Renewable Energy and Employment:

The Experience of Egypt, Jordan and Morocco

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November 2019

Doi: 10.30573/KS--2019-DP69

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Key Points

While the renewable energy sector needs more workers per megawatt of energy generated than fossil fuel-based energy sectors, a sound and dynamic labor market is necessary for local populations to enjoy the benefits of employment. A well-functioning market can help improve labor market information and assess the training needs of employees in the renewable energy sector.

- Measures are needed to tackle segmentation and distorted market signals, such as educational choices that seem unresponsive to labor market demands, the oversupply of applicants for public sector positions, and a large gap between formal and informal sector earnings.
- While the combination of unemployment among highly skilled workers and skill shortages is evidence of an educational system that trains individuals for unsuitable skills, the fact that it continues to be geared toward public sector requirements adds to the skills challenge.

Many solar power plants or wind power units are located in rural areas where the labor force is more likely to be less skilled. A potential solution is to decentralize energy competencies to better respond to local needs and to promote more inclusion of the local population.

There have been concerns in the countries studied that local content requirements do not necessarily generate more jobs. Despite this challenge, opportunities exist through increased economic efficiency and joint coordination among industrial actors, which could have positive welfare implications for local workers.

The deployment of renewable energy technology and its links to employment policies cannot be considered in isolation from other complementary policies, such as industrial, export and educational strategies. Hence a comprehensive policy approach is necessary.

Summary

The combined challenges of growing energy demand and labor market pressures present the governments of Egypt, Jordan and Morocco not only with an opportunity to diversify their countries' energy mixes but also with the chance to mitigate high youth unemployment. Although the deployment of solar photovoltaic (PV) generation, wind and concentrated solar power (CSP) technologies still accounts for a small proportion of the electricity generated in these Middle East and North Africa (MENA) countries, renewable energy use is growing rapidly.

The governments of Egypt, Jordan and Morocco have hoped that the inclusion of renewables in their electricity generation mix could present an opportunity to create value-added employment for their national populations. All three countries are endowed with young, growing and increasingly well-educated populations.

While the favorable demographics of these MENA countries may suggest that large workforces could take on the jobs created in and around the renewable energy sector, challenges remain. In fact, the employment situations in these countries is marked by high job demand and a significant skills mismatch.

Initiatives are taking place to remedy these labor challenges. By introducing renewable energy technologies, Egypt, Jordan and Morocco may serve as examples to other countries set to do so, with the intention of linking these initiatives to employment goals. Accordingly, the experience of these countries may offer relevant examples for countries considering deploying solar and wind energy projects with the goal of linking them to their employment strategies.

Direct employment in solar and wind power, 2018

Source: IRENA jobs database.

Introduction

Egypt, Jordan and Morocco have made significant progress in the deployment of renewable energy technologies. Their respective governments have all hoped that the inclusion of renewables in their energy mixes would present an opportunity to create value-added employment for their national populations – especially given that they all face the dual challenge of demographic growth and relatively high youth unemployment. While analysts have thoroughly researched the deployment of renewable energy technologies across countries, they have focused less on their links with employment.

The experience of these three Middle East and North Africa (MENA) countries provides insights into deployment strategies for renewable energy capacity and their potential links with employment policies. While all three countries are endowed with young, growing and increasingly well-educated populations, constraints in their respective labor markets have limited job opportunities for their national labor forces. This is particularly the case in

Jordan and Morocco, which depend on imports for the greater part of their electricity consumption.

This paper has two main objectives:

- To give an overview of the approaches taken by these three governments in linking their renewable energy policies to their employment strategies; and
- To provide insights stemming from these experiences.

This paper first highlights current and future renewable energy targets. It then provides an overview of the demographic and labor market challenges facing Egypt, Jordan and Morocco. Next, it presents the selection and use of policy instruments adopted to better harness the local human capital in the respective renewable energy sectors. Finally, it highlights key initial insights from the experiences of these countries and identifies potential policy directions.

The Context for Renewable Energy and Employment

Besides having the potential to bring significant investment, solar and wind power generation in Egypt, Jordan and Morocco could provide skilled jobs across a variety of sectors to an expanding workforce. Indeed, the combined challenges of growing energy demand and labor market pressures present the governments of those three countries not only with an opportunity to diversify their energy mix, but also to help mitigate high youth unemployment and assist in creating higher-skilled jobs. Given their relatively young populations, the implications for the respective labor markets of Egypt, Jordan and Morocco are significant. This section provides an overview of the context and evolution of renewable energy in these MENA countries and then highlights its links to employment.

The domestic drive for renewable energy

Population growth and economic growth have been accompanied by rapidly increasing electricity demand in Egypt, Jordan and Morocco. According to International Energy Agency (IEA) estimates, the demand for electricity in these three countries is set to continue to grow above 3% per annum for the next two decades (IEA, 2018). Egypt, Jordan and Morocco have historically been dependent on fossil fuel for most of their electricity generation (Figure 1). This is still the case for Jordan and Egypt, which had levels of dependence on oil and gas of 95% and 92%, respectively, in 2016. On the other hand, Morocco's energy mix, although

Figure 1. Electricity generation by fuel, 2016.

Source: IEA World Energy Balances (2018 edition).

more diversified than Egypt's or Jordan's, was still very reliant on hydrocarbon fuels. Indeed, coal dominates Morocco's electricity generation capacity, with coal responsible for 58% of power production in 2016, followed by natural gas (20%) and oil (10%). Solar and wind power (12%), and hydropower (1%) provided the remainder of the country's electricity mix.

To enhance the security of supply, the governments of these three MENA countries began progressively to add renewable energy to their electricity generation mixes. With some of the highest solar

irradiance levels in the world¹ – along with high wind energy potential² – these three countries have accelerated the development of their solar and wind production in recent years. However, as seen in Figure 1, the contribution of these renewable energy technologies to total electricity generation remains small in these countries, accounting for 8% in Egypt and less than 5% in Jordan. In Morocco, renewables have more impact, providing about 15% of the country's electricity generation IEA, 2018. Figure 2 shows the recent evolution and breakdown of wind, solar and concentrated solar power (CSP) for the three countries.

Figure 2. Electricity generation by renewable energy technology, 2008-2017 (MW).

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Source: IRENA (2018a).

Although the renewables' capacity installed is still small, it has been growing rapidly in the past few years. Of the three countries studied, Morocco led installed capacity in 2017 with 1,258 megawatts (MW), followed by Egypt with 866 MW (Figure 3). While the Moroccan and Egyptian renewable energy sectors were mainly focused on large wind parks, solar photovoltaic (PV) technology (362 MW) was more prevalent in Jordan. Morocco leads the three in CSP technology with installed capacity of 180 MW.

The three renewable energy markets are growing and are progressively opening to private investment. This will help to address the issues of energy

dependence on fossil fuels and future electricity demand. Recent renewable energy targets ensure more capacity will be developed in the future – particularly in the case of Egypt (Table 1).

However, deploying renewable energy technology represents not only the potential to further reduce these three countries' heavy reliance on oil and gas for power generation, but also to satisfy existing and future electricity demand. The three countries also saw the inclusion of renewables in the energy mix as presenting an opportunity to tackle high rates of youth unemployment (15-24 years of age), which reach 34% in Egypt and 40% in Jordan (ILO 2017a).

