meetMED

Mitigation Enabling Energy Transition in the MEDiterranean region

Together We Switch to Clean Energy

# QUALITY INFRASTRUCTURES FOR DEFINED EE AND RES EQUIPMENT AND SERVICES IN THE SEMCs

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The meetMED project is a two-year project funded by the EU and jointly carried out by the Mediterranean Association of the National Agencies for Energy Management (MEDENER) and by the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE). Its main goal is to reinforce regional cooperation aimed at fostering the energy transition in Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia under the umbrella of the UfM REEE platform.

The meetMED team in Brussels coordinates the project partners and experts in implementing the project activities, in the following areas of work: assessing EE and RES strategies and policies; advancing vocational training and public awareness; attracting sustainable RE and EE investments; supporting the UfM Renewable Energy and Energy Efficiency Platform.

The meetMED activities target and benefit a wide range of stakeholders, including policy makers, public authorities, investors and financial institutions as well as local communities and final customers. meetMED supports regional cooperation by building the technical capacity and raising the public awareness necessary to implement RE and EE projects and solutions, while creating synergies with other initiatives targeting energy transition in the Mediterranean region.

MEDENER is an international non-profit organization gathering agencies from the northern and southern Mediterranean countries in charge of implementing public policies on energy efficiency and the promotion of renewable energy sources, by implementing regional projects facilitating the sharing of know-how and best practices among its members and international partners, as well as accelerating the transfer of skills, methods and technologies in the field of energy efficiency and renewable energy.

RCREEE is an intergovernmental organization aiming at enabling the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE brings together regional governments and global organizations to initiate and lead clean energy policy dialogues, strategies, technologies and capacity development in order to increase Arab states' share of tomorrow's energy. Its key work areas are capacity development and learning, policies and regulations, research and statistics, and technical assistance.

# Credits

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# Acknowledgements

This report concerns a new important area that the meetMED project is approaching in the Mediterranean region, meaning upscaling the renewable energy and energy efficiency industries, through assessing the related quality control systems in place, and evaluating the existing quality infrastructure in eight Mediterranean countries.

A national quality infrastructure entails several conformity control entities, interacting consistently with each other for the sake of promoting the economic objectives of the government, including developing the local industry, boosting the competitiveness of the national enterprises in the global markets, removing trade barriers abroad and enhancing the efficient use of the natural resources, whilst preserving the environment and population's health and safety.

In this study, attention was paid to the applicable quality control tools and methods for renewable energy and energy efficiency products and services in the Southern and Eastern Mediterranean countries, as well as to the available national institutions managing those systems, such as Accreditation Councils, Metrology institutes, Standardization organizations, Certification and Inspection bodies along with the Testing and Calibration laboratories.

The report analyses the important role of product standardization and personnel certification as effective tools for the deployment of new clean energy practices at the regional and national levels. In order to do so, this report compiles the results of the questionnaires developed and conducted by the meetMED experts to the key national quality infrastructure representatives across the SEM region. Furthermore, it provides categorized recommendations that were generated during a scoping consultation workshop for the validation of the data collected in the questionnaires, which was held on 29 October 2019 in Algiers, and brilliantly organised thanks to Ms. Nadia Chioukh from APRUE, Mr. Ashraf Kraidy and Mr. Khalid Salmi from RCREEE.

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# Acronyms

| | |
|---|---|
| **AC** | Air Conditionner |
| **AFRAC** | African Accreditation Cooperation |
| **AFRIMETS** | Intra-Africa Metrology System |
| **AFSEC** | African Electrotechnical Standardisation Commission |
| **AIDMO** | Arab Industrial Development and Mining Organization |
| **ALGERAC** | Organisme Algérien d'Accréditation |
| **AMEE** | Moroccan Agency for Energy Efficiency |
| **ANM** | Agence Nationale de la Métrologie |
| **ANME** | National Agency for Energy Management |
| **APLAC** | Asia Pacific Laboratory Accreditation Cooperation |
| **APLMF** | Asia-Pacific Legal Metrology Forum |
| **APMPM** | Asia Pacific Metrology Programme |
| **APRUE** | Agence Nationale pour la Promotion et la Rationalisation de l'Utilisation de l'Energie |
| **ARAC** | Arab Accreditation Cooperation |
| **ARSO** | African Organisation for Standardisation |
| **ASHRAE** | American Society of Heating, Refrigerating and Air-Conditioning |
| **ASTM** | American Society for Testing and Materials |
| **BIPM** | International Bureau of Weights and Measures |
| **CDER** | Renewable Energy Development Center in Algeria |
| **CEN** | European Committee for Standardization |
| **CENELEC** | European Committee for Electrotechnical Standardization |
| **CENER** | The National Renewable Energy Centre of Spain |
| **CETIME** | Centre technique des industries mécaniques et électriques |
| **COOMET** | Euro-Asian Metrology Cooperation |
| **COPANT** | Pan American Standards Commission |
| **CRTEN** | Centre de Recherches et des Technologies de l'Energie |
| **CSERS** | The Centre for Solar Energy Research and Studies |
| **CTMCCV** | Centre technique des matériaux de construction, de la céramique et du verre |
| **EA** | European co-operation for Accreditation |
| **EE** | Energy Efficiency |
| **EGAC** | Egyptian Accreditation Council |
| **EOQ** | European Organization for Quality |

| | |
|---|---|
| **EOS** | Egyptian Organization For Standardization & Quality |
| **EURAMENT** | European Association of National Metrology Institutes |
| **IAAC** | Inter American Accreditation Cooperation |
| **IAF** | International Accreditation Forum |
| **IANOR** | L'Institut Algérien de Normalisation |
| **IEC** | International Electrotechnical Commission |
| **ILAC** | International Laboratory Accreditation Cooperation |
| **ILC** | Inter-laboratory comparison |
| **IMANOR** | Institut Marocain de Normalisation |
| **IMEKO** | International Measurement Confederation |
| **INNORPI** | Institut National de la Normalisation et de la Propriété Industrielle |
| **ISO** | International Organization for Standardization |
| **JAS-AU** | Jordanian Accreditation System - Accreditation Unit |
| **JSMO** | Jordan Standards and Metrology Organization |
| **LATEB** | Laboratory of thermal and energy for buildings |
| **LIBAC** | Lybia Accreditation Center |
| **LNCSM** | Libyan National Centre for Standardization & Metrology |
| **LPEE** | Laboratoire Public d'Essais et d'Etudes |
| **MEPS** | Minimum Energy Performance Standards |
| **MLA** | Multilateral Recognition Agreement |
| **MRA** | Mutual Recognition Arrangement |
| **MVA** | Manufacturing value added |
| **NERC** | National Energy Research Center |
| **NIS** | National Institute for Standards |
| **NREA** | New and Renewable Energy Authority |
| **OIML** | International Organization of Legal Metrology |
| **ONML** | Office National de Métrologie Légale |
| **PAC** | Pacific Accreditation Cooperation Incorporated |
| **PASC** | Pacific Area Standards Congress |
| **PSI** | Palestine Standards Institution |
| **PT** | Proficiency Test |
| **PTB** | Physikalisch-Technische Bundesanstalt (Germany's national metrology institute) |
| **PV** | Photo-voltaic |
| **QA** | Quality Assurance |
| **QI** | Quality Infrastructure |
| **QMS** | Quality Management System |
| **RCREEE** | Regional Center for Renewable Energy and Energy Efficiency |
| **RES** | Renewable Energy Systems |

| | |
|---|---|
| **RSS** | Royal Scientific Society |
| **SCOP** | Seasonal Coefficent Of Performance |
| **SEER** | Seasonal Energy Efficiency Ratio |
| **SEMAC** | Service Marocain d'Accréditation |
| **SEMCs** | Southern and Eastern Mediterranean Countries |
| **SIM** | Inter-American Metrology System |
| **SMIIC** | Standards and Metrology Institute for the Islamic Countries |
| **SWH** | Solar water Heaters |
| **TC** | Technical Committee |
| **TUNAC** | Conseil National d'accréditation en Tunisie |
| **TUNAC** | Tunisian Accreditation Council |
| **WELMEC** | European Legal Metrology |
| **WIPO** | World Intellectual Property Organization |
| **WMO** | World Meteorological Organization |

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# Glossary

**Accreditation:**
Certification of competence in a specified subject or areas of expertise, and of the integrity of an agency, firm, group, or person, awarded by a duly recognized and respected accrediting organization. Accreditation is the term applied to the third-party assessment of the conformity of conformity assessment bodies with the relevant standards.

**Audit:**
Systematic, independent, documented process for obtaining records, statements of fact or other relevant information, and objectively assessing them to determine the extent to which specified requirements are fulfilled.

**Arab Accreditation Cooperation (ARAC):**
ARAC is the association for the regional cooperation among accreditation bodies in the Arab region, whose mission is to coordinate and develop the accreditation infrastructures in the Arab region. Through the ARAC Multilateral Recognition Arrangements (MLA), ARAC facilitates the acceptance of the results of conformity assessment services in one country by Regulators and the marketplace in another country without further examination, for the benefit of the Arab community and the global economy.

**Arab Industrial Development and Mining Organization (AIDMO):**
Arab organization specialized in the fields of industry, mining and standardization, operating under the League of Arab States and working with a strategy development through a joint Arab economic action approved by the Arab Summit Conferences. AIDMO aims to achieve several objectives, which includes achieving Arab industrial coordination and integration, contributing to the development of industry in the Arab world and strengthening its capabilities in the fields of industry, energy, mining, specifications and standards to enhance the development of production and productivity. Also, AIDMO strives to develop unified standards for the Arab region to achieve quality and excellence of Arab products and facilitating their trade.

**Certification:**
Certification is the provision by an independent body of written assurance (a certificate) that the product, service or system in question meets specific requirements. Certification is also known as third party conformity assessment.

**Conformity Assessment:**
Different techniques that ensure a product, process, service, management system, person or organisation fulfils specified requirements of a standard. It can be performed in three different ways:

- First party (assessment by manufacturer/supplier them self)
- Second party (assessment of manufacturer/supplier by user or purchaser)
- Third party (assessment of manufacturer/supplier by someone independent).

**Conformity Assessment Bodies:**
Bodies performing conformity assessment services, that include certification bodies, inspection bodies and testing laboratories.

**Inspection:**
Examination of a product design, process or installation and determination of its conformity with specific requirements or, on the basis of professional judgement, with general requirements. Inspection of a process may include inspection of persons, facilities, technology and methodology.

**Inter-laboratory Comparison test:**
the organization, performance, and evaluation of measurements or tests on the same or similar items by two or more laboratories or inspection bodies in accordance with predetermined conditions.

**International Accreditation Forum (IAF):**
The IAF is the world association of Conformity Assessment Accreditation Bodies and other bodies interested in conformity assessment in the fields of management systems, products, services, personnel and other similar programmes of conformity assessment.

**International Electro Technical Commission (IEC):**
It is the international standards and conformity assessment body for all fields of electro technology, that publishes international standards for electrical, electronic and related technologies.

**International Laboratory Accreditation Cooperation (ILAC):**
ILAC is the international organisation for accreditation bodies involved in the accreditation of conformity assessment bodies including calibration laboratories, testing laboratories, medical testing laboratories, inspection bodies and proficiency testing providers.

**International Organization of Legal Metrology (OIML):**
An intergovernmental organization that was created in 1955 to promote the global harmonization of the legal metrology procedures that underpin and facilitate international trade.

**International Organization for Standardization (ISO):**
ISO is an international standard-setting body composed of representatives from various national standards organizations. The organization promotes worldwide proprietary, industrial, and commercial standards.

**Manufacturing value added (MVA):**
Manufacturing value added of an economy is the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate inputs.

**Metrology:**
Science of weights and measures, determination of conformance to specification or technical requirements, and development of standards. Not to be confused with Meteorology, the science of weather phenomenon.

**Quality:**
The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs: In manufacturing, a measure of excellence or a state of being free from defects, deficiencies and significant variations. It is brought about by strict and consistent commitment to certain standards that achieve uniformity of a product in order to satisfy specific customer or user requirements.

**Quality Audit:**
Periodic, independent, and documented examination and verification of activities, records, processes, and other elements of a quality system to determine their conformity with the requirements of a quality standard.

**Quality Assurance:**
All activities ensuring that a product or service will meet the expectations from consumers, investors and other stakeholders. Quality assurance (QA) builds up on standards intended to ensure that products and services perform as expected, as well as on the mechanisms to verify that such requirements are fulfilled, such as testing, certification and inspection.

**Quality control:**
An aspect of the quality assurance process that consists of activities employed in detection and measurement of the variability in the characteristics of output attributable to the production system and includes corrective responses.

**Quality Infrastructure:**
National institutional infrastructure needed to implement quality assurance mechanisms. It encompasses different elements closely interrelated, including accreditation, certification, standards, testing, inspection, metrology, and quality management systems.

**Quality Management System:**
A quality management system (QMS) is a set of policies, processes and procedures required for planning and execution (production/development/service) in the core business area of an organization (i.e., areas that can impact the organization's ability to meet customer requirements).

**Proficiency Test:**
The evaluation of a participant's performance against pre-established criteria by means of inter-laboratory comparisons. In other words, a proficiency test is a method used to demonstrate competency and validate a laboratory's measurement process by comparing your results to the results of a reference laboratory and other participant laboratories.

**Standard:**
Document, established by consensus and approved by a recognized body, that provides – for common and repeated use – rules, guidelines or characteristics for activities of their results, aimed at the achievement of the optimum degree of order in a given context.

**Standards Development Organisation (SDO):**
Any organization developing, coordinating or issuing mandatory or voluntary technical standards.

**Standardization:**
Formulation, publication, and implementation of guidelines, rules, and specifications for common and repeated use, aimed at achieving optimum degree of order or uniformity in a given context, discipline, or field.

**Surveillance:**
Systematic iteration of conformity assessment activities as a basis for maintaining the validity of the conformity statement.

**Testing:**
Testing is the determination of one or more of an object or product's characteristics and is usually performed by a laboratory.

# Executive Summary

During the last decade, renewable energy solutions and energy efficiency technologies became progressively used in different areas of activity across all economic sectors. Nonetheless, the utilization rate of the green energy solutions did not evolve as expected, due to the fact that the local industry of RE and EE systems and components in the Southern and Eastern Mediterranean countries is still facing unfavourable manufacturing conditions, thus depriving its capacity to satisfy the local rising demand, and to compete in the regional market drowned by low quality imported products.

In addition, the negative consumers' expectations in some cases (either by the poor quality of RE and EE products or by the inferior quality of execution) contributed to the stagnation of the market. From this perspective, the meetMED project through this study intends to assess the level of the quality assurance for some defined RE and EE goods and services across the Southern and Eastern Mediterranean countries, in order to screen out all relevant quality infrastructure entities in that region, appraise the applicable tools and methods used to assure the quality of the above mentioned products, and propose a course of action needed to upgrade the level of the subject quality infrastructure toward harmonizing a regional quality market in the Southern and Eastern Mediterranean region.

The first part of this report provides an overview of the energy-economy nexus in the Middle East and the North Africa, with detailed highlights on the industrial trends in oil exporting countries compared to the energy importing ones. Focusing on the region's energy plans and targets, a special analysis of the interaction between clean tech industries and the manufacturing sector shows that the rate of RE and EE industrial integration in local markets is still facing problems to support the energy plans implementation, especially for wind and solar.

The same section discusses the importance of the quality infrastructure systems at the national level for each country toward upscaling RE and EE market, exposing the key elements of that system in different areas of expertise (namely accreditation councils, metrology institutes, standardization organizations,

certifications and inspection bodies, and testing and calibration laboratories) and their interaction with the international recognized structure in the quality assurance field. Also, the advantages of establishing such national quality infrastructure systems are presented for all the intervening stakeholders in industrial value chain, such as: Policy makers, Manufacturers, Practitioners and End consumers... across five market incorporation stages in each country.

The second part of this report evaluates the countries' situational quality infrastructure related to renewables and energy efficiency. Eight countries are profiled in terms of institutional capacities and RE-EE quality management mechanisms applied: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia. The profiles give a clear snapshot of the main quality institutions in each country, by focusing on the operational methods for assuring the quality of local manufactured or imported products. This approach is further extended to analyse other important factors of the national quality infrastructure system, namely the national ability to develop RE and EE standards, the adoption of international related standards, the management of the national conformity assessment schemes (when applicable), the accreditation level of local conformity assessment entities, and finally the testing capabilities for each product or service.

The preliminary analysis of the country profiles stipulates that the overall quality infrastructure in all targeted countries has considerable similarities in terms of institutional capacities, since they have the whole QI organizational diagram in place, except for Lebanon, Palestine and Libya in terms of Metrology and testing capacities. Regarding the evaluation factors, and their distributed results at the defined quality infrastructure market stages, the outcomes shows that Egypt leads the region with very good quality control capabilities for different products, such as solar PV components, solar thermal system and different household appliances.

Jordan and Tunisia have the most upgraded conformity assessment bodies, essentially the testing capabilities for the highly energy used appliances and renewable systems, followed by Algeria and Morocco, who actively contribute to the development of RE and EE standards at the national, regional and international level. Lebanon has a promising status despite the absence of a national recognized entity responsible for accreditation activities. Finally, despite the unstable situation in Libya and Palestine, significant efforts are needed to set a clear framework for quality control and certification manage-

ment systems for related RE and EE products and services in favour of the local economy.

The above-mentioned analysis was based concretely on the information and ideas collected through the questionnaires developed and circulated to all national quality infrastructure entities in the eight targeted countries. Main feedbacks accumulated stress on the necessity of supporting the national governments to establish, update and upgrade the level of their national quality infrastructure dedicated to RE and EE goods and services, within a clear and solid framework, and according to international standards associated with harmonized procedures. Furthermore, the identified needs are entirely centred around prioritizing RE and EE products by establishing relevant harmonized quality assurance schemes for the highly used ones, raising the end consumers' awareness about the certification and labelling programs, and designing training packages focused on the RE and EE quality services, in order to foster the bilateral and multilateral cooperation between the subject countries.

