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THE WORLD BANK

ESMAP
Energy Sector Management Assistance Program

JOB CREATION AND SKILLS DEVELOPMENT DURING THE ENERGY TRANSITION - MOROCCO

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1818 H Street NW, Washington, DC 20433 USA

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Cover: Jamaa el Fna market square, Marrakesh, Morocco.

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Acronyms and abbreviations

AMEE	Agence marocaine pour l'efficacité énergétique / Moroccan Agency for Energy Efficiency
AMISOLE	Association Marocaine des Industries Solaires et Eoliennes / Moroccan Association of Wind and Solar Industries
ANAPEC	Agence national de promotion de l'emploi et des compétences / National Agency for the Promotion of Employment and Capacity
ANRE	Agence nationale de régulation de l'electricité / National Agency for Electricity Regulation
CMC	Cité des métiers et des compétences / Center for Skills and Jobs
CSP	concentrated solar power
CESE	Conseil economique social et environmental marocain / Moroccan Economic, Social, and Environmental Council
CNRST	Centre national de recherche scientifique et technique / National Center for Scientific and Technical Research
EPC	engineering, procurement, and construction
ESMAP	Energy Sector Management Assistance Program
HCP	Haut commissariat au plan / High Commission for Planning
GDP	gross domestic product
GIZ	German Agency for International Cooperation
GW	gigawatt
IRESEN	Institut de recherche en énergie solaire et énergies nouvelles / Research Institute for Solar Energy and New Energy
IFMEREE	Institut des métiers des énergies renouvelables et de l'efficacité énergétique / Training Institute for Renewable Energy and Energy Efficiency Jobs
MASEN	Moroccan Agency for Sustainable Energy
MENA	Middle East and North Africa
MEAS	Ministère de l'emploi et des affaires sociales / Ministry of Employment and Social Affairs
MTEDD	Ministère de la transition énergétique et du développement durable / Ministry of Energy Transition and Sustainable Development

MW	megawatt
OFPPT	Office de la formation professionnelle et de la promotion du travail / Office of Vocational Training and Job Promotion
O&M	operation and maintenance
ONEE	Office national de l'électricité et de l'eau potable / National Electricity and Clean Water Office
PPP	public-private partnership
PV	photovoltaic
R&D	research and development
RTCM	Règlement Thermique de Construction au Maroc / Moroccan Thermal Construction Regulation
SIE	Société d'ingénierie énergétique / Energy Engineering Company; Société d'Investissements Energétiques / Energy Investment Company
SMEs	small and medium enterprises
TVET	technical and vocational education and training
VSMEs	very-small-, small-, and medium-sized enterprises

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The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and 24 partners to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and programs to achieve the WBG Climate Change Action Plan targets.

This report on Morocco is one of three country case studies under Phase 2 of the umbrella project called **The Disruptive Energy Transition and Opportunities for Job Creation in the Middle East and North Africa**. Made possible by funding from ESMAP and the Climate Support Facility, this project was initiated in 2019 in response to requests from various Middle East and North Africa (MENA) governments to explore the nexus between the clean energy transition and employment. Phase 2 of the umbrella project was led by Tu Chi Nguyen and Ashok Sarkar (MENA Energy and Extractives Global Practice, World Bank) and includes Alpha Balume, Cornelia Jesse, Manjula Luthria, and Yao Zhao.

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Questions on this report may be directed to Tu Chi Nguyen (tnguyen19@worldbank.org), Ashok Sarkar (asarkar@worldbank.org), and Yao Zhao (yzhao5@worldbank.org).

EXECUTIVE SUMMARY

THE ENERGY TRANSITION IS A DRIVER FOR THE CREATION OF DECENT AND INCLUSIVE GREEN JOBS IN MOROCCO

The energy transition is expected to have a positive impact on the Moroccan labor market. It could create 25,000 net jobs per year over the period 2020–50.

Morocco holds a premier spot in the energy transition of the Middle East and North Africa (MENA) region (KAPSARC 2019). With its ambition to exceed 52 percent of renewable energy in its energy mix by 2030, Morocco has also set an indicative target of 80 percent by 2050 (MTEDD 2021), besides the goal of saving 30 percent of its energy consumption by 2030. The green job creation potential is considerable. The investments alone to meet the 2030 renewable energy and energy efficiency targets could support the creation of 25,000 net jobs per year over 2020–50, or 8.5 percent of the country's annual job shortfall, according to the results of Phase 1 of the current study, conducted by the World Bank (World Bank 2022). The strong job creation forecast is already tangible, with 68 percent of VSMEs (very small, small, and medium enterprises) in the clean energy sector planning to expand their workforce within three years.

THIS STUDY IDENTIFIES OPPORTUNITIES TO OPTIMIZE THE GREEN JOB POTENTIAL IN MOROCCO

It is in this context that the World Bank is assessing the opportunities for and challenges to achieving this job creation potential, helping countries formulate, adopt, and implement appropriate policies, incentive systems, infrastructure, institutions, programs, and human capital development frameworks. The goal is to create an enabling environment for job creation and transformation, particularly for developing the necessary green workforce for a clean energy transition. This report focuses on the renewable energy sector (solar photovoltaic, concentrated solar power, and wind) as well as on the energy efficiency of buildings. Besides providing inputs to clean energy and education projects, this study has also informed Morocco's recent Country Climate and Development Report (CCDR). The study has drawn on the following sources of information:

- Review of relevant literature and other similar studies to better understand national contexts.
- A total of 15 in-person interviews with public and private entities involved in the energy transition sector.
- An online survey of operational data from Moroccan renewable energy and energy efficiency companies, including their perceptions of the obstacles to job recruitment.
- The work carried out by the German Agency for International Cooperation (GIZ), within the framework of its analysis of the employment situation in renewable energy and energy efficiency VSMEs (GIZ 2022).

THE RENEWABLE ENERGY AND ENERGY EFFICIENCY SECTORS FACE SHORTAGES OF HIGHLY SKILLED WORKERS: SPECIALIZED TRAINING PROGRAMS ARE NEEDED

The analysis maps the jobs needed along the value chains for each phase of the development and operation of renewable energy or energy efficiency projects, from planning to decommissioning. New jobs created due to renewable energy and energy efficiency require specialized technical knowledge. While activities related to construction, installation, and operation and maintenance generate the vast majority of jobs today (62 percent among small and medium enterprises), the areas with strong growth potential are service activities (quality management, auditing, training, commercial services, and other services related to energy efficiency) and technical engineering activities. These are all specific professions and predominantly require high skills, which must be acquired through academic or dedicated vocational training programs.

Most jobs have synergies with conventional energy sectors. They will thus only require reskilling/upskilling of existing qualifications. Retraining and continuing education for existing employees is thus an essential lever for the development of employment in the clean energy sectors. Horizontal mobility is therefore an opportunity to compensate for potential job losses in the conventional energy sector.

Besides the technical skills/knowledge specific to renewable energy or energy efficiency, transversal and soft skills appear essential in the energy transition professions. There is a growing demand for higher cognitive transferable skills such as logic, critical thinking, complex problem solving, and reasoning, which are cross-cutting across the value chain as well as across skill levels. Also, most professions are increasingly demanding digital skills, due to the digitalization of the economy and the energy sector.

STAKEHOLDERS IDENTIFIED REGULATION, LACK OF COMPETITION, AND FINANCING AMONG THE CHALLENGES FOR JOB CREATION

As per international literature, the main job creation lever, especially in developing countries, is business development. Net job creation is typically led by a small number of start-ups. Policy makers also play an important role in job creation. They can support this process by making technology, capital, and finance available, or by promoting business networks. Similarly, labor market policy plays a central role in supporting job creation. It is worth ensuring that companies have access to people with the right skills to help them start up and grow. Further, flexible training, education, and employment services are needed to address potential skill gaps, which can act as barriers to business growth and expansion.

Among the different levers, companies in Morocco identified regulation, competition within the sector, and financing as the top challenges. Other challenges included market size/supply chain, quality, and cost of labor and innovation. Companies also found it difficult to fill positions requiring high skills, for example, supervisors and engineering managers. The recruitment difficulties stem from a lack of practical experience and soft skills among candidates.

THE ENERGY TRANSITION'S JOB CREATION POTENTIAL CAN BE ENHANCED THROUGH OPPORTUNITIES IDENTIFIED FOR THE MOROCCAN GOVERNMENT, LOCAL AUTHORITIES, AND BUSINESSES

Based on the challenges identified above, the study offers a set of seven recommendations for the Moroccan government, local authorities, and businesses. The recommendations are grouped under two pillars. Pillar 1 fosters the growth of renewable energy and energy efficiency businesses so that they can reach their maximum job creation potential. Pillar 2 ensures that the clean energy jobs created are filled by local graduates or workers.

PILLAR 1: FOSTER THE GROWTH OF RENEWABLE ENERGY AND ENERGY EFFICIENCY BUSINESSES

- In addition to the ambitious quantified targets and existing strategic documents, each technology can contribute to a **clear development plan that is oriented toward renewable energy and energy efficiency**. This plan should include national targets for job creation and a national plan for equipment manufacturing, focusing on the markets with the highest potential (especially wind power). Further, this plan should continue to include certain requirements for maximizing local benefits in projects.

- Sixty-four percent of the companies responding to the survey consider financing a major obstacle to their development. **Business development will thus require targeted financial access support for VSMEs** to enable them to participate in major projects. Redirecting financial support mechanisms from nonrenewable sectors such as butane gas to green projects would encourage businesses to use new, and occasionally more economically viable, energy sources. Communication surrounding financial support mechanisms should be strengthened.

- Regulations should level the playing field and extend opportunities to all actors. In particular, stronger **quality controls would limit the impact of the informal sector**, while the appropriate application of standards should be verified and enforced. Finally, the implementation of existing legislation is imperative so that the low- and medium-voltage markets are truly open to private players (other than the National Electricity and Clean Water Office [l'Office National de l'Electricité, ONEE]).

- Strengthen communication and synergies between different actors—whether government, independent, or private—on skills supply and demand. **An independent observatory to monitor employment and student training statistics** is essential to provide data for policy making and to match skills supply with market needs.

PILLAR 2: MATCH THE SKILLS OF THE MOROCCAN WORKFORCE WITH THE MARKET'S NEEDS

Mismatch between skill supply and market needs is a major obstacle to job creation in Morocco, and has produced recruitment difficulties, as highlighted in the online survey. These difficulties affect both high- and low-skill jobs. We note in particular:

- **The need to strengthen the pool of technicians with more and better professional training.** Unemployment remains high in Morocco, especially among young people, and vocational training remains scarce. More technical and vocational education and training (TVET) needs to be offered in regions with high solar and wind potential, along with apprenticeships promoted widely through a

communication campaign. TVET programs possess excellent potential to meet short-term skill needs. Finally, large international companies could become more involved in developing vocational training programs to ensure their workforce needs are matched with the workers.

- **The need to increase the employability of highly skilled workers.** "Soft skills" (specified below) and interdisciplinary capacity must be given more focus in schools and universities for the energy transition professions. In particular, the online survey highlighted the difficulties involved in recruiting workers skilled in strategy, leadership, coordination, business management, innovation, communication, and negotiation. Although graduates with technical skills are sufficient in number, they will require several years to acquire the credentials required to participate in large-scale renewable energy and energy efficiency projects. To enable students to work on real-life cases, and thus gain practical experience, Morocco may wish to consider mandatory training and apprenticeships for public sector renewable energy and energy efficiency project contracts.

- Finally, it is **important to maintain a just transition, one that eases lateral mobility, while providing decent jobs benefiting all Moroccans.** This means rural populations and the Moroccans at the margins, namely, young people and women. Allocating aid across the country would help support lagging regions, since renewable energy resources are located in remote areas in the south and the mountainous north. Disadvantaged youth should be provided better access to training through boarding schools and scholarships. Companies should adopt inclusive measures, for example, through introducing criteria and performance conditions related to gender equality in public contracts (actions to increase women's access to operation and maintenance positions, improve working conditions, etc.). Trade unions and industry associations, in addition to firms, can facilitate the movement of workers across sectors, providing short-term courses, on-the-job training, and employment matching services. It will also be useful to compartmentalize training (structuring topics by modules), to allow workers to easily obtain the missing skills.

Table ES.1 presents the recommendations of this report by pillar.

Table ES.1 Summary of recommendations

Recommendation	Related challenge	Priority	Complexity
1 • To develop the renewable energy and energy efficiency sectors			
1.1 • Provide appropriate financial support to small and medium enterprises (SMEs) to enable them to participate in large-scale projects	Unfavorable and complex incentive schemes for SMEs and end users	🔴🔴🔴	🟢⚪⚪
1.2 • Create a clear development plan, maximizing local content	An industry still underdeveloped and lacking a clear orientation	🔴🔴🔴	🟠🟠⚪
2 • To ensure available jobs are filled			

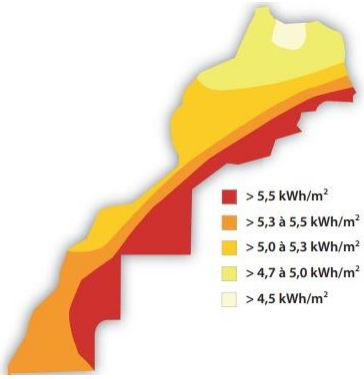
2.1 • Improve coordination, communication, and synergy among all stakeholders	Lack of sensitization, communication, and coordination between the actors of employment and the actors of the energy transition	●●●	●●○
2.2 • Improve the quality of the services provided by Moroccan companies and promote the economic integration of the informal sector	Poor quality of installations	●●●	●●●
2.3 • Increase the employability of low- or semiskilled workers	High unemployment and a lack of appropriate skills among youth	●●○	●○○
2.4 • Increase the employability of highly qualified workers	Lack of practical experience for highly qualified workers and a lack of qualified personnel	●●○	●○○
2.5 • Support a just energy transition, contributing to the objectives of decent work for all, social inclusion, and poverty eradication	Lack of investment in training, which could prevent or mitigate identified skills shortages	●●○	●●●

Level of priority or complexity: ●●● High; ●●○ Medium; ●○○ Low.

1. INTRODUCTION AND METHODOLOGY

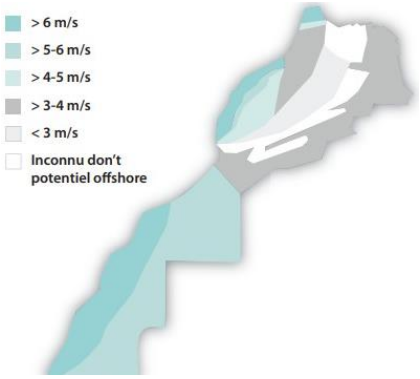
Countries in the Middle East and North Africa (MENA) are among the global front-runners in the clean energy transition. The favorable weather conditions of these countries and their modest use of renewables (1 percent of the overall energy mix compared with the world average of 13 percent) (World Energy Council 2018) means the region holds enormous growth potential in its use of solar and wind energy resources. Morocco, in particular, possesses interesting wind and sun potential, as shown by figures 1.1 and 1.2 (WFC 2016).

Figure 1.1 Solar potential (kWh/m²)



Source: World Future Council, A Roadmap for 100% Renewable Energy in Morocco (2016)
Note: kWh/m² = kilowatt-hour per square meter.

Figure 1.2 Wind potential (m/s)



Source: World Future Council, A Roadmap for 100% Renewable Energy in Morocco (2016)
Note: m/s = meter per second.

The potential for energy efficiency improvements is also excellent considering the higher energy intensities across all demand-side sectors, such as buildings, industries, public facilities, and services, compared with other countries and the global average.

Having recognized this potential for sustainable energy alternatives, policy makers in many countries in MENA have recently begun to increase their renewable energy and energy efficiency targets and investments.

An energy transition can generate productive jobs critical for the region. Analysis by the International Renewable Energy Agency (IRENA 2022) estimates that the energy transition could generate 106 million jobs in the energy sector worldwide by 2030 under a planned policies energy scenario, and 139 million under a 1.5°C Scenario. In Africa alone, the energy transition could boost employment in renewables (smaller scope than energy) to over 4 million by 2030, from about 350,000 in 2020, and to over 8 million by 2050 under the 1.5°C Scenario. Most of these jobs would be in solar, bioenergy, and wind. Estimated job creation stems from greater labor intensity as the sector shifts away from a centralized, fossil-fuel-dependent supply chain toward large-scale deployment of renewable energy and energy efficiency infrastructure. The shift to a supply chain dominated by smaller, private sector–owned distributed energy resources will also be a factor if it works alongside demand-side management and uses demand response alternatives.

Greater labor intensity and other technological changes can also create jobs and transform them too (shift of skills profiles or change in job quality). However, new jobs created through the energy transition will have to be weighed against likely job elimination in legacy subsectors and job categories. Thus, effective management of

the job market transition will be critical to ensure that the clean energy transition leads to net job creation and/or improvements in job quality, spurring economic development.

Early evidence for MENA shows a positive job impact, although rigorous evidence remains scarce, for MENA as well as the developing world. The World Bank, with funding from the Energy Sector Management Assistance Program (ESMAP),[1] conducted an analytical activity to build evidence on the job creation potential in Morocco and the challenges in meeting the country's employment needs. Morocco must formulate, adopt, and implement the right mix of policies, incentive systems, infrastructure, institutions, programs, and human capital development frameworks to create a conducive environment for job creation and transformation to complement the sustainable energy growth paths.

The first analytical phase centered on the opportunities for and challenges to job creation and transformation in Morocco, with a focus on the challenges faced in sectors offering the most significant employment opportunities, especially, renewable energy and energy efficiency, and the related value chains (e.g., manufacturing, finance, and support sectors), besides the development of policy recommendations for maximizing the opportunities and addressing the challenges identified.

OVERALL APPROACH OF THE ANALYSIS

This report presents the opportunities for and challenges to job creation in Morocco through the clean energy transition. It also presents policy recommendations for maximizing the opportunities and addressing the challenges identified. The three steps outlined in figure 1.3 were followed to obtain such results.

Figure 1.3 Inception, data, and analysis

Inception	Data collection	Data analysis
1. **Overview of the initial work** performed by the World Bank *(Phase 1)* 2. Conduct of a preliminary literature review to **identify knowledge gaps** to be filled during the data-collection phase	1. In-depth **review of the existing literature** 2. Conduct of **interviews** of key public stakeholders 3. Release of an **online survey** intended for companies of the renewable energy and energy efficiency sectors	1. **Analysis** of the collected data 2. Elaboration of **recommendations** 3. **Synthesis** in the present report

[1] ESMAP is the Energy Sector Management Assistance Program, which is a partnership between the World Bank and 18 partners. Their focus is to help low- and middle-income countries reduce poverty and boost growth through environmentally sustainable energy solutions. More details can be found at http://esmap.org/node/70853.

DATA COLLECTION

Energy transition in general comprises activities related to energy efficiency and renewable energy production. The main sources of renewable energy are solar, notably photovoltaic (PV), besides wind, geothermal, hydro, marine, and biomass. The methodology and the scope of the work were validated during the inception phase. The scope of the analysis includes utility-scale solar PV, industrial sector distributed PV, concentrated solar power, residential rooftop solar, utility-scale wind, and energy efficiency for commercial buildings. The required data were gathered from multiple sources throughout the analysis:

- **Literature review.** Available specialized literature (e.g., recent market insights or socioeconomic impact assessments) was reviewed to better understand national contexts and assess the opportunities for and challenges to job transition through the clean energy transition.
- **Online survey.** An online survey was conducted from November 2021 to March 2022 to glean insights from local renewable energy and energy efficiency companies (private and public) in Morocco. Of particular interest were perceptions about the jobs affected by the clean energy transition. Quantitative data on the affected jobs were also acquired. The survey was sent via email to numerous enterprises. Contacts were obtained via networking, online research, and local contacts' support. Table ES.1 and tables 1.1–1.3 provide an overview of the survey respondents' characteristics.

Table 1.1 Technological area

Technological area	Number of respondents*
Industrial sector distributed solar photovoltaic (PV)	14
Residential rooftop solar PV	19
Utility-scale solar PV	7
Concentrated solar power	7
Utility-scale wind	11
Energy efficiency for commercial buildings	13
Other energy efficiency	9
Battery storage	6
Electric mobility (electric vehicles and charging infrastructure)	4
Conventional power generation	10
Other	20

Table 1.2 Value chain

Positioning in the value chain	Number of respondents*
Project planning and development	18
Legal and financial structuring	4
Financing	6
Equipment manufacturing	2
Procurement (import, export, transport, logistics)	6
Wholesale	4
Retail and distribution	5
Engineering	22
Construction and equipment installation	14
Plant operation	6
Plant maintenance	14
Decommissioning and recycling	1
Other activity	16

*A company might operate in several technological areas and be positioned in several segments of the value chain.

Table 1.3 Employees

Number of employees	Number of respondents*
One-employee business	1
Between 2 and 5	4
Between 5 and 10	3
Between 10 and 20	7
Between 20 and 50	3
Between 50 and 100	3
Between 100 and 1,000	5
More than 1,000	0

**Disclaimer:* Because of the small number of respondents, the survey's results cannot ensure complete representation of the sample and cannot be analyzed independently. However, they serve to support the conclusions drawn from the interviews, the local experts' knowledge, and the literature review. The same struggles were faced by the GIZ (executive summary iii) and highlight the importance of interviews to obtain substantial results.

- **Interviews with local public stakeholders.** Key public stakeholders were interviewed to collect complementary qualitative data and obtain a representative and complete perspective on the clean energy transition and its impact on the national labor market (expectations regarding job transition, perception of current gaps to be overcome, possible mitigation measures). The interview guide is in appendix 1. Table 1.4 provides the list of interviews completed in the specific context of this project.

Table 1.4 Key stakeholders interviewed

Category	Organization	Date
Private energy company	Société d'Ingénierie Energétique (SIE)	12/10/2021
Public energy agency	Agence Marocaine pour l'Efficacité Energétique (AMEE)	12/14/2021
Public energy agency	Institut de Recherche en Énergie Solaire et Énergies Nouvelles (IRESEN)	12/14/2021
Public energy agency	Moroccan Agency for Sustainable Energy (MASEN)	02/16/2022 04/20/2022
Energy association	Association Marocaine des Industries Solaires et Eoliennes (AMISOLE)	12/20/2021
Energy association	Résovert-Orient	03/04/2022
Private energy company	Energy Pro Tech	03/04/2022
Private energy company	PROMINOX	02/23/2022
Private job/education agency	Instituts des métiers des énergies renouvelables et de l'efficacité énergétique (IFMEREE)	12/23/2022
Public job/education agency	Office de la Formation Professionnelle et de la Promotion du Travail (OFPPT)	02/02/2022

Category	Organization	Date
Public job/education agency	Ministry of National Education, Vocational Training, and Higher Education	05/31/2022
Other	Gesellschaft für Internationale Zusammenarbeit (GIZ) and RESING	04/27/2022

2. COUNTRY CONTEXT

This section presents the context in which the clean energy transition is occurring in Morocco:

- First, it focuses on the **renewable energy and energy efficiency targets and policies** set by the government of Morocco.
- Second, it reviews the **response of the institutional framework, national programs, and education system** to achieve/support these targets.
- Third, it analyzes the **achievements enabled by such actions** in the renewable energy and energy efficiency sectors.
- Fourth, it focuses on the **outlook and trend of the clean energy transition** over the next 10 years.
- Finally, it provides an **analysis of the Moroccan labor market** to help understand in which context a job transition could take place, with a focus on the green economy.

RENEWABLE ENERGY/ENERGY EFFICIENCY TARGETS

Morocco announced increased climate ambitions in November 2021, at the 2021 United Nations Climate Change Conference (COP26) in Glasgow. It announced a new target of reducing greenhouse gas emissions by 45.5 percent by 2030 compared with the business-as-usual scenario, of which 18.3 percent is unconditional and is to be achieved without support from international cooperation. The Nationally Determined Contribution covers seven major sectors for mitigation (energy generation, industry transportation, residential, agriculture, waste, and forestry), but relies heavily on energy sector decarbonization to achieve its targets. Morocco leads in renewable energy in Middle East and North Africa (MENA), and has the highest score according to the green future index developed by the Massachusetts Institute of Technology (MIT Technology Review 2022).

In 2015, Morocco had announced the objective to rapidly increase the share of renewable energy capacity to 52 percent of total installed capacity by 2030. The Low Carbon Strategy 2050 suggests increasing renewable energies' share, in terms of energy produced as well as capacity, to 70 percent by 2040 and 80 percent by 2050 in the electricity mix (MTEDD 2021). The presence of good-quality solar and wind resources has helped Morocco achieve renewable energy generation at significantly lower costs than coal (National Electricity and Clean Water Office and Moroccan Agency for Sustainable Energy [ONEE-MASEN]).

