermediate Solar Training	One year of solar equipment installation experience	

4.3. ECOWAS Region

In the realm of qualification frameworks within the ECOWAS region, notable developments are occurring, with several member states actively engaged in this process. While the ECOWAS RQF itself is yet to be fully established, it is poised to build upon the ongoing efforts in member countries such as Nigeria, Gambia, Ghana, Cabo Verde, and Senegal. These nations have already made substantial strides in describing their qualifications within a national (NQF) framework, each with unique characteristics.

Adopting a unified approach is imperative in the quest to harmonise learning outcomes' descriptions and qualifications development. Whether the primary focus lies in enhancing the relevance and flexibility of educational programmes, simplifying the recognition of prior learning, promoting lifelong learning, enhancing the transparency of qualifications systems, facilitating credit accumulation and transfer, or establishing robust quality assurance mechanisms, governments are increasingly turning to qualifications frameworks as a strategic tool for educational reform⁹.

In alignment with ECOWAS' commitment to harmonisation, the Ministers of Higher Education from Member States convened in December 2019 to endorse the work conducted by experts on the Framework for Recognition and Equivalence of Certificates in the ECOWAS Region, which is rooted in the ECOWAS Convention for the Recognition and Equivalence of Certificates adopted in 2003. Additionally, they approved the draft ECOWAS Benchmarks for the Harmonisation of University Education. These pivotal documents, alongside other supporting materials, are currently awaiting approval from the ECOWAS Parliament, the Council of Ministers, and ultimately, the Heads of Governments within the ECOWAS Region.

Given that qualifications and their classifications are intrinsically linked to societal values and occupational roles while also being responsive to labour market demands on both national and regional scales, it is anticipated that there will be numerous deliberations and negotiations between ECOWAS and its member states as they seek common ground throughout the harmonisation process. Although discussions regarding this relationship may be complex, the future ECOWAS RQF will probably find connections with existing sub-regional and regional instruments such as the West African Examinations Council (WAEC), the West African Economic and Monetary Union (WAEMU), and the Conseil Africain et Malgache pour l'Enseignement Supérieur/African and Malagasy Council for Higher Education (CAMES), with regards to qualifications regulation and quality assurance initiatives.

Education challenges in the ECOWAS Region persist in the areas of gender equality, supply of qualified teachers, availability of quality education statistics and quality management, reduction in the out-of-school population, eliminating school dropouts and improving access to higher education levels. Faced with country-by-country education policies and practices, regional undertakings are being focused on harmonising them. At present, Nigeria, The Gambia, Senegal, Ghana, and Cabo Verde in the ECOWAS region have NQF levels described: Nigeria with 6 levels (up to doctorate degree), The Gambia 5 (including a fundamental level), Ghana and Cabo Verde 8 levels (up to doctorate degree) and Senegal 5 levels (up to engineering level).

In the ECOWAS region, while a common regional qualification and certification framework is yet to be established, there are several international accrediting bodies overseeing higher education institutions. For French-speaking African countries, the African and Malagasy Council for Higher Education (CAMES) plays a significant role, while English-speaking countries are guided by the West African Examinations Council.

⁹ Employment News. <https://employmentnews.gov.in/NewEmp/MoreContentNew.aspx?n=Editorial&k=93>

CAMES, a quality assurance and certification body for higher education in Member States, has a mission with seven aims, primarily focused on harmonising higher education and research policies in the CAMES region. Four of CAMES' nine programmes directly relate to the qualification's framework, including diploma recognition and equivalence, inter-African consultative committees, competitive examinations, and quality assurance. CAMES has established quality standards for institutional evaluation, face-to-face training offerings, open and/or distance learning, and research programmes. Furthermore, the LMD manual outlines training courses and defines transferable credits across higher education and research institutions in member countries.

Table 16: Research Institutions in ECOWAS

Institution	Countries active
African and Malagasy Council for Higher Education (CAMES)	Bénin, Burkina Faso, Côte d'Ivoire, Guinée, Guinée-Bissau, Mali, Niger, Sénégal, Togo
West African Examinations Council	Ghana, Nigeria, Sierra Leone, Liberia, and the Gambia
National Universities Commission (NUC) / National Examination Council (Nigeria)	Nigeria

Moreover, certain countries in the region have dedicated councils responsible for Technical and Vocational Education and Training (TVET) qualifications frameworks. Cabo Verde has seamlessly integrated the European qualifications framework into its national system for continuous vocational training, a development supported by organisations such as the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the European Commission.

It's worth noting that Liberia is currently in the process of formulating its National Qualification Framework, with an anticipated implementation date set for 2023.

Table 17: Qualification Framework in ECOWAS

Qualification Framework	Country
Council for Technical and Vocational Education and Training (Ghana): National TVET Qualifications Framework	Ghana
National Board for Technical Education (Nigeria): National Vocational Qualification Framework (NVQF)	Nigeria
NTA Gambia National Training Authority: Gambia Skills Qualification Framework	Gambia
National Council for Technical, Vocational and other Academic Awards (NCTVA)	Sierra Leone
Liberia does not have a National Qualification Framework. A work has started in 2022 and the document should come into effect in 2023	Liberia
Professional qualification levels in Cabo Verde. National Commission of Professional Equivalences (CNEP) is a specialised body of the National Qualifications System (SNQ), whose instrument is the National Qualifications Framework (NQF)	Cabo Verde

4.3.1. ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)

In a region like ECOWAS, where there is currently no established qualification framework in place, the support for renewable energy and energy efficiency policy is crucial and provided by ECREEE¹⁰. ECREEE assists the 15 ECOWAS Member States in the development, adoption, and implementation of national renewable energy and energy efficiency policies and targets, regulatory frameworks, standards (e.g., for appliances, generation equipment, and building codes), as well as incentives (e.g., tax exemption, public procurement, portfolio standards) and financial mechanisms (e.g., feed-in tariffs, net metering, investment subsidies)¹¹.

ECREEE has established a scheme for certifying the skills of solar PV installers and other sustainable energy professionals: the Regional Certification Scheme for Sustainable Energy Skills programme. The objective is to introduce a quality mark for sustainable energy skills that is recognised by professionals and end users across borders in all 15 ECOWAS member states. ECREEE serves as the regional certification body and aligns all structures and procedures with the requirements of the ISO/IEC 17024:2012 standard, "Conformity assessment — General requirements for bodies operating certification of persons."¹²

The scheme initially focuses on certifying installers of simple off-grid PV systems but will gradually cover installers of more complex off-grid and on-grid PV systems, as well as other renewable energy and energy efficiency professionals. The first step was to develop a Job Task Analysis (JTA) for Off-Grid Solar PV Installers, which was developed collaboratively with input from approximately 100 stakeholders from all ECOWAS member states and validated at a regional workshop held in Praia, Cabo Verde, on December 14-15, 2015. The regional certification body partners with training institutions that prepare certificate holders for the exams, and other training institutions organise the certification exams.

The establishment of the regional certification scheme is supported by the International Renewable Energy Agency (IRENA), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the EUEI Partnership Dialogue Facility (EUEI PDF), the Austrian Development Agency (ADA) and the African Development Bank (AfDB).

While the framework has been endorsed by the ECOWAS member states, there is not yet a framework for certifying other renewable energy technologies, but this is a planned next step.

Since 2015, ECREEE has begun implementing a regional certification process for installers of solar PV systems. Eventually, certification will take place at three levels: isolated PV systems (level 1), microgrid systems (level 2), and large-scale commercial power plants (level 3). The ultimate aim is to set up an independent regional certification body. Today, these bodies are gradually being established, and the first certification examinations have taken place in five countries: Benin, Burkina Faso, Ghana, Nigeria, and Senegal. Focal points for the certification system have been designated in each country's Ministry of Energy.