Figure 3. Installed solar PV, CSP and wind power capacity (2017).

Source: IRENA (2018a).

Table 1. Future renewable energy targets.

	Domestic capacity targets	Share of electricity generation targets
Egypt	Solar PV: 700 MW by 2027 Concentrated solar power: 1.1 GW by 2020 2.8 GW by 2030 Wind power: 7.2 GW by 2020	20% by 2022 *42% in 2032
Jordan	Solar PV: 1 GW by 2020 Wind power: 1.2 GW by 2020	10% by 2020 20% by 2025
Morocco	Solar PV: 2 GW by 2020 Concentrated solar power: 2 GW by 2020	52% by 2030 100% by 2050

Source: REN21 (2018) Renewables 2018 Global Status Report: Tables R8 and R10. * Egypt's ISES to 2035.

BOX 1. MOROCCO AND THE GERMAN ENERGIEWENDE

Morocco and Germany have shared a mutual interest in renewable energy since the early 1980s. More recently, the North African country has taken an interest in the German Energiewende. The Energiewende – or ‘energy transition’ – is an ongoing, nationally coordinated, comprehensive undertaking that has two fundamental drivers: the development and deployment of renewable energy sources and an increased and widespread implementation of energy efficiency measures, all of which is taking place in a relatively short timeframe. The transition plan relies heavily on renewable energy (particularly wind, photovoltaics, and hydroelectricity), energy efficiency and energy demand management.

This common interest led to the creation in 2012 of the German-Moroccan Energy Partnership, a central platform for institutionalized energy policy dialogue between Germany and Morocco. It aims to assist Morocco in developing and rolling out a national energy policy capable of securing a sustainable power supply. The Energy Partnership focuses on long-term energy strategies, support for close-to-market investment projects, research cooperation, low carbon strategies, development cooperation, advice on deregulation and the feed-in of PV-generated power into low voltage and medium voltage grids. The German Federal Ministry for Economic Affairs and Energy and the Moroccan Ministry of Energy, Mining and Sustainable Development coordinate the partnership.

Source: Morris (2018), German Federal Foreign Office (2017). <https://www.energypartnership.ma/german-moroccan-energy-partnership-parema/>

The potential for jobs in the renewable energy sector

The promise of greater job opportunities in these three countries has existed since the earliest plans to deploy renewable energy technologies. This is partly spurred by many economic studies that have shown that, per unit of energy produced, renewable power generation is more labor intensive than fossil fuel fired power plants.³

With the announcement of several renewable energy plans by 2030, highlighted in Table 1, there is the potential for around 60,000 local renewable energy-related jobs by 2025 for the three countries combined. It is important to note that, because of frequent changes in renewable energy targets and the different methodologies used, estimates of potential job creation vary greatly. A 2011 World

Bank study put the renewable energy employment creation potential in Morocco, Algeria, Egypt, Tunisia and Jordan at between 64,000 and 79,000 local jobs by 2025. IRENA (2016, 11) has published more recent estimates suggesting that there could potentially be 16,000 renewable energy jobs across the North Africa region. Accordingly, when measuring employment, several considerations ought to be taken into account.⁴

As of now, the renewable technology sector still represents just a small percentage of employment in the region, at less than 1% of the total.⁵ Based on the latest available estimates, Jordan currently has about 6,900 workers employed across all renewable energy technologies, with solar PV employing the vast majority (6,100) of those workers (Figure 4). Jordan also has the highest number of workers (800) in wind power. The equivalent employment

Figure 4. Direct employment in solar and wind power, 2018.

Source: IRENA jobs database.

levels in Egypt and Morocco reflect their lower usage of these renewable energy technologies. Concentrated solar power (CSP) in Morocco, with 1,800 employees and solar PV in Egypt, with 3,000, are the renewables sectors that employ the greatest number of workers in those two countries, respectively. Egypt is more diversified, employing workers across solar PV, CSP and wind power. These results are consistent with the economic literature, which indicates that solar PV is the most labor-intensive green power technology.

One of the common strategies used to link renewable energy projects with employment has been to make use of local content requirements (LCRs). These are state policy measures that typically require a certain percentage of intermediate goods to be used in the production processes to be sourced from domestic manufacturers. Such measures, which prioritize jobs for indigenous workers, often serve as either a precondition to receiving government support or as an eligibility requirement for government procurement in renewable energy projects. However, the evidence from this job creation approach is mixed.⁶

For instance, estimating employment, particularly in the MENA region, requires adjusting for different stages of economic development. For example, many of the jobs in the earlier stages of renewable energy developments are in construction and manufacturing and are thus temporary. However, as we will see later in this paper, these types of jobs account for the majority of the workforce. Moreover, the lower the cost of labor in a country, the greater the number of workers that will be employed to produce a unit of output, whether in manufacturing, construction or operations and maintenance. When labor costs are low, manpower is more affordable than mechanized means of production. This means that changes to levels of production in any given

sector of the economy are likely to have a greater impact on jobs in developing countries than in developed countries.

In addition to variations across renewable technologies, employment estimations also need to be adjusted to reflect the fact that technologies and production techniques will mature over time, leading to reduced employment. In doing so, it is important to assess net job creation. A net job creation number for the renewable energy sector could be calculated by factoring in the job loss impact from the coal and natural gas sectors due to the increased uptake of renewable energy technologies.

Types of jobs in the renewable energy sector

While the number of jobs created is important, the types of employment across the different activities help to inform us about the skills needed to fill them. IRENA identifies six types of activities in the life of a solar PV plant and wind farm project from planning to decommissioning (2017a, 2017b). In each case, the three most employment-intensive activities, accounting for almost all direct and indirect employment, are operations and maintenance, installation/construction and manufacturing.

Labor requirements across the solar PV and wind power value chain range from manual and technical occupations, such as construction workers and engineers, to administrative workers such as legal and financial analysts. Figures 5a and 5b show the main distribution of jobs across these two sectors. For solar PV, construction workers, factory workers, engineers, and health and safety experts account for most of the occupations. For wind power, construction workers and technicians, operators and engineers make up two-thirds of the occupations in the sector (Figure 5b). Both solar

Table 2. Distribution of human resources required along the value chain for the development of a 50 MW solar PV plant and 50 MW wind farm, by activity (%).

Work activity	Solar PV	Wind farm
Project planning	1	2
Manufacture of main components	22	17
Transport	2	1
Installation/plant construction	17	30
Operations and maintenance	56	43
Decommissioning	2	7

Source: IRENA (2017a, 2017b).

Figure 5. Workforce requirements in the solar PV and wind power value chains.

Source: IRENA 2017a; 2017b.

PV and wind power require a sizable proportion of jobs considered to be low-qualified occupations. This is particularly true during the construction and manufacturing phases. Although the implicit assumption is generally that the solar and wind equipment is imported, mostly from China, some MENA countries, including Egypt, have developed limited local manufacturing capability. At the same time, both solar and wind power projects require medium to highly skilled workers, such as technicians, operators, engineers and other specialists.