Efforts to increase energy efficiency in the industry, buildings, and transportation sectors are also helping to prevent additional pressure on Morocco's energy requirements. Morocco initially aimed for a 12 percent reduction in energy consumption by 2020 and 15 percent by 2030 (IEA 2019). In 2014, following a national debate on the subject, Morocco defined and adopted a national energy efficiency strategy, establishing specific energy savings targets to be achieved by 2030 (AMEE 2014), including an overall 20 percent reduction in energy demand compared with business as usual. Action plans for transport, buildings, industry, agriculture, and street lighting were also prepared. A target of 8 percent reduction by 2030 has been set specifically for the residential and commercial sectors (including residential and commercial buildings, as well as public lighting), 22 percent for the transport sector, and 20 percent for the industrial sector (IEA 2019).

RESPONSE OF POLICIES, THE INSTITUTIONAL FRAMEWORK, NATIONAL PROGRAMS, AND THE EDUCATION SYSTEM TO RENEWABLE ENERGY AND ENERGY EFFICIENCY TARGETS

POLICIES TO ACHIEVE THE RENEWABLE ENERGY AND ENERGY EFFICIENCY TARGETS

Morocco has designed policies that are conducive to achieving its ambitious renewable energy and energy efficiency targets. The government has adopted a broad strategy that includes three main pillars of action: (1) promulgating regulations and laws to support the expansion of renewable energy and energy efficiency; (2) establishing institutions capable of designing and implementing renewable energy and energy efficiency projects; and (3) implementing projects and major financial investments to build the required renewable energy and energy efficiency facilities (WFC 2015). Another major objective of the national energy strategy is to ensure an enabling environment for business growth and job creation, supported by the development of higher education programs for the renewable energy sector:

- ***Among the main laws and regulations*** introduced on the matter in the past few years, Law 13-09 was promulgated in 2010 to promote and liberalize the renewable energy sector with an aim to prioritize the development of renewable energy sources. The latest version, that of December 2015, introduces a net metering scheme for grid-connected solar and wind power plants; this version will allow private investors to sell up to 20 percent of their surplus output to the grid. The law also further regulates the electricity sector by introducing specific permitting procedures for independent power producers depending on the renewable energy plant capacity. It is worth pointing that these regulations have not been implemented yet— for example, energy efficiency Law 47-09, adopted in 2011 to make energy consumption more efficient and enable related cost savings through the use of solar water heaters, energy saving equipment, and energy-efficient light bulbs, and Decree no. 2-17-746 relative to mandatory energy audits and audit organisms.
- ***At the project level***, Morocco offers long-term power purchase agreements for large- and small-scale renewable energy producers, which are awarded via competitive biddings.

INSTITUTIONAL FRAMEWORK TO ACHIEVE THE RENEWABLE ENERGY AND ENERGY EFFICIENCY TARGETS

The government also established a series of public agencies and institutions to better organize and structure the promotion of renewable energy and energy efficiency development, besides maximizing job creation. Key stakeholders include:

- The newly rebranded Ministry of Energy Transition and Sustainable Development (MTEDD), which is in charge of the energy sector policy in Morocco and has the responsibility to ensure energy supply is secure, establish rules for energy markets, and oversee the transition to a low-emission economy.
- The ONEE, which is the public-owned utility in charge of electricity generation, transmission, and distribution in much of the country.
- The Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE), which is responsible for the development of energy management policies and in 2016 became the Moroccan Agency for Energy Efficiency (AMEE).

- MASEN, which is a public-private venture and was in charge of implementing the Moroccan Solar Plan in 2009, when Morocco announced it would install 2 gigawatts (GW) of solar capacity by 2020.

- *Sociéte d'Investissements Energétiques* (SIE), which was founded in 2010 as an investment fund for the energy sector in Morocco to facilitate the diversification of energy resources and promote renewable energy and energy efficiency, and was transformed into a super ESCO (energy service company) in 2020 (ESI Africa 2021) for energy efficiency projects.

- The Research Institute for Solar Energy and New Energy (IRESEN), which was founded in 2009 to promote countrywide research, development, and innovation in renewable energy technologies.

- REUNET (RE University Network), which was founded in 2013 as a joint initiative of Moroccan academics, researchers, scientists, and engineers to promote the use of renewable energy in Morocco through training, research, and innovation.

- The National Agency for Electricity Regulation (ANRE), which supports the implementation of the country's energy transition, including regulating access to the grid and setting wheeling tariffs. Bulk and retail electricity tariffs are set by the interministerial commission on prices.

- CESE (Economic, Social, and Environmental Council of Morocco), which is an independent constitutional institution founded in 2011 that provides analysis and critical assessments of other entities' work.

- ANAPEC (National Agency for the Promotion of Employment and Capacity) and OFPPT (Office of Vocational Training and Job Promotion), which contribute to the accuracy of data on employment in Morocco (GIZ/IDE-E 2016). The OFPPT also provides technical education and professional training related to energy efficiency and renewable energy.

- CNRST (National Center for Scientific and Technical Research), which oversees the coordination of collaborative research programs among universities and scientific institutions in Morocco and in foreign countries, and is predominantly focused on fundamental research.

- The Moroccan Association of Wind and Solar Industries (AMISOLE), which was created in 1987 to promote the interests of Moroccan professionals and industries involved in the renewable energy sector. Further, the Ministry of Energy and Mines is currently creating a list of skills needed and available in the renewable energy sector. In parallel, the SIE is creating its own list of the skills required in the energy service companies sector.

ENABLING POLICIES AND PROGRAMS

As part of its Strategic Vision for Education 2015–30, the government has committed to reforms in this area. The authorities' efforts are bolstered by the World Bank's Education Sector Support Program, with a loan of $500 million:

- The Green Generation Strategy and the Morocco Forest Strategy are dedicated to supporting entrepreneurship in rural areas and promoting agri-food and forest value chains. Hence, they hold the potential to generate many jobs (World Bank 2021a).
- IRESEN's annual research and development (R&D) call, "Green INNO-PROJECT," focuses on strengthening the incubation of early-stage companies and entrepreneurs. It also provides research grants for doctoral and master's students who prepare their PFEs in the framework of university- and industry-led innovation projects (e.g., Innotherm, InnoPV, and InnoWind projects).
- The construction of the thermo-solar power plant in the village of Aïn Beni Mathar has led to the hiring of 500 workers, of whom 250 are the village's residents. The project also created indirect jobs in the food, transportation, and housing sectors.
- The United Nations Development Programme and the Global Environment Facility have launched a solar pumping program to promote solar photovoltaic (PV)-powered drip irrigation pumping systems in Morocco. This program includes institutional capacity building to develop "high-quality markets and jobs."
- **Industrial development fund.** Granting up to 10 percent subsidies to companies that create more than 250 jobs, participate in technology transfer, or whose investment amount equals or exceeds DH 200 million. This subsidy is applicable to any industry meeting the eligibility criteria, and it can especially benefit producers of clean technologies and renewable energy.
- Although Moroccan law does not impose a minimum requirement for local content, workforce localization has been an important government aspiration. MASEN, in collaboration with ANAPEC, has encouraged the use of local staff and materials. According to a report on the evaluation of renewable energy manufacturing potential, under the Moroccan Solar Plan, bidders are encouraged to promote local benefits.

EDUCATIONAL SYSTEM'S RESPONSE TO RENEWABLE ENERGY/ENERGY EFFICIENCY TARGETS

The institutional framework introduced earlier partakes in the design of a large panel of academic and professional trainings that aids in the identification of skills needed by companies to extend their operations in the renewable energy and energy efficiency sectors.

SPECIALIZED ENERGY COURSES IN ENGINEERING SCHOOLS AND UNIVERSITIES

For several years now, the government has demonstrated a strong desire to train managers to facilitate globalization and support market opening (Gardelle 2018). Thus, significant efforts have been made to strengthen and develop institutions and training opportunities related to renewable energy and energy efficiency. Specialized energy courses have been created within the major engineering schools and universities. Among these initiatives to improve the training system and integrate young people into the labor market, the following can be mentioned:

- A professional baccalaureate in renewable energy was created in Ouarzazate in 2021. Organized in alternation between a technical high school and the training institute for renewable energy and energy efficiency professions in Ouarzazate, it has to date a capacity of 60 students.

- REUNET is a network founded in 2013 by Moroccan academics, researchers, and engineers to promote the use of renewable energy and the importance of energy efficiency in Morocco through training, research, and innovation. More than 200 teacher-researchers have been trained thanks to REUNET so far.

- Morocco has several teaching platforms related to energy efficiency/renewable energy, either public platforms such as the Poly-Disciplinary Faculty and the Faculty of Sciences and Techniques, both located in Beni Mellal, in addition to the Faculty of Sciences at Semlalia of Cadi Ayad University, the Superior School of Technology of Agadir (which issues one professional license), the National School of Applied Sciences (ENSA) (two master's programs), or private platforms like the one provided by the equipment manufacturer Lorenz. For Souss-Massa, professional training in renewable energy is provided mainly by the association RESOVERT (GIZ 2019).

- A summer school (MASEN Talent Campus) on renewable energy technologies and products has been organized by MASEN to students in universities and engineering schools.

- The OFPPT is developing several training modules on renewable energies through Cité des métiers (CMC) (OFPPT 2021); the aim is to develop and implement a program for youth across the country. CMCs are expected to help bridge the gap between school and work for Moroccan youth, enhancing regional competitiveness to support economic development.

TRAINING SYSTEM AND R&D

- IRESEN provides scientists and students with access to research and innovation platforms, for example, the Green Energy Park (R&D platform located in Benguerir for testing and training in renewable energy) and the Green and Smart Building Park, which is an educational platform mainly dedicated to energy efficiency/renewable energy. Partnerships between IRESEN and Moroccan universities have led to the development of a renewable energy industry in Morocco.[2]

- IRESEN, the University Cadi Ayyad of Marrakech, and CIEMAT in Spain have created a concentrated solar power (CSP) master's degree related to R&D (IEA 2019).

- A 2 kilowatt system is available to train engineers, technicians, and PV system installers at the National School of Mineral Industry. The Technopark of Casablanca has also built a PV power plant and a skills center with three training modules. The technopark is a model center dedicated to developing technological innovations adapted to Morocco's specific context. For example, one of the projects was the development of a transportable solar suitcase to support medical operations in the desert.

[2] As evidenced in publications such as "Competitive and efficient Lithium-ion batteries: a solution of choice for the storage of solar energy," "Storage of solar thermal energy by melting phase change materials within a hybrid system Habitat-Solar SensorMCP: Application to the passive heating of housing in Morocco," and "Evaluation of the performance of thermo-solar sites."

INTERNATIONALIZATION OF MOROCCAN HIGHER EDUCATION

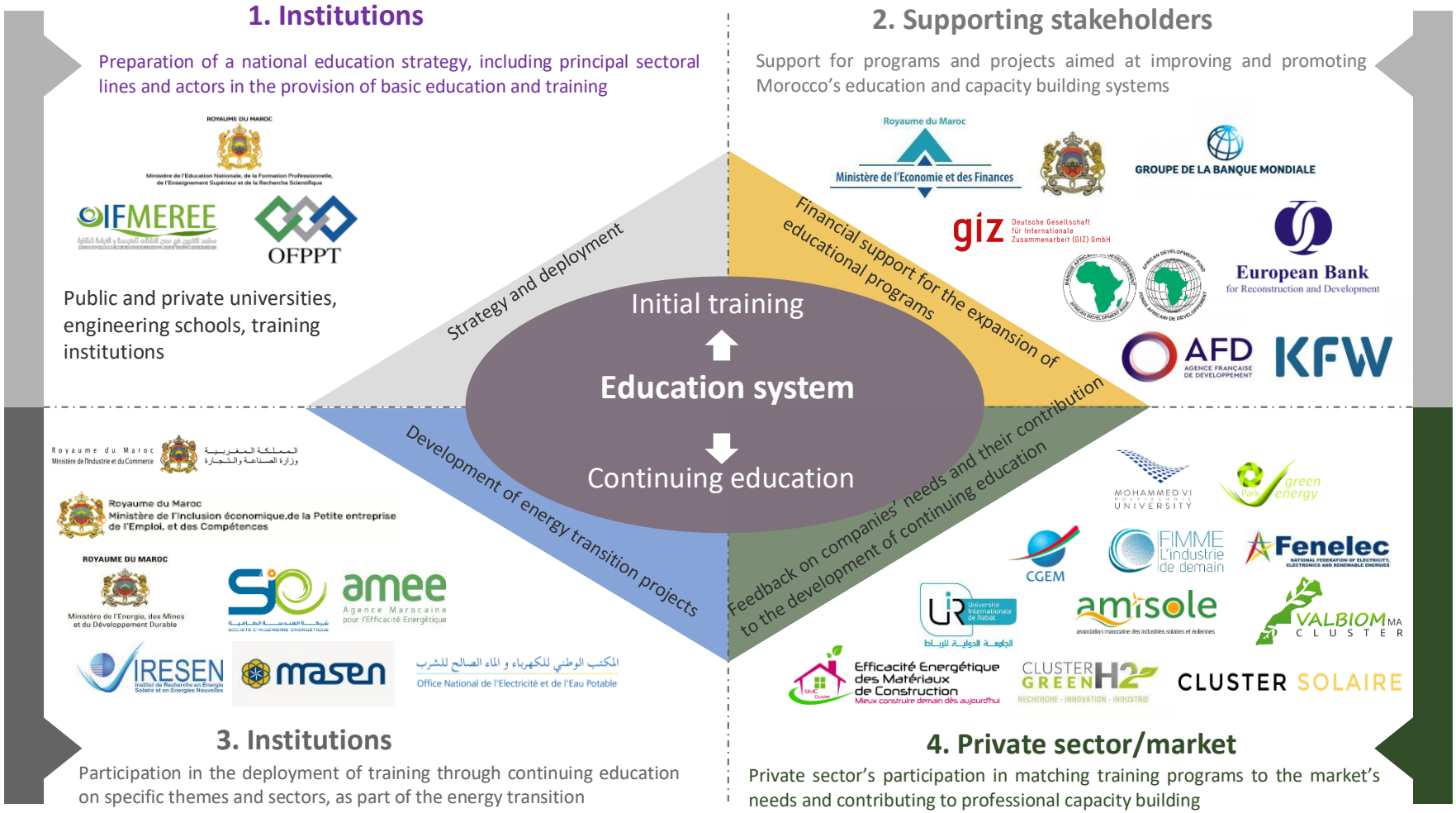
- MICEP (Morocco–Ivory Coast Energy Park) is a research partnership between IRESEN and the INPHB Institute in Côte d'Ivoire to promote energy-efficiency-/renewable-energy-related training, knowledge transfer, and innovation.
- GreenAIN (Green Africa Innovation Network) has been implemented by IRESEN and includes 16 African institutions in the renewable energy sector for training, R&D, and innovation.
- CNRST (National Center for Scientific and Technical Research), the Mohamed V University of Rabat, the Cadi Ayyad University of Marrakech, and the Mohamed Premier University of Oujda are part of the research project "Energy, Environment, and Sustainable Development" (E2D2) under the ARCUS program (Actions in Regions of University and Scientific Cooperation). This program brings together three French universities and institutions from Lebanon, the Palestinian Territories, and Morocco under the direction of the French ministry of foreign affairs.

VOCATIONAL TRAINING

- The strategy on vocational education and training for 2021 gathered all partners around a shared modern vision of skill development, centered on employability, efficient governance, and use of resources. This strategy is not specific to the energy transition. Employment Strategy 2025 not only focuses on active labor market measures, but also on more comprehensive support, including skill development, skill update, and skill upgrade. The National TVET [technical and vocational education and training] Strategy includes a provision for the creation of regional commissions to coordinate TVET activities, build collaboration, manage regional programs, and evaluate effectiveness. The commissions are supposed to be partnership bodies comprising employers, employer associations, universities, trade unions, and the government. Training in Morocco has four qualification levels: specialization, qualification, technician, and specialized technician.
- The OFPPT manages two-thirds of the vocational training in Morocco (OECD 2018a) (all sectors combined, including energy transition sectors). The system also includes several hundred private centers offering formalized training.
- AMEE provides continuing professional education on the topics of energy efficiency and solar energy. A Marrakech-based training center offers short courses, which impart the knowledge and teach the tools for designing, sizing, monitoring, certifying, and maintaining equipment and/or construction projects in energy efficiency and renewable energy. The center also trains trainers on how to transfer know-how. The trainings are intended for engineers, technicians, or trainers in renewable energy and energy efficiency.
- Additional trainings for technicians in wind energy have been launched by vocational training institutes.
- The APIELO project (support for the improvement of the energy infrastructure in the Oriental region) has created continuing education courses for engineers, architects, technicians, etc., and training modules in renewable energy and energy efficiency.

Figure 2.1 provides a schematic view of the education system.

Figure 2.1 A schematic view of the education system



ACHIEVEMENTS IN THE CLEAN ENERGY TRANSITION

Morocco experiences and expects strong growth in electricity demand. On average, electricity consumption increased 13 percent over 2015–19 (IEA 2019) and is projected to grow by 5.6 percent annually through 2030. Improved to electricity access has placed enormous new pressures on the country's economy, which relies heavily on fossil fuel imports for electricity generation. In 2019, Morocco's installed generation capacity reached 10.7 GW. Sixty-three percent of this capacity was accounted for by thermal plants, 17 percent by hydropower, including pumped hydroelectric energy storage, 13 percent by wind, and 7 percent by solar (PV and CSP) (ONEE 2020).

ACHIEVEMENTS IN RENEWABLE ENERGY

Of all the countries in the MENA region, Morocco is the most advanced in terms of deployment of renewable energy projects (KAPSARC 2019). According to the Moroccan Ministry of Energy, as of April 2021, several dozen large or utility-size projects were under development or in the pipeline. This represents an investment of about $5.5 million (Aujourd'hui le Maroc 2022). These projects represent a total installed capacity of 2,180 megawatts (MW) (solar and wind, but not including hydro) (Les Echos 2021). According to ONEE (2021), 37 percent of Morocco's generation capacity was accounted for by renewable energy sources at the end of 2020. The figure is 20.6 percent excluding pumped hydroelectric energy storage.

The Moroccan strategy has focused on the development of large-scale projects. For example, the 582 MW capacity Noor Ouarzazate CSP and PV complex is among the largest solar parks in the world (Renewables Now 2018). The industrial fabric has evolved in recent years—MASEN's objectives of 30 percent industrial integration have been exceeded in most new projects (see table 2.1).

Table 2.1 Industrial integration level for a selection of Moroccan renewable energy projects

Project	Technology	Size (MW)	Industrial integration level (%)
Noor Ouarzazate I	Solar CSP	160	34
Noor Ouarzazate II	Solar CSP	200	40.6
Noor Ouarzazate III	Solar CSP	150	42
Noor Ouarzazate IV	Solar PV	72	24
Noor Laâyoune	Solar PV	85	22.1

Source: MASEN 2021; Morocco World News 2021a.
Note: CSP = concentrated solar power; MW = megawatt; PV = photovoltaics.

Approximately 50 projects are currently under construction or development. They represent an additional investment of $5.8 billion (Morocco World News 2021a). The International Energy Agency (IEA 2019) estimates that to meet the government's targets, additional investment of $30 billion will be needed.

ACHIEVEMENTS IN ENERGY EFFICIENCY

Energy efficiency has been a national priority in Morocco since 2009, even though progress has not been notable since then. In its 2020 report, the CESE highlighted the major role AMEE should play and reiterated the importance of energy efficiency (LeVert.ma 2020).

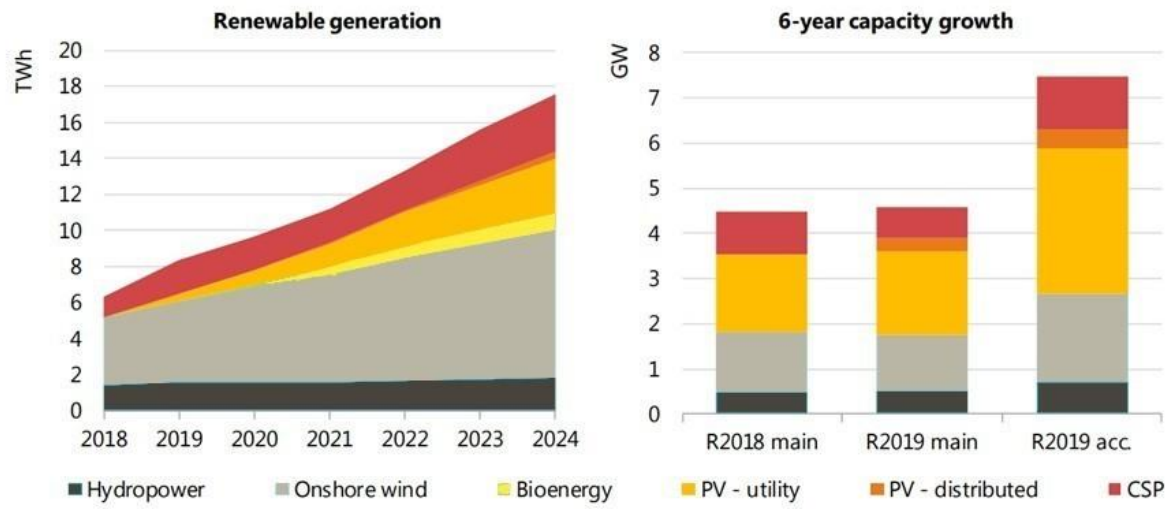
As the economy and population grew, energy consumption has likewise increased steadily. To be more precise, oil and electricity consumption has risen, whereas biofuels and waste fuels have fallen (IEA 2019). The annual growth rate is 5 percent, whereas Morocco's energy intensity has decreased by 9 percent since 2007 (IEA 2019). Morocco's energy intensity is the tenth lowest among the IEA member countries, below the IEA average, and just below the IEA European average. At the same time, energy consumption per capita is among the lowest in the IEA member countries and almost fourfold lower than the world average. Several initiatives have begun the transition to more efficient products and appliances (e.g., banning the import of old cars and improving thermal regulations for new buildings):

- $170 million was mobilized within the Morocco Sustainable Energy Financing Facility, MorSEFF (European Bank for Reconstruction and Development funded) (DAI n.d.), to finance over 270 projects by the end of 2019, resulting in energy savings of approximately 305,000 megawatt-hours/year.
- The Nama Facility provided funding of $22 million for the integration of energy efficiency measures in 12,000 homes (EconoStrum 2020).

OUTLOOK AND TREND

The Moroccan renewable energy sector has boomed over the past decade (compound annual growth rate [CAGR] of +25 percent over 2015–20) (Wood Mackenzie 2021). All government measures and the projects associated with them have been carried out in compliance with the Nationally Determined Contribution, which set country-specific environmental objectives after the Paris Agreement. The mitigating scenario includes 61 projects, with potential mitigation of 400 $GgCO_2$-eq over 2020–30. Among these projects, eight concern energy generation. The six unconditional objectives represent a budget of $8.1 billion, whereas the conditional objectives (affecting only solar and wind installations) represent a budget of $9 billion (figure 2.2).

Figure 2.2 Morocco renewable energy forecast summary



Source: IEA 2019.
Note: CSP = concentrated solar power; GW = gigawatt; PV =photovoltaics; TWh = terawatt-hour.

Over the next five years, analysts expect the sector to continue its sustained growth (CAGR of +20 percent over 2020–24). The following growth rates are expected:

- Onshore wind power installed capacity is expected to increase from 1.94 GW in 2020 to 3.8 GW in 2025. The associated investments over 2020–25 are estimated at $2.6 billion, and an additional $2.9 billion until 2030 with the unconditional target.

- Solar energy installed capacity is expected to increase from 750 MW in 2020 to 2.9 GW by 2024 (i.e., additional investments estimated at $2.1 billion and $6 billion until 2030 under the unconditional objectives).

