meetMED

Mitigation Enabling Energy Transition in the MEDiterranean region

Together We Switch to Clean Energy

MAPPING EE AND RES MARKET POTENTIAL AREAS WITH HIGHER IMPACT ON LOCAL ECONOMY AND JOB CREATION

Tunisia, Egypt and Lebanon

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

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

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

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

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

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This meetMED report is within the meetMED work package on “REEE Sustainable Growth and Investments”. The report collects the results of questionnaires, interviews and desk research in meetMED target countries to identify energy efficiency and renewable energy market potential areas with higher impact on local economy and job creation. This report aims mainly at mapping the impact on the labor market of RE and EE projects, by identifying the number of jobs created, as well as the employment factor, per technology and all along the value chain.

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Acronyms

AFEX	Arab Future Energy Index
ANME	National Agency for Energy Conservation
AUB	American University of Beirut
AUC	American University in Cairo
AUE	Arab Union of Electricity
BDL	Banque du Liban
CEDRO	Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon
CSP	Concentrated Solar Power
DREG	Decentralized Renewable Energy Power Generation
EDL	Electricité du Liban
EE	Energy Efficiency
ESCO	Energy Service Company
ESCWA	United Nations Economic and Social Commission for Western Asia
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gas Emissions
GIZ	German development agency
GNP	Gross National Product
GWh	Gigawatt hours
IEA	International Energy Agency
ILO	International Labor Organization
IRENA	International Renewable Energy Agency
Ktoe	kilo tonne of oil equivalent
LAU	Lebanese American University
LCEC	Lebanese Center for Energy Conservation
LED	Light-Emitting Diode
LU	Lebanese University
MENA	Middle East and North Africa
MEPS	Minimum Energy Performance Standards
MEW	Ministry of Water
MJ	Megajoule

Mtoe	Mega tonne of oil equivalent
MUSD	Million USD
MW	Megawatt
MWp	Megawatt Peak
NEEAP	National Energy Efficiency Action Plan
NGO	Non-Governmental Organization
NREAP	National Renewable Energy Action Plan
O&M	Operations and Maintenance
OECD	Organization for Economic Co-operation and Development
PPA	Power Purchase Agreements
PPP	Power Purchasing Parity
PROSOL	Tunisian Solar Programme
PV	Photovoltaic
R&D	Research and Development
REEE	Renewable Energy and Energy Efficiency
REN21	Renewables Now
RES	Renewable Energy
SEM	Southern and Eastern Mediterranean
SWH	Solar Water Heater
TJ	Terajoule
TOE	Tonne of oil equivalent
TSP	Tunisian Solar Plan
UfM	Union for the Mediterranean
UNDP	United Nations Development Program
UNHCR	United Nations High Commissioner for Refugees
USJ	Université Saint-Joseph

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Executive Summary

During the past decade, developing countries were interested in finding new energy alternatives, in order to decrease the burden on the government's expenditure and to allow a more sustainable scheme for the economy. Southern and Eastern Mediterranean Countries (SEMCs) are among those countries that found that renewable energy (RE) and Energy Efficiency (EE) are the best solution to guarantee the existence of an energy resource, even after the exhaustion of natural resources.

Apart from that, RE and EE projects have major impacts on the economy. This can include the improvement of the quality of life, through the increase in the access to electricity in rural areas and the decrease of the green gas emissions. In addition, it enhances the energy situation of the industrial and residential sectors, since the power would be generated domestically. Hence, the payments for the electricity bill will reduce. This gives space for value creation, and so new jobs will be created.

It is worth noting that since 2011 the region has been experiencing major economic challenges. On the one hand, Egypt and Tunisia faced economic recession, due to the 2011 revolutions. On the other hand, Lebanon has been affected by the crisis in Syria, as 1.5 million refugees surged the borders, according to UNHCR (2018). Such circumenstances affected the labor market and caused the increase of unemployment rates. As a consequence, the impact on employment of RE and EE projects is one of the most important effects to assess.

On a global level, it is estimated that 1 million new jobs will be created between 2020 and 2030 (ILO, 2018). The SEM region is not so far from that: in Tunisia, the PROSOL project alone is contributing to the increase of wages of hundreds of families. In 2022, it is expected that 11,200 direct jobs will be created, due to the installation of 1120 MWp of solar PV (GIZ (2016) and Missaoui (2019)), and 1,229 direct jobs will be created by installing 1755 MW of wind energy by 2030 (Mahmoud, 2019).

In Egypt, in 2018, and due to the country vision and commitment to increase RE in the country's energy mix, the capacity installed of RE has increased by 25%, approximately, compared to the previous year, to reach 4812.8 MW. This has contributed to the creation of 14,345 direct jobs. At the end of 2030, and following the Egyptian vision for 2030, it is estimated that there will be 4,380 direct jobs and 34,472 indirect jobs created. For EE technologies, LED production have always been an engine for creating most direct jobs. However, for indirect jobs, motor technologies have been generating more than the 60% of the jobs since 2016 and it is expected to keep the same trend for the next ten years.

In Lebanon, RE industry generates between 1.8 and 4 times more jobs per MW installed than conventional sources. By 2021, the total installed capacity of solar PV, which is considered as an established sector in Lebanon, will be around 948.3 MW and will create more than 7,274 of direct cumulative jobs and 8,949 of indirect cumulative jobs. Additionally, the total targeted capacity by 2025 will be around 600 MW, which can create 1,320 direct jobs. Moreover, as an emerging technology in the country, wind energy projects will be able to create around 891 direct jobs and 1391 indirect jobs by 2025 in case the national target is achieved. Based on the results of this study, it is worth mentioning that the construction and installation phase is representing the most labor-intensive stage in all renewable energy projects in the country.

Generally speaking, by analyzing the supply chain, it has been found that the wind energy industry creates the majority of direct jobs during the construction phase. Nevertheless, most of permanent jobs are usually created in the operations and maintenance (O&M) stage. With regards to the solar energy, the construction phase generates the majority of direct jobs, while the O&M stage creates most of the indirect jobs.

This report aims mainly at mapping the impact on the labor market of RE and EE projects, by identifying the number of jobs created, as well as the employment factor, per technology and all along the value chain. In order to do so, the report is divided into two main parts: the first one focuses on the impact of RE and EE on the local economy, including that on GDP and trade balance, based on the literature reviews and previous international studies; the second part delivers instead a full assessment of all technologies and the number of jobs they generated with further elaboration on the first three countries in

the region that implemented detailed tools and studies to calculate such an impact atthe national level. At the end of each country profile, recommendations are set for each of the main sectors, technologies and parts of the supply chain, which the focus should be put in the future. Furthermore, the way forward to achieve higher RE and EE related employment in these countries is presented.

At the regional SEM level, it is estimated that more than 200,000 direct jobs will be created in solar the industry by 2030, and more than 50,000 direct jobs in the wind industry. In fact, 54% of those jobs will be generated in the Egyptian economy, for both industries, followed by Algeria (22%) and Morocco (10%). Nevertheless, Palestine has only a share of 0.5%, based on the announced targets and estimated employment factors.

Part I:
General Overview of the RES and EE Impact on the Local Economy

1.1. Impact of RES and EE on the Local Economy

With the technological advancement that the whole world is currently witnessing and the worldwide uprising direction towards the transition to more sustainable energy, renewable energies are no more considered as temporary industrial trend. Conversely, they are becoming more than conventional options for some industries, especially solar photovoltaics (PV) and wind technologies (REN21, 2019). Not only the use of renewables that is rapidly progressing but also how to use energy more efficiently is becoming indispensable.

What is worth noticing is the fact that after 2035, primary energy demand will not increase and will on the other hand stabilize at a certain level, despite of the increase in global population. This simply means that new sources of energy will witness an expansion in order to respond to the increase in demand (Mckinsey & Company, 2019). Nevertheless, the electricity consumption share, in total energy consumption will increase from 19% today to 29% by 2050. Renewable energy sources will contribute to up to 50% of power generation by 2035 and to 75% by 2050 (Mckinsey & Company, 2019). In fact, for most of the countries, renewable energy sources are estimated to become costly affordable before 2030. Therefore, we can expect an expansion of the renewable energy sector and its contribution to the energy mix. Hence, based on the future directions and estimations, the use of renewable energies will exceed that of fossil fuels, thus it is important to study the impact of using such alternatives on the inclusive growth of all countries. The section below summarizes the main impacts of RES and EE on the economic growth.

1.1.1. Impact of RES on the GDP

To start with the most important and noticeable effect on the local economy, the impact that the use of renewable energy could have on the Growth Domestic Product (GDP) of any country should be considered. Studies have shown that the GDP is mainly affected by the economic characteristics of the country, including its structure, the opportunity cost of using renewable energy sources and whether the supply chain includes imported inputs or not and to which extent they contribute to the final output. Hence, its impact is variable across regions and countries (IRENA, 2016).

In general, the relationship between energy consumption and economic growth could be unidirectional, bidirectional or neutral. A unidirectional relationship can be either from energy consumption or from economic growth (Marinaş M-C, Dinu M, Socol A-G, Socol C, 2018).

The unidirectional causality from energy consumption suggests that energy consumption will strongly influence economic growth, whether positively or negatively. Lean, H.H., Smith, R. (2013) found that there is a positive relationship between diesel and motor petrol and economic growth in Malaysia on the long run. Hence, the economy could be negatively affected if a transmission to renewables happen, in next years, as Apergis, N., Payne, J.E. (2012) underline. In contrast, the unidirectional causality from economic growth indicates that there is a relationship between the economic activity and energy consumption, whether positively or negatively. Ocal, O., Aslan, A.) 2013) focused on the case of Turkey and they found that due to this relationship energy consumption had a negative impact on economic growth.

The neutral causality, on the other hand, is the case in which there is no relationship indicated between the two mentioned variables. This could be seen in Menegaki, A.N. (2011), who applied a random effect model[1] to 27 European countries, where he proved that changing these countries energy portfolio will not affect the overall economy and, hence, its effect on the GDP is neutral.

Finally, the bidirectional relationship means that the causality goes both ways and the two variables are interdependent. Therefore, the economic impacts of renewable energy cannot be generalized for all the countries.

It is worth highlighting that some studies mainly focused on the impact of RES on the GDP in gross values. It is estimated that doubling the share of RE in the global energy mix by 2030 will allow for an increase ranging from 0.6% to 1.1% or an increase between 700 billion USD and 1.3 trillion USD compared to the business as usual (IRENA, 2016). According to the same source, the main trigger behind this increase is the increase investment shares in RES.

Not only we should focus on the clear impacts of renewable energy on the GDP, but, in order to capture all the effects related to the economy, we should also tackle the impact renewable energy has on the decrease of the

(1) The model was based on co-integration and a panel error correction model.

Greenhouse Gas Emissions (GHG). Economically, the transition to renewable energy will generate positive externalities on the economy, by increasing the economic welfare. Therefore, such approaches should be considered while measuring the effect on real GDP (RCREEE, 2014).

RES and EE projects are technology intensive, so developing countries need to import related know-how. This is considered as a burden on the trade balance, especially for countries with under-developed manufacturing sector. In addition, RES will substitute fossil fuels, for which countries are either net exporters or net importers. Apart from that, many governments depend on its rents, as main revenue. That is why we should analyze the relation between RES and trade balance.

1.1.2. Impacts of the RES on the trade balance

It is also crucial to study the impact of RES on the trade balance, meaning on net exports. The results vary across countries, it generally depends on whether the country is an importer or exporter of fuel (IRENA and CEM, 2014). Countries that export fuels will witness a decrease in domestic consumption of fuels; thus, this surplus in production will only be devoted to exports. In addition, countries that import fuels will decrease their use of fossil fuels and subsequently their imports, thus improving their balance of trade, ceteris paribus.

In net exporters countries, governments rely on fossil fuels rents and the trade balance structure depends on them, too, as oil and gas contribute to the majority of exports revenues and other industries are crowded out of the trade scheme (Geoffron & Chevalier, 2013). In addition, such economies find themselves vulnerable to any fluctuations in the hydrocarbon market. Recent evidence show that the world is shifting to alternative energy sources. Hence, trade patterns will change inevitably affecting their economies. In net importers countries, the decrease of conventional energy sources' imports helps the economy in its decarburization process. This enhance the development of a green innovative technology sector, which no doubt increases the level of competitiveness of the local economy in international markets (Braun, Blazejczak, Edler, & Schill, 2011).

However, it is worth highlighting that other factors must be taken into consideration. As some countries import equipment that are necessary for the imple-

mentation of renewable energy projects, the overall effect on trade balance will depend whether the amount of money saved, due to conventional sources renunciation, is bigger than the one spent on technology and equipment imports (IRENA, 2016).

1.1.3. Impacts on the value creation

The renewable energy and energy efficiency industries involve activities in different sectors of the economy. There are many opportunities to create value in the different segments of the value chain of RES. At each stage, value is added to the product by different sub-sectors and sub-processes (Hatlelid & Aass, 2016). Value creation can, then, be generated in all parts of the value chain, by having all different agents contributing to the final product either directly or indirectly. It is defined as the output minus the total of the input (Lehr & Banning, 2019).

In order to assess the impact of the value creation in any country, we need to know to what extent the value is created locally in the country where the RE project is located, as well as how much of the value is a result of imported inputs. This mainly depends on the maturity of the RE sector in the country where the project is being realized.

Despite the importance of the concept and the significant impact it can have on the economies, if taken into account, the effect of value creation on renewable energy and energy efficiency sectors are still not widely studied at the international level nor at the regional one,. Not so many studies or reports have focused on this issue in the MENA region, therefore, there is a lack of data concerning this topic.

1.1.4. Impact on job creation and employment

One of the most important and intensive impact of RES and EE is the possible changes in local economies affecting the national labor market. In recent economic studies, it is shown that employment rate in the renewable energy sector has been increasing during the past years. This would certainly offset the effect of job losses that would occur in the conventional energy sector in the next years (IRENA, 2016).

In fact, the renewable energy sector creates more jobs than the fossil-fuel energy sector. The renewable energy sector created 11 million direct and indirect jobs in 2018 compared to 9.8 million in 2016 (IRENA, 2019). Solar PV generated 3.6 million jobs alone and, by that, it achieved the largest number of jobs created, taking into account that China contributed to more than 39% of those jobs (IRENA, 2019).

One of the clearest examples on the importance of jobs creation via RES can be shown in the USA, where the solar industry employed the double of workers compared to the coal industry, taking into consideration that the former contributed by only 1% of the total power capacity of the country, while the latter contributed by 26% (Solar Foundation, 2016). Hence, despite it is still paving the way in the MENA region, the solar industry has a great potential in creating jobs, especially considering the targets set for the future in the different countries.

Giving more attention to specific technologies, it is worth noting that hydropower technology employed 1.5 million people in direct jobs positions. Major trends show that employment in Solar PV and Wind technology sector increased, whilst decreasing in solar heating and cooling and large hydropower in the same year. It is also worth mentioning that the bioenergy technology shares in creating jobs did not significantly change since 2012. The number of jobs created was always around 2.6 million on average.

It is also important to analyze each technology, while focusing on the labor intensity in each part of the value chains. Internationally speaking, the highest employment rate are found in the phase of manufacturing and construction, in the case of solar and wind technologies (IRENA, 2011). In contrast, biofuels require more employees in the distribution phase.

Nevertheless, it is worth noting that shares could vary across regions and countries, depending on its economic characteristics, targets and technological specifications. In the USA, for instance, installation phase is the most labor intensive one in the whole value chain, employing 44% of people more than the manufacturing phase (Greenpeace & EPIA, 2008). That is why when analyzing the labor intensity in the different phases of the value chain in the MENA region, we should take into account the fact that these countries are still progressing and are still building new RE plants every day. Hence, the

current estimations might differ from the international benchmarks due to the level of maturity of the markets for these technologies.

1.1.4.1. Gender distribution in the labor workforce in the RES

Gender equality is a key factor to guarantee sustainable development. Worldwide, women are still underrepresented in the renewable energy sector as in the conventional energy sectors (SEI, 2017). It is estimated that women represent 32% out of total employment in the renewable energy industry (IRENA, 2019). Nevertheless, there is a general trend towards lessening the gender gap in all the countries, as it is beginning to happen in some of the developed countries, such as the USA and France.

Despite the fact that the percentage share of women is still low in the renewable energy field, it is worth highlighting that this percentage exceeds the women average participation in the oil and gas field, amounting only to 22% (IRENA, 2019). More importantly, most of the women in both renewable energy and oil and gas industries carry out administrative jobs (almost 45% of them) or non-technical jobs (35%) and only 28% of them have jobs related to science, technology, engineering and mathematics (IRENA, 2019).

When it comes to specific distribution, the presence of women remain low in all related renewable energy sectors, such as construction, engineering, financial and business services and manufacturing. Female labor only represents 9%, 12%, 15% and 24% of the total workforce, respectively (ILO, 2018).

The main constraint to female participation is that they have no access to skills and qualifications required for the green jobs (ILO, 2015). Hence, ensuring their access to the required qualifications is key to enhance their participation, especially since women are more affected by climate change and environmental disasters than men (ILO, 2018).

1.2. Regional Overview of the SEM Region

1.2.1. General Overview

Figure 1: Map of the SEM countries covered in this report. Source: (RCREEE, 2019).

The Southern Eastern Mediterranean (SEM) region is a linking bridge between Southern Europe and North Africa, which mainly gathers 8 countries: namely, Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia.

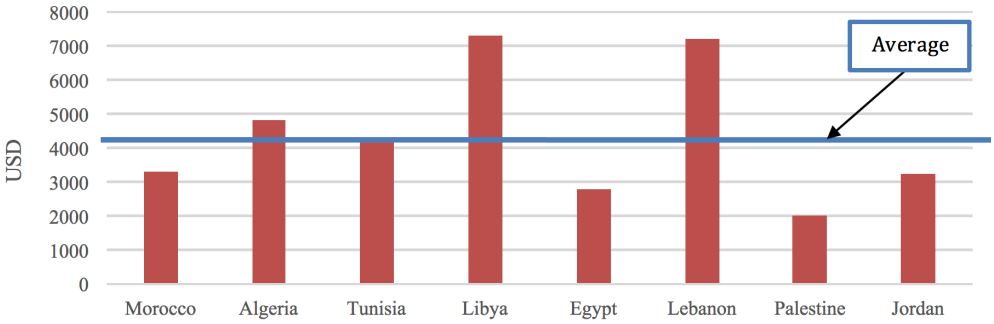
The weather in the region is a combination of both an African and Mediterranean climate with generally dry summers and rainy winters, characterized by high temperatures throughout the year and cooler nights.

The region is endowed with diversified conventional energy resources as well as natural resources. Most of the countries lie on the solar belt having high average annual solar irradiations.

For a long time, SEM countries struggled with serious socio-economic challenges and dysfunctional economic systems and policies. The global and European financial crises in the early 2000s combined with the decline of commodity prices and the failure of the Arab Spring had a negative impact on the SEM countries' macroeconomic performance, which triggered a new wave of intra-regional conflicts and worsened the existing geopolitical and security risks.

Although the rate of GDP growth remained positive in most of the countries, it markedly slowed down in the 2010s particularly in the countries where the Arab Spring had a high geopolitical impact, such as Libya and Egypt. In per-capita terms, Lebanon and Libya currently have the highest GDP per capita and consequently higher living standards while due to geopolitical conflict in Palestine and high population increase in Egypt, these two countries have the lowest GDP per capita in the region. Furthermore, and as it can be seen in Figure 2, only three countries are above the regional average of GDP per capita, being around USD 4,370. However, this average is way below the global average of GDP per capita, which is around USD 17,300. Consequently, this is considered insufficient to generate enough jobs for the rapidly growing labor force and to eradicate poverty in the region.

Figure 2: GDP per capita of different SEM countries in 2018



Another important economic indicator is energy intensity that measures the energy inefficiency of an economy. Figure 4 presents the energy intensity of the 8 SEMCs in 2016 and it shows that Libya has the highest cost of converting the energy into GDP, followed by Algeria and Tunisia. Moreover, Lebanon is considered as the country with the lowest price of converting the energy into GDP among the SEMCs with 0.15 ktoe/MUSD. However, these remain above the average energy intensity of EU countries, which is around 0.096 ktoe/MUSD.

Considering the interdependence and bidirectional causality among energy consumption and GDP, most of the SEM countries have set ambitious energy efficiency and renewable energy targets in order to decrease their energy consumptions and diversify their national energy mix.