So far, at least seven exams of level 1 (domestic off-grid solar PV system technicians) have been implemented (Table 18). For level 2 (designers, installers, and inspectors of PV mini-grids), ECREEE has called for expressions of interest from institutions willing to become training or examination centres (a centre cannot host both training and examination) some months ago.

¹⁰ Clean Energy Mini-Grid Policy Development Guide available in Portuguese - CCREEE. <https://www.ccreee.org/news/clean-energy-mini-grid-policy-development-guide-available-in-portuguese/>

¹¹ . <http://www.ccreee.org/node/5997>

¹² . <http://www.ccreee.org/node/5997>

This pilot phase was useful to adjust the practical organisation of the exams and correct any imperfections in the process. Participation in the certification exams is subject to a fee of 100,000 FCFA. PV installation companies have shown great interest in this initiative. Some companies did not hesitate to pay for their employees, while some candidates came from neighbouring countries to take the exam. For example, one candidate came from Niger to participate in the exam in Burkina Faso, while another travelled from Côte d'Ivoire to Benin. A gender policy has been established to encourage the certification of female employees; for the pilot phase, the examination fees for girls were covered by GIZ.

The certification bodies are currently being set up for the period 2023-2027. The next certification exams will take place by the end of 2023 or in early 2024.

In addition to the examination centres, ECREEE has also selected training centres in certain countries to bring certification candidates up to the required standards. During the pilot phase, the upgrading of candidates was not considered. Examination and training centres are selected by ECREEE following a call for applications. To be eligible, these centres must have adequate equipment for practical work and competent trainers. After selection, an MoU is signed between each test centre and ECREEE, and the certification exams are co-organised by the two entities. Examination tests are supplied by ECREEE, which has a database of questionnaires built up as part of the certification process. The test papers vary from one exam to another, or from one centre to another.

Table 18: The five test centres for the Level 1 pilot phase of the certification system

Country	Examination Centre	Number of examinations organised	Examination Centre contact person
Benin	ESMER	2	Dr Isdeen Yaya NADJO, Director of Innovation and Corporate Relations
Burkina Faso	Institut 2iE	1	Dr Y. Moussa SORO, Head of Energy Department
Ghana	KNUST	1	Dr Charles Sekyere, Head of Mechanical Engineering Department
Nigeria	ASTEVEN Institute	1	Offer Nnaemeka, Chief Operating Officer
Senegal	ESP	2	Prof Khaly TALL, Head of Electrical Engineering

Regarding training in solar energy, ECREEE has developed some initiatives within the scope of the project "Promotion of Solar Thermal Technologies Market in West Africa (SOLTRAIN)". The goal of the SOLTRAIN is to contribute to the transition from a fossil fuel-based energy supply system to a sustainable energy supply system through solar thermal energy. The activities of SOLTRAIN included the training, the demonstration project, market studies, awareness raising activities and the participation of the Solar Heating & Cooling Programme (SHC) of the International Energy Agency activities.

The 1st phase of the project was implemented by ECREEE from 2015 to 2020 with the technical support of AEE INTEC and financial support from ADA. The second phase in October 2023, was implemented by SHC, CERMI and ECREEE, and the purpose of the activity was to train Cabo Verde professionals and other selected students in solar thermal technology, with a special focus on Large-scale Solar Water Heating and Solar Cooling. ECREEE staff in charge of the SOLTRAIN sub-programme were also taking part in the training.

However, ECREEE is keen to develop a new, more ambitious project in line with its new 2023-2027 strategic plan, covering the 15 countries of the ECOWAS region and focusing on concrete achievements that will have an impact on people's lives.

4.3.2. Senegal

Senegal lacks a unified national qualifications framework (NQF) that comprehensively encompasses qualifications from all levels and subsystems. Instead, there are at least two separate qualifications frameworks: one for higher education following the Licence-Master-Doctorat (LMD) system, and another known as the National Vocational Qualifications Framework (NVQF). Notably, the national education qualifications framework, which includes credentials like the Certificat de fin d'études élémentaires (CFEE), the Brevet de fin d'études moyennes (BFEM), and the baccalauréat, does not incorporate a unified national standard qualifications framework (CNC) as of now.

To effectively contribute to the development of a comprehensive and cohesive qualifications framework, it is essential to establish a shared vision, embracing a participatory governance approach to steer the process. In recent times, as part of an extensive reform initiative called the Programme for the Improvement of Quality, Equity and Transparency (PAQUET - Education and Training Sector 2013-2025), Senegal has laid the groundwork for an education and training ecosystem that recognises qualifications as a vital component in meeting development goals and private sector demands.

The novel approach to Technical and Vocational Education and Training (TVET) implies that market demands serve as the cornerstone and primary indicators of the relevance and coherence of future developments within the TVET system. Senegal's National Vocational Qualifications Framework (NVQF) encompasses qualifications spanning five levels, governed by two distinct ministries. The lower four levels fall under the jurisdiction of the ministry responsible for TVET, while the highest level is overseen by the ministry responsible for higher education. Senegal's NVQF aligns with national, regional, and international instruments, including the 2015 Orientation Law, regional consultation frameworks like the UEMOA, the Alliance for Vocational and Technical Training, ECOWAS, the CAMES Programme for the Recognition and Equivalence of Diplomas (PRED), and international agreements.

Article 28 of Law 2015-01 stipulates the organisation of vocational and technical training into various certification levels, with defined national training objectives, programmes, progression pathways, and assessment criteria. The programme durations for each level and their subdivisions are established through decrees. It is noteworthy that level descriptors are grounded in occupations rather than learning outcomes. Nevertheless, the TVET, considers both the acquisition of skills derived from demonstrating learning outcomes and meeting labour market demands. The development of qualifications is closely tied to acquiring the academic knowledge and professional skills necessary to meet the standards outlined in the 2015 Framework Act.

Vocational certifications in Senegal are overseen by two institutions:

1. **Department of Examinations, Professional Competitions, and Certifications (DECPC):** DECPC oversees the National Vocational Qualifications Framework (NVQF), specifically the reference framework for technical and professional certifications. It is responsible for issuing certificates at four of the five levels within the industrial and tertiary sectors of the framework.

DECPC has implemented a policy shift from the Pedagogy by Objectives (PPO) to the Competency-Based Approach (APC). However, over the past 15 years, only a limited 10% of learners have benefited from the APC approach. Standards have been redefined based on the concept of professional status, and the certification process includes the definition of skills and criteria for each training programme.

Notably, the current director of DECPC has also served as the coordinator for Senegal in the UNESCO-supported ECOWAS initiative aimed at establishing a comprehensive national qualifications framework. This initiative involves various stages, including analysing work situations, developing competency profiles and frameworks, creating qualifications frameworks, and establishing training frameworks and standards. Active employer participation is considered a crucial component of this process.

2. **Department of Vocational and Technical Training (DFPT):** DFPT focuses on developing a variety of vocational training curricula that grant access to qualifications within the vocational and technical training sub-sector of Senegal. It emphasises teaching practices aligned with the Competency-Based Approach (APC), as mandated by the Orientation Law 2015-01.

The certification process facilitated by DFPT involves collaboration with partners from the private sector. DFPT utilises several resources and guidelines, including the Orientation Law of 2015, the consultation framework of WAEMU (West African Economic and Monetary Union), the Alliance for Vocational and Technical Training, and directives issued by DFPT itself. These directives outline training programmes that adhere to the APC approach, starting with an analysis of the work environment and culminating in the development of training standards.

Article 29 of Law 2015-01 concerning vocational and technical training, mandates the ministry in charge of vocational and technical training to conduct examinations, professional competitions, and certifications. It also regulates the issuance of diplomas and professional qualifications, which are systematically catalogued, classified, and made publicly available by the national classification system.