This growth is mainly driven by Morocco's adoption of long-term renewable energy targets, with support from transparent and timely competitive auctions since 2009 (IEA 2019). The government encourages private investment, while good visibility is ensured on the timing of competitive tenders with independent power producers. A centralized auction program has procured large volumes of renewables, contracting over 1.8 GW by 2019. According to the IEA, 2.8 GW of renewable energy growth is expected to be tied to competitive bidding; 1.3 GW to engineering, procurement, and construction contracts; 0.1 GW to self-consumption; and 0.1 GW to corporate power purchase agreements. Further, a 90 percent import duty reduction applies to most renewable technologies (Climate Investment Funds 2021). This will require building more interconnections and maintaining a capacity reserve margin. Finally, Morocco has attractive solar and wind energy sources. Its irradiation rate is 30 percent higher than the best sites in Europe (Reegle 2014), and the average wind speed in the 10 percent windiest areas along the coastline is 8.84 meter per second (m/s) (Global Wind Atlas 2021), peaking at 11 m/s in the north (WindEnergy 2001). In 2017, Morocco had a total final consumption of 16.1 million tons of oil equivalent (Mtoe), which represented an increase of 34 percent over the previous decade.

The transport, industry, and construction sectors are the most energy intensive. They currently represent the greatest potential for energy savings (24 percent, 17 percent, and 14 percent, respectively) (The Japan Times 2021). Fuel oil or other petroleum products are by far the most significant energy sources. They represented 68 percent of the overall use in 2017. Electricity is the second-most-important source, representing 27 percent of the overall use, followed by biofuels and waste, at 3 percent, and natural gas, at 2 percent. Savings in the transport sector in particular are crucial since transport depends on oil and represents the largest share of Morocco's energy consumption, with 5.8 Mtoe in 2017. The residential sector consumed 4.0 Mtoe in 2017, which represents a 26 percent increase over 2007. Cooking in Morocco represents roughly two-thirds of this sector's total energy use. Other main residential energy needs include water heating, refrigeration, lighting, and electrical appliances. Finally, for the industrial sector, the nonmetallic minerals industry and the mining and quarrying industry are the two most important industries with respect to the use of energy. They represent about 60 percent of the sector's total use. The extraction and chemical processing of phosphate rocks in Morocco accounts for over 20 percent of industrial energy consumption and represents 50 percent of the total gross domestic product (GDP) (El Iysaouy et al. 2019).

The main factors driving progress on energy efficiency is the ambitious 2030 strategy, which has benefited from significant stakeholder engagement and consultation (including with AMEE, public institutions, and nongovernment organizations).

LABOR MARKET CONTEXT, ESPECIALLY IN THE GREEN ECONOMY

LABOR MARKET CONTEXT

Morocco has undergone major socioeconomic changes since 2000. Per capita purchasing power parity income has doubled, reaching $7,500 in 2019. Literacy rates and health outcomes have also improved, and the country's Human Development Index has risen by about 30 percent (UNDP 2020). This growth trend is expected to continue through 2040.

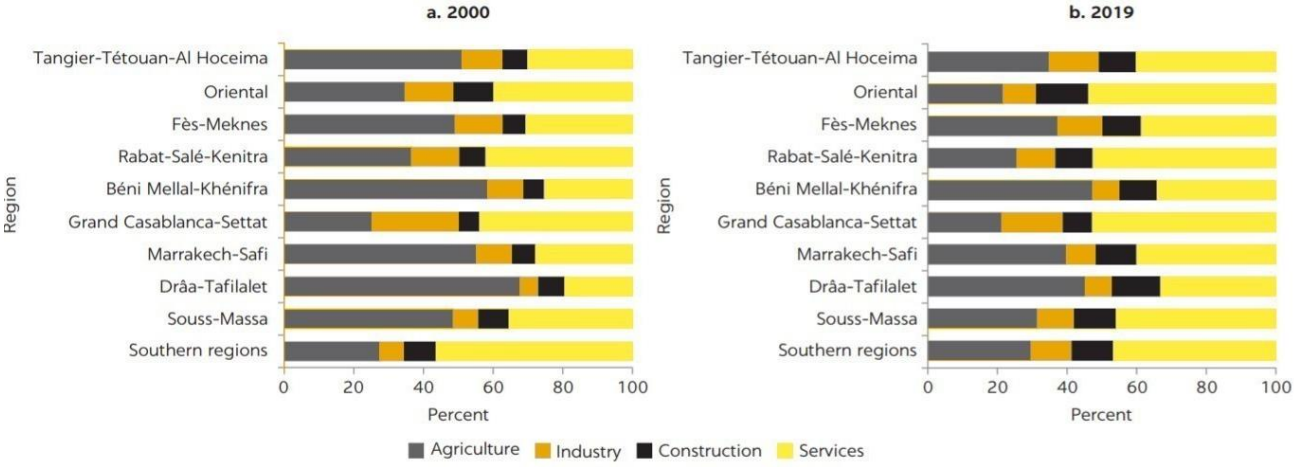
However, Morocco's economic growth over the past 20 years has not been labor intensive. Its job generation capacity has been limited, and it has had only a minor effect on the structure of GDP.

While growth is accompanied by a transfer of jobs from agriculture to industry in other countries, in Morocco, the process is different. Workers have moved from agriculture to the services sector, mainly into informal jobs. Thus, services has a more rapidly growing share in the GDP than industry, signaling "premature deindustrialization." In 2018, services accounted for 59.2 percent of the GDP (+2 percent since 2000), industry accounted for 25 percent (-13 percent since 2000), and agriculture accounted for 15.8 percent (-24 percent since 2000) (World Bank 2021b). In 2019, the Moroccan economy created 165,000 jobs (+1.5 percent), resulting in a creation of 250,000 jobs in urban areas and a loss of 85,000 in rural areas (HCP 2020). The services sector created 267,000 jobs, the construction sector 24,000, and industry, including handicrafts created 17,000 jobs. A total of 146,000 jobs were lost in the agriculture, forestry, and fishing sectors (figure 2.3).

Morocco is currently enjoying a demographic bonus, with a dominant (74.1 percent of the total population) and growing working-age population. This bonus will last through 2040. In 2019, 45.8 percent of the working-age population was "active" (see Figure 2.4). Of the 14.3 million inactive Moroccans, the vast majority are women (World Bank 2021b). Female labor force participation was 20 percent in 2020 (Aujourd'hui le Maroc 2021).

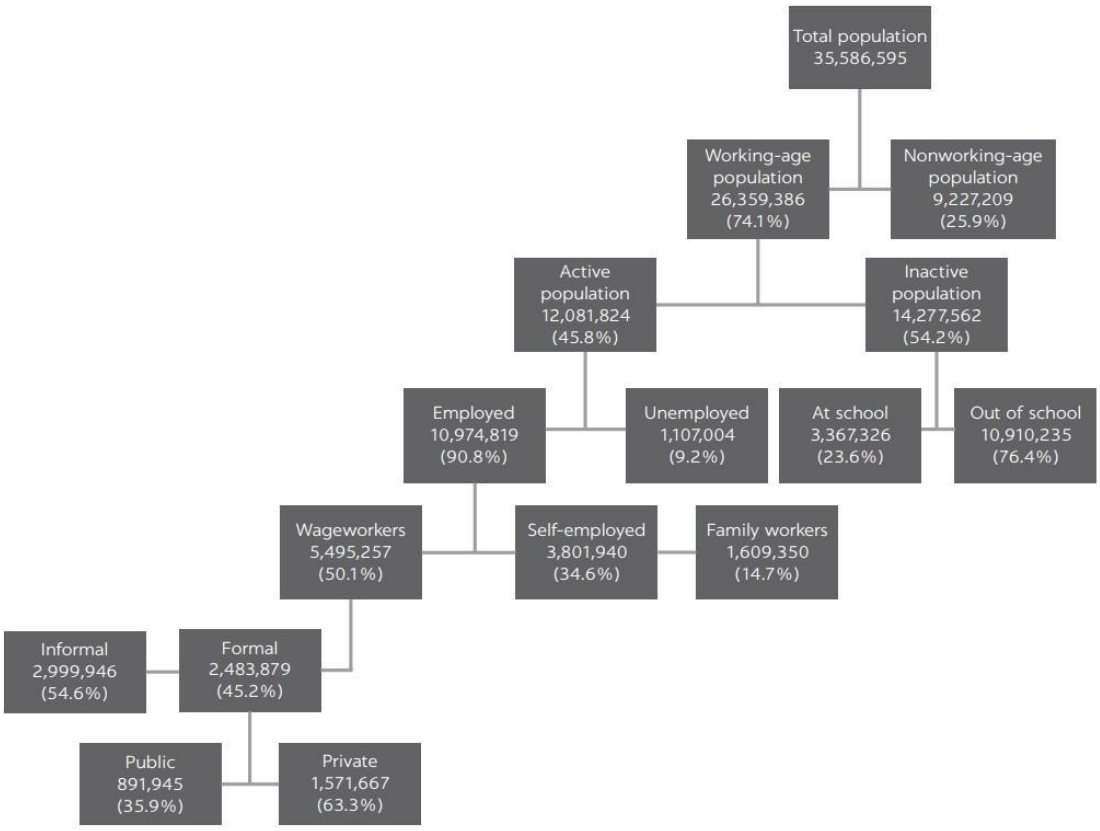
Unemployment has been relatively stable since 2009, but inactivity is on the rise, along with a high unemployment rate. Morocco's inactivity rate has risen, from 47 percent in 2000 to 54 percent in 2019, with over half of the country's working-age population either not working or not looking for work.

Figure 2.3 Movement of workers between 2020 and 2019



Source: UNDP 2020.

Figure 2.4 Labor status of the population in Morocco



Source: World Bank 2021b.

Morocco's economic structure consists of a range of employment profiles. This includes a few large companies and many small enterprises operating partially or totally informally, self-employed workers, domestic work, and unpaid family work. The labor market remains marked by slow employment growth, and a high degree of informality is prevalent in the economy:

- **Low-quality jobs.** The informal economy accounts for 40 percent of all jobs (Legatum Institute 2020). Approximately 80 percent of workers have no health coverage, while 22 percent are unpaid family workers, 32 percent are self-employed, and 27 percent are employed without a contract. Low productivity and low wages are consequences of this prevalence of informal employment (Mzaghrani 2020).

- **A discouraging job environment.** Morocco's unemployment rate remains high (12.8 percent in 2021); this tends to discourage job seekers. Regional disparities are notable—more than 18.2 percent of rural inhabitants are unemployed, compared with 4.8 percent of urban inhabitants (Morocco World News 2021b).

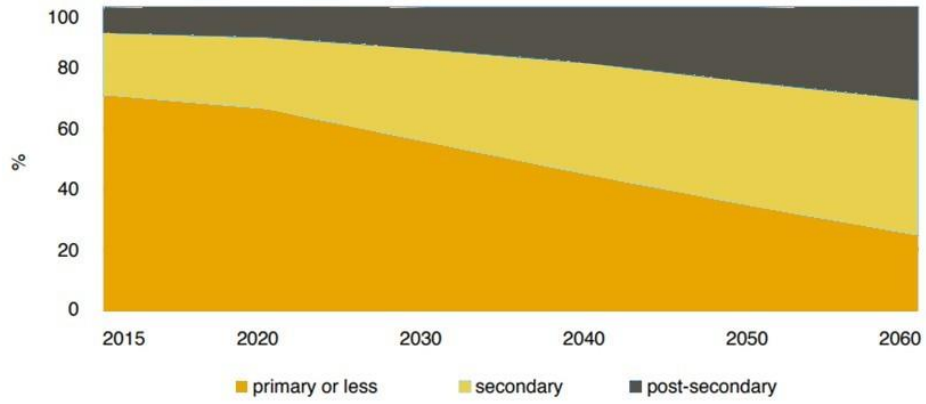
- **A "missing middle" issue.** Morocco has a concentration of small and micro firms, with some large firms, but not many medium-size companies. Besides the massive presence of micro firms, the regional distribution also shows that medium-large companies cluster in Grand Casablanca-Settat and Souss-Massa, whereas large enterprises are in the south (World Bank 2021b).

EDUCATION LEVELS OF THE LABOR FORCE

Morocco's human capital index rose 6 percent over 2010–20 (compared with a 5 percent global average). This growth was mainly due to advances in education. However, the current workforce remains poorly educated, despite these advances. The Moroccan population attended school for an average of 5.6 years in 2019. Men attended school for 6.6 years and women for 4.7 years (UNDP 2020). One-third of the population remains illiterate; 42 percent of women and 22 percent of men are illiterate. The Programme for International Student Assessment (PISA) ranked Morocco at 75 among 79 countries in 2019, further highlighting the country's shortcomings.

Morocco expects to see a growth in school enrollment and, consequently, greater educational attainment. According to expert projections (figure 2.5), Morocco will experience relatively slow growth in education compared with other MENA countries. In 2060, another 7 percent of Moroccans aged 15 and above would still have no formal schooling; 46 percent of those aged 25–44 will have postsecondary education, but only 16 percent of Moroccans aged 65 and above would have postsecondary education. By contrast, in the Arab Republic of Egypt, 98 percent of people aged 25–44 are expected to have achieved postsecondary education (and 75 percent of people aged 65 and above) (Lutz et al. 2018).

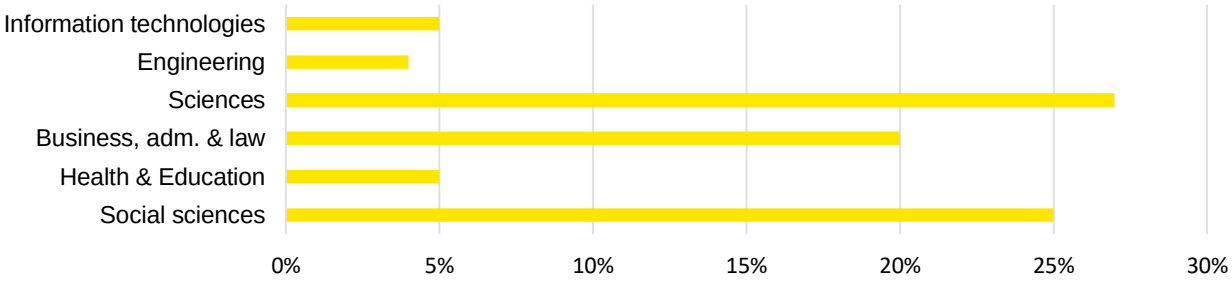
Figure 2.5 Highest educational attainment in Morocco (population aged 25+)



Source: Lutz et al. 2018.

As shown in figure 2.6, most university students study science (27 percent) and the social sciences (25 percent). Only 4 percent pursue engineering studies. By way of comparison, in Jordan, about 17 percent of students are in engineering schools, compared with 7 percent in Egypt (KAPSARC 2019).

Figure 2.6 Tertiary education graduates by academic field in Morocco in 2016



Source: UNESCO 2019.
Note: The most recent data available are from 2016.

INCLUSIVITY IN THE LABOR MARKET

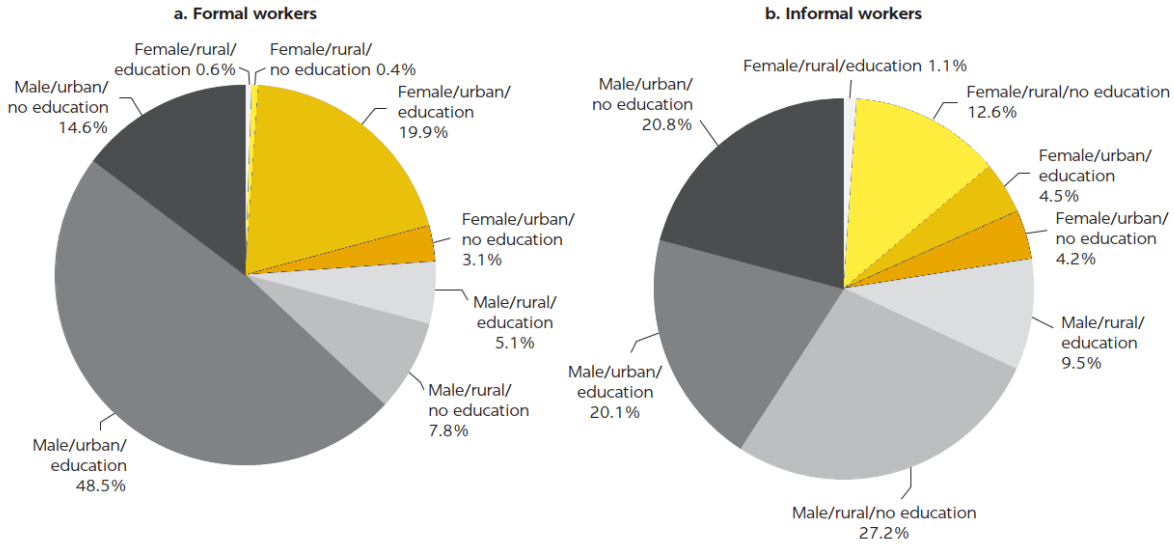
The Moroccan labor market is marked by low inclusivity for women:

- Female labor force participation has declined from 28 percent to 21 percent over 2000–19. Despite significant investments to boost schooling and improve legislation, international comparisons indicate that the female labor force participation rate in Morocco is well below what is needed to be achieved for the country's current level of development.

- Significant urban and rural disparities exist (see figure 2.7). Urban women have the lowest participation rate, as their participation corresponds to education and family status. The rural participation rate is higher, although women are almost all employed informally, mainly in agriculture.

- Women in the entire industrial workforce constitute less than 10 percent (excluding mining and quarrying). In rural Morocco, women in the industry comprised less than 15 percent of the workforce in 2019, whereas their numbers in urban areas fell from about 40 percent to nearly 20 percent from 1999 to 2019 (Bargain and Lo Bue 2021). Only 5.1 percent of working-age women are employed in industry, compared with 14.3 percent in agriculture.

Figure 2.7 Distribution of workers by area, education, and gender



Source: ONEE 2021, Annual report.

The youth (15–24 years) unemployment rate has risen steadily over the past 20 years; it was 31.2 percent in 2020:

- The unemployment rate is especially high among new graduates and postgraduates (18.5 and 23.9, respectively).

- Twenty-nine percent of 15- to 24-year-olds are considered "not in employment, education, or training" (NEET) (World Bank 2021b). The NEET phenomenon discourages many young people, hindering their long-term ability to acquire skills and contribute to the economy.

INCOME, BENEFITS, AND EMPLOYMENT SECURITY

For Moroccans employed in large-scale projects, jobs are generally decent, with a salary that is satisfactory compared with the Moroccan average.

Large noncompensatory wage differentials exist between workers with similar productive endowments: higher earnings are frequently observed when workers (even unskilled ones) are in specific segments of the labor market. Indeed, despite the existence of excess labor supply, wages in the formal sector do not adjust. And the informal sector is not absorbing all job seekers. Moreover, surveys show that private firms are willing to pay a premium (as suggested by efficiency wage theories) to guarantee the productive output of workers.

The tax wedge is relatively high in Morocco compared with surrounding countries. It amounts to 38 percent for workers earning the average wage and 22 percent for workers earning the minimum wage.

IMPACT OF ENERGY TRANSITION ON EMPLOYMENT

The jobs affected by the energy transition can be classified as follows according to the International Labour Organization framework:

Jobs created (or new jobs) are those jobs that cannot be filled by people who lost jobs in similar occupations in other industries in the same country or region.

Jobs transformed (or jobs with new characteristics) are jobs in the same occupations that continue to exist, but with changes in their skill profiles and/or qualification requirements to accommodate new demand.

Jobs substituted (or jobs destroyed and reallocated) become vacancies in other industries in the same country or region.

Jobs eliminated (or jobs destroyed and not reallocatable) become unfilled vacancies in the same occupations in other industries within the same country or region.

DIRECT IMPACT OF THE ENERGY TRANSITION ON EMPLOYMENT

Morocco's ambitious energy efficiency and renewable energy strategy and policy fostered the recent development of these sectors; this in turn created a major opportunity for more local employment and skills development. An estimated 25,000 people were directly employed in renewable energy in Morocco in 2021 (IRENA n.d.). Most of these jobs have been generated at the Noor Ouarzazate solar facility, which consists of three CSP and a PV assembly plant. The MENA region assessment of the local manufacturing potential for CSP projects found that CSP has local employment generation potential in Morocco and can create economic opportunities for local communities. Besides economic benefits from construction and civil works, manufacturers can also reap economic benefits by exporting CSP components (World Bank 2011).

The energy efficiency market has already created a number of jobs in Morocco. A 2014 diagnostic had estimated 3,000 energy-efficiency-related jobs created (65 percent of which pertain to the heating–ventilation–air-conditioning segment) (GIZ 2016a).

According to Phase 1 of this World Bank study, the current government renewable energy and energy efficiency targets are estimated to create 760,000 net jobs per year over 2020–50, or an average of 25,000 per year (World Bank 2022). These figures include direct, indirect, and induced jobs. Table 2.2 breaks down job creation (direct, indirect, and induced) per year by four impact mechanisms (investment, investment displacement, substitution, and revenue). The respective shares for individual impact mechanisms differ by technology. For CSP and energy efficiency projects, most jobs created will be investment related (investment impact). For the other sectors, the majority of jobs are expected to be created as a result of Moroccans saving on energy bills (substitution impact). These results reflect the comparatively high investment in CSP and energy efficiency in buildings, while other clean technologies allow for comparatively low energy costs.

Table 2.2 Distribution of net job impact by impact mechanism, 2030–50

Drivers		Utility PV	CSP	Industrial sector distributed PV	Residential rooftop solar	Utility-scale wind	Energy efficiency
Investment impact Investments to support clean energy expansion	**Stimulates employment.** Moving expenditures from capital-intensive to labor-intensive sectors; developing the local supply chain	27,000	213,000	10,000	24,000	86,000	130,000
Investment shift impact Redirecting funds from other projects/spending to support clean energy investments	Displaces jobs in other sectors (e.g., fossil fuels)	- 61,00	-131,000	- 26,000	- 40,000	- 216,000	- 42,000
Substitution impact Energy savings from efficiency/renewables respent locally	Stimulates employment as consumers (residential, commercial, industrial) spend their savings in the economy	98,000	195,000	43,000	49,000	359,000	115,000
Revenue impact Lost energy company revenues	Displaces jobs in the utility sector	- 6,000	- 13,000	- 3,000	- 4,000	- 22,000	- 24,000
Subtotal by technology	-	58,000	264,000	24,000	29,000	207,000	179,000

Source: World Bank 2022.
Note: CSP = concentrated solar power; PV = photovoltaic.

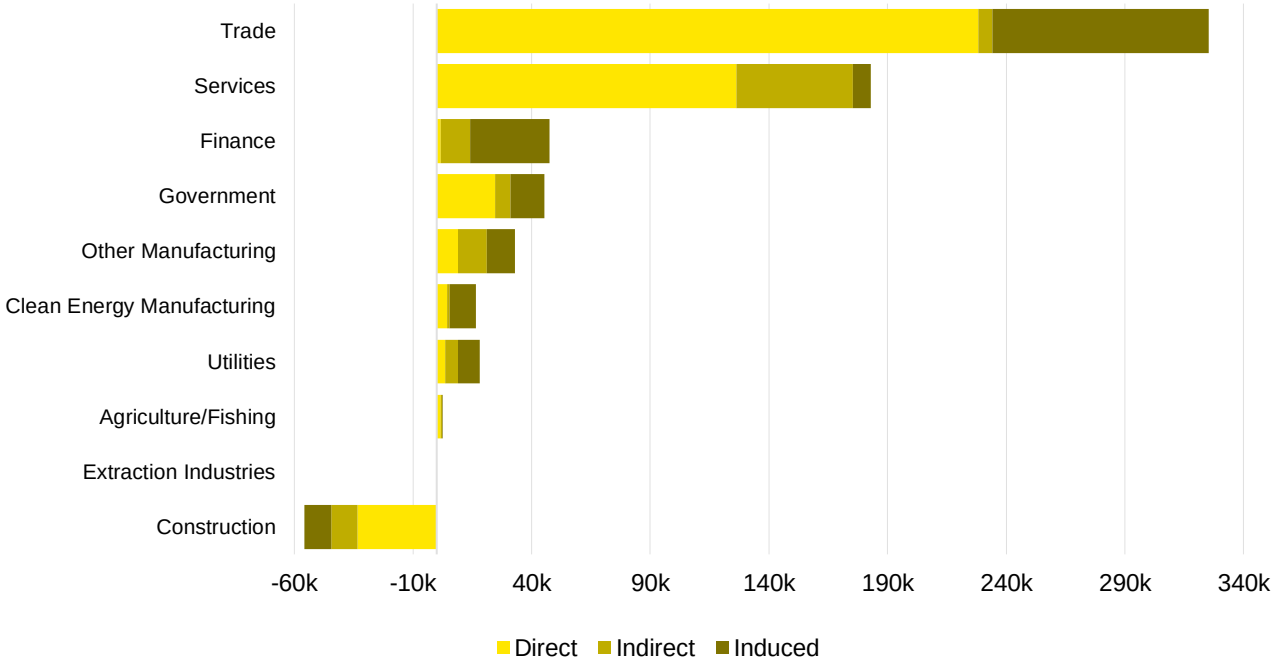
As shown in figure 2.8, employment growth will be highest in the trade and services sector:

- Investments in clean energy technology are lavished on sales and marketing, equipment purchase, developer profits, and operation and maintenance;
- Clean energy projects hire workers, under direct and indirect employment; and
- Saved energy costs are spent on services and goods.