Figure 3: Regional GDP vs. Regional electricity consumption

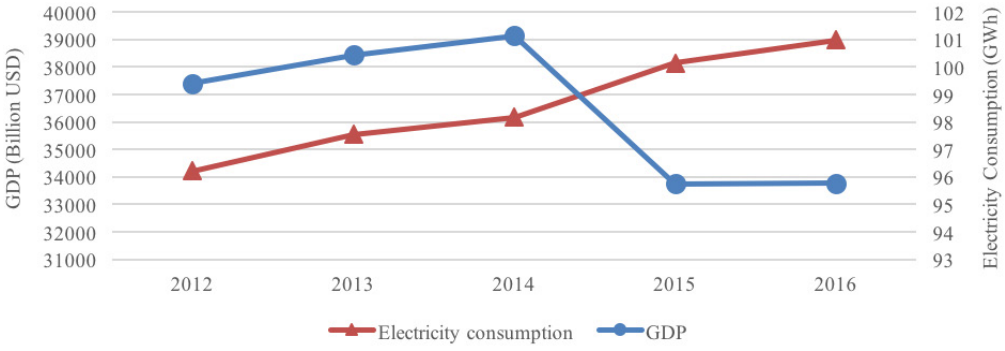
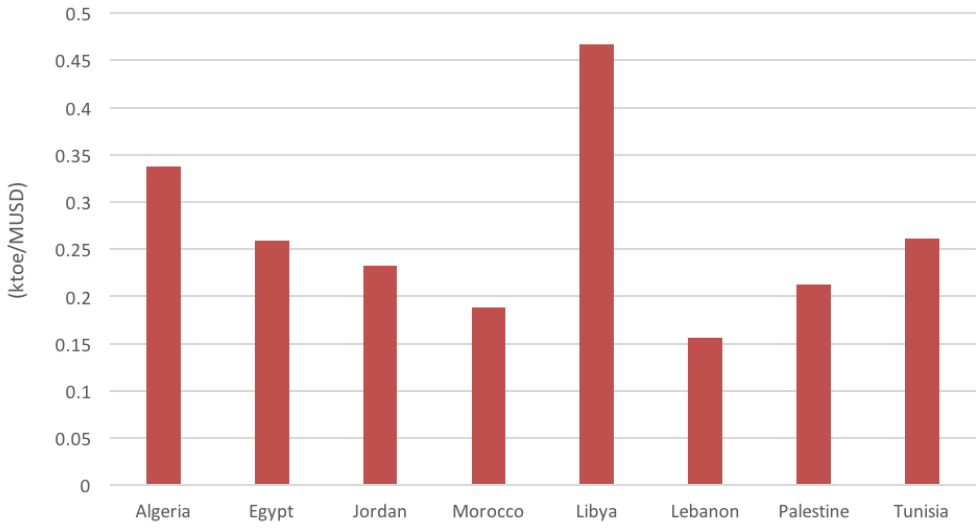


Table 1 below illustrates the adopted RE and EE targets by different SEMCs and it shows that most of the countries have clear RE and EE strategies, except for Algeria and Libya that do not have updated energy efficiency targets. As a result, Algeria and Libya obtained the lowest scores among the SEM countries according to the Arab Future Energy Index for energy efficiency (AFEX-EE, 2017). It can also be noticed that Tunisia, which was leading the ranking with 71%, continues its success in EE planning, regulatory framework, financial incentives and EE institutions followed by Jordan and Morocco with 70% and 69% respectively (AFEX-EE, 2017).

Figure 4: Energy intensity of different SEM countries in 2016



On the other hand, Morocco, Egypt and Jordan led the ranking in RE due to the significant progress towards meeting their ambitious targets by installing additional wind, CSP and PV plants as well as issuing tenders for most of the planned projects that scaled up the participation of private sector in the renewable energy in the region. (AFEX-RE, 2019).

Table 1: RE and EE targets in the SEM region

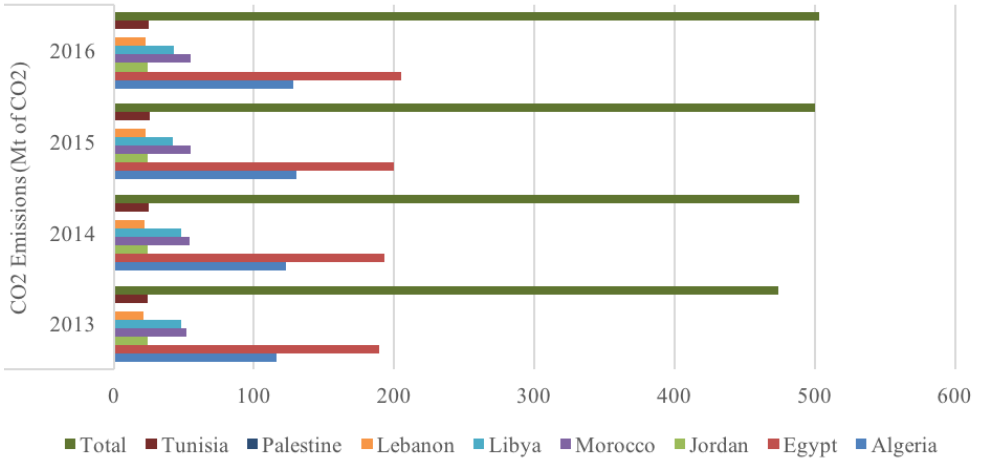
Country	Energy Efficiency				Renewable Energy		
	Strategy	Target			Strategy	Target	Year
		Sectors	Energy	%			
Algeria	NEEAP 2011-2013 and Renewable Energy and Energy Efficiency Development Plan	200 Million Tons equivalent of CO_2 / Gain of 7 Million TOE by 2030			Renewable Energy and Energy Efficiency Development Plan	37%	2030
Egypt	NEEAP 2017-2020	National	20 Mtoe	18%	National renewable energy strategy	42%	2035
		Buildings	8.6 Mtoe	16%			
		Industrial	6.8 Mtoe	18%			
		Transport	4.6 Mtoe	23%			
Jordan	NEEAP 2017-2020	National	1975 GWh	17,50%	Master Strategy of Energy Sector in Jordan 2015-2025	15%	2025
		Residential	998 GWh	22,40%			
		Industrial	383 GWh	12,70%			
		Commercial	376 GWh	20,00%			
		Water Pumping	163 GWh	9,80%			
		Street Lighting	55 GWh	19,10%			
Lebanon	NEEAP 2016-2020	Average Yearly saving	302.96 GWh/year over 5 years	Reduce growth rate from 7% to 5.8% by 2020	National renewable energy action plan for 2030	12%	2020
		Power (primary energy measures)	686136.822 GWh				
		Horizontal measures	49200 GWh				
		Building sector	148922.44 GWh				
		Industry and Agriculture	610251 GWh				
		Public sector	19731 GWh				
Libya	NEEAP 2014-2016				Libya Renewable Energy Strategic Plan 2013-2025	7%	2020
						22%	2030

Country	Energy Efficiency				Renewable Energy		
	Strategy	Target			Strategy	Target	Year
		Sectors	Energy	%			
Morocco	National Energy Efficiency Strategy 2030	National		25%	National Energy Strategy 2009	42%	2020
		Residential		20%			
		Transport		35%			
		Industrial		2.5% reduction in energy intensity per year	Announcement (2)	52%	2030
		Agriculture		0.2% reduction in energy intensity per year			
Palestine	NEEAP 2015-2017	National	137 GWh		National energy strategy for 2020	25%	2030
		Residential & Tertiary	130 GWh				
		Industrial	6 GWh				
		Water Pumping	1 GWh				
Tunisia	New Energy Program 2013-2020	Building	8 Mtoe	49%	The Tunisian Solar Plan (TSP)	30%	2030
		Industrial	4.4 Mtoe	26%			
		Transport	4.1 Mtoe	25%			

Moreover, renewable energy is accounted as the most powerful mitigation measure for climate change, especially since the SEM region is considered as one of the regions with the highest greenhouse gases (GHG) emissions, as shown in Figure 5. As the GHG emissions will make significantly rise temperatures in the region, this will definitely lead to the need of increasing the RES as well as the EE measures in order to mitigate these effects. As mentioned earlier, since conventional energies are known for contributing the most to GHG emissions, their impacts on climate change, human health, agriculture (Crop yields) and building materials should be studied and quantified to be monetized and included in the GDP calculations. Despite its massive importance, ascribing monetary values to external impacts on climate, health, biodiversity and other environmental qualities is acknowledged to be complex and typically argued as imprecise. The sole study tackling this issue in the SEM region in 2014 showed that electricity generation externalities from fossil fuels can be estimated to reach USD 12 billion, the highest amount of which was observed in Egypt and the lowest one in Palestine according to their energy mixes (RCREEE, 2014).

(2) During the 21st session of the UNFCCC's Conference of the Parties (COP21), Morocco announced a further planned increase in the renewables capacity to reach 52% of the total by 2030.

Figure 5: CO_2 emissions (Mt of CO_2) in the SEM region



1.2.2. Employment in the SEM Region

Until now, there is no dedicated study tackling the economic impacts of RES and EE on the labor market in the SEM region. Most of the consulted studies were either international studies, mainly focusing on Europe and USA, or national studies, focusing on specific countries based on the data available. Therefore, the main aim of this report is to provide a general overview of the impact of RES and EE on inclusive growth, specifically focusing on the impact on job creation and trying to figure out which parts of the supply chain are more labor intensive in Egypt, Lebanon and Tunisia.

Until 2012, there were no clear and concrete available numbers regarding employment in the SEM region except for some countries, such as Tunisia and Morocco. Egypt also had some figures but it was principally based on personal estimations and stand-alone projects. International and regional numbers were mainly provided by IRENA annual reports on employment and REN21 reports.

After 2012, studies mainly focusing on the employment effects of RES and EE started to increase, providing us with more accurate data regarding the number of direct and indirect jobs. (GIZ, 2016) provided a clear and well-articulated study on the employment effect of RE and EE in Tunisia, tackling all technologies in both industries. In 2017, a study commissioned by the GIZ, (RCREEE, 2017), assessed the employment effects of RE and EE and provided for the first time accurate estimation of the number of jobs created in Egypt.

In 2019, another full study was conducted by Ulrike Lehr and Maximilian Banning in order to assess RE expansion in Algeria. This measured the impact of RE projects on the local economy, by using an input-output model. The study took into consideration two different scenarios: one considered the base scenario and another based on the declaration of the government in 2018, especially concerning the operations and maintenance phase (O&M); while, for indirect jobs, solar energy will create the greater share of them, especially during the installation phase.

Based on the regional and international studies, an average employment factor was calculated for the main uprising RE technologies in the region, namely solar PV and wind. The average values were taken from (GIZ, 2016) and (RCREEE, 2017), whose authors have done a full literature review on this topic and calculated the employment factors for Egypt and Tunisia. These numbers together with the international average from (Rutovitz, 2015) have been taken into consideration when calculating the potential direct(3) job creation for the whole SEM region based on their announced targets for 2030 as per (Mahmoud, 2019).

Table 2: Renewable energy targets and estimated direct jobs to be created by 2030. Source: Own estimations based on data from (GIZ, 2016) (RCREEE, 2017) (Mahmoud, 2019)

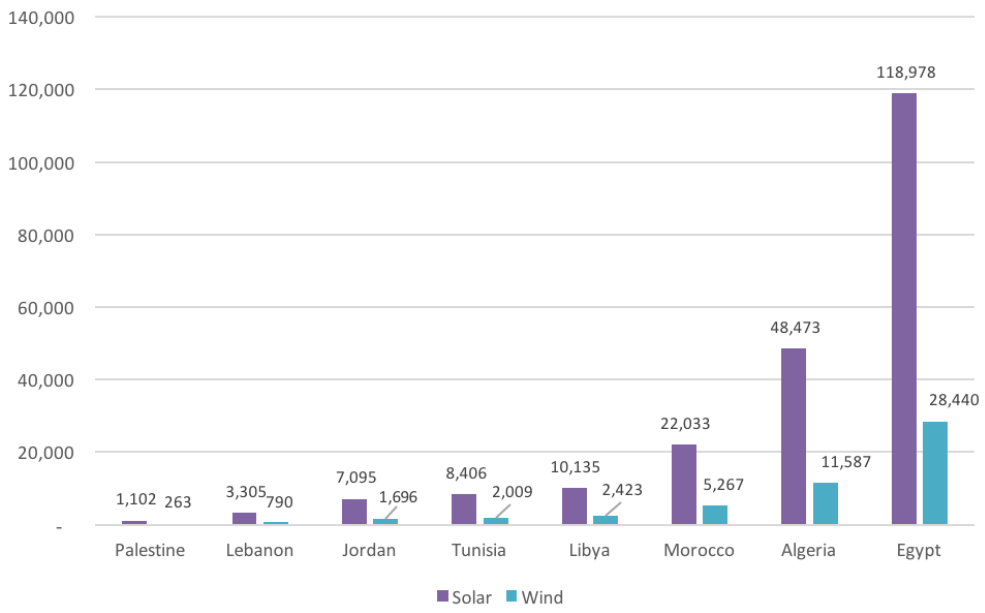
Country	Targets (MW)	Capacity (MW)		Potential Direct Jobs Created by 2030	
		Solar	Wind	Solar	Wind
Palestine	500	300	200	1,102	263
Lebanon	1,5	900	600	3,305	790
Jordan*	3,22	1,932	1,288	7,095	1,696
Tunisia	3,815	2,289	1,526	8,406	2,009
Libya	4,6	2,76	1,84	10,135	2,423
Morocco	10	6	4	22,033	5,267
Algeria	22	13,2	8,8	48,473	11,587
Egypt**	54	32,4	21,6	118,978	28,44

*** The target for Jordan is for 2025**
**** The target for Egypt is for 2035**

(3) Direct jobs are those induced directly in the production of the RE and EE technology production sector. This differs from indirect jobs, which are those induced in economic sectors related to that technology. For instance, to build a turbine factory, you need inputs from steel industry, the metal shaping industry, and the cable industry (RCREEE, 2017). In addition, there are induced jobs, which are jobs created outside of the industry, however they are maintained due to the activity of the industry (DTI, 2004).

Regarding the targets mentioned above based on the RE trend that have been steadily progressing in the past 8 years according to (Mahmoud, 2019), PV contribution in the RE mix jumped from 5%, in 2010, to 9%, in 2014, and reaching 45% in 2018, whilst wind energy contribution decreased from 76% in 2010 to only 41%, in 2018. Hence, and By acknowledging the continuous price decrease that the solar PV is witnessing as well as the market saturation for the wind energy in some of the countries, an assumption has been made that the solar PV will continue increasing till it reaches 60% of the total RE installed capacity in 2030 while the wind energy will most probably stagnate around 40% over the total energy mixcontribution. Hence, the targets were distributed accordingly and the potential direct jobs creation was calculated as per Figure 6.

Figure 6: Potential direct jobs created through solar PV and wind technologies in SEMCs by 2030



Comparing these numbers with the total workforce in each of the mentioned countries, it is evident how much RES can contribute in decreasing the unemployment rate in the SEMCs if the targets are followed and the plans realized.

Looking at Figure 6, it is clear that solar PV create more jobs than wind energy. This might be the natural result of the assumption of having more installed solar PV than wind energy in the RE mix, but it is also due to the fact that PV requires more work force in each part of the supply chain than wind energy.

This can be noticed if we only compare the employment factor per part of the supply chain for each of the technologies, as will be explained in the rest of the report for each of the countries separately.

It is also worth highlighting that the figures above only represent the potential creation of direct jobs based on the employment factors approach. The employment factor simply reflects the country's part of activities connected to the installation, manufacturing and operation and maintenance of the respective RE and EE technologies and services. Meaning that if more local value is contained in these activities, the respective employment factor can be increased or decreased accordingly. Hence, the above assumption should be modified in the future, to take into account the specific employment factor for each country regarding the different technologies, in order to incorporate its economic context, the productivity of its labor force, the manufacturing rate of each of the products, the skill level and other economic variables that totally differs from one country to another.

In addition, indirect jobs were not included in the estimations, because of the complication in its calculations. Nevertheless, indirect jobs should also be taken into account if we want to capture the full effect of the deployment of more RES on the inclusive growth of their local economies, since this will definitely contribute to increasing the number of created jobs.

In order to give a general overview and a clear assessment of the region, this report will mainly focus on Tunisia, Egypt and Lebanon, by tackling their general economic situation, energy market specification, labor market characteristics, in general, and in renewable energy, specifically, per technology and per parts of the supply chain, the gender distribution in their labor market and, finally the representation of youth in these countries where data is available.

Part II:
Country Profiles

2.1. Tunisia

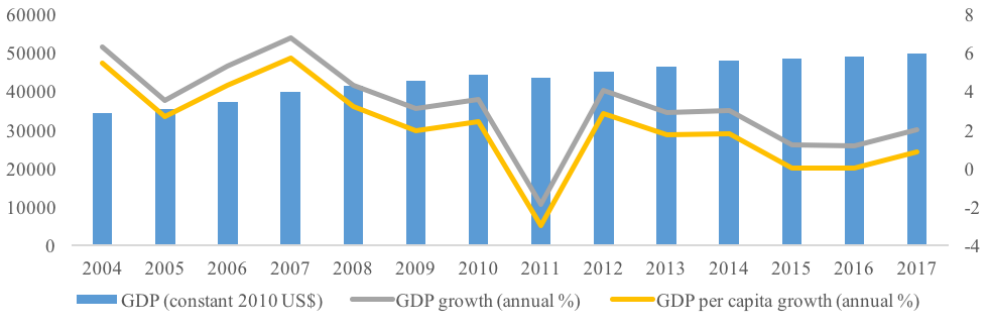
2.1.1. Macroeconomic Context

As mentioned earlier in the report, the whole SEM region had a fluctuating economic situation over the past years. In Tunisia, the economic activity slowed down after 2007, due to the subprime financial crisis, as shown in Figure 7. Then, the 2011 revolution came into the scene to aggravate the economic status. Over the past decade, the Tunisian GDP had a moderated growth rate; it has recorded 2%, on average, between 2009 and 2017. Since 2011, the Tunisian economy has been facing fluctuations and the convergence process slowed down (OECD, 2018). It is worth noting that the economy has started recovering and growth started strengthening since 2016, as economic reforms policies started to affect the real economy (OECD, 2018).

In 2015, the economy has been slowing down, because of non-structural factors affected by instability in certain sectors. Reserves of oil and gas had decreased and sectors like chemicals and hydrocarbons production had affected both the GDP and the unemployment rate, which on his turn had its effects on the GDP per capita (Central Bank of Tunisia, 2017). Consequently, investment in RE will not only help in supporting the amount of the output of the country, but also it will increase the stability of the labor market.

Under the economic reforms that have been conducted following the revolution, the public sector salaries increased in 2012. The GDP per capita increased by 2.8% to reach 4127.40 USD. However, it can also be noticed that the GDP per capita has followed a slowing pattern since 2013 and it had reached its lowest growth rate in 2015, recording 4270.874 USD, this may be induced by the low investment rates and job creation in the private sector (OECD, 2018).

Figure 7: GDP level and growth rate and GDP per capita growth rate in Tunisia from 2009 to 2017, Source: (Databank, World Development Indicators and Sustainable Energy for All)



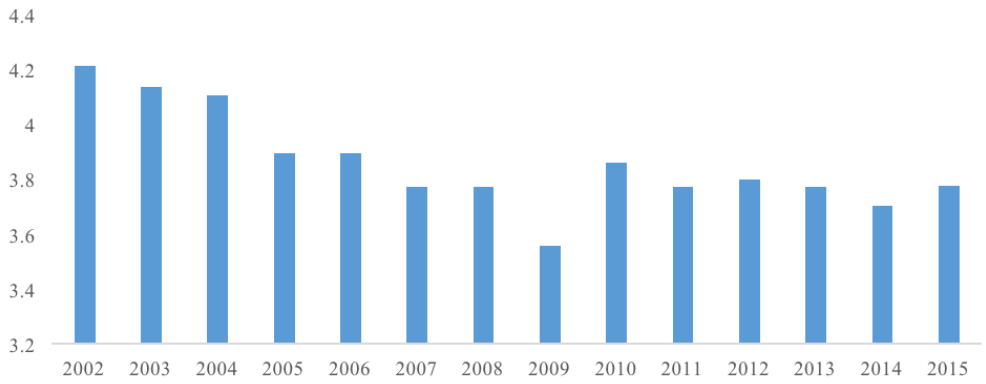
2.1.2. Energy Market in Tunisia

In order to study the energy market in Tunisia, we must first analyze the energy intensity in the country. The energy intensity measures how much energy is used to produce one unit of economic output, according to the World Bank definition. Comparing the periods between 2002 to 2006 and between 2010 to 2015, as can be seen in Figure 8, we can notice that the energy intensity is generally lower during the later period compared to the former one. This could be explained by different factors, but the clearest of them was the emergence of the PROSOL project, which had an objective to increase the usage of solar energy in residential, industrial and services sectors and, hence, primary energy consumption had decreased. Despite the emergence of some of the RES, we could not ignore the fact that a major economic shock happened in 2011, having direct effect on the total output, thus causing a slowdown in the economic activity.