The last part highlights lessons learnt and success stories being implemented at the regional or country level for upgrading the level of quality infrastructure, either by reinforcing the institutions, like the PTB program for strengthening the solar quality infrastructure in the Maghreb Countries; or by improving manufacturing, like the SHAMCI program for standardizing and certifying the quality level of solar thermal collectors and systems in the Arab region; or by empowering the workforces in the energy sector, like the PA-CEMP program for qualifying and certifying energy management professionals in the Arab countries.

A serious support is needed to follow up the suggestions and outcomes of this work, in order to continue developing this untapped subject and proceed with upscaling the local clean tech industry, on the one hand, and boosting the deployment of sustainable energy practices across the Mediterranean region, on the other hand.

# Context and Objective

This report aims at identifying and assessing the existing quality infrastructures for defined EE and RES equipment and services in SEMCs. As part of the meetMED activities aimed at reinforcing public awareness and capacity building of local stakeholders on EE and RES, this study will help pave the way for a regional quality market.

Quality for RES and EE products and services has become increasingly important as RES and EE applications (e.g. building insulation materials, energy efficient windows, solar water heaters, energy-efficient appliances...) are being largely used in the Mediterranean region. To ensure minimum quality requirements, needed quality infrastructures should be available for the successful implementation of specific RES and EE schemes or programs. These quality infrastructures include laboratories, testing facilities, as well as inspection, certification or accreditation bodies.

**Figure 1:** Solar Thermal Testing Laboratory in Egypt

The level of quality control infrastructures in the SEMCs was assessed with the aim of elaborating a set of recommendations to further develop the regulatory framework, thus enabling the SEMCs to cover country-specific RES and EE sectors. This covers two main components - products and services - in specific sectors to make consumers gain confidence on the goods or services available in the market and to make informed choices when choosing energy products and installers.

Rather than evaluating the level of the existing quality infrastructure in the targeted Southern and Eastern Mediterranean countries, the objective of this assessment study is to identify the weaknesses and strengths of the institutions working on the conformity assessment fields, and analyse their needs in terms of laboratories, testing equipment, and relevant expertise to perform the required tests according to the international standards and guidelines adopted at the national level. Thus, the final analysis and benchmark of the previous specifications, is to generate recommendations and thoughts on the operational development of functional and effective RES and EE regional quality markets.

# Methodology and Work Plan

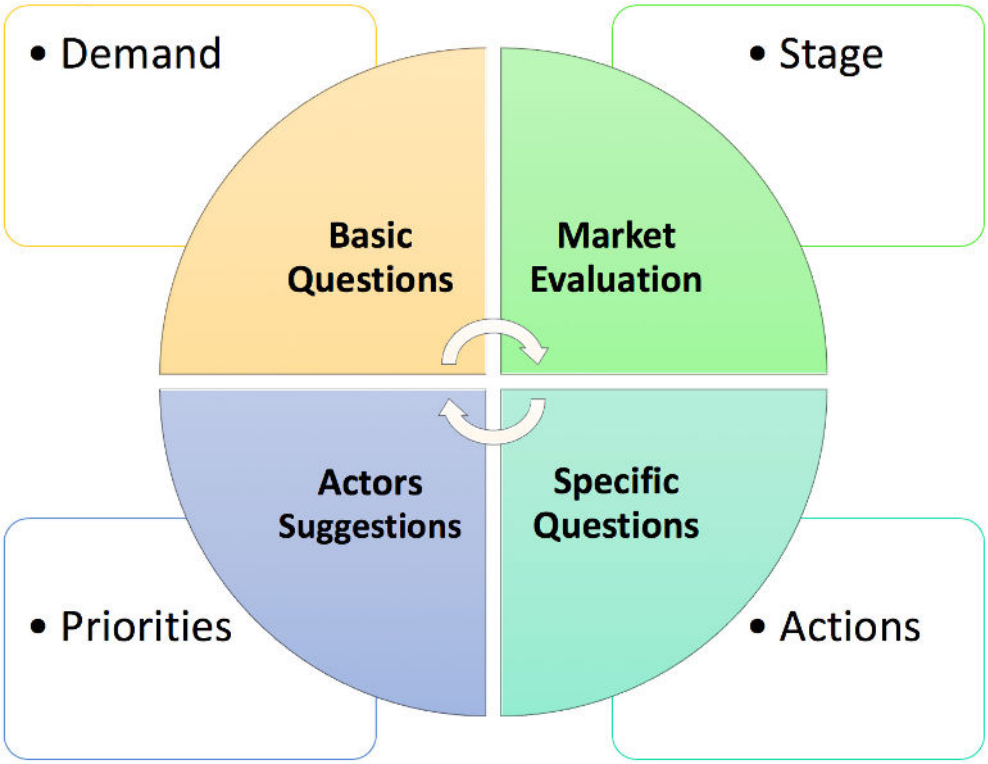
First, the implementation of this activity entails the screening of the quality assessment bodies already existing in the eight target countries (Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia), and the identification of all operational good practices either nationally or regionally. This first step was necessary to build a regional database of all standardization, accreditation, metrology, certification, testing and inspection bodies in place, and to select the main actors for the direct consultations.

Subsequently, a detailed questionnaire by sector of activity was developed. This contains basic questions for describing the current situation of the quality market in the region, evaluating the market maturity stage, and highlighting the operational good practices in each country.

The main institutions and bodies involved are laboratories, testing facilities, conformity (inspection and certification) assessment bodies, metrology institutes, standardization organizations and accreditation councils. When necessary or appropriate, specific interviews with representatives from quality infrastructure institutions, national energy authorities and energy-related areas were conducted to endorse quality markets and schemes (e.g. building components, solar collectors and solar panels; manufacturers, suppliers and installers; energy certification of buildings, labelling of products and accreditation of professionals) in the eight targeted Mediterranean countries.

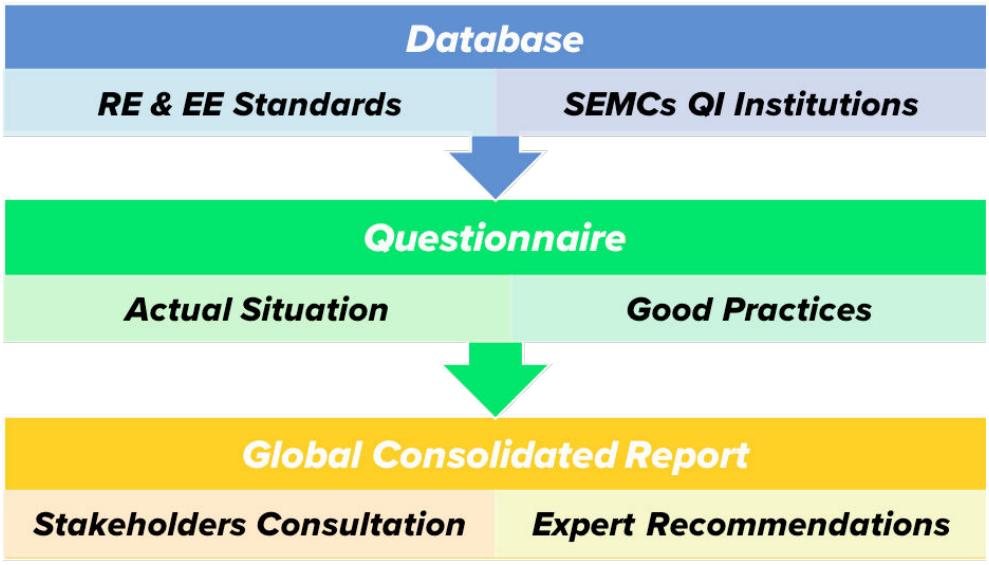
Finally, a set of recommendations at the country level is provided based on the information on the regulatory, legal and institutional framework, existing quality infrastructures and good practices gathered in the questionnaires and through consultation interviews.

**Figure 2:** Consultations Methodology




All recommended actions and activities focused on the sustainability of the measures needed at the country level, as well as on the development of functional and effective RE and EE quality markets for the whole region. In light of the recommendations generated through questionnaires and consultations, a global consolidated report on aligning the quality infrastructure level, harmonizing practices, and then developing a regional quality market, is drafted based on the analysis of obstacles, needs, opportunities, weaknesses, strengths for each quality component at different levels.

**Figure 3:** Activity Work Plan



# 1. Regional Overview

## 1.1. Southern and Eastern Mediterranean region at a glance

**Figure 4:** Southern and Eastern Mediterranean Countries Map

The Southern and Eastern Mediterranean region consist of eight countries located on the Southern shores of the Mediterranean Sea, which are: Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia. With respect to energy supply and considering the huge non hydro-energy potential in this region, all countries heavily rely on fossil fuels for different consumption sectors.

Those countries could be grouped in three different categories depending on their nature of energy dependency: energy exporters (Algeria and Libya), which have significant oil/gas resources and considerable price fluctuations; partial importers (Egypt and Tunisia); and the net energy importers, which have a high rate of energy imports dependency (Morocco, Jordan and Palestine).

In terms of renewable resources, the Southern and Eastern Mediterranean (SEM) region is favourably positioned to promote clean energies, with one of the highest solar radiation rates worldwide, with an the average global hori-

zontal irradiation(1) of around 2100 kWh/m$^2$ per year, In addition to the wind optimum speeds across the coasts, ocean resources and abundant space for large renewable projects.

New energy trends in the region show that renewables are constituting only 6% of the total installed power generation capacity. Currently, several countries in the region are seriously among the global frontrunners in sustainable energy deployment, also due to the important investments deployed in the last years in renewables across the Arab region.

Moreover, since government commitments to renewable energy increase and considerable financing sources with innovative mechanisms appear, the SEM region is becoming one of the most important clean-tech markets in the world, with a considerable penetration volume of renewable energy and energy efficiency technologies (solar thermal products, photovoltaic panels, wind turbines, waste to management equipment's, energy insulation material for green buildings and even carbon capture and storage systems) into different supply and demand economic sectors.

## 1.2. RES-EE industry perspectives in SEM Region

In terms of sustainable energy industry, optimism spread regarding the potential for clean technologies manufacturing in the MENA Region, especially with the high targets announced by the local governments in the region for sustainable energy generation as a part of their energy mix. However, these optimistic targets were not operationally linked to very clear plans for integrating these technologies in the industries on the ground. In fact, they did not reflect the expected local manufacturing stream based on the national commitments, and did not allow to produce locally durable and reliable RE-EE products at reasonable costs.

With respect to the wind energy industry, one of the very positive initiative highlighted across the region, is the first blade plant of wind turbine manufacturing in Africa and the Middle East, inaugurated by Siemens Gamesa group in Tangier, Morocco. The factory, ideally positioned between Europe and Africa, is providing the company with direct access to some of the most important

(1) Total amount of shortwave radiation received from on a horizontal surface

markets, allowing the production of blades up to 75 meters' length "made in Morocco" out of composite materials.

**Figure 5:** Inauguration of the first blade plant SIEMENS-GAMESA in Morocco(2)

In spite of the socio economic impacts generated by such opportunity, and its contribution to Morocco's national program to achieve production of electricity from clean energy, the industrial inclusion of local manufactured rotors and other wind components plays an important role in achieving considerable economies of scale for Morocco, through delivering key wind energy projects forming the 850 MW integrated Moroccan wind program, and the possible exports opportunities that will be created to other countries in Africa and Middle East countries, like Algeria, Egypt, Mauritania and Tunisia.

Solar power industry is also witnessing a significant momentum, making this technology more robust and commercially attractive for the industrial investors. Confidence in solar energy is increasing due to the announcements of coming programs under energy strategies in the region, as a result of its competitive pricing and interest rates, and generous solar resources. Several solar thermal industrial structures were identified in Jordan, Egypt, and Tunisia, where the local manufacturers take the advantage of important market share rates, as well as of some limited export opportunities to neighbouring SEM countries, and to Europe, like the Tunisian Solar Thermal factories.

Rather than wind and solar energy industries, green building materials and energy efficient household equipment are becoming increasingly important, because of their favourable return on investment and the high levels of energy consumption in different SEMCs.

(2) Picture Source: https://leseco.ma/siemens-gamesa-exporte-sa-1re-pale-eolienne-made-in-morocco

# 2. Up-Scaling RE and EE Markets

## 2.1. Background

According to the analysis of Solar water heaters policy indicators, conducted by the Regional Center for Renewable Energy and Energy Efficiency in 2011 across the Arab region, the following results were obtained:

**Figure 6:** Policy Indicators - Standardization & Certification in RCREEE Member States

| Policy Indicators | Egypt | Jordan | Lebanon | Palestinian Territories | Syria | Algeria | Libya | Yemen | Morocco | Tunisia |
|---|---|---|---|---|---|---|---|---|---|---|
| Standardization | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | ✓ | ✓ |
| Testing | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ | × | ✓ | ✓ |
| Certification | × | × | ✓ | × | × | × | × | × | × | ✓ |
| Quality control (regulations and rules) | × | × | ✓ | × | × | × | × | × | ✓ | ✓ |
| R&D Programs/Fund | × | × | × | × | × | × | × | × | × | × |
| Policies and Regulation | × | ✓ | × | × | × | ✓ | × | × | ✓ | ✓ |
| Governmental Initiatives | ✓ | ✓ | ✓ | × | ✓ | × | × | × | ✓ | ✓ |
| Trade Movements & Export Regulations | × | ✓ | × | × | × | × | × | × | × | ✓ |
| Taxes | × | × | × | × | × | × | × | × | × | ✓ |
| Law enforcement (to install SWH) | × | × | × | × | × | × | × | × | × | ✓ |

✓ = existing/non-problematic  × = missing/problematic

Most of the countries in the analysis have the necessary standardization and testing parameters for solar thermal products and services. However, there was an overall down trend on quality control (e.g. certification and quality regulations) and lack of existing infrastructure to enforce RES-EE quality assurance schemes.

**Selected countries snapshot**:

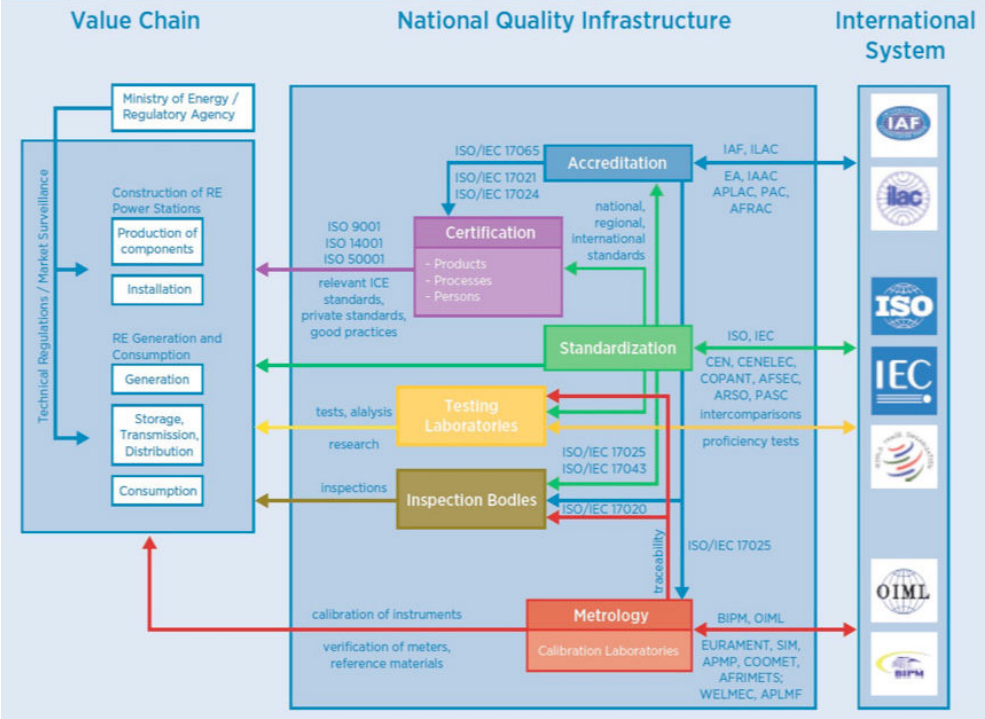
- **Lebanon**: Lebanon has witnessed a huge SWH market growth in the last seven years. Successful financing schemes and regular market monitoring are two strength points in the SWH Lebanese experience. Current challenges are SWH installation mandates, increasing market penetration, providing tax exemptions for SWH systems and quality assurance mechanism at the national level.
- **Jordan:** Since 2012, Jordan has been progressively advancing in its SWH support framework, with initial targets to increase market penetration to 25% by 2020. However, no quality certification schemes were in place. Also, providing more financial support was another challenge.
- **Egypt:** Fuel subsidies present a challenge for SWH, affecting solar water heaters market competitiveness in Egypt. Certification and quality control were major challenges hindering SWH markets. Another challenge is providing policies and regulations in favor of SWH.

One of the major recommendations generated through the above mentioned study is to ensure sustainable growth and the successful application of RE systems and EE technologies; serious care should be taken in the quality of the products and services delivered to the customers at all the appropriate levels (micro, small, medium or large; national, regional or local) of the value chain.

## 2.2. RES-EE Quality Infrastructure system

Assuring the quality of RES and EE products and services consists of applying standards, which are intended to ensure that products and services perform as expected, as well as the mechanisms to verify that such requirements are fulfilled, e.g. testing and certification. These processes ensure that a product or service will meet the expectations from consumers, investors and other stakeholders. Establishment of quality assurance framework requires a concrete, stable and strong quality infrastructure, meaning that the quality infrastructure is an essential component that needs to be established to provide operational quality assurance mechanisms to the RES-EE market.

**Figure 7:** Quality Infrastructure Elements – Source [3]




The national quality infrastructure system represents the total institutional network at the country level, as follows:

1. Relevant regulatory agencies and bodies mandated to regulate, formulate, edit and implement technical regulations as standards. These structures are also responsible for adopting and adapting the international standards to their specific national context, further to the national market surveillance.