The construction sector also sees a marked employment growth due to clean energy projects. This benefit is partially offset by declining jobs in construction and installation for conventional energy.

The energy transition has the potential to decentralize jobs; it can not only transform job types, but also disperse them geographically. Indeed, renewable energies disperse jobs by encouraging local economic activity and local employment.

Figure 2.8 Cumulative net direct, indirect, and induced job creation (job year) by sector



Source: World Bank 2022

3. HOW THE CLEAN ENERGY TRANSITION CHANGES JOB CHARACTERISTICS

This section presents the characteristics of the jobs affected by the clean energy transition:

- It begins with an **analysis of the types of jobs impacted by the renewable energy as well as the energy efficiency sector**, with a focus on the occupations that could shift from the conventional energy sector to the renewable energy and energy efficiency sectors.
- It then reviews **the core skills companies need to operate in the renewable energy and energy efficiency sectors**.

OCCUPATION

Studies show that the energy transition creates both low- and high-skilled jobs—jobs in construction and production on the one hand and in engineering or project management on the other hand (Czako 2020; see box 3.1 for a definition of skill levels). This section describes jobs directly affected by the energy transition and jobs along the entire value chain of energy efficiency or renewable energy projects.

Box 3.1 What are low, mid-range, and high skills?

According to the International Standard Classification of Occupations 2008 (ISCO-08), occupations are classified by the skill level—low, medium, and high—as follows:

- **High skills.** Occupations requiring high skills often require one to six years of higher education. They involve the performance of complex tasks, either technical/practical or theoretical, that require decision-making capacity and include a complex problem-solving dimension. These occupations could include managers, technicians, and associated professionals.
- **Mid-range skills.** Occupations requiring mid-range skills generally require a secondary education and involve performing tasks such as operating machinery and electronic equipment, driving vehicles, performing maintenance and repair, or manipulation. Many occupations at this skill level require advanced literacy and numeracy, as well as good interpersonal and language skills. These occupations comprise clerical support workers, service and sales workers, craft and related trades workers, and plant and machine operators and assemblers.
- **Low skills.** Low-skilled occupations require some form of primary education or at least on-the-job training. They involve the performance of simple and routine physical or manual tasks. Many of these jobs require physical strength and endurance. For some jobs, basic numeracy and literacy skills may be required, although they are not a significant part of the job in this case. These occupations include laborers and simple artisanry.

OCCUPATIONAL PROFILES ALONG THE VALUE CHAIN

The following section maps the jobs needed along the energy efficiency and renewable energy value chains for each phase of the development and operation of corresponding projects (tables 3.1 and 3.2). The value chain presented here is quite extensive; this is to highlight where governments have to intervene (mostly in the early phases) and to emphasize the need for their involvement if projects are to be executed efficiently:

- **Renewable energy legislation and planning** is a first step of the process; it requires notable legal experts and energy sector planners.
- **Enabling infrastructure investment** follows, with a need for financial experts in particular.
- **Feasibility, financing, and project tendering** is the final step before commencing with project design; it is carried out by several experts and involves new experts as well as those from the previous phases.
- **Project development** requires high-level skills for the most part, due to the studies and assessments that are conducted at this early stage of renewable energy project development (primary resources, water, environmental and social impact assessments, grid connection, and economic and financial analyses). Project development includes a prospecting phase to identify land potential to obtain building permits and administrative authorizations. Knowledge of the local regulatory framework and mastery of language and cultural codes are required.
- **Component manufacturing and assembly** require a mix of skills, with a sizable share of low and medium skills. Low-skilled workers are operators in manufacturing, assembly, and logistics, while medium-skilled workers perform quality assurance, handle logistics, marketing, sales, and also include electrical technicians for electronic and electric machinery, cabling, and grid connection.
- **Engineering, procurement, and construction** (EPC) requires all types of workers (from low- to high-skilled workers, plus engineers and managers). Low skills correspond to construction and transportation workers, and machine operators. Medium skills correspond to installers, welders, pipe fitters, plumbers, electricians, and technicians. High-skilled workers are mostly engineers (construction, system design, software developer, etc.) and project leaders.
- **Operation and maintenance** is mainly performed on-site by specialized technicians or subcontractors. Plant management and team supervision are performed as part of highly qualified jobs (performance monitoring, financial and commercial management, technical asset management, etc.).
- **Decommissioning and recycling** require technical experts as well as environmental specialists to lead the process, besides medium- and low-skilled workers to execute it.

Table 3.1 Mapping of renewable energy projects and skills

	Project development	Components manufacturing and assembly	Engineering, procurement, construction	Operation and maintenance
High skills	- Architect - Project designer (engineer) - Market analyst - Economic/financial/risk specialist - Atmospheric scientist and meteorologist - Social impact specialist - Lawyer - Sustainability specialists (natural resource/ environmental planner, social scientist) - Planner (permit monitoring, amendment, application) - Resource assessment specialist and site evaluator - Land development adviser - Land use negotiator - Lobbyist - Mediator - Public relations officer - Financial specialist - Communication specialist	- Design and conception engineer - Researcher - Modeler - Manufacturing engineer - Thermodynamics engineer - Electrical and electronical engineer - Marketing specialist	- Wind/PV/CSP system designer (electrical/mechanical/ structural engineer) - Software engineer - Operations head - Project manager - Business development manager (sales manager) - Project designer (engineer) - Health and safety executive (HSE) engineer - Quality assurance engineer - Grid engineer - Measurement and control engineer - Commissioning engineer (electrical) - Logistics specialist - Wind resource assessment manager	- Plant director - Operation and maintenance (O&M) manager - O&M engineer
Mid-range skills	- Measurement expert - Data acquisition expert - Water supply expert - Plumbers - Environmental impact assessment (EIA) specialist - Procurement professional	- Manufacturing quality assurance experts - Shift supervisor - Logistics professional - Sales personnel - Logistics expert - Electrical and electronical technician - Health, safety, and quality control expert	- Wind/PV/CSP operator and installer - Project and installation evaluator - Quality assurance specialist - Welder - Pipe fitter - Plumber specialized in solar/wind - Electrician specialized in solar/wind - Wind/PV/CSP system technician	- Mechatronics technician - Plant operation manager - Administration personnel - Production technician - Wind/PV/CSP maintenance technician - Electrical and grid maintenance operator - Electrical maintenance technician - Inspector - Storage maintenance technician
Low skills		- Manufacturing operator - Assembly operator - Logistics operator - Equipment transporter - Laborer - Machine operator - Electrical operator	- Construction worker - Transportation worker - Laborer - Machine operator - Electrical operator - Equipment transporter	- Production operator - Plant worker - Cleaning operator - Site maintenance operator - Logistics operator - Equipment transporter

Source: World Bank and EY 2021.

Note: CSP = concentrated solar power; PV = photovoltaic.

The projects aimed at improving energy efficiency cover a variety of sectors and therefore have a much wider scope in terms of job creation.

Table 3.2 Mapping of energy efficiency projects and skills

	Project development	Component manufacturing and assembly	Engineering, procurement, construction	Operation and maintenance
High skills	- Architect - Project designer (engineer) - Energy efficiency technology development designer - Market analyst - Economic/financial/risk specialist - Public relation officer - Environmental consultant - Lawyer - Planner (permit monitoring, amendment, application) - Policy maker / legislator / politician - Educator and trainer - Researcher	- Design and conception engineer - Energy modeler - Quality insurance specialist - Logistic expert - Life cycle cost/ sustainability expert - Marketing specialist - Thermodynamic, electrical, and electrodynamical engineers	- System designer (electrical/mechanical/structural engineer) - Construction engineer - Commissioning engineer - Software engineer - Quality assurance engineer - Health and safety executive (HSE) engineer - Measurement and control engineer - Industrial energy specialist - Weatherization/energy saving possibilities expert	- Energy auditor - Building inspector - Building owner and manager - Recycling specialist - Energy manager - Maintenance, performance, data expert
Mid-range skills	- Staff of policy makers and government office workers - Procurement professional	- Manufacturing technician - Electrical and electronics technician - Shift supervisor - Quality assurance expert - Logistics professional - Salesperson - Wholesale and retail distributor of energy efficiency appliances	- Electrician - Plumber - Carpenter - Plasterer - Roofer - HVAC, insulation, heating, windows, lighting, and water heating technician - Project/installation evaluator - Automation system installer	- Administration personnel - Facilities technician - Electrical maintenance technician - Inspector - Energy tracking and monitoring, measurement, and data acquisition technician
Low skills		- Manufacturing operator of energy efficiency appliances, materials, and industry equipment - Craftsman - Assembly operator - Logistics operator - Equipment transporter	- Construction worker - Transportation worker - Laborer - Electrical operator - Equipment transporter	- Production operator - Maintenance and repair operator

Source: Sooriyaarachchi et al. 2015; Goldman et al. 2010; UNESCO-UNEVOC 2020.

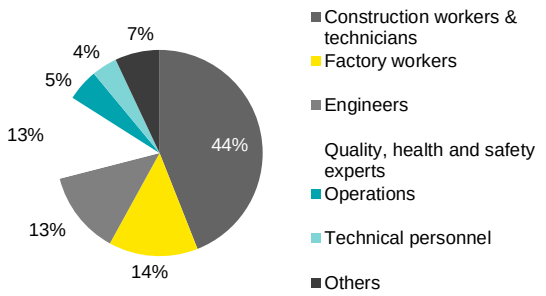
Box 3.2 Case study 1: The value chain links with the highest job creation potential

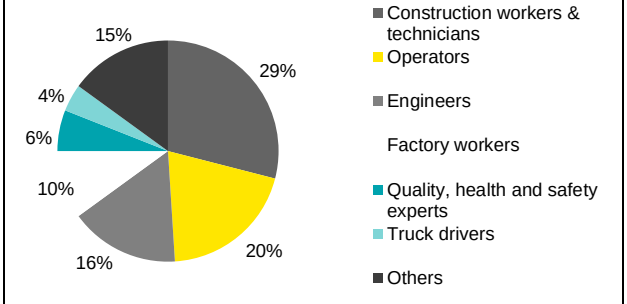
The needs of different occupations vary depending on their position in the value chain and the technology(ies) involved. Indeed, the study *Renewable Energy and Employment: the Experience of Egypt, Jordan and Morocco* (KAPSARC 2019) shows that the distribution of human resources required along the renewable energy and energy efficiency value chains varies, for example, for the development of a 50 megawatt solar photovoltaic (PV) plant and the development of a 50 megawatt wind farm.

The results are illustrated in figure B3.2.1 (in number of person days).

Figure B3.2.1 Workforce requirements in the solar PV and wind value chains

Work activity	Solar PV	Onshore wind farm
Project development	230	2,580
Component manufacturing and transport	5,520	18,967
Assembly **Engineering, procurement, and construction**	3,910	34,480
Operations and maintenance	12,880	2,665
Decommissioning	460	8,420





Source: KAPSARC 2019.

The demand for semiskilled workers (requiring vocational skills) and unskilled workers is higher than the demand for skilled workers (requiring a degree or diploma qualification). This is due to the relatively high number of technicians, machine operators, drivers, and laborers needed for the construction phase of both wind and solar PV projects.

JOBS AFFECTED BY THE DEVELOPMENT OF RENEWABLE ENERGY AND ENERGY EFFICIENCY IN MOROCCO

AREAS OF JOB DEVELOPMENT POTENTIAL IN MOROCCO

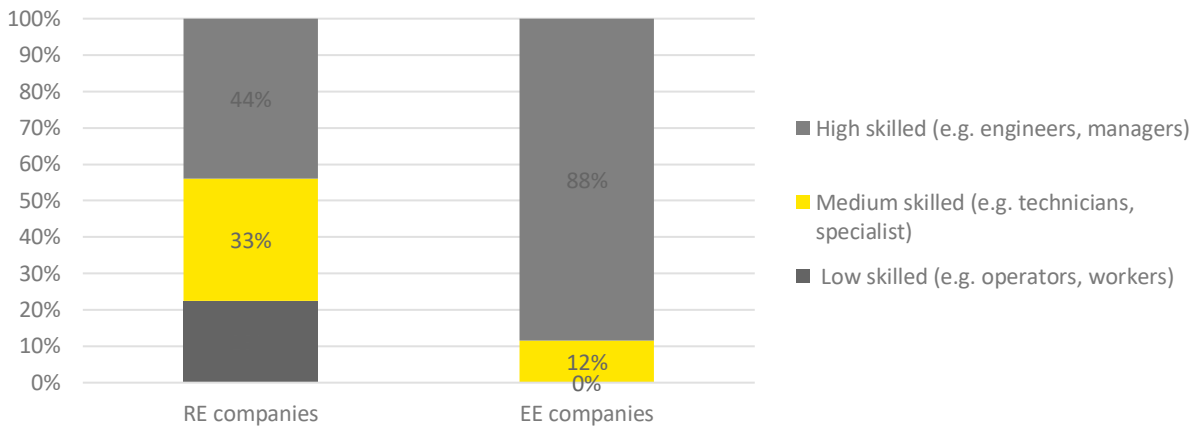
The online survey conducted as part of this study shows that companies in the renewable energy and energy efficiency sectors hire predominantly highly skilled employees.

Importing renewable energy technologies (from China in particular) is more efficient for Morocco than developing its own technologies (IRENA and EIB 2015). Jobs in manufacturing are hence fewer in Morocco now. While Morocco cannot meet the need for semi- and low-skilled workers like technicians, who are required (see figure 3.1), it can provide workers in project management, installation, construction, and operation and maintenance (O&M). In these links of the value chain, in terms of volume, most jobs are service jobs and in engineering and consulting. This explains the many high-skilled jobs (44 percent) among the companies responding to the survey. Installation and O&M involve a skilled workforce of technicians, with specific expertise in the renewable energy sector (medium-skilled jobs represent 33 percent of the workforce, compared with 23 percent for low-skilled jobs).

Energy efficiency projects in Morocco typically call for highly skilled jobs (88 percent of the workforce of the surveyed companies). Indeed, as for renewable energy, component manufacturers barely have a toehold in Morocco, whereas the bulk of the affected jobs are in consulting, engineering, and O&M. Specifically, the most significant job development potential in Morocco is listed given below:

- **Service area:** Quality management; auditing; training; awareness; commercial services; consulting; distribution of solar modules, accessories, or specific components; and other services related to energy efficiency.
- **Technical engineering:** Development of project concepts, technical studies, feasibility studies, and construction plans.
- Microactivities in subcontracting networks (manufacturing of accessories).
- **O&M area:** Technical repair intervention and routine tasks (cleaning of modules, etc.).
- R&D area.
- Training and education.
- Experts in sustainable management in relation to environmental pressures.

Figure 3.1 Distribution of low, medium, and high skills in the companies that responded to the survey



Source: Online survey.
Note: In percentages. EE = energy efficiency; RE = renewable energy.

CREATION OF NEW JOBS IN MOROCCO

Renewable energy development is creating many new jobs that require specialized technical knowledge (e.g., wind power project manager, energy performance, and environmental certification engineer or eco-designer). A report of the International Labour Organization (ILO 2018) identifies a set of new jobs created by encouraging renewable energy development. For solar energy, and among the areas in which Morocco has a job creation strong potential, we can identify the following job types:

- **Solar installers.** Install, set up, maintain solar modules, panels, or support structures and wiring that connect a solar energy system to the electrical grid in compliance with system design.
- **Solar service technicians.** Monitor, diagnose, optimize, and repair underperforming panels (quality assurance professionals).
- **Solar plant managers.** Coordinate the day-to-day work (materials; time and budget constraints; coordination of engineers, system designers, and installers).

Development of the wind energy sector is also leading to new sector-specific jobs:

- **Wind turbine technicians.** Install, inspect, operate, maintain, and repair wind turbines.
- **Wind plant managers.** Oversee electric power generation and distribution systems, as well as O&M, repair, safety, performance, and profitability.
- **Quality engineers.** Develop processes, test procedures, and implement systems that ensure compliance with quality standards and safety requirements.

For energy efficiency, newly created jobs in Morocco include:

- Energy efficiency auditors, which involves helping industrial establishments measure energy consumption, assess and identify areas of improvements, analyze options, and develop energy efficiency plans, and
- Energy efficiency managers, which involves measuring and monitoring energy consumption, and planning and implementing energy efficiency measures within production units.

SYNERGY EFFECT WITH OTHER SECTORS

- Studies of the energy transition show that most jobs will require only reskilling/upskilling of existing qualifications (Jagger, Foxon, and Gouldson 2014). Employment in the energy transition sectors would thus require the retraining and continuing education of former employees, who are changing sectors (OECD 2019). This presents an opportunity for the conventional energy sector to offset job losses through retraining (CLER 2021). Three key examples of job transformation opportunities are given below:
    - **Electricians with solar component expertise.** Install, maintain, repair electrical wiring, equipment, and fixtures for photovoltaic (PV) systems and ensure compliance with electrical and building conventional codes.
    - **Plumbers with solar component expertise.** Install, and repair tanks, piping, and other components of solar thermal systems, besides issuing permits and ensuring compliance with conventional plumbing and building codes, and selling equipment and systems.
    - **Heating, ventilation, and air-conditioning technicians.** Install, service, and repair commercial solar thermal systems.

Box 3.3 Case study 2: New energy jobs emerging from the energy transition

In a 2018 study, the OECD identified retraining for new jobs emerging from the energy transition. These conversions are based on both transferable and new capabilities.

Table B3.3.1 Retraining for energy transition jobs

Country	Initial job	Initial education	Continuous education	New job
Denmark	**Industrial electrician/power technician**	Professional training diploma/engineering diploma	Knowledge of energy sources, ability to integrate energy systems, project management, energy systems integration, project management	Director, renewable energy
Denmark	**Industrial worker/electrician**	Vocational diploma/bachelor's degree	Assembly and integration of pieces, use of tools	Onshore wind technician
France	**Product designer**	A total of 22 initial training courses with different specializations	Integration of environmental issues	Ecological designer

Source: OECD 2018b.

REQUIRED SKILLS AND CAPABILITIES

Besides the technical skills and knowledge specific to renewable energy or energy efficiency, soft skills appear essential in the energy transition professions.

Higher-order cognitive transferable skills are in growing demand (e.g., logic, critical thinking, and complex problem solving). If this is true for other sectors, it may be even more true during the energy transition. Indeed, it is worth noting that studies show a greater breadth of knowledge is required in the energy efficiency and renewable energy sectors, whereas business processes require less routine and automation (Czako 2020).

Eleven core competencies have been identified (table 3.3). They cut across the renewable energy and energy efficiency value chains and across skill levels (low, medium, and high).

These competencies include the ability to communicate and negotiate. Indeed, in Morocco, diverse stakeholders increasingly require employees to show high-level coordination and social skills, such as the ability to communicate with customers. This skill will therefore be necessary for local utility representatives, land use negotiators, and public relations officers, as well as finance experts and consultants.

In addition, in most professions, digital skills are in increasing demand. Digital competence is in particular demand for most semiskilled and skilled job positions, especially during the O&M phase.

Table 3.3 Key skills and capabilities in the energy transition sector

Skill category	Corresponding occupations
Strategy and leadership	- Project designers and managers - Commissioning engineers - Business developers - Plant operation manager - Plant director
Coordination management and business	
Innovation	- Design and concept engineer - Researchers - Modelers - Manufacturing engineer - Project designers and managers - Construction professionals - System designers - Electrical grid engineer - Commissioning engineers - Software engineer - Business developers
Communication and negotiation	- Local utility representatives - Land use negotiators - Public relations officers - Finance experts and consultants
Marketing	- Marketing specialists - Sales personnel
Systems and risk analysis	- Plant operations manager - Administration - Production technician - Maintenance technician - Electrical and grid maintenance operator - Electrical maintenance technician - Inspector - Storage maintenance technician
Environmental awareness and eagerness to learn about environmental issues	- All jobs along the renewable energy and energy efficiency value chains
Interdisciplinary	- Administration - Plant director
Advocacy and campaigning	- Local utility representatives - Land use negotiators - Public relations officers

Foreign language	- Majority of jobs requiring high qualifications, all along the value chains, especially in the case of partnerships (co-contracting, subcontracting, joint ventures) with foreign companies
IT	- Design and conception engineer - Researchers - Modelers - Manufacturing engineers - Project designers and managers - Construction professionals - System designers - Electrical grid engineer - Commissioning engineers - Software engineer - Business developers - Plant operations manager - Administration - Plant director

4. OPPORTUNITIES AND CHALLENGES FOR CLEAN ENERGY JOB TRANSITIONS

This section presents an analysis of the opportunities and challenges for a job transition in the context of clean energy transition in Morocco:

- In revisiting the **conceptual framework and conditions for a job transition**, it reviews the main levers for job creation in Morocco.
- It provides an **analysis of Morocco's current business environment** at a macroeconomic level to facilitate an understanding the business drivers and barriers.
- The **structure of the sector and the market** will be analyzed, along with the opportunities and challenges arising from access to financial services and infrastructure, and possibilities surrounding local content.
- It addresses the **challenges and opportunities for technology and innovation** with regard to renewable energy and energy efficiency in Morocco.
- It focuses on **human-capital-related challenges and opportunities**.
- It provides an in-depth **analysis of the challenges and opportunities linked to the policies, institutional frameworks, national programs, and education system**, initially presented in section 3.2 of this report.

REVIEW OF THE CONCEPTUAL FRAMEWORK AND CONDITIONS FOR A SUCCESSFUL JOB TRANSITION

LEVERS FOR JOB CREATION

In its report on labor market policies, the Organisation for Economic Co-operation and Development (OECD 2021) reviews the main levers for job creation, particularly in developing countries.

New jobs are created when industries grow and new businesses are created and existing businesses expand. Indeed, net job creation is typically led by a few startups. New firms depend on the local economic contexts from which they emerge; most high-growth companies typically develop in densely populated clusters marked by high levels of tertiary education. Policy makers play a significant role in job creation by supporting technology, capital, affordable space, and startups through not only facilitating financing, but also promoting business networking. Labor market policy is also pivotal in supporting job creation; it businesses helps start and grow by ensuring they have access to people with the right skills. Further, flexible training, education, and employment services are needed to address potential skill gaps, which can curtail business growth and expansion.

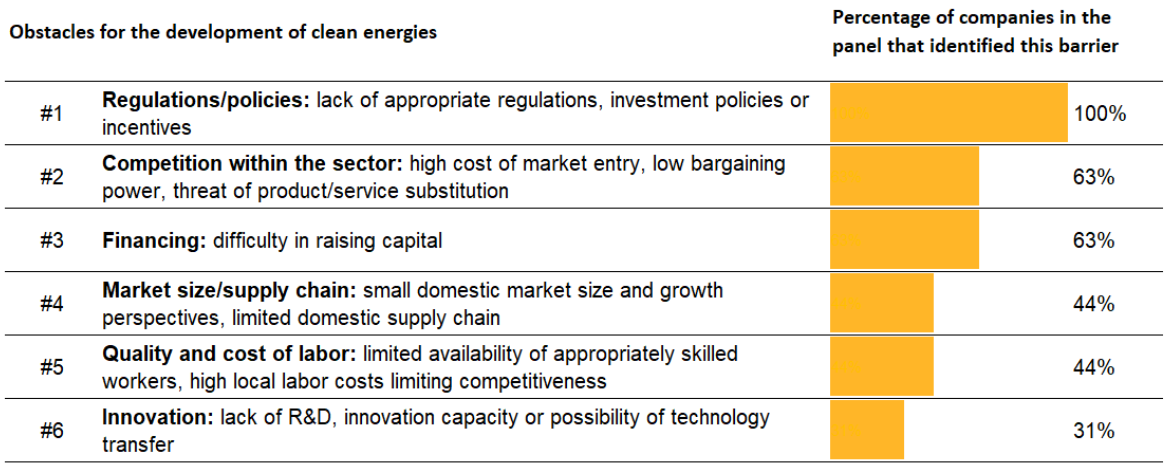
SUMMARY: THE MAIN JOB CREATION LEVERS IDENTIFIED IN MOROCCO

Among the different levers, the online survey identified the top factors limiting job creation as well as factors supporting renewable energy and energy efficiency objectives in Morocco (figure 4.1):

- 100 percent of the respondents consider **regulation** as a major obstacle to their development. This highlights the need to identify barriers for the energy efficiency and renewable energy markets to take off.
- 63 percent of the respondents consider **competition within the sector** as a major challenge.
- 64 percent of the respondents consider **financing** as a major challenge.