Given the socio-economic imperatives, government priority sectors, labour market demands, and the intricacies of the professional landscape, a multi-stakeholder approach is imperative for the establishment of a CNC or NVQF.

Seen that Senegal maintains two distinct frameworks: the NVQF and LMD system, the primary challenge lies in identifying a legitimate entity that can gain acceptance from all stakeholders. Another significant hurdle pertains to the way social partners are represented in the deliberative and decision-making processes concerning qualifications.

The NVQF is structured around five distinct levels, each governed by separate ministries. Specifically, levels V to II, which encompass qualifications like the BTS (Brevet de technicien supérieur), fall under the jurisdiction of the Ministry responsible for Technical and Vocational Education and Training (TVET). Meanwhile, level II qualifications, including the Diplôme d'Ingénieur Technologique (DIT) and the highest qualification, the Diplôme d'Ingénieur de Conception (DIC), are overseen by the Ministry in charge of higher education. These qualifications are applicable to both industrial and tertiary employment sectors.

Here is a breakdown of the qualifications within the NVQF:

- CAP: Certificat d'aptitude professionnelle
- BEP: Brevet d'enseignement professionnel

- BT: Brevet de technicien
- BTS/DUT: Brevet de technicien supérieur/diplôme universitaire de technologie
- Engineering degree

The qualifications cover industry and tertiary labour market work.

- Level V - CAP: skilled worker certificate
- Level IV - BEP: Certificate of vocational education
- Level III - BT: Technician certificate
- Level II - BTS/DUT: Higher technician certificate/University Technology Diploma
- Level I - Engineering Diploma

Remarkably levels II and I correspond to qualifications equivalent to or higher than Licence or Master. Diplomas of higher education such as Higher diploma of technology (DST), Diplomas of specialised studies (DES) and other university diplomas besides the DUT, notably the University diploma of management (DUG), and University or Interuniversity diplomas (DIU) are also proposed by Higher education institutions. Senegal is working towards a single unified National Qualifications Framework (NQF) structure with a comprehensive scope encompassing qualifications from all sub-systems and levels. National education qualifications such as the Certificat de fin d'études élémentaires (CFEE), the Brevet de fin d'études moyennes (BFEM) and the baccalaureate are part of the overall qualifications system, but do not integrate yet a normative national qualifications framework.

4.3.3. The Gambia

The development of a National Qualifications Framework (NQF) for the education system in The Gambia started in 2015 under the auspices of the Ministry of Higher Education, Research, Science and Technology (MoHERST) and the Ministry of Basic and Secondary Education (MoBSE). The development of the Gambia Skills Qualifications Framework (GSQF) in 2007, followed by its subsequent implementation in 2008, established a coherent structure of standards, levels, and qualifications. This framework was designed with the overarching goal of improving and regularising the acquisition of occupational skills, all while ensuring quality assurance. While the GSQF drew heavily from well-established frameworks and practices in the UK and the EU, and partly from experiences in Botswana, Ghana, South Africa, and Namibia, it also placed significant importance on addressing the unique needs and realities of The Gambia.

It's important to note that the GSQF, while comprehensive in its approach, does not encompass both academic and vocational learning. Instead, it functions as a partial qualifications framework, focusing on technical, vocational, and literacy skills. Importantly, its design allows for future extension into a full qualifications framework with minimal adaptations as necessary.

The GNQF (Gambia National Qualifications Framework) encompasses all levels, forms, and categories of education and training in The Gambia, both in the public and private sectors. It is designed to be inclusive, covering general education, technical and vocational training, higher education, informal and non-formal learning, and lifelong education. The framework aims to create clear and practical pathways between different education levels and professional qualifications.

The functions of the GNQF include:

- Facilitating smooth vertical and horizontal progression to standardise and harmonise qualifications, enabling learners to move easily between institutions, occupations, and sectors.
- Recognising and assigning credits to prior experiential learning, especially for those who have acquired training through informal or non-formal means.
- Assessing learning through various modes, as long as it meets defined minimum competency standards.
- Recognising and determining equivalences of foreign qualifications within the National Qualifications Framework.
- Developing demand-driven national standards for qualifications that are relevant to both formal and informal sectors, enhancing employability.
- Ensuring the recognition and comparability of Gambian qualifications on a global scale.

The GNQF is based on a "learning-outcomes approach," focusing on the standards of knowledge, skills, competencies, and attitudes that learners acquire. Qualifications are grouped into levels based on their difficulty, with level descriptors defining the outcomes for each level. While qualifications at the same level may vary in content and purpose, they are considered equivalent in terms of progression and capability requirements.

This approach represents a shift from traditional institutional-based models of qualifications to outcome-based models, where qualifications are independent of the institutions providing the programmes. The GNQF defines 10 unique levels of competence, with descriptors outlining the expected competencies for each level, which are not specific to any field of specialisation.

The GNQF comprises components such as basic and secondary school qualifications, technical and vocational education and training qualifications, higher education (academic) qualifications, and occupational qualifications.

In this framework, GNQF uses a credit system based on the idea that one credit equals fifteen (15) hours of guided learning and thirty (30) hours of individual learning, motivated in context in each case. Therefore, one credit equals forty-five (45) hours of notional hours of learning i.e. refers to the learning time that it would take an average learner to meet the outcomes defined (SAQA, 2000). It includes concepts such as:

- Contact time
- Time spent in structured learning in the workplace
- Individual learning
- Assessment¹³

¹³ What is a SAQA Unit Standard? – Greatgreenwedding.com. <https://greatgreenwedding.com/what-is-a-saqa-unit-standard/>

Table 19: The GNQF levels and its associated credits

Levels	TVET	Higher Education	Occupational Qualifications (Non-formal and Informal Sectors)	Minimum Credits Required (1 Credit Hour=15 Hours Guided Learning and 30 Hours of Individual Learning)
Level 10	Doctorate	Doctorate		120 credits after Level 9
Level 9	Master Technical/Technology Degree (MTec)	Master's Degree/Master of Philosophy (M. Phil).	Occupational Certificate 8	30 credits after level 7 (Minimum of 12 Months) or 60 credits after level 7 (Minimum of 24 Months).
Level 8	Technical/Technology Postgraduate Diploma/Certificates.	Postgraduate Diploma/Certificates	Occupational Certificate 7	30 credits after level 7 (i.e. Minimum 12 Months after level 7).
Level 7	Bachelors Technical/Technology Degree (BTec)	Bachelor's degree	Occupational Certificate 6	60 credits after level 6 (Minimum of 24 Months) or 120 credits level 3 (Minimum of 48 Months).
Level 6	TVET Higher Diploma/TVET Higher National Diploma	Higher Diploma/Higher National Diploma	Occupational Certificate 5	30 credits after Level 5 (Minimum of 12 months) or 90 credits after level 3 (Minimum 36 Months).
Level 5	TVET Diploma/TVET National Diploma	Diploma/National Diploma	Occupational Certificate 4	30 credits after level 4 (Minimum of 12 Months) or 60 credits after level 3 (Minimum 24 Months after level 3)
Level 4	TVET Certificate 4	Certificate	Occupational Certificate 3	30 credits after level 3 (Minimum 12 Months)
Level 3	TVET Certificate 3		Occupational Certificate 2	30 credits after level 2 (Minimum 12 Months)

The rationale and justification for the new integrated and comprehensive Gambia National Qualifications Framework (GNQF) are multi-faceted. Firstly, despite existing collaboration between educational sub-sectors, the absence of a unified national framework has hindered effective linkages between these sectors, particularly inhibiting Technical and Vocational Education and Training (TVET) graduates from pursuing higher education qualifications, notably at the University of the Gambia. The GNQF seeks to articulate and establish the necessary linkages within the education system, enabling more efficient coordination and management of the sector.

