

Strategic Recommendations and Roadmap for Regional Solar PV and SHC Qualification and Certification Frameworks in the EAC Region

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

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Executive Summary (EN)

The "Strategic Recommendations and Roadmap for Regional Solar PV and SHC Qualification and Certification Frameworks in the EAC Region" document aims to enhance the standards, capacities, and processes for solar energy training and certification within the East African Community (EAC). It is part of a broader initiative to develop robust solar energy qualification frameworks across various regions, emphasizing the need for high-quality standards in the solar industry for long-term sustainability and trust in solar markets, particularly in developing regions.

The document highlights the critical importance of establishing robust, harmonised, and quality-driven solar energy training and certification frameworks within the EAC region and stresses the need for collaborative and regionally harmonised efforts to ensure that standards are relevant to the EAC and consistent with global best practices. It calls for ongoing evaluation and adaptation, making frameworks flexible and responsive to new developments and underscores the role of advanced EAC countries in leading by example and fostering a unified regional standard.

In addition, the recommendations are aimed at bolstering the solar energy sector within the East African Community (EAC). The document's proposed strategies serve as a robust framework for cultivating a skilled and responsive workforce that aligns with the dynamic needs of the solar energy industry. The recommendations call for the development of industry-driven qualifications, a competency-based approach to training, integration of soft skills, continuous review, and improvement. They also highlight the need for inclusive frameworks considering gender equality, digital transformation, and climate change adaptation. The certification processes are enhanced through standardisation and collaboration at higher education levels, focusing on practical skills for technicians, and ensuring alignment with global standards while meeting local needs.

Finally, the roadmap outlines a structured approach to developing a skilled solar energy workforce in the EAC. It involves phases such as Capacity Building and Quality Assurance, Implementation and Integration, Monitoring Evaluation and Feedback, and Adaptation and Expansion. Each phase details players and responsibilities, activities, timeframes, and how each action relates to the strategic recommendations. The roadmap establishes a coherent and effective approach to developing the solar energy sector in the EAC by enhancing training quality and harmonizing qualifications which lead to a more skilled workforce ready to meet the industry's current and future demands. This strategic progression, backed by quality assurance and inclusive practices, sets the stage for sustained growth, and contributing to a sustainable energy future.

Overall, the document provides a strategic and actionable plan for enhancing the solar energy sector's qualifications and certifications in the EAC. It envisions a future where the solar industry is inclusive, technologically advanced, resilient, and contributes significantly to a sustainable and equitable energy future for the region.

Résumé exécutif (FR)

Le document "Recommandations stratégiques et feuille de route pour les cadres régionaux de qualification et de certification en matière d'énergie solaire PV et CRS dans la région CAE" est une analyse complète et un plan stratégique visant à améliorer les normes, les capacités et les processus de formation et de certification en matière d'énergie solaire au sein de la Communauté de l'Afrique de l'Est (CAE). Il fait partie d'une initiative plus large visant à développer des cadres de qualification solides pour l'énergie solaire dans diverses régions, soulignant la nécessité de normes de haute qualité dans l'industrie solaire pour la durabilité à long terme et la confiance dans les marchés de l'énergie solaire, en particulier dans les régions en développement.

Le document sert d'instrument de transformation, il souligne l'importance cruciale d'établir des cadres de formation et de certification solides, harmonisés et axés sur la qualité dans le domaine de l'énergie solaire au sein de la région CAE. Il souligne la nécessité de collaborer et d'harmoniser les efforts au niveau régional pour s'assurer que les normes sont pertinentes pour la CAE et cohérentes avec les meilleures pratiques mondiales. Il appelle à une évaluation et à une adaptation permanente, afin de rendre les cadres flexibles et de les adapter aux nouveaux développements. Elle souligne le rôle des pays avancés de la CAE, qui doivent montrer l'exemple et encourager l'adoption d'une norme régionale unifiée.

En outre, les recommandations formulées dans le document représentent une étape cruciale dans le renforcement du secteur de l'énergie solaire au sein de la Communauté de l'Afrique de l'Est (CAE). Les stratégies proposées dans le document servent de cadre solide pour cultiver une main-d'œuvre qualifiée et réactive qui s'aligne sur les besoins dynamiques de l'industrie solaire. Plusieurs recommandations appellent au développement de qualifications adaptées à l'industrie, à une approche de la formation basée sur les compétences, à l'intégration des compétences non techniques, à un examen continu et à l'amélioration. Le rapport souligne également la nécessité de mettre en place des cadres inclusifs tenant compte de l'égalité des sexes, de la transformation numérique et de l'adaptation au changement climatique. Les processus de certification sont améliorés par la normalisation et la collaboration au niveau de l'enseignement supérieur, en se concentrant sur les compétences pratiques des techniciens, et en assurant l'alignement sur les normes mondiales tout en répondant aux besoins locaux.

Enfin, la feuille de route décrit une approche structurée pour développer une main-d'œuvre qualifiée dans le domaine de l'énergie solaire dans la CAE. Elle comprend des phases telles que le renforcement des capacités et l'assurance qualité, la mise en œuvre et l'intégration, le suivi, l'évaluation et le retour d'information, ainsi que l'adaptation et l'expansion. Chaque phase détaille les acteurs et les responsabilités, les activités, les calendriers et la manière dont chaque action est liée aux recommandations stratégiques. La feuille de route a établi une approche cohérente et efficace pour développer le secteur de l'énergie solaire dans la CAE. L'amélioration de la qualité de la formation et l'harmonisation des qualifications ont conduit à une main-d'œuvre plus qualifiée, prête à répondre aux demandes actuelles et futures de l'industrie. Cette progression stratégique, soutenue par une assurance qualité et des pratiques inclusives, a préparé le terrain pour une croissance soutenue et une contribution à un avenir énergétique durable.