About 40 percent of the respondents identified other challenges (market size/supply chain, quality and cost of labor and innovation).

Figure 4.1 Clean energy development barriers as ranked by survey respondents



Source: Online survey conducted by the World Bank
Note: R&D = research and development.

Box 4.1 Case study 3: A study of the Noor 1 project's impact on Moroccan economic development

A study of the social impact of the Ouarzazate-based Noor 1 concentrated solar power project on Morocco's territorial economic development highlights the main opportunities and challenges. Overall, the project benefits local business activities, transfers significant know-how, and helps develop national expertise.

Although local companies were integrated in the project, many small and medium firms complained that their business opportunities are limited by a lack of capacity especially compared with foreign firms and more qualified foreign workers. This raises the underlying issues of competition within the sector.

Table B4.1.1 Noor 1's economic impacts and significance

Economic impact	Type	Significance of impact	Details
Improvement of the activities of local businesses	+	●●●●	Increase in the activity of existing local companies for supplying the materials and equipment needed for the activity, as well as for daily equipment maintenance. Companies for assembling the solar field are created on site. Development of industrial activities in the region via

			the involvement of local small and medium companies in maintenance, guarding, and industrial cleaning services.
Improvement of activity and economic attractiveness	+	●●●●	Development of individual small businesses. Extensive training and support are provided, enabling local youth to progress, with the necessary guidance and support offered by the regional investment center. Industrial consolidation enables attracting local companies to invest in new production lines and encourages international investors to create local branch offices.
Technology development	+	●●●●	Development of leading national expertise. Training of technicians in new renewable energy and nonpolluting technologies. Acquisition of expertise especially related to concentrated solar power technology by local employees. Technology transfer in the field of solar energy.
Industrial integration and competitiveness	+	●●●●	Use of local equipment and services for the construction and operation of Noor 1. Launch of new industrial activities such as the production of "torque tubes." Strengthening the high-tech capacity of local firms through knowledge collaboration and increasing technology in collaboration with foreign firms enhances the capacity of local industry.
Economic exclusion of small and medium firms	-	●●●●	Although the local content requirement was considered beneficial, many small and medium firms complained that their chances of business opportunities are limited due to their lack of capacity compared with foreign firms and more qualified foreign workers.

Source: Laaroussi et al. 2021.

OVERALL BUSINESS ENVIRONMENT FOR THE RELEVANT SECTORS

A job transition in favor of the clean energy sector can happen only if the green economy, especially the renewable energy and energy efficiency sectors, benefit from a steady, sustained growth. Growth stems from macroeconomic stability, adequate regulations, investment policies, and incentives.

Compared with other Middle East and North Africa (MENA) countries, Morocco's macroeconomic stability is favorable, and, according to the Economic Situation Report 2021, it has good economic, financial, and innovation stability. However, it lags in human resources, both in terms of education and health. There also exist gaps in access to credit and the settlement of insolvencies, which poses obstacles to the emergence of innovative companies. Morocco was affected by the health crisis, but is faring better than its neighbors, thanks to an exceptional year in agriculture. Recovery is slow in industry and services, where many companies are overindebted. In 2022, the government launched an NDP (New Development Plan).

Regarding regulations, the stakeholders believe the laws are too inefficient to meet their needs. More precisely, the country faces difficulties with a host of issues, including the following:

- Access to low- and medium-voltage networks (covered by law 13-09) is complex and involves too many constraints for small private companies. These networks are therefore not used, even though the law allows it, because an application decree has not been released (EcoActu 2021). This is one of the most critical barriers since employment potential exists in very small, small, and medium enterprises. This point is emphasized in nearly every interview and literature citation. It is also not a recent issue. The regulation also hinders of self-consumption/on-farm installations (GIZ 2017a; Medias24 2021a).[3]

- The network is controlled by operators, whose interests are at odds with private investors; entry procedures are lengthy (Medias24 2021b).

- Local actors have limited knowledge of the legal and regulatory framework.

- Particularly for energy efficiency, professionals do not comply with the 2015 RTCM (Moroccan thermal construction regulation); public administration exerts no control (M'lahfi, Amegouz, and El Qandil 2020).

- Another example is butane gas, which is still highly subsidized, despite the potential in solar heating, especially solar pumping in farms still using this gas (L'Opinion 2021). The recent decree on energy auditing gives impetus to industrial energy efficiency, but the decree is insufficient. Only the largest companies benefit, and their consumption is neither controlled nor monitored. The building sector lacks strong regulations.[4]

- In general, the laws tend to favor large-scale projects over small-scale projects, even though the latter present significant job creation potential.

- New regulations are introduced at a less-than-ideal pace.

- These delays surrounding the modification of the regulatory and legal framework lead to a lack of confidence of local professionals and especially of foreign actors who want to develop energy efficiency and renewable energy activities in the country by recruiting and training local workforce. At the same time, investors who have decided to stay, work with minimal risk and do not recruit much.

SECTOR STRUCTURE AND MARKET

According to the survey, the highest barrier to developing local production is the lack of a clear and significant market perspective.

Also, the competition between small and big companies tends to favor the latter since they have better financing capacity. In public tenders, small and medium enterprises (SMEs) have little chance of winning, if only because of the large volume of contracts (GIZ 2017b).

[3] Stakeholder consultation (2021), Training Institute of Renewable Energy and Energy Efficiency Jobs (IFMEREE).

[4] Stakeholder consultation (2022), Office of Vocational Training and Job Promotion (OFPPT).

It is therefore essential that local companies benefit from competitive advantages, for example, the proximity of European and MENA markets and low transports costs (especially significant for large equipment and machinery parts, e.g., masts in the wind industry), but also the design of components specifically adapted to Morocco's economic and local conditions (in particular, high temperatures, dust, and humidity) (IRENA and EIB 2015). Innovation and design must be oriented toward economic models that help integrate technologies and industry.

ACCESS TO FINANCIAL SERVICES AND INFRASTRUCTURE

The share of domestic financing is positively correlated to job creation because the cost of domestic financing (interest payment) is reinjected into the local economy, unlike the cost of international financing, which leaves the local economy. Among the various issues, we can mention the following:

- A lack of accessible financial support or subsidies for small-scale projects (compared with large-scale projects that impede SME development). This lack of financial support can be linked to the regulatory framework (Choukri, Naddami, and Hayani 2017; WFC 2016), and was highlighted by the GIZ (2022) survey, only one-fifth of whose respondents mentioned that they were helped.

- Insufficient local and regional consideration and therefore the lack of investment in renewable energy/energy efficiency locally and regionally compared with international/government projects. Everything is centralized, and the regions are struggling to develop their own incentive tools and strategies. It is crucial for projects to adapt to local conditions unknown to global entities, and to create markets that support the local workforce (KAPSARC 2019).

- The government's generally unclear behavior, with its regulations and incentives at odds with its objectives, not only makes it hard to see potential investors but also deters them from investing (GIZ 2017b), especially in view of the high up-front costs, which can entail significant risk (IRENA and EIB 2015).

- Lack of knowledge on the potential financing capacities (GIZ 2016b).

- Small-scale photovoltaic (PV) applications represent a potential niche market for industrial players and offer opportunities in the export market for SMEs. In particular, net metering is too limited, and the lack of incentives to store energy reduces the profitability of these systems, besides leading to low application of small-scale PV.

Box 4.2 Case study 4: Suppression of fossil fuel subsidies: the example of Namibia

Clear communication with stakeholders and the public is a key element of an effective reform strategy. Close consultation with the main stakeholders, including inviting them to participate in the formulation of a subsidy reform strategy, can help build consensus for reform. In 1996 in Namibia, the National Energy Council established the national deregulation task force to examine fuel price deregulation through a consultative process involving all stakeholders. This resulted in the 1998 White Paper, which stressed the importance of focusing subsidies on remote areas, transparency, and gradual deregulation (Namibia, Ministry of Mines and Energy, 1998. These provisions were key to securing widespread support for the reform. In Niger, the authorities opted for a similar approach. They set up the "Comité du Differé" in 2010 to discuss how to advance fuel subsidy reform. This committee's role was to ensure all relevant stakeholders were on board and forge a consensus on the main reform elements.

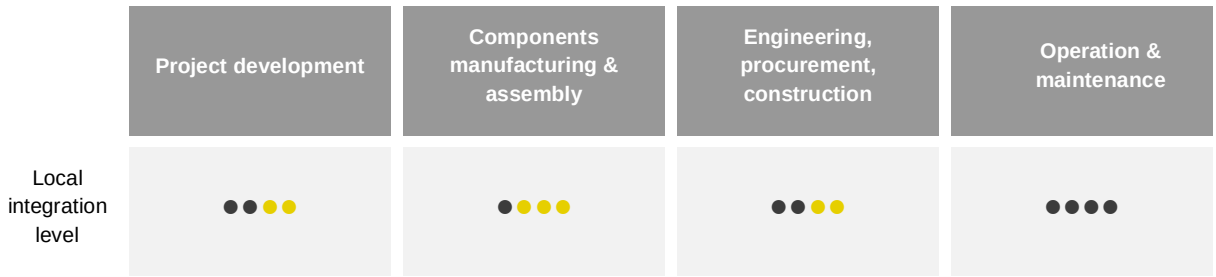
LOCAL CONTENT IN MOROCCO

Despite its good innovation capabilities, Morocco has not yet been able to fully utilize its strengths to create attractive manufacturing output. This is mainly due to the market's size, which does not justify the development of a local industry in this field (only one unit is currently operational in El Hoceim: ALMADEN), and the regulatory and customs framework. For instance, PV panel assembly units have had to shut down because the production cost for their panels is still high compared with panels imported from China. This is mainly due to mechanisms applied by the Ministry of Industry, which imposes tariffs on the import of panel components but exempts the import of complete panels from taxes.

Therefore, for now, Morocco imports renewable energy and energy efficiency subcomponents instead of manufacturing its own, even though a significant number of jobs lies in this part of the value chain (figure 4.2). According to the GIZ (2022) survey, the number of business areas in the renewable energy and energy efficiency sectors is still limited for SMEs: the vast majority of them work in decentralized PV installation or energy efficiency for building and industry. Along the value chain, more than 62 percent of jobs are generated by construction, installation, and maintenance.

This represents an untapped opportunity for the country. This opportunity may emerge as particularly interesting if and when Morocco strengthens its interactions with international partners who enjoy several competitive advantages, for example, lower costs for labor, raw material, land, and energy.

Figure 4.2 Summary of the local integration of the different links in the value chain



IDENTIFICATION OF CHALLENGES RELATED TO LOCAL CONTENT IN MOROCCO

Local content is difficult because the most common approach is top-down, involving large-scale entities and decisions made at the national level (WFC 2015). Another crucial point is the absence of local preference written into the law, meaning companies can recruit foreign, cheaper workforce, for instance, with the involvement of Chinese workers. Funders tend not to agree to make industrial integration mandatory. This issue is even more important because the lack of work for Moroccans means a lack of pre- and in-service training opportunities that could be used for future projects.

The local value-added remains limited in the sector. Only a few local companies are active in solar panel manufacturing and project development and engineering. Over the past few years, two solar panel manufacturers have been established in Morocco: Droben (10 megawatts [MW]/year plant near Casablanca) and Cleanergy (5 MW/year plant). These have been established to make modules with imported cells. The total manufacturing capacity may be sufficient to supply modules for small projects, but the development of large-scale plants would require new manufacturing capacities.

Regarding large-scale projects, relatively few Moroccan companies managed to get involved in engineering, procurement, and construction (EPC) contracting frameworks. They find it difficult to compete with large foreign firms, which have economies of scale and greater research and development (R&D) resources. Nevertheless, many local companies are becoming subcontractors.

OPPORTUNITIES FOR LOCAL CONTENT IN MOROCCO

The following components offer promising local capacity potential for renewable energies (WFC 2015):

- **Solar PV.** This technology offers promising local capacity potential. Morocco can rely on robust mechanical, electrical, and electronics industries, especially cable producers, which may be an asset for supplying future PV plants in the short-term perspective. Construction also offers significant local content potential, with leading EPC companies having both the technical skills and critical sizes to provide civil, mechanical, and electrical engineering services. Local steel companies could provide the necessary steel support structures for PV modules, provided they invest in specific equipment. Engineering firms, in particular, are well positioned to offer quality services in this area.

- **Concentrated solar power.** This technology has great potential for local industrial integration. A study by the Energy Sector Management Assistance Program (ESMAP 2011) estimated local value addition between 28 percent and 39 percent. Moroccan industries could do well especially in steel structures, and cables and electrics. Significant gains have been obtained, with Moroccan subcontractors effectively achieving such numbers in Noor installations, supervised by the Moroccan Agency for Sustainable Energy (MASEN).

- **Onshore wind.** Morocco aims at strengthening its safety management processes through the development of a national industrial capacity. Wind project developers are strongly encouraged to include a plan to develop a domestic manufacturing and/or an assembly industry for wind components. Indeed, Morocco has one of the lowest costs of kilowatt-peak wind power in the world, the technology has been mastered, and Moroccan actors are specialized in the field. Thus, there exists strong potential for the local manufacture of wind turbine components, and Moroccan actors have already proven their capability, considering several companies have been involved in wind projects in the past decade and have developed

a know-how in this sector (e.g., the Siemens factory of Tangier dedicated to the production of blades for Morocco and Europe). Local companies would also be able to produce the main electrical components, cables, and parts of generators in the short to medium term. Transport, civil engineering work, and foundations of upcoming projects could also be performed by local players. Moroccan companies have excellent capability for innovation, partnership development, and technological cooperation with international companies; this would help them produce blades locally for future projects.

- With its 3,500 kilometer maritime coastline, Morocco is in an excellent location to develop offshore wind energy—an industry that can strengthen the country's position and create new jobs and expertise.

- Besides the technologies within the scope of this study, two other technologies—**hydrogen and biomass**—offer promise with regard to local content. Biomass could create many direct and indirect jobs along the entire value chain (collection, fuel manufacturing), but it is limited by the prevalence of informality in resource collection, which contributes to the creation of a parallel economy. Regarding hydrogen, other specific challenges exist, including water management, cost management in industry for transport, and storage (an issue for smaller companies), and an eco-mobility development strategy that can be effective only if it is adapted to Moroccan particularities (obsolete fleet, three-wheelers, motorbikes). What is important to note is that for these two markets to take off, a precise and accurate strategy will have to be defined; else, results will be as disappointing, as for renewable energy and energy efficiency.

- Within 5 to 10 years, Morocco could also position itself as a **battery producer**, with the potential to create a battery assembly and cell production industry.

Box 4.3 Case study 5: Austrian communities of energy develop local assets efficiently

In view of Austria's goal of becoming fossil fuel free by 2050, the country's federal government has established the Climate and Energy Model program with an aim to support regions committed to becoming independent of fossil energy resources. The program involves three phases: development of the implementation concept (usually a lead organization in the region takes on this task); the appointment of a "model region manager" to assist in projects' implementation (this function is financially supported by the program for two years); and the implementation of the projects. The program supports the "model region" by co-financing projects, up to 30 or 40 percent.

Three factors were identified for a successful implementation:

- **A practical and sensible concept.** The concept describes the *status quo*, sets goals and benchmarks, identifies potential, and sets out concrete actions. It is important to delimit the size of the region—60,000 inhabitants has proven ideal.

- **One person in charge.** The success of a model region often depends on a single person in charge of implementing the action plan and its projects. This person also acts as the contact person for the region's stakeholders. Without such a person, implementation cannot be successful.

- **Integration of the region into the development process.** Cooperation with stakeholders can enhance the local economy, increase the involvement of local policy makers and citizens, and increase awareness of projects, and projects' development can be expanded and anchored within a region. Co-financing by local communities is crucial.

TECHNOLOGY AND INNOVATION

TECHNOLOGY: A CHALLENGE TO STRENGTHEN SERVICE QUALITY, ESPECIALLY FOR SMALL PROJECTS

- Service quality was identified as a major barrier in small renewable energy or energy efficiency projects. Standards and the accreditation system are still struggling. The accreditation system in particular is not sector specific. Instead, standards and requirements from other sectors (such as civil or electrical engineering) are applied. Unqualified electricians and plumbers can install PV technologies informally and without training. Because the technologies are not adapted to the local environment, some of them malfunction after they are connected to the grid—say, solar water heaters connected during foggy weather, or installed without filters, causing damage to units. This harms the sector's image. Standards and certifications, when they exist, are not rolled out systematically, nor are they widely communicated to sector actors and the general public.

- The number of entities controlling the standards is limited, and only the largest clients can access them: SMEs are either unaware of their existence or cannot afford to know, since the main actors in control are laboratories entering the market, because they see an economic opportunity. This highlights the absence of a national standards strategy.

- SMEs are more affected by informality because competition with other informal SMEs provides cheaper, but lower-quality, products (for example, PV, solar heating) and undermines the sector's credibility. Compared with other MENA countries, Morocco has many more provisional and successful businesses. Informality, however, hinders the long-term availability of skilled labor. This can discourage formal firms from hiring, opting for permanent resources, and expanding their market. They generally prefer working with independent workers or short-term contracts.

- Customs control of imports pay little attention to the age and condition of imported solar equipment. This affects these products' users in different ways: control is much more common for large companies or projects than for smaller entities or ordinary citizens. The market is thus left with obsolescent equipment from Spanish projects, for example, which, however, continue to be offered to farmers for solar pumping.

- It can be argued that these quality issues stem from an informal, unregulated market for the sale of equipment like PV panels or thermal panels. These low-cost alternatives offer no minimum guarantee of quality, which harms market development. At the same time, several standards apply to ReN equipment (IMANOR), but consumers lack awareness of the existence of these standards. Sometimes even professionals are unaware.

To respond to these challenges, initiatives and quality standards are emerging. For example, companies have taken to assigning the label "taqa pro" to signify quality. Morocco offers educational sessions in training centers at the Moroccan Agency for Energy Efficiency (AMEE) in Marrakech and the Training Institute for Renewable Energy and Energy Efficiency Jobs (IFMEREE) in Oujda. The first two training sessions (in 2019 and 2021) have certified 28 and 31 companies, respectively. Taqa pro has three tiers, applied in descending order:

- **taqa pro PV.** For companies and self-employed entrepreneurs installing PV systems at less than 20 kilowatts (kW), including systems for self-consumption at remote sites.

- **taqa pro PV+.** For companies installing PV systems at 20 kW to 2 MW, including systems for self-consumption.

- **taqa pro solar pumping.** For companies and self-employed installers of PV solar pumping systems.

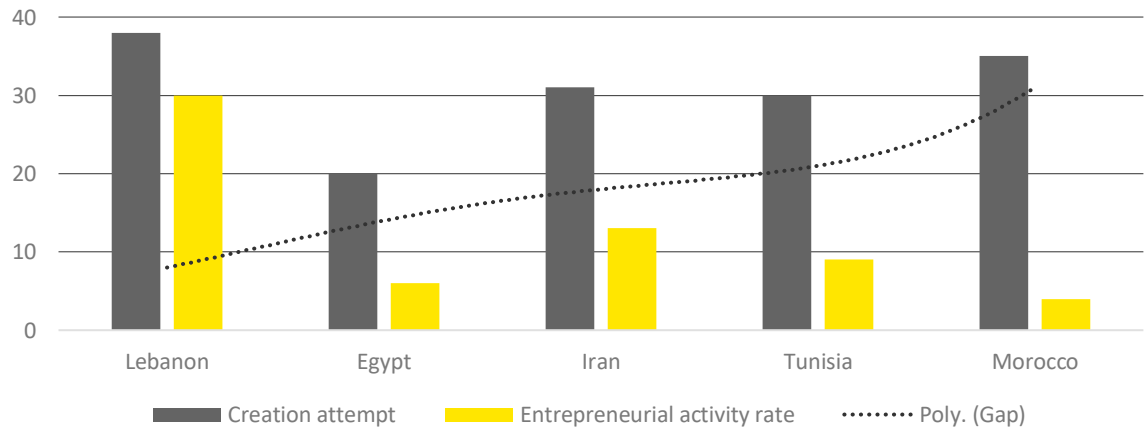
But there are barriers to access. Although AMEE in Marrakech may certify entities as taqa pro, not everyone can travel for training. The IFMEREEs in Oujda, Tangier, and Ouarzazate do not offer the training, partly due to lack of collaboration among entities. Also absent from this process is the Office of Vocational Training and Job Promotion (OFPPT), despite its many technicians trained and certified taqa pro.

INNOVATION: A MAJOR OPPORTUNITY FOR MOROCCO

The development of new clean energy transition technologies (e.g., green hydrogen development or the development of energy storage solutions, for example, batteries) is an opportunity to maximize the share of renewable energy on a large scale. Mastering the development of these technologies is thus an opportunity to develop the renewable energy sector in Morocco.

Globally, it has been shown that most jobs are created by young firms that were established less than five years ago. In Morocco, there are several initiatives in green energy that are targeting SMEs and aspiring to modernize the industry. Moroccan companies have relatively high innovation capabilities, for developing partnerships and technological cooperations with international companies; these would help them produce blades locally for upcoming projects. Indeed, many Moroccans are entrepreneurs by necessity. The typical Moroccan entrepreneur is less educated compared with global benchmarks: 42 percent of young Moroccans ages 18–29 intend to become entrepreneurs, reflecting the reality that for many young Moroccans, entrepreneurship is an alternative to a paid job in an environment where job creation is limited and education requirements are relatively high (IFC 2019). This alternative is more of a constraint than a choice, however, since entrepreneurship limits the creation of stable and sustainable jobs. These same young entrepreneurs are likely to join the traditional working world at the first opportunity. As shown in figure 4.3, the number of business startups is high in Morocco, at least compared with other countries in the region.

Figure 4.3 Gap between startup attempts and launch in the Middle East and North Africa



Source: World Bank 2017.

Yet entrepreneurial activity remains low. The main challenges identified include the following:

- Innovation is the main development pathway for startups and entrepreneurs, which have limited resources and support structures. Innovation clusters are near Kenitra-Casablanca and remain scarce elsewhere.
- Existing innovation fails to address Morocco's most pressing issues with adapted services and products with high added value.
- Informality in small and medium companies hinders workforce productivity and competitiveness.
- There is a lack of mentorship for women.
- Green entrepreneurship is hampered by low quality and low return on investment on innovative projects.
- Fifty-four percent of entrepreneurs (Ford et al. 2017) reported poor access to market information, noting this was the biggest barrier to doing business in Morocco.

Moreover, the GIZ (2022) survey shows relatively low membership in professional groups, which reduces the catalytic role such organizations generally play in creating competitive advantages such as technological capabilities, industrial complementarity, skill synchronization, and product offerings likely to generate relationships and synergies between activities.

Lack of human capital and low technical progress are thus two important factors limiting Morocco's ability to benefit from knowledge and technology transfer. They slow Morocco's progress toward a high-value-added economy.

Besides the Research Institute on Solar Energy and New Energies' (IRESEN's) research, development, and innovation efforts (table 4.1), other R&D structures include the Moroccan Foundation for Advanced Science Innovation and Research (MAScIR), the laboratories of the International Rabat University, and the Mohammed VI Polytechnic University at Ben Guerir.

Table 4.1 IRESEN's energy research, development, and innovation infrastructures in Morocco

Platform	Technologies	Timelines
Green Energy Park	All solar technologies	Launched in 2017
Green and Smart Building Park	Green buildings, energy efficiency, smart grids, and electric vehicles	Launched in 2019
Agro Energy Tic Valley	Bioenergy, biomass, and energy storage	Launched in 2020
Morocco–Ivory Coast Energy Park	Solar photovoltaic	Launched in 2018

Source: IRESEN
Note: IRESEN = Research Institute on Solar Energy and New Energies.

Box 4.4 Case study 6: Success story of a wind turbine manufacturer in India

Suzlon emerged in 1995 and is one of the largest global manufacturers of wind turbines today. It is the largest wind turbine manufacturer in India, providing over 50 percent of the wind turbines for the domestic market. Suzlon operates in 21 countries around the world and is also active in developing and operating wind farms. The company has headquarters and development centers in Europe, Australia, and China, although most of its production facilities are in India. The company acquired the knowledge for its successful development through several beneficial collaborations. In 1995, it entered into a technical collaboration agreement with Südwind, a German company with a strong background in the wind energy technology sector.