It is worth noting that the energy intensity level did not change dramatically through the years. It averaged around 3.5 MJ/2011 USD PPP, for the period between 2010 and 2015. In addition, according to Figure 9, total energy consumption has been growing fast from 1990 to 2010, with an average of 19.6%, every five years. However, since 2010, the consumption has slowed down, to grow by only 6.1% from 2010 to 2015. This could be explained by the general economic context that has characterized this phase accompanied with low economic activity. In 2010, oil products consumption had decreased, in favor of natural gas, constituting 52.1% and 20.08%, respectively, from total energy consumption. In addition, geothermal and solar energy had been introduced

to the picture in the same year, making 0.36% of total energy consumption. Yet, this percentage did not drastically change in 2016; it only increased to 0.63%. For electricity consumption, it grew by 14.94%, from 2010 to 2016. Hence, we can conclude that Tunisia still has a long road to achieve clean energy usage, as it still relies on oil products.

Figure 8: Energy intensity level of primary energy (MJ/2011 USD PPP) in Tunisia from 2002 to 2015, Source: (World Bank, Sustainable Energy for All)



It is also interesting to see the final consumption per sector that can be summarized in Figure 10. In 2016, the residential, industrial and transport sectors consumed around 20%, each. While agriculture, commercial, and public services sectors represent 4% and 6%, respectively, of total consumption.

Figure 9: Share of different energy sources (in percentage-left axis), in total final energy consumption (in ktoe-right axis), 1990-2016 in Tunisia, Source: (World Bank, Sustainable Energy for All, 1990-2016)

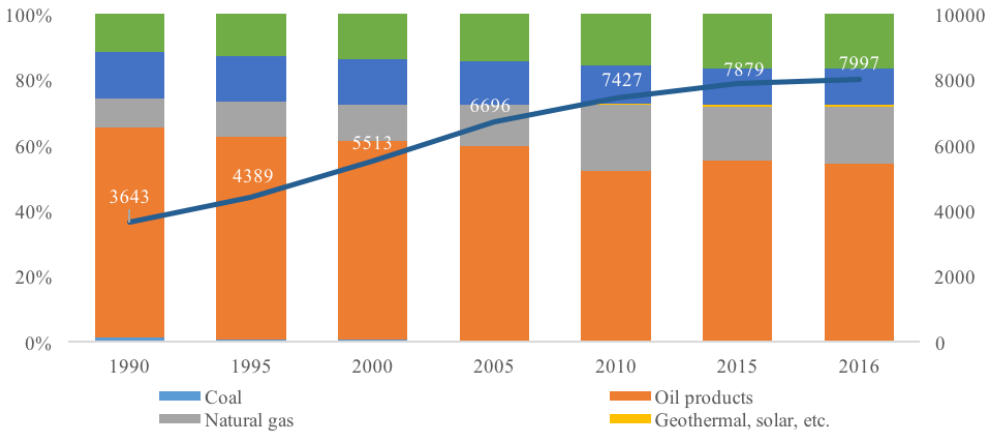
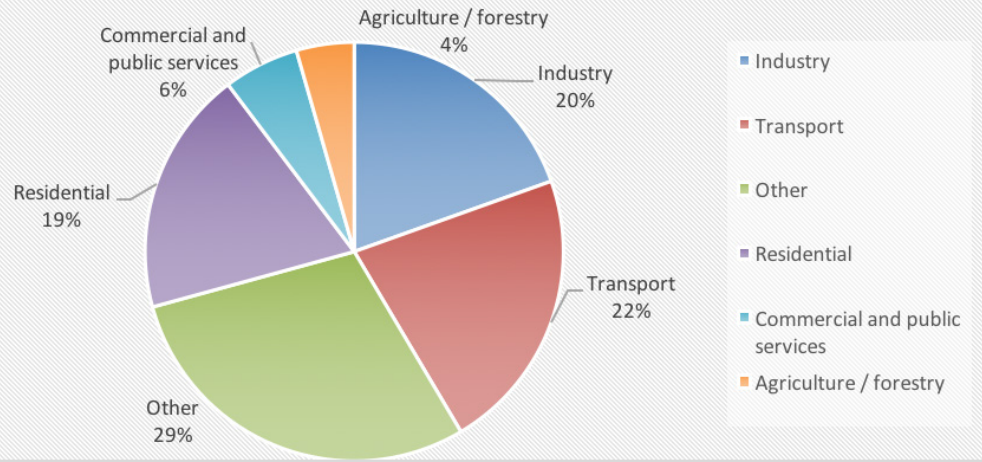


Figure 10: Final energy consumption in Tunisia in 2016 per sector(in percentage). Source: (IEA, Statistics)



Furthermore, it is worth noting that the total electricity output has had an increasing trend, since 2006. Since 2010, the pace of this increase has been accelerating to reach 20000 GWh in 2015. If we investigate electricity consumption, in Figure 11, we will notice that it has the same trend. Also, throughout 2011, the year of the revolution, the electricity consumption did not significantly decrease (3%).

In addition, the share of renewables other than hydroelectric sources, in the total production of electricity, is higher than that of hydroelectric energy. In particular, in 2012, there has been a radical change in the usage of renewables, because their share in total production increased significantly since then.

Figure 11: Electricity consumption and share of electricity produced from hydroelectric sources and other renewable energy sources in Tunisia from 2009 to 2015, Source: (World Bank, Sustainable Energy for All)

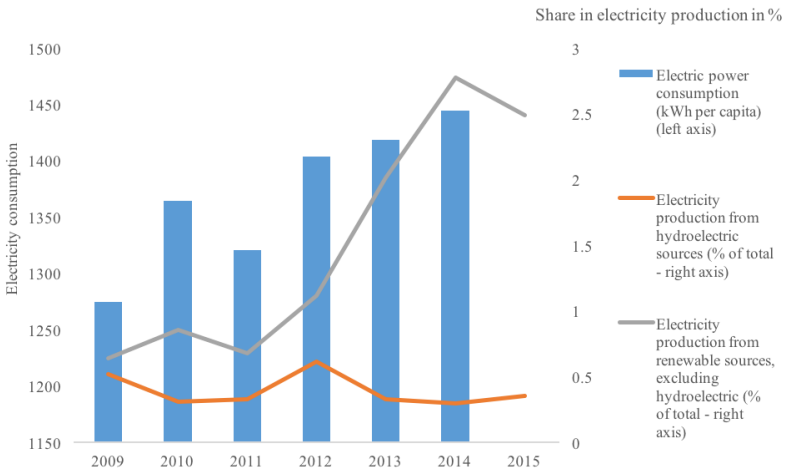
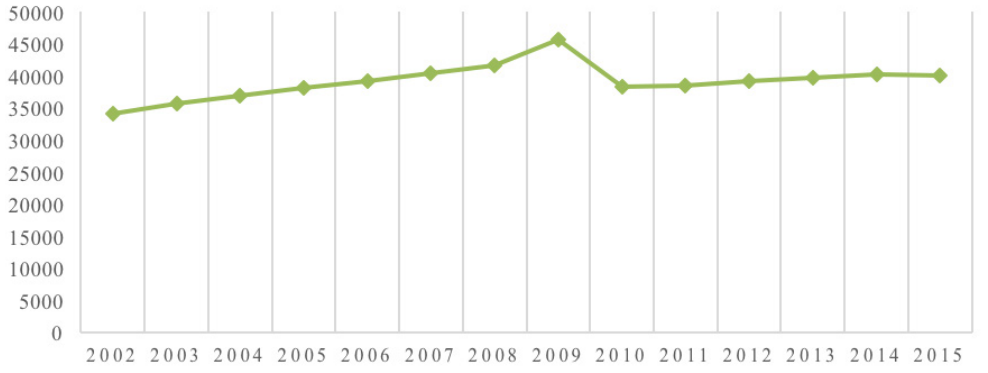


Figure 12 indicates that the renewable energy consumption has not faced any radical changes in its trend, since 2010. It had been slowly increasing between 2002 and 2007 and in 2009, it reached its maximum, 45000 TJ. However, since then it has decreased to reach 40000 TJ in2015. It is important to understand why the consumption of RE did not witness any major changes during the previous years. Fossil fuel subsidies have created a pressure on its demand, while resources remained the same (GIZ, 2012). Nonetheless, in 2013 the government adopted a reform plan that includes eliminating subsidies in order to save public expenditures (GSI and IISD, 2014). Consequently, demand for fossil fuels decreased by 14%, between 2012 and 2013.

In fact, because of such policies, we could estimate a continuing decrease in the demand for fossil fuels and an increase in the demand for RE. This expansion in the market for RES should be accompanied by more projects, thus increasing the installed capacity coming from RE projects. Undoubtedly, this will increase the number of jobs created by the sector.

Figure 12: Renewable energy consumption (TJ) in Tunisia, for the period between 2002 and 2015. Source: (World Bank, Sustainable Energy for All)



2.1.3. General Characteristics of the Labor Market in Tunisia

Many scholars and supporters of RES promote them as a way out of high rates of unemployment, besides being a great policy tool to create jobs. Since the main purpose of this report is to see how RES and EE measures can create jobs, we have to study first the labor market in Tunisia.

The following section will focus on the unemployment rate in the country over the past decade, taking into consideration the age distribution and the youth participation as well as the gender distribution in the market, as can be seen in Figure 13.

In general, the trend shows that there are no major fluctuations in the unemployment rates in the country, although 2011 is considered as an exception, since the unemployment rate increased by 5.29%, approximately, due to the 2011 Tunisian revolution. In 2012, the economy started healing and unemployment rate decreased from 18.3% to 16.63%. By 2013, the economy kept absorbing the shock and the unemployment rate decreased to 15.9%, but this did not change until today.

2.1.4. Youth and Women Status in the Tunisian Labor Market

Not only the focus should be on the general unemployment rates in every country, but also youth representation can be considered as a major workforce and positive boost to any economy if taken into consideration, mainly because of the productivity level that can be achieved and increased because of youth participation. Furthermore, achieving gender equality is important for different workplaces, not only because it is fair, but also for its effects on the overall economic performance, as gender equality is internationally associated with improved national productivity as well as economic growth.

In the Arab region, youth are known as a vulnerable group in the labor market, where they represent the majority of the population. Hence, they will be a target group for any fluctuations or shocks on the market.

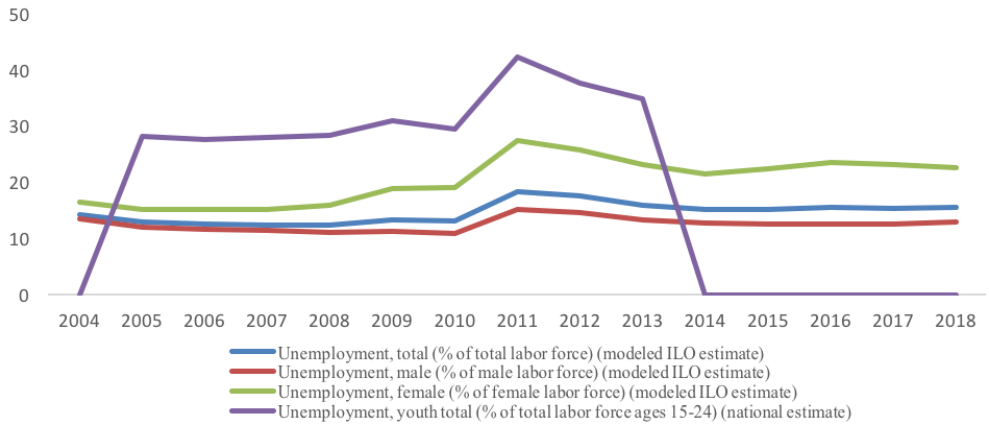
In the Tunisian economy, as we can see in Figure 13, youth are generally marginalized. Taking into account that information about youth unemployment rate is only available for the period between 2005 to 2013, the lowest youth unemployment rate was recorded in 2006 when it reached 27.6%. It reached its maximum during the 2011 revolution (42.2%), but it decreased afterwards, reaching 37.6% and 34.7% respectively in 2012 and 2013.

As for gender equality, the gender gap in the Tunisian labor market can be measured by comparing unemployment rate for females and males. From Figure 13, we can observe that female unemployment rate is higher than the male one by 9.6%, in 2018. Nevertheless, this gap was not that serious between 2004 and 2008 and it did not start increasing until 2009. This could be due to the subprime crisis, back in 2008, when many businesses were forced to shrink their sizes or went bankrupt. Since 2009, the gender gap has been averagely around 9.5%; undoubtedly, 2011 was an exception considered the geopolitical instability, as previously mentioned. The gap increased to 12.34% in 2011 and 10.98% in 2012 and then, it continued decreasing afterwards.

It is also good to understand the types of jobs that women are highly motivated to acquire. Up untill now, women have been found more in the administrative and bureaucratic positions, dominating 54% of these positions. However, women only represent 22% of technical departments' total employment (GIZ & ANME, 2019). This can be explained by the fact that women do not have access to suitable training and skills required for those jobs, as we mentioned in section 1.1.4.1. We cannot ignore the fact that women face also the problem of accessing management positions, as they only represent 5 to 6%. This could also be seen at the international level, both in developed and developing countries (GIZ & ANME, 2019).

Focusing more on the renewable energy sector, the same results can be found. Women are represented the least in the Solar Thermal energy sector, recording a level even below the national average. Male represent a majority of 84% out of the total employment of the sector. Wind energy, instead, is the most welcoming sector for women employment, as it accommodates 39% of female employment out of the total. It is followed by the Solar PV sector, in which female employment represents 29% (GIZ & ANME, 2019).

Figure 13: Unemployment rate, total, youth, female and male, in Tunisia (in %), between 2004 to 2018. Source: (World Bank, World Development Indicators and Sustainable Energy for All)



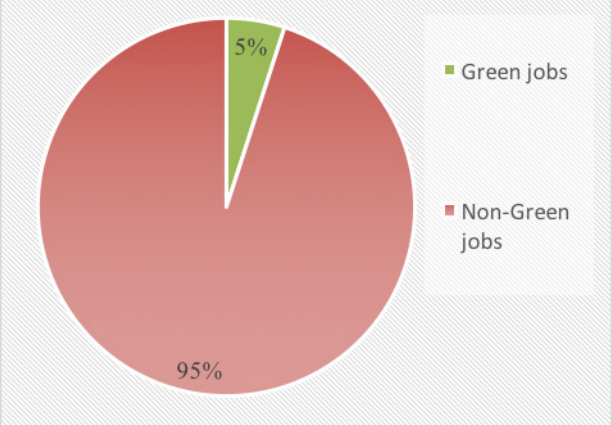
2.1.5. RE Projects Impact Analysis – Employment

Tunisia has a sustainable development plan and a vision for 2030, as most of the developing countries. One of the main pillars of this plan is to make evolve its energy sector and diversify its energy portfolio. Actually, the roots of the energy action plan come from 2005, when the government decided to reduce the fossil energy consumption by 24% in 2006 and by 40% in 2030 (Baccouche, 2014). In order to achieve that, Tunisia will improve and expand its usage of RES. It aims to produce 30% of electricity from renewable energy resources by 2030, with an installed capacity of 3815 MW (French Embassy in Tunisia, 2018; RCREEE, AFEX, 2019). Tunisia mainly uses solar PV, solar SWH, wind and hydropower, to attain this objective. However, some attempts were also made in order to introduce marine energy, biomass and waste recovery (French Embassy in Tunisia, 2018).

The share of green employment out of total employment is estimated to be almost 6% by 2030, as in Figure 14 (ILO, 2018). Adopting green energy alternatives will not be the only reason behind this, but also the waste and water efficiency strategy, as well as the investment in the agriculture sector will play a vital role. During the period between 2020 and 2030, 1 million new jobs will be created, and the share of green employment will increase by 1%. Recent studies show that RES have a faster rate of job creation than EE. In Tunisia, we

could find the same results, since RE projects are intended to have a larger target group, especially the PROSOL program for thermal applications and PV electricity production (GIZ, 2016). It is estimated that 4000 jobs would be created by 2020 (Renewable Energy Solutions For the Mediterranean, 2018). The job creation depends on the innovation capacity of the domestic economy and how they can use local inputs in the value chain (Döring, M. , 2019). In 2015, almost 3000 jobs have been created by RE and EE projects, jointly.

Figure 14: Estimated share of green employment in total employment in Tunisia in 2030. Source: (ILO, 2018)



To have a complete understanding of the job creation effect of the RE projects, we also need to analyze the supply chain of every technology implemented in Tunisia. This will provide information on which part of the life cycle of the project generates more jobs. Based on the available literature and the interviews conducted by the study team during the scoping mission to Tunisia, it has been concluded that most of the RE projects employ more people during the construction phase (Renewable Energy Solutions For the Mediterranean, 2018), but if we focus on specific technologies, such as the SWH in which most of the parts can be locally manufactured, then the manufacturing phase will be the most labor intensive part of the supply chain (Missaoui, 2019). In the coming section, the report will focus on stating and analyzing the most recent results obtained from Tunisia, the methodologies that were used and the most important conclusions that can be drawn from this.

2.1.5.1. Solar PV

Tunisia has been trying to progress with the installation of solar PV since 2010. The market started to progress with the introduction of PROSOL program and the installed capacity jumped from 2 MW in 2010 to reach 37 MW in 2016 (RCREEE, AFEX, 2019). By 2018, there should be 50 MWp and 18,000 installations of solar PV in Tunisia.

Based on the data availability and the Input Output method used by (GIZ, 2016) in 2016, the study estimated the number of direct jobs that can be created through PV installation. The number of direct jobs created in 2015 was 471, and it increased to reach 580 in 2017 (GIZ, 2016).

It is worth noting that despite the fact that PV still constitutes the least share from the RE installed capacity, it still contributed to 23% of the jobs created in 2015 by RE projects (Renewable Energy Solutions For the Mediterranean, 2018). These results are mainly because PV projects are considered to be more labor intensive than wind projects as we will see in the next section.

Table 3, below, summarizes the number of direct jobs to be created using solar PV, based on the estimated installed capacity following the Tunisia solar plan and targets. The estimations show that almost 500 direct jobs were created in 2018. This number will increase by 170% in 2020, with the creation of 1350 direct jobs. In 2022, and with the increase of the installed capacity as per the Tunisian targets, the PV will be creating 11200 direct jobs, which is equal to 730% compared to 2020.

Table 3: Estimated number of direct jobs to be created using solar PV.
Source: Own calculation based on data from (GIZ, 2016) and (Missaoui, 2019)

Year	Number of direct jobs estimated
2018	500
2019	550
2020	1350
2022	11200
2025	14200

When it comes to the specific parts of the supply chain, it is worth noting that the installation phase is the highest one in terms of job creation, as it has an employment factor equal to 42 jobs/MW, followed by the manufac-

turing phase, which has a factor equal to 14 jobs/MW (Shweinfurth & Ben Khemis, 2016). In contrast, the maintenance phase only creates 0.8 jobs/MW. Hence, solar PV technologies are characterized by labor intensity, during the installation phase. It is estimated that the number of cumulated direct jobs created in the agro-sector will increase from 64 in 2017, to 531 in 2021 (GFA Consulting Group, 2018).

2.1.5.2. Wind

When it comes to the wind energy, despite the huge potential the country has in installing this technology, Tunisia is still facing a lot of challenges and obstacles mainly due to the lack of openness of the electricity market to private investors as well as the lack of potential exports of wind electricity to other countries (GIZ, 2016).

In 2017, 78% of the total RE installed capacity was generated by the wind technology projects (French Embassy in Tunisia, 2018). This percentage even increased in 2018, when 84% of the RE installed capacity in Tunisia came mainly from wind, with a capacity of 245 MW.

Nevertheless, when it comes to the employment effect, it is worth noting that in 2015 only 5%, of the jobs created by RE projects originate from implemented wind projects (Shweinfurth & Ben Khemis, 2016). This could be explained by the fact that Tunisia does not produce any turbines and it imports them. Hence, there is no value added by the local industry (GIZ, 2016).

Looking at the data scarcity when it comes to this topic in Tunisia, based on international benchmarks and data from (GIZ, 2016), Table 4 below summarizes the estimated number of direct jobs that can be created in the future based on the announced targets by 2030.