2. Conformity assessment institutions mandated to provide evidence of the standards fulfilment by measurements and procedures (calibration, tests, audits, inspection and certification) in accordance with the ministries and regulatory agencies regulations.

(3) Diagram Source: Quality Infrastructure for Renewable Energy Technologies - Guidelines for Policy Makers (2015)

## 2.3. Key Elements of the National Quality Infrastructure System

With many public and private stakeholders, the general QI network is very complex and dynamic. Establishing clear rules for the interaction among the different elements, as well as ensuring the technical competence of the institutions are the most important aspects to make the RES-EE market transparent and reliable:

**Figure 8** : Key Pillars of National Quality Infrastructure System

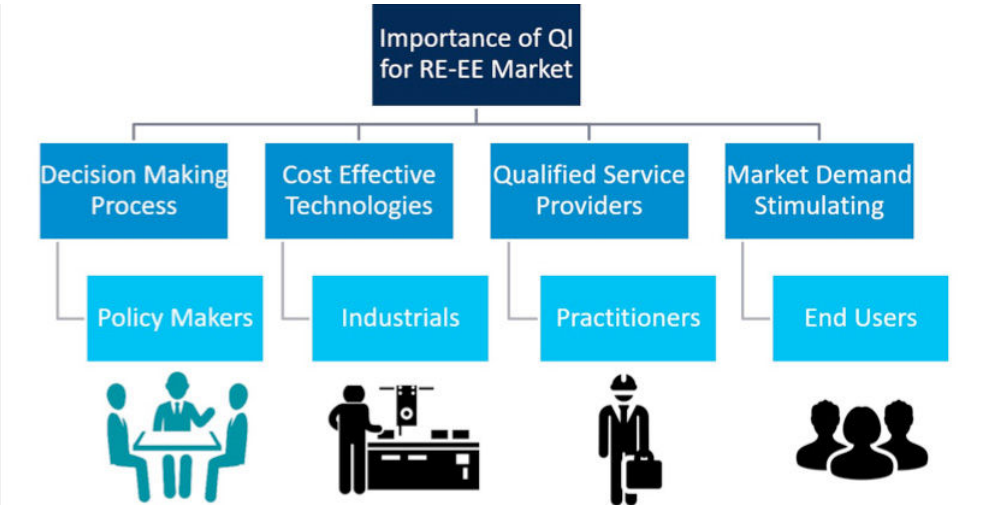
| Structure | Role |
|---|---|
| National Accreditation Body **(NSB)** | An independent authoritative body securing the impartiality of its decisions. It gives formal recognition that a body or person is competent to carry out specific tasks. It needs cooperation with NMIs and NSBs. The NMIs make their technical experts available for the accreditation process and provide traceability, which is crucial for laboratory accreditation but challenging to achieve. (***Accreditation is voluntary***) |
| National Metrology Institute **(NMI)** | Normally a governmental institution that realizes and disseminates the units and assures quality of measurements through traceability to the International System of Measurement Units. Also, it gives the traceability to the laboratories of Legal Metrology, industry, research institutions, and others. (***Calibration is voluntary. Verification is mandatory***). |
| National Standardization Body **(NSB)** | A private, public or mixed institution, which is sustained by the development and the dissemination of standards and related services. Technical Committees unite the interested parties to develop standards. The standards developed by the NSB have a voluntary character. (***They may constitute an element for mandatory technical regulations***) |
| Certification Body **(CB)** | A conformity assessment body, performing the formal verification that a product, service and management system of an organization, or the competence of a person, corresponds to the requirements of a standard. The CB's demand recognition of their technical competence by an internationally recognized accreditation body: Certification bodies for **QMS** according to **ISO/IEC 17021** Certification bodies for **products** according to **ISO/IEC 17065** Certification bodies for **persons** according to **ISO/IEC 17024** |

| Structure | Role |
|---|---|
| Inspection Body **(IB)** | Private organizations or government authorities that conduct examination of the design of products, services, procedures or installations and evaluate their conformity or non-conformity with requirements, which exist in the form of laws, technical regulations, standards and specifications. An accreditation body should accredit **inspections** according to **ISO/ IEC 17020.** |
| Testing Laboratory **(TL)** | Facilities that determines the characteristics of a product in comparison with the requirements of a standard. The tests can vary from a simple visual evaluation or a non-destructive evaluation (after which the products can be used) to a totally destructive analysis (after which the products cannot be used) or any combination of both. An internationally recognized NAB should accredit the quality management of **testing laboratories** in accordance with **ISO/IEC 17025**. |

The key pillars of a national QI are the National Standards Body (NSB), the National Metrology Institute (NMI) and the National Accreditation Body (NAB), Testing Laboratories (TL), Inspection Bodies (IB) and Certification Bodies (CB). The interrelation of the previous element is essential to give confidence for the users or the authorities that the product, the process or the service is conform to the expected performance specifications.

## 2.4. Advantages of Quality Infrastructure for RE-EE products and services

**Figure 9:** Impact of Quality Infrastructure on RE-EE Markets



### a. Advantages of QI for Policy Makers:

- **Supporting the development of emerging markets:** QI helps to screen out poor products, to protect fragile and growing markets, enabling larger markets and upscale technology impacts.
- **Enabling technology promotion:** QI provides assurance that desired performance will be achieved, (e.g. it gives performance ratings to be directly adopted for calculated performance-based incentives).
- **Stimulating new businesses:** Growing markets, secured by appropriate QI, attract capital to feed new business ventures, creating jobs and achieving economy of scale.

### b. Advantages of QI for Suppliers:

- **Reducing trade barriers and expanding markets:** QI creates expanded markets by reducing costs of international trade through harmonization and reciprocity based on mutually accepted QI.
- **Improving product Design:** Testing and certifying of products help to refine specific design elements, leading to a more robust commercial product.
- **Improving manufacturing and industrial process:** When a (QMS) is developed, the product quality is improved, and manufacturing volume can be increased without sacrificing quality.

### c. Advantages of QI for Practitioners:

- **Improving hiring and competitiveness of installation firms:** Strong QI enhances end-user confidence that the product will work as advertised, produce as expected and save money.
- **Improving incomes and mobility:** Certified practitioners are hired first, are afforded higher wages and are more mobile than non-certified practitioners.

### d. Advantages of QI for End Users:

- **Building confidence in Product:** Strong QI enhances end-user confidence that the product will work as advertised, produce as expected and save money.
- **Enabling sound product comparisons:** QI provides objective information on product performance and durability, which is needed for a reliable product comparison.

- **Increasing financial resources:** Strong QI offers financial organizations assurance that products are high-quality and that product loans will be paid, resulting in more available loans.

## 2.5. Quality Infrastructure incorporation to RE-EE Market

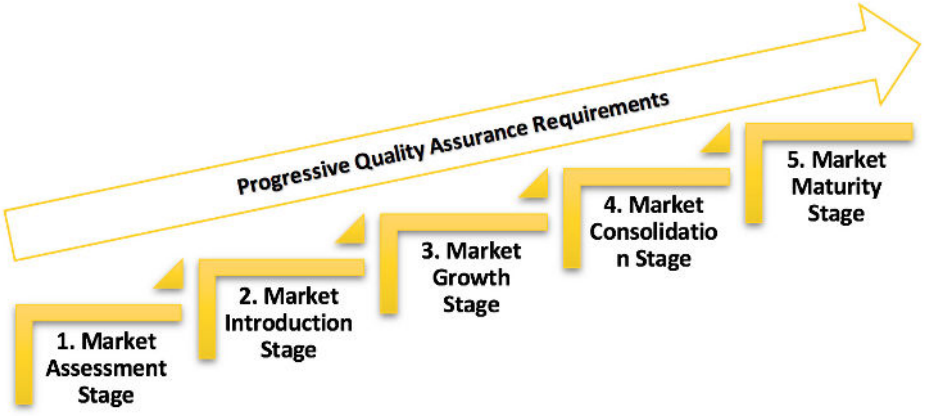
For the sake of advancing the industry of RES and EE technical equipment, policy supporting mechanisms are very crucial to boost the effective deployment of cleantech practices. Integrating quality assurance requirements and establishing a national quality infrastructure are handy in order to facilitate the screenng out of the poor quality products and systems.

Yet, several challenges could restrain the implementation and development of country level quality assurance systems, such as:

- **Increasing costs** related to the government investment in laboratories, training activities
- **Early technology failures** due to the quality of equipment and installation services
- **Lack of RE and EE systems knowledge** which restrains developing relevant programs and strategies
- **Lack of existing infrastructure to enforce QA:** market may fail due to the non-industrial compliance
- **Inferior imports:** lowest-cost and poor-quality imports poisoning an emerging market
- **Improperly designed subsidies,** which are less effective when destined to high technical risk products

Actually, the main issue is to recognize which quality infrastructure elements are essential when the energy market is still evolving, and where the cleantech industry is at a starting stage. Based on the circumstances of each country, and depending on its market devlopment stage, the incorporation of quality infrastructure elements should be performed increasingly and appropriately in accordance with what is already existing at national level.

**Figure 10:** QI Incorporation for each market Stage




Implementing an entire quality assurance system may be extremely difficult and complex at some market stages.However, some basic activities are typically needed at all levels, like conducting a regular market survey mainly before and after applying any incentives or change. To summarize, below are the recommended actions that should be performed at country level according to the market progress situation:

1. **Market Assessment Stage** (market of any significance does not exist yet):
   - Establish a local industry-based association as a key partner to government and other stakeholders for guiding QI/QA evolution and facilitating industry acceptance of QA requirements.
   - Develop initial quality infrastructure and market support plans (incentives, tax exemptions ...).

2. **Market Introduction Stage** (market is very small and beginning to grow):
   - Screen imports based on international standards by inspecting/reviewing certification documents.
   - Develop practitioner training activities in accordance to their roles (installation, maintenance ...)
   - Develop a standards committee responsible for development of increasingly broad and rigorous national standards following or adopting the international ones, which is basis to develop national QI.
   - Research international and regional quality infrastructure to support the ongoing in-country planning, through partnerships with other countries and organization.

3. **Market Growth Stage** (market is a combination of imports and locally produced products):

   - Train certified practitioners to correctly install, operate and maintain the systems is essential at this stage, in order to have certified available practitioners in the market.
   - Develop dedicated unaccredited test laboratories that could perform the corresponding testing requirements of the international standards.
   - Develop equipment testing and certification standards based on international standards, along with setting up guidelines for system compliance reviewers, and conformity assessors.

4. **Market Consolidation Stage** (market is large enough, expanded QI is needed to reach maturity):

   - Establish the whole organization structure used for testing and certifying products. At this stage, the laboratory and the certification body must be separate to avoid conflicts of interest, and both should prepare for accreditation.
   - Implement published web-accessible ratings database, as this eliminates false advertising claims by suppliers, and enhance consumer confidence in the products in question.
   - Participate in regional and international standards-making committees to help advance the national quality infrastructure and influence the incorporation of national-specific aspects into international standards.

5. **Market Maturity Stage** (market is mature with higher volume and ready for international trade):

   - Require accreditation for test laboratories, certification bodies, training institutes, and inspection bodies. One challenge in a mature market is the time required to achieve accreditation, which could take up to two years for a test laboratory or certification body.
   - Engage in and maintain international quality infrastructure and implement of globally accepted standards and certification requirements.

# 3. Country Profiles

## Structure of the Questionnaires Results Analysis

In order to build a concrete analysis for the situation of quality infrastructure related to RE and EE technologies products and services in a given country, a detailed questionnaire was developed and circulated to all conformity assessment bodies among the targeted SEM countries. Specific information was generated based on the answers provided by national actors, and the results were analysed to draw a broad snapshot on the real and actual status of all relevant quality infrastructure components in the subject countries.

Beside the questionnaires, a regional consultation workshop was organized to verify and update the collected results. Relevant regional and international actors and experts were involved to discuss the obstacles, needs, opportunities, weaknesses and strengths for each quality component in Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia. The stakeholders' and experts' opinions were formulated as recommendations on the evident opportunities to develop a regional RE and EE quality infrastructure market.

The comprehensive analysis performed was oriented to give a general overview about the market structure on the eight countries. With the desire to develop a standardized evaluation of the institutional capacities, conformity assessment methods, operational activities and effective tools of support, the country profiles were specifically structured along the following axes:



Figure 11: Map of Algeria

- Sustainable energy market economics, and supportive regulatory policies
- RE-EE International standardization involvement, with special focus on the participation in the standard development committees, and the adoption of international standard.
- Management of the national certification systems between the concerned institutions under the operational existing conformity assessment process.
- Technical capabilities of the testing laboratories.
- Accreditation approach and steps, and the interrelation with the national accreditation councils.

# 3.1. Algeria

## 3.1.1. Algeria at a glance

**Figure 11:** Map of Algeria

**Figure 12:** Overview of the Industry Sector in Algeria

| | |
|---|---|
| **Area** | 2,381,741 km² |
| **Population (2018 est)** | 42.0 million |
| **Geographical group** | North Africa |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** ***at constant 2010 prices in US$*** | 203.8 billion |
| **MVA (2018)** ***at constant 2010 prices in US$*** | 8.7 billion |
| **MVA per capita (2018)** ***at constant 2010 prices in US$*** | 208 |
| **Share of MVA in GDP (2018)** | 4% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Coke, refined petroleum products, nuclear fuel (80%)<br>2. Food and beverages (10%)<br>3. Non-metallic mineral products (3%) |
| **Share of manufactured exports (2016)** | 30% |
| **Competitive Industrial Performance** | 95 (of 150 ranked) |

Algeria is located in North Africa, on the Southern shore of the Mediterranean Sea. In terms of area, Algeria is the biggest country in the Maghreb and MENA region. Algeria is a member of OPEC and an important hydrocarbon producer in the region as well as exporter of natural gas to Europe, its local economy is heavily dependent on its fossil fuel sector. Regarding renewable energy and energy efficiency, Algeria is considered as one of the middle-advanced countries. In 2015, the country updated its RE and EE Development Plan to 2030 and put greater focus on the deployment of large-scale renewables, including solar Photovoltaic and onshore wind installations, through various incentive measures.

## 3.1.2. QI Market Structure in Algeria

### a. National Standardization Body

***Institut Algérien de Normalisation* (IANOR):**
The Algerian institute of Normalization Standardization (IANOR) was set up as industrial and commercial public undertaking (EPIC) in Algeria by Executive Decree N 98-69 of 21 February 1998, modified and completed by the Executive Decree N 11-20 of 25 January 2011.

IANOR tasks include in particular:

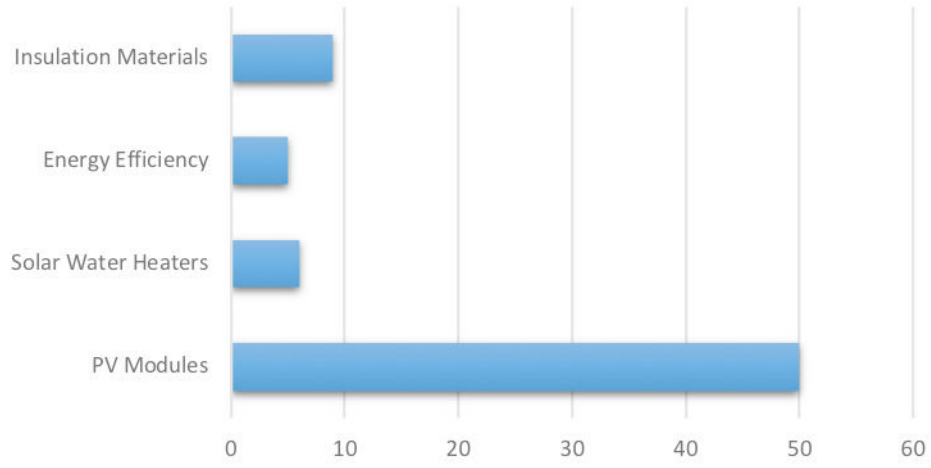
- ✓ to ensure the development of national standards in coordination with the other sectors;
- ✓ to identify national standardization needs;
- ✓ to ensure the implementation of the national standardization plan;
- ✓ to ensure the dissemination of information on standardization and related activities;
- ✓ to manage the national information point on technical barriers to trade of the World Trade Organization (WTO);
- ✓ to manage the mark of conformity to Algerian standards.

Furthermore, IANOR possesses different technical committees at national level, mandated for standardization in several sectors related to RE and EE, as follows:

- **Photovoltaic Energy** under the national technical committee (CTN N° 12) for electronic components;
- **Solar Thermal Energy** under the national technical committee (CTN N° 60) for energies;
- **Energy Efficiency** under the national technical committee (CTN N° 69) for mastering energy efficiency;
- **Home Appliances** under the national technical committee (CTN N° 14) for safety and household electrical equipment;
- **Insulation Materials** under the national technical committee (CTN N° 39) for building construction;

Concerning the standards, national technical committees of IANOR have adopted international relevant standards for RE-EE products/services from the international and / or regional standards of the organizations, in which IANOR is member (ISO, IEC, ARSO, AIDMO, SMIIC). Adopted standards are categorized as follows:

**Figure 13:** RE-EE Adopted Standards by IANOR




### b. National Certification Body

IANOR is also mandated by law to act as national certifying entity. IANOR provides economic operators with a diversified offer of certification programmes covering products (TEDJ mark) and services (label Acceuil) as well as Halal certification of food products. TEDJ is a mark of conformity to Algerian standards. It is voluntary based quality mark, which attests that the product has been evaluated and certified as conforming to the relevant Algerian standards.

TEDJ Mark covers several products such as: cement, plaster, plasterboard, tubes ...

This certification applies to any organisation (private company or public institution, in the industrial or service sector) whatever its type, size and product, for a given activity carried out on one or more sites. Yet, TEDJ certification is based on the respect of the required standard(s), noted during an audit, which gives rise to an audit report. This compliance must be ensured during the entire period of validity of the certificate.

IANOR product certification procedure goes as follows:

- Request evaluation and assessment,
- Sampling and testing,
- Audit of the factory and verification of the factory production control/ quality management system,
- Conformity assessment of results,
- Decision to grant the Algerian standards conformity mark,
- Periodic monitoring.