Another factor that needs to be considered is the sustainability of the newly created renewable energy sector jobs. The starting phase – constructing solar power plants, wind parks or

installing PV systems – needs more jobs than the second phase, which involves the maintenance of these installations. While jobs in construction, installation and manufacturing are temporary, those created in operations and maintenance last throughout the lifetime of the project. Given that solar PV and wind farms in MENA are typically located in arid desert areas, requiring higher rates of component replacements and more frequent maintenance (operations and maintenance), activities in that segment are expected to create a higher demand for employment. Indeed, the local desert conditions, with a high capacity factor (more operating hours per year), high temperatures, high turbulence and sand storms, result in accelerated wear and tear of components and a higher rate of failures after a few years.

Domestic and Labor Market Considerations

Implementing renewable energy at scale requires a multi-skilled workforce. Further deployment of renewable technologies offers opportunities for local employment. Egypt, Jordan and Morocco are endowed with young, growing and increasingly well-educated populations, but while the favorable demography in these countries represents an emerging workforce that can potentially take on the jobs created in and around the renewable energy sector, challenges exist. Indeed, the current employment situation in these countries is marked by a significant skills mismatch, which, in turn, causes imbalances between supply and demand in the labor market.

Demographic dividend and youth unemployment

A large proportion of Egypt, Jordan and Morocco's population is young. Around half of the population in the three countries is under the age of 25 (Figure 6): 55% in Jordan, 50% in Egypt and 45% in Morocco.

The labor force in these three countries has also grown significantly since 2010, rising between 1.7% and 3.6% per year on average (Figure 7). Jordan, which has experienced an average labor force growth of 3.6% per year due to a large influx of migrants, is projected to slow to 1.3% per year after 2018.

Figure 6. Share of the total population under 25 years of age (male and female), 2015-2030.

Source: United Nations, World Population Prospects: The 2017 Revision. Medium variant scenario.

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Morocco's labor force is expected to grow at around 1% per year out to 2030, while Egypt's is expected to accelerate at 2% per annum, adding 8 million jobs to its existing labor force between 2018 and 2030 (ILOSTAT modeled estimates, November 2018).

Jordan's labor force has increased mainly because of an influx of refugees from surrounding countries (Box 2). This has resulted in more casual jobs, which has led to substitution for lower-skilled jobs. Casual jobs are typically characterized by lower levels of productivity, partly because of lower investment in human capital. They also tend to be of much lower quality than formal jobs. Some 37.5% of young people in Jordan were employed in casual

work in 2015 (OECD 2018), while the figure was estimated to be 53% in Egypt in 2017 (ILOSTAT).

Given their relatively young populations, the three countries studied in this paper have entered a phase that can yield a 'demographic dividend' (Figure 8). This situation occurs when a rapid expansion of the labor force, compared with the number of dependents, takes place, resulting in a boost to productivity and an increase in per capita income. In all the countries reviewed, the 2015-2030 period is when this demographic dividend will peak and will potentially offer both economic and employment opportunities. This will take place as long as the labor market can absorb this emerging population.

Figure 7. Labor force projections, 2010-2030 (ages 15 and older) (2010=100).

Source: Labour market projections -- ILO modeled estimates, Medium variant scenario. May 2018.

BOX 2. THE REFUGEE CHALLENGE IN JORDAN

Jordan has experienced substantial demographic changes since 2011 due to the influx of Syrian refugees. As of 2015, Jordan's population of 6.6 million was home to a further 2.9 million non-Jordanians, of whom 1.3 million were Syrian.

According to the International Labour Organization (ILO), in 2014 about 51% of Syrian men living outside camps were employed in the Jordanian labor market, though the unemployment rate for this group was as high as 57%. The situation is more challenging for women. While only 7% of Syrian refugee women were employed in Jordan, a figure comparable to their participation rate in Syria before the crisis, the unemployment rate of those living outside camps was 88%. This compares to a rate of about 28% before these women became refugees.

This development has placed significant strains on Jordan's labor market, leading with a burgeoning casual employment sector. It has also affected the country's health and education sectors.

Source: Jordan, Department of Statistics, Population and Housing Census 2015; ILO (2015).

Figure 8. Total dependency ratio (ratio of population aged 0-19 and 65+ per 100 residents aged 20-64).

Source: United Nations, World Population Prospects: The 2017 Revision. Medium variant scenario.

Poor labor market outcomes

The favorable demographics of these three MENA countries means there is a potentially substantial workforce to take on the jobs created in and around the renewable energy sector. However, the employment situation in these countries is marked by difficulties in creating the new jobs needed to keep up with their young and growing working-age populations.

For instance, Egypt has long been slow to absorb new entrants into its labor market, even during periods of higher economic growth – a situation which worsened following the 2011 Arab Spring. Between 2010 and 2015, the Egyptian labor force saw an additional 460,000 people on average enter the labor supply per year, but growth in employment was much lower, at about 200,000 per year (ILO 2017b, 14). Estimates from the World Bank have

shown that about 240,000 people enter the job market in Morocco each year, while only 129,000 new jobs are being created per annum (World Bank 2017, 16). The Jordanian economy has also faced similar challenges with the supply of new workers into the labor market – particularly young Jordanians and refugees – despite improved access to education and increased levels of educational attainment over the last few decades (Government of Jordan 2017). Consequently, many educated people of working age have remained economically inactive or have chosen to emigrate, while refugees have enlarged the size of the casual labor market (Government of Jordan 2015), (see Box 2).

Moreover, unemployment is still high in these three MENA countries for people under 25 years of age. While the unemployment rate is below 10% for those 25 years of age and above, it is generally higher for their younger counterparts – reaching

Figure 9. Unemployment rates in Egypt, Jordan and Morocco.

b. by education level (most recent year)

Source: International Labour Organization (ILO).

40% in Jordan and 20% in Morocco for workers aged between 15-24 (Figure 9a). This may be an indication of a significant skills mismatch.

Unemployment rates are also highest for young new entrants into the labor market who have had intermediate and higher education, though they are low for those who have no formal education (Figure 9b). For more highly educated entrants, a slow school-to-work transition may be the main reason behind these high unemployment rates — a situation exacerbated by the higher educational achievements of new entrants and their consequent expectations. The lower employment participation rate among these educated entrants can be partly explained by the fact that most jobs created in these countries of late have been low-paid, low-skilled jobs, taken by migrant workers and refugees. This has discouraged local labor participation, particularly among more educated jobseekers.

Human capital development amplifies the skills mismatch

Even though access to, and participation in, education has progressed in these three countries, the disparity in local education levels has long been a concern. In 2015, Egypt had one of the most polarized education distributions across MENA countries: although 53% of the population aged between 25-44 had no education, 36% had an upper or post-secondary education. However, the sector of people with the highest level of education in Egypt is forecast to increase as a share of the country's overall population.

While Jordan is projected to experience slower educational change, a large percentage of Morocco's population will likely continue to have little formal education. A high early dropout rate from the

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education system is one of the major impediments to the development of human capital in that country, with a large proportion of young people leaving the education system without any qualifications.

Overall, future estimates of educational attainment suggest progress and, to some extent, a reversal of this dropout situation, with an expected increase in post-secondary education in Egypt, Jordan and Morocco (Figure 10). This scenario assumes that educational attainment will improve significantly in these three countries, along with a reduction in the current gender divergence in education (Lutz et al. 2018).

As Figure 11 shows, university students in the three countries tend to favor fields such as social sciences and health and education, reflecting their aspiration to work in government. Fewer students pursue scientific, technical and engineering subjects – fields representing most jobs in the private and renewable energy sectors.