Table 4: Estimated number of direct jobs created by wind technology, in Tunisia. Source: Own calculation based on (GIZ, 2016) and (Missaoui, 2019)

Year	Installed capacity in MW	Employment factor	Number of direct jobs estimated
2019	240	0.7	168
2022	1025	0.7	717.5
2025	1245	0.7	871.5
2030	1755	0.7	1,229

In 2019, it is estimated that 168 direct jobs will be created, this number will increase by 327% in 2022, reaching 717.5 direct jobs. In 2030, it is planned to install 1755 MW, which will create 1,229 direct jobs (Mahmoud, 2019).

Finally, if we want to assess the supply chain labor intensity, by taking into account that the manufacturing is nearly existent for the wind turbines in Tunisia, this can be assessed by mainly comparing the employment factor for the rest of the supply chain. According to (GIZ, 2016), the employment factor along the supply chain is quite low and nearly equal, as it equals to 0.3 jobs/MW and to 0.4 jobs/MW, during the implementation and operation and maintenance phases, respectively. Hence, the wind energy employs almost the same labor force during the different phases of the supply chain.

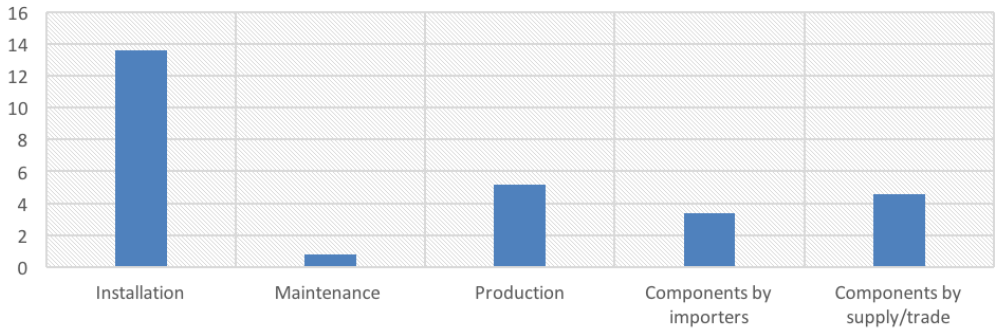
2.1.5.3. Solar Water Heaters (SWH)

Tunisia owns a success story compared to its regional counterparts with respect to the implementation of solar energy initiatives. PROSOL is an ambitious program that is enhancing the use of Solar Water Heaters (SWH) in the country, resulted from the collaboration between the Tunisian government and the National Agency for Energy Conservation (ANME). The program covers three sectors: residential, industrial and tertiary sectors. The industrial and tertiary PROSOL aim to implement 30000 m^2 by 2016 (Baccouche, 2014). This program does not only have positive consequences on energy savings and environmental indicators, but also on job creation and the improvement of social welfare. The key factor that contributed to PROSOL success was the application of effective public policy tools to guarantee the attainment of its objectives, for instance, cutting power over entities that did not meet their liabilities and collaborating with banks and donors to carry out actions against them. In addition, payment through direct government assistance could be delivered to suppliers and installers (GIZ, 2016). Furthermore, besides the PROSOL pro-

gram, the Tunisian government created another workstream of the project to ensure the application of its 2030 vision. In fact, it inaugurated the PROSOL ELEC program in order to support the use of solar PV connected grids.

Hence, the job creation process in the SWH sector is mainly generated by the PROSOL program. The PROSOL project for SWH has the second largest employment rate in the whole RE sector in Tunisia (GIZ, 2016). As indicated the program has three sectors to cover. In this part, we will only mention the implications of the residential and tertiary PROSOL programs: The PROSOL for service sector targets hotels, hospitals and clinics, hammams (Turkish baths) and university centers (GIZ, 2016); the residential PROSOL program increased the total installed capacity from 120,000 m^2 in 2004, to 816,000 m^2 at the end of 2015. In addition, 1,465 jobs were created, including 1,200 installers, 52 suppliers and 7 local manufactures (GIZ, 2016). Currently, in the Tunisian SWH industry, there are 100 suppliers for SWH, 10 producers/manufacturers and 300 accredited installation companies (Missaoui, 2019). It is worth noting that RE projects created 2,052 jobs in 2015: 71% of them were generated by the residential PROSOL, while only 1% of them was created by the tertiary PROSOL (Renewable Energy Solutions For the Mediterranean, 2018).

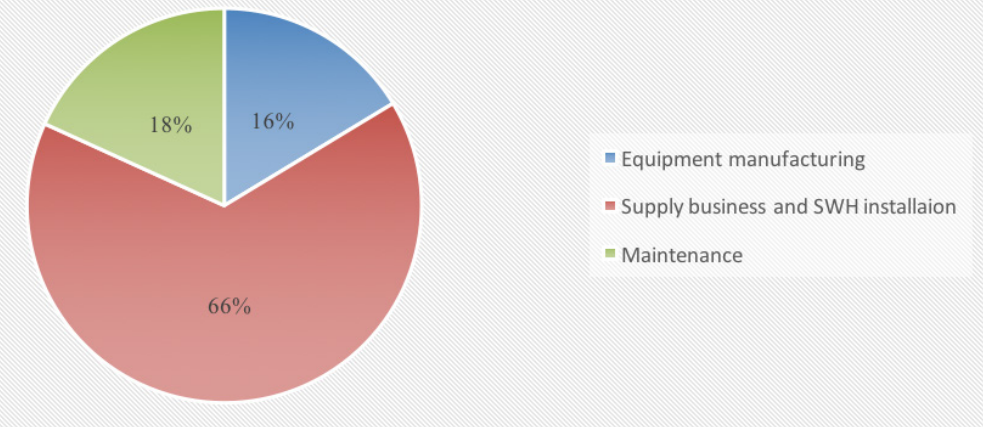
Figure 15: Employment factors in the Residential PROSOL supply chain. Source: GIZ 2016



By analyzing the supply chains in residential PROSOL, the highest employment factor was recorded in the installation phase and it was equal to 17.2 jobs/1000 m^2, while the lowest employment factor was in the maintenance phase, as it only created 0.8 jobs /1000 m^2. After the installation phase, there is the production one, with a factor of 5.2 jobs /1000 m^2. Among the jobs, 237 of them were created during the equipment manufacturing, 950 during the supply business and SWH installation and 264 during the maintenance activ-

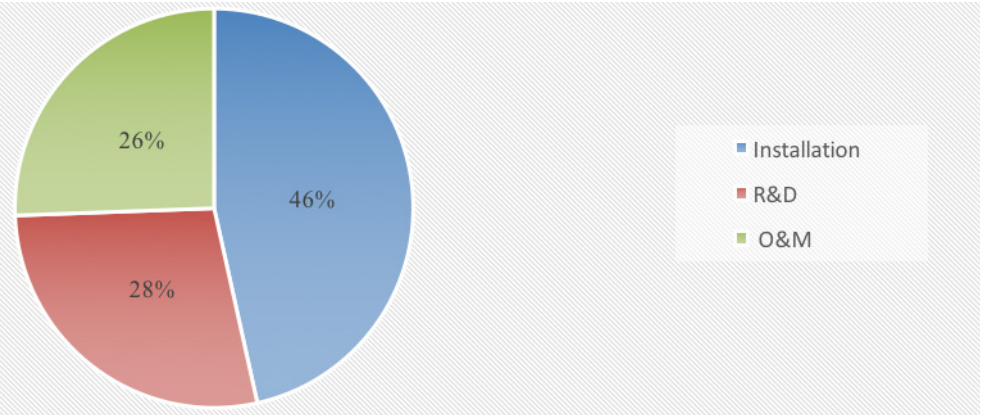
ity. Hence, the supply and installation phases have the highest ranks in terms of job creation. However, since 2010 the trend has been slowing down during this phase. Job creation has decreased by 15%, approximately between 2010 and 2015. During the same period, job created during the after-sale service increased by 60%. Consequently, in the future there may be some changes in the intensity of labor across the project life cycle (GIZ, 2016).

Figure 16: Number of jobs created, along the supply chain of SWH (PROSOL), in Tunisia



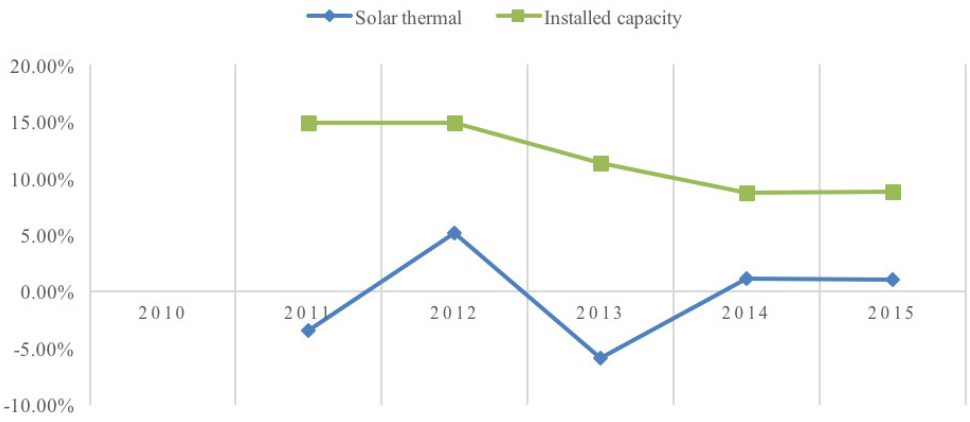
For the tertiary PROSOL, as shown in Figure 17, if 1 MW is installed, 46% of direct jobs created will be in the installation phase. However, the rest of direct jobs will be divided between the two other phases, which are the R&D and the O&M phases, having a share of 28% and 26%, respectively. Hence, we can say that the installation phase is the most labor-intensive part of the supply chain.

Figure 17: Repartition of jobs created, along the supply chain of tertiary PROSOL, in Tunisia. Source: GIZ, 2016



In general, solar thermal technology, which is the one employed in solar water heaters, have been the largest source of job creation among all RES as it created 1,468 jobs in 2015 (GIZ, 2016). Observing the trend shown in Figure 18, we can see that the highest rate of growth, in solar thermal created jobs, is recorded in 2012, as it generated 1,528 jobs. This may be due to the fact that, during the first year of project implementation, there is more capacity installed and, therefore, more labor is used. When the installed capacity rate of growth decreases, the intensity of labor decreases and less jobs are created.

Figure 18: Growth rate of jobs created and installed capacity by Solar Thermal between 2011 to 2015, Source: (GIZ, 2016)



2.1.6. EE Measures Impact Analysis – Employment

In general, unlike RE, EE measures do not create as many jobs internationally. The main reason behind this is the fact that they are not as labor intensive as the RE technologies. In the SEMCs, the situation is much worse because the EE potential in still untapped in the whole region despite its importance and despite the targets previously mentioned in section 1.2.1 above.

In Tunisia, EE did not create as many jobs as RE technologies did. Looking at Figure 19, energy audits and program contracts and EE in buildings had the highest shares of total number of jobs created by EE technologies between 2005 and 2010. In fact, energy audits and program contracts kept a share of 50%, which means that this technology is labor intensive. Since 2007, the

share of EE in buildings has shrunk to 39.22%, in average. Energy management equipment only contributed to job creation, in 2007, 2008 and 2010, its share was 2.26%, 10.76% and 13.68%, respectively. In addition, ESCO appeared for the first time, in 2010, generating 12.55% of the EE jobs. This may be due to some regulations that motivated the activity of companies interested in EE solutions and awareness.

Furthermore, EE in buildings achieved the highest employment factors, among other technologies, in recent years. In 2015, EE in buildings created 372 direct jobs, which is the highest figure after the cross-cutting activity, which enabled the generation of 975 jobs. Cogeneration, on its side, created 105 jobs in the same year. Motor vehicle inspection, audits and energy savings equipment technologies created 35, 47, 260 direct jobs, respectively (GIZ, 2016).

For the supply chain, all the jobs created by energy audits, program contracts and ESCO, for the period between 2005 and 2010, were during the engineering and development stage. The EE in buildings created jobs during the installation (59%) and the trials and tests (41%) stages. The cogeneration technology mainly generates employment during operations and maintenance and installation phases, since only 2% of jobs created by this technology were in the engineering and development phase. In contrast, the installation stage represented 4% of the jobs created by diagnostic stations, while the energy management equipment depends on this phase (62%). This previous technology characterized by the fact that it is the only technology that generated employment, during the supply stage.

These results match the results of the scoping mission that was done by the study team in Tunisia, where Missaoui (2019) highlighted the fact that EE in buildings is the most labor intensive measure as regards EE and it has a great potential in the future, mainly in the installation phase. It is worth noting that Tunisia should not only focus on the EE in new buildings, but also on the renovation of old buildings as it is as labor intensive as the construction of new ones, since it requires almost the same level of efforts (Missaoui, 2019).

Figure 19: Share of each EE technology in total number of jobs created, per year, in Tunisia, Source: (GIZ, 2016)

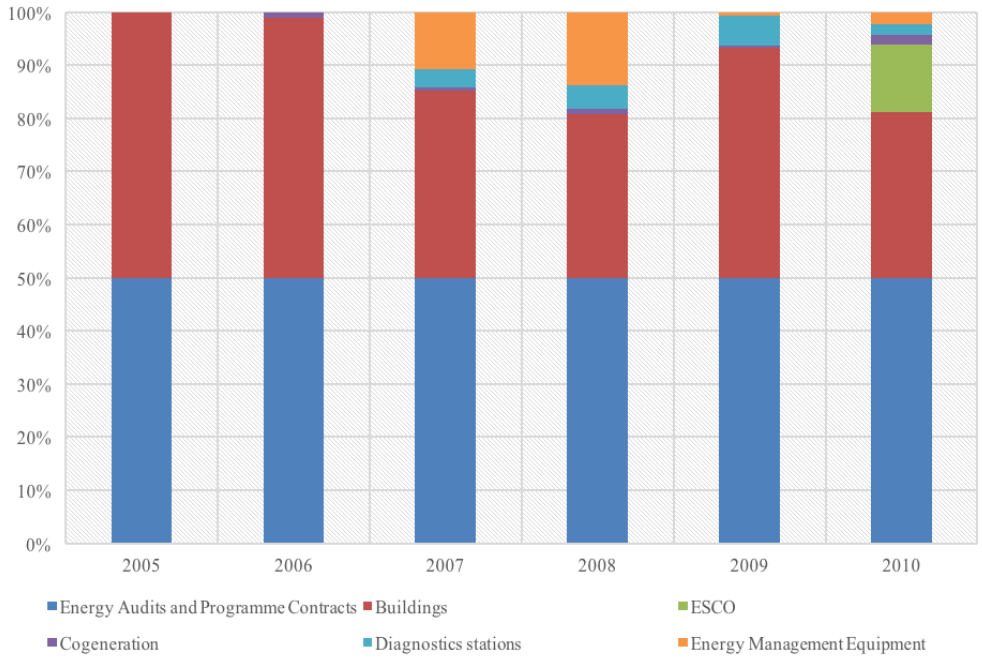
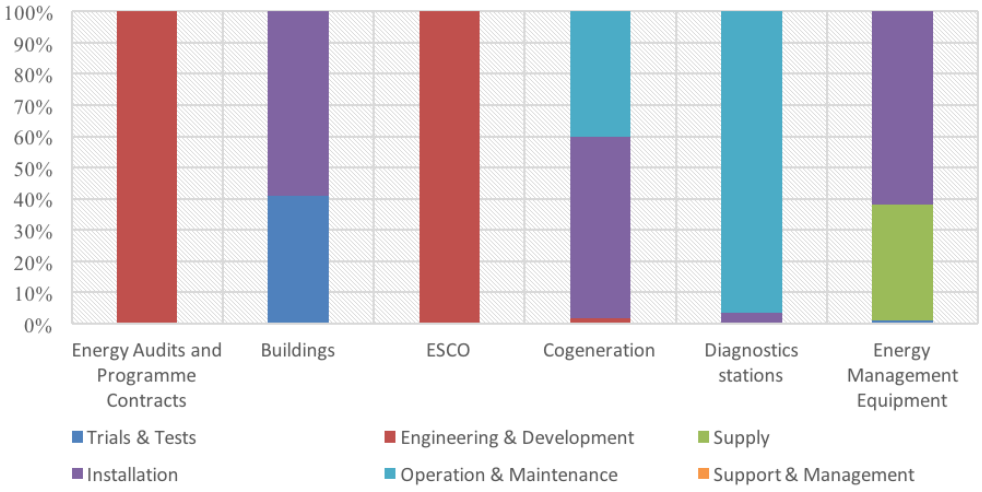


Figure 20: Distribution of jobs, along the supply chain, in Tunisia, Source: (GIZ, 2016)



2.1.7. Recommendations on the priority sectors to focus on in Tunisia

It is worth highlighting that the sustainability of RE and EE markets is necessary for the stability of permanent jobs and the transformation from intermittent to permanent jobs. The analysis in the previous sections have shown that the SWH technology is currently the most labor-intensive in Tunisia, thanks to PROSOL project. When it comes to the supply chain, it has been proven that the installation phase is the most labor-intensive. Finally, when it comes to the economic sectors, the building sector has shown a great potential to employ a lot of people, considering the number of employees it requires to renovate existing buildings and to increase the number of new insulated buildings.

When it comes to the future predictions in the country, based on the 2030 solar plan the orientation of investment in Tunisia is currently going more towards solar energy more than wind. The total planned installed capacity is 2,289 MW and 1,526 MW, in solar and wind energy, respectively. Nevertheless, despite the large amount of jobs created because of the SWH in the past period, this should not necessarily be the case in the future, especially in light of the technology orientation.

Noting that wind energy is more labor intensive throughout its supply chain as argued and proved in the literature, an increased investment in the wind energy technologies in the country shall automatically enhance the ability of this industry to create new and more jobs in the RE field in Tunisia.

The wind energy industry may be a gateway, not only because of its ability to create more jobs, but also because of the market saturation that Tunisia might witness in the near future for solar energy because of the huge success of the PROSOL project.

A very important factor that should be highlighted is the importance of awareness raising campaigns that should be organized by the country to promote the RE component in all its policies. Furthermore, considering its great potential to create a considerable amount of jobs, the installation and construction phases should be set according to specific quality assurance programs ensuring the efficiency of the systems to be installed and, thus, the durability and sustainability of the jobs created.

Attention should be paid not only to increasing RE in the country, but also EE. Tunisia has been one of the leading countries when it comes to EE development in the past years. Since buildings insulation is one of the most job creating technologies in the country, it will deserve particular attention in the coming years in Tunisia. Policies should be oriented to enhance laws and regulations on the renovation of existing buildings as well as on the creation of new insulated buildings that will improve energy efficiency in the residential and commercial sectors.

On the short and mid-term, employment should be considered as a co-benefit and not as a key criterion for RE or EE prioritization; on the long term, instead, employment and industry development could be justified for public investments in the fields of RE with a high added value. Finally, everyone should understand that employment in RE and EE is a common responsibility: policy, finances, vocational training, R&D, industrials, etc...

When it comes to the profile of people working in the RE and EE fields, the focus should be given to youth aging between 20 to 35 years in order to increase the productivity in the sector and to allow for the creation of new jobs in these fields. Also, we should focus not only on creating more jobs but also on creating jobs for the highly qualified graduates in this field who are still looking for good jobs in the country. It is worth noting that Tunisia is one of the most advanced countries in the region when it comes to the integration of RE and EE components in their undergraduate as well as graduate programs in most of their universities. In addition, they are also known for offering a lot of vocational trainings in sustainable fields. Hence, all these graduates must be utilized efficiently within the country. Finally, women should be given more important roles in these sectors in order to achieve the envisaged gender equality soon.