As for RE and EE sectors, IANOR has not developed any certification system yet. However, a certification scheme for solar collectors and solar water heaters is being developed within the framework of the PTB regional cooperation project on the reinforcement of the Quality Infrastructure for Solar Energy in the Maghreb. IANOR is also benefiting from technical assistance under the European Union support programme for RE-EE sectors in Algeria entitled “certification and energy labelling of household electrical equipment”. In the same context, IANOR is taking an active part on the elaboration of the national strategy for the development of off-grid renewable energies (managed by the Ministry of Environment and Renewable Energy).

Currently, IANOR is engaged in the accreditation process for the products scope of cement and HDPE (High-density polyethylene) pipes for drinking water applications (according to ISO/IEC 17065).

### c. National Accreditation Body

**ALGERAC:**
Created by the executive Decree N° 05-466 of 6 December 2005, the Algerian Accreditation body (ALGERAC) is an industrial and commercial public institution. ALGERAC is placed under the supervision of the Algerian Ministry of Industry and Mines (MEM).

ALGERAC's main mission is the accreditation of conformity assessment bodies in Algeria:

- ✓ Testing laboratories and calibrations laboratories (ISO/IEC 17025)
- ✓ Inspection bodies (ISO/IEC 17020)
- ✓ Certification bodies (ISO/IEC 17021)
- ✓ Certification bodies proceeding to the certification of persons (ISO/IEC 17024)
- ✓ Certification bodies proceeding to the certification of products/processes/services (ISO/IEC 17065).

ALGERAC is also a member in the following International and Regional Bodies:

- **ARAC** (Arab Accreditation Cooperation) Associate Members 2010 - Founding Member
- **MAGAC** (Founding Member of the Maghreb Accreditation Network) - June 2011
- **ILAC** (International Laboratory Accreditation Cooperation) Full Members - 15 October 2017
- **EA** (European cooperation for Accreditation) Associate Members - 5 October 2017
- **SMIIC** (Accreditation Committee of Islamic Countries) Member since May 2012.

### d. National Metrology Institute

**Office National de Métrologie Légale (ONML):**
The national office of legal metrology (ONML) is a public organization of an administrative status (EPA), under the Algerian Ministry of Industry, Small and Medium Enterprises and Investment Promotion, and created in 1986 by the Decree n°86-250 of 30 September 1986. Its objectives are the safeguarding of the public guarantee as well as the

protection of the national economy in terms of national and international trade and consumer protection.

ONML's main mission is to ensure the reliability of the measurement of instruments requiring legal qualification and having a direct impact on:

- ✓ Fairness of trade
- ✓ Health
- ✓ Security
- ✓ Environment
- ✓ Quality of industrial production

### e. National Testing and Calibration Laboratories

**Renewable Energy Development Center (CDER):**
The Renewable Energies Development Center (CDER) is a research centre resulting from the restructuring of the High Commissioner for Research, established on 22 March 1988. It is a scientific and technological public institution (EPST) responsible for conducting research and development programs - both scientific and technological ones - of energetic systems using solar, geothermal and biomass energy.

As a scientific centre, the CDER actively participates in the national program for research and technological development in Algeria, with its research teams and its three research units:

- Solar Equipment Development Unit (UDES)
- Applied Research Unit for Renewable Energies (URAER)
- Research Unit for Renewable Energies in Saharan Regions (URERMS)

Regarding its intervention in the area of standardization of RE conversion equipment, CDER has set up three testing laboratories:

**The Photovoltaic Test Lab (PVTL):**
Created in 2018, it is a test laboratory for photovoltaic modules, which performs 12 of the 19 tests required by the IEC 61215 standard (the remaining 7 tests will be operational during 2020). The tests are performed as part of a national voluntary based quality system. The laboratory is currently in process to get the accreditation (ISO/IEC 17025) in coordination with ALGERAC.

**Figure 14:** CDER - PVTL Lab in Algeria

**The Solar thermal energy Test Lab (LEsS):**

Created in 2010, it initially serves to perform thermal testing for solar thermal collectors (performance, reliability and durability according to EN 17975-1 and ISO 9806:2013). It is currently being developed to perform reliability and thermal performance tests for solar water heating systems.

**Figure 15:** CDER - LEsS Lab in Algeria

The laboratory is operating to provide solar thermal equipment testing on a voluntary basis. Also, it performs mandatory tests linked to the eligibility conditions for the subsidized Algerian SHW program ALSOL, and later on to accommodate tests for the national solar certification mark under development.

LEsS Lab is in the final steps of an ongoing accreditation process according to ISO/CEI 17025, in collaboration with an expert since 2015.

**The Laboratory of pyranometers calibration (LT):**

Created in 2010, this laboratory was in charge of the calibration of pyranometers (solar irradiation measurement instrument). According to ISO 9847, it is equipped with a reference pyranometer, connected to the World Radiometric Center (WRC Davos Switzerland). The laboratory is in the final steps of an ongoing accreditation process according to ISO/CEI 17025.

**Figure 16:** CDER - LT Lab in Algeria

# 3.2. Egypt

## 3.2.1. Egypt at a glance

**Figure 17:** Map of Egypt

**Figure 18:** Overview of the Industry Sector in Egypt

| | |
|---|---|
| **Area** | 1,002,000 km$^2$ |
| **Population (2018 est)** | 99.4 million |
| **Geographical group** | North Africa |
| **Stage of Industrialization** | Emerging Industrial Economies |
| **GDP (2018) at constant 2010 prices in US$** | 283.5 billion |
| **MVA (2018) at constant 2010 prices in US$** | 42.3 billion |
| **MVA per capita (2018) at constant 2010 prices in US$** | 425 |
| **Share of MVA in GDP (2018)** | 15% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Coke, refined petroleum products, nuclear fuel (39%)<br>2. Food and beverages (15%)<br>3. Chemicals and chemical products (10%) |
| **Share of manufactured exports (2016)** | 78% |
| **Competitive Industrial Performance** | 71 (of 150 ranked) |

Egypt spans from the North-eastern corner of Africa to the South-eastern corner of the Mediterranean Sea. Egypt represents the most populated energy market and the largest oil and gas consumer in the region. It is also an important non-OPEC fossil fuel producer and it plays a considerable role in international energy trade. Since 2014, the government of Egypt launched significant supporting mechanisms to deploy solar Photovoltaic and wind projects, in order to boost renewable energy production. In order to attract further investments in the energy sector, the country also adopted incentive investment measures in 2015, which positioned Egypt as one of the leading MENA countries in the renewable energy field.

## 3.2.2. QI Market Structure in Egypt

### a. National Standardization Body:

**Egyptian Organization For Standardization and Quality (EOS):** The Egyptian Organization for Standardization and Quality Control (EOS) was established in 1957. In 1979, a new Presidential Decree was issued, reorganizing EOS as the only official and competent authority entrusted with all matters related to standardization, quality control and metrology. EOS elaborates national standards for raw materials, products, testing methods, symbols and terms, quantities and units, calibration and verification of measures and measuring instruments.

Moreover, it provides the necessary measures for quality control of raw materials and products in conformity to national standards through the verification of quality, legislation and application of the Quality Mark Scheme. There are 18 sections for testing materials and products and 14 for industrial metrology.

EOS also organizes training programmes and seminars in collaboration with other organizations on all matters related to standardization. It is a member of ISO, OIML, ARSO, AIDMO, EOQ, IMEKO, ASTM, and CEN. EOS is responsible for adopting international standards and issuing Egyptian standards in performance and safety and energy efficiency, covering the products mentioned below:

- ✓ Air Conditioners
- ✓ Refrigerators
- ✓ Washing Machines

- ✓ Electrical Water Heaters
- ✓ Electrical Lamps
- ✓ Fans
- ✓ Dish Washers
- ✓ Televisions
- ✓ Solar thermal collectors-test methods
- ✓ Solar domestic water heating systems

EOS is responsible for issuing standards for energy related services (i.e. ISO 50001 energy management system) too.

### b. National Certification Body

The Egyptian Organization for Standardization and Quality (EOS) operates 2 product certification schemes:

- the Conformity Mark Scheme, mandatory for products, for which a Ministerial Decree has been issued
- the Quality Mark Scheme, voluntary and upon request from the industrial organization.


For EE products, EOS is also responsible for granting licenses for using energy label of home appliances and electrical lamps, through its Energy Efficiency & Saving Unit, which is one of the mechanisms that have been implemented based on the Ministerial Decree No. 171/2011, aiming to organize labelling for home appliances products before being introduced on the markets. Then, a modified ministerial decree No. 912/2017 was issued to set labelling procedures for all products having energy efficiency aspects.

For renewable energy products, EOS is the exclusive authority for issuing SHAMCI quality mark for solar water heaters and solar collectors in Egypt, which is a mandatory national applied scheme, according to the Ministerial Decree No. 914\2018.

EOS Accreditation in this scope is processing according to ISO/IEC 17065.

### c. National Accreditation body

**Egyptian Accreditation Council (EGAC):**
The Egyptian Accreditation Council is recognized by the Presidential Decree number 312/1996 as the sole national body for the assessment and accreditation of conformity assessment bodies performing testing/calibration laboratories, inspection and certification of products and systems as well as personnel. EGAC is headed by the Egyptian Minister of Trade and Industry and governed by a board of 14 members, representing all stakeholders and concerned bodies. EGAC is a signatory member of ILAC, AFRAC and IAF.

With a broad scope of activities including accreditation of certification bodies (Product-System-Personnel), inspection bodies, and laboratories (Testing/ Calibration), the major responsibilities of EGAC are summarized below:

- Set up a system to evaluate conformity assessment bodies, and issue accreditation certificates.
- Grant, suspend, or withdraw accreditation for conformity assessment bodies.
- Carry out continuous surveillance of the accredited bodies.
- Contribute to upgrading the quality of services of conformity assessment bodies according to the international criteria.
- Encourage the exchange of experiences among different accreditation bodies.
- Support mutual recognition between conformity assessment bodies working in Egypt and abroad and conclude agreements for this purpose.
- Represent the State abroad in accreditation activities and cooperate with corresponding bodies.

### d. National Metrology Institute

**National Institute for Standards (NIS):**
The National Institute for Standards is the measurement institute of the Arab Republic of Egypt and the custodian of traceable standards to the International System (SI) of units. NIS is the largest metrology body in the Middle East and Africa, and the sole representative of Egypt at the International Bureau of Weights and Measures (BIPM).

NIS was established in 1962. Since its establishment, NIS has developed and maintained the nation's primary measurement standards and disseminated them to the end user with the highest possible accuracy. These primary standards underpin an infrastructure of traceability through Egypt and the world to ensure accuracy and consistency of measurements.

Through six scientific metrological divisions that comprise twenty scientific laboratories, NIS is able to deliver accurate Calibration and measurements services and technical consultancies in many sectors such as trade and industry, health and safety, environment, agriculture, etc. One of the main roles of NIS is to conduct research activities aiming at finding new measurement techniques so as to meet the Egyptian demands and support different organizations across the country and the region in making the best use of measurements.

### e. National Testing and Calibration laboratories

Regarding the testing and calibration facilities, Egypt has several public entities that provide testing products according to the nature of the product. The assessment was limited to the main public authorities performing tests and calibration activities for renewable energy and energy efficiency products.

EOS disposes of some testing and calibration laboratories dedicated to:

- ✓ Engineering products performing energy performance tests for Air Conditioners, Refrigerators, Washing Machines, Electrical, Water Heaters, Electrical Lamps, Fans, Dish Washers and Televisions.
- ✓ Construction materials: performing several tests for building construction and insulation materials.
- ✓ Industrial Calibrations: performing electrical, mechanical and physical calibration activities.

**New and Renewable Energy Authority (NREA):**
The New and Renewable Energy Authority was established in 1986 to act as the national focal point for expanding efforts to develop and introduce renewable energy technologies to Egypt, on a commercial scale together with the implementation of related energy conservation programs. NREA is entrusted to plan and implement renewable energy programs in coordination with other concerned national and international institutions within the framework

of its mandate, which includes and not limited to:Renewable energy resource assessment.

- Implementation of renewable energy projects.
- Research, development, demonstration, testing and evaluation of the different RE technologies focusing on solar, wind and biomass.
- Proposing the Egyptian standard specifications for renewable energy equipment and systems, and conducting tests to evaluate their performance, under the Egyptian prevailing conditions, hence issuing respective licensing certificates to that effect.
- Rendering of consultancy services in the field of renewable energy.
- Technology transfer and development of local manufacturing of Renewable Energy equipment.
- Education, training and information dissemination.

In RE-EE testing related context, NREA possesses different testing laboratories, such us:

- ✓ Solar Photovoltaic cells and modules testing laboratory
- ✓ Solar Thermal collector and heating systems testing laboratory
- ✓ Energy performance testing laboratories for electrical refrigerators
- ✓ Energy performance testing laboratories for automatic washing machines
- ✓ Energy performance testing laboratories for electrical water/air heaters
- ✓ Energy performance testing laboratories household Dishwashers
- ✓ Energy performance testing laboratories for air conditioners.

**Figure 19:** NREA Solar Water/Air Heaters Test Lab in Egypt

In the present study, special focus was given to the NREA Testing Laboratory for Solar Water/Air Heaters, which was established in 1994 according to ASHRAE and Egyptian standards. The test lab was upgraded in 2016 according to ISO9806 and EN12976, and it provides all solar thermal testing types for solar collectors and solar heating systems, according to the international references ISO 9806 and EN 12976.

The equipment's upgrade of this solar thermal testing laboratory was turnkey project (Designed and Built) by PSE EG Co from Germany. All sensors were initially calibrated in the Fraunhofer institute, while the national institute for calibration in Egypt (NIS) was responsible for calibrating other sensors except the solar radiation sensors. Currently, NREA is in the process of getting an international accreditation for its solar thermal laboratory (in cooperation with CENER) according to ISO/IEC 17025.

# 3.3. Jordan

## 3.3.1. Jordan at a glance

**Figure 20:** Map of Jordan

**Figure 21:** Overview of the Industry Sector in Jordan

| | |
|---|---|
| **Area** | 89,318 km$^2$ |
| **Population (2018 est)** | 9.9 million |
| **Geographical group** | Asia & Pacific |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** *at constant 2010 prices in US$* | 32.1 billion |
| **MVA (2018)** *at constant 2010 prices in US$* | 4.9 billion |
| **MVA per capita (2018)** *at constant 2010 prices in US$* | 499 |
| **Share of MVA in GDP (2018)** | 15% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Food and beverages (20%)<br>2. Chemicals and chemical products (17%)<br>3. Coke, refined petroleum products, nuclear fuel (9%) |
| **Share of manufactured exports (2016)** | 83% |
| **Competitive Industrial Performance** | 82 (of 150 ranked) |

Jordan is an Arab country located in Western Asia, particularly on the East Bank of the Mediterranean Sea. Jordan imports energy resources to meet its domestic energy demand for fossil fuels. These energy imports account for more than 40% of the country's budget, which is considered as a challenging issue that restrains the country in securing its energy supply. As one of the promising countries in the renewable energy sector, the government of Jordan set a 10% target of energy mix from renewables by 2020. The country also set up the Jordanian RE and EE fund (JREEEF), as well as duties and taxes exemptions on all manufactured locally and imported renewable energy sources equipment and systems, to encourage the use of clean technologies at the national level.

## 3.3.2. QI Market Structure in Jordan

### a. National Standardization Body

**Jordan Standards and Metrology Organization (JSMO):** The Jordan Standards and Metrology Organization was established as a public organization according to the Standards and Metrology Law (1994 and 2000). It is actively represented in international and regional standards organizations, such as ISO technical committees and policy development committees, AIDMO, SMIIC...

JSMO's main objectives are:

- Adopt a national system for standardization and metrology based on accepted international practices
- Keep pace with scientific and technical developments in the fields of standards, metrology, conformity assessment and laboratory accreditation
- Ensure the health and safety of the consumers and protection of the environment by making sure that goods, products and services comply with technical regulations
- Ensure the quality of local goods, products and services through the adoption of appropriate Jordanian standards to enhance their competitiveness in local and international markets to support the national economy

By Law, JSMO is responsible for:

- Issuing, approving, reviewing, amending and monitoring the implementation of standards and technical regulations with regard to all goods, products and services (with the exception of pharmaceutical products, medicines, veterinary medicines, serums and vaccines);
- Establishing a national system of measurement and supervising its implementation;
- Calibrating, controlling and supervising measuring instruments and practices;
- Controlling the quality of precious metals and jewelry (testing and stamping);
- Granting conformity certificates, including the quality mark;
- Accrediting testing and calibration laboratories and certification bodies in accordance with approved international practices
- Agreement with national, regional and international organizations and authorities on mutual recognition of conformity certifications (quality badges, laboratory accreditation certificates and efficiency of its granting bodies).

In line with the Jordanian energy strategy, JSMO established a technical committee related to energy efficiency standardization, that was mandated to issue technical regulations for eco design and labelling, to issue standards for minimum energy performance standards (MEPS), in communication with actors from the private sectors through industry and energy chambers. JSMO through its EE technical committee, adopted considerable international and regional standards:

| For Products | For Services | For Persons |
|---|---|---|
| Household Electrical Appliances<br>Electrical Low Voltage Products<br>Solar thermal collectors & SWH<br>Solar PV modules | Energy Management System<br>Energy Audits for Transport and Building sectors | Processes and competency of Energy Auditors |

### b. National Certification Body

According to its legal and regulatory framework, the JSMO certification department is also fulfilling its mandate as the national certification body of Jordan, by issuing conformity certificates for products to ensure their compliance with JSMO adopted standards and granting the Jordanian quality mark for relevant products.

The Jordanian quality mark certificate (JQM) is granted based on performance and safety for the following RE-EE products:

Solar PV modules – Household Electrical Appliances - Refrigerators - Air conditions - TV - Washing machines - Dish washing machines - Household and similar electrical appliances - Household lamps.