Furthermore, the GNQF serves as a crucial reference point for educational service providers by furnishing a unified and comprehensive organisational structure for both existing and new qualifications. It plays a pivotal role in harmonising and standardising qualifications at both the national and international levels. Within the Gambia, this framework promotes lifelong learning, facilitates access, encourages mobility, and enables

progression within and between various education and training sectors. It achieves this by integrating vocational education and training, general education, as well as tertiary and higher education into a national framework with levels accommodating diverse categories and forms of learners.

On an international scale, the GNQF ensures recognition in other countries and enhances the comparability of qualification standards, thereby facilitating international graduate mobility and bolstering competitiveness.

4.3.4. Cabo Verde

Cabo Verde's National Qualifications Framework (NQF) has a decade of experience and functions as an integral part of the National Qualifications System (SNQ). This characteristic profoundly shapes the essence and roles of the NQF, establishing its close ties with other components of the SNQ.

The SNQ encompasses the necessary tools for fostering, expanding, and harmonising training offerings and qualifications. It also facilitates the assessment and certification of competencies that contribute to the professional, personal, and societal advancement of individuals while aligning with the requirements of the economic system. The SNQ is brought to life through the coordinated efforts of the following instruments:

- The NQF, denoted as QNQ in Portuguese
- The CNQ
- The credit system
- The individual repository of qualifications and competencies
- The system is dedicated to monitoring, evaluating, and enhancing the quality of the SNQ
- The system designed for the recognition, validation, and certification of competencies, known as RVCC

Cabo Verde's National Qualifications Framework (NQF) encompasses eight levels and is notably inclusive and comprehensive. It covers qualifications ranging from basic to secondary and higher education, as well as the processes for validating, recognising, and certifying competencies acquired through non-formal and informal learning.

These qualification levels are designed to reflect specific learning outcomes and are characterised by descriptors in three key domains of learning:

- **Knowledge:** This domain pertains to the body of facts, principles, theories, and practices associated with a particular field of study, work, or professional training. It represents the result of assimilating information through the learning process.
- **Skills:** Skills encompass the ability to apply acquired knowledge and utilise available resources to complete tasks and resolve problems. This domain encompasses cognitive skills, involving logical, intuitive, and creative thinking, as well as practical skills, which entail manual dexterity and the use of methods, materials, tools, and instruments.
- **Responsibility and Autonomy:** This domain relates to the demonstrated capacity to apply knowledge, skills, and personal, social, and methodological skills in professional contexts. It extends to study and training environments, facilitating both professional and personal development.

The adoption of a learning outcomes approach in designing and describing qualifications is a central objective of the NQF. Learning outcomes serve a multifaceted role, influencing both the conceptual and technical design of competence units and training modules that structure qualifications. Moreover, they contribute to creating a more socially inclusive pathway to qualifications, particularly benefiting individuals with limited formal education but substantial life and work experiences.

The online National Catalogue of Qualifications currently includes 64 professional qualifications of four NQF levels (2, 3, 4, and 5), distributed in 15 professional families. The webpage of each professional family contains extensive information on the respective qualifications, in particular the professional profile by units of competence and the training plan by modules described in learning outcomes of varied granularity.

Table 20: Structure of the education system

Section of the law no. 13/2018	Subsystem	Cycles	Qualifications	Observations: age, progression
Section IV	Secondary education four years	- 9 th –12 th years	Diploma and certificate	Progression upon conclusion of secondary education:
		- Two optional pathways: general and technical. Permeability between general and technical is guaranteed.		- To higher education
		- Artistic education: via technical pathway or via complementary year of secondary education	For the technical pathway: double certification (academic and professional) For artistic education:	- Professional training
			diploma	(initial and continuous)
Section V	Higher education: - University Education - Polytechnic Education	<u>Three cycles of study:</u>	<u>Academic degrees:</u>	Licenciatura degree: Can be awarded in university and polytechnic education
		1. Licenciatura: Credits correspondent to six to eight semesters. Some areas of study require higher number of credits	- Licenciatura	
		2. Master: Credits corresponding to three to four semesters.	(certificate)	
		In some cases: Integrated cycle after secondary education of ten to twelve semesters	- Mestrado (Master):	Master and doctorate degrees: Only in university education
		3. Doctorate	certified by a magister letter	
			- Doctorate: doctoral letter	

		<u>Post-secondary education:</u> courses of professional nature, not leading to academic degree (CESP – Courses Higher Professional Studies)		DESP: Credits transferable to continue education to obtain licenciatura degree in the same area of study
			Non-academic postsecondary courses (CESP) lead to Diploma of Higher Professional	
			Study (DESP)	
Section VI	Extra-school education	<u>Adult education</u>	<u>Basic education and youth and adults</u>	In both modalities: Learning is organised in units (accumulation and transfer), flexible and adaptable to different individual needs and competences
		- Alphabetisation	- <u>First cycle (two years):</u> certificate	
		- Continuing education: cultural, scientific and technological upskilling	- <u>Second cycle (two years):</u> diploma (equivalent to diploma of basic education)	
		<u>Basic education of youth and adults</u> articulates general and professional training (age: 15+, with or without schooling)	<u>Technical-professional training</u> is closely articulated with the national system of professional training and apprenticeship	
		<u>Component of technical-professional training</u>		
		- Skill development for the exercise of a profession and integration in the world of work		
		- Lifelong learning		

Related to the teaching of solar systems, in addition to being one of the subjects taught in the degree courses in electrical engineering, several professional courses are taught in various professional schools. CERMI (Centre for Renewable Energy and Industrial Maintenance), for example, is an international centre, particularly aimed at the ECOWAS and Portuguese-speaking African markets (PALOP), whose main focus is training and training professionals linked to renewable energy and energy efficiency, offering level 4 and 5 courses (according to NQF), as per the table below:

Course	Level
Instalação e Manutenção de Sistemas Eólicos Produção de Energia Elétrica de Baixa Potência	5
Instalação e Manutenção de Sistemas Solares Térmicos de Aquecimento de Água Sanitária	4
Instalação e Manutenção de Sistemas Solares Térmicos de Aquecimento de Água Sanitária	5
Instalação e Manutenção de Sistemas Fotovoltaicos de Produção de Energia Elétrica	5
Instalação e Manutenção de Sistemas Domésticos de Energias Renováveis	IV
Técnico de Energia Renováveis	V

4.4. African Continental Certification Framework (ACQF)

The ACQF is a significant initiative within the African continent, with the intent of driving transformations in the realms of education, training, and workforce development. While it aspires to create a brighter future for Africa's youth, promote cross-border mobility, and foster a culture of lifelong learning, it's important to recognise that its impact may vary in different contexts and regions.

The ACQF aims to serve as a unifying force, bringing together over 40 African countries in a concerted effort to establish National and Regional Qualifications Frameworks (NQFs). It acknowledges the potential within African youth and seeks to provide them with a pathway to enhance their skills, gain recognition for their achievements, and contribute to the continent's socio-economic development.

This initiative underscores the importance of comparability and transparency in qualifications, facilitating the recognition of skills and diplomas across borders. It lays the foundation for mutual trust and cooperation among qualifications frameworks and systems within Africa, fostering the free movement of people, knowledge, and trade.

An initial phase (ACQF-I, 2019-2022) was followed by a second phase, ACQF-II (2023-2026), further strengthening the educational and qualifications landscape of the African continent. Its overall objective is to enhance mobility and lifelong learning opportunities for African youth by improving the comparability and transparency of qualifications, recognising skills and diplomas, fostering mutual trust, and facilitating information-sharing among qualification frameworks and systems in Africa.