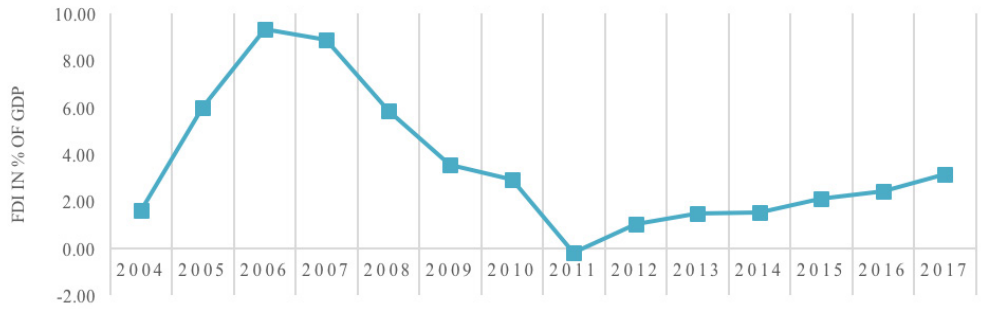
3.1. Egypt

3.1.1. Macroeconomic Context

In 2003, the Egyptian government announced an ambitious economic plan in order to boost the economic activity. Privatization and foreign investment were two crucial elements in this plan. Figure 21 shows that the economic activity was progressively accelerating since 2004 and it became fruitful from 2005 to 2008. The GDP growth rate went from 4.47% in 2005, to 6.84% in 2006 and 7.16% in 2008. Nevertheless, the impact of the 2008 international subprime crisis on the Egyptian economy started to be evident in 2009. The main channel, through which the financial crisis affected Egypt was the Foreign Direct Investment (FDI). In Figure 22, we can see the relationship between the FDI and the GDP, showing a sharp decrease in the period between 2006 and 2011. Furthermore, it is worth noting that the amount of jobs created at that time was not enough to decrease unemployment rates, as we will see in the labor market analysis. Consequently, we can say that FDI were directed to capital-intensive sectors, such as the oil and gas sectors.

Figure 21: Level of GDP and growth rate of GDP and GDP per capita, in Egypt, for the period between 2004 and 2017, source: (World Bank, 2004-2018)

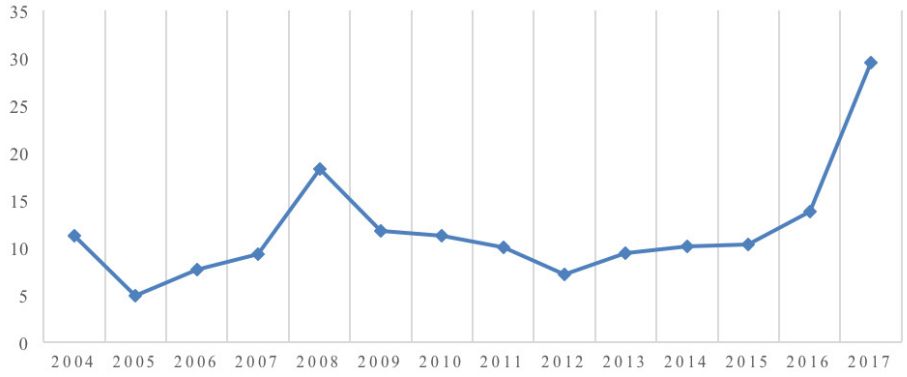
Figure 22: Share of Foreign Direct Investment (FDI) in GDP, in Egypt.
Source: (World Bank, 2004-2018)



In addition, in 2011 the economy faced a severe shock due to January 25th Revolution. Political instability and lack of security have affected strategic economic sectors, such as the tourism sector as well as the domestic production. Therefore, foreign exchange reserves(1) decreased enormously, imports remained unchanged, while exports decreased. All these factors contributed to an increase in inflation rates.

However, inflation rate did not start rocketing until 2015, as shown in Figure 23. It increased from 10.36%, in 2015 to 13.8%, in 2016, reaching 29.5%, by the end of 2017. This is explained by the economic reform plan that was adopted by the Egyptian government in 2015. This mainly includes the depreciation of the Egyptian pound and eliminating subsidies on fuel and electricity. The main objective of these reforms was the liberalization of the market, aimed to decrease the expenditure burden on the government and to reallocate the resources, so as to reach those who are depending on aids and subsidies.

Figure 23: Annual inflation rate, calculated using consumer prices, in percentage, in Egypt,
Source: (World Bank, World Development Indicators and Sustainable Energy for All)

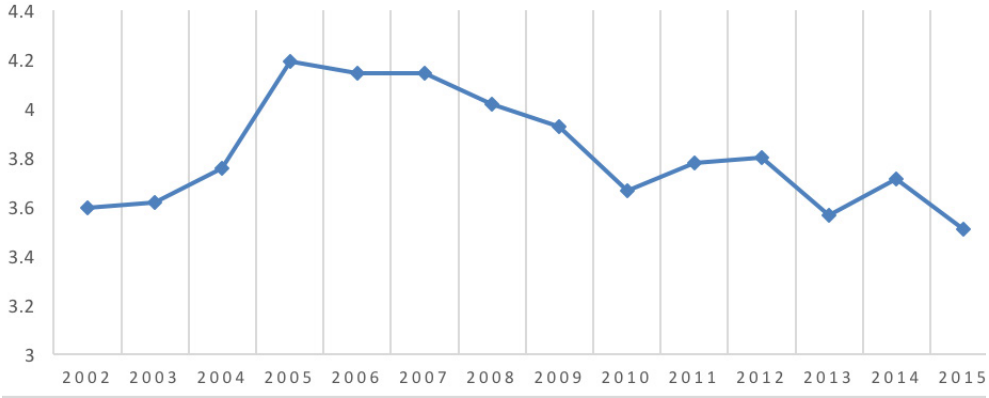


(1) Foreign Exchange reserves are defined as the agglomeration of foreign currency assets stocks plus gold, held by at a central bank. (OECD, 2014)

Therefore, by analysing the economic situation of the country, sustainable energy solutions may seem like the optimum solution to enhance the economic conditions in the country and at the same time help decrease the environmental impacts of conventional energy solutions in an attempt to mitigate the impacts of climate change. This emergence in new markets as previously explained will help create more clean jobs, which will be further explained in the coming sections.

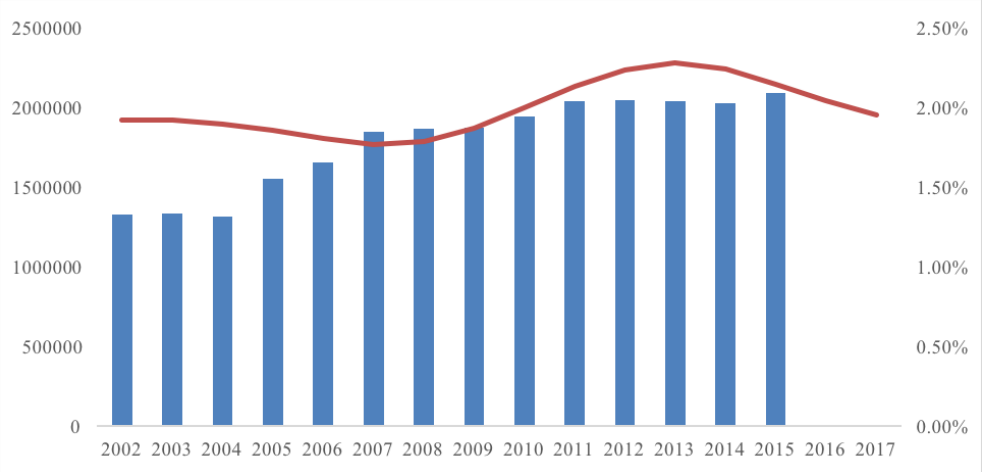
3.1.2. Energy Market in Egypt

Figure 24: Energy intensity level of primary energy (MJ/2011 USD PPP), in Egypt.
Source: (World Bank, Sustainable Energy for All)



The energy intensity level of primary energy has drastically changed after 2011 revolution. Figure 24, above, shows that it was high between 2004 and 2008, being around 4 MJ/2011 USD PPP, on average. This can be explained with the boost of the economic activity and the fossil fuel sector during the same period, as already mentioned.

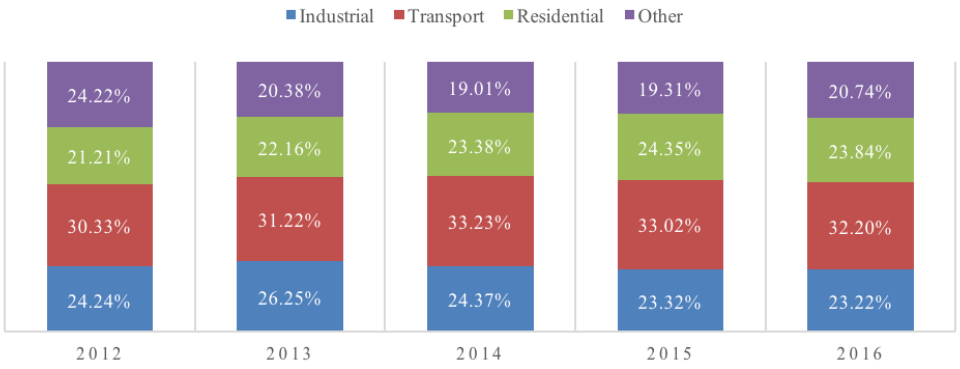
Figure 25: Total Energy Consumption in TJ and population growth in %, from 2002 to 2015, in Egypt, Source: (World Bank, Sustainable Energy for All)



Since 2009, the economic activity has started to slow down and so did the energy intensity of primary energy. It decreased by 7% between 2009 and 2010, and it continued decreasing since then. In contrast, looking at Figure 26, it can be noted that energy consumption has been increasing since 2004. If we compare this to the trend in population growth, we will see that there has been an increase in total population from 2009 until 2014. This could explain the increase in the total energy consumption during the same period.

Through the years, the share of each sector in energy consumption did not change, as shown in Figure 26. The transport sector is the greatest consumer of energy, with a share of about 32% between 2012 and 2016. In addition, the residential and industrial sectors have, approximately, the same share in total energy consumption, which is around 23%. This indicates the importance of public awareness in changing the energy consumption pattern in Egypt. Consequently, energy efficient policies have the same importance as diversifying the energy mix.

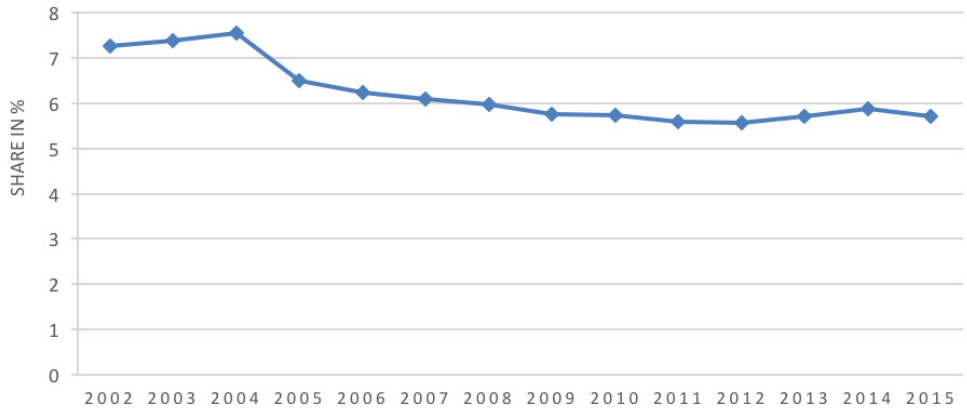
Figure 26: Energy consumption in Ktoe per sector, in Egypt, from 2012 to 2016.
Source: (IEA, Statistics, 2012-2016)



3.1.3. Renewable Energy Market

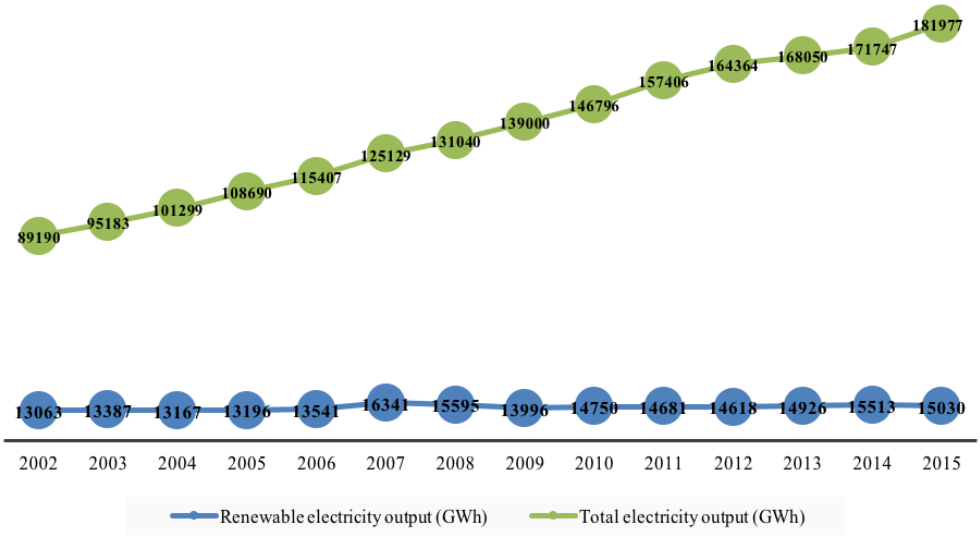
Looking at Figure 27, the share of renewable energy in total final consumption decreased by 24%, during the period between 2004 and 2015. This decrease in the share of RE might seem surprising since the government had adopted energy efficiency policies and inaugurated a number of renewable energy projects during those 10 years. Nonetheless, this can be explained by the fact that the increase of the conventional energy sources added to the grid in order to close the electricity gap faced by the country surpassed the increase in the renewable energy additions.

Figure 27: Share of renewable energy in total final energy consumption, in percentage, in Egypt, from 2002 to 2015



As for the electricity output, this has been increasing for the past ten years as shown in Figure 28. While total electricity output increased by 80% between 2004 and 2015, renewable electricity output increased by 14%, which can be considered as a good increase compared to the regional context.

Figure 28: Total electricity output and renewable electricity output in GWh, in Egypt, from 2002 to 2015. Source: Sustainable Energy for all by the World bank Group



3.1.4. General Characteristics of the Labor Market in Egypt

3.1.5. Labor market: Egypt

3.1.5.1. Unemployment Rate

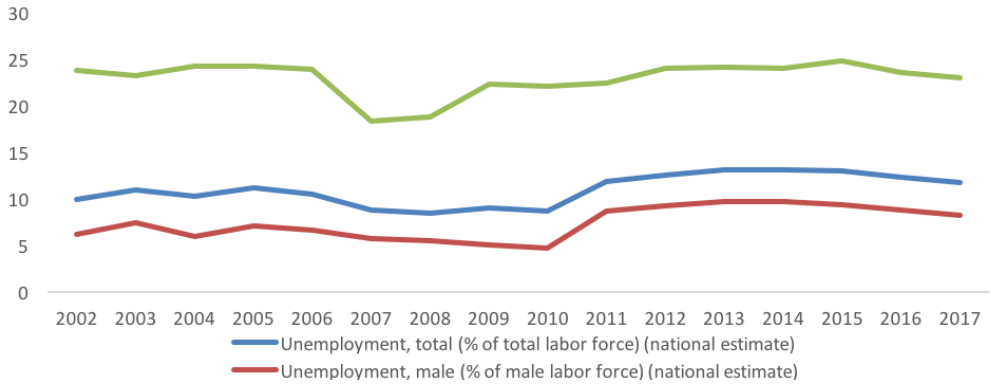
As in Figure 29, unemployment rate decreased by 2% between 2005 and 2007, thanks to the economic reform plan adopted during that period. However, this decrease is considered moderate, if compared to the amount of FDI, which entered the country during the same period. In 2011, unemployment rate increased to 11.8% from 8.7% in 2010 and this trend continued until 2013, reaching 13%, where it plateaued for two years. However, after 2015 it start-

ed decreasing and returned to 11.7% in 2017. This could be explained by two main factors: first, the economy started absorbing the shock of 2011 and the country started retrieving its stability on multiple levels, for instance security; second, the 2015 economic reform encouraged the market to stabilize at the equilibrium level according to the competition rules, due to the liberalization of markets. As a result, the domestic production came back to life.

3.1.5.2. Gender Gap and Youth

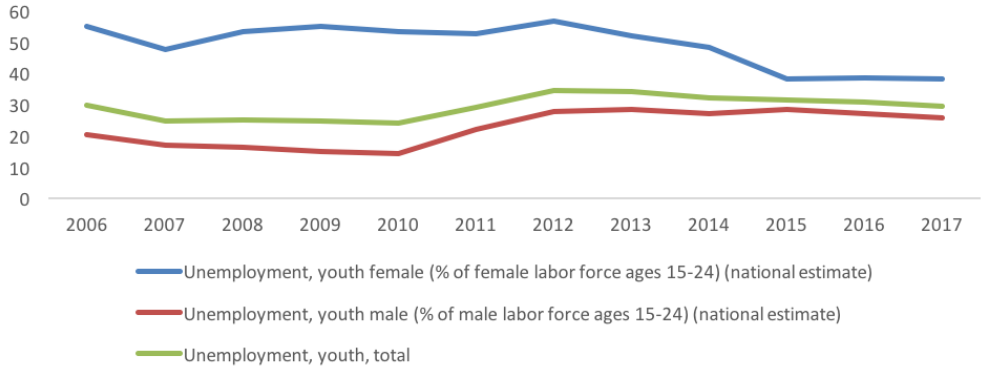
According to Figure 29, there is a major gender gap in the Egyptian labor market, which amounted to 14.78% in 2017. As we can see, this gap has been stable throughout the years; the only exception was in 2009 and 2010, when it increased to 17.3%. This should lead to the conclusion that no efficient policy was taken into consideration to solve the issue in the past years.

Figure 29: Unemployment rate in percentage in Egypt, in all labor force and by gender, between 2002 and 2017. Source: World Development Indicators by World Bank Group



As regards youth unemployment, the trend is almost the same as for gender, since the average rate of unemployment is 32.1% for the period 2012-2017. However, the gap in unemployment rate between young men and women has been shrinking through the years, starting from 2011. In 2015, it reached its minimum and it accounted for 10% approximately.

Figure 30: Unemployment rate, total and by gender, in Egypt, between 2006 and 2017,
Source: World Development Indicators by the World Bank Group



3.1.5.3. Employment in RE

Egypt is considered one of the best countries in the region for implementing wind and solar energy projects. However, in terms of job creation, it is considered as one of the lowest, compared to other countries outside of the North Africa region (Farag & Komendantova, 2014).

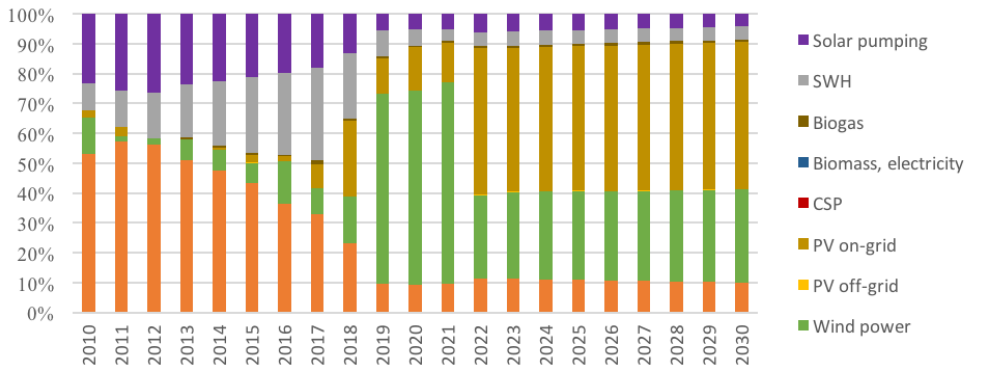
Over the years, the potential for job creation was calculated in Egypt based on estimations with no concrete data or methodologies. Hence, no clear numbers were found on the RE and EE employment effect in Egypt before 2017. Nevertheless, (RCREEE, 2017) captured all these effects in a study where it created an excel-based tool to calculate employment in the current and future years based on the Input-Output and the employment factors methodology. The study was commissioned by the GIZ and executed by GWS in Germany. The main developed tool was updated by the study team to insert, on the one hand, the new installations in 2017 and 2018 and, on the other hand, to update the future installations based on the new targets announced, which were collected during the scoping mission in Egypt. The main result of the study as well as the updated tool are summarized in the below section.

Since 2015, there has been an increase in the number of jobs created by the RE sector. It increased from 4,995 in 2014 to 6,995 in 2015. In 2018, there has been a great increase in the total number of jobs created, as it increased to 14,344, which is, approximately, the double of the number of jobs created in

2017 (own calculation based on (RCREEE, 2017)). If we look at the installed capacity that was implemented at that time, we can see that there has been an increase of 6%, between 2014 and 2015 (IRENA, 2018). In addition, the highest capacity was installed in 2018 with 4812.8 MW, which is equal to 24.79% annual growth rate. This means that the RE sector is still expanding and, in the future, more jobs will be created, especially in the solar water heaters market.