Public sector employment has long been on an upward trajectory in MENA, trending higher following the Arab Spring, as the region's governments sought to rapidly create employment as a way of addressing social unrest. Although government hiring has been curtailed in recent years, behaviors are slow to change. Indeed, educated new entrants continue to queue for government jobs, despite falling civil service wages. Non-wage benefits, such as allowances and job security, continue to be determining factors. However, some evidence suggests that better labor market information about alternative career choices could help to reverse this situation.

The scarcity of local graduates in vocational training programs is also an important issue because many

of the technicians now working in the renewable energy field were trained in these programs. While the numbers enrolling in vocational training in Egypt is comparable with the average for OECD countries, the enrollment rate is very low in Jordan and Morocco (Figure 12).

The culture of on-the-job training also appears to be lacking in the three countries studied, with less than 30% of companies offering formal training in the survey years (Figure 13). Egyptian and Jordanian companies were the least likely to offer training, with only 10% and 3%, respectively, doing so, considerably below the OECD average of 40%.

These educational choices are influenced by the dominant role of government, which continues to be an important employer in the region. A significant contributing factor to unemployment in the three countries is workers' high job expectations, particularly hopes of jobs in the public sector, and especially from workers with some formal education. The low valuation of these credentials by the private sector exacerbates these hopes. As such, this situation sends signals or information to individuals about opportunities and conditions in the job market. This, in turn, affects individual human capital decisions.

One of these signals relates to the wage and benefit structure, distorting labor market incentives. Individuals tend to pursue formal education in the expectation of higher returns in the public sector. This explains the high proportion of graduates in social sciences and humanities, even if the private sector undervalues these subjects. Hence, persistent skills mismatches in these countries help to explain high youth unemployment – a situation more serious in Jordan and Morocco than in Egypt.

Figure 10. Population aged 25+: highest educational attainment.

Source: Lutz et al. (2018).

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Figure 11. Tertiary education graduates by educational field (%), latest year available.

Source: UNESCO, February 2019 release. Based on latest year available: Egypt (2016); Jordan (2015); Morocco (2016).

Figure 12. Percentage of students enrolled in vocational programs in upper secondary education.

Source: OECD World Indicators of Skills for Employment.

Figure 13. Percentage of companies offering formal training (latest years available).

Source: World Bank, Enterprise Surveys.

Renewable Energy and Employment: An Overview of Policy Experience

To take advantage of this demographic and economic opportunity, the governments of Egypt, Jordan and Morocco have all come up with plans not only to deploy the technology but also to prepare their labor markets for the renewable energy sector. This section provides a brief overview of the policy experiences of Egypt, Jordan and Morocco related to the links between the deployment of renewable energy and employment. The analysis will highlight three interrelated activities for each country's experience:

- The adoption of general policy statements around deploying renewable energy and its associated employment.

- The identification of more specific targets for renewable energy sector training needs.

- Local content requirements to help secure jobs for the local working age population.

The experience of Egypt: Creating local jobs through the development of the industrial value chain

Despite Egypt's introduction of many different policies and programs to ease labor market pressures – such as the Youth Employment National Action Plan 2010-15, the Egyptian Observatory for Education, Training and Employment and the Egyptian Forum for Youth Employment Promotion (ETF 2015, 21) – the country has long been criticized for the lack of a comprehensive employment strategy. In response to this criticism, the Egyptian government has in recent years announced several comprehensive policy

statements and job creation initiatives. Although most of these were targeted at the labor market in general, considerable effort was directed at the emerging renewable energy sector.

Policy statements

The first pillar of the Egyptian government's strategy was to develop the renewable energy sector, including its labor force. To do so, it released two policy statements in 2015: The Integrated Sustainable Energy Strategy to 2035 and Vision 2030. These policy statements were used to set the broad values and principles for the deployment of renewable energy and its associated economic framework, including employment. While the economic dimension within the Strategy to 2035 aims to substantially increase the share of renewable energy in the national energy mix by 2030, the goals of Vision 2030 are to help support students and trainees to acquire the necessary skills to empower them technically and technologically. Underlying these goals was the hope that the interactions between these two objectives would help to reduce substantially the proportion of young people not in employment, education or training by 2020.

The Integrated Sustainable Energy Strategy to 2035 policy statement gave renewable energy a central role, targeting 20% renewables in Egypt's energy mix by 2022 and 42% by 2035. The potential for creating local jobs was addressed in Egypt Vision 2030, which is a broad statement of principles and goals, aiming to achieve a diversified, competitive and balanced economy within the framework of sustainable development. While Vision 2030 also sets out to increase the share of renewable energy

in the national energy mix by 2030, education, training and innovation also figure prominently.

The Egyptian government has, in parallel with these general policy statements, launched labor market initiatives that specifically target the renewables sector. This was done in response to the concern that planned projects for solar thermal power plants and large wind farms in Egypt would require a workforce trained to a level consistent with international standards. It was estimated that about 2,500 qualified staff would be needed for the operations and maintenance phase alone (FES 2016).

Skills development

In anticipation of these expected employment increases in the solar and wind power sectors, the Egyptian government launched renewable energy training programs for students at technical schools

in various governorates. The renewable energy curriculum was introduced in early 2018 and seeks to encourage specialization in renewable energy and training in solar and wind. The three-year certificate program, developed by the Egyptian Ministry of Education and the U.S. Agency for International Development (USAID), aims to train over 300 technical school students (IRENA 2018, 47).⁷

This initiative is part of the Workforce Improvement and Skills Enhancement project (WISE) (Box 3).

WISE includes classroom instruction and hands-on practical experience to help train technicians and ensure they are ready to work immediately in the renewable energy sector. It is part of a pilot program launched at two technical schools in Aswan and at another school in Hurgada. The coursework will eventually be implemented at 57 schools in nine other governorates (IRENA 2018).

BOX 3. EGYPT'S WORKFORCE IMPROVEMENT AND SKILLS ENHANCEMENT (WISE)

WISE is part of the Egyptian state's plan to link technical education to the needs of the labor market by entering into partnerships with industrialists and investors to supply practical training opportunities for students.

Project components:

- Improving technical secondary education and labor skills to meet the needs of the market through improving curricula, training teachers and linking with the private sector.
- Promoting innovation and quality assurance at technical schools.
- Establishing partnerships between businesses and technical schools in order to understand the skills needed for employment, create a pool of qualified candidates and find jobs for students through career centers and employment fairs.
- Improving the performance of the private sector through enhanced labor productivity gained via in-house training and improved human resource strategies that reduce turnover.
- Building the capacity of business associations to advocate for policy and regulatory reforms related to workforce development and labor market efficiency.

Source: U.S. Aid (2015); Al Monitor, February 27, 2018.

The Egyptian government has continued on this collaborative path, setting up another employment-related initiative, the RENAC-OASIS Solar Academy Egypt (ROSAE), formed through a partnership between the Renewables Academy (RENAC) and Oasis Renewable Energy (ORE), with the support of the German Agency for International Cooperation (GIZ).⁸ Since 2010, ROSAE has provided practical training courses and capacity-building services in solar energy to develop the capacities of the sector in Egypt. It offers courses for engineers, installers, technicians, undergraduates, schools and investors with an interest in solar electricity (off-grid and grid tied) and solar thermal energy. Besides lectures and workshops, practical exercises form a key element of the courses.