Key Planned Outcomes and Outputs:

- **Strengthened Capacities:** ACQF-II plans to enhance capacities at the national, regional, and continental levels for developing and implementing qualifications frameworks and cooperating with ACQF. This involves various activities like training programmes, conferences, study visits, and thematic webinars.
- **NQFs Development:** The project aims to support African countries in developing and implementing their National Qualifications Frameworks (NQFs) and related policies. This support involves expert assistance, research, and surveys on NQFs and related thematic areas.

- **ACQF Implementation:** ACQF-II seeks to ensure the effective implementation of ACQF. This includes establishing a governance structure, launching the ACQF Qualifications Platform, referencing NQFs to ACQF, and conducting a Recognition of Prior Learning (RPL) campaign.
- **Common Profiles of Qualifications:** The project intends to develop common profiles of qualifications relevant to emerging occupations, green and digital skills, and free trade in Africa. These profiles will enhance mutual understanding between NQFs on the continent.

The European Training Foundation (ETF) is the main implementing agency, working in collaboration with the African Union Commission (AU Commission). The project involves an implementation team comprising experts with diverse expertise in qualifications and credentials, qualifications frameworks, governance of NQFs, and more. This team will ensure project activities' quality, relevance, and adaptation to the evolving landscape of qualifications and learning systems. ACQF-II builds upon the policy and technical foundations laid during ACQF-I (2019-2022). ACQF-I achieved significant milestones, including the finalisation of the ACQF Policy Document, the development of ten ACQF Guidelines and Training Modules, the establishment of governance structures like the ACQF Advisory Group, and comprehensive capacity development programmes.

5. Stakeholder consultation results

Following the desk research on the above-mentioned regional and national qualification frameworks, a survey was conducted with the aim to comprehensively assess the solar workforce landscape, with a particular focus on "Solar Workforce Certification" and solar training opportunities. The survey's fundamental purpose lay in the seamless integration of information gathered through desk research. Questions on gender, country of origin, region, representing entity and role within the entity of the interviewed person, ensured that the survey's findings are robust and representative of the diverse solar workforce landscape in the targeted regions.

As detailed in the methodology section (see 3.2), the overall objective of the survey is to (A) assess awareness, (B) identify gaps and needs, and (C) evaluate the certification framework within the solar industry. To achieve them, the specific objectives, which have driven the survey's structure, are the following:

- Section A: Awareness of Solar Workforce Certification and Training
- Section B: Solar Training Courses
- Section C: Solar Workforce Certification

The survey's results are described according to the survey's structure in the next paragraphs (see 5.2, 5.3, 5.4).

5.1. Participant profiling

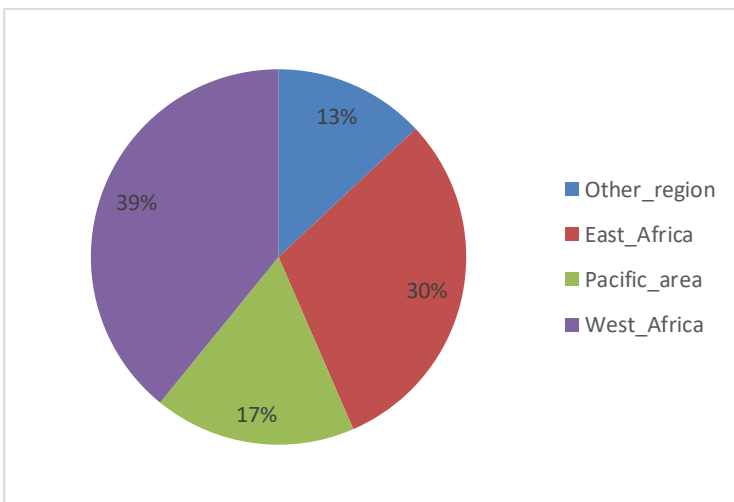
The survey drew participation from individuals and entities, providing valuable insights into the solar workforce certification and training sector.

The majority of survey respondents were male, accounting for 91% of the participant pool, whereas a minority of female participants only reaches 9% of the respondents. The participation of women in the survey was uniquely represented by those from East Africa.. It underscores the lack of female representation from other regions in the survey, pointing towards a possible regional disparity in gender participation or varying levels of access and engagement across different areas. The survey did not provide specific data on the age

of participants, thereby lacking detailed insights into youth participation, potentially limiting the applicability and relevance of the survey results to younger demographics.

Participants hailed from various countries, reflecting the global survey’s sampling strategy. Regionally, the responses spanned a range of areas. West Africa emerged as the dominant region with 39% of the respondents, followed by East African participants accounting for 30% of the total, whereas participants from the Pacific region only reached 17%. A minor portion, accounting for 13%, are from European companies working in the target regions ("Other regions" in the graphic below).

Table 21: Regional survey - Online participation



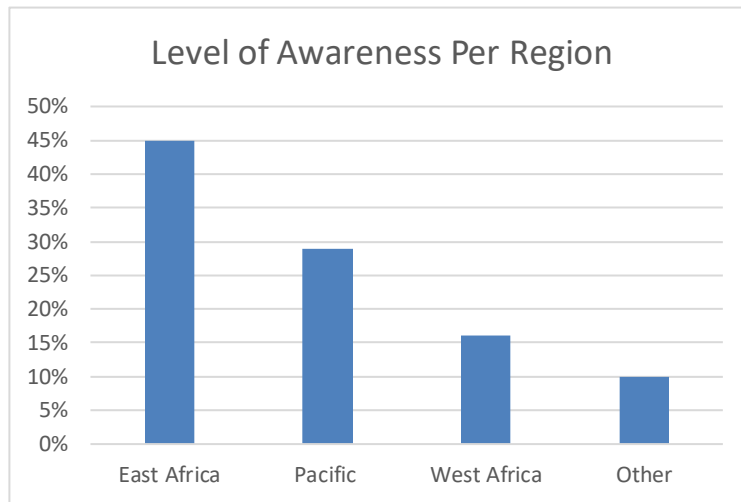
A broad spectrum of entities took part in the survey. Companies were also well-represented, constituting 45% of the participant pool. Furthermore, several entities from various countries were represented, spanning from governmental bodies and academic institutions to private sector companies and solar industry associations.

In addition, contribution from experts not currently affiliated with any specific entity was gathered to leverage on their long-standing involvement in PV, solar thermal and other renewable energy sectors, accounting for 18%. Others fell under the category of training developers/providers (18%), with a non-respondent minority was recorded.

5.2. Awareness of Solar Workforce Certification and Training

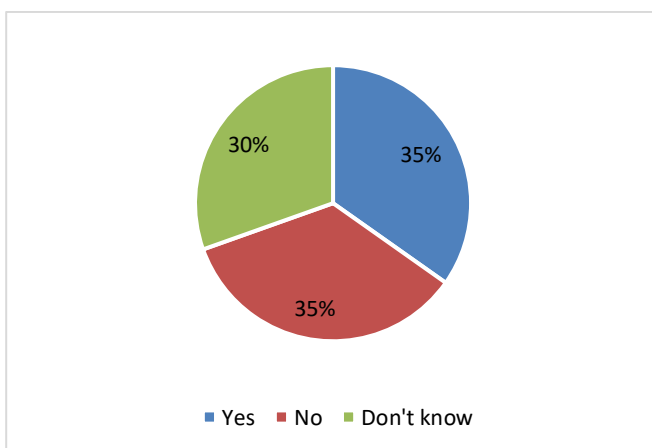
The survey results reveal a varied spectrum of awareness concerning the solar workforce certification and training across the different target regions. On the one hand, East African/Pacific Countries record a high level of awareness, recognising the existence of certification prerequisites and associated training opportunities. On the other hand, West African Countries show a lower level of awareness, with limited information about the target topics.