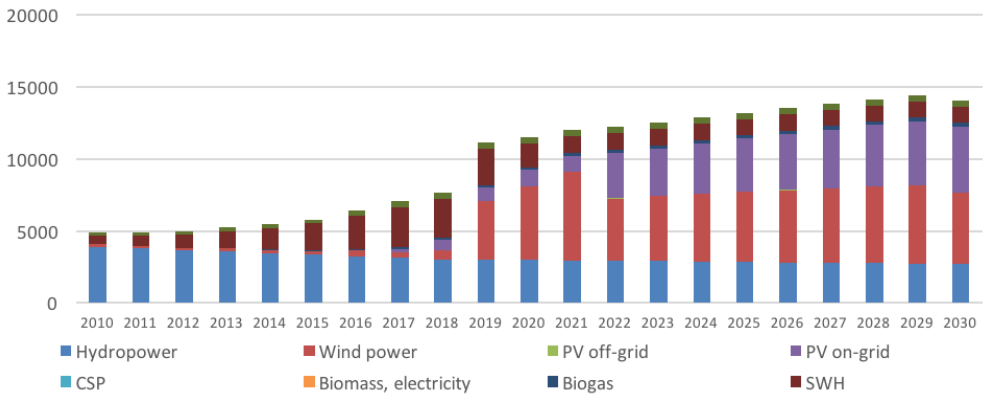
Figure 32, shows that the number of jobs created by the RE technologies were, approximately, the same from 2010 to 2014. In average, this accounted for 5,096 jobs created per year. In 2015, this number increased by 28% compared to the previous year. However, in 2018 the annual growth rate was 87.8%, reaching a number of 14,345 direct jobs created. In 2019, this number increased to 16,383.

Figure 31: Share of each technology in total jobs created by the RE sector, in Egypt, between 2010 and 2030. Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



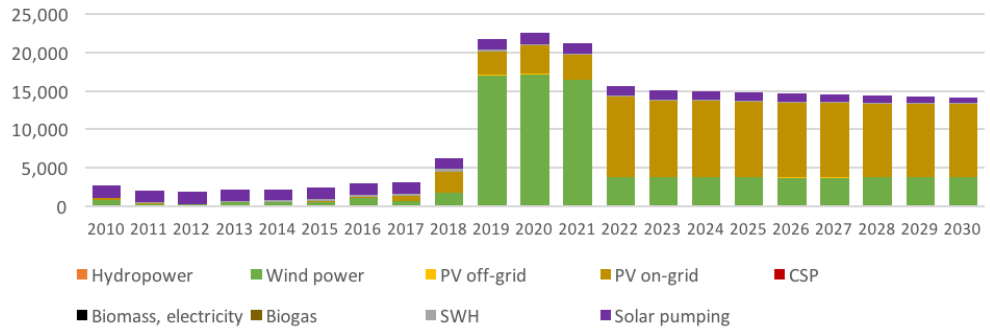
As we can see from Figure 31, the pattern of jobs created by renewable energy has changed during the past ten years. In 2010, 78% of direct jobs were created by hydropower, while solar water heaters represent 12.36%. In 2018, 7629 direct jobs were created, the hydropower sector contributed to 39,70% of them and SWH contributed to 35,35%.

Figure 32: Direct jobs created by RE sector per technology, in Egypt, from 2010 to 2030, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



As Figure 33 shows, the number of indirect jobs created was always less than 3000 until 2017. However, if we look at the rate by which indirect jobs grow, we will see that in 2013, they increased by 12.8%, creating around 2133 indirect jobs. In 2016, the increase amounted to 25,27%, thus creating 2973 jobs. In 2018, this number increased to 6267, and it is estimated that it will increase to 21798 in 2019. From 2010 to 2017, most jobs created were induced by the solar pumping. Nevertheless, after 2017 the PV and wind sectors started to rise based on the newly installed capacities and the numbers started to increase as will be seen in details in the following sections.

Figure 33: Number of indirect jobs created per technology, in Egypt, from 2010 to 2030, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



3.1.5.3.1. Solar PV

The share of PV on grid and off grid for the total number of direct jobs created, combined, did not exceed 1%, until 2016. In 2018, it increased to 10%, creating 796 direct jobs, most of which generated by the PV on grid technology. For the period between 2020 and 2030, the share of PV on grid technologies for total number of direct jobs created will vary approximately between 10% and 33%. The share of PV on grid was 10% until 2017, and that of PV off grid did not exceed 1% in indirect jobs. In 2017, the share of PV on grid increased to 20.14% and, in 2019, it is estimated to record 13.71%. During those past three years, it created 132, 626 and 2737 indirect jobs, respectively. The PV off grid will keep its dominating position and its share will increase to 90% of the total number of direct jobs created by PV technology.

3.1.5.3.2. Wind

For the last ten years, the share of wind power, in total number of direct jobs created, did not exceed 4.6% on average. In 2019, it is expected to create 4052 direct jobs, as the annual increase is 44%. In 2020, it is estimated to create 51% of total direct jobs, while in 2030, this share will increase to 35.5%.

In contrast, for indirect jobs, the number of jobs created by the wind power technology is important, since it represented 25.66%, 14.65% and 25.21%, in 2010, 2014 and 2018, respectively, of the total indirect jobs created. On average, 322 indirect jobs were created annually by this technology between 2010 and 2015. This number increased to 1225, for the four following years. The highest number will be achieved in 2020, with 17005 indirect jobs created. However, the lowest will be seen in 2023 and it is equal to 3502 indirect jobs.

3.1.5.3.3. Solar Water Heaters

Between 2010 and 2017, the annual growth rate of the number of direct jobs created by this technology is 24.78%, on average. In 2010, the SWH technology created 607 direct jobs and it reached 2812 direct jobs in 2017. The year 2018 witnessed a growth rate equal to 35%, creating 2696 direct jobs. For the period between 2019 and 2030, this technology will keep on average a share of 8.9%, out of total number of direct jobs created by RE.

Speaking of indirect jobs, in general, SWH represents very small share in the total number of indirect jobs created, over the years. Between 2010 and 2013, its share was only 3.75%, on average. This number was equal to 6.9% between 2014 and 2017. In 2010, 72 indirect jobs were created, which increased to 345 in 2017. In 2018 and 2019, 346 and 333 indirect jobs were created, respectively.

3.1.5.3.4. Future Predictions

According to predictions, the year 2020 will face a great increase in the number of jobs created, as it will equal to 37,127 jobs, thus increasing by 51% and 20% in 2020 and in 2021, respectively compared to the previous year, and then only by 2%. In 2023, it will decrease by 1% and, later, the number of direct jobs will witness no change, as it will settle around 438 jobs created annually. The share of hydropower in the total number will sharply decrease, since it will reach 8.83% by 2030. In contrast, wind power will represent 14.11% in 2030, but the rest of the technologies will keep their shares and conserving their minority status. It is also interesting to analyze the number of indirect jobs created to see if they have the same pattern or not.

Figure 34: Total employment estimated to be created per year, in Egypt, from 2022 until 2030, source: Own calculation based on the update of the tool developed by (RCREEE, 2017)

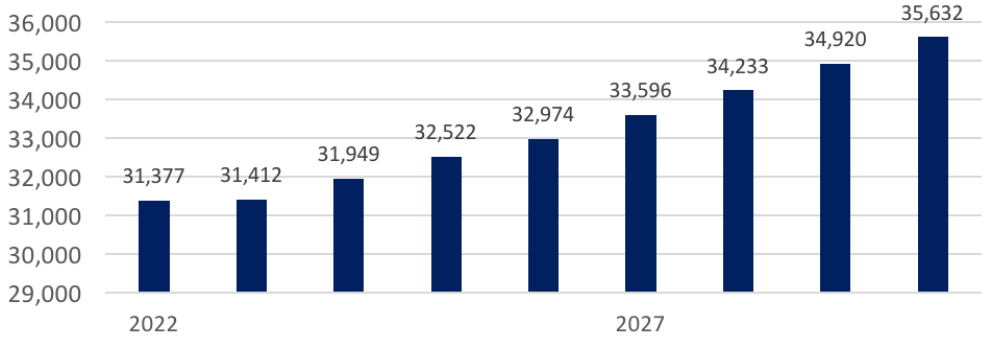
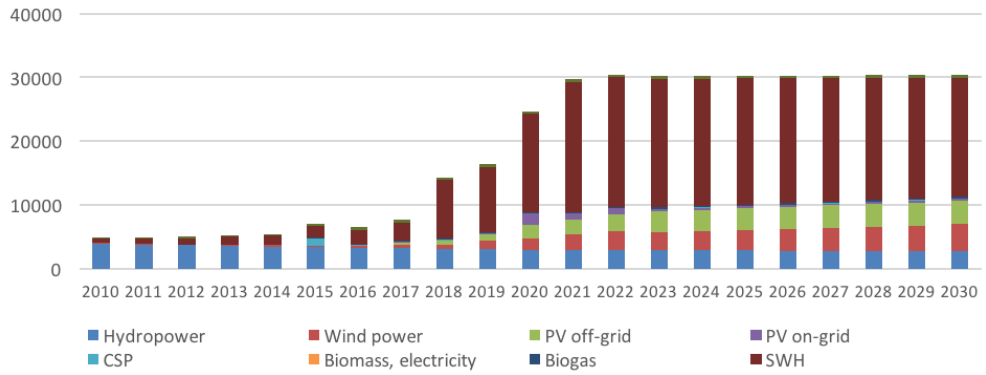
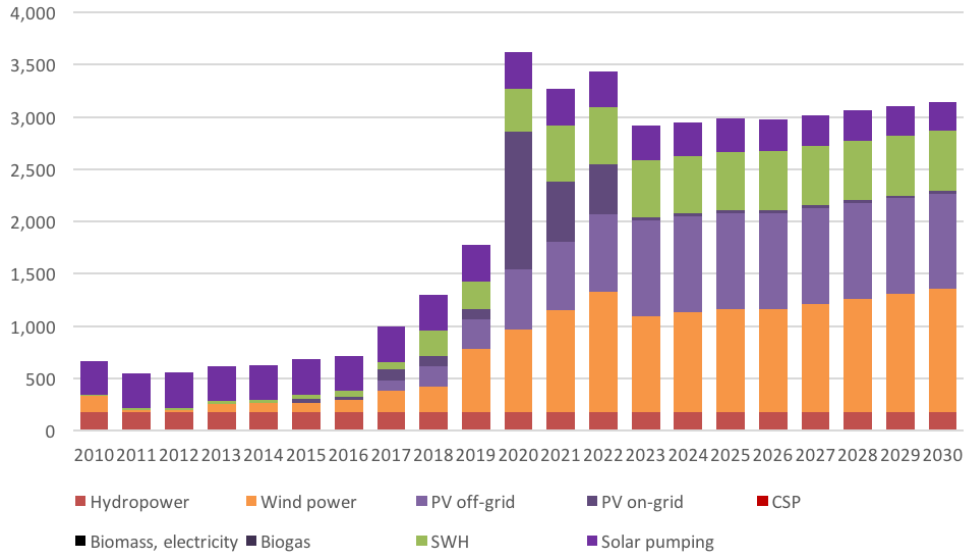


Figure 35: Direct jobs created by RE sector per technology, in Egypt from 2010 till 2030, source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



To conclude, with reference to the latest forecasts, there will be a substantial increase in the number of indirect jobs created by RE technologies in 2020, as it will increase by 103.9%. Between 2020 and 2030, 34,472 indirect jobs will be created. Furthermore, most of the jobs will be created by wind power and PV off-grid combined, while the annual share of solar pumping will only represent 10%, on average, during this ten-year period.

Figure 36: Number of indirect jobs created per technology, in Egypt, from 2010 to 2030, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



3.1.6. Youth and Women Status in the Labor Market

Based on our interviews with the Egyptian stakeholders, the study team has concluded that the gender gap is still high in the RE sector in Egypt, as in the other sectors. Generally speaking, according to (Hegazi, 2019), the gender distribution, when it comes to technicians and engineers, is 70% males and 30% females, whereas the situation is inversed at the experts level where we find 70% of females and 30% of males.

As for the age distribution of the workers in the RE sector, there was no mention of the topic in the literature consulted. The study team have tried to figure out this distribution during the scoping mission, but the results came vague and partially inconsistent. Hence, it should be further studied in the future to come up with a clear picture of youth participation in the RE and EE sectors in Egypt.

3.1.7.EE Measures Impact Analysis – Employment

Unlike RE, measuring the effect of EE on the job creation is really hard and has not been studied a lot in the region. The EE field in the whole MENA region is still underdeveloped and needs to be better exploited in the future. This means it has great potential for creating jobs in the future based on the targets set in each country's NEEAPS, as mentioned in section 1.2.1.

Nevertheless, based on the comprehensive excel-based tool developed under (RCREEE, 2017), the employment effects of the different EE technologies in Egypt were calculated. The tool uses data on the different EE measures used, the employment factor for each of the measures, the level of efforts needed for each part of the supply chain, the Egyptian market employees' productivity level, the economic indicators, such as the GDP, exchange rate and investment amounts, and calculates the potential job creation for Motor, LED production, Power Factor Correction Panel, Lighting and Steam, which are the most used technologies in Egypt. Based on the study team mission to Egypt, the interviews have shown that the data collected in 2017 for EE can be used since no major changes have occured in the sector. For this reason, the

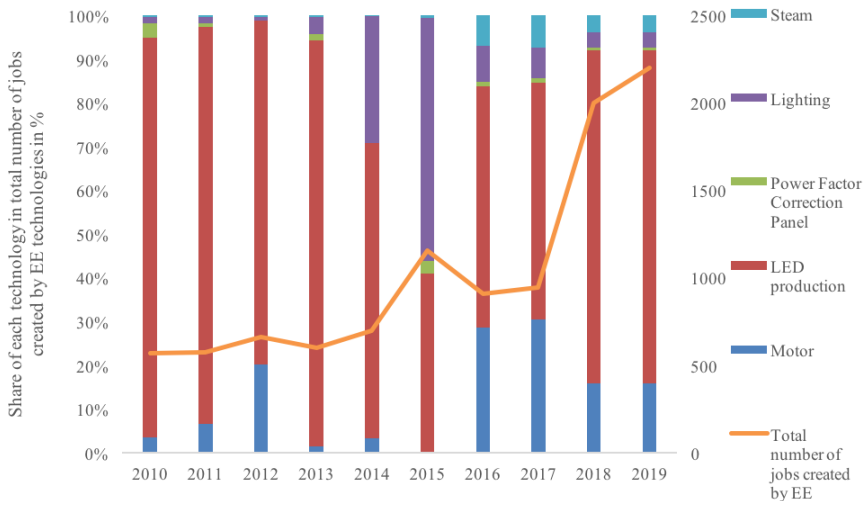
tool was updated with the most recent numbers and the results are analyzed in the following sections.

Looking at the employment figures, we can notice that the number of jobs created substantially increased after 2017, as seen in Figure 37. This trend started in 2015, with the creation of almost 1,158 jobs, even if it decreased to almost 909 jobs in 2016. For the period between 2010 and 2014, the number of jobs created was low, as it was below 1000 jobs. On average, 599 jobs were created, the majority of which were generated by the LED technology, which can mainly be the result of the massive awareness campaigns that were done regarding this topic and the decrease in investments in other EE measures.

In 2013, efficient lightning created around 23 jobs. In addition, 2014 and 2015 were exceptional years, since lighting generated 29% and 56% of total jobs created, respectively. However, in 2016 this share decreased to 8% and, by that, the pattern of the technology mix creating jobs returned back to normal, where LED production constitutes the majority.

Furthermore, while motor technology created 4% and 7% of the total jobs, respectively in 2010 and 2011, its share increased to 20% in 2012. Afterwards, its share sharply decreased until it reached 0% in 2015. Starting from 2016, this technology has been present, with a share that is not less than 15%. Therefore, we can say that there has been an increase in the investment in this sector.

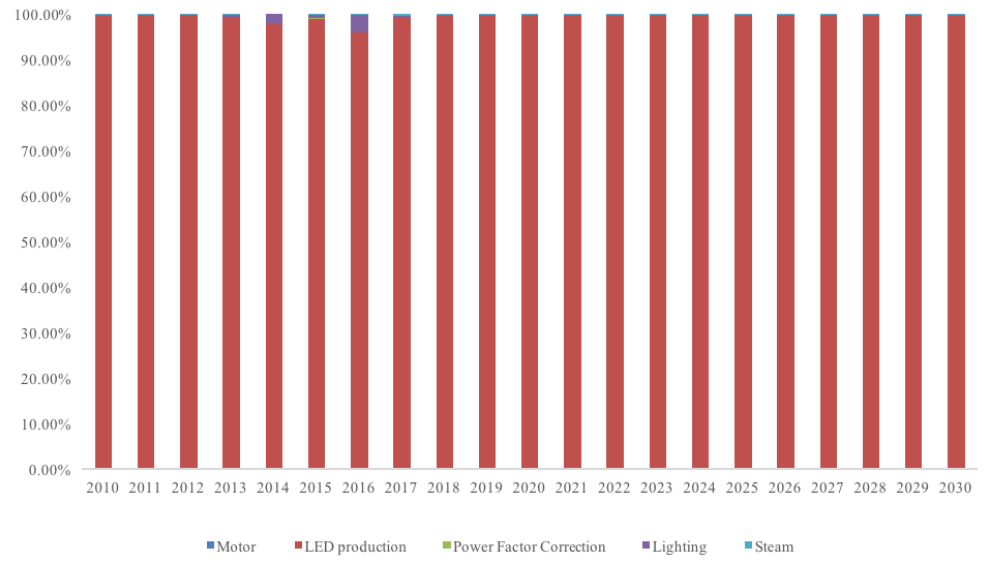
Figure 37: Total number of jobs created by EE technologies and the share of each in total, in Egypt, from 2010 to 2019, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



3.1.7.1. Direct Jobs

As shown in Figure 38, approximately 100% of the direct jobs created was due to LED production technology development over the years. The lowest share was seen in 2014 and it was equal to 97.69%. As seen in the previous section, LED production technology on average drove 76% of the total jobs created. Hence, we can expect the number of direct jobs created is much higher than the one of the indirect jobs. In fact, on average, 76.56% of total jobs created were direct, in nature. Noting that predictions indicate that the situation will be no different in the future.

Figure 38: Share of each EE technology in the total number of direct jobs created by the EE technologies, actual, 2010-2019 and estimated, 2020-2030, In Egypt, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



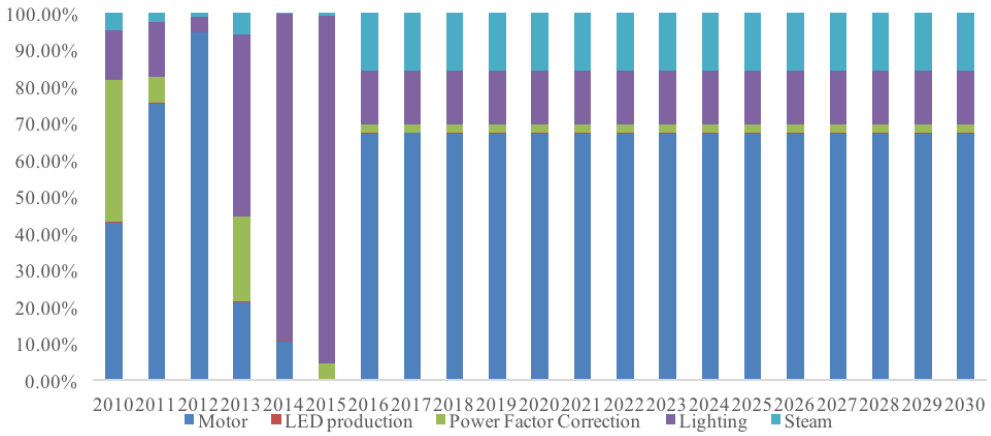
3.1.7.1. Indirect

According to Figure 39, the highest number of indirect jobs created was 679 in 2015 and the lowest one was 40 in 2013. In addition, we can see that the pattern of the shares of indirect jobs was varying over the years between 2010 and 2015. However, the situation has totally changed from 2016 until 2019. For instance, the power factor correction share represented 38.6% of the total number of indirect jobs in 2010. This share decreased to 7.23%, 23% and 4.58%, in 2011, 2013, and 2015, respectively. In contrast, it did not create

any indirect job in 2012 nor 2014. Furthermore, we can see that for the first three years under investigation, the motor technology had a share of 42.76%, 75.2% and 94.53%, respectively. However, in 2014 and 2015, the majority of indirect jobs was created by the lighting technology.

In the period between 2020 to 2030, the pattern will remain the same. The motor, the steam and the lighting technologies are representing around 67%, 15% and 14%, respectively. The number of indirect jobs created will be approximately tripled in 2030, since 516.015 indirect jobs are created in 2019 and it will be 1472.251, in 2030.