Local content

The government of Egypt has also established employment quotas through local content requirements. One of the objectives of this program was an attempt to help Egyptian manufacturers develop a comparative advantage in improving the value chain, particularly downstream. As a result, several local players, including cable manufacturers and engineering, procurement and construction (EPC) contractors, have become active in the renewable energy market. They have managed to build a considerable market share for all renewable energy technologies, such as solar PV, CSP and wind. Egyptian manufacturers currently produce half of the components used in the country's wind farms (IRENA 2018a).

The consequence of this policy measure has been felt in the Egyptian electricity sector – the localization program succeeded in meeting a 30% local content target for overall wind farm requirements. Encouraged by these results, the government now aims to increase this target to 70%

by 2020 (IRENA 2018a, 82). The government has also set similar goals for CSP plants, where it aims to increase local content to 50% by 2020 (IRENA 2018a, ii).

The experience of Jordan: Preparing youth for the private sector

Like Egypt, Jordan has also relied on a more comprehensive approach to policy. As discussed earlier, the Jordanian economy has been unable to keep up with the entry of millions of new workers into its labor market – particularly young Jordanians and Syrian refugees – contributing to high rates of unemployment and underemployment. In response, the Jordanian government has issued policy statements to promote its transition to renewable energy, together with the promise of job opportunities. These statements emphasized the preparation of young people for the required skills to work in this emerging sector. The government has also attempted to develop a more entrepreneurial approach to developing the sector.

Policy statements

One early plan to address these employment challenges was Jordan's National Employment Strategy 2011-2020, which established the foundation for tackling the country's employment challenges. This strategy was launched in 2010 by the Ministry of Planning and International Cooperation, together with the Ministry of Labor. Its three-part approach to increasing employment in Jordan's private sector called for:

Making private sector jobs more attractive to Jordanians – including the establishment of Jordanian-only professions and quotas for

■ hiring Jordanians – by dropping waiting lists for government jobs.⁹

■ Gradually shifting the Jordanian economy away from its reliance on migrant labor by revisiting immigration and emigration policies.¹⁰

■ Preparing Jordanians for jobs.

It has long been the case that Jordanians mostly prefer public sector to private sector jobs. To help attract Jordanians to the private sector, the government has introduced several measures including dropping the public service job waiting list to reduce the impression that public jobs are readily available and that obtaining them is just a matter of time spent waiting while unemployed. The government also proposed several measures in the National Employment Strategy, including increasing wages to boost the desirability of private sector jobs.

Moreover, by promoting alternative career choices in the private sector, the government hopes to influence the educational choices of young Jordanians toward new emerging sectors, including renewable energy. The program hoped to improve the image of private sector jobs in a wide variety of industries by better aligning the skills and expectations of young people with jobs, instituting national school-to-work transition programs such as job counseling, mandatory internships and employability skills, and expanding awareness campaigns.

The Jordanian government continued on this path by introducing new initiatives, some of which focused on the potential of the emerging renewable energy sector to help combat high unemployment and provide high-quality jobs for its domestic population. While a renewable energy and energy efficiency law (Law No. 13 of 2012) supplied a framework for renewable energy, the National Green Growth Plan

for Jordan (NGGPJ), introduced in 2017, provided much of the vision behind Jordan's drive for an expanding and sustainable economy based on sectors including renewable energy, among others. The plan also aimed to create the conditions for increased job creation, higher incomes for citizens, and a labor force resilient to external shocks. In line with these goals, the Jordanian government has further encouraged institutions for environmental research and education to offer new environmental degrees, courses and school curricula.

The NGGPJ complemented another policy statement released two years earlier, Jordan Vision 2025, with as many as 10 of the 20 desired outcomes of the NGGPJ aligned with the Vision policy statement. Under the plan's targeted scenario, the authorities aim to progressively work on structural reforms geared to job creation and labor market reform. Vision 2025 calls for a substantial cut in the unemployment rate, from the current 13% to between 8% and 9.2% by 2025.

However, the policy statements and initiatives set out by the Jordanian government require the implementation of many large-scale public sector programs, requiring funding and human and institutional capacity. An issue raised in the National Green Growth Plan is that at many levels – both public and private – the ability to develop, implement or maintain large-scale renewable energy projects is lacking at the local level (NGGPJ 2017, 20).

Despite a complex network of partners, donors, funding packages and programs directed at the renewable energy sector in Jordan, the lack of transparency and coordination of green projects and programs in the public sector has affected their cost and effectiveness. The lack of unified and consistent data, as well as dysfunctional inter-ministerial and cross-sectoral coordination, has also discouraged

a well-informed decision-making process (NGGPJ 2017, 98).

Skills development

For renewable energy projects to be successfully implemented, the NGGPJ also calls for a workforce informed by robust data and equipped with specialized skills (NGGPJ 2017, 78). While attracting foreign practitioners is still a possible solution, it is likely to be costly and may challenge desired models of sustainable capacity building which emphasize increasing the employment of Jordanians (FES 2016, 115).

Another challenge that has implications for both employment and training relates to the fact that the majority of job creation in Jordan tends to take place in the country's capital Amman, while most jobs in renewable energy projects are in rural regions in the north and south of the country. Consequently, there is a geographical mismatch between where jobs are created and where people live. Skills apart, this situation is reinforced by the fact that workers are not very mobile because of the traditional strength of social and family ties. However, the government's

2017 Green Growth Corridor initiative sought to partly address this issue by developing solar PV infrastructure along this regional axis (Box 4). It is hoped that this will help to create a need for local labor.

Local content

Compared with other emerging renewable energy markets, such as Egypt, Jordan has a low emphasis on local content rules. At most, the country has vague local content provisions, which reward bid competitiveness. That said, renewable energy power systems that have 'Jordanian origin labeling' entitle their developers to an added 15% feed-in premium tariff. The Jordanian parliament is discussing a proposal to make a domestic content requirement of up to 35% mandatory for future solar PV energy projects (Bellini 2018).

This situation can partly be explained by the fact that, even with efforts to develop solar and wind power, Jordan's demand-side economy is characterized by a 'missing middle': a small number of large and well-established trading companies coupled with a densely populated micro and small

BOX 4. JORDAN'S GREEN GROWTH CORRIDOR

The green growth corridor is based on the National Electric Power Company's Green Corridor project, which runs along the backbone of Jordan, between Aqaba and Amman. This provides a framework for a number of interlocking renewable energy projects. The focus is on improving Jordan's energy resilience, as well as providing new economic growth opportunities along the route. The plan also aims to strengthen rural communities and their surrounding ecosystems by diversifying incomes, ensuring resource availability and reducing environmental impacts. Job provision is an important aspect of this rural cluster to encourage equitable income distribution.

Source: A National Green Growth Plan for Jordan (2017).

Figure 14. Jordan: Future local manufacturing opportunities, solar PV.

Note: Jobs created by industry activity per MW installed.
Source: IRENA-ESCWA (2018).

enterprise sector, which finds it difficult to make the transition to mid-size. Nevertheless, the potential for manufacturing seems to exist, along with the increase in jobs it could create. Figure 14 provides a review of the key success factors for local integration in PV-related equipment manufacturing.