A comprehensive knowledge transfer on the manufacture of different wind turbines continued over a period of five years. In 2001 Suzlon entered into an agreement with Enron Wind Rotor Production B.V. and obtained a license from Aerpac B.V. to be able to manufacture wind rotor blades (Lewis 2007). In parallel to this external knowledge acquisition, the company has made intensive efforts concerning in-house research and development and participation in learning networks, for example, through the creation of research centers in the Netherlands and Denmark, to leverage the local expertise and connect to existing learning networks.

In the later years, the company followed a straight policy of expansion and acquired the technological know-how to manufacture all parts of a wind power plant. In 2006, it purchased the Belgian company Hansen Transmissions, which specialized in the production of gear boxes for wind power plants, and in 2007, it purchased a controlling stake in REpower, a German turbine producer. In 2009 Repower was taken over completely, involving the integration of specialized knowledge in the field of large offshore wind turbines. Suzlon's position on the world market thus solidified step by step, and today, the company is able to deliver turnkey projects because it integrated all parts of the wind power value chain, including project development and operation and maintenance (Walz, unpublished).

Source: World Bank 2011.

Box 4.5 Case study 7: Expanding renewable energy coverage in Denmark by combining electricity and heat production

The majority of Denmark's power plants can coproduce electricity and district heating. The country has made great efforts to set up heat and/or cooling distribution networks for collecting waste heat from factories, incinerators, and transport systems, and combining it with the heat produced by solar thermal power plants, wind turbines, conventional gas and coal-fired power plants, and coal-fired power plants. These efforts have been to enable high-efficiency, low-cost heat production and reduce fossil fuel use. This could be of particular interest in Morocco to heat the numerous hammams. Further, in the National Waste Management Strategy published in 2013, the country specified that the organic fraction of household and service sector waste and service should be increasingly used as feedstock in agricultural biogas plants to improve energy production. This could constitute an opportunity to valorize biomass, a currently underdeveloped sector in Morocco.

ANALYSIS OF WORKFORCE ADEQUACY

The Moroccan labor market is beset with low-quality jobs and a "missing middle" workforce environment. The low stock of human capital in the Moroccan economy penalizes the dynamism of the economy and limits its growth potential. Unemployment rates among post-secondary graduates have been rising steadily since the mid-2000s. Education and vocational training do not allow for a good integration into the labor market either, with unemployment rates fluctuating around 20 percent depending on the diploma (OECD 2018a). One explanation for Morocco's workforce underutilization is the lack of dynamism in net job creation, the pace of structural transformation, and also, above all, the mismatch between supply of training and the demand for employment.

Thirty-two percent of the companies surveyed as part of a World Bank (2013) study found that inadequate labor was a major constraint to conducting their operations. The rate is much higher than global averages and in North Africa, where the figure is 21 percent. The perception of this constraint was higher for smaller firms (38 percent) and those operating outside of Morocco's major cities (World Bank 2013).

Since 2013, the government has sought to address the root causes of its education crisis (World Bank 2020a). It has committed, for example, to continuing reforms in its 2015–30 education vision plan, as well as in its new education law, adopted in 2019. Further, many companies are developing in-house training programs to address the mismatch between their needs and the skills available in the current labor force. Universal access to higher education is not a given but is improving. Public actors described the jobs-skills mismatch are not seen as obstacles to the development of energy efficiency and renewable energy. Morocco is considered the vanguard for energy efficiency and renewable energy in Africa, and an ecosystem of professionals exists to support the country's strategy (financial management, technicians). Despite this, imbalances between labor supply and demand may remain, as with most countries where renewable energy is taking off.

This section updates an earlier assessment of the adequacy of the quantity and quality of the workforce in the energy efficiency and renewable energy sectors.

Respondents were asked to identify "hard-to-fill" vacancies in the occupational categories shown in figure 4.4. They were asked to indicate the level of recruitment difficulty by assigning a rank to each group on a scale of 1–3 (1 representing the easiest to fill vacancies). The numbers are the sums of all the answers.[5]

[5] Online survey.

Figure 4.4 Online survey respondents identify "hard-to-fill" vacancies

Source: Online survey conducted by EY.

JOB MISALIGNMENT ANALYSIS: SUPPLY OF SKILLED WORKERS

"HARD-TO-FILL" VACANCIES—SUPERVISORS AND ENGINEERING MANAGERS TO IMPLEMENT LARGE-SCALE PROJECTS

Figure 4.4 illustrates the distribution of recruitment difficulties for each occupational category. Skilled technical jobs (requiring an engineering degree) were reported to be the hardest to fill, followed by management and sales jobs, which required medium to low technical certifications. According to the GIZ (2022) survey, technicians and engineers are the two most difficult positions to fill, with 51 percent and 40 percent, respectively, of companies describing recruiting challenges for these positions.

The results of the online survey highlight the difficulties in recruiting for certain types of jobs, especially high-skilled jobs, which require high specialization:

- **Project development.** Marketing and procurement, lobbyists, and negotiators are the positions most difficult to recruit for: 73 percent of respondents reported "strong difficulties" in recruiting for these positions. These positions are followed by engineers and specialists (renewable energy project finance, energy efficiency financing, legal, resource assessment, etc.). Seventy-five percent and 3 percent of respondents, respectively, said they face "strong" or "some" difficulties filling these positions.
- **Construction/installation and operation and maintenance (O&M).** For the positions of engineers and managers, 55 percent of respondents declared facing "strong" or "some" difficulties in recruiting.
- **Equipment manufacturing and distribution.** Consistent with the low development of this link in the value chain in Morocco, for most respondents (44 percent), the qualification of recruitment difficulties

is “not applicable.” However, with potential for the development of a local manufacturing industry in Morocco, the demand for engineering capacity (and therefore highly skilled engineers) is likely to increase in the coming years.

ANALYSIS OF THE CAUSES OF SKILLS SHORTAGES

Table 4.2 Analysis of the causes of recruitment difficulties or skills shortages for high-skilled profiles

Causes of recruitment difficulties and skills shortages	Level of importance
Candidates do not have the right qualifications (for instance, practical experience)	●●●●
Candidates have the right degree or qualification but lack skills or competency	●●●●
Too few candidates apply	●●●●

Source: Online survey conducted by EY

Recruitment difficulties for highly qualified workers stem from several factors:

- **Lack of practical experience** is a major barrier to recruitment for positions in large-scale projects:
  - Those with postsecondary and tertiary educations would require several years to obtain strong references regarding their work experience.[6]
  - In general, and not specifically for the energy efficiency and renewable energy sectors, companies tend to ask for highly specialized workers with experience in management positions.
- **Candidates may have the right degree or qualification but lack skills or competency:**
  - Behavioral, communication, and language skills are particularly important in the energy transition. The online survey highlighted how scarce these skills are in the job market (World Bank 2021c). It shows that recruiters have significant difficulties in recruiting for positions requiring advanced/knowledge-intensive skills.
  - Recruitment is the most difficult for jobs in strategy and leadership, coordination management and business, innovation, communication, and negotiation (table 4.3). There are no significant differences between the survey results for energy efficiency and renewable energy companies.

[6] Stakeholder consultation (2021), Societé d’Ingénierie Energétique (SIE).

Table 4.3 Survey respondents identify recruitment challenges for clean energy companies

Skill category	Level of importance
Strategy and leadership	●●●●
Coordination management and business	●●●●
Innovation	●●●●
Communication and negotiation	●●●●
Marketing	●●●●
Systems and risk analysis	●●●●
Environmental awareness and eagerness to learn about environmental issues	●●●●
Interdisciplinary	●●●●
Advocacy and campaigning	●●●●
Foreign language	●●●●
IT	●●●●

Source: Online survey.

- A lack of highly skilled applicants is the third leading cause of recruitment difficulty:
    - There is an imbalance between the number of university graduates and the number of jobs created. In general (across all fields), the estimated number of university graduates for every management position created is 10:1 (OECD 2018a).
    - One recruitment challenge for Morocco is the intense competition, across sectors, for talented employees. While Morocco's labor market offers a range of specialties, salespeople are in particular demand, along with chief financial officers, IT specialists, data scientists, programmers, and technicians in automation, robotics, and electronics.

- Beyond this issue of competition, the Higher Planning Commission (HCP) estimates that 23.3 percent of Moroccans want to emigrate, citing access to more remunerative positions abroad, better management, and public health care and education as reasons. Moroccan emigrants tend to be well educated, and, so, this raises concerns about a brain drain: about a third of these potential émigrés have some postsecondary education, whereas 17 percent have completed high school—all sectors combined (IFC 2019). It is estimated that Morocco sustains an annual loss of 8,000 senior executives (including about 600 engineers), all of them trained in the kingdom's public and private sectors. What share of this talent drain affects the energy sector is difficult to quantify, although interviews with the renewable energy and energy efficiency sector suggest some impact.

- In Morocco, only 4 percent of students pursue engineering studies. By way of comparison, in Jordan, about 17 percent of students attend engineering school, and in Egypt the figure is 7 percent (KAPSARC 2019). Thus, the low rate of higher-education graduates in the active population, and more particularly engineers, emerges as a challenge to be overcome. The overall structure of the training offered does not reflect the structure of the Moroccan economy (OECD 2018a).

- Finally, wages are higher in the public than the private sector; this encourages qualified individuals to accept prestigious jobs in the public sector (IFC 2019).

JOB MISALIGNMENT ANALYSIS: SUPPLY OF SEMI- AND LOW-SKILLED WORKERS

IDENTIFICATION OF "HARD-TO-FILL" VACANCIES: A GROWING NEED FOR TECHNICIANS AND SPECIALIZED TECHNICIANS

Energy efficiency and renewable energy sectors, along with other sectors (such as the conventional energy sector), appear to lack technicians.

Project development. This segment of the value chain makes little use of semi- or low-skilled individuals. The energy-efficiency-/renewable-energy-related occupational profiles most likely to grow over the next five years are technicians and technical sales personnel. This is because distributed solar PV companies, particularly small rooftop installers, rely on a high number of business development personnel for sales.

- **Construction/installation and O&M.** Fifty-six percent of companies consider that they face "strong" or "some" difficulties in recruiting workers and technicians.

- **Equipment manufacturing and distribution.** Consistent with the neglect of this link in the value chain in Morocco, most respondents rated recruitment difficulties as "not applicable," while 33 percent said they had no difficulties. With the development of a local manufacturing industry, the need for specialized technicians is expected to continue increasing significantly over the next few years.

ANALYSIS OF THE CAUSES OF SKILLS SHORTAGES

The lack of semi- and low-skilled workers, especially technicians, is caused by the following factors:

- Morocco's informal economy gives rise to low rates of technical and vocational education and training (TVET); skills are acquired through relationship-based apprenticeships. Although attendance in TVETs has grown, too few workers have completed any training. For instance, in 2019, across all sectors, 16 percent of unemployed men and 11 percent of unemployed women had completed TVET; 10.3 percent of employed workers report TVET—about 1 million workers (World Bank 2021b).
- Unskilled labor is recruited locally. Educational and training institutions are dispersed geographically in ways that may not be fully aligned with market needs; their dispersion is based on the location of energy efficiency/renewable energy projects. Although Morocco has a sound educational and vocational training infrastructure, its supply of renewable energy skills lags in regions that have the greatest wind and solar potential.
- Finally, local populations appear to know little about the energy transition; this limits the sector's appeal. For example, only 21 percent of farmers report being informed about nearby renewable energy projects (Komendantova 2020).

INCLUSIVITY

GENDER DIVERSITY

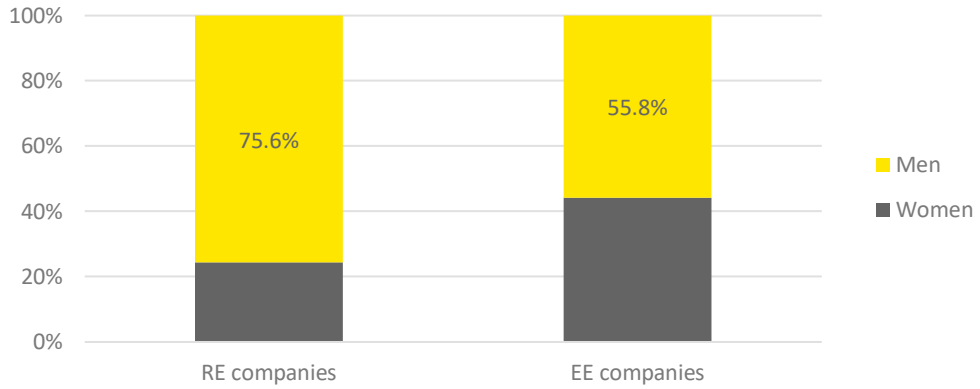
Women constitute 24 percent of the workforce in renewable energy companies; they remain underrepresented, at close to the cross-sector national average (21 percent in 2019). Women constitute 44 percent of the workforce in companies specializing in energy efficiency (figure 4.5). Women perceive the energy efficiency sector as more attractive than the renewable energy sector. This is because the energy efficiency sector requires more highly qualified employee profiles, as seen above, and because work in energy efficiency is usually office based and, indeed, most women hold management positions. This result is confirmed by the GIZ (2022) survey, in which 26.5 percent of women are managers or engineers, while only 19 percent work as technicians, compared with 53 percent of men. The dearth of women in installations can be explained in several ways[7]:

- Companies are less inclined to recruit women for fieldwork because women are often considered less mobile (renewable energy projects are sometimes based in remote areas).
- In field projects that recruit women (e.g., solar pumping installations), local social acceptance is difficult to gain, especially among farmers.
- In the coming years, automation, as well as greater use of artificial intelligence (AI), is expected to lead to the diminution of manual labor in favor of office work. Gender diversity will, as a result, increase in the renewable energy and energy efficiency sectors.[8]

[7] Stakeholder Consultation (2021), Moroccan Association of Wind and Solar Industries (AMISOLE).

[8] Stakeholder Consultation (2021), IFMEREE.

Figure 4.5 Average percentage of men and women in the respondent companies of the online survey

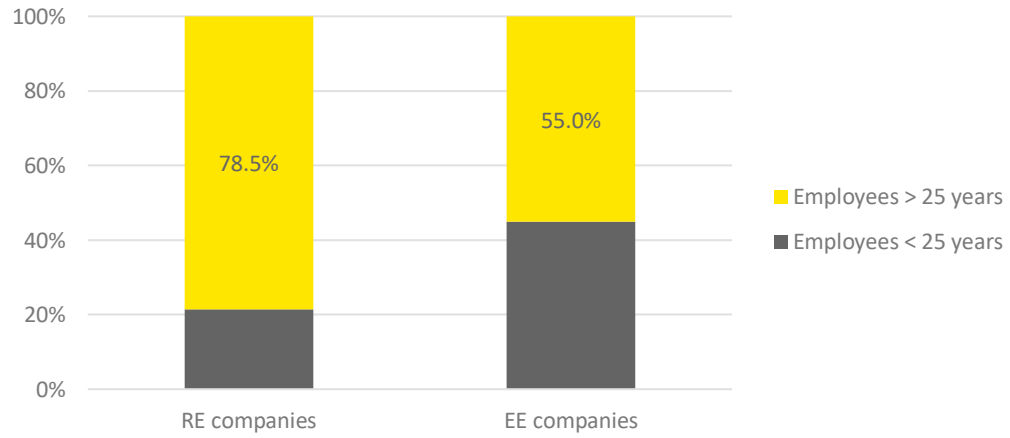


Source: Online survey.
Note: EE = energy efficiency; RE = renewable energy.

YOUTH EMPLOYMENT

Forty-five percent of the workforce of the surveyed energy efficiency companies is below the age of 25 (figure 4.6). This figure drops to 22 percent for renewable energy companies. These figures are relatively higher than the national average and reflect the existence of substantial training in the energy transition field.

Figure 4.6 Average percentage of employees above and below 25 years in the surveyed companies



Source: Online survey.
Note: EE = energy efficiency; RE = renewable energy.

CHALLENGES REGARDING LABOR REGULATIONS AND WORKERS' PROTECTION

The population faces challenges related to labor regulations and workers' protection:

- **Restrictive employment protection legislation that does not promote flexibility.** For companies to function properly, and thus for productivity and economic growth, it is essential that the level and composition of the workforce can be adapted to changes in demand and technology. The main regulations of the labor market are governed by the 2004 Labor Code. The law provides for two types of employment contracts: open-ended and fixed-term contracts. For fixed-term contracts, hiring rules in Morocco are more restrictive than in neighboring countries; the aim is to favor stable, long-term employment. Fixed-term contracts are not widely used in Morocco.

- **Degraded working conditions in informal employment** (as evidenced by the tragedy in a plant in Tangier in 2021). For employees involved in small-scale renewable energy or energy efficiency projects, reliance on the informal sector remains high—working conditions are therefore degraded.

Social insurance benefit only a minority of workers—currently, 22 million Moroccans do not have health insurance. In terms of social protection, private sector employees are eligible for pension, health, and other types of social insurance through the National Social Security Fund (*Caisse nationale de sécurité sociale*, CNSS).

Morocco introduced the Compensation Fund in 2014. The fund concerns private sector employees with the CNSS who are registered with the National Agency for the Promotion of Employment and Capacity (ANAPEC). Compensation for loss of employment equals 70 percent of the average monthly salary declared during the past 36 months preceding the date of loss of employment. During the allocation period, the person may undergo a qualifying training program from ANAPEC and OFPPT, if necessary, to find a new job. These "active labor market programs" focus on unemployed young graduates, inactive women, and the disabled (e.g., subsidized internships for newcomers, training, or self-employment assistance).

In a recent report, the CESE (Economic, Social, and Environmental Council) **noted several limitations of this allowance**. **First**, restrictive eligibility **meant the** mechanism ultimately benefited only a few people (Morocco Latest News 2021). **Second, it targeted employees earning DH 4,000 and less**. The report also indicated that the job-loss compensation system offers paltry benefits both in minimum-income guarantees and return-to-work assistance.

Generous unemployment benefits are especially effective in the transition to secure employment. In countries with better relative benefits, individuals use them as a financial buffer while searching for more secure jobs rather than accepting any job offer (Otto and Lukac 2021).

In April 2021, the government announced the launch of the compulsory health insurance scheme, which will eventually benefit informal stakeholders and the self-employed. In February 2022, the parliament passed a law covering universal access to family allowances, retirement, and job-loss benefits by 2025 at an annual cost of $5.2 billion.

INSTITUTIONAL FRAMEWORK, NATIONAL POLICIES AND PROGRAMS, AND EDUCATION SYSTEM

INSTITUTIONAL FRAMEWORK

To be successful and achieve a set of predefined targets and goals, an energy transition must be backed by institutions and programs that define a clear pathway, through explicit milestones and measurable targets and key performance indicators. Following are the main challenges in governing institutions/programs that aspire to maximize the labor market benefits of clean energy:

- Strengthening links between institutions specializing in energy efficiency and renewable energy (AMEE and IRESEN) and institutions specializing in employment and training: OFPPT, ANAPEC, and the Ministry of Education. Joint projects among these entities could be expanded beyond their present limits. For example, the sole training that the AMEE and OFPPT offer now is in "eco-driving"—automotive driving behaviors that limit emissions. Expansion of training programs appears even more important in view of the CESE recommendations that the AMEE receive strong government-level support.
- Facilitating access to the network of private companies that are not facilitated, the latter having to request the agreement of distributors.
- Improving synergies among the National Center for Scientific and Technical Research (CNRST) and IRESEN and the R&D department of MASEN (three research centers) and R& (two research centers).
- Better communication between AMEE and Sociéte d'Investissements Energétiques (SIE) (and among the actors in renewable energy and energy efficiency) to avoid overlap of objectives.

EDUCATIONAL AND TRAINING PROGRAMS

A RICH, FLEXIBLE, AND INTERNATIONALLY ORIENTED EDUCATION SYSTEM

Recent energy transition initiatives in Morocco's educational ecosystem present the country with a major opportunity. With its rapid economic development and willingness to emulate successful initiatives, Morocco has shown a willingness to adapt to companies' expectations, inspired by what can be done elsewhere. R&D is a major focus (Gardelle 2018). Surveys conducted by the Center for Research on Training among various engineering schools in Morocco show that innovation is considered central to their training programs. Meanwhile, a major internationalization dynamic is at work throughout the country's higher education institutions. Several schools have recently emerged from an international partnership framework (e.g., branches of major French schools such as EIGSICA, ENSAM, or the École Centrale de Casablanca). Their strong international focus is attracting many students from francophone Sub-Saharan Africa (approximately 7,000 in 2015) (Gardelle 2018).

Moreover, the education system is relatively flexible and receptive to change. Over the past 20 years, universities and schools have developed their programs to adapt to industry needs, while young people are being taught in the various multinational companies now active in the country.

Box 4.6 Case study 8: Three training institutes and Morocco's national energy strategy

To support the national energy strategy, three training institutes for renewable energy and energy efficiency professions (IFMEREEs) have been established as part of a public-private partnership. The IFMEREEs are located in Oujda (operational since 2015), Tangier (2019), and Ouarzazate (2020). In 2021, the Ouarzazate campus registered 160 students.

The institutes are administered by the IFMEREE SA, a management company owned by five equal shareholders: Moroccan Agency for Sustainable Energy (MASEN); National Electricity and Clean Water Office (ONEE); Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE); Federation of Metallurgical, Mechanical and Electromechanical Industries (FIMME); and National Federation of Electricity, Electronics and Renewable Energies (FENELEC).

The IFMEREEs offer several types of training and services:

- Training technicians for renewable energy and energy efficiency jobs. Two-year training courses cover five areas: energy-efficient buildings, solar photovoltaic, wind energy, solar thermal systems, and biogas.
- Continuing education and credentialing for company workers and for contractors and job seekers. To further support renewable energy/energy efficiency companies and organizations, the institutes offer à la carte training cycles as needed.
- Services, technical support, consulting, and studies in renewable energy, energy efficiency, and sustainable development: examples include energy audits, studies on integrating solar energy (photovoltaics and thermal), implementation of an energy management system, and so on.

To enable practical work, the institutes have high-quality installations and didactic tools, besides the latest technology (e.g., photovoltaic installations, solar pumps, heat pumps, wind turbines, measuring devices and instruments). The main axes of IFMEREE's strategy are innovation and green entrepreneurship. The IFMEREE Entreprendre program aims to stimulate the entrepreneurial spirit of students and support its students and graduates in their business creation projects.

Source: IFMEREE 2022.

THE PRIVATE SECTOR AND THE EDUCATIONAL SYSTEM: MORE PARTNERSHIPS NEEDED

- Historically in Morocco, the educational system has engaged with the private sector in limited ways. It arranges internships for its students, basing most placements on *ad hoc* initiatives and personal relationships. However, public authorities have recently offered training more in line with employers' demands.
- In 2014, the Moroccan government established the Observatory of Jobs and Competencies, a tripartite body that tracks labor market trends in the country. The observatory is responsible for monitoring and analyzing labor market assessments, conducting studies, and providing data to guide employment policy. At the regional level, the observatory's mandate is to assist regional entities with specialized labor assessments. However, the group is facing some barriers; among them is an institutional culture that resists information sharing and is beset with complex institutional bonds and weak analytical capacity.

- For instance, in December 2021, ANAPEC and private sector actors signed eight agreements surrounding the creation of 6,000 direct jobs and 1,200 entrepreneurial positions in technology, industry, and services (L'Observateur 2021). The objective was inclusion. The program is geared to youth, nongraduates, and individuals neither employed nor engaged in education and training. Such initiatives appear important: the skills impart by training centers and universities are not aligned with what is demanded of professionals (KAPSARC 2019), and practical (as opposed to theoretical) training suffers in comparison. Better communication with private sector actors would help.