Figure 39: Share of each EE technology in the total number of indirect jobs created by EE technologies, actual, 2010-2019, and estimated, 2020-2030, In Egypt, Source: Own calculation based on the update of the tool developed by (RCREEE, 2017)



3.1.8. Recommendations on the Priority Sectors to Focus on in Egypt

The results of the analysis done in the previous section have shown that the wind energy has created most of the jobs in the RE field in Egypt in the past period with an average of 1,225 jobs per year. When it comes to the supply chain, the results have shown that the construction phase creates most of the direct jobs in the solar and wind energy, whilst the operations and maintenance phase creates most of the indirect ones. When it comes to EE, LED production has proved to create most of the direct jobs, whilst motor technologies have created most of the indirect ones since 2016.

One of the most important examples to be mentioned with reference to employment in the RE sector in Egypt, is the Benban project. Considered as one of the biggest solar plants all over the world, with 32 individual plants (20-50) MW each totaling 1,465 MW and producing 4,395 GWh, the Benban project succeeded to create a lot of new direct and indirect jobs in the Benban area. The project is estimated to employ almost 10,000 workers over its lifetime. Economic and environmental impacts can be monetized in the future following the externalities definition, so as the project is expected to save 2 million tons of CO_2 per year. It is also worth noting that the project created a new community environment, which did not exist before and contributed massively to improving the livelihood of people living there.

As the Egyptian 2030 Strategy foresees a substantial increase of the RES share, particularly of solar PV, in the future the power, industrial, transport and building sectors will be a priority. Furthermore, the agriculture sector remains an important component of the Egyptian GDP and is considered as its main competitive advantage. The biogas energy would help a lot in promoting the agriculture production and empowering farmers, especially female ones. It is inevitable that the exports depend massively on agriculture, and Egypt is a member of many international agreements related to green trade. Hence, improving the efficiency of the sector will improve the trade balance and lead to the increase of the indirect positive impact of RE on employment.

Focusing on the supply chain, the focus should be on having more manufacturing in the country in order to increase the local components and, thus, the number of direct and indirect jobs respectively, which may lead to increasing the trade between the SEMCs in the future. There should be laws and regulations enforcing a certain amount of local manufacturing of the RE and EE components, which is necessary for the stability of permanent jobs as well as for the transformation from intermittent to permanent jobs.

With respect to the most important labor-intensive technologies, in the future priority should be given to the solar heating, due to its major potential. This technology is still untapped despite the very successful examples that have been proven in other countries, such as Tunisia and Lebanon. Subsequently, the decentralized off-grid solutions should also be prioritised in the next years because of the major impact they can have on creating employment as well as on increasing the livelihood in such places. Furthermore, emerging tech-

nologies, such as the electric vehicles, will have a great potential in the future as their potential has not been explored in most of the countries yet.

Therefore, a series of activities are still needed to identify the existing country capacity to accommodate the upcoming changes in the sector, in particular the expected need to raise RE contribution to the energy mix, which will bring the new technologies, such as E-Mobility, large scale utility electricity, thermal storage, and artificial intelligence.

Finally, we should further invest in a better qualification of man power to adapt to the requirements of the modern solar and wind industry: youth aging between 20 to 35 years will be key in order to increase the productivity of the sector and to facilitate the creation of new jobs in these fields. It is worth noting that Egypt has recently launched two or three focused graduate programs on RE and EE in three of its major universities and has included dedicated courses related to RE in its undergraduate engineering programs, whose graduates should be offered good jobs in the country. Finally, women should be given more roles in these sectors, in order to achieve the envisaged gender equality in the near future and increase their participation in these sectors.

4.1. Lebanon

4.1.1. Macroeconomic Context

The Lebanese economy is service oriented, comprising mainly business services, hotels and restaurants, health and education services as well as financial services. The service and banking sectors accounted for more than 76.67% of Gross National Product (GNP) in 2016, industrial sector for 20.13% and agriculture only for 3.2%. Lebanon was classified as an upper-income country by the World Bank.

As subsequences of the war in Syria, Lebanon received a considerable number of refugees that increased the population from 4.9 million in 2012, to 6.1 million in 2017, which represents a growth rate of 5.5%. Figure 40 shows the variation of the country population between 2012 and 2017. During the same period, the country's GDP moved from around USD 39.82 billion, in 2012, to USD 42.80 billion in 2018, reflecting a growth rate of 7.5%, as shown in Figure 41;whilst the GDP per capita continued its decline started in 2007, due to the subprime financial crisis despite the slight improvement that occurred in 2015. In fact, the continuous decrease in the Lebanese GDP per capita simply shows that the population increase in the country surpassed the GDP increase over the years (World Bank, World Development Indicators and Sustainable Energy for All). Additionally, this significant population growth can be also considered as one of the main sources of the increase in electricity demand and consumption in the past years. Figure 42 illustrates that, starting from 2012, the electricity consumption increased dramatically, especially between 2012 and 2013. The total consumption in 2012 was 13,776 GWh, then it increased to 16,358 GWh in 2013 (18.7% increase). However, the consumption in the following years was slight compared to 2013, as it reached only 16,966 GWh in 2016

.

Figure 40 : Population variation between 2012 and 2017 in Lebanon (World Bank, 2012-2018)

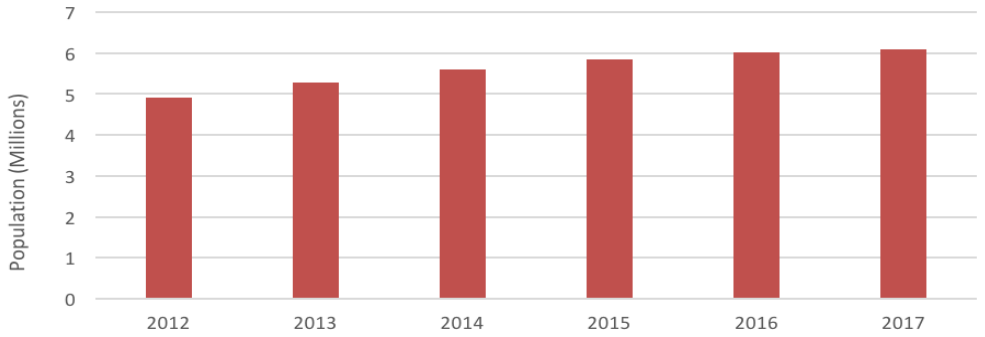
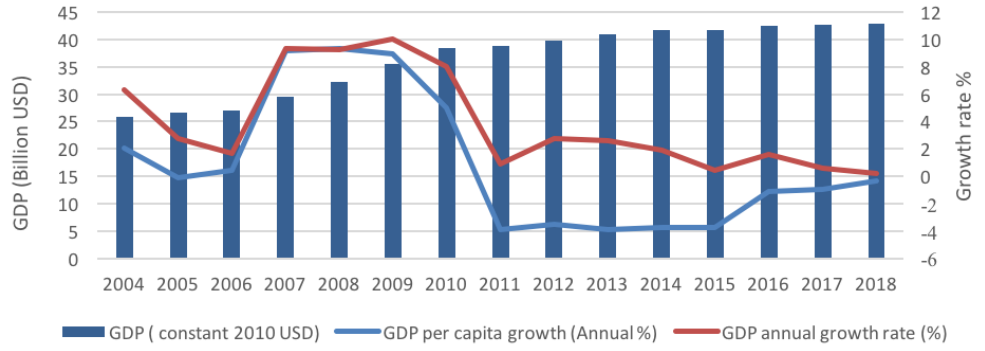


Figure 41: GDP level (in Billion USD) and growth rate (in percentage) and GDP per capita growth rate (in percentage) in Lebanon from 2004 to 2018 (World Bank, World Development Indicators)



4.1.2. Electricity and Renewable Energy Market in Lebanon

Focusing on the electricity consumption per economic sector in Lebanon, Figure 42 shows that the residential sector represented 39% of the total consumed electricity in 2016. In addition, due to the population increase, the electricity consumption in residential sector dramatically increased between 2012 and 2013 by around 1000 GWh. Furthermore, due to the significant gap between supply and demand, a big share of residential buildings relies on diesel generators in order to compensate this deficit. However, the high prices of electricity provided by these private diesel generators along with the increasing population can contribute to the promotion of solar home systems and, consequently, to the employment stimulation in the solar energy field. On the

other hand, the electricity consumption shares of the industrial and commercial sectors were around 26% and 16% respectively in 2016. Figure 43, illustrates the electricity consumption over the last 10 years (IEA, Statestics, 2010-2016).

Figure 42: Electricity Consumption (GWh) in Lebanon 2012-2016 (IEA, Statistics , 2012-2016)

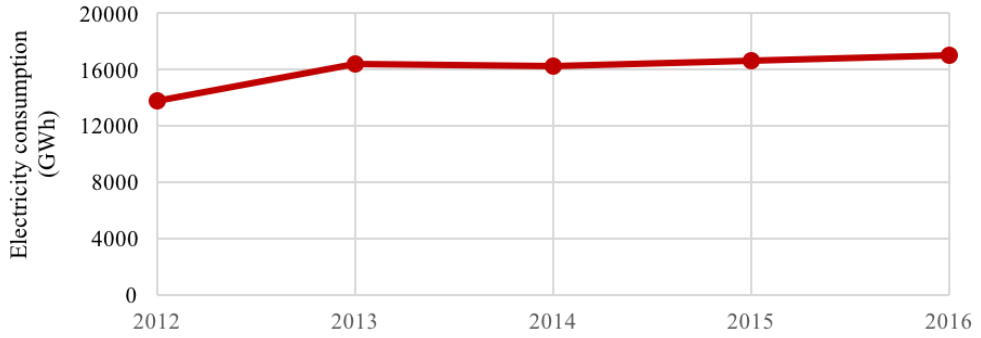
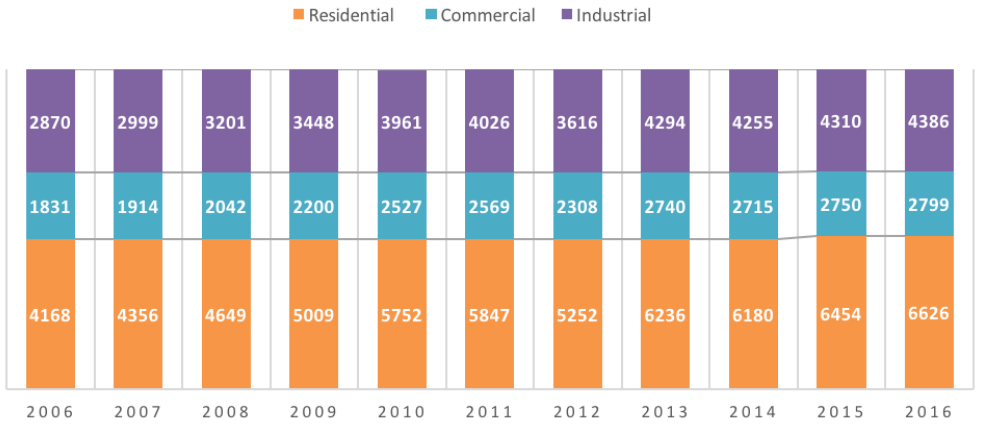


Figure 43: Electricity consumption (GWh) per sector in Lebanon (IEA, Statistics, 2012-2016)



Lebanon is blessed with an abundance of water, wind and sun. However, this potential is so far nearly not explored as citizens, even in the center of Beirut, face daily power cuts of at least three hours. As of 2017, the maximum electricity generation capacity was 3046 MW, far less than the 2017 summer peak demand of 3500 MW (AUE Stastistical Bulletin, 2017). This shows that the country currently suffers from a deficit between supply and demand. This fact has been validated by most of the interviewed Lebanese experts that estimated the gap by around 2 GW. Unfortunately, a series of political hurdles have deprived the Lebanese people from enjoying a steady provision of power.

The strong political influence of generators' owners poses a threat to the consistent supply of electricity. The generator's market size amounts to $1.5-$2 billion, which highlights the magnitude of the business (Dziadosz, 2018). The strong relationships that the owners built with key governmental officials are a major hindrance to the growth of renewable energy production. However, the government of Lebanon is aware of the importance of renewable energy technologies and energy efficiency measures for the resolution of the Lebanese electricity system challenges and, thus, for the improvement of the country's energy situation. Hence, the Lebanese government developed its second National Energy Efficiency Action Plan (NEEAP) for the period 2016 to 2020, building on the initiatives proposed in the first NEEAP 2011-2015. The implementation of the NEEAP 2016-2020 would need between 600 and 950 Million USD over a period of 5 years, creating a huge positive market momentum (LCEC, 2017). The implementation of the NEEAP would result in savings exceeding 225 Million USD per year starting from 2020. The sum of the overall estimated savings of the proposed measures over the 5 years of the second NEEAP's implementation are around 686.1 GWh for the power sector and 828.1 GWh for end-use energy. That would imply a total saving of 1,514.2 GWh over the 5 years leading to average yearly savings of 302.9 GWh (LCEC, 2017). Additionally, the developed Renewable Energy Action Plan (NREAP), covering the same period 2016-2020, set out the country's primary purpose of achieving 12% of renewable energy by 2020, through three main pathways: First, by increasing wind energy production reaching 2.06% of the energy demand; second, by increasing solar energy production to meet 4.2% and by increasing biomass use reaching 2.5% of energy demand by 2020; finally, the remaining renewable energy capacity will be met by new and existing hydropower plants (LCEC, 2017).

Hydropower is currently considered as the most established renewable energy source in Lebanon and contributes to around 4.5% of the energy mix with a nominal capacity of 280 MW. Lebanon is currently looking to expand hydropower with the recent call to "build and operate hydroelectric plant". However, hydraulic energy production has largely been inconsistent due to intermittent rainfalls and poor maintenance (MEW, 2018).

According to the Wind Atlas published in 2010, Lebanon has the potential to produce, approximately, 5,400 MW of wind energy (UNDP, 2010). However, the wind energy sector is new in Lebanon with no prior experiences in the

installation and operation of wind farms. The GoL has recently selected and signed a PPA with 2 private developers for the installation of the first 200 MW wind farm in the Northern and mountainous district of Akkar. In fact, using this wind farm, Electricité du Liban (EDL) will sell the generated power and provide stable electricity for around 145,000 households.

This process has been followed by an additional bidding process, currently under way, to install additional capacity between 200 and 400 MW (UNDP-CEDRO, 2019).

Solar energy is also a valuable resource in Lebanon. With around 3000 hours of sunshine, adding this energy to the national grid could greatly contribute to the growth of clean energy in Lebanon. Solar PV is already a solid sector with a decent number of competitive private companies in Lebanon, where solar energy currently represents around 0.6% of the country's energy mix (UNDP, 2017). In order to grow this energy source and upscale its total installed capacity that is currently around 20MW, the MEW is launching, through Power Purchase Agreements (PPAs), two separate bids for solar PV farms with total production capacity of around 450 MW, (MEW, 2018). Additionally, it is considered that solar PV can contribute towards the decentralization of power supply. The market trends show an increasing interest in the installation of this kind of facilities.

On the other hand, Solar Water Heating is considered as one of the most developed RE local markets with an estimated value of USD 30 million in 2012. The SWH market is mostly composed of open vacuum tubes (79%), Flat plate collectors (66%), and a minor share of compound systems (7%) (UNDP,2014). A target of 1,054,000 m^2 of cumulative installed SWH area has been announced in the NREAP 2016-2020. Until December 2016, the total area installed reached 525,000 m^2.; whilst since 2011, the Lebanese market has been steadily growing by almost 50,000 m^2 per year, thus more than doubling its magnitude after relying on the loans and subsidies provided by the banks through BDL and the MEW.

4.1.3. General Characteristics of the Labor Market in Lebanon

The Lebanese labor market is highly complex, its various aspects are fragmented and should be dealt with separately in order to understand them.

In general, the Lebanese labor market is characterized by low activity and employment rates, a low contribution of women to economic life, a large informal sector, a high influx of foreign workers, and a large number of skilled Lebanese people seeking and obtaining employment abroad. A fundamental problem pertaining to youth unemployment is the long time spent searching for jobs by those, who want to enter the labor market for the first time. In addition, young people face challenges related to permanent work and fair wages. The average length of unemployment is one year, what is internationally classified as long-term unemployment.

Before the Syrian crisis, labor market conditions in Lebanon were already dire: high unemployment rates coexisted with skills mismatch in the labor market and a high prevalence of low-quality and low-productivity jobs. The massive influx of Syrian refugees increased the labor supply by around 40% with the largest impacts on women, young people and unskilled workers.

In terms of job creation, Lebanon needs to create six times more jobs than the current situation, in order to absorb the 23,000 yearly labor market entrants. A shift has been registered to the low-skill sector with a small wage increment between primary, secondary and tertiary education, with a low return on education, and further stimulating brain drain. Most of the SMEs in the country play a major role in the Lebanese economy, yet need major support.

4.1.4. Youth and Women Status in the Labor Market

Labor market data are scarce, incomplete and outdated. Moreover, there is contradiction in some of the figures available. Unemployment rates are assessed at 6.7% by the World Bank in 2016, at 10% by the Central Administration of Statistics in 2012, at 25% by the Ministry of Labor and the National Employment Office in 2017.

Youth unemployment is high. The National Youth Policy Document states that youth unemployment rate is 35% and unemployment is higher among the highly educated ones: 21.8% for secondary graduates and 36.1% among university graduates. Educated people spend almost the same time to find a job as those who are less educated, with 1.4 years for secondary education graduates and 1.2 years for tertiary education graduates.

According to the Central Administration of Statistics, the labor force participation rate is 49.2% with only 25.6% of female participants, which is considered as one of the lowest female activity rates in the world. This is attributed to social, cultural and economic reasons. Female employees have a higher educational attainment level with 43% of employed women having a university degree. Moreover, 76% of those employed between 15 and 64 years old are males, while 24% are females. The wage gap between males and females amounts to 6% based on 2009 data.

4.1.5. RE Projects Impact Analysis – Employment

Generally, as fuel input management is not necessary in most technologies, with the exception of the bioenergy technology, the RE sector generates more jobs than fossil-fuel based energy as more people are needed, especially at the construction, manufacturing, and installation stage, and less in the operation and maintenance phase. Since RE supply is more labor-intensive than traditional fossil-fuel-based supply, per MW and per dollar, RE industry generates between 1.8 and 4 times more jobs per MW installed than conventional sources. Additionally, jobs created by the RE sector can also be safer in terms of potential health risks, compared to employment within the fossil fuel energy sector, ensuring longer-term employment periods and increased human capital.

4.1.5.1. Solar PV

With more than 3.61 million jobs created in 2018, solar PV requires the highest number of workers among renewable energy technologies (IRENA, 2019). Recently, the UNDP assessed the jobs created across different active segments of renewable energy supply value chain in Lebanon. According to this study,

it is estimated that around 641 indirect jobs can be created through the installation of 73MW of solar PV, which represents 8.8 jobs/MW (UNDP-CEDRO, 2019). However, as one of the emerging RE technologies in Lebanon, the current installed capacity of solar PV is around 40 MW, and this contributed to the creation of around 670 direct and indirect jobs over the past years (UNDP-DREG, 2017).

The total number of cumulative created direct jobs related to the current solar PV installed capacity in Lebanon is, thus, around 304 jobs, representing 7.6 jobs/MW. The current number of jobs created per MW can be used as the employment factor for the estimation of the potential of Solar PV technology.

According to the conducted interviews, most Lebanese stakeholders claimed that thanks to the economic maturity of the Lebanese service sector, the service components of the supply chain for RES technologies, such as design, planning, installation, transportation and logistics, and operation and maintenance, witness high opportunities for local provision. However, due to the lack of the required infrastructure, experience and skilled labor for producing renewable energy systems, local manufacturing of the main components is difficult to achieve in the short-medium term. Consequently, most of the conducted studies show that possible jobs will be mainly created during the construction and O&M stages in Lebanon for all renewable energy technologies.

According to the NREAP and conducted interviews, the upcoming solar PV projects together with other renewable energy projects, are summarized in Table 5. The present data show that the total installed capacity of solar PV systems in the country by 2021 will be around 948.3 MW, which will create more than 7,274 of direct cumulative jobs and 8,949 of indirect cumulative jobs.

Based on the targeted installed capacity in the country and according to the latest study conducted by UNDP-CEDRO on the assessment of job created within the RE sector in Lebanon, Table 6 summarizes the estimated number of direct and indirect jobs created through investments in solar PV technology across different existing segments of the supply chain based on short-term plan in Lebanon. The installation stage is able to create much more direct and indirect jobs than the operation and maintenance one as new projects will be commissioned every year.