Dans l'ensemble, le document fournit un plan stratégique et réalisable pour améliorer les qualifications et les certifications du secteur de l'énergie solaire dans la région CAE. Il envisage un

avenir où l'industrie solaire est inclusive, technologiquement avancée, résiliente, et contribue de manière significative à un avenir énergétique durable et équitable pour la région.

Abbreviations

ACQF - African Continental Qualifications Framework
BTNET - Business, Technical, Vocational Education, and Training
CAMES - African and Malagasy Council for Higher Education
CBA - Competence-Based Assessment
DECPC - Department of Examinations, Professional Competitions, and Certifications
CFEE - Certificat de fin d'études élémentaires
DFPT - Department of Vocational and Technical Training
DIT - Directorate of Industrial Training
EAC - East African Community
EACAT - Credit Accumulation and Transfer system
EACREEE - East African Centre of Excellence for Renewable Energy and Efficiency
EAQFHE - East African Qualifications Framework for Higher Education
ECOWAS - Economic Community of West African States
EPRA - Energy and Petroleum Regulatory Authority
EQAP - Educational Quality and Assessment Program
GN-SEC - Global Network of Regional Sustainable Energy Centres
GNQF - Gambia National Qualifications Framework
GSES - Global Sustainable Energy Solutions
ICT - information and communication technology
IRENA - International Renewable Energy Agency
ISA - International Solar Alliance
IUCEA - Inter-University Council for East Africa
LDC - Least Developed Countries
LMD - Licence-Master-Doctorat
MoBSE - Ministry of Basic and Secondary Education
MoHERST - Ministry of Higher Education, Research, Science and Technology
NACTE - National Council for Technical Education
NUC - National Universities Commission
NVA - National Vocation Awards
PV – Photovoltaics
QF – Qualification Frameworks
RQF - Regional Qualification Frameworks
RTTI - Rwandan TVET Trainer Institute
SHC - Solar Heating and Cooling
TBS - Tanzania Bureau of Standards
UHEQF - Uganda Higher Education Qualifications Framework
UNESCO - United Nations Educational, Scientific and Cultural Organisation
UNIDO - United Nations Industrial Development Organisation
UVQF - Uganda Vocational 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

High quality capacities and processes 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 improvements directly affect the quality of infrastructure, and thus contribute to 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.

However, currently the qualification frameworks (QF) for Solar Photovoltaics (PV) and Solar Heating and Cooling (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. These frameworks contribute to the comparability, quality, and transparency of qualifications, making it easier to recognise diplomas and certificates across borders.

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 Organisation for Standardisation (ISO) have worked extensively to develop internationally acceptable certification standards for solar products and services.

To tackle these multifaceted challenges, the United Nations Industrial Development Organisation (UNIDO) and the International Solar Alliance (ISA) have embarked on the "Structuring of an International Network of Solar Technology and Application Resource Centres (STAR C)" 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.

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 Regional Economic Communities, including the Economic Community of West African States (ECOWAS), the East African Community (EAC), and the Pacific Community (SPC), in the establishment of qualification frameworks (QF) and certification

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>

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.

Recognising the significance of solar energy, the UNIDO has embarked on a comprehensive initiative to advance solar energy skills, certification, and QF. This initiative fosters a harmonised approach to solar energy development across three distinct regions: ECOWAS, EAC, and the Pacific region.

Scope of the activity

The scope of this document in enhancing solar qualification and certification actions encompasses a multifaceted approach aimed at improving the overall quality and reliability of solar energy systems. This includes the development of concrete recommendations to refine and standardise solar qualifications and certifications. Such recommendations focus on upgrading capacities and processes, ensuring that regional best practices are adopted and implemented nationally. A key aspect of this approach is the creation of a clear roadmap for the regional solar qualification and certification processes. This roadmap details governance structures, enforcement mechanisms, and strategies for effective information dissemination at the national level. Additionally, the scope of this activity includes cross-cutting areas such as gender sensitivity, integration of digital technologies, and incorporating climate change adaptation measures. Considering these factors, the quality frameworks designed enhances the solar energy sector's efficiency and reliability and ensure it is inclusive, future-proof, and environmentally sustainable.

The Baseline Assessment conducted as part of this initiative is a critical foundation for developing targeted solar qualification and certification frameworks. This assessment comprehensively analysed existing legislation, standards, and regional capacities and needs. It paid particular attention to the unique aspects of each region, including the maturity levels of solar markets and distinct climate conditions. Based on these findings, the initiative developed tailored frameworks and curricula for solar PV and SHC training, which are intended to enhance regional adoption and implementation at the national level, ensuring that high-quality training is delivered to professionals involved in preparing, implementing, operating, and maintaining solar energy systems.

The assessment document provided several key insights into the current state and future solar qualification and certification prospects in various countries. These insights included:

1. **Quality Standards' Importance:** The document underscored the crucial role of product and service quality standards in the solar field.
2. **Challenges in the EAC region:** the EAC region faces significant challenges in assuring product quality and services across the solar value chain. These include gaps in qualification and know-how, and a need for more experience in quality installations, which are vital for effective solar energy deployment.
3. **Need for Specialised Qualification and Certification Schemes:** The document emphasised the necessity for reliable and specialised qualification and certification schemes that address the needs of various stakeholders in the solar value chain, including consumers.
4. **Fragmentation and Lack of Training Institutions:** There is a noticeable lack of institutions offering quality curricula and training tailored to the diverse needs of experts in the solar energy sector.