Table 22; Level of awareness per region



The reasons behind this difference can be diverse. Taking Kenya and Fiji as a sample, the first one has developed an advanced network of education and training infrastructure, including vocational and technical training centres, universities, and industry partnerships. These institutions play a significant role in raising awareness about certifications and qualifications and lead the knowledge sharing and awareness-building in this sector. In Kenya, the role of the institutions is facilitated by strong international collaborations with organisations and countries, which contribute in promoting the certification and QF. Fiji, instead, is a Pacific Island nation with related geographic isolation characterising its country profile, and thus hampering access to international resources, exchanges and collaborations in several sectors, including the certification and QF. Consequently, even internal resources allocated to education and awareness campaigns in this sector are limited and not prioritised.

Table 23: Regional awareness of Solar Workforce Certification Requirements (Do you know whether a solar workforce "Certification" is a requirement in your region?)



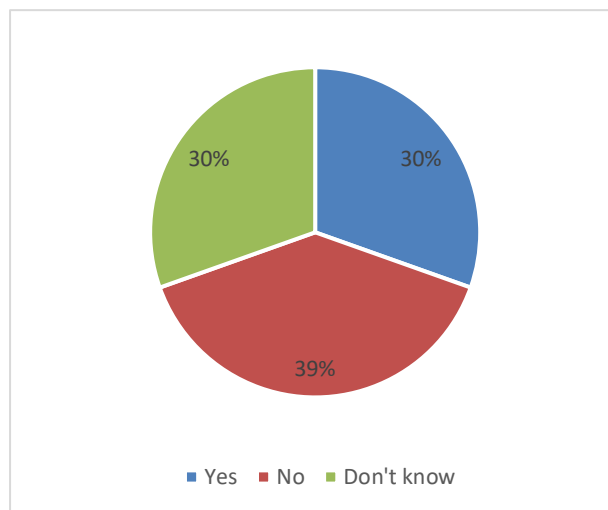
Regarding policies and regulations, there is a discrepancy across regions. The majority of respondents expressed concerns about the limited impact of existing policies and emphasised the need for more effective policy frameworks to enable laws and regulations in the sector of solar workforce certification and training.

East and West Africa are aligned regarding the relevance of mandatory trainings. They emphasise the importance of structured training programmes to ensure competence within the solar workforce.

Interestingly, West Africa is the only region showcasing an awareness of existing solar training courses, which may suggest an effective role of educational institutions and training centres in promoting the availability and accessibility of training programmes. Thus, East and West Africa prove a correlation between the awareness and existence of certification and QF. Respondents from the two regions emphasise the importance of training programmes dedicated to solar system maintenance as well as the Training of Trainers (ToT), recognising their pivotal role in maintaining the long-term functionality of solar systems.

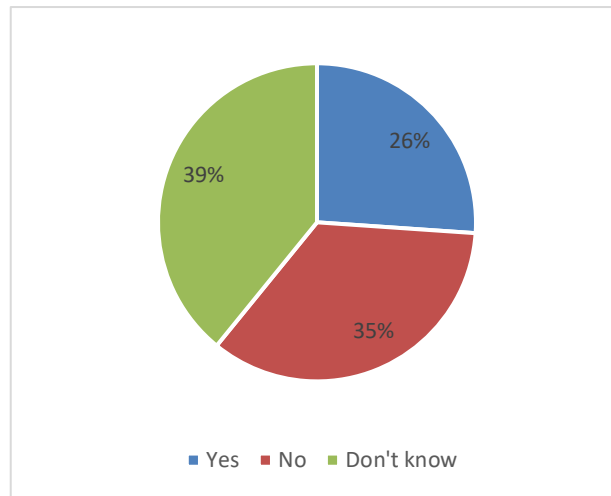
Another aspect which needs further investigation is related to collaborations and partnerships among sectoral stakeholders and about how to foster them. The absence of communication tools (webinars, e-platforms, WhatsApp or Facebook), for promoting synergies is mostly evident in East Africa and West Africa where additional efforts for facilitating collaborations and exchanging information is necessary. In these regions, different collaborative partnerships between academia, industries, and organisations are registered, but just in a limited way.

Table 24: Collaborative Efforts in Developing Qualification Frameworks. Are you aware of collaboration or partnerships between sectoral stakeholders to develop and update the qualification framework?



Gender sensitive policies in the renewable energy sector, particularly in relation to training programmes, vary across the target countries, however, East Africa and West Africa are the leading regions. Gender empowerment actions in the energy sector are still very limited in all the target countries. More concrete initiatives, starting from awareness campaigns, should be encouraged. This approach may effectively educate stakeholders, including governments, businesses, and communities, about advantages of gender-inclusive policies, for promoting gender balance and equal opportunities in the sector. Additionally, it would be beneficial to allocate additional resources to further investigate this topic, mostly to identify barriers and obstacles and thus elaborating on dedicated strategies to improve women’s presence in the energy sector. In this regard, the promotion of targeted training programmes explicitly designed to empower women in renewable energy may help. These programmes should concentrate on skill development, leadership training, and the provision of mentorship opportunities.

Table 25: Presence of policies to specifically train and integrate women into the solar PV and solar thermal professions.



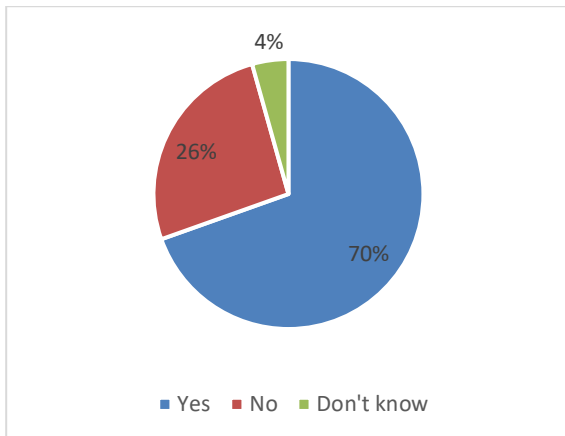
The collected data shows diverse scenarios across the regions in relation to initiatives and awareness raising on solar workforce certification and training actions. While some regions exhibit strong awareness and well-established programmes, others, especially East Africa, may need specific attention on promoting a stronger local solar workforce. Collaborative efforts, improved communication tools, and effective monitoring mechanisms are vital to ensure the quality and relevance of certification and training programmes. Additionally, national/regional policies endorsing mandatory solar training and gender inclusivity in the sector may contribute significantly to the establishment of a skilled and diverse solar workforce.

5.3. Solar Training Courses

Approximately 35% of the surveyed participants have been actively engaged in solar training courses, showing relevant interest in solar education and related topics. Moreover, most respondents positively evaluated the quality of the training they received, defining them as "very high".

According to collected data, it emerges that private companies adopt different approaches to deliver internal training courses. These are either based on full in-house programmes or sometimes also on outsourced modules. The two different approaches give an initial idea of the commitment of a certain company in fostering internal skills development among its own staff members. Notably, a significant portion of interviewed organisations (70%) mandates employees' participation in training, showing a pronounced commitment in skills and expertise enhancement among their workforces. However, it is important to note that while there is a clear need for training initiatives, there is still an absence of certification frameworks.

Table 26: Solar training course provided



The survey participants seem to perceive an existing demand for training programmes about solar thermal and solar PV technologies in the target regions. This insight is a direct expression of the transversal need for skilled professionals in the sector. Additionally, according to survey results, training programmes adequately cover PV related topics, but focus less on solar thermal subjects. The observed disparity in training focus between solar PV and solar thermal technologies can be largely explained by regional variances in technology adoption and specialisation. For example, in regions such as ECOWAS, there has been a significant advancement in solar PV technology, with a more recent shift towards intensifying efforts in Solar Thermal. This indicates a developmental trajectory where PV technology takes precedence before a gradual adoption of Solar Thermal practices. On the other hand, East Africa is noted to be less advanced in both technologies, suggesting a different set of challenges and priorities that might affect the demand and focus on specific training programs.