The experience of Morocco: Matching the supply and the demand for renewable energy jobs

Of all the MENA countries, Morocco is the most advanced in terms of renewable energy project deployment. The country's interest in renewable energy dates to the early 1980s when it was part of a collaboration with the German government. In

1982, in response to the second oil shock (1979), Morocco decided to create a center for renewable energy (The Moroccan Center for Renewable Energy Development). The goal at that time was limited to examining new energy generation technologies because of the country's imported energy dependence. More tangible government efforts began in 2009 when the King of Morocco gave priority to renewable energy and energy efficiency. To support these efforts, the center became a public agency for the implementation of national renewable energy and energy efficiency development policies, the Agence Nationale pour le Développement des Énergies Renouvelables et de l'Efficacité Énergétique (ADREE).

Morocco's policy framework was then oriented towards the major aims of mitigating energy import

dependence – resulting in an openness towards all sources of energy, including unconventional oil and gas, and nuclear power – as well as job creation and industrial policy (Steinbacher 2015).

Policy statements

Launched in 2009, Morocco's National Energy Strategy (NES) was one of the most ambitious and comprehensive renewable energy strategies in the MENA region. Benefiting from international support from a variety of sources, including the World Bank, the African Development Bank, the European Investment Bank, Germany's KfW and the French Agence française de développement (Afd), the strategy intended Morocco to achieve 42% of total installed power generating capacity from solar, wind and hydropower resources by 2020, with 2 gigawatts (GW) of installed capacity for each resource, or 6 GW overall. As discussed earlier, these targets were later raised to 52% by 2030 by King Mohammed VI of Morocco during the 2015 United Nations Climate Change Conference in Paris.

One of the early goals of the NES was to ensure an enabling environment for businesses to grow and create jobs, supported by the development of higher education programs for the renewable energy sector. Among its many initiatives were the integration of university programs that included technical and economic components related to energy, and the appropriation of new technologies through research and development (R&D), technology transfer and increasing the attractiveness of Moroccan renewable energy exports in both Africa and Europe.

To complement these efforts, the Moroccan government later launched multiple initiatives with ambitious goals to promote employment. In 2015, the National Agency for the Promotion of Employment and Skills (ANAPEC) launched its

2020 Vision to expand the agency's coverage to include unskilled job seekers. ANAPEC is a public service company, which aims to spread the use of renewable energy and promote energy efficiency in Morocco. ANAPEC is also an active intermediary in the labor market where it helps to match supply and demand for renewable energy jobs. For the latter, ANAPEC launched three labor programs:

- Idmaj (wage subsidies for unemployed graduates);
- Te'hil (youth training); and
- Moukawalati (promoting entrepreneurship through training and financial assistance).

Relevant ministries also contributed to the effort by initiating strategies on:

- Improving the training system and integrating young people into the labor market through internships or skills matching.
- Increasing employment and productivity.
- Supporting microenterprise financing.

On the demand side, many sectoral plans (e.g., Morocco's Global Jobs and Moroccan Green Plan) aim to promote job creation through macroeconomic and sectoral policies (e.g., compensation reform, flexible exchange rate policy, and pro-growth sector strategies).

Despite these multiple efforts, challenges remain. In fact, the growth and availability of 'green' training courses did not generate the hoped-for outcomes as many university students continued to specialize in less technical fields, such as social sciences. This continued imbalance helped to sustain Morocco's high unemployment levels.

Skills development

With job creation falling short of its targeted expectations, the Moroccan Center of Conjunction looked at the German approach to renewable energy projects as a potential model for Morocco (Azzelzouli 2018). Deemed more flexible because of its decentralization of energy competencies, the German model includes participatory initiatives and strengthens the participation of communities and cities (Steinbacher 2015). This decentralized model could make it possible to develop small-scale, community-based energy systems and to take more responsibility for the country's production of energy, an observation also shared by ADEREE.

ADEREE began to encourage renewable energy initiatives at the local level by starting a process of decentralization and communal mobilization

throughout the country. The Jiha Tinou Program, started in March 2012 (ADEREE/GIZ 2012), aimed to encourage local initiatives and expand the capacity of local-level actors to achieve nationwide objectives. More specifically, it provided local technical assistance in planning, implementing and evaluating projects.¹¹ The program highlighted the important role that local-level participation could play in developing Morocco's renewable energy sector.

Another key challenge facing Morocco is to better identify at which points along the renewable energy value chain the country could create the most jobs. Initially, there was hope that industrial-style manufacturing and R&D activities would be feasible, given the availability of high- and low-skilled Moroccan labor to supply both industry strands. Spillover from systematic renewables deployment was also expected for related sectors

BOX 5. IFMEREE: IMPROVING THE QUALITY OF THE MOROCCAN WORKFORCE IN THE RENEWABLE ENERGY SECTOR

The Moroccan government created IFMEREE in 2011 to meet the specific vocational training needs of the green energy sector. The state company manages three institutes: in Tangier in the northwest (operational at the beginning of the 2018 academic year), in Ouarzazate in the south (scheduled to open in 2019) and in Oujda in the northeast (in service since November 2015). IFMEREE offers specialized diplomas (BTS) in solar thermal systems, solar photovoltaic systems, wind energy efficiency systems in buildings, and biogas. Two groups have already been trained. Eventually, the three institutes are expected to train 1,000 people per year.

The cost of setting up these institutes is some 26 million euros, with most of the investment financed by the European Union (10 million euros in the form of a grant) and the French Development Agency (10 million euros in the form of a loan). The rest (6 million euros) came from Morocco's state budget. The German Cooperation Agency GIZ also provided support, contributing 2 million euros in equipment and for the training of teachers.

Source: Instituts de Formation aux Métiers des Energies Renouvelables et de l'Efficacité Énergétique (IFMEREE).
<https://www.ifmerree.ma/>

such as construction, transportation, research and service industries (Marktanner and Salman 2011; El-Katiri 2016).

Local content

Implementing a manufacturing strategy is complex. It became clear over time that it was more economically efficient for most renewable energy technologies, such as solar panels, to be imported to Morocco. Indeed, countries such as China were progressively able to provide renewable energy technology equipment at very competitive prices. Since jobs were unlikely to be created directly in manufacturing, the focus began to shift instead to the secondary effect of job creation, with jobs in project management, installation and construction, and operation and maintenance being targeted (Azzelzouli 2018).

The Moroccan economy comprises many small and medium-sized enterprises (SMEs), working independently and with little integration, which makes it challenging for them to compete with large foreign companies, which benefit from economies of scale and greater research and innovation resources. The entrepreneurial ecosystem – still under development – has meant that very few national companies could become involved in industrial schemes under a general contract or

an EPC contract. These companies have neither the financial nor the human resources to invest in complex projects such as CSP. As such, national companies have been limited to being financial partners or potential subcontractors (World Bank 2017, 38). Nevertheless, small-scale solar PV applications represent a potential niche market for industrial actors and present opportunities in the export market for SMEs (EIB-IRENA 2015).

These challenges began to negatively impact employment outcomes in the early phases of renewable energy project development. Indeed, job creation initially took some time to materialize. The complexity of CSP technology made it difficult for national private operators to benefit initially, even though the Moroccan Agency for Sustainable Energy reported a 32% local integration rate for the Noor I solar power plant project (Azzelzouli 2018). Other barriers focused on local capacity included:

- The dependence of local authorities on centralized funds that are often not regionally allocated.

- A lack of local know-how and legal expertise necessary to promote renewable energy development.

- A lack of consideration for the potential of renewable energy among regional authorities.