5. **Regional Harmonisation and Collaboration:** The document highlighted the success of regional approaches, as seen in some African economic communities, in harmonizing qualification and certification standards.
6. **Comprehensive Approach to Solar Skills and Certification:** The document underscored the comprehensive approach needed for advancing solar energy skills, certification, and qualification frameworks.

These insights from the document paint a picture of the current challenges and potential strategies for improving solar energy qualification and certification, particularly in regions currently underserved and facing unique difficulties.

Strategic Recommendations for Enhancing Capacities in the Solar Qualification and Certification

Building on the detailed assessment provided earlier, the subsequent section will offer targeted recommendations specifically designed for the East African Community (EAC). These recommendations are formulated based on the EAC's distinct economic profile, socio-political environment, and ecological consideration. Aimed at bolstering regional cooperation, enhancing economic growth, and promoting sustainable development practices, these suggestions seek to leverage the EAC's unique strengths and address its challenges. Through strategic initiatives in areas such as infrastructure enhancement, trade optimisation, energy collaboration, and policy harmonisation, the goal is to pave the way for a more integrated, prosperous, and resilient East African region.

Improving the qualification and vocational framework involves creating a system more responsive to the needs of learners, industries, and society. To achieve this goal, the following strategies will form the cornerstone of a future roadmap:

- a. **Industry-driven qualifications:** Engage employers and industry representatives in the development of qualifications and vocational frameworks. Ensure that the skills and competencies included in the framework align with the current and future demands of the job market.
- b. **Promote Decentralised Solar Solutions:** Tailor training programs to the advancement of decentralised solar solutions that are critical in rural and underserved areas, which are common in the East African Community context.
- c. **Recognition of prior learning:** Establish mechanisms for recognizing prior learning and experience. This allows individuals with relevant skills gained through work experience, informal learning, or non-formal education to gain credit and progress through the framework.
- d. **Flexible pathways:** Create flexible pathways for learners to access and progress through the vocational framework. Allow for multiple entry and exit points, recognizing that individuals may have different starting points and learning preferences.
- e. **Competency-based approach:** Shift towards a competency-based approach, where qualifications are based on demonstrated skills and abilities rather than solely on academic achievements. This approach focuses on what learners can do rather than the time spent in learning.
- f. **Quality assurance and accreditation:** Ensure a robust quality assurance and accreditation system for vocational training providers that ensures consistency and high standards in solar training and certification, potentially under the guidance of the Inter-University Council for

- East Africa (IUCEA) or other regional bodies Regular evaluations and monitoring can maintain the standard of education and improve the credibility of qualifications.
- g. **Focus on soft skills:** Include soft skills such as communication, teamwork, problem-solving, and adaptability in the vocational framework. These skills are essential for success in the workplace and contribute to overall employability.
 - h. **ICT integration:** Integrate information and communication technology (ICT) in the vocational framework to enhance learning, assessment, and collaboration. Utilise e-learning platforms and digital resources to make education more accessible and engaging. This aligns with the EASTRIP initiative to harness ICT for enhancing Technical and Vocational Education and Training (TVET) program quality and relevance in sectors like energy and manufacturing.
 - i. **Continuous review and improvement:** Regularly review the vocational framework to ensure its relevance and responsiveness to changing industry needs and technological advancements.
 - j. **Leverage Regional Centres of Excellence:** Utilise established centres of excellence within the EAC, as identified by IUCEA, for delivering high-quality solar training and certification. These centres can also serve as hubs for developing and disseminating best practices and innovations in solar energy.
 - k. **Inclusive framework:** Design a framework that is inclusive and caters to the needs of diverse learners, including individuals with disabilities, those from disadvantaged backgrounds, and different age groups.
 - l. **Career guidance and counselling:** Provide comprehensive career guidance and counselling services to help individuals make informed choices about their vocational pathways. This support can lead to better matching of skills with job opportunities.
 - m. **Partnerships and collaboration:** Foster partnerships and collaboration between educational institutions, industry stakeholders, government agencies, and other relevant organisations like the Energy and Petroleum Regulatory Authority (EPRA) in Kenya, or the Tanzania Bureau of Standards (TBS) in Tanzania, TVET institutions across the EAC, overseen by national bodies such as Kenya's TVET Authority, Tanzania's Vocational Education and Training Authority (VETA), and others in Uganda, Rwanda, and Burundi, should work together to align their curricula with the regional framework. This collaboration has the potential to significantly enhance training programs and improve employment outcomes. Leveraging EACREE as a technical hub allows for the utilisation of specialised resources and expertise to develop more robust and effective training strategies. This strategic partnership could serve as a catalyst for creating high-quality opportunities and fostering a more skilled workforce.

Enhanced Certification Processes for Solar Energy Qualification

In the realm of solar energy qualification, the development and implementation of effective certification processes are vital. These processes must be standardised, aligned with international best practices, and adaptable to local contexts and requirements. The EAC exhibits a varied landscape in terms of solar energy development, with only a handful of member countries having advanced processes in place. The disparities in progress and implementation across the member states present a significant challenge to the regional integration of solar energy systems. In response to the identified issues within the EAC's processes, the forthcoming recommendations aim to address these gaps, ensuring that less advanced member states can look to their more developed counterparts as models for establishing robust solar qualification and certification frameworks. This

approach not only seeks to elevate the overall capacity within the EAC but also strives to create a unified regional standard that fosters sustainable energy practices, thereby enabling a cohesive and cooperative advancement in solar energy adoption. Incorporating a specific focus on solar PV and solar thermal training curricula at both higher education and technician levels through collaboration with regional entities like the IUCEA is crucial for achieving this goal.