For Solar thermal collectors and systems, the Jordanian Standards and Metrology Organization concluded a cooperation agreement with RCREEE in 2018 in order to coordinate efforts for implementing the regional scheme "Solar Heating Arab Mark and Certification Initiative (SHAMCI)" at the national level in Jordan. Thus, JSMO became the second certification body empowered to grant SHAMCI mark in the Arab region after EOS in Egypt.

Regarding energy efficiency, a mandatory MEPS and labelling program is applied in Jordan, in which JSMO contributed by preparing the technical regulations for the energy efficiency label, that determines the energy efficiency minimum requirements, and monitoring the harmonized placing of the labels on the products.

As for the quality control and market surveillance, the imported RES and EE products are controlled by checking test reports issued from the exporting countries. This is assured by the Anti-counterfeiting, Verification, and Notification Unit in JSMO; then, the unit conforms the testing reports according to the technical regulation relevant to the RES or EE products, which determine the minimum technical requirements for labelling. JSMO is under the process to be accredited according to the ISO/IEC 17065 for solar energy products.

### c. National Accreditation Body

**Accreditation Unit of the Jordanian Accreditation and Standardization System (JAS-AU):**

The Accreditation Unit of the Jordanian Accreditation and Standardization System (JAS-AU) is the national accreditation body in Jordan, which accredits conformity assessment bodies according to the relevant international standards. JAS-AU is mandated to perform accreditation of testing and calibration labs according to ISO/IEC 17025, accreditation of medical labs according to ISO 15189, accreditation of product certification bodies according to ISO/IEC 17065, and provision of training services in its related field of activities in Jordanian.



**Figure 22:** NERC Solar Thermal test lab in Jordan

The Accreditation Unit of the Jordanian Accreditation and Standardization System (JAS-AU) has recently received international recognition from the International Laboratory Accreditation cooperation (ILAC), and a regional recognition from the Arab Accreditation Cooperation (ARAC). Therefore, all certificates of accreditation issued by the Accreditation Unit (JAS-AU) for testing laboratories, calibration laboratories and medical laboratories becomes recognized and accepted regionally and worldwide, which is a very important achievement for preserving the country's resources, and a good step towards the upgrade of the national quality infrastructure in Jordan.

### d. National Metrology Institute

**JSMO Metrology Department:**

The Jordanian Standard and Metrology Organization (JSMO) is committed to provide a national system for metrology, in the framework of the Metrology Department, and in line with the international requirements as well as with all the efficiency, transparency, impartiality and integrity requirements. It is also committed to ensure national uniform measurements that are internationally recognized, and to contribute to the national economy by better protecting human health, the safety of citizens and the environment.

JSMO Metrology department is considered as umbrella of the national metrology, responsible for the application of the law, regulations and instructions of metrology in Jordan, and it always seeks to provide all the necessary resources and potential for the development of the National System for Metrology and achieve continuous improvement. This entity provides services of calibration and verification of legal measuring instruments and inspections in the Kingdom, as established under the law for Jordan Institution for Standards and Metrology No. (22) of (2000), through its various divisions, including: pressure, temperature and length division, weights and balances division, pre-packaged division, counters taxi division and, finally, fuel and volumes division.

## e. National Testing and Calibration Laboratories Body

**The National Energy Research Center (NERC):**

The National Energy Research Center (NERC) is one of the specialized technical centres of the Royal Scientific Society (RSS) in Jordan. This has been established in 2015 for the purposes of research, development and training in the fields of new and renewable energy and raising the standards of energy use in the different sectors. NERC consists of four specialized divisions, which carry out technical work and implement projects:

- ➔ Wind Energy Division
- ➔ Photovoltaic Division
- ➔ Energy Efficiency and Solar Thermal Division
- ➔ Oil shale and Bioenergy Division

With respect to testing, NERC has six specialized RES and EE testing laboratories as follows:

1. Air conditioners testing lab
2. Clothes washers testing lab
3. Refrigerators testing lab
4. Solar thermal system testing lab
5. Lighting testing lab
6. Photovoltaic system testing lab

**Figure 22:** NERC Solar Thermal test lab in Jordan

Fulfilling its national role as the official Jordanian government consultant on matters of RE/EE national policy, strategy and planning, carrying out research in development of innovative technologies, which are both technically and economically viable and environment friendly, NERC manages and operates laboratories, units as well as research and experimental stations in order to develop and use new and renewable energy sources, and to provide required energy performance tests for renewable energy and energy products, as follows:

**Figure 23:** Energy performance tests carried out by NERC

| For RE Products | For EE Products |
|---|---|
| Solar PV Modules according to IEC 61215<br><br>Solar Thermal Collectors according ISO 9806 | AC According to BS EN 14825 & BS EN 14511<br><br>Clothes washing machine according BS EN 60456<br><br>Domestic Refrigerators according to BS EN 62552 |

All above mentioned tests are carried out by NERC on voluntary basis, under a national certification scheme, or on mandatory basis for the public tenders under projects managed by the Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF), in order to verify the products compliance with the defined minimum eligibility requirements and technical regulations. NERC testing laboratories are accredited by JAS-AU according to ISO/IEC 17025, for the following scopes:

- **AC**: SEER and SCOP.
- **Refrigerator**: Energy performance.
- **Solar Thermal**: Collector's performance.
- **PV Panel**: IV curve and panel efficiency.
- **Washing machine:** Energy index & water consumption.

# 3.4. Lebanon

## 3.4.1. Lebanon at a glance

**Figure 24:** Map of Lebanon

**Figure 25:** Overview of the Industry Sector in Lebanon

| | |
|---|---|
| **Area** | 10,452 km$^2$ |
| **Population (2018 est)** | 6.1 million |
| **Geographical group** | Asia |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** *at constant 2010 prices in US$* | 43.6 billion |
| **MVA (2018)** *at constant 2010 prices in US$* | 2.2 billion |
| **MVA per capita (2018)** *at constant 2010 prices in US$* | 363 |
| **Share of MVA in GDP (2018)** | 5% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Food and beverages (32%)<br>2. Basic metals (29%)<br>3. Non-metallic mineral products (11%) |
| **Share of manufactured exports (2016)** | 94% |
| **Competitive Industrial Performance** | 84 (of 150 ranked) |

Lebanon is a country in Western Asia on the Eastern shore of the Mediterranean Sea. Lebanon relies on importing fossil fuels to meet its domestic energy demand and aims to have 12% of its electricity and thermal energy from renewable resources by 2030.

The Lebanese government has also adopted its first "National Energy Efficiency and Renewable Energy Action Plan" since 2011, as a mechanism dedicated to financing green energy projects in the country, where private sector entities can apply for subsidised loans for any type of environmentally friendly projects. Yet, Lebanon is still suffering from disruptions on the delivery of energy to end users.

## 3.4.2. QI Market Structure in Lebanon

### a. National Standardization Body

**The Lebanese Standards Institution (LIBNOR):**
The Lebanese Standards Institution (LIBNOR) is a public institution attached to the Ministry of Industry. It was established in 1962 by a law, giving it solely the authority to issue, publish, and amend national standards as well as to authorize the use of the Lebanese Conformity Mark proving the compliance of products to Lebanese standards. Standards are discussed and prepared by technical committees formed by LIBNOR for this purpose.

These committees include representatives from both public and private sectors, such as ministries, public administrations, laboratories, universities, syndicates, Chambers of Commerce Industry and Agriculture, associations, NGOs and others. Lebanese national standards are in principle voluntary. However, due to public security reasons, public health, and/or national interest, a standard may be granted the mandatory status by a decree from the Council of ministers and upon approval by LIBNOR's Board of Directors.

Some of LIBNOR's technical committees are mandated to design national standards for the green energy:

**Figure 26:** LIBNOR Standardization Technical Committees in RE-EE Fields

| Technical Committe | Title | Standardization Scope |
|---|---|---|
| NL TC 180 | Solar Energy | Standardization in the field of solar energy utilization in space and water heating, cooling, industrial process heating and air conditioning |
| NL TC 3010 | Home appliances | Safety requirements and energy performance for electrical appliances primarily for household purposes |
| NL TC 205 | Building Environment Design | Standardisation in the field of green buildings |
| NL TC 3018 | Heating, Ventilation and Air Conditioning (HVAC) | Terminology, dimensioning, testing, functional requirements, maintenance requirements, performance requirements and safety requirements of: Heating systems, water-based cooling systems, heat exchangers, ventilation systems, refrigerating systems, heat pumps, air conditioning units, hydronic room fan coil units, and liquid chilling packages. |
| NL TC 3008 | Thermal insulation | Thermal performance and insulation of materials, products, components, elements and systems, including insulation of installed equipment in buildings and some industrial sector. |

Providing all national, regional and international standards to its customers through its information centre, LIBNOR has signed many MoUs and agreements with different European and Arab standardization bodies. It is also a member of ISO, AIDMO and an affiliate member of CEN.

### b. National Certification Body

LIBNOR aims at serving the Lebanese society and economy by also acting as a certification body for granting the NL Conformity Mark to interested parties, thereby contributing to the improvement of quality and sales of Lebanese products. NL Conformity Mark is a mark owned by LIBNOR, as per law of 23-07-1962.

The NL Conformity Mark indicates the conformity of certified products and goods to national standards. This conformity mark helps to increase the level of customer confidence and facilitates national, regional and international trade. LIBNOR shall grant the right to use it to whom interested based on defined conditions.

The certification process starts with the submission of an application together with the required documents and fees. If documents are found to be complete and requirements fulfilled, LIBNOR audit team shall conduct the necessary on-site assessment and product analysis for full verification.

### c. National Accreditation Body

**Lebanese Accreditation Council (COLIBAC):**
The Lebanese Accreditation Council (COLIBAC) is established by the Law No.572 of 11 February 2004. COLIBAC is currently a non-operational entity, and unable to fulfil its role in conformity assessment. It is also unable to fulfil its tasks under the relevant Lebanese laws relating to the activities of national accreditation bodies or conformity assessment bodies.

Accreditation in Lebanon is accordingly provided by foreign accreditation bodies signatories to the relevant ILAC-MRA, IAF-MLA or EA-MLA agreements. The situation is partly solved by accepting the results provided by accredited Conformity Assessment Bodies abroad. COLIBAC was accepted as an associate member of the Arab Accreditation council (ARAC) during its 2019 General Assembly.

### d. National Metrology Institute

Metrology in Lebanon is still incomplete, in particular the implementation of legal aspects. The new Metrology Law No.158 was promulgated on 17 August 2011, foreseeing the establishment of the National Metrology Council (NMC) and the appointment of National Metrology Institutes.

However, the enforcement of this law requires the adoption of several implementing decrees, replacing the outdated regulations in the field and setting the rules governing metrology, to ensure proper measurement operations, according to international requirements and guaranteeing consumer protection and fair competition.

## e. National Testing and Calibration Laboratories Body

**Industrial Research Institute (IRI):**
Established in 1953, the Industrial Research Institute (IRI) is registered as a Lebanese nonprofit institution declared of public utility by D/L n° 10059 dated 17 August 1955, linked to the Ministry of Industry by Law n° 642/1997, with administrative and financial autonomy for studies, industrial research and scientific testing, calibration, inspection and certification (system, product and personnel).

The activities and services of the Institute are organized to conduct studies and research relevant to the establishment of new industries, as well as to provide, at an international scientific level, reliable services in testing and analysis and to grant certificates of quality or conformity with standards and purchase specifications. IRI is mandated by the Lebanese Government through decrees to also perform inspections / tests for specific imported goods. Within its structure, IRI comprises 14 laboratories, among which six are already accredited by the American accreditation body ANAB according to ISO 17025. In terms of testing activities related to renewable energy products, IRI disposes of testing laboratory for solar water heaters and solar thermal collectors, for relevant testing methods in accordance with ISO standards.

**Figure 27:** IRI SWH Test Lab in Lebanon

# 3.5. Libya

## 3.5.1. Libya at glance

**Figure 28:** Map of Libya

**Figure 29:** Overview of the Industry sector in Libya

| | |
|---|---|
| **Area** | 1,676,198 km$^2$ |
| **Population (2018 est)** | 6.5 million |
| **Geographical group** | North Africa |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** ***at constant 2010 prices in US$*** | 44.6 billion |
| **MVA (2018)** ***at constant 2010 prices in US$*** | 430.2 million |
| **MVA per capita (2018)** ***at constant 2010 prices in US$*** | 66 |
| **Share of MVA in GDP (2018)** | 1% |
| **Major manufacturing activities (VA in % to total MVA)** | - |
| **Share of manufactured exports** | - |
| **Competitive Industrial Performance** | Not ranked |

Libya is a country in the Maghreb region of North Africa, bordered by the Mediterranean Sea to the North. As a member of OPEC, Libya holds one of the world's largest crude oil reserves and is an important natural gas and oil exporter to the world and especially Europe. However, Libya's fossil fuel sector has been severely hit by the unstable conditions since 2011. With oil and gas accounting for 96% of total government revenue, Libya's economy is heavily dependent on its fossil fuel sector.

In 2013, the Libyan government launched the Renewable Energy Strategic Plan (2013-2025), which aims to achieve 7% renewable energy contribution to the electric energy mix by 2020 and 10% by 2025. This will come from wind, Concentrated Solar Power, solar PV and solar heat.

## 3.5.2. QI Market Structure in Libya

### a. National Standardization Body

**Libyan National Centre for Standardization and Metrology (LNCSM):**

The Libyan National Center for Standardization and Metrology (LNCSM) is a governmental institution established by Decree No. 62 in 1989 and based in Tripoli, with two branches in Benghazi and Misurata. LNCSM is governed by a Board of Directors, headed by the Ministry of Planning, and comprising 10 representatives from different Ministries.

The main task of LNCSM is to develop national Standards (and/or adapt international standards). With more than 350 experts involved in developing standards from different Libyan stakeholders, LNCSM has developed and adopted around 4500 standards.

LCNSM experts are participating in plenty of technical committees of different regional and international standards organization around the globe, such as ISO, AIDMO, ARSO ... However, LNCSM membership in ISO was interrupted in 2014. LNCSM is also actively represented in SMIIC technical committee (TC4) supporting Energy Efficiency and Renewable Energy. Internally, two technical committees have been created in LNCSM for standardization issues in RE and EE field, respectively by decrees (05/2016) and (06/2016), in order to promote the quality and standardization in the subject area of activities.

LNCSM also manages a voluntary Libyan Quality Mark scheme nationally, specifying relations and organizing the conditions for the permission of its use. LNCSM responsibilities are extended also to the harmonization of Libyan standards with Arab, regional and international specifications.

### b. National Certification Body

In spite of the Libyan Quality Mark that is being supervised on a voluntary basis by LNCSM, no dedicated certification body has been set up in Libya so far, due to the absence of a national quality infrastructure policies.

### c. National Accreditation Body

In 2005, the Libyan General People's Committee has issued decree No. 27, on the reorganization of LNCSM adding Accreditation to its activity. Now, it accredits more than 40 inspection bodies according to the ISO/IEC 17020 (no one with RE or EE scope), and one calibration laboratory according to ISO/IEC 17025. Later in 2013, the Ministerial Council Decree No. 604 was issued and established the Libyan Accreditation Center (LIBAC).

**Libyan Accreditation Center (LIBAC):**
LIBAC was officially and independently established in 2019, with the main mission to serve the Libyan economy, by managing and promoting the importance of accreditation according to the international references and standards, supporting the local industries to facilitate the Libyan trade movements abroad, and ensuring safety, health and environment for the Libyan population.

Currently, LIBAC is in an ongoing process for getting the international recognition from the relevant international forums in collaboration with the Arab Accreditation Cooperation (ARAC), which LIBAC is a member to. In parallel, LIBAC created three main technical committees to prepare a national program defining the relevant procedures and requirements needed for accrediting:

- ✓ The inspection bodies according to the ISO/IEC 17020,
- ✓ The testing/calibration laboratories according to the ISO/IEC 17025,
- ✓ The entities granting professional certificates for persons according to the ISO/IEC 17024.

### d. National Metrology Institute

There is no official metrology institute in Libya, except the Metrology department of LNCSM, mandated to:

- ✓ Develop and implement the national measurement system,
- ✓ Develop and adopt measurement and calibration methods,
- ✓ Approve bodies authorized to calibrate and mark weights and measures according to the national measurement system.

### e. National Testing and Calibration Laboratories Body

**The Centre for Solar Energy Research and Studies (CSERS):** The creation of the Centre for Solar Energy Research and Studies in Tripoli, Libyadates back to 1978 but ithas been running as an independent organization only since 1993. It is strongly connected to the Ministry of Higher Education and Scientific Research. CSERS carries out studies and research programs in the field of solar energy, proposes plans for a wider use of solar energy and provides a better understanding of this field.

The main responsibilities of CSERS cover also the modelling of solar energy systems, testing their performance, developing their components by calibrating the solar equipment manufactured locally and internationally, and setting the basic procedures and regulations necessary to meet those objectives. Furthermore, CSERS is actively committed to propose and contribute in setting the national standards for equipment and systems used for solar, wind and other renewable energy conversion, as well as in testing those systems and taking part of granting the related quality certificates at the national level.

Unlike the other Libyan conformity assessment bodies, CSERS is considered as one of the well-developed energy testing facilities across the region and the continent, in terms of technology and equipment. It encompasses three testing/calibration laboratories as follows:

1. **Climate Data Lab:** This lab contains four main components, which are the calibration laboratory, the maintenance workshop facility, the mobile servicing workshop and the automatic system for measuring climate factors.

2. **Solar Thermal Conversion Lab:** this lab carries out measurements and tests on components of the solar heat transfer system, and conduct quality and performance tests according to the international standards used in solar thermal energy field, either for solar thermal collectors or solar thermal heating and storage systems, under standard conditions and outdoor conditions.

3. **Solar PV Conversion Lab:** This lab carries out measurements and tests on the components of solar PV systems, including solar cells, PV materials, solar panels, batteries, as well as the overall performance of the systems under standard conditions and outdoor conditions.

   The Solar PV lab testing equipment is characterized by an automated operational system, linked to sophisticated computing programs, in order to measure:

   - the solar PV cell properties;
   - the performance of all the PV system components.