Moreover, the professional background of the survey respondents provides another layer of insight. The majority of respondents are from companies primarily engaged in solar PV rather than solar thermal. This skew in professional expertise and industrial focus could have a considerable influence on the survey results, reflects a bias towards PV technology. Such a bias could stem from the industry's current trends, where PV technology, due to its broader applications and more established market presence, receives more attention and resources, both in practice and training. This industry tilt towards PV technology over solar thermal could therefore be both a cause and a reflection of the current training program emphases observed in the survey.

In addition this could be due to PV's rapid growth and high demand, especially in areas where solar energy can be directly converted into electricity. This demand-driven focus on PV has often resulted in the development of more comprehensive training programs in this field. Additionally, PV technology has witnessed significant advancements and wider adoption in various applications. Furthermore, it is typically more straightforward and cost-effective to create and provide training in PV technologies due to their broader scope and more established infrastructure, which, in turn, influences the coverage of training programs.

Table 27: Inclusion of Solar Thermal Topics in Current Training Courses

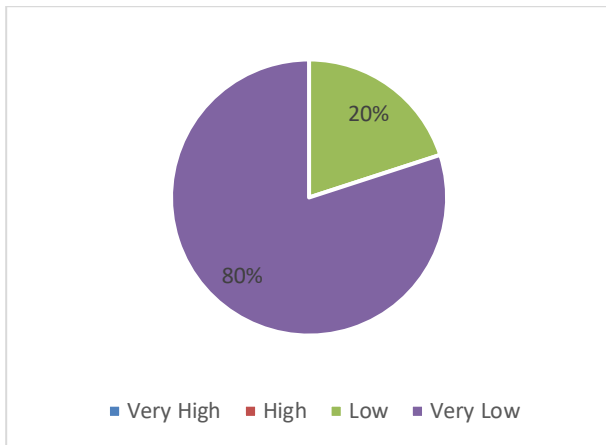
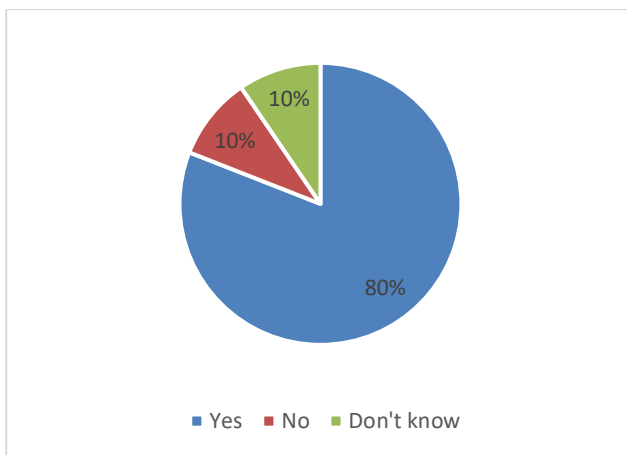
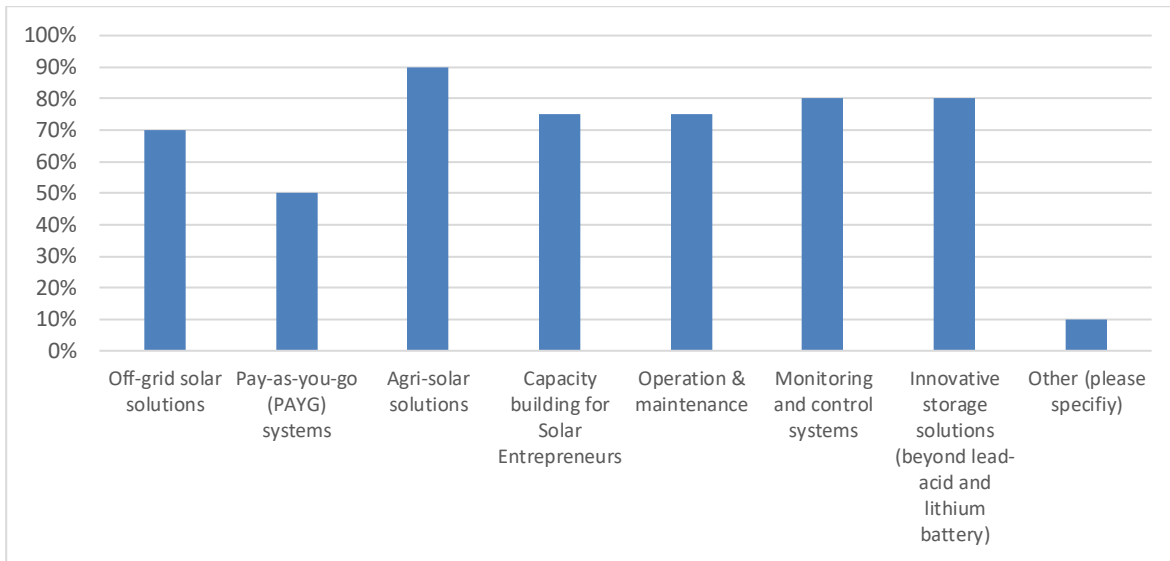


Table 28: Interest in Expanding Solar Thermal Topics in Future Training Courses



Apart from solar thermal and PV related topics, respondents expressed their interest in some emerging topics, such as Pay-as-you-go (PAYG) systems, integrated mini-grids, and tailored solutions for agricultural applications: these training subjects reflect the dynamic nature of the solar industry market trends.

Table 29; Additional Training Topics Required



Among the reported findings, the data collection activity has also unveiled several key challenges to be considered. These include the cost associated with training actions, the limited availability of training equipment, and the crucial need for qualified trainers. Respondents are aligned on the promotion of a more practical-oriented approach for improving the training quality, but also in involving experienced trainers, and introducing standard qualifications for trainers.

In addition, respondents have offered valuable suggestions for enhancing training quality: the introduction of refresher courses for trainers and the usage of appropriate training equipment. Respondents also acknowledge the significance of identifying legal requirements for training certification and bridging gaps in national training capacities.

In conclusion, data reflects a transversal need on improving training quality, also including more practical activities. Participants understand the importance of considering emerging technologies and industry trends for the training organisation, in order to meet the ever-evolving demands of the solar sector. Tackling identified challenges and adopting the proposed enhancements will undoubtedly support the development of quality solar training programmes.

5.4. Solar Workforce Certification

Survey findings about Solar Workforce Certification (SWC) and Solar Thermal Certification provide valuable insights about the perception, participation, and challenges associated with certification programmes in the solar industry. First of all, it is important to underline that the majority of survey respondents (approximately 70%) were not well positioned in terms of Solar Workforce Certification (they don't have any certification, or they are not interested in getting it). This suggests a significant portion of the surveyed population lacks formal certification in solar-related roles. Suggestions for improving the SWC framework coming for the survey activity are reported below:

- **Establishing Regional Certification Centres:** Respondents consistently proposed the establishment of Regional Certification Centres. This aspect is mostly due by limited centralisation and uniformity for solar technical training and certification. Regional Centres would serve as pivotal hubs for standardised, high-quality training programmes. By centralising resources and expertise, these

Centres could provide more accessible and consistent certification offers across various geographic areas.