- a. **Standardisation and Collaboration at Higher Education Level:** Leverage the collaborative platform of the IUCEA to standardise and quality-assure solar PV and solar thermal training curricula. This collaboration should be aligned with the East African Qualifications Framework for Higher Education (EAQFHE), ensuring a consistent and high-quality educational standard across the region. Moreover, develop common curricula that are standardised across universities in the region. This harmonisation ensures that graduates from different institutions have equivalent skills and knowledge, facilitating easier recognition of qualifications across borders.
- b. **Focus on Technician Level Training:** Ensure that the certification processes for technicians focus on practical skills essential for installing, maintaining, and troubleshooting solar PV and thermal systems. Make training programs accessible to a broader range of participants, including those with varying educational backgrounds. Scalable training modules can cater to different levels of expertise and experience.
- c. **Emphasis on Integrating Less Advanced Countries:** Special emphasis should be placed on integrating countries within the East African Community (EAC) that need more advanced solar energy training frameworks. This could involve providing additional resources, training programs, and expertise to these countries. Develop training programs specifically tailored to the unique needs and existing levels of expertise in these less advanced countries. This approach ensures that all countries within the EAC can progress and benefit from the regional harmonisation of solar energy qualifications.
- d. **Ensuring Alignment with Global Standards and Local Needs:** Align the certification processes with international standards, ensuring that the qualifications are recognised and respected globally. Adapt the certification processes to meet the specific needs and challenges of the local contexts, considering local climatic conditions, technological advancements, and typical energy needs of the region.

By focusing on these critical areas, the certification processes in solar energy can achieve a balance between international alignment and local relevance. This approach enhances the quality of solar energy education and training and supports the overall growth and sustainability of the solar energy sector, particularly in regions like the EAC.

Enhanced Solar Thermal and PV Technology Certification Process

In the EAC, despite a strong regional commitment to renewable energy, the presence of highly advanced solar initiatives is limited. From the assessment conducted it is evident that the region as a whole is interested in solar thermal and PV technology in utility-scale, off-grid, and distributed renewable energy systems, and is working towards improving quality infrastructure frameworks for renewable energy and energy efficiency. This suggests a regional effort rather than individual country advancements. The success of initiatives in this regard will likely depend on collaboration between EAC member states, leveraging the experience and progress of more advanced countries to guide and support the development in others. However, the EAC region is engaged in efforts to develop regional quality infrastructure frameworks that would encompass solar photovoltaics and solar thermal energy, as indicated by solicitations for advisory support on such initiatives. The

overall regional approach indicates a push towards harmonizing solar product, service, and qualification standards, which suggests that advanced initiatives may be developed within this framework. This approach is designed to leverage cross-border harmonisation and economies of scale for a more effective regional impact.

In the EAC, where solar thermal and photovoltaics technology potential is vast yet unevenly distributed, enhancing certification processes is crucial. Lessons from EAC's front-runners could pave the way, with their advanced practices serving as a model for others. An EAC-wide certification framework, rooted in the success of leaders in the field, can elevate standards, ensure quality, and foster trust. This could involve:

- a. Collaborative development of regional qualifications, harmonizing certifications to reflect the distinct climates and economies within the EAC.
- b. Tailored training initiatives that emphasise local manufacturing capabilities and practical installation skills, especially in pioneering states.
- c. Targeted application of solar thermal systems in sectors with high energy consumption, like hospitality and healthcare, which can demonstrate tangible benefits and encourage wider adoption.
- d. Incentives and supportive policies to nurture market growth and consumer confidence across the region, learning from the best practices of EAC leaders.
- e. Incorporating emerging solar thermal and PV applications into curricula to keep the region at the cutting edge of technology.
- f. Public education campaigns to raise awareness of the benefits and practicalities of solar thermal and PV technology, leveraging successful case studies from within the EAC.

A strategic approach, combining regional expertise with a commitment to shared progress, can thus catalyse a more uniform and sustainable solar thermal landscape across the EAC.

Effective Communication Strategies for Solar Certification Awareness

In light of the process-related challenges identified within the East African Community (EAC), it is clear that a unified approach to communication strategies is essential. The disparity in advancement levels among EAC partner states necessitates a set of recommendations that encourage less advanced countries to adopt the successful practices of their more developed counterparts. The communication strategies that follow are intended to facilitate better knowledge transfer, policy alignment, and collaborative efforts across the EAC. They aim to bridge the developmental divide by promoting transparency, increasing engagement, and fostering shared understanding. These strategies will focus on leveraging the strengths of advanced member states to provide a blueprint for effective communication that supports the EAC's collective growth and regional integration objectives.

Effective dissemination of solar qualification and certification information is critical to ensure broad awareness and understanding among stakeholders. This can be achieved through well-planned awareness campaigns and diverse communication channels.