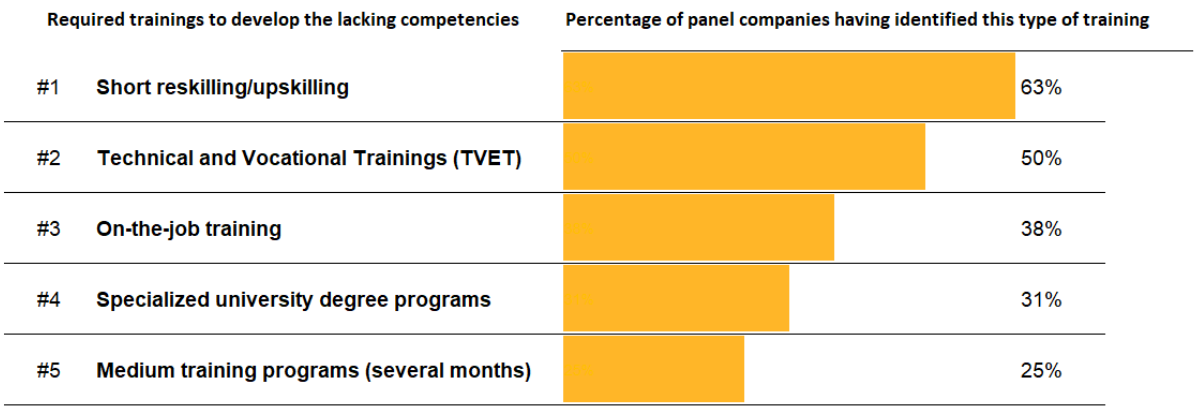
- The OFPPT has sought to address this issue with more schools that tailor their training to local needs—a viable solution if implemented in every region involved.

RELEVANCE OF UNIVERSITY COURSES

Except for the professional licenses and renewable energy courses offered by engineering schools, university graduate courses do not always meet the labor market's needs. For universities and their generalist programs, skills are undefined; this produces a qualitative mismatch between the stock of available skills and the market's needs. A high unemployment rate can be observed among university graduates (OECD 2018a).

PROFESSIONAL TRAINING: A MAJOR OPPORTUNITY, BUT STILL INCOMPLETE AND NOT WIDELY AVAILABLE

Figure 4.7 Adequate training for employees according to companies



Source: Online survey.

- Vocational training reveals a significant need for workers in manufacturing and construction (Blohmke, Sohm, and Zickfeld 2013). However, youth view the renewable energy and energy efficiency sectors as less attractive than the public sector. Further, the public sector's high wages encourage many skilled individuals to accept prestigious jobs in that sector rather than venturing into the private sector, where competition is skewed and initiative and risk-taking are inhibited (IFC 2019).

- Interviews and online surveys reveal a shortage of certification courses to equip technicians and engineers to work in the renewable energy and energy efficiency sectors (e.g., stainless steel welders

certified to work only on new technologies, such as solar-powered aircraft). Sixty-three percent of the online survey's respondents believe that short reskilling/upskilling courses are best for the renewable energy and energy efficiency sectors. More generally, relevant certifications or qualified individuals are in short supply (e.g., basic safety training for onshore wind, offered by the Global Wind Organisation).

- On-the-job training and reskilling/upskilling should also be reinforced. Here, the private sector is essential. Good practices already exist. In Noor Ouarzazate, for example, MASEN imposed knowledge transfer and upskilling through a multiyear transition period during which Spanish operators trained Moroccan staff to operate plants by themselves. Further, the Cluster Solaire fosters the integration of Moroccan solar businesses by training entrepreneurs for project development.[9]

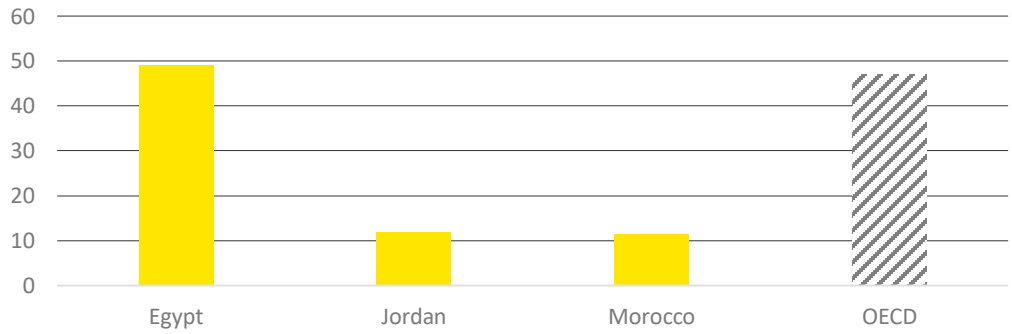
TECHNICAL AND VOCATIONAL EDUCATIONAL TRAINING IN MOROCCO: STILL UNDERUTILIZED

Morocco is facing the following challenges to its TVET system:

- Too few young people are entering TVET (10 percent, compared with 45 percent in OECD countries—see Figure 4.8). In particular, rural women and youth have limited access to TVET institutions. TVET, which is perceived to offer low-quality education, suffers from a poor image, while technicians are in high demand, especially in climatic, electrical, and mechanical engineering.[10] The survey nevertheless reinforces TVET as a popular training course, second only to reskilling/upskilling (see figure 4.7).

- The geographic distribution of TVET facilities could be improved. Since renewable energy is mainly rural, there is a mismatch between the skills of the local population and the sector's requirements. There is significant potential to improve the local population's living standards (GIZ 2016c; WFC 2015). The regionalization of TVET has progressed slowly, partly due to inadequate human resources to run a more decentralized system (World Bank 2020b). TVET establishments, which are mainly located in urban areas, have few boarding facilities (World Bank 2020b). As explained above, the Centers for Skills and Jobs (CMC) of the OFPPT could be part of the solution.

Figure 4.8 Students enrolled in vocational programs in upper secondary education (%)



Source: KAPSARC 2019.

Note: OECD = Organisation for Economic Co-operation and Development.

[9] World Bank decision note on the report (internal expertise).

[10] Stakeholder consultation (2021), Research Institute for Solar Energy and New Energy (IRESEN).

Box 4.7 Case study 9: Training future engineers at the Delft University of Technology

The faculty of industrial design engineering at the Delft University of Technology introduced a new bachelor's degree program in 2007. In this program, students take theoretical courses and practical design projects as before, but new program elements synthesize theory and practice, aiming to help students apply facts, theories, and insights in their design projects. The approach was founded on three program design principles rooted in pedagogical theories. The first design principle is to provide an authentic context. The second design principle is to distinguish knowledge, skills, and attitude development, synthesizing the three into academic competencies. The third and final principle is to focus on a chain of meaningful and realistic activities rooted in theory, in turn enriching students' understanding through reflection.

KEY OBSTACLES AND ENABLERS OF THE JOB TRANSITION: A SUMMARY

Morocco faces various challenges in developing renewable energy and energy efficiency and generating jobs to service these sectors. The first job creation lever is domestic supply of technologies, services, and products—supply marked by innovation, control, norms, standards, and a regulatory framework. Also important are the means to guide the market toward expansion. The factors listed below are seen as the main obstacles to expansion:

- **Moroccan industry is hampered by imports of manufactured goods.** Despite a good innovation pipeline, Morocco has not yet fully used its assets to produce quality manufacturing output. Too many VSEs (very small enterprises) limit financial resources and thus the ability to compete with foreign companies. In terms of financing, SMEs face difficulties, while incentives are sometimes unclear. Subsidies exist for butane gas, for example, and not technologies like solar.

- **Installations are marked by inconsistent quality, while working conditions are skewing the market and reducing trust among clients.** The informal labor sector limits the development of skilled labor, discouraging formal firms from expanding their markets. Formal firms generally prefer independent workers and open-ended contracts. The prevalence of informality means poor-quality facilities, which diminish client confidence and affect the credibility of the entire market, even though some firms produce high-quality products. Service quality is especially challenging for professionals running small operations, which produce poor-quality goods, which drive down prices. This is unfavorable for SMEs.

The second job creation lever is access to technologies that can enable developing a local market that can grow to a national and regional scale. Users, especially rural users, have limited exposure to knowledge about renewable energy and energy efficiency. The main obstacles to improving access are listed below:

- **Unfavorable incentive schemes for SME and end users.** The present financial scheme focuses primarily on large-scale projects, which relegate to the sideline small businesses, which have enormous job creation potential. The various energy efficiency subsidies are also heading in the wrong direction, supporting butane gas, which farmers use to power water pumps. Further, announced subsidies, especially for solar pumps, are not implemented: farmers expected support and waited for the program. However, because the program was not implemented, they did not invest in solar heating and the market languished. Finally, there is a lack of knowledge about financing capacities in Morocco.

- **Lack of awareness and general communication, coordination, and collaboration among stakeholders.** Independent entities are needed to provide regulations and quality controls. Further, unclear regulations and unenforced rules have slowed the market's development and made it unclear to investors.

- **High rural unemployment and lack of qualified workers.** Without local content criteria in regulations, the local population cannot be trained to acquire and utilize knowledge.

There is also a mismatch of the skills available in the Moroccan labor force and the market's needs—another job creation lever. This mismatch is evident in the recruitment difficulties noted in the results of the online survey. These difficulties affect both high- and low-skilled jobs. Of particular note are the following difficulties:

- **High youth unemployment and lack of skills.** The energy efficiency and renewable energy sectors, along with other sectors (such as conventional energy), appear to lack technicians. Although TVET has grown, too many youth lack access. Indeed, the low rates of TVET stem from Morocco's overreliance on informal learning. The informal sector imparts skills through informal apprenticeships. Although education and vocational training infrastructure exists across Morocco, renewable energy skills are scarce, especially in the regions with the greatest wind and solar potential.

- **Lack of practical experience among highly qualified employees.** Along with the shortage of highly qualified employees, few workers have access to practical training and soft-skills acquisition.

5. RECOMMENDATIONS FOR A JOB-ENHANCING CLEAN ENERGY TRANSITION

A set of recommendations for a job-friendly clean energy transition emerged from a literature review, an online survey, and interviews with public sector stakeholders (table 5.1). These seven recommendations provide the framework for an action plan on boosting local content for selected technologies. Each policy recommendation addresses a technology and its barriers and therefore constitutes an overall action plan instead of a collection of discrete recommendations. The recommendations fall into three categories, supply, demand, and skills—all mandatory for a healthy and sustainable job market.

Each measure highlights key characteristics:

- **Assigned priority.** This derives from the impact of individual measures on local content, if implemented.
- **Complexity.** Some measures may require more effort to implement than others. The perceived complexity for implementing each measure has, therefore, been assessed and described.
- **Possible authorities.** Each measure may require a different mix of stakeholders. However, implementing stakeholders are specified for each measure, although these should be viewed as the consultant's suggestion, which will have to be validated by the actors involved.

Table 5.1 Job-enhancing recommendations

Recommendation	Challenge addressed	Priority	Complexity
To develop the renewable energy and energy efficiency sectors			
1. Provide appropriate financial support to SMEs to enable them to participate in large-scale projects	Unfavorable and complex incentive schemes for SMEs and end users	●●●	●○○
2. Create a clear development plan, maximizing local content	An industry still underdeveloped and lacking a clear and precise orientation	●●●	●●○
To ensure available jobs are filled			
3. Improve coordination, communication, and synergy among all stakeholders	Lack of sensitization, communication, and coordination between employers and energy transition principals	●●●	●●○
4. Improve the quality of the services provided by Moroccan companies and promote the economic integration of the informal sector	Poor-quality installations	●●●	●●●
5. Low- or semiskilled profiles with better qualifications	High unemployment and a lack of appropriate skills among youth	●●○	●○○
6. Providing work experience for highly skilled workers	Lack of practical experience for highly qualified profiles and a lack of qualified personnel	●●○	●○○
7. A just energy transition that supports the objectives of decent work for all, social inclusion, and poverty eradication	Employers underinvest in employee training; prevent or reduce identified skills shortages	●●○	●●●

Level of priority or complexity: ●●● High; ●●○ Medium; ●○○ Low
Note: SME = small and medium enterprise.

RECOMMENDATIONS TO DEVELOP THE RENEWABLE ENERGY AND ENERGY EFFICIENCY SECTORS

1. Provide appropriate financial support to small and medium enterprises to enable them to participate in large-scale projects

Current situation

Before the adoption of its national strategy, Morocco created two incentive programs. The first program focused on a public-private partnership (PPP) to provide rural households with solar photovoltaic systems to produce off-grid electricity. The second program (EnergiPro) encouraged energy-intensive industrial groups to generate electricity from renewable sources with up to 10 megawatt capacity. For large-scale projects, the Moroccan approach uses the project financing model under a PPP. For local manufacturing, other incentives exist, for example, exemption from value-added tax and customs duties, as well as exemption from a patent for the first 15 years and corporation tax for the first 5 fiscal years (UN 2018). Investment in power plant construction is usually made through PPPs, which always involve a government energy agency (usually the National Electricity and Clean Water Office [ONEE] or the Moroccan Agency for Sustainable Energy [MASEN]). However, investments can be fully public (usually through ONEE) or fully private. The possibility of private investment was provided for in law 13-09. In Morocco, funding for such projects comes from the regular government budget, the Hassan II Fund for Economic and Social Development, the Energy Efficiency Fund (FEE), the Energy Development Fund, the Energy Investment Company's (SIE's) Renewable Energy Fund (FER), and ONEE's own funds. Morocco receives financial support from several institutions and countries, for example, the KfW, the Agence Française de Développement (AFD), the Arabian Gulf states, and others. In energy efficiency, the focus is on decentralized solutions (e.g., customized financial assistance to companies to upgrade their industrial facilities). The Moroccan Agency for Energy Efficiency (AMEE) also promoted the SDL to finance energy efficiency projects (Netherlands Enterprise Agency 2018). The Morocco Sustainable Energy Financing Facility (MorSEFF) can provide, among other things, a $4.5 million credit and free energy audits (Supertaqa 2021).

Identified limitations

The current financial regime is focused primarily on large-scale projects, whereas small and medium enterprises (SMEs) have the greatest employment potential. Energy efficiency subsidies continue their strong support for butane gas, which farmers use to power water pumps. Another issue is the lack of follow-through on announced subsidies, especially for solar pumps. Finally, there is a lack of knowledge of potential financing capacities.

Morocco's regulatory framework gives the ability to grant decrees to medium- and low-voltage networks. Further, the resale of electricity (to ONEE) is limited to 10 percent of annual production, which covers the self-consumption threshold. One also notices how many actors with different interests are granted ONEE-issued permits, or how network operators have no obligation to provide absorptive capacity (Medias24 2021b). For the Moroccan Thermal Construction Regulation (RTCM), the main obstacles to its application are additional costs, difficulty, and limited knowledge (M'lahfi, Amegouz, and El Qandil 2020).

Description of the recommendation	• Targeting grants to very-small-, small-, and medium-sized enterprises (VSMEs) in markets where the need for financial assistance is the greatest and financial assistance has the strongest impact.
	  o Among the different incentives (tendering, feed-in tariffs, net metering, subsidies, credits), subsidies appear best able to offset the high up-front costs that usually deter small consumers (WFC 2016) in the low- and medium-voltage market. Subsidies have the strongest impact, according to the German Agency for International Cooperation (GIZ 2022) survey, compared with other means of support.
	  o More generally, the GIZ (2022) survey showed that government entities, nongovernment organizations, and foundations benefit only a few VSMEs.
	• **Improve awareness of subsidies by promoting them to the entities involved and limiting unmonitored announcements, which can have a negative effect on the market.**
	  o Increase awareness of all incentive schemes, especially in rural areas. Operators are largely unaware of the benefits of using renewable energy and should be educated. More generally, training and awareness must occur in parallel.[11]
	  o The Solar Cluster, for example, is working on a green financing guide to highlight eligibility criteria, the terms of grants, and the process to follow (Finances News Hebdo 2021).
	  o Effectively implement subsidies shortly after their announcement so as to prevent the market from stagnating while waiting for subsidies.
	• **Limit subsidies for nonrenewable sectors (such as butane gas) to encourage people to move toward green consumption patterns.**
	  o Transfer butane gas subsidies to solar heating and especially solar heat pumps in rural areas.
	  o For the specific case of water pumps, promote the use of solar heating technologies instead of gas and teach farmers how to use them. More generally, solar heat pumps represent an excellent opportunity for job creation, primarily in the installation phase. The installation of energy-efficient lightning on poultry farms also appears to be one of the main opportunities (GIZ 2016c).

Governance	The government has an important role to play. Without a clear and targeted government program, private investors will be reluctant to invest. Financial institutions, such as the MorSEFF, local private banks, or the SIE, may also be among the entities responsible.

[11] Stakeholder consultation (2021), Moroccan Agency for Energy Efficiency (AMEE).

2. Create a clear development plan, maximizing local content	
Current situation	Despite its good innovation potential, Morocco has not been able to develop a competitive industry along the entire value chain of renewable technologies. The shortcomings are most apparent at the manufacturing stage, where foreign companies, for example, those in solar photovoltaics, dominate, resulting in job creation that is mostly symbolic. However, Morocco has local expertise, for example, in cable production or wind turbine blade manufacturing. The development of local industry is especially interesting because it represents many potential jobs. This could also be done in new sectors such as biomass (heating of hammams in particular) or hydrogen, provided the obstacles specific to each sector are overcome. In terms of company size, the market is characterized by a plethora of small developers, a few large foreign companies, but a small number of intermediate SMEs.[12] The locations for renewable energy (and to a lesser extent energy efficiency) installations are primarily in remote areas, where the wind and solar potential is the highest. These areas are mostly populated by farmers, who represent 40 percent of the workforce. In a country like Morocco, the decentralized nature of renewable energy can have enormous benefits, especially for poorer areas, since renewable energy technologies can provide a safe and reliable energy alternative that can raise the standard of living of rural and less developed communities (WFC 2016). The integration of the local population is important for youth, since many of them leave for big cities in search of jobs that require technical skills they do not possess (Eurasia Review 2018).
Identified limitations	The local value-added remains limited in the sector. Only a few local companies are active in solar panel manufacturing and in project development and engineering more generally. Not only are costs higher, but the development path is unclear, in turn limiting investment and efficiency. The green economy landscape is full of SMEs, but the market is still dominated by large, self-sufficient companies. Because the local population lacks relevant skills, people do not know how to mount or supervise installations, especially for energy-efficient structures and buildings (KAPSARC 2019). Also, most of the time, they do not even know these technologies exist, or do not know about the different forms of financial support they might have access to. Farmers also have limited capacities, and their remote locations makes it difficult to supply them (GIZ 2016c). Local content is also difficult because of the top-down approach so common with large entities, where decisions are made at the national level (WFC 2015). In fact, all decisions are centralized, when it is clear that a regionalized energy efficiency and renewable energy development strategy would produce better outcomes. Finally, a crucial issue is the absence of local preference written into the law. This issue is especially important because unemployment in Morocco means people are receiving no pre- and in-service training that could benefit future projects.

[12] Stakeholder consultation (2021), IRESEN.

Description of the recommendation

- **Establish a clear strategic vision, defining how each technology contributes to the national goal and how a national plan for renewable energy equipment manufacturing should target the markets with the highest potential (especially wind) and leverage existing skills.**
    - Build a trained local workforce. In this regard, the recent Centers for Skills and Jobs (CMCs) established throughout the country present an excellent opportunity to develop local skills specific to renewable energy/energy efficiency. This can also be done, for instance, by pushing synergies between the Office of Vocational Training and Job Promotion (OFPPT) and the national agricultural school of Meknès.
    - Provide an investment and development plan. This is an important recommendation. The phosphate industry, which was able to develop and create jobs with clear objectives and guidelines, can be used as a model.[13]
    - Support both large- and small-scale projects so that a wide range of companies can grow and develop local skills.[14]
    - Focus development on the industries with the strongest local assets (especially wind, due to location and established players) so that the market can take off and build on this momentum for broader development.
- **Establish national targets for job creation in renewable energy/energy efficiency technology.**
- **Continue to require more local benefits linked to projects, and set up a method for monitoring local benefits, with a guide (noncontractual) for formalizing the methodology for calculating the local share.**
    - Add a national preference, for instance, in the form of a minimum percentage of local industrial integration, with controls on the real application of this preference.[15]
    - One should not aim, however, at maximizing the local content at all costs. Companies will first require skilled workers to transfer competencies to Moroccans from other nationals, for example, Spanish engineers working on Noor Ouarzazate.
- **Enhance knowledge transfer through joint ventures between international and national companies, through the former's participation in initial training programs, continuing education, and on-the-job training.**
- **Adapt the working environment to local opportunities and constraints.**
    - Reaffirm the role of local stakeholders—citizens, businesses, and local authorities—and provide them with the means to seize local opportunities offered by the energy transition.
    - The country could learn from the German model, which focuses on the decentralization of energy expertise (mostly engineers) while strengthening the local participation of communities.
    - Small demonstration projects can help local people learn how the technology works and can be maintained (IIASA 2019). Such projects engage youth who are uninformed about renewable energy projects in their regions (Komendantova 2020).
    - Promote the use of digitalization, which has a strong potential to connect rural and urban areas (IFAD 2020).

Governance	The government can provide a clear path and guidelines for development and define laws that support Moroccan businesses and reassure investors. Local authorities are the main interlocutor in this process, since they are likely to be the ones who (that) understand and are the most willing to help the populations. Training centers like the OFPPT could also provide support.

RECOMMENDATIONS TO ENSURE AVAILABLE JOBS ARE FILLED

3. Improve coordination, communication, and synergy among all stakeholders

Current situation	Policy coherence and integration require increased coordination and improved collaboration among the international, national, regional, and local levels. It is therefore recommended to establish multistakeholder alliances and deepen the policy dialogue among the different levels of government (WFC 2015). This is even more important given the decentralized nature of renewable energy projects. More generally, communication among all stakeholders, including the Moroccan people, is needed to raise awareness about the energy transition and improve their knowledge of possible solutions. Further, no group is at present measuring and monitoring the supply of skills and the provision of education among the population. According to the interview with the Ministry of Education and Research (ENSSUP), it is important to qualitatively and quantitatively analyze possible training, and more particularly, measure the real needs of the market, to avoid hiring workers who do not suit the market's demand.[16]
Identified limitations	Achieving an effective energy transition requires cooperation among the ministries and departments that are involved in the transition and also working on the required jobs and skills. Whether in terms of regulations, financial support, or general knowledge of local renewable energy projects, the Moroccan people, especially in rural areas, are not well informed about how to get help and guidance. More generally, the various stakeholders are not aware of opportunities. Morocco also lacks a clear and logical development plan. As we have seen before, some subsidies are announced but not provided; a law is proclaimed but not enforced. During some of the stakeholder interviews, it became apparent that a number of different ideas were tested without a clear plan. This is important because a lack of market visibility can hinder strong investment. The GIZ (2022) survey, made it clear that membership in professional groups is still limited among the employees of VSMEs, even though membership in the Moroccan Association of Wind and Solar Industries (AMISOLE) and the Solar Cluster was seen.

[13] Stakeholder consultation (2022), Prominox.

[14] Stakeholder consultation (2021), AMEE.

[15] Stakeholder consultation (2022), Prominox.

[16] Stakeholder consultation (2022), Ministry of Education.

Description of the recommendation

- **Continue to strengthen the links between the industrial and professional sectors, research and development centers, and training organizations through joint programs and information sharing between stakeholders.**
    - Strengthen the links between research centers (the National Center for Scientific and Technical Research [CNRST] and the Research Institute for Solar Energy and New Energy [IRESEN] in particular), and between research centers and universities.
    - Strengthen the links between institutions specializing in energy efficiency and renewable energy, that is, AMEE and IRESEN, and institutions directly concerned with employment and training: the OFPPT and the Ministry of Education, especially since the Moroccan Economic, Social, and Environmental Council (CESE) recommends strong support for AMEE at the government level. At present, links exist but joint projects are limited in scope (e.g., AMEE and the OFPPT providing training on eco-driving).
    - Create synergies along the entire value chain of a product, for instance, with quality control checks, optimized twinning, or contractual arrangements. Links can also be made between local companies and large national/international firms (GIZ 2016a).
    - Organize focus groups with enterprises devoted to problematic issues of employment and energy transition.[17]
- **Encourage SMEs to join a professional group, organization, or business network.**
- **Analyze and report at regular intervals information on the status of skill development and the number of jobs created (e.g., a biannual report).**
    - Greater and more effective coordination among all education stakeholders, especially businesses, is needed. This is important for various training providers so that they can work collaboratively to ensure stable and permanent processes, detect shortages, learn from successful experiences, and mobilize resources.
    - Establish mechanisms for sharing information and feedback on renewable energy projects among political actors.
- **Creation of an observatory of green jobs and professions** (including a specific section on energy transition), with (1) a diagnosis of the needs in trades and training aligned with the strategic objectives of the energy transition and (2) a benchmarking exercise on the best models to follow in the deployment of training for the energy transition.
    - Develop a clearly defined labor market information system that **efficiently collects, analyzes, and disseminates labor market information**: Key labor market indicators (unemployment rate, share of labor workforce participation rate), and market needs in terms of occupations and skills, and qualifications. The system would be responsible for:
        - Collecting and analyzing labor **market needs data** (current needs and forecasts), which can be obtained from relevant ministries and authorities, from the primary job portals (since they provide real-time information on job offers and related expected skills), from tracer studies, and from interviews with companies, and

	▪ Studying gaps between the skills in the workforce and the qualification levels expected in the labor market. o Organize a clearly defined education information system that **centralizes information** on graduates' careers and available education programs. The system would be responsible for: ▪ **Listing all available education programs** in renewable energy and energy efficiency in Morocco, and ▪ Collecting data via an administrative-based monitoring system—among other data sources, for example, labor force surveys—for tracing graduate employment. Regular and systematic graduate tracer surveys would indicate whether graduates have found jobs upon graduation, how difficult it was for them to find a job, and whether their occupation and industry correspond to their studies. Identification of available professional training and certifications that employers can use to enable their employees to become qualified.
Governance	All stakeholders—whether they are village residents, government officials, private sector stakeholders, associations, or training centers and universities—must be involved in this process. The government will have to supervise synergies and ensure effective communication is maintained. Concerning the implementation of a labor market information system and an education information system, a new entity (an oversight agency, for instance) should be created. A vast amount of information requires analysis. This oversight agency could fall under the Ministry of Education, especially since it is not involved in the renewable energy and energy efficiency development plan.