CSERS testing laboratories have not been accredited according to the international ISO/IEC 17025 standard yet.

**Figure 30:** CSERS Solar PV Conversion Lab

# 3.6. Morocco

## 3.6.1. Morocco at a glance

**Figure 31:** Map of Morocco

**Figure 32:** Overview of the Industry sector in Morocco

| | |
|---|---|
| **Area** | 446,550 km$^2$ |
| **Population (2018 est)** | 36.2 million |
| **Geographical group** | North Africa |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** at constant 2010 prices in US$ | 129.0 billion |
| **MVA (2018)** at constant 2010 prices in US$ | 19.7 billion |
| **MVA per capita (2018)** *at constant 2010 prices in US$* | 543 |
| **Share of MVA in GDP (2018)** | 15% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Food and beverages (23%)<br>2. Non-metallic mineral products (17%)<br>3. Chemicals and chemical products (16%) |
| **Share of manufactured exports (2016)** | 87% |
| **Competitive Industrial Performance** | 61 (of 150 ranked) |

Morocco is a country located in the Maghreb region of North Africa and it overlooks the Mediterranean Sea to the North. Despite its diversified energy mix, Morocco relies mostly on fossil fuels to meet its domestic energy demand. The Moroccan government aims to generate 52% of electricity from renewable sources by 2030, focusing mostly on solar and wind energy, thus making the country a leader in RE technologies deployment worldwide. Since 2009, the government of Morocco has launched energy reforms to foster the development of the country's industry in the sectors of renewable energy and energy efficiency, to penetrate regional and international markets, and to encourage the development of indigenous resources helping to improve energy security and deliver on Morocco's clean energy and climate change commitments.

## 3.6.2. QI Market Structure in Morocco

### a. National Standardization Body

**Institut Marocain de Normalisation (IMANOR) :**
IMANOR is a nonprofit public institution created by law n° 12-06 of 2006 related to standards, certification and accreditation. Its overall mandate consists of serving public and private Moroccan economy players by developing national standards, certifying and assessing products and organizations conformity, as well as providing technical assistance in order to boost quality and durability of products and services and to preserve consumers' health, safety and "halal" way of life.

IMANOR issues Moroccan standards and adopts international/regional ones, certificates the compliance with standards and normative references, publishes and disseminates standards for related products, but it also takes care of information and training on standards as well as their implementation techniques.

IMANOR is committed to represent Morocco in international and regional standardization organizations. It is an active member in ISO committees dedicated to standardizing with respect to energy management and energy saving, solar energy and thermal performance, and energy use in the facilities where people live and work. IMANOR is also member of IEC, CEN, CENELEC, SMIIC, AIDMO and ASTM.

Internally, since 2010 IMANOR has dedicated technical committees to manage standardization issues related to solar energy (PV, solar thermal collectors, solar water heater), energy performance labelling of electrical appliances, and energy audits. Those committees are also involved in national cooperation initiatives with the national energy authority and other institutions for defining MEPS in standards related to some electrical appliances.

### b. National Certification Body

IMANOR provides economic operators with a diversified range of management system certification programs covering several standards like the ISO 50001 for energy management, as a recognition of the Moroccan commitments and efforts for the continuous improvement of energy performance and energy saving nationally.

All the certifications for the management systems apply to any organization (private company or public institution, in the industrial or service sector) regardless of its type, size and product, for a given activity carried out in one or more sites, with respect to the same management system. The activities and sites are specified by the organization at the time of its request and are confirmed and described in the certificate of compliance.

As far as people are concerned, IMANOR has developed a system to qualify auditors of different management system certification. With respect to products, IMANOR is mandated to grant the NM mark, which is a voluntary national certification mark affixed to a product, to attest that it has been evaluated and certified in accordance with the appropriate Moroccan standards. Furthermore, IMANOR is in process to start granting certificates for RE-EE products, such as solar equipment and household appliances.

IMANOR has been accredited according to the ISO/IEC 17021 by the Ministry of Industry in Morocco.

### c. National Accreditation Body

**Service Marocain D'accreditation (SEMAC):**
The Moroccan Accreditation Service (SEMAC) is the sole Moroccan accreditation body for the accreditation of conformity assessment bodies and it operates under the final responsibility of the Minister of Industry, Trade, Investment and Digital Economy. It is committed to a continuous progress and is constantly striving to promote, on the one hand, the usefulness of accreditation and, on the other hand, to align its provisions with internationally agreed practices. This is achieved thanks also to its participation, as an Associate member, in ILAC since 2005, EA since 2012, ARAC since 2011 and IAF since 2015.

Since 2001, SEMAC has granted about 130 accreditations to conformity assessment bodies in different fields, the majority of which are according to NM ISO / IEC 17025. Since mid-2015, many Moroccan regulatory authorities have agreed on the important role played by accreditation by reducing duplicate control, oversight and inspection visits. As a result, the Ministry of Equipment, Transport and Logistics now requires SEMAC accreditation for Civil Engineering Laboratories and Vehicle Technical Control Centres to obtain the necessary authorizations to perform requested services.

### d. National Metrology Institute

***Laboratoire Public d'Essais et d'Etudes*** **(LPEE) :**
The LPEE is a public laboratory for tests and studies that was created in 1947. Currently, the LPEE provides services in various domains: civil engineering, building, environment, hydraulics and other related industries. With its own specialized centre for metrology, one of the main missions of LPEE is essentially to provide measuring services for instruments and advanced equipment customizable to customers' needs.

### e. National Testing and Calibration Laboratories Body

**Moroccan Agency for Energy Efficiency – AMEE:**
The Moroccan Agency for Energy Efficiency – AMEE is a strategic public institution, whose mission is to contribute to the implementation of the national energy policy

that aims at reducing energy dependence and preserving the environment, through democratization and promotion of EE measures.

As part of the promotion of EE measures and RE equipment (solar water heaters, PV panels), the AMEE has equipped itself with test labs for the quality control and labelling of these systems, in order to upgrade the existing quality level of RE and EE equipment on the national market. AMEE testing laboratories are categorized as follows:

- **Test benches for solar collectors and water heaters:** AMEE thermal laboratory was created in 2002 and it has different test benches to evaluate the thermal performance as well as the reliability and durability of individual thermosiphon solar water heaters (according to the ISO 9806) and solar collectors with liquid circulation (according to the EN 12976).
- **Test bench for PV modules:** AMEE is also acquiring testing tools for labeling and quality control of PV modules, aimed at different uses in autonomous power generation systems or in solar pumping fields. This test lab is an electrical performance test bench for PV modules (according to the IEC 61215).

The AMEE is currently in an ongoing process for getting the accreditation according to the ISO/IEC 17025, with the support of the PTB program in order to strengthen the solar quality infrastructure in the Maghreb countries.

**Figure 33:** AMEE Solar Testing Laboratory in Morocco

# 3.7. Palestine

## 3.7.1. Palestine at a glance

**Figure 34:** Map of Palestine

***Figure 35:*** Overview of the Industry Sector in Palestine

| | |
|---|---|
| **Area** | 6,220 $Km^2$ (West bank & Gaza strip) |
| **Population (2018 est)** | 5.052 million |
| **Geographical group** | Asia |
| **Stage of Industrialization** | Other Developing Economies |
| **GDP (2018)** at constant 2010 prices in US$ | 14616 million |
| **MVA (2018)** at constant 2010 prices in US$ | - |
| **MVA per capita (2018)** at constant 2010 prices in US$ | - |
| **Share of MVA in GDP (2018)** | - |
| **Major manufacturing activities (VA in % to total MVA)** | - |
| **Share of manufactured exports** | - |
| **Competitive Industrial Performance** | Not ranked |

Palestine is located in Western Asia and bordered by the Eastern shore of the Mediterranean Sea, including the West Bank and the Gaza Strip. With limited availability of primary energy resources, financial constraints, and a peculiar political situation, the Palestinian energy sector relies almost entirely on energy imports, with more than 90% of the total electricity supply imported.

Palestine aims to achieve 10% of domestic electricity generation from renewable energy by 2020. The Palestinian Energy Authority also adopted its first "National Energy Efficiency Action Plan" in 2012 with a EE target of 5% cumulative energy savings by 2020. Palestine is also one of the pioneering countries in solar thermal energy, with the highest rate of market penetration in terms of SWH.

## 3.7.2. QI Market Structure in Palestine

### a. National Standardization Body

**Palestine Standards Institution (PSI):**
The PSI was established in 1994 with a presidential decree issued by President Yasser Arafat but started operations just in 1997. Currently, PSI works according to the law on standards and metrology no. 6/2000. The PSI is governed by a Board of Directors from the public and private sectors, chaired by the Minister of National Economy. In addition to its headquarters in the city of Ramallah, the PSI has three more branches in Gaza, Nablus and Hebron.

PSI has an autonomous status, considered the sole body responsible for issuing Palestinian standards, and it is recognized both locally and internationally as the focal point for Palestinian participation in the global system of harmonized standards. It is a member of AIDMO and became a subscriber member of ISO in 2001 and a correspondent member in 2004.

The PSI's mission is to facilitate trade and investment in Palestine by fulfilling needs of the business community related to metrology, standards, testing and quality conformity assessment, while ensuring consumer and environmental safety. Its main responsibilities and duties cover the following:

- Prepare and adopt Palestinian standards for products, and services;
- Review, amend, replace and publish the Palestinian standards;
- Grant conformity marks and compliance certificates;
- Provide inspection and testing services, and approve labels for products;
- Establish a national system of metrology, unify the tools and methods of measurement;
- Provide calibration services.

The standards are developed by specialized technical committees, but no one of them is specifically dedicated to RE and EE issues. These committees gather experts representing national authorities, private sector, academia, and consumer associations, to develop standards for the following sectors: food, agriculture, cosmetics, chemicals, plastics, textiles, leather, petroleum, construction, engineering products, such as hydrologic and mechanical equipment, tools, information technology, management and environment services.

### b. National Certification Body

In terms of quality certification, the PSI issues conformity certificates being the authorized body to grant such certificates. Four types of certificates are considered, namely Quality Mark, Supervision Mark, Halal and conformity certificates, according to the internal certifications system, as follows:

- **Quality certificate:** a proof that the product complies with health and safety requirements, and that the product is made according to standards and good manufacturing practices.
- **Supervision certificate (PSM Mark):** a proof of conformity of products to the technical specifications in the Palestinian standards/regulations.
- **Halal certificate:** proof of the harmonization with the Halal standards that were issued by the standards Institute for Islamic countries (SMIIC) and the adopted quality standards.
- **Imported Conformity certificates:** attesting that the sample or batch complies with the technical regulation or related standards for products to be imported to Palestine. Conformity certificates are issued upon request by any concerned party for the following sectors: food, chemical, constructional, mechanical, industrial and electrical industries.

PSI is aiming also to expand its scope of certification by granting certificates for quality management systems, service providers and personnel, but no certification activities are in place with respect to renewable energy or energy efficiency.

### c. National Accreditation Body

**Palestine Accreditation – PALAC:**
PALAC is the sole accreditation body in Palestine, where accreditation activities started since the creation of the Palestine Standards Institute (PSI) in 1996, although the 1st accreditation certificate was issued in January 1997 for a building and construction lab based on ISO/IEC Guides. PALAC is directly connected to the Minister of National Economy and is working according to the approved accreditation system.

### d. National Metrology Institute

The Palestinian Government paid great attention to the issue of metrology and authorized Palestinian Standards Institution (PSI) to prepare a national metrology system to regulate the whole metrology activities in Palestine. In 2003, the Palestinian metrology system was approved by cabinet. Hence, it was decided to create the National Measurement Directorate within PSI, which is responsible for the implementation of the system according to the international regulation and practices.

The whole metrology activity in Palestine is regulated and implemented according to the following official documents:

- **The National Measurement System,** authorizing the National Measurement Directorate in PSI to regulate and implement the metrology activities in Palestine. Thanks to this system, the National Measurement Directorate was authorized to prepare all the special instructions and supplements for all the metrology activities in line with international practices and requirements, as well as to supervise their implementation.
- **The Metrology Regulations**, determining and explaining the administrative and technical requirements of the National Measurement System, and for the manufacturing, importing and using of the legal controlled equipment.

The available and used regulations in Palestine are: National metrology system, legal metrology regulations, type approval regulations, authorization for verification regulations, authorization for maintenance and repairing of legal equipment, road tankers regulations, pre-packages control regulations, weighing instruments regulations, water meters' regulations.

### e. National Testing and Calibration Laboratories Body

In Palestine, there was no clear indication about operational testing laboratories dedicated for RE or EE products. However, PSI offers testing services for specific electrical equipment. Regarding the Industrial calibration, PSI offers also temperature calibration (for different thermometers, refrigerators, freezers…), and electrical measurement devices calibration (voltage, current, resistance).

# 3.8. Tunisia

## 3.8.1 .Tunisia at glance

**Figure 36:** Map of Tunisia

***Figure 37:*** Overview of the Industry Sector in Tunisia

| | |
|---|---|
| **Area** | 163,610 km$^2$ |
| **Population (2018 est)** | 11.7 million |
| **Geographical group** | North Africa |
| **Stage of Industrialization** | Emerging Industrial Economies |
| **GDP (2018)** ***at constant 2010 prices in US$*** | 50.2 billion |
| **MVA (2018)** ***at constant 2010 prices in US$*** | 7.8 billion |
| **MVA per capita (2018)** ***at constant 2010 prices in US$*** | 672 |
| **Share of MVA in GDP (2018)** | 16% |
| **Major manufacturing activities (VA in % to total MVA)** | 1. Food and beverages (21%)<br>2. Textiles (15%)<br>3. Non-metallic mineral products (11%) |
| **Share of manufactured exports (2016)** | 92% |
| Competitive Industrial Performance | 63 (of 150 ranked) |

Tunisia is a North African country, located in the Maghreb region and bordering the Mediterranean Sea in the North. Tunisia mostly relies on gas imports to meet its primary energy needs: almost 97% of its electricity generation came from gas in 2016. However, its energy policy puts the emphasis on renewable energy. Furthermore, electricity generation from wind power strongly increased since 2014, as a result of the government efforts to integrate 30% of total electricity generation from renewable energy resources by 2030.

Tunisia has also focused strongly on energy efficiency as a way of diversifying its energy mix, as existing regulatory frameworks and energy efficiency laws demonstrate. The government is currently adopting its third energy program with energy efficiency targets.

## 3.8.2. QI Market Structure in Tunisia

### a. National Standardization Body

**Institut National de la Normalisation et de la Propriété Industrielle (INNORPI):**
INNORPI is a non-administrative public institution, endowed with a civil status and financial autonomy. Established by the law n° 82 — 66 of 6 August 1982, it is placed under the aegis of the Ministry in charge of industry and energy in Tunisia. It is managed by a Joint Consultation Committee representing different concerned Departments.

The mission of INNORPI is to undertake all activities related to standardization and to quality of goods and services, which support the protection of industrial property. Accordingly, INNORPI is responsible for:

- ✓ drawing up, in cooperation with concerned bodies, the General Program of standardization, setting up technical standardization committees, organizing their work within INNORPI, and acting as the secretariat of these committees. INNORPI is also the National Information Point on standards.
- ✓ certifying the conformity of products and services as well as the management systems.
- ✓ granting patents, registering brand names, trademarks and service marks as well as industrial designs and patterns, receiving and registering any titles relating to industrial property rights.

INNORPI represents Tunisia at the International Organization for Standardization (ISO), the International Electro Technical Commission (IEC), and the World Intellectual Property Organization (WIPO).

Through its technical committees, INNORPI is developing and adopting international standards for RE and EE. For instance, the TC 67 for solar energy is mandated to develop standards for: PV System - PV Inverters - Solar Heating Storage Balloons - Solar Thermal Sensors - Solar Water Heaters - PV Devices - Accumulators for Storage of Renewable Energy - PV Modules - Battery Charge Controllers for PV Systems - PV Pumping Systems - PV Concentrator (CPV).

### b. National Certification Body

The INNORPI is the only public certification body in Tunisia. Its certification system for products is developed in accordance with the ISO/IEC 17065 and ISO/IEC 17067 standards. In practice, certification can adapt to the client's request and issued according to the certification programs for the areas of competence of INNORPI.

Regarding energy services accreditation, INNORPI is granting certificates of conformity for the ISO 50001 and ISO 17024. With regard to products, INNORPI is involved in MEPS and labelling activities for household electrical appliances in coordination with the concerned national authorities and involved also in developing a regional label for solar thermal products in line with the ISO/IEC 17065.

An ambitious ISO 17065 accreditation project for the certification schemes of some products was launched at INNORPI.

### c. National Accreditation Body

**The National Council of Accreditation (TUNAC):**
The National Council of Accreditation (TUNAC) is a non-administrative public institution with moral and financial autonomy. TUNAC's main task is to evaluate and accredit conformity assessment bodies (laboratories, inspection and certification bodies) according to relevant national and international standards.

Since 2008, TUNAC has signed mutual recognition agreements with ILAC (International Laboratory Accreditation Cooperation) and EA (European Cooperation for Accreditation) for the accreditation of laboratories for analysis, testing and calibration. TUNAC is also a signatory of the mutual recognition agreements with IAF (International Accreditation of Forum) and EA for the accreditation of certification bodies for Quality and Environmental Management Systems.

### d. National Metrology Institute

**Agence Nationale de la Métrologie (ANM):**
The Tunisian agency for metrology (ANM) is a public non-administrative entity, that was created in 2009, with a specific mission to:

1. Implement the strategic orientations for the development of the national policy in metrology.
2. Develop metrology standards and technical guides, and publish them in coordination with the National Institute for Standardization and Industrial Property (INNORPI).
3. Lay down the requirements necessary for the establishment and realization of national standards, which make it possible to reproduce the units of measurement of the international system of “SI” units that can be materialized.
4. Ensure the connection of measuring instruments to national standards.
5. Carry out the import and export files of measuring instruments.