The focus should be on the implementation of awareness campaigns that clearly communicate the importance and benefits of solar certification to a **broad range of stakeholders**, including potential solar professionals, industry players, policymakers, and the general public, where the advantages of accreditation will be emphasised, such as improved quality of solar installations, increased consumer trust, enhanced safety, and the long-term sustainability of solar investments. To maximise the effectiveness and impact of the campaign, it's essential to harness **various**

communication channels. This approach should leverage digital platforms, such as social media, websites, and online forums, to reach a broad audience efficiently. Complement these online efforts with face-to-face activities like workshops and seminars. These in-person events offer detailed information and practical experiences on solar certification, effectively catering to specific audience needs. Technical training sessions can be organised for installers, while informational briefings for policymakers and investors will broaden the campaign's reach and deepen its influence. For this purpose, **collaboration with universities, colleges, and vocational training centres** to integrate information about solar certification into their curricula is vital. They should be the core of this activity, leading consistent and Continuous Communication, providing regular updates about the latest developments in solar certification standards and processes, and establishing feedback mechanisms where stakeholders can express their concerns, ask questions, and provide suggestions regarding solar certification. This two-way communication fosters a sense of community and involvement. The below roadmap outlines this process in phases detailing where the different actors can contribute. Nevertheless, all the dissemination process must be reinforced with collaborative efforts for broader reach, creating **partnerships with industry and government bodies.** Their endorsement can lend credibility and attract wider attention.

By implementing these dissemination strategies, stakeholders across various sectors can be educated and informed about the significance of solar certification, thus fostering a more robust and qualified solar industry. This approach enhances the understanding and adoption of solar certification and supports the overall growth and sustainability of the solar energy sector.

Cross-Cutting Areas in the Design of Quality Frameworks

a. Gender Inclusivity:

In the context of the EAC's varied landscape of solar energy development, with only a select number of countries possessing established frameworks, it becomes essential to underscore Gender Inclusivity as a cornerstone for regional progress. To address the disparity and guide less advanced nations, the region must adopt proven strategies from their advanced counterparts to foster inclusivity. Gender Inclusivity not only upholds principles of fairness and social justice but also enriches the solar industry with diverse perspectives and skills.

Implementing strategies for equal opportunities and representation across all member states will be crucial. This could involve benchmarking against advanced EAC countries to develop incentives such as scholarships aimed at underrepresented genders, ensuring the creation of gender-sensitive training materials free from stereotypes, and highlighting the achievements of diverse individuals in solar energy. Additionally, the formulation of inclusive policies, with clear targets for female participation and gender balance in leadership roles, is vital. This approach will also include specialised training programs designed to elevate the involvement of women and other marginalised groups within the solar sector, mirroring the successes of the EAC's more developed nations and creating a unified, progressive framework for the entire community.

Within the East African Community (EAC), some member states have made strides in integrating gender inclusivity in various sectors, including renewable energy. However, specific practices and the degree of success can vary widely and are influenced by a range of factors, including cultural, social, and economic policies.

For example, Rwanda has been recognised for its significant efforts in promoting gender equality. The country has implemented various initiatives to ensure women's participation in all sectors of society, including renewable energy. Kenya is another EAC country that has shown progress in terms of gender inclusivity, particularly in the energy sector. Kenya's Energy Policy, which acknowledges

the importance of gender consideration in energy projects, can serve as a model for other EAC countries. Moreover, initiatives by Kenyan non-profits and government agencies have focused on mainstreaming gender in renewable energy projects, ensuring that women are both beneficiaries and active participants in these initiatives. Tanzania has also made efforts to improve gender inclusivity. Some programs target women for training in solar panel installation and maintenance, aiming to increase their participation in the solar energy workforce.

It should be noted that these practices and initiatives could be considered successful in the context of their respective countries, and their adaptability to other EAC member states would depend on the local context, resources, and commitment to gender inclusivity.

Strategies that ensure equal opportunities and fair representation for all genders must be implemented to achieve this. In order to foster an inclusive environment, from developing gender-sensitive training materials to creating specialised programs and policies, each of these strategies is designed to break down barriers and create a more equitable landscape in the solar energy industry:

- **Equal Opportunities and Representation:** Develop strategies to ensure equal opportunities and representation for all genders in solar energy training and certification programs. This might involve offering scholarships or incentives to encourage participation from underrepresented groups.
- **Gender-Sensitive Training Materials:** Ensure that training materials and methodologies are gender-sensitive and do not perpetuate stereotypes. Incorporating case studies and examples that highlight the contributions of diverse individuals in the solar sector can be effective.
- **Development of Inclusive Policies:** Create and enforce policies that promote gender inclusivity within solar energy training and certification programs. This could include setting targets for female participation and ensuring gender balance in decision-making roles.
- **Specialised Training Programs:** Offer technical training programs or incentives aimed at increasing the participation of women and other underrepresented groups in the solar sector.
- **Vocational Workshops from Early Ages:** Introduce vocational workshops focused on solar technologies at early educational stages. These workshops should be designed to spark interest and provide foundational knowledge in renewable energy. By targeting young learners, these workshops can play a pivotal role in shaping future generations' perceptions and capabilities in the solar energy field, ensuring a diverse and well-prepared workforce. This early engagement can also help normalise the presence of all genders in technical roles, laying the groundwork for a more inclusive industry.

b. Digitalisation:

Following the emphasis on gender inclusivity, the next pivotal aspect in the development of solar energy training and certification is Digitalisation. This facet is crucial in adapting to the rapidly changing technological landscape of the solar energy sector. Within the East African Community (EAC), several member states have taken significant steps towards the digitalisation of the energy sector, leveraging technology to enhance efficiency, accessibility, and sustainability.