4. Improve the quality of the services provided by Moroccan companies and promote the economic integration of the informal sector	
Current situation	Informality in Morocco is a heavy burden for the labor market. According to a recent High Commission for Planning (HCP 2021) study, informality represented 28.7 percent of the jobs created in 2013 and accounted for 11 percent of the gross domestic product (GDP). Although informality is not the highest in the renewable energy and energy efficiency sectors, they nevertheless suffer the consequences since informality creates unfair competition. Prices can be 50–70 percent lower.[18] Almost all women in rural areas and 55 percent in urban areas work under informal conditions (World Bank 2021d). Informality is also prevalent in the construction sector; here, informality is linked to energy efficiency (GIZ 2016b). Overall, a sustainable

[17] External World Bank workshop input.

[18] Stakeholder consultation (2022), Energy Pro tech/réseau vert.

	transition cannot be achieved without creating safe and secure jobs for Moroccans—which runs contrary to the informal system. Many people still have no health insurance.
Identified limitations	An unregulated and informal market for energy efficiency and renewable energy equipment adversely affects the sector and creates unfair competition for SMEs. This market is encouraged by the lack of a system of quality control for equipment and inappropriate regulations. More generally, the labor market lacks flexibility and opportunities for women.

Description of the recommendation	• **Strengthen the taqa pro label to cover market needs by adjusting access to the label and expanding its prevalence.**
	  ○ A robust certification system, specific to renewable energy and energy efficiency, will help assess and justify workers' competencies.
	  ○ A consumer communication strategy would help consumers understand the value and relevance of accreditations and recognize the quality of services provided (GIZ 2016b).
	• **Strengthen human and financial resources to systematize quality controls for installations.**
	  ○ Ensure that quality control regulations are followed to avoid the installation of poor-quality materials by untrained and unsupervised workers.
	  ○ Controls should also be applied to imports since poor-quality materials often come from end-of-life foreign items.
	• **Create additional incentives for companies/workers benefiting from certification programs, for example, access to continuous training, issuance of work permits, professional licenses, or other (subsidized) services.**
	• **The development of reliable certifications in general would also reinforce trust in the Moroccan workforce on an international level.**
	Certifications also concern the integration of renewable energy certificates, which serve as a proof of the renewable origin of the *electricity produced*. Morocco could draw substantial benefits from a deeper development of the international renewable energy certificates market, which will not only benefit Morocco's own domestic market but also those in neighboring countries (Renewables Now 2021).

Governance	The government has a key role to play in this regard, since informality is a nationwide issue. The government is also the entity that can deploy regulations and impose enforcement. Independent entities, under the supervision of the OFPPT or AMEE, for example, should monitor the deployment of regulations and enforcement, and ensure all firms, especially the smaller ones, have fair access to these control entities.

5. Enhancing the employability of low- or semiskilled profiles	
Current situation	As explained earlier, youth unemployment is high in Morocco (31 percent), and the figure is much higher among graduates (25.7 percent) than those with no prior education (4.4 percent) (Le Matin Maroc 2021). Few young people are enrolled in technical and vocational education and training (TVET) (10 percent, compared with 45 percent in OECD countries). Instead, Morocco uses on-the-job training more regularly than its Middle East and North Africa (MENA) neighbors. Thirty percent of companies utilize on-the-job training (KAPSARC 2019).
Identified limitations	One main issue with the Moroccan educational system is the gap between the training offered and the market's needs. Companies may find it difficult to recruit technicians, even though many are needed in the manufacturing and construction phases. Although TVET has increased, the number of people with vocational training remains low. More generally, the current TVET is not of sufficient quality, with informal apprenticeships; it suffers from the sector's poor image and is generally considered to be of low value.

Description of the recommendation	• **Establish or expand TVET offerings in regions with high solar or wind potential and promote these offerings via a broad communication campaign (posters and awareness in schools).**
	  ○ Promote TVET programs to increase the number of technicians. Also, one should not overlook the importance of presenting green jobs as decent jobs that promote and protect the rights of young workers (Nebuloni and van der Ree 2020).
	  ○ Develop such programs throughout the country so as to provide local jobs for youth and, if possible, in areas with the highest solar or wind potential.
	  ○ Focus all types of training, and especially TVET, on competency-based assessment rather than theoretical knowledge (World Bank 2020b).[19] Develop specific training pathways to focus primarily on two types of workers: technicians (plumbers, electricians, workers) without specific energy efficiency or renewable energy knowledge, and specialized technicians (GIZ 2016b).
	  ○ Accredit the skills acquired upon training completion so as to serve as quality assurance for future installations and limit informality (GIZ 2016b).
	• **Encourage horizontal mobility, by making trainers aware of the value of decompartmentalizing disciplines—especially in the construction and conventional sectors.**
	  ○ According to the survey, short-term reskilling/upskilling is the most appropriate way to meet the market demand. This result is confirmed by the GIZ (2022) survey, which also highlights the usefulness of on-the-job training, especially for VSMEs, which currently have fewer opportunities to provide such training.

[19] Stakeholder consultation (2022), Prominox.

	• **Involve the private sector in the development of professional training programs.**
	  o Employers have to be more involved in curriculum development and workplace learning opportunities so as to ensure that the skills taught match those required in the labor market: anticipating future needs is mandatory to avoid any mismatch.
	  o The private sector can be especially influential in terms of short reskilling courses and on-the-job training, as shown by knowledge transfer between Spanish and Moroccan workers in Noor Ourzazate.[20]

Governance	The OFPPT, together with stakeholders like the HCP, the National Agency for Employment and Skills Promotion (ANAPEC), the Ministry of Employment and Social Affairs (MEAS), the General Confederation of Moroccan Enterprises (CGEM), AMEE, and the Department of Vocational Training (DFP), have an opportunity and incentive to collect, collate, analyze, and disseminate relevant information about how skill development affects labor market outcomes (World Bank 2020b). Also, networks of installers (like RESOVERT in Souss-Massa) could serve as relays, pooling training costs and supporting the organization of training courses (GIZ 2016b).
6. Increasing employability among the highly qualified	
Current situation	As explained before, Morocco faces a high youth unemployment rate (31 percent), which is even high among recent graduates (25.7 percent) than those with no prior education (4.4 percent) (Le Matin Maroc 2021). Few young people are enrolled in TVET (10 percent, compared with 45 percent in OECD countries). The country uses on-the-job training more regularly than its MENA neighbors. Thirty percent of companies use on-the-job training (KAPSARC 2019).
Identified limitations	One main issue with the Moroccan educational system is the imbalance between the training offered and the market's needs. This is especially the case for highly skilled jobs, recruitment for which faces severe difficulties. Highly educated students possess more theoretical than practical knowledge,[21] and those capable of providing a certificate are lacking.[22] Not only is the population not receiving appropriate training, the sectors in demand are not those preferred by students during their training: there is a lack of engineers compared with those with a social sciences or education background, for instance (KAPSARC 2019), and the most talented are often recruited by companies abroad. Recruiters perceive this lack of seniority as an obstacle when it comes to becoming involved in large-scale projects. There is a lack of employability for those with postsecondary and tertiary education. The number of graduates may be sufficient, but it will take several years to have a workforce with strong references.[23] In general, and not specifically for the energy efficiency and renewable energy sectors, companies tend to require highly specialized worker profiles and management experience.

[20] World Bank decision note on last report version (internal expertise).

[21] Stakeholder consultation (2022), Prominox.

[22] Stakeholder interview (2022), OFPPT.

[23] Stakeholder consultation (2021), SIE.

	Further, behavioral, communication, and language skills are especially important in the energy transition. The online survey highlighted a scarcity of these skills in the job market (World Bank 2021c). It shows that recruiters struggle to recruit for jobs requiring advanced, knowledge-intensive skills. Strategy and leadership, coordination management and business, innovation, communication, and negotiation are the skills for which recruitment difficulties are the greatest.

Description of the recommendation	• **Consider making training mandatory in public sector renewable energy project contracts through long-term internships, apprenticeships, or ad hoc collaboration with universities, to allow students to work on real practical cases.**
	  ○ Promote careers such as engineering instead of social sciences or education. For these jobs to be attractive, young people should have the opportunity to apply the skills acquired previously and have opportunities related to the skills required by careers that are promoted.
	  ○ Collaboration and internships would also likely promote careers in the country, limiting the brain drain. Higher salaries may also be required.
	• **Strengthen the share of coursework devoted to soft skills and strengthen interdisciplinarity in schools and universities teaching the energy transition professions.**
	  ○ For engineers, special focus should be on foreign language and soft skills (e.g., strategy and leadership, coordination management and business, innovation, communication, and negotiation).[24]
	• **Recruit teachers with industry experience and provide them with opportunities for professional development.**

Governance	The OFPPT, together with stakeholders like the HCP, ANAPEC, MEAS, CGEM, AMEE, and DFP, have an opportunity and incentive to collect, collate, analyze, and disseminate relevant information about how skill development affects labor market outcomes (World Bank 2020b).

7. Support a just energy transition, contributing to the objectives of decent work for all, social inclusion, and poverty eradication

Current situation	The job market in Morocco is marked by great disparities. Unemployment rate is high among women and youth, especially women. Despite the relatively high level of development, female job market participation in Morocco is among the lowest worldwide (20 percent). Experts estimate that the participation level should be 15–20 points higher, based on data for GDP, education level, and numbers of children (L'Economiste 2021). This number conceals further disparities since fewer women are employed in urban than rural areas. Also, some jobs appear to be targeted much more at men. According to the GIZ (2022) survey, 19 percent of women are technicians, compared with 53 percent of men. Thirty percent of young people are unemployed. Even youth with high educational levels struggle to enter the job market. Linked to high official

[24] Stakeholder consultation (2022), Ministry of Education.

	unemployment levels is the continued prevalence of job informality in Morocco, which represents over 12 percent of the GDP and 30 percent of jobs (Meziouni, Elomari, and Aissaoui 2021).
Identified limitations	The integration of more women into the labor market remains a persistent challenge in Morocco. Yet, the benefits of increased female labor market participation are significant. Women spend more on health and education, perhaps because they tend to care for children and make decisions about children's education and health care. However, when jobs are scarce, men have priority: 75 percent of men, compared with 47 percent of women (World Bank 2021e). Also, enterprises appear to lack confidence regarding employing women, who remain unaware of employment opportunities. Youth are viewed as less attractive hires due to their lack of experience. The difficulties in finding a job lead to some to cease looking for one. Although the informal market provides a means to earn money, the lack of social insurance and regulations in general threaten workers' rights.

Description of the recommendation	• **Implement a national "just transition" strategy and widely communicate its benefits to society.**
	  ○ This can be done, for example, through "just transition week" announcements via radio and TV and local public awareness events.
	  ○ Promote adequate and sustainable social protections amid job losses and layoffs, as well as skill development and social dialogue, including effective exercise of the right to organize and bargain collectively.
	  ○ Provide targeted learning and empowerment opportunities for women and youth. A good example of this is the FAREDEIC program on the use of solar heating devices, which specifically targets women (WECF-France 2021).
	  ○ Include studies and impact assessments in environmentally sound economic and social policies so as to achieve an optimal policy mix.
	• **Improve the conditions of access to training for youth from disadvantaged or rural backgrounds.**
	  ○ Systematize the implementation of internships and scholarships.
	  ○ Support entrepreneurship, especially for young people, through mentoring programs or through start-up incubators.
	• **Encourage companies to adopt inclusive arrangements by implementing criteria and performance conditions related to gender diversity in public procurement.**
	  ○ These criteria may include planning actions for greater female access to operational management positions and to prevent drudgery, give women more flexible part-time work, or provide childcare facilities.
	  ○ Support IGA programs. In particular, those carried out by MASEN were almost exclusively for women, which is a meaningful targeted action.

Governance	The government (Ministry of Solidarity, Social Integration and Family) and the corporate social responsibility department of different entities like MASEN.

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APPENDIX 1: INTERVIEW GUIDE—DISRUPTIVE CLEAN ENERGY TRANSITION AND EMPLOYMENT OPPORTUNITIES

CONTEXT AND OBJECTIVES OF THE ACTIVITY

The clean energy transition and associated technological innovations can promote job creation and shift the skill profiles of occupations. Early evidence from the Middle East and North Africa shows a positive job impact, although rigorous evidence for countries in the region is still scarce. In this context, the World Bank is conducting a study, financed by the Energy Sector Management Assistance Program, to build evidence on the job creation potential and the challenges involved in meeting the evolving employment. The goal is to help countries formulate, adopt, and implement appropriate strategies, policies, regulations, incentive schemes, programs, and human capital development frameworks for a job transition. As part of the first phase of the study, the World Bank assessed the net direct, indirect, and induced job impacts of a disruptive clean energy transition in Egypt, Morocco, and Yemen.

The World Bank has hired EY to undertake Phase 2 of the study. The analysis in Phase 1 will be deepened through country case studies for Morocco and Egypt. Phase 2 will include:

- Country-specific deep-dive analyses of the opportunities and challenges related to job creation and transformation, with a focus on sectors offering the most significant employment opportunities, in particular, the renewable energy and energy efficiency sectors and the associated value chains (e.g., manufacturing, finance, support sectors); and
- Policy recommendations for maximizing the opportunities and addressing the challenges identified.

These efforts have focused on the following renewable energy and energy efficiency technologies:

- Solar (concentrated solar power, utility-scale photovoltaic, industrial-sector distributed photovoltaic, residential rooftop solar) and wind (utility scale);
- Energy efficiency for commercial buildings;
- And the activity may be expanded to include additional clean energy technologies such as electric vehicles and battery energy storage.

As part of Phase 2, data and information are being collected from actors linked to the energy and jobs/education sectors in Egypt and Morocco. The aim is to complete the knowledge obtained via existing literature review. EY will first conduct face-to-face or phone interviews with such stakeholders. It will then send an online survey to companies related to the renewable energy and energy efficiency sectors, to verify some of the findings of the interviews.

EY will conduct interviews with four types of actors. Each type will be asked specific questions, according to their main areas of expertise. In this interview guide, each group of questions is thus assigned to one or several types of actors, according to the code given in table A1.1.

Table A1.1 Four types of actors interviewed

Code	Type of actor interviewed
A	Public energy institutions as well as public and private agencies
B	Energy trade associations and energy companies
C	Public institutions as well as public and private agencies in the jobs/education sectors
D	Development finance institutions

QUESTIONS

- **1. Clean energy achievements, trends, and the labor market context (A, B)**
    - ***1.a)*** What are the current government objectives for the renewable energy and energy efficiency sectors, in terms of capacity and job creation?
    - ***1.b)*** How have the renewable energy technologies (solar and wind) evolved?
        - Which technologies have been the most deployed in the past 5–10 years (in terms of cumulated and annual installed capacity)? To what extent (cumulated installed capacity and annual capacity additions in megawatts)?
        - On which value chain segment(s) are local actors positioned (installation, operation and maintenance [O&M], manufacturing, project development…)? In other words, which parts of the value chain are local, and which are imported? Is there any available study on this subject?
        - What are the evolutions that you expect in the next 5–10 years (annual growth rate and share in total installed capacity, as well as evolution of local content in relation with projected growth rate and projected growth in share in overall installed capacity)?
    - ***1.c)*** How has the demand-side commercial buildings energy efficiency sector evolved?
        - Which technologies have been the most deployed in the past 5–10 years (in terms of annual investments in energy efficiency technologies and savings that could be achieved for commercial buildings as a result)? To what extent (annual growth in market volume, number of commercial building energy efficiency retrofit projects…)?
        - On which value chain segments are local actors positioned (construction, installation, O&M, manufacturing, project development, design …)?

        - What are the evolutions you expect in the next 5–10 years (in terms of investment volume, share of buildings, local content)?

    - ***1.d)*** For both the renewable energy and energy efficiency sectors, and the green economy overall, how many people are employed (direct employment—full time and part time) in the entire value chain in the country? How many are domestic against foreign workers? Through which channels are workers recruited?

- **2. Impact of the clean energy transition on jobs and the required skills (A, B, C, D)**

    - ***2.a)*** What are the skills required for the existing jobs in the different segments of the renewable energy and energy efficiency value chains for the following activities: manufacturing, import, project development, distribution, design and engineering, construction, installation, and O&M?

    - ***2.b)*** How have these skills evolved? Are the skills required for the newly created renewable energy and energy efficiency jobs different from the current skills required in existing renewable energy and energy efficiency jobs? If so, in which value chain segment(s) and why?

    - ***2.c)*** What are the challenges to the quality of these new jobs (education and training, high skilled vs semiskilled vs low skilled, wages, employment type [full time vs part-time], employment security, benefits)? Are there opportunities for or challenges to including minorities, women, and young workers?

    - ***2.d)*** Have skills shortages already been identified in the renewable energy and energy efficiency sectors, and by whom (for direct and indirect jobs, for technical as well as nontechnical skills)? If so, what are the identified skills shortages? How were the required skills developed?

        - At what occupational level were these shortages identified (low-skilled jobs such as O&M, medium-skilled jobs such as solar installers and wind turbine operators, high-skilled jobs such as engineers and architects)?

        - Were these shortages identified for technical (such as engineers) or nontechnical (such as green financing experts) occupations?

        - What are the characteristics of these missing skills (technical, language, IT/digital, project management, soft skills such as teamwork and communication)?

    - ***2.e)*** Were some jobs transformed as a result of the clean energy transition (i.e., existing occupations whose skills/qualification requirements changed to match the demand of the renewable energy and energy efficiency sectors)? If so, how were they transformed in the renewable energy and energy efficiency sectors?

    - ***2.f)*** How has the development of the renewable energy and energy efficiency sectors impacted job requirements in the conventional energy sector? How many jobs were eliminated? What are the characteristics of these jobs (occupations, skills)? Will they change over time?

- ***2.g)*** What are the opportunities that you see for employment in the energy efficiency and renewable energy sectors and for skills transfer to these sectors from the conventional energy sector? In your opinion, will workers losing their jobs in the conventional energy sector be able to fill vacancies in the same occupations in the energy efficiency and renewable energy sectors ("jobs substituted")? Do you have a quantitative estimate of the number of such workers?

- ***2.h)*** In your opinion, how may the clean energy transition indirectly impact employment in the country—by creating or displacing manufacturing or service jobs in industries associated with conventional energy, renewable energy, and energy efficiency (e.g., industries supplying intermediate goods for building retrofits, for instance, steel, and transportation)?

    - How do you expect jobs in these industries (and required skills) to evolve in the next 5–10 years?

    - Is the development of the renewable energy and energy efficiency sectors the sole driver of these evolutions, or do they also depend on other trends (such as cost reductions, increasing automation, and digitization)?

- **3. Opportunities and challenges for job transition (A, B, C, D)**

    - ***3.a)*** What might prevent young graduates entering the job market (or students in schools aspiring to get into renewable energy or energy efficiency occupations) from occupying newly created positions in the renewable energy and energy efficiency sectors?

    - ***3.b)*** What might prevent existing workers from acquiring the required skills to occupy positions in the renewable energy and energy efficiency sectors?

    - ***3.c)*** What are the challenges confronting workers losing their jobs in the conventional energy sector as they seek to acquire the skills they need to occupy new positions in the renewable energy and energy efficiency sectors?

    - ***3.d)*** For workers whose jobs will be transformed by the clean energy transition (i.e., jobs in the same occupation continue but with an altered mix of skills and/or qualification requirements), what are the challenges that may prevent them from acquiring the required skills to adapt to their new jobs? Which opportunities can be seized to maximize their chances of adapting?

    - ***3.e)*** To answer these questions, we will analyze a set of factors facilitating or hindering the job transition. The following list provides examples of such factors, but it is neither exhaustive nor limitative.

A1.2 Factors facilitating/hindering the job transition

Examples of factors	Components
Overall business environment	Macroeconomic stability, governance, regulations, investment policies, incentives
Enabling factors for sector development	Access to financial services and infrastructure, local financing capacity, ease of access to inputs, regional comparative advantage (cost of labor, raw material, inputs)
Sector structure and market	Entry barriers, competition within the sector, regional and international competition, public sector's dominance, private sector participation, market size
Digital economy, technology, and innovation	Connectivity, technology adoption, time of experience with the technology, possibility of technology transfer, research and development, and innovation capacity
Labor market regulations and social protections	Labor costs, prevalence of formality, labor protections
Human capital	Labor force and demography, presence of industrial actors with relevant skills, availability of skilled workers, training needs and opportunity to develop or "green" workforce, etc.

- **4. Enablers of a job-enhancing clean energy transition (A, C)**
    - ***4.a)*** Institutional framework (A, C)
        - Which are the public authorities involved in policy making related to clean energy jobs and skills development? What are their mandates/powers with respect to the policy-making process?
        - What are the institutional arrangements for skills identification and development? Who is responsible for collecting and analyzing information on skills needs and skills development? How frequently is this analysis updated?
        - What is the level of coordination of efforts between line ministries and other government agencies? How do public authorities coordinate with industries on employment and skills issues related to clean energy? Are there any joint working groups or joint initiatives among different entities?

- How do different line ministries and other government agencies manage to align their policy decisions and regulatory requirements with clean energy job trends and the skills demand?
- In your opinion, is there a gap between the institutional frameworks required and the existing frameworks? Why?

- ***4.b)*** Enabling policies and programs (A, C, D)
  - What are the key national strategies/policy documents that relate to clean energy jobs and skills? Are they available online? If not, would be it be possible to obtain a copy?
  - What is the level of coherence among policies on energy, labor, social protection, education, and skills?
  - What are the existing policies and programs that support private sector development and investments in clean energy? Are you aware of plans to develop new policies and programs?
  - What are the existing policies and programs that promote the localization and creation of local value chains? Are you aware of any plans to develop new policies and programs?
  - What are the existing education- and skills-related policies that facilitate the development of human capital for energy transition?
  - What are the existing policies and programs that are seen to strengthen labor market and social protection systems? What are the policies and programs that support greater inclusion of minority, women, and young workers? Are you aware of any plans to develop new policies and programs or update existing policies and programs?
  - Are you aware of specific policies and programs to mitigate adverse impacts due to job substitution and elimination?
  - What additional policies and programs could be implemented or strengthened to maximize the clean energy transition's job potential?

- ***4.c)*** Educational and training programs/projects* (B, C)
  - What are the existing educational and training programs/projects that aspire to develop new skills required by the clean energy transition? Are these programs a part of formal education? Who developed/supported these programs? Are these nationwide programs or pilot programs? If it is a pilot program, can it be scaled up?
  - What data do you have on the program outcomes (i.e., number of people trained)?

- Are you aware of any new programs that will be developed in the future?
- In your opinion, is there a gap between the educational/training programs required and the existing programs? Why? What are the policies that could fill this gap?
- What certification/accreditation systems exist for the new skills required by the clean energy transition?

*These programs and projects include educational and training programs of different levels—not only postsecondary (formal TVET [technical and vocational education and training] and university), but also short-term training modules, as well as on-the-job, industry, and employer-provided training and upskilling.

NEXT STEPS: INTRODUCTION TO THE ONLINE QUESTIONNAIRE

We will conduct an online survey to quantify the findings from the interviews. The survey will primarily target small and medium companies in the renewable energy and energy efficiency sectors.

For Egypt. Our plan is to contact members of sectoral professional associations. Do you have any advice for us in our efforts to assemble the largest possible panel of respondents? Do you know any professional renewable energy or energy efficiency associations that will/may be willing to share their membership contact information, or share the online survey with their membership?

THE WORLD BANK

ESMAP

Energy Sector Management Assistance Program