### e. National Testing and Calibration Laboratories Body

**Centre Technique des Matériaux de Construction, de la Céramique et du Verre (CTMCCV) :**
The CTMCCV was established in 1982 as an entity of economic interest with legal personality and financial autonomy. In terms of RE and EE testing and calibration means, the CTMCCV disposes of a laboratory of thermal and energy performance for buildings.

The laboratory of thermal and energy for buildings (LATEB) resulted from a fruitful cooperation between CTMCCV and ANME, as part of the implementation of the national energy management policy, related to thermal and energy regulations for buildings, as well as of the promotion of renewable energies across the country. The main mission of the LATEB laboratory is testing and

verifying the thermal quality and energy performance of materials, products and equipment used in RE and EE sector.

**Figure 38:** LATEB Solar thermal Lab in Tunisia

LATEB is mainly composed by 5 testing labs:

- Solar thermal laboratory for durability and performance tests of solar collectors according to ISO 9806 and systems according to EN 12975.
- Solar Photovoltaic Laboratory for the safety of the systems and design tests according to IEC 61215 & IEC 61730.
- Laboratory for thermo-physical characterization of materials, for thermal resistance tests of insulation materials.
- Laboratory portable device (Building diagnostics,...)
- Training and technology intelligence unit.

LATEB laboratory performed more than 70 tests for solar energy equipment since its launching in 2009. Moreover, LATEB offers training activities for RE and EE professionals in different area of activities, especially in thermal regulation applications and insulation materials installers.

Recently, LATEB started an accreditation procedure according to the ISO/IEC 17025 in collaboration with TUNAC, and with the support of the PTB program for strengthening the solar energy quality infrastructure in the Maghreb countries.

In relation to its activities and mission, the CTMCCV has concluded a collaboration agreement with CETIME (Centre technique des industries mécaniques et électriques) in order to join forces and conduct the necessary energy performance tests for electrical appliances (Air Conditioners, washing machines, refrigerators, electrical lamps) in CETIME test labs.

# 4. QI Benchmarking Analysis in SEMCs

As a result of the prior identification and assessment of all quality infrastructures for defined RE and EE products and services in the eight targeted countries, a standardized approach was developed and applied to evaluate the quality of the local market in each country. This methodology consists in attributing a score for each country, according to the existing institutions in the national context, and the interaction among the defined quality infrastructure elements.

The final results will be used as weighting factors and references to prioritize the activities supporting the RE and EE quality control system in each country, then selecting the most appropriate and effective support tools and measures to upgrade regionally the RE and EE quality market level.

## 4.1 Existence of Key QI components at the national level

**Figure 39:** Analysis of the key QI elements existed in SEMCs

| National QI elements | Algeria | Egypt | Jordan | Lebanon | Libya | Morocco | Palestine | Tunisia |
|---|---|---|---|---|---|---|---|---|
| ***Standardization*** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| ***Metrology*** | ✓ | ✓ | ✓ | - | - | ✓ | ✓ | ✓ |
| ***Accreditation*** | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ | ✓ |
| ***Certification*** | ✓ | ✓ | ✓ | ✓ | - | ✓ | ✓ | ✓ |
| ***Testing & Calibration*** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | ✓ |
| ***Inspection*** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

In terms of existing quality infrastructure elements able to perform quality control activities on the local markets, the preliminary analysis of the institutional capabilities in the region shows that almost all countries possess the main

pillars, such us standardization bodies, and inspection services which are provided in house by the certification entities, except for Libya where the LNCSM provides inspections to grant the national Libyan Quality mark. LNCSM performs also limited metrology activities through its metrology department, in the absence of a clear regulatory evidence for that.

National accreditation councils are in place in the eight countries, except for Lebanon where the accreditation services are provided by foreign recognised actors. For testing capabilities, all SEM countries have national testing and calibration laboratories dedicated for main RE and EE products and systems, excluding Palestine.

## 4.2 Quality Control Factors of RE and EE Products and Services

In order to link the responses collected through surveys to the main points needed to describe the markets stages and to identify the major characteristics of the RE and EE quality control system in a country in relation to its institutional abilities, a scoring approach was conceived describing the essentail stregnths and needs at the country level. This approach focuses on weighting particular factors, which are:

1. **Development of national standards**: Based on the availability of national RE and EE technical committees, and the membership to regional or international TC for standards developement.
2. **Adoption of international standards**: Based on the ability to adopt RE and EE relevant standards.
3. **Management of the conformity assessment process**: Based on the availability of a national or regional RE or EE conformity assessment scheme, and on the interaction among entities to manage it (if applicable).
4. **Accreditation to conformity assessment bodies**: Based on the accreditation status of the conformity assessment entities. Three accreditation types will be taken into consideration here, which are the ISO/IEC 17065 for the certification body, the ISO/IEC 17020 for the inspection body and the ISO/IEC 17025 for the testing laboratory.
5. **Testing Capabilities**: Based on the number and type of products' and systems' technology that can be tested according to RE and EE international relevant standards. Eight technologies will be taken into account

here, which are: Solar PV, Solar Thermal, ACs, Refrigerators, Washing machines, Lamps, electrical water heaters and insulation materials.

To draw a clear picture about the current level of the regional quality infrastructure in the SEM countries according to the above factors, a scoring benchmark system was applied to the contexts of the eight countries. The results of the final evaluation are summarized below:

**Figure 40:** Scoring of Quality Infrastructure Assessment factors for defined RE and EE Products and services

| RE-EE QI factors | | Algeria | Egypt | Jordan | Lebanon | Libya | Morocco | Palestine | Tunisia |
|---|---|---|---|---|---|---|---|---|---|
| Development of National RE and EE standards (1) | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 |
| Adoption of international RE and EE standards (1) | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| Management of the RE-EE conformity assessment process (1) | | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| Conformity assessment bodies accreditation (3)[4] | CB (1) | 0 | 0.5 | 1 | 0 | 0 | 0.5 | 0 | 0.5 |
| | IB (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | TL (1) | 0.5 | 0.5 | 1 | 0.5 | 0 | 0.5 | 0 | 0.5 |
| Testing capabilities by type of technology (4)[5] | Solar PV (0.5) | 0.5 | 0.5 | 0.5 | 0 | 0.5 | 0.5 | 0 | 0.5 |
| | Thermal Solar | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0 | 0.5 |
| | AC | 0 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 0.5 |
| | Refrigerator | 0 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 0.5 |
| | Washing Machines | 0 | 0.5 | 0.5 | 0 | 0 | 0 | 0 | 0.5 |
| | Lamps | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.5 |
| | Electrical heaters | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Insulation materials | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0.5 |
| **Final Score** | | **4.5** | **8** | **7.5** | **3** | **2** | **5** | **0** | **7.5** |

(4) Score of 1 point is attributed for each accreditation certificate, and 0.5 if the accreditation process is ongoing.
(5) Score of 0.5 point is attributed for each technology testing laboratory.

The interpretation of the evaluation results shows that Egypt, Jordan and Tunisia are leading in the region in terms of advanced operational quality infrastructure for the RE-EE defined products and services. Jordan has the most accredited conformity assessment bodies, while Egypt and Tunisia have the most developed infrastructure for testing capabilities. Morocco and Algeria are in an intermediate stage toward upscaling the level of their national quality infrastructure, since what seems to be needed at this stage is the enhancement of testing facilities for household appliances.

For Lebanon and Libya, a special focus needs to be put on the institutional framework, reaffirming the need for rules establishing a solid national quality control system, with a clear distribution of roles and responsibilities among the main quality infrastructure actors, as well as enhancing the national testing and certification abilities. Regarding Palestine, the local RE and EE quality market is still untouched, and important efforts are required at all levels to establish an operational conformity assessment system for RE and EE products.

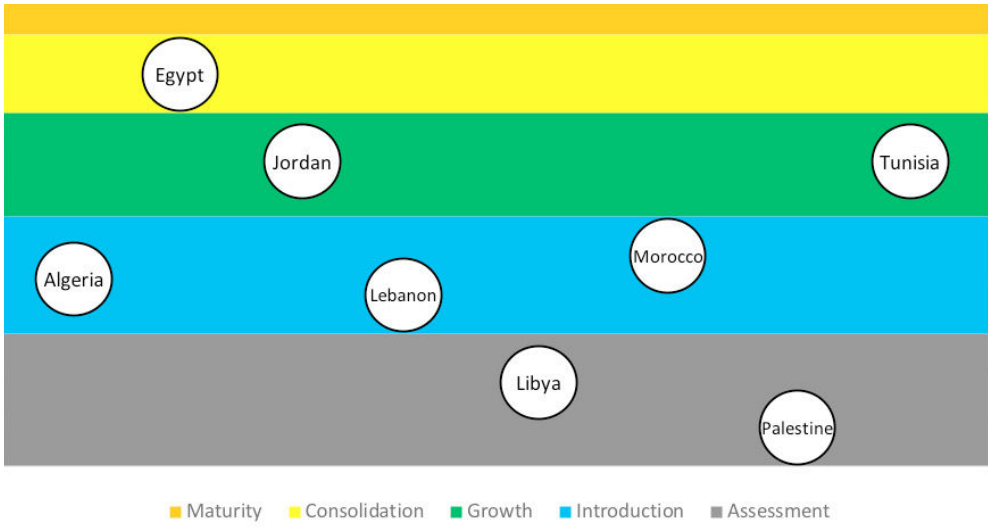
## 4.3 Definition of the Quality Infrastructure Market Stages

**Figure 41:** Rating Scale of the QI Market Stages

| Market Stage | Assessment | Introduction | Growth | Consolidation | Maturity |
|---|---|---|---|---|---|
| **Minimum Score** | 0 | 2.5 | 6 | 8 | 9 |
| **Maximum Score** | 2.4 | 5.9 | 7.9 | 8.9 | 10 |

In reference to the market stages detailed in the paragraph 2.5 “Quality Infrastructure Incorporation in RE-EE market” and based on a standardized methodology for RE QI assessment developed by international experts in energy standardization (IEC technical committees), the above scaled rating is attributed to each market stage in order to evaluate the scores of each country according to that scale, and then weight the national QI level according to its relevant level of development. The final countries’ categorization is presented below:

**Figure 42:** Quality Infrastructure Market Stages in SEMCs




The classification of the countries shows that **Egypt** belongs to the 4th stage of consolidation, which reflects the availability of significant standardization measures encouraging the improvement of RE and EE quality management for the local manufacturing capabilities.

The **Jordanian** and **Tunisian** markets are associated to the growth stage, because the national technical committees are in line with the RE and EE standardization activities, and the acceptable level of their testing means that serve the limited local manufacturing in the RE field, especially for Tunisia.

The **Moroccan** and **Algerian** quality infrastructure markets fit in the 2nd stage, since the testing facilities are under commissioning. Also, the certification management system is in place and has been developed with the assistance of the PTB program, in order to boost the lower RE and EE manufacturing capacities in both countries.

Despite being also at the initial stage, **Lebanon** is still requiring more efforts to get a clear regulatory framework managing the quality control system between all conformity assessment entities at the national level.

For **Libya** and **Palestine**, the interpretation shows that their markets correspond to the 1st assessment stage, because there are no dedicated standardization committees for RE and EE, neither RE or EE certification systems, nor local manufacturing capacities are available.

# 5. Success Stories and Good Practices

## 5.1 PTB Program about Strengthening Quality Infrastructure for Solar Thermal Energy in the Maghreb Countries

### a. About PTB

The Physikalisch-Technische Bundesanstalt (PTB) is the National Metrology Institute of Germany. Founded in 1887, PTB is Germany ‘s highest authority when it comes to accurate metrology. PTB stands for progress and reliability in metrology for the benefit of society, trade, industry, and science.

PTB is among the top names in metrology worldwide and in this sense a real “global player”. As National Metrology Institute working also in international cooperation, PTB is committed to the development policy of the German Government and acts according to the Sustainable Development Goals of the United Nations. One of the major tasks, that PTB is mandated to perform, is to eliminate technical barriers to trade and standardize metrology, based on which the PTB international cooperation department was established.

The International Cooperation department of PTB supports developing and emerging countries to develop and apply an internationally recognized quality infrastructure that has been tailored to suit the countries ‘needs. PTB ‘s international cooperation is based on the belief that quality infrastructure is essential for our daily lives: for free, fair, and safe trade, for reliable and safe health care, for environmental protection and for the expansion of renewable energies.

### b. Project Objective and Approach

The regional project "Strengthening Quality Infrastructure for solar thermal energy in the Maghreb" falls among the 45 cooperation projects that PTB is running in more than 83 countries in the world, with the perception that expanding quality infrastructure and upgrading technology to provide clean and more efficient energy in all countries is a main pillar to encourage growth and help the environment.

PTB 's objectives entail to further develop the quality infrastructure for solar thermal energy in the Maghreb countries and to improve its cooperation with training institutes. Consequently, quality assurance services for solar thermal energy systems will be provided to institutes, responsible for the implementation of promotion programmes and to the companies of this sector.



The project is realized in close cooperation with other partners and is financed by the German Federal Ministry for Economic Cooperation and Development, BMZ. The project has a budget of 4 Million Euros for 2 phases: phase 1 ran from 2012 to 2016, Phase 2 has been running from 2016 and it will end in 2020. The implementation is in three partner countries: Algeria, Morocco, and Tunisia. During the first phase, Mauritania was also a partner country.

The partner institutions in the three countries include: Metrology laboratories - National standards institutes - Testing laboratories - Certification bodies - Universities and Research institutes - National Accreditation bodies.

The project is composed of four fields of intervention, namely:

- **Testing**: Improvement of conformity tests for solar water heating systems according to international standards.
- **Metrology**: Improvement of metrological traceability in this field (flowmeters; pyranometers; anemometers).
- **Certification**: Support to the selection, harmonization, and introduction of a certification system for solar water heaters.
- **Universities**: Enhancement of education on quality infrastructure in the solar energy sector.

The activities of the projects include the training of personnel and management staff of the participating institutes (technology centres, calibration and testing facilities, standardization bodies) and the provision of technical advice by regional and international experts.

In this way, the practical knowledge is transmitted and the partners are supported in its practical implementation. Involving all partners in the specific measures elaborated at the regional level allows not only to gain knowledge but also to reinforce the links established within the scope of the previous project in order to strengthen regional exchange.

### c. Expected Impact and outcomes

Due to the availability of competent experts, as well as of reliable measuring instruments and approved testing services, customers' confidence in solar thermal energy will be increased. In addition, by choosing a certification system – ideally, one harmonized at the regional level – the basis for an increased market transparency regarding the quality of solar water heating systems will be formed. As a result, many users more will benefit from the support programmes for solar water heaters; hence, the demand for those systems will increase. The replacement of conventional systems with solar water heaters will help to reduce CO2 emissions and increase the percentage of renewable energy sources in this region.

The strengthening of infrastructure and quality assurance will help increase the durability of solar water heating systems, also improving their environmental balance to a greater extent. University graduates who specialized in this sector will improve their chances of successfully holding a skilled job. At the same time, they will integrate the aspects of quality assurance even further into their work, thus contributing to higher product and service quality, as well as improving the competitiveness of the solar energy sector in the Maghreb.

# 5.2 SHAMCI Regional Certification Scheme for RE products

### a. About SHAMCI

Although the Arab region is located in the global Sun Belt making it one of the richest regions in solar energy, the solar water heating potential remains untapped in most Arab states. A study conducted on the SWH market in the Arab region showed that there is a significant lack of quality control for the SWHs market, which damaged the reputation of the technology, and lowered consumers' confidence.

The Solar Heating Arab Mark and Certification Initiative (SHAMCI) is the first Arab certification scheme for solar thermal products and services in the Arab region. The project provides a regional industrial and regulatory compliance framework for policy makers, industrial sector, and end-consumers.

Inspired by the European Solar Keymark program, SHAMCI is built around specific characteristics and needs of the Arab states in the Middle East and North Africa. The project was initiated by the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) with the support of the Arabian Industrial Development and Mining Organization (AIDMO), based on the request of the Arab Ministerial Council of Electricity (AMEC) of the Arab League.

SHAMCI promotes the adoption of standard quality measures, accreditation systems and quality labels across the Arab region. It is mainly developed to benefit consumers of solar thermal products and services, manufacturers and authorities in the Arab region. SHAMCI-labeled products combine international standards with regional specific characteristics, thus assuring products high quality, safety, reliability, durability and high performance.

### b. SHAMCI Structure and Management

**SHAMCI Network:** The SHAMCI Network is composed by international stakeholders and is responsible for developing and running SHAMCI. The members of the network are representatives from energy authorities, the industrial

sector, certification bodies, testing and inspection bodies, but also consumers, NGOs, international organizations, and other concerned stakeholders.

**Figure 43:** 5th SHAMCI Network Meeting - Oct 2016, Cairo

The membership to the Network includes 3 types/ levels:

- Official representatives,
- Observers,
- Private sector

The members are in charge of the following activities:

- Developing and updating the certification standards and scheme.
- Harmonizing certification practices and processes.
- Approving and listing certified products.
- Organizing regular network meetings and facilitating communication between stakeholders (in general twice a year).
- Selecting, verifying, and monitoring test laboratories and ensuring results accuracy.

SHAMCI Network provides a platform for regional solar thermal stakeholders to engage in policies design and knowledge exchange.

**SHAMCI Secretariat:** The SHAMCI Secretariat is managing and supporting the SHAMCI Network. It is hosted by the RCREEE, which is acting as the legal body for the SHAMCI Network. The SHAMCI Secretariat, in coordination with the Chairman of the Network, is representing the Network and can sign agreements at regional and international level. The SHAMCI Secretariat manages the budget of the Network and of the Secretariat in terms of revenues and expenses and prepares the financial and technical reports to be presented to the network in the periodic meetings.