Kenya has been a leader in integrating digital solutions in its renewable energy sector, particularly in solar power production. The country has been using digital technology for grid management and to support the adoption of renewable energy sources. Additionally, Kenya's mobile payment system, M-Pesa, is extensively used to facilitate pay-as-you-go solar power solutions, providing access to energy in remote areas. Rwanda has been implementing advanced metering infrastructure (AMI)

and integrating ICT to improve the management of its energy distribution networks. This includes digital platforms for monitoring and managing renewable energy production, particularly in solar and hydropower. Finally, Tanzania has been deploying solar power microgrids with digital interfaces that allow for remote monitoring and management. These systems are designed to increase energy access in off-grid areas and are equipped with digital payment systems to manage electricity billing and consumption.

Across the EAC, there are efforts to establish digital platforms for energy trading between countries, which would enhance the regional integration of energy markets and optimise the distribution of electricity generated from renewable sources.

It is important to note that these initiatives are often supported by international partnerships, private investments, and policy frameworks that encourage innovation and the use of digital technologies in the energy sector. The success of digitalisation in energy within the EAC also depends on the continued development of regional infrastructure, such as high-speed internet and mobile connectivity, which are crucial for the implementation of these technologies.

Embracing digital tools and platforms not only modernises the delivery of training and certification processes but also ensures efficiency and wider accessibility. Incorporating digital literacy as a fundamental component of training programs, investing in robust digital infrastructure, and utilizing advanced data management techniques are essential steps. Recognizing the varying levels of digital infrastructure and adoption across the EAC, it is essential to develop a strategic approach to digitalisation that can be embraced by all member states, regardless of their current digital advancement. Moreover, the integration of technologies such as the Internet of Things (IoT), artificial intelligence (AI), and concepts from Industry 4.0 into the energy sector holds significant potential for the future development of the region. These technologies could revolutionise energy systems management, predictive maintenance, and energy efficiency, driving further innovations and sustainability in the renewable energy sector. The recommendations provided below take into account the EAC's distinctive circumstances, aiming to build upon the successes of more digitally advanced countries within the bloc to guide and uplift the others. These measures will guarantee that participants are well-equipped with the necessary digital skills, making the certification process more adaptable, accessible, and in tune with the demands of the modern energy industry.

- **Incorporation of Digital Tools:** Utilise digital tools and platforms in the delivery of training and certification processes. This could include online courses, virtual simulations for practical training, and digital platforms for certification exams.
- **Data Management and Analysis:** Employ digital solutions for data management and analysis, enabling more efficient tracking of training outcomes, certification renewals, and ongoing professional development.
- **Digital Literacy and Training:** Incorporate digital literacy as a core component of solar energy training programs. This ensures that all participants are skilled in using digital tools essential in the modern energy sector.
- **Investment in Digital Infrastructure:** Invest in digital infrastructure to facilitate online learning, virtual simulations, and automated certification processes, making training and certification more accessible and efficient.

c. Climate Change Adaptation:

In the realm of climate change adaptation specifically related to the energy sector within the EAC, several partner states have embarked on significant initiatives that showcase their commitment to building resilience against the impacts of climate change. Tanzania has been actively promoting solar power to achieve rural electrification. This reduces the dependency on biomass and fossil fuels,

helping to mitigate climate change while adapting to its effects by providing a reliable source of energy. Although Burundi is one of the less economically developed EAC partner states, it has been making strides in renewable energy investments, such as small-scale hydropower projects, which are intended to be less susceptible to climate variability. Additionally, there are initiatives that include climate change mitigation or adaptation measures, such as solar water pumping systems and green cooling technologies. These systems do not only provide essential services in a sustainable manner but also help reduce the energy sector's carbon footprint and adapt to the changing climate conditions by ensuring efficient water management and reducing reliance on traditional cooling methods.

EAC member states are also part of the Eastern Africa Power Pool (EAPP), which aims to facilitate cross-border energy trade. This interconnectivity allows countries to balance the variability in renewable energy generation and improve overall resilience to climate impacts.

These initiatives reflect a growing recognition within the EAC of the importance of developing energy systems that are not only sustainable but also adaptable to the changing climate. However, the success and advancement of these initiatives can vary based on political will, investment levels, technological capability, and international support.

Climate Change Adaptation involves embedding resilience and adaptive strategies into the training curriculum, focusing on how solar installations can be designed and maintained to endure climate-related challenges. The curriculum should not only teach technical skills but also emphasise sustainable practices and the role of solar energy as a climate-friendly solution. Additionally, it's vital to foster research and development in solar technologies that are resilient to the impacts of climate change. This approach ensures that the training is current and forward-looking, preparing participants to respond to the evolving environmental challenges effectively.

- **Resilience and Adaptation in Curriculum:** Integrate climate change resilience and adaptation strategies into the training curriculum. Teach how solar installations can be designed and maintained to withstand climate-related challenges, such as extreme weather events.
- **Promoting Sustainable Practices:** Emphasise the role of solar energy as a climate-friendly solution and encourage sustainable practices throughout the training and certification processes.
- **Curriculum Integration:** Integrate climate change adaptation and resilience-building strategies into the training curriculum, teaching how to design and maintain solar installations in the face of climatic changes.
- **Research and Development Support:** Encourage and support research and development in solar technologies that are resilient to climate change impacts.

All these dimensions seamlessly converge into a holistic approach, wherein the integration of cross-cutting areas aims to achieve a unified objective. By aligning quality frameworks with national and regional policies on gender equality, digital transformation, and climate change adaptation, we ensure a cohesive and policy-supported framework. It's crucial to regularly assess and update these frameworks, maintaining their relevance and efficacy in addressing these diverse yet interconnected areas. This involves conducting periodic reviews and actively seeking feedback from participants and stakeholders. Ultimately, it's essential to maintain the flexibility of these frameworks, enabling them to adapt and evolve with new developments and insights in these critical aspects.