- **Enhanced Information Dissemination:** A prominent challenge identified by respondents is the lack of awareness and information regarding SWC programmes. In this sense, proactive communication can attract more individuals to consider a career as solar technicians, ensuring a continuous stream of skilled workers entering the industry.
- **Youth Engagement:** Another critical aspect emphasised by respondents is the need to engage young individuals in solar technical training. This strategic focus on youth aligns with the industry's long-term sustainability goals. Engaging the younger generation and highlighting the advantages of a career in solar technology ensures a robust workforce pipeline for the future. Achieving this may involve collaborations with educational institutions, outreach programmes, and mentorship opportunities to inspire and guide aspiring solar technicians.
- **Promotion of International Collaboration:** Recognising the interconnected nature of the solar industry, respondents stressed the importance of international collaborations. Collaborative efforts can facilitate the exchange of best practices, harmonise certification standards across borders, and pool resources to support training initiatives. This global perspective acknowledges that advancements in solar technology and workforce development benefit from shared knowledge and cooperative endeavours.

Moreover, some key obstacles can be identified. Firstly, the lack of regulatory mandates requiring installer certification stands out as a fundamental obstacle. Considering this missing aspect, there are no incentives for both individuals and organisations to actively pursue certification framework. The implementation of regulatory mandates is therefore crucial, as it plays a pivotal role in standardising the solar industry and may ensure that certified professionals possess the necessary skills and knowledge to deliver high-quality solar installations.

Another crucial barrier highlighted by respondents pertains to the financial costs and time associated with obtaining certification. These investments pose significant deterrents, particularly in regions where financial resources are limited. Aspiring solar technicians often find these financial and time constraints insurmountable, hampering their pursuit of certification. Addressing this challenge requires innovative initiatives aimed at alleviating the financial burden associated with certification. Flexible training options can also play a crucial role in accommodating the diverse needs and time constraints of individuals aspiring to join the solar workforce.

Conclusion

Based on the valuable insights gained from the assessment, several key themes emerge that unite these regions in their collective journey towards solar energy development. These overarching themes include the formidable challenges posed by limited resources, the urgent call for greater awareness, the crucial need for inclusivity, with a particular focus on the involvement of youth and women, the imperative to align national policies with the evolving solar energy landscape, and the critical importance of fostering greater collaboration between all stakeholders.

In conducting this assessment, several challenges were encountered that may have influenced the results. Firstly, the limited number of respondents posed a significant challenge, potentially impacting the survey's representativeness and the breadth of insights gathered. Additionally, there was a noted reluctance among

participants to revisit topics that had been discussed in previous initiatives without ever reaching effective solutions. This may have led to a lack of enthusiasm in providing thorough and engaged responses. Furthermore, the geographic diversity of the respondents, while beneficial for a global perspective, also brought complexities in aligning and comparing data across different regions with varying levels of technological advancement and market dynamics. The challenge of engaging a balanced representation of professionals from both Solar PV and Solar Thermal sectors was also evident, potentially skewing the data towards the needs and trends of the more represented technology.

Challenges and recommendations:

Some of the challenges observed during the assessment were:

1. **Resource Constraints:** The three regions grapple with a challenge of limited resources, encompassing the scarcity of financial capital, suitable infrastructure, and a skilled workforce. These limitations pose significant hurdles to the widespread adoption of solar technologies, but when addressed, they could lead to significant progress and domestic green job creation.
2. **Awareness Gap:** A lack of awareness surrounds solar energy's qualifications and frameworks, hindering its acceptance and growth, affecting the general populace and key decision-makers who are instrumental in driving solar energy initiatives forward.
3. **Inclusivity Challenges:** While there is a recognition of the importance of inclusivity, barriers persist, hindering the meaningful involvement of youth and women in the solar energy sector. These obstacles may be deeply rooted in socio-economic disparities, cultural factors, or disparities in access to education.
4. **Policy Misalignment:** The misalignment of national policies with the evolving solar energy landscape is a substantial challenge, creating regulatory hurdles that impede progress and the transition to cleaner energy solutions.
5. **Collaboration Deficits:** The fragmentation of efforts and a lack of collaboration between diverse stakeholders, including governments, businesses, and civil society, present a challenge to realising the sector's full potential.

In response to these complex challenges, the study proposes a roadmap for advancing the shared mission of these regions towards harmonized, sustainable, and inclusive solar energy landscapes. A strategic path forward involves:

1. **Resource Mobilisation:** Initiatives designed to secure funding, both domestically and internationally, alongside strategies for the efficient allocation of resources, are essential to overcome resource constraints and provide the necessary foundation for solar energy development. Resource mobilisation may come from a variety of sources, including private sector, international funding partners and national governments.
2. **Awareness Campaigns:** A comprehensive approach to raising awareness can target diverse audiences, from the general public to policymakers, effectively educating them about the myriad benefits of solar energy and its potential to drive economic growth, green job creation and sustainability.
3. **Inclusivity Programs:** Tailored programs and policies should be thoughtfully implemented to involve youth and women in the solar energy sector actively. These initiatives must address cultural and educational disparities that hinder their participation, thereby ensuring a more inclusive and diverse workforce. For example, the CORE initiative of which UNIDO is a Steering Committee member conducts training-of-trainers with a gender-lens across the three regions in question.
4. **Policy Alignment:** The alignment of national, regional and international policies is crucial. A revision and update of these policies to eliminate regulatory barriers and foster a conducive environment for

solar technology deployment are paramount. Moreover, such policies should consider quality assurance and training efforts to create skilled solar PV workforces as cornerstones of their respective countries' clean energy transition efforts.

5. **Collaborative Platforms:** The establishment of collaborative platforms is essential to bring together diverse stakeholders. These platforms can facilitate knowledge sharing, the dissemination of best practices, and the initiation of joint projects, thereby promoting a holistic approach to solar energy development.

These insights form the foundation upon which the next phases of the STAR-C Project will be built and, more broadly, the overall mission to cultivate harmonised, sustainable, and inclusive solar energy landscapes. Future efforts will focus on recommendations and a roadmap for future frameworks, on the one hand by addressing structural challenges observed as described above and on the other hand by focusing on the regional needs in terms of curricula. They will evolve into dynamic tools that will offer policy guidance and actionable recommendations and provide stakeholders with strategies for improving capacity and concrete standards for deploying PV and SHC technologies.

The design and development of these documents will be guided by a commitment to facilitate regional adoption, ensuring a seamless transition to national implementation. Furthermore, recognising the central role of education and training in promoting solar energy initiatives, Project STAR-C will create curricula and modules meticulously tailored to each region's unique conditions and needs.

The curricula will encompass both solar photovoltaic (PV) and solar thermal subjects and include introductory sections on solar PV technology and Solar Heat Industrial Processes (SHIP) design methodologies, energy planning and data collection, and system integration concepts on both process and supply levels. Additionally, they will offer practical applications for productive uses, such as solar pumping, solar cooling, and solar-powered workshops. Furthermore, a focus on management and financing aspects, including business models, green procurement, promoting sustainability, data analysis for energy planning, and the development of Detailed Project Reports, will provide comprehensive training.

Each region will benefit from supplementary modules that cater to its specific needs and priorities. For the Pacific region, the emphasis will be on the design and installation of PV, Hybrid, and GC Battery Systems, further enhancing the Diploma in Design and Installation of PV Systems. In the ECOWAS region, thermal systems, including the installation of solar water heaters, large-scale solar water heating, solar cooling, and manufacturing standards, will be the primary focus. For the EAC region, the curriculum will encompass diverse systems and their potential applications, such as solar water pumping, irrigation systems, hybrid systems, solar cooling, solar home systems, and hydro systems.

In conclusion, Project STAR-C's mission is informed by a deep understanding of the challenges and aspirations that bind these regions. It is poised to forge a path towards harmonised, sustainable, and inclusive solar energy landscapes. This pathway aligns perfectly with the global imperative to combat climate change and promote renewable energy solutions.

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