Insights Into the Links Between Employment and Renewable Energy

Despite the challenges these three MENA countries face in linking employment to their renewable energy agenda, it is possible to draw some potential insights for countries that want to promote ambitious renewable energy projects and link these to domestic employment outcomes. While labor market reforms are an indispensable component of policy reforms, they are insufficient to address the full scope of the employment challenges facing these countries; a more comprehensive approach is thus necessary. This section highlights the main initial insights based on the experience of the countries reviewed and identifies potential pathways forward.

Efficient policy integration is essential

One of the well-supported insights from the experiences of Egypt, Jordan and Morocco is that employment policies cannot be established in isolation from all other complementary policies such as industrial, export and educational strategies. A comprehensive approach to policy helps to develop industrial ecosystems, improves labor market information and contributes to improving renewable energy sector training needs. The latter is essential in helping countries develop a supply of labor that more closely aligns with market demands.

Integration: Individual interventions cannot be a substitute for an integrated employment and growth policy capable of tackling existing problems.

Coordination: Greater, more efficient coordination among all relevant stakeholders helps contribute to effective policies and leads to a greater chance of success. For instance, in the case of skills development, it is important

that various training providers work together to achieve process stability and permanence, detect shortages, learn from successful experiences, and mobilize resources.

Delivery: Despite the strong emphasis on broader national strategies, another important lesson is that the concrete implementation of policies depends heavily on the government's ability to deliver and implement labor market reforms effectively.

Dynamic labor markets are important

A common theme across the experiences of Egypt, Jordan and Morocco is that a dynamic labor market is essential. As discussed previously, several challenges have impeded employment outcomes, despite ambitious renewable energy targets and national employment plans. Moreover, segmentation and distorted market signals remain. Examples include educational choices that seem unresponsive to actual labor market demands, large queues for public sector positions, and a very large gap between formal and casual sector earnings.

Fluidity: Sectoral flexibility of labor smooths employment effects across sectors. This means that labor markets need to allow workers to change jobs between sectors without long periods of unemployment.

Geographical mobility: Labor mobility across regions is an important issue, given that most workers live in urban areas and that many renewable energy projects, and the jobs they generate, are in remote areas.

Information: Lack of information raises transaction costs and limits the information flow in a market demand-driven economy. Indeed, the less perfect the labor market, the higher the costs tend to be (Chateau et al. 2011). Supporting an emerging renewable energy sector requires labor market information that can better match supply and demand. Accordingly, signals for labor market needs must be shared systematically and effectively between all the actors involved: governments, industry, workers, students and training institutions. Examples of improved labor market information include making use of social networks to link job seekers, such as the Suryamitra mobile phone application¹² or the Clean Energy Access Network (CLEAN)¹³ initiative in India. These are schemes that could be further adapted to the MENA context.

Evaluation: The national policy drafting process requires a rigorous evaluation system. While general policy statements can help set goals and future directions for the labor market, it is important at the outset to create a definite framework for monitoring progress and identifying emerging challenges that must be addressed as the policy proceeds. Labor market outcomes that are not measured adequately can not only deprive governments of valuable information but also prevent them from learning from programs. The latter is crucial as it leads to incremental program improvements.

Decentralization of energy competencies

Many solar power plants or wind farms are in rural areas where the labor force is more likely to be lower skilled. Moreover, many of the developers and engineers in this sector have the minimum

knowledge of the equipment, structures and production methods needed for energy efficient structures and buildings. A potential solution is to decentralize energy competencies to better respond to local needs and to promote more inclusiveness of the local population.

Organizational constraints: Morocco's policy framework shows that decisions regarding its energy transition are always made 'top-down' (Steinbacher 2015). The decentralization of energy competencies is a feature of the German approach to developing renewable energy and making it more broadly accessible. The German model is more flexible, includes participatory initiatives, and strengthens the participation of communities and cities.

Rural resiliency: Jordan has introduced its plan for a green growth corridor to help support rural resiliency. Morocco and Egypt, in particular, have the potential for small (micro and mini) green electric plants which can contribute to better coverage of the energy demands of rural populations.¹⁴ In order to succeed, such developments would need to be backed by the availability of a trained local workforce.

Community-based, cooperative: Regulators and policymakers who engage with local communities appear to effectively minimize the risks of public resistance and intrusive energy consumption. Consequently, this cooperative grassroots approach may represent an opportunity to encourage the development, at a local level, of the technical know-how necessary to make renewable energy projects successful.¹⁵

Skills development encompasses many dimensions

There is still a mismatch between graduates and the labor market across the three countries reviewed. This extends to the renewables sectors, particularly in regions where most of the solar and wind farms are located. The combination of highly skilled unemployment and skills shortages indicates an educational system that trains individuals in unsuitable skills. The fact that the tertiary educational system, in particular, is still geared towards the needs of the public sector adds to the skills challenge.

Deficiency: Successful skills development policies need to start early. Low quality education remains a major constraint across the three countries studied. Although governments have managed to increase the numbers of children enrolled in primary and secondary schools, many are not meeting the basic learning level and have learning deficits (Steer 2014).

Perception: Another related issue is the low enrolment in technical and vocational training (TVET). Although Egypt does well in this regard, TVET remains a crucial concern for Jordan and Morocco. TVET programs are considered to lack prestige and are perceived as being a low-status option for students who did not do well in the country's education system, exacerbating the problem. Combatting these perceptions will require continuing efforts, including ensuring that offerings are market-driven and lead to real opportunity, and that they align with student preferences.

Access: There is a lack of access to high quality national programs that facilitate a smooth school-to-work transition, including vocational training and career guidance. At the same time, we observe a progressive transformation of the skill levels of the population in these three countries, which may help to create a more resilient labor force better equipped to take advantage of new jobs in sectors such as renewable energy.

Misalignment of skills: The resulting lack of adequate skills, and the imbalance in the labor market it creates, is a major barrier to accessing renewable energy jobs. Large numbers of the unemployed are well-educated graduates, but their skills do not match jobs in the renewable energy sector. This is particularly the case for Jordan and Morocco, where the skills mismatch takes the form of an oversupply of university students majoring in social sciences, education and humanities, while a lower percentage of students pursue scientific, technical and engineering subjects – fields of study that better prepare students for jobs in the renewable energy sector. Vocational and technical training remains well below the OECD average or the levels seen in countries such as Germany which are leading renewable energy deployment.

Collaboration with industry: Strengthening the collaboration between centers of education and industry may be another way to address the skills mismatch. Indeed, dedicated labor market programs focused explicitly on new renewable energy sector skill requirements can be an important addition, particularly for SMEs, which most often face challenges in upgrading the skills of their workforce due to their limited

ability to provide training. The planning and development of relevant educational programs in Germany¹⁶ could serve as an example.

This approach could be extended to involve mentoring and apprenticeship programs.

Resilience: It is important that governments, in partnership with industry, help build a resilient labor force, ready to adapt to change. Individuals need to have the capacity to learn in order to be trainable throughout their life.

This reinforces the realization that the skills and knowledge needed to be successful in the renewable energy field, such as electrical, industrial maintenance, and engineering skills, are largely transferable from other industries. The acquisition of related skills in primary and secondary schools is crucial as it forms the basis for lifelong learning.