By integrating these cross-cutting areas into the design of solar energy qualification and certification frameworks, the solar industry can become more inclusive, technologically advanced, and resilient,

ultimately contributing to a more sustainable and equitable energy future. The solar energy sector can ensure that its qualification and certification frameworks are technically robust, socially inclusive, and environmentally resilient.

Enhanced Roadmap for Solar Energy Development in EAC

The development of the roadmap for the EAC solar energy project is based on an in-depth stakeholder analysis (table 1.1). This critical first step involved identifying key players whose interests, influence, and potential contributions shape the project's trajectory. By evaluating how the project impacts each stakeholder and vice versa, the analysis provided a clear understanding of the landscape, highlighting areas of collaboration and potential resistance. It also informed strategies for stakeholder engagement, ensuring that the roadmap would reflect a comprehensive approach, balancing various needs and driving towards a cohesive goal. For example, international bodies such as UNIDO and ISA could focus on capacity building measures in cooperation with local and regional actors such as EACREEE to support regional harmonisation. With this foundation, the roadmap was designed to address the unique challenges and leverage the strengths within the EAC, laying the groundwork for effective implementation of solar energy qualifications and certifications.

Table 1.1 Stakeholder analysis

Stakeholder Name	Impact <i>How much does the project impact them? (Low, Medium, High)</i>	Influence <i>How much influence do they have over the project? (Low, Medium, High)</i>	What is important to the stakeholder?	How could the stakeholder contribute the project?	How could the stakeholder block the project?	Strategy for engaging the stakeholder
Energy specialised regional bodies	High	High	Harmonizing solar energy qualifications and certifications in EAC.	Coordinating regional efforts and policies.	Diverse regulatory environments across member states.	Regular regional meetings and policy alignment discussions.
Government Bodies and Regulatory Authorities	Medium	Medium	Implementing EAQFHE for solar training and certification.	Standardization of qualifications across the region.	Varying national education and energy policies.	Harmonizing policies through EAC forums and IUCEA.
Educational institutions and Training service providers	High	Medium	Aligning curricula with EAQFHE and industry needs.	Upgrading and standardizing solar energy courses.	Lack of regional harmonization and resources.	Engagement with industry and EAC educational initiatives.
Industry and Employers	Medium	Low	Adoption of regionally recognized qualifications.	Advocacy for harmonized skills and hiring certified professionals.	Divergent industry standards and practices.	Engagement in regional skills forums and sector dialogues.
Academia	Low	Medium	Research and development of region-specific solar technologies.	Providing research-based insights and expert training.	Limited regional collaboration and funding.	Fostering regional research networks and partnerships.
NGO and international bodies	Low	High	Supporting sustainable energy policies and community initiatives.	Community engagement, capacity building, and advocacy.	Complex socio-economic and political landscapes.	Building networks and alliances with local and regional actors.

The roadmap for enhancing solar qualification and certification within the EAC reflects a strategic and structured approach to developing a skilled workforce in the solar energy sector, enhancing solar qualification and certification, involving players like the EACREEE and IUCEA, and aligning with strategic recommendations. Indeed, these two institutions could even play a critical leading role in the implementation of the different steps outlined in the roadmap. For example, EACREEE could lead on developing industry partnerships or IUCEA on designing competency-based curricula. This initiative aims to align educational frameworks with industry standards, foster regional collaboration, and ensure the integration of all member states, particularly those with less advanced training infrastructures. Each phase of the roadmap is meticulously designed to build upon the previous, ensuring a coherent and inclusive progression towards establishing a robust and sustainable solar energy sector in the EAC.

Phases:

1. **Capacity Building and Quality Assurance**
2. **Implementation and Integration**
3. **Monitoring, Evaluation, and Feedback**
4. **Adaptation and Expansion**

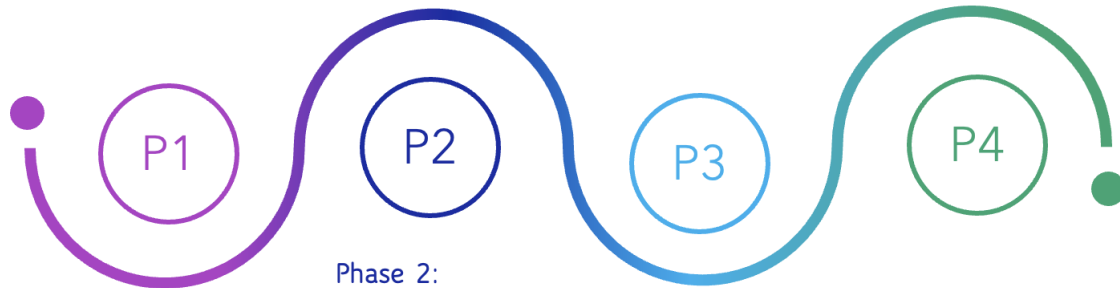
For each phase, the roadmap would specify:

- a. **Players & Responsibilities:** Identify which organisation is responsible for each action, such as EACREEE developing industry partnerships or IUCEA designing competency-based curricula.
- b. **Activities:** List specific tasks, like conducting workshops for industry feedback or developing e-learning modules.
- c. **Timeframe:** Provide start and end dates for each phase and activity.
- d. **Strategic Recommendations Integration:** Indicate how each action ties back to the strategic recommendations such as engaging industry in qualification development or ensuring quality through accreditation.