### c. Solar thermal products certification process according to SHAMCI

The requirements for SHAMCI certification of solar collectors and solar water heaters are given by SHAMCI Certification Scheme Rules, elaborated by the SHAMCI Network, and defining the test methods to be used to check if requirements are fulfilled. Issuing SHAMCI will depend on the following bodies:

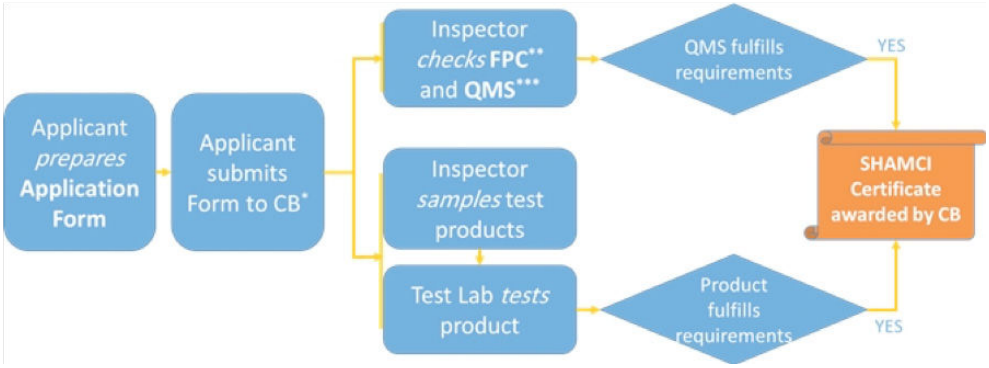
- **Inspection Bodies:** responsible for collecting product samples according to specific reports and pass it to testing labs.
- **Testing Laboratories:** responsible for performing product testing procedures and determine their applicability to be granted the SHAMCI mark.
- **Certification Bodies:** responsible for awarding the SHAMCI mark.

SHAMCI scheme covers the following products:

- **Solar thermal collectors,** as defined in scope of ISO 9806 (latest version).
- **Solar water heating systems,** as defined in scopes of ISO 9459-2 and ISO 9459-5 (latest version).

For solar thermal industrials in the countries where SHAMCI scheme is implemented that try to test the quality of their products, the following diagram is an easy and approachable guide of how to obtain a SHAMCI mark:

**Figure 44:** SHAMCI Certification Process




** CB: Certification Body*

*** FPC: Factory Production Control*

**** QMS: Quality Management System*

There are three main phases to obtain a SHAMCI Certificate as per below:

**Figure 45:** Submission Process for SHAMCI Certification

| Phase | Involved Parties | Procedure | Outcomes |
|---|---|---|---|
| **1. Application** | Certification body (CB)<br><br>The applicant company | 1- The applicant company contacts the national SHAMCI authorized CB to inquire the required application documents.<br>2- The applicant fulfils the application requirements, prepares the required documentation, pays the application fees and delivers the fully application to the CB. | - The application folder is received by the certification body.<br><br>- The procedure for conformity assessment starts. |

| | | | |
|---|---|---|---|
| **2. Conformity Assessment** | Certification body (CB)<br><br>Inspection body (IB)<br><br>Testing Laboratory (TL) | 3- Inspection of the applicant's facility (the production lines and the applied quality management system).<br>4- Selecting valid samples of the product to be tested.<br>5- Testing the product samples. | - Inspection report<br>- Testing report<br>- Both reports are submitted by the IB and the TL to the certification body |
| **3. Certification** | Certification body | 6- Conformity check based on the testing and inspection reports, if the tested sample and the applicant's facility QMS are in accordance with SHAMCI standards requirements. | - In case of conformity ➜ SHAMCI certification is granted to the applicant<br>- In case of non-conformity ➜ informing the applicant about the refusal due to non-conformity. |

### d. SHAMCI Impetus in the SEM Region

Despite great potential of the SEM region for solar thermal energy, the solar thermal market is moving at a very slow pace, due to lack of technical expertise, insufficient policy framework and limited funding resources to support the industry. Previous studies have shown that poor quality and reliability have had an impact on the reputation of SWH manufacturers and suppliers in Egypt for example. Another example is Jordan, where the national action plan targets an optimistic SWH market share going to more than 20 % by 2020.

Earlier in 2017, RCREEE and the Egyptian Organization for Standardization and Quality (EOS) signed a cooperation agreement authorizing EOS to award "SHAMCI" quality certification for solar thermal products in Egypt as the certification body. Four Egyptian solar water heaters manufacturers submitted a request for the mark. Recently, EOS granted the SHAMCI mark to NOVA company in Egypt (200L locally manufactured SWH) that fulfilled SHAMCI standards.

**Figure 46:** SHAMCI Implementation Activities Across SEM Region

Later in 2018, RCREEE signed the second cooperation agreement with the Jordanian Standards and Metrology Organization (JSMO), which made it the official certification body to issue “SHAMCI” quality mark in Jordan. Accordingly, JSMO became the second Arab certification body following the EOS in Egypt. As a result, the Jordanian Official Gazette published JSMO Board of Directors’ decision to endorse and grant SHAMCI mark for solar thermal systems. The decision highlights the qualifications needed for obtaining the SHAMCI mark in the Kingdom, the details of the application process and the relevant committees. Besides, it clarifies all the relevant fees to granting and obtaining SHAMCI for a two-year period, to be renewed after.

Now, after having the SHAMCI certification scheme been adopted both in Egypt and Jordan, this will surely help enforce existing policies on clean-tech industry in both countries, especially considering that the Global Solar Certification Network has recognised SHAMCI scheme as the official quality mark for the Middle East and North Africa area.

SHAMCI-labelled products will ensure top quality, safety, reliability, durability and high performance in the growing target markets, which will help authorities improve customers' confidence, facilitate regional collaborations, eliminate trade barriers and promote compliance with industrial quality standards and monitoring. SHAMCI will also benefit manufacturers, as it standardises product testing, guaranteeing high-quality products without upping costs.

With the objective of ensuring and harmonizing the quality assurance of solar thermal products across the Arab region, SHAMCI remains open to all interested countries. It is clear that the successful implementation of SHAMCI depends on the quality infrastructure status of each country, accordingly, and after starting with Egypt and Jordan, RCREEE is expecting to implement and operate SHAMCI in Lebanon and Tunisia shortly, based on their institutional capacities and readiness, since it is a government-supported programme. Also, with the same perspective in mind, Algeria and Morocco are the next targeted countries to follow their neighbours towards a SHAMCI harmonized solar thermal market in the region.

## 5.3 PA-CEMP Regional Certification Program for EE Personal

### a. About PA-CEMP

PA-CEMP
Pan Arab Certified Energy Management Professional

Over the years, the importance of energy efficiency has steadily increased in the Arab countries posing itself as a key element of the Arab political agenda. Policy makers are progressively recognizing energy efficiency as a suitable and vital means to address the triple challenge of economic recovery, energy dependency and climate change.

The successful execution of energy efficiency plans relies on highly skilled and well-trained workforce and experts. RCREEE in collaboration with the Energy Department of the League of Arab States assessed the need to introduce the "Pan-Arab Certified Energy Management Professional" program (PA-CEMP). Through a standardized training program, PA-CEMP aims to equip Arab energy managers with solutions to reduce the energy consumption in a cost-effective approach. This would support Arab countries in planning and implementing EE plans and related measures as well as in achieving energy targets.

The Pan Arab Certified Energy Management Professionals program (PA-CEMP) is an in-depth professional certification program for Energy Managers tailored for the Arab region. The Executive Bureau of the Arab Ministerial Council of Electricity endorsed the program during its 32th session on 31 May 2016.

### b. PA-CEMP Objective and Approach

PA-CEMP aims to assist EE policy makers and program administrators in planning and implementing EE programs and measures in the Arab region, through:

- Raising the professional standards of those engaged in energy management and, hence, energy efficiency;
- Identifying individuals with acceptable knowledge of the principles and practices related to energy management as well as of the laws that govern and affect energy managers by completing an examination and fulfilling prescribed standards of performance and conduct.
- Providing energy managers with necessary experience to develop energy management activities.
- Award special recognition to those energy managers, who have demonstrated a high level of competence and ethical fitness for energy management through endorsed certificates.
- Assisting the implementation of local and regional laws and regulations, which specifies the qualifications of the service provided, relevant to energy saving, and energy management.

### c. PA-CEMP Structure and Management

PA-CEMP is managed by board members from the secretariat of the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) and the Arab Ministerial Council for Electricity. The PA-CEMP Secretariat is mandated to undertake the following tasks:

- Collect applications and conduct background checks;
- Contract trainers, consultants and training institutions;
- Organize PA-CEMP trainings, exams and certificate renewals;
- Endorse exam results and award certificates;
- Determine and Manage PA-CEMP legal, financial and contracting matters;
- Promote PA-CEMP and develop marketing materials;
- Deliver progress reports to PA-CEMP board.

### d. Technical Content

**Electrical Energy:**

- This section tackles all matters related to electrical systems in terms of production, distribution and consumption within all kinds of facilities.

**Thermal Energy:**

- This part reviews the engineering principles, application and energy conservation measures of the different thermal systems in industrial and commercial facilities.

**Energy Management:**

- PA-CEMP program focuses on developing a supporting management structure to enable deep efficiency improvement within the different industrial and building facilities. Some guidance will be provided on establishing an energy management system (EnMS) according to the requirement of ISO 500001.

**National Energy Policies:**

- PA-CEMP is distinguished by including national situation updates, where applicants are required to prove knowledge of their country energy status.

### e. PA-CEMP Certification process

PA-CEMP certification process goes as follows:

1. Submitting the application and the supporting documents proving the experience and educational background and level;
2. Application review by PA-CEMP Secretariat to determine the applicant's eligibility;
3. Payment of application fees as determined by PA-CEMP board upon approval;
4. Attending 4-day preparatory course and sit for PA-CEMP examination on the fifth day;
5. Granting PA-CEMP Certificate upon passing the examination.

Regarding the eligibility requirements, PA-CEMP criteria varies according to the speciality, degree and experience of each applicant. The applicants for PA-CEMP should be working full time in a governmental, commercial or industrial facility responsible for energy, operation, production or maintenance, or as Energy Service Provider, Energy Management consultant or Auditor. Furthermore, required years of experience varies according to applicants background as per the below table:

***Figure 47***: PA-CEMP Eligibility Criteria and Years of Experience

| Categories | Education Degree | Required Experience |
|---|---|---|
| 1 | Applicants holding **engineering** degree | **3-year** experience in energy engineering/management |
| 2 | Applicants holding a **non-engineering** degree | **5-year** experience in energy engineering/management |
| 3 | Applicants holding a **technical** degree | **8-year** experience in energy engineering/management |

According to PA-CEMP rules, the examination is a 3-hour live exam that covers the whole content of the preparatory course. Minimum Score of 70% is required to be granted a PA-CEMP certificate valid for two years. The evaluation is conducted by a team of experts determined by PA-CEMP secretariat according to specific criteria.

After two years, the certification ought to be renewed. For the PA-CEMP certificate renewal, the applicant needs to:

1. Demonstrate the continued employment in energy management/engineering field;
2. Be a member of energy/engineering related association;
3. Submit an energy management/engineering case study.

### f. PA-CEMP Facts and numbers across the SEM Region

Since November 2017, several PA-CEMP certification rounds have taken place in the SEM Region, often in cooperation with the national associations of engineers, and engineers training centers. More than 32 rounds were organized by RCREEE in Cairo, Amman, Tripoli and Beirut, under the auspices of the energy ministries and agencies respectively in Egypt, Jordan, Libya and Lebanon. About 300 energy practitionners from all Arab countries were granted the PA-CEMP certificates since then, with a global completion rate of 60%.

**Figure 48:** PA-CEMP Certification Round in Egypt

Following the successful execution of the previous sessions, and as next steps to further develop the program, RCREEE is targeting the duplication of the program in other countries of the region. In November 2019, RCREEE and the Order of Tunisian Engineers (OIT) concluded a principal co-operation agreement in preparation for the implementation of the Pan Arab Certified Energy Management Professionals (PA-CEMP) program in Tunisia. Conjointly, RCREEE is currently preparing to launch new similar certification programs in several disciplines, as required by the RE-EE driven market in the SEM region.

# 6. Conclusion and Recommendations

In cooperation with the Algerian National Agency for the Promotion and Rationalization of Energy Use (APRUE), RCREEE has organized a regional consultation workshop on Quality Infrastructure for RE & EE Products and Services held in October 2019 in Algiers, as part of its involvement in the activities of the meetMED Project.

Based on the different consultations conducted with eminent national and regional experts running the quality institutions across the SEM region, and as defined in the questionnaires completed by the relevant QI bodies representatives from the targeted countries, several recommendations were generated.

Involved participants were mainly national experts from conformity assessment bodies, metrology institutes, standardization organizations and accreditation councils from some of the meetMED target countries (Algeria, Egypt, Libya, Morocco and Tunisia), who genuinely discussed the issues and challenges in the field of standardization, certification and testing in their respective countries.

**Figure 49:** meetMED QI Regional Consultation Workshop - OCT 2019, Algiers

External regional and international experts contributed with their national and regional experiences and initiatives as well (i.e. Quality assurance systems in the EU), in order to contribute to the formulation of recommendations towards the development of a regional quality market

The overall comprehensive opinions focused on considering the market strengths identified during this study, and built up on the specific weaknesses at country level (especially regulatory and institutional frameworks in some countries). Bilateral and multilateral cooperation opportunities for the region were also boosted, for the sake of harmonizing the quality assurance mechanisms among the SEMCs.

In conclusion, the formulated policy recommendations for developing a regional quality market for RE and EE goods and services, and its implementation later on in the SEM target countries, are summarized as follows:

1. Accelerating and continuing the collaboration among countries, and with the relevant regional organizations, in a regular manner so as to update the situation of the assessed markets.
2. Support the operational concept of developing a regional quality infrastructure all over the region as well as the comprehensiveness of the quality assurance according to the existing systems and current needs, in line with the level of market development.
3. Suggest to the EU commission to continue supporting this activity and converting it into a sustainable working group where it is possible to share knowledge and competences bilaterally between Southern and Northern Mediterranean countries.
4. Prioritize the renewable energy and energy efficiency products and services, focusing on the development of new quality assurance mechanisms for highly used products, mainly the air-conditioning quality schemes.
5. Harmonize standardization, certification and testing procedures for the concerned RES-EE products and services and support the alignment of the accreditation processes in order to make the steps clearer, and easy between different countries.
6. Endorse the interrelation exchange between quality and energy concerned agencies in the countries, favoring growth in trade supporting the local industrial development and future economic planning.

7. Encourage research and development activities to develop RE-EE standards and labels more suitable to the SEM regional context for energy and industry.
8. Support the design of a regional training package for quality in RE and EE services, with focus on systems installation and maintenance in order to elaborate guidelines and tools harmonized at the regional level.
9. Establish awareness raising campaigns, and public relations protocols to ensure the knowledge transfer to consumers and end users, thus helping them to make informed choices for RE-EE systems, products and services.
10. Ensure confidence among involved parties/partners and continuous peer-to-peer exchange particularly in the framework of the international and regional organizations composed by national relevant institutions.

# ANNEX - List of Relevant Standards

| Standard Reference | Standard Name |
|---|---|
| **ISO/IEC 17000** | Conformity assessment — Vocabulary and general principles |
| **ISO/IEC 17020** | Conformity assessment — Requirements for the operation of various types of bodies performing inspection |
| **ISO/IEC 17021** | Conformity assessment - Requirements for bodies providing audit and certification of management systems. |
| **ISO/IEC 17025** | Conformity assessment - General requirements for the competence of testing and calibration laboratories. |
| **ISO/IEC 17024** | Conformity assessment - General requirements for bodies operating certification of persons. |
| **ISO/IEC 17065** | Conformity assessment - Requirements for bodies certifying products, processes and services. |
| **ISO 9806** | Solar energy - Solar thermal collectors - Test methods. |
| **ISO 9847** | Solar energy - Calibration of field pyranometers by comparison to a reference pyranometer. |
| **IEC 61215** | Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Special requirements for testing of crystalline silicon photovoltaic (PV) modules. |
| **IEC 61730** | Photovoltaic (PV) module safety qualification - Requirements for construction and testing. |
| **EN 12975** | Thermal solar systems and components - General requirements for solar collectors. |
| **EN12976** | Thermal solar systems and component - General requirements for Factory made systems. |
| **BS EN 14825** | Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling. Testing and rating at part load conditions and calculation of seasonal performance. |
| **BS EN 14511** | Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors. Terms and definitions. |
| **BS EN 60456** | Clothes washing machines for household use. Methods for measuring the performance. |
| **BS EN 62552** | Household refrigerating appliances. Characteristics and test methods. |
| **ISO 50001** | Energy Management |

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- Centre for Solar Energy Research and Studies (CSERS) https://csers.ly
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- Egyptian Accreditation Council – EGAC: http://www.egac.gov.eg
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- Institut Marocain de Normalisation – IMANOR : https://www.imanor.gov.ma
- Institut National de la Normalisation et de la Propriété Industrielle - INNORPI: http://www.innorpi.tn
- International Accreditation Forum - IAF: https://www.iaf.nu
- International Laboratory Accreditation Cooperation - ILAC: https://ilac.org
- International Renewable Energy Agency - IRENA Inspire: http://inspire.irena.org/Pages/qualityassurance/qualityassurance.aspx
- International Standards Organization – ISO Glossary: https://www.iso.org/glossary.html

- ISO/IEC 17000:2004 (EN) Conformity assessment — Vocabulary and general principles (Preview): https://www.iso.org/obp/ui/#iso:std:29316:en
- Jordan Standards and Metrology Organization - JSMO: http://www.jsmo.gov.jo
- Jordanian Accreditation and Standardization System - Accreditation Unit - JAS-AU: http://www.au.gov.jo/AU
- Laboratoire Public d'Essais et d'Études - LPEE http://www.lpee.ma
- Lebanese Standards Institution - LIBNOR: http://www.libnor.gov.lb
- Lebanese Ministry of Economy and Trade: https://www.economy.gov.lb/en/services/quality-unit---qualeb/activities/accreditation https://www.economy.gov.lb/en/services/quality-unit---qualeb/activities/metrology
- Libyan National Centre for Standardization & Metrology – LNCSM: https://lncsm.org.ly/wp
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