Sustainability: Education and training policies need to be aligned to meet new skill demands. It is essential, too, that an appropriately skilled workforce is permanently available. This implies a need for continuous training at local training institutes and minimizing the need for external technical assistance. To do this, education and training policies need to take into account factors such as economic diversification towards a knowledge-based economy, an increase in digitalization and the automation of production processes. By doing so, it will be possible for policymakers to better assess the implications for future skill needs and to act more proactively to develop the skills required for the evolving labor market.

Hence, it is important to assess how the acquisition of skills is organized, and how effective the labor markets are in generating the skill sets that will be useful for new growth sectors, such as renewable

energy. It also prompts a discussion of a country's educational and training system and how it is organized. This discussion should include the coverage and quality of the education system, who pays for education and what incentives there are for individuals to engage in training.

Limits and opportunities related to local content requirements

There have been concerns in the three countries studied that LCRs do not necessarily generate more local jobs. In the renewable energy sector, there are two potentially opposing effects of LCRs. One is an output effect, where an increase in input prices leads to an increase in energy costs. One of the consequences of this is reduced renewable energy production, which, in turn, negatively impacts employment levels in the electricity generation sector. The other effect is an increase in the cost of domestic equipment resulting in a substitution effect, where labor serves to substitute costly equipment. In this scenario, employment levels may benefit. However, these effects remain difficult to estimate. Accordingly, opportunities may exist under the right conditions.

Economic inefficiency: The skills gap in the local market makes it difficult to adhere to regulations to recruit staff locally for many jobs. Using international knowledge on technical subjects can be useful from an industry standpoint, but such possibilities can be made difficult by LCRs that set quotas for the use of local expertise and resources.

Joint coordination: The establishment of joint ventures between industrial actors engaged in the solar and wind power value chain could help to promote local jobs. Accordingly, governments

could consider further developing mechanisms in concert with these actors to promote local job development in the renewables sector. Dedicated education programs could then help to support the development of local industries in solar and wind power.

Welfare: Despite the criticisms of LCRs, some claim that their usefulness or disadvantages should be seen in the context of their welfare effects such as increased employment (Kuntze and Moerenhout 2013). Another benefit is related to the learning-by-doing potential and for the development of local intellectual property (IP).

Opportunities: Large-scale solar power projects offer local content possibilities, particularly in

the construction phase. During construction, leading companies have opportunities to provide construction and service operations in many areas. For solar power plants, this includes work in mechanical and electrical services. Wind power projects offer possibilities for work in cables, electrical works, mechanical lifting and construction materials, and services.

Egypt has been the most successful of the three countries reviewed in building renewable energy capacity, with the localization of 30% of wind farm equipment and a target of 70% by 2020 (IRENA 2018a). Most of this outcome is due to the country's relatively well-developed manufacturing base. Some further lessons can therefore be taken from the Egyptian experience.

Conclusions

The solar and wind energy potential of Egypt, Jordan and Morocco could bring significant benefits to these three countries, provide jobs across a variety of sectors for an expanding workforce, and provide a model for other countries on the cusp of shifting toward a more sustainable energy future. It is widely agreed that there is a positive relationship between education and other dimensions of economic and human development. Populations around the world show a clear desire for more and better education, but education remains an under-financed and under-prioritized developmental sector in many parts of the world.

The number of jobs in the MENA renewables sector will likely remain small overall and cannot be counted on to fully employ the growing number of young people entering the region's labor market. However, the green power sector's development can nonetheless become an important motor of job creation with spillovers from and to related subindustries, scientific research and new business opportunities. It is therefore important to have the right conditions in place to take advantage of any future job opportunities that the renewable energy sector may offer.

Endnotes

¹ Egypt, Jordan and Morocco have irradiation levels up to 2,500 kWh per square meter per year, particularly in the south and east of each country (Global Solar Atlas - <https://globalsolaratlas.info>).

² The MENA region also has significant wind potential. Wind speeds in countries such as Morocco, Egypt and Tunisia are among the highest in the world and the potential for wind energy in Egypt alone is estimated to be several thousand MW (see Global Wind Atlas: <https://globalwindatlas.info>. Also see: IRENA Global Atlas for Renewable Energy: <https://irena.masdar.ac.ae/gallery/#gallery>).

³ See, among others: Blyth et al. (2014), Wei et al. (2010), Kammen et al. (2004).

⁴ For an overview of issues in estimating the employment generated by energy sector activities, see Bacon and Kojima (2011).

⁵ Total employment in 2018 was as follows: Egypt: 28.1 million; Jordan: 2.1 million; Morocco: 11.7 million. Source: ILOSTAT.

⁶ Theoretical analysis by Rivers and Wigle (2011) concludes that the overall potential of LCRs to create jobs is ambiguous. See also: Stone et al. (2015); Kuntze & Moerenhout (2013).

⁷ Also see www.al-monitor.com/pulse/originals/2018/02/egypt-launches-renewable-energy-curriculum.html#ixzz5FfXczpH1.

⁸ See <https://www.renac.de/projects/current-projects/solar-academy-egypt-rosae/>

⁹ Details of Jordanian-only professions and sector-specific quotas for Jordanians are available in Leading Point (2016).

¹⁰ In early 2016, the government of Jordan proposed the 'Jordan Compact,' which aims to convert the burden of hosting refugees into a development opportunity. To do so, the Compact outlined a strategy for refugees

to contribute to the economy, become self-reliant, and maintain skills that will allow them to eventually return to and rebuild Syria (Razzaz 2017, 37).

¹¹ Local support was provided for policymakers through the transfer of institutional and personnel know-how and access to information through education and citizen orientation.

¹² India's Suryamitra mobile phone application connects employers with employees, reducing the transaction costs for one-off jobs while giving employees an opportunity to apply for permanent jobs in the industry. It is downloadable on any mobile device and can be updated in real time to reveal job openings and solar technicians in each locality. Whether the application will benefit poor and rural workers remains to be seen. Source: Bharath et al. (2017).

¹³ India's Clean Energy Access Network (CLEAN) was created in 2014. Its members include both training institutes and renewable energy enterprises. CLEAN allows employers to post job openings and training institutes to post the availability of trained candidates. Knowing when and where trained people will be available can be very useful to off-grid enterprises. Source: Bharath et al. (2017).

¹⁴ Decentralizing electricity generation was considered the least important goal of Moroccan renewable energy policy (Steinbacher 2015).

¹⁵ For more information on some of the grassroots benefits see FES (2018).

¹⁶ In the German 'dual system' model of technical education, students attend formal schooling for between 1-2 days a week and spend the remainder of the week on the apprenticeship site. These are long-term formal commitments arranged through a process much like conventional recruitment. Graduates are often hired at their apprenticeship site at the conclusion of several years of study.

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Sylvain was a senior research fellow in the Energy and Macroeconomics program, where he led the research on energy transitions and employment. Participating on various advisory committees, he also provided policy insights and advice on labor market strategies. Sylvain has held similar research responsibilities relating to energy efficiency and rebound, and the future energy demand in transportation.

About the Project

This paper is part of the project titled ‘Modeling Final Energy Demand Using the Structural Time Series Model’. This project examines how factors such as economic growth, income, energy prices, economic structure, and energy efficiency influence the demand for energy at national, sectoral, and household levels. This project also measures the impact of various energy policies, such as energy price reform, on energy demand, government revenues, and social welfare in the Kingdom.

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