For example, in the first phase, EACREEE might be responsible for organising roundtable discussions with industry stakeholders to align the qualifications with market needs, to be completed within the first six months. This aligns with the strategic recommendation of industry-driven qualifications. This approach ensures the roadmap is comprehensive, detailed, and actionable, with clear directives for all stakeholders involved.

The roadmap aims to create a cohesive and dynamic educational ecosystem for solar energy in the EAC, adapting to technological advancements and diverse regional needs. It envisions a systematic approach to enhancing the solar energy sector's qualifications and certifications in the EAC, with a focus on inclusion, quality, and sustainability. It includes detailed planning, collaborative development, capacity building, and a commitment to continuous improvement, ensuring that all member states, especially those less advanced, can benefit from and contribute to the region's energy goals.

ROADMAP FOR ENHANCING SOLAR QUALIFICATION AND CERTIFICATION WITHIN THE EAST AFRICAN COMMUNITY (EAC)



Phase 1: Capacity Building and Quality Assurance

- Objective: Focus on enhancing the capabilities of educational institutions and implementing quality assurance protocols.
- Outcome: Improved teaching quality and standardised training practices across the region.

Phase 2: Implementation and Integration

- Objective: Roll out the standardized curriculum and integrate less advanced countries into the framework.
- Outcome: Unified educational standards across the EAC, ensuring inclusivity and coherence.

Phase 3: Monitoring, Evaluation, and Feedback

- Objective: Continuously assess the effectiveness of the implemented curriculum and gather feedback for improvements.
- Outcome: Data-driven insights for refining the educational programs and aligning them more closely with industry needs.

Phase 4: Adaptation and Expansion

- Objective: Update and expand the curriculum to include emerging solar technologies and new market requirements.
- Outcome: A dynamic, responsive educational framework that caters to the evolving landscape of the solar energy sector.

Phase 1: Capacity Building and Quality Assurance

- **Timeframe:** Q1-Q2 2024
- **Players & Responsibilities:**
 - EACREEE: Develop and conduct training for educators and administrators.
 - IUCEA: Implement quality assurance standards.
- **Activities:**
 - Organise 'train-the-trainer' programs.
 - Establish a quality assurance committee and process.

Strategic Integration: Emphasis on quality assurance and competency-based training

Phase 2: Implementation and Integration

- **Timeframe:** Q3 2024-Q2 2025
- **Players & Responsibilities:**
 - **Higher Education Institutions, Training institutions, Universities:** Adopt and integrate the new standardised curricula.
 - **EACREEE & IUCEA:** Support less advanced countries in curriculum implementation.
- **Activities:**

Phase 3: Monitoring, Evaluation, and Feedback

- **Timeframe:** Q3- Q4 2025
- **Players & Responsibilities:**
 - **IUCEA:** Lead the evaluation of curriculum effectiveness.
 - **EACREEE:** Gather and analyse feedback from all stakeholders.
- **Activities:**
 - Conduct periodic assessments and surveys.
 - Host feedback forums and stakeholder meetings.
- **Strategic Integration:** Continuous improvement and ICT integration in curriculum.

Phase 4: Adaptation and Expansion

- **Timeframe:** Q4 2025 onwards
- **Players & Responsibilities:**
 - **EACREEE & IUCEA:** Update and expand curricula to include new technologies and methodologies.
- **Activities:**
 - Integrate emerging solar technologies into curricula.
 - Secure partnerships for ongoing curriculum development.
- **Strategic Integration:** Emphasizing sustainable and forward-looking education practices.

Conclusion

The conclusions drawn from the "Strategic Recommendations and Roadmap for Regional Solar PV and SHC Qualification and Certification Frameworks in the EAC Region" are multifaceted and underscore the critical importance of establishing robust, harmonised, and quality-driven solar energy training and certification frameworks within the EAC region.

Key to these conclusions is the recognition that the development and implementation of such frameworks must be a collaborative and regionally harmonised effort. This approach ensures that the standards set are not only relevant to the specific needs of the EAC region but also consistent with global best practices.

The conclusion highlights the imperative for EAC countries with advanced solar frameworks to lead by example, offering a blueprint that others can emulate. It urges for a harmonised regional effort, where industry-driven qualifications, recognition of prior learning, and competency-based approaches are standardised. The integration of ICT and soft skills into vocational frameworks is emphasised, ensuring that education is responsive to evolving industry demands.

Cross-cutting themes—gender inclusivity, digital transformation, climate change adaptation—are viewed not just as ethical imperatives but as strategic enhancements to the region's solar energy sector. By embedding these themes into training and certification programs, the roadmap envisions a sector that is not only technically robust but also equitable and resilient to environmental changes.

The roadmap laid out not only addresses the immediate need for improved solar installation standards and consumer trust but also lays the groundwork for a sustainable and resilient solar energy sector. The roadmap also emphasises the importance of ongoing evaluation and adaptation, suggesting that the frameworks be flexible and responsive to emerging trends, technological advancements, and evolving market needs.

The conclusion calls on all stakeholders to adopt a collaborative and adaptive mindset, to share knowledge and to strive for continuous improvement. It's a call to action to leverage the unique strengths of the EAC, to transform challenges into opportunities, and to commit to a sustainable energy future that is accessible to all. This holistic approach ensures that the EAC's roadmap and the recommendations for solar energy development are not just a plan for energy advancement but a blueprint for regional growth, equity, and environmental stewardship.