Table 5: Renewable Energy Projects in the Pipeline, (LCEC, 2018)

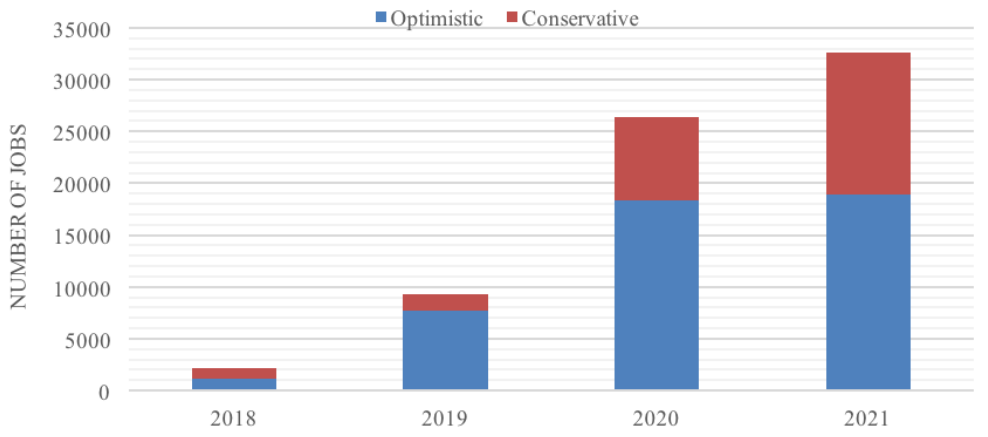
Technology	Installed Capacity	Future projects	Completion Year
Wind	Negligible	Round 1 200 MW: 60MW + 60MW + 80MW	2020
		Round 2 200 MW to 400 MW	2021-2025
Solar PV	40 MW	Round 1 Solar plant 180 MW	2020
		Round 2 solar plant 360 MW	2020
		Round 2 solar plant 360 MW	2021-2025
		Round 2 Beirut River Solar Snake (BRSS) 7MW	2019
		10 public bids project: -300 kWp at the Casino du Liban -200 kWp at Beirut Port -300 kWp at the Lebanese University	2019
		541 kWp in 113 public schools with the Ministry of Education and Higher Education	2019
CSP	None	50 MW as per NREAP 2016-2020	2019
SWH	660,000 m^2	Normal annual growth is around 50,000 m^2 and expected to increase once the solar ordinance is implemented.	2019

Table 6: Estimation of the number of direct and indirect jobs created through PV projects in Lebanon (Own estimation based on RCREEE data)

Year	2018	2019	2020	2021
Cumulative capacity	**40**	**48.3**	**588,3**	**948,3**
Number of jobs during the construction	301	62	4066	2710
Number of jobs in O&M	3	7	48	77
Total number of direct jobs	**304**	**69**	**4114**	**2787**
Number of indirect jobs related to construction stage	333	69	4503	3002
Number of indirect jobs related to O&M stage	17	37	290	698
Total number of indirect jobs	**350**	**106**	**4793**	**3700**
Total number of jobs	**670**	**175**	**8907**	**6487**

Recent studies conducted by the UNDP CEDRO and the Lebanese Ministry of Energy and Water provided similar estimations for the cumulative number of jobs created in the Solar PV field by 2021. In fact, the optimistic scenario shows that almost 6,267 jobs will be created by 2021 while the conservative scenario estimates only 4,619 direct jobs. Figure 44 shows the total estimated number of direct and indirect jobs created based on the two scenarios between 2018 and 2021. It can be noticed that almost 6,500 jobs will be created during the first two years while starting from 2020 more than 12,000 employees will join different segments of the solar PV supply chain.

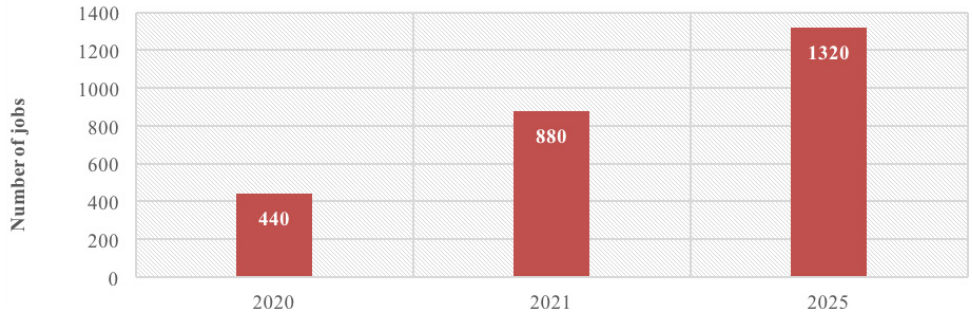
Figure 44: Solar PV employment estimate between 2018 and 2021 in Lebanon. Source: (UNDP, 2019)



4.1.5.2. Wind

Looking at the neglected investments and current installed capacity of wind turbines, the jobs created through this technology can be considered insignificant in the present. However, in order to assess the future employment, a regional wind power employment factor can be utilized for reasonable estimations. This employment factor can be calculated based on the actual employment factors in Egypt and Tunisia that represent 1.1 and 3.3 respectively (RCREEE, 2017). Thus, the estimated wind energy employment factor is around 2.2 direct jobs per MW installed. Moreover, according to Figure 45, the total targeted capacity will be around 600 MW by 2025, which can create 1,320 direct jobs.

Figure 45: Evolution of the possible number of jobs created related to wind energy projects in Lebanon. (Own estimation based on RCREEE data)



The assessment of jobs, created by the supply chain of wind power along with created indirect jobs, can be conducted based on the presented estimation by the UNDP CEDRO and according to the planned total installed capacity. Table 7 illustrates the estimation of the number of direct and indirect jobs that can be created across different segments of the supply chain by the wind energy projects in Lebanon. The total cumulative number of jobs created will be around 5940 by 2025. Additionally, as shown in Table 7, the installation and construction stages are generally more labor intensive than the O&M stage, except during the last year where the number of indirect jobs created in O&M becomes higher than indirect jobs related to construction stage. This last finding has been also stated by most of the interviewed stakeholders in Lebanon, who considered that most of the permanent jobs will be created within the operation and maintenance stages.

Table 7: Estimation of the number of direct and indirect jobs created through Wind in Lebanon, (Own estimation based on RCREEE data)

Year	2020	2021	2025
Cumulative capacity	**200**	**400**	**600**
Number of jobs during the construction	720	720	720
Number of jobs in O&M	57	114	171
Total number of direct jobs	**777**	**834**	**891**
Number of indirect jobs related to construction stage	656	656	656
Number of indirect jobs related to O&M stage	245	490	735
Total number of indirect jobs	**901**	**1146**	**1391**
Total number of jobs	**1678**	**1980**	**2282**

On the other hand, UNDP studies estimate that, by 2021 the total cumulative number of employees in the wind energy field will reach 2,753 employees, based on the optimistic scenario; whilst this number drops to only 302, in case of the conservative scenario. This significant difference between the two scenarios is related to the final total predicted wind power capacities. In fact, the optimistic scenario considers the construction of two projects: the first one of 200MW in 2020 and, then, another one of 300 MW by 2021; whereas the conservative considers only one project of 200 MW and, thus, it does not consider any jobs created during the installation phase in 2021.

4.1.5.3. Solar Water Heating

The conducted interviews confirm that Solar Water Heating systems are the most used renewable energy in Lebanon, with more than 550,000 m^2 of cumulative area in 2017. Further, it has been mentioned that the number of direct jobs created in 2017 through the installation of ~ 50,000 m^2, is around 1,000 jobs, meaning 2 jobs per each 100 m^2. The current employment rate makes possible estimating the jobs that can be created in the solar water heating field, based on the targeted total cumulative area by 2020 and according to the yearly average growth. Hence, the total estimated number of direct jobs to be created by 2020 is around 21,080 jobs. Apart from that, residential SWH can opt for low interest loan backed by BDL for systems that do not exceed 5,000$. Additionally, customers using systems from companies qualified by LCEC, may benefit from a 200$ rebate, through the bank loan. These available financial schemes have a high impact on catalyzing the SWH market for domestic use. Consequently, and according to the UNDP study (UNDP, 2014), the residential sector share represented 74% of the total installed area in 2014, followed by the commercial sector with 22% and finally the industrial sector. Furthermore, 90% of Lebanese stakeholders claimed that the residential buildings will remain the most labor-intensive sector for SWHs, if the government will not implement any new policies or financial schemes to promote the utilization of SWH in the commercial or industrial sectors. This latter is useful to assess SWH employment capacity per sector in the coming years, based on the total estimated number of jobs by 2020. Figure 46 illustrates the estimated number of direct jobs created per sector: the residential sector can create more than 15000 jobs, followed by the commercial sector, where more than 4000 jobs can be created and, finally, the industrial sector with the lowest number of jobs.

Figure 46: Share of the installed SWH area per sector in Lebanon, (UNDP, 2014)

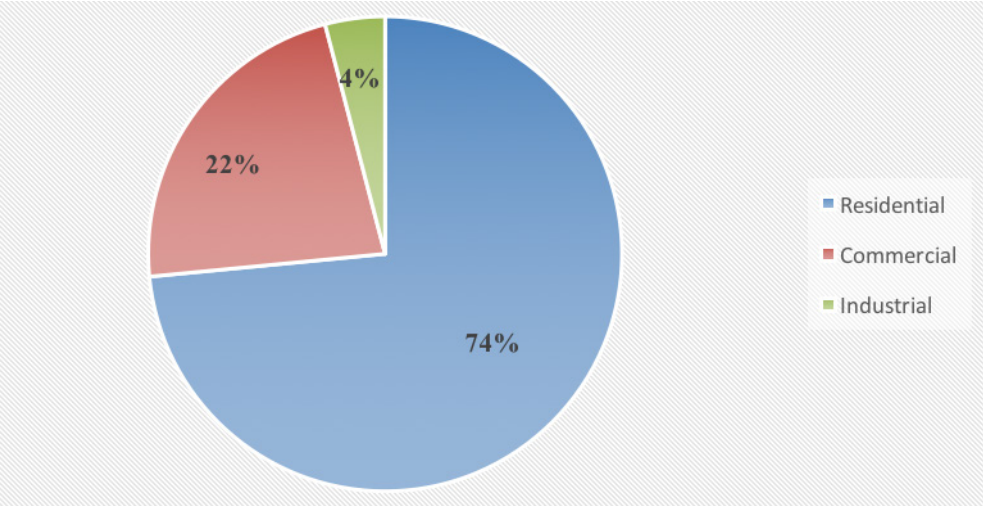
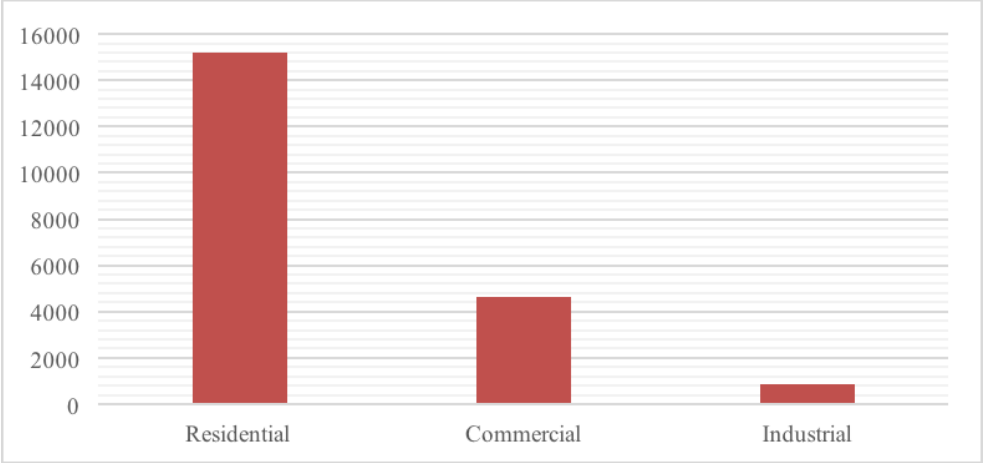


Figure 47: Estimated number of direct jobs created per sector by SWH technology in 2020, (Own estimation based on RCREEE data)

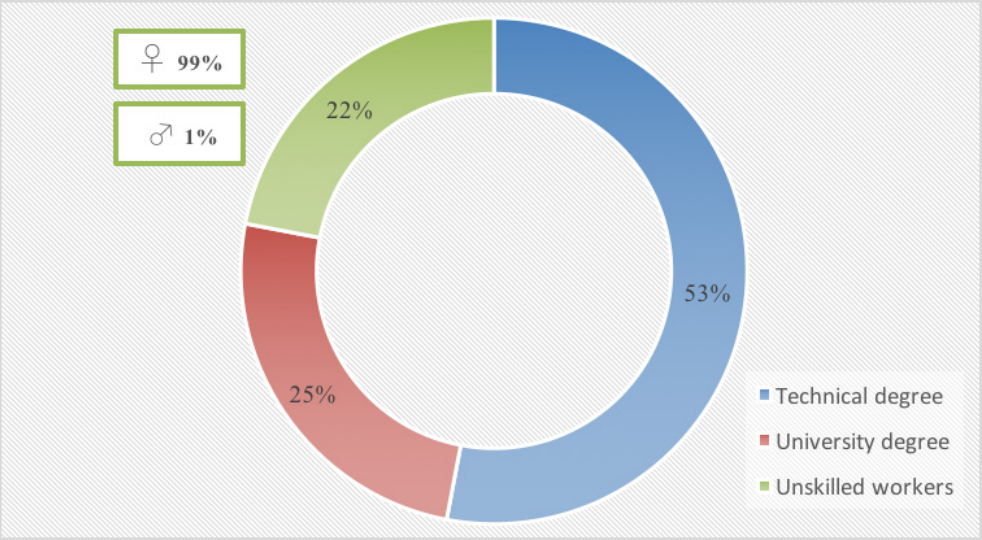


4.1.6. Labor Profiles and Gender

The interviews conducted with different Lebanese stakeholders show that qualified employees, with technical degrees, occupy more than 50% of the total jobs created in Lebanon, followed by employees with university degrees, that represent around 25%, while the rest of the jobs are occupied by unskilled workers (Figure 48). Moreover, females represent 10% of the total number of employees in the renewable energy field, as they represent around 40% of

highly skilled labor with a university degree, but only 1% of the employees with technical degrees (Figure 48).

Figure 48: Labor profile and gender distribution in renewable energy market in Lebanon. Source: Own estimation based on interviews



Research and academic institutions should support the promotion of renewable energy technologies, by providing qualified candidates to the local markets. According to our interviews, it has been shown that several renewable energy programs and courses have been launched recently, in order to accompany the development of renewable energies in the country. In addition to the master's program in RE offered as part of a joint graduate program between the faculties of engineering of the Université Saint-Joseph (USJ) and the Lebanese University (LU), several graduate and undergraduate programs integrated renewable energy courses. Moreover, another professional graduate degree in RE is PRO-GREEN Technologies that has been launched jointly by the Lebanese American University (LAU), the American University of Beirut (AUB) and the American University in Cairo (AUC), and co-financed by the European Union Tempus grant and the Munib and Angela Masri Institute of Energy and Natural Resources. Also, several professional vocational trainings have been held by national and international organizations for the installation and maintenance of solar PV systems. These consisted in a 60-hour course, targeting technical schools integrated into the curriculum by the Small Decentralized Renewable Energy Power Generation (DREG) Project. This resulted

in the graduation of qualified solar PV technicians, DREG donated PV lab equipment to the schools and connected solar PV companies in Lebanon with the employment offices of technical schools. Furthermore, there are professional trainings provided by UN-ESCWA for solar PV installers as well as several train-the-trainers programs. As a result, the country has currently more than 5000 annual graduate students with basic knowledge on renewable energy and energy efficiency and between 30 to 40 specialized graduates in renewable energy.

4.1.7.EE Measures Impact Analysis – Employment

Due to the lack of studies and initiatives focusing on the impact assessment of EE measures on employment in Lebanon, it was difficult for all interviewed stakeholders to estimate the potential of the current energy efficiency strategy in the country. As stated above, Lebanon has developed and adopted the second National Energy Efficiency Action Plan (NEEAP) 2016-2020, which is divided into two main sections: the power sector measures and the end-use measures. The power sector measures tackle energy efficiency in electricity generation, transmission and distribution while the end-use comprises 5 types of measures:

1. Horizontal End-Use measures
2. End-Use measures in the Building Sector
3. End-Use measures in the Industry and Agriculture
4. Measures in Mobility and Transport
5. End-use measures in The Public Sector

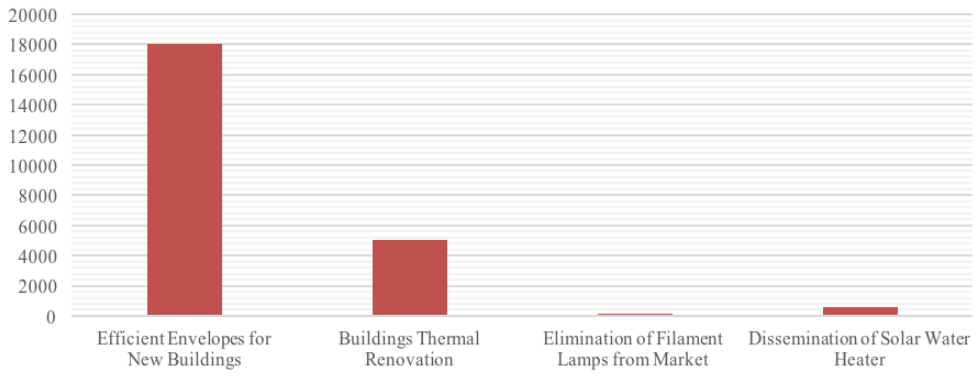
As illustrated in Table 8, the total required investments for conducting EE measures in power generation sector is around 473.5 Million USD, which will provide 687 GWh energy saving. Moreover, in order to achieve 828 GWh of energy savings , an investment of 748 to 843 Million USD in different end-use measures has to be ensured, as detailed below. The total investment needed for enforcing different EE measures can reach 1316.5 Million USD, which will allow the country to save more than 1500 GWh per year.

Table 8: Required investment and expected savings due to energy efficiency strategy in Lebanon, (LCEC, 2018)

Sector	Measures	Investment (Million USD)	Savings (GWh)
Power Sector Measures		473.5	687
End-use Measures	Horizontal measures (MEPS, awareness campaigns)	587.8	49
	Building sector	37.2	149
	Industry and Agriculture	120.6-215.6	610
	Public sector	2.2	20
	Sub-total	**748-843**	**828**
	Total	**1221.5-1316.5**	**1,514**

Furthermore, the Plan Bleu project, the only study tackling the effects on employment of the EE measures in the building sector in Lebanon, estimates that up to 23,750 jobs can be created by 2030. The main measures that have been considered cover the first two types of the current Lebanese NEAAP and are related to efficient envelopes for new buildings, buildings thermal renovation, elimination of filament lamps from the local market, as well as dissemination of SWH. Figure 49, below, illustrates the total potential for job creation in Lebanon through EE measures in the building sector by 2030 (Plan-Bleu, 2011).

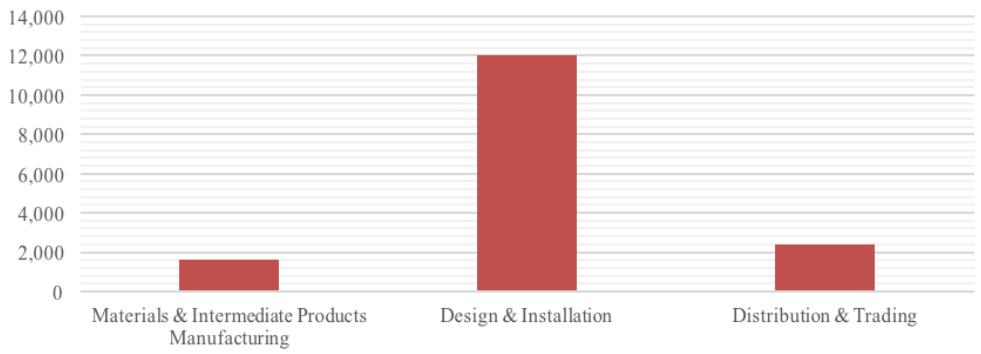
Figure 49: Potential of jobs creation due to EE measures in building sector in Lebanon by 2030, (Plan-Bleu, 2011)



It is easy to notice that the most labor-intensive EE measure is the generalization of efficient envelopes for new buildings, which includes the manufacturing of materials and intermediate products, design and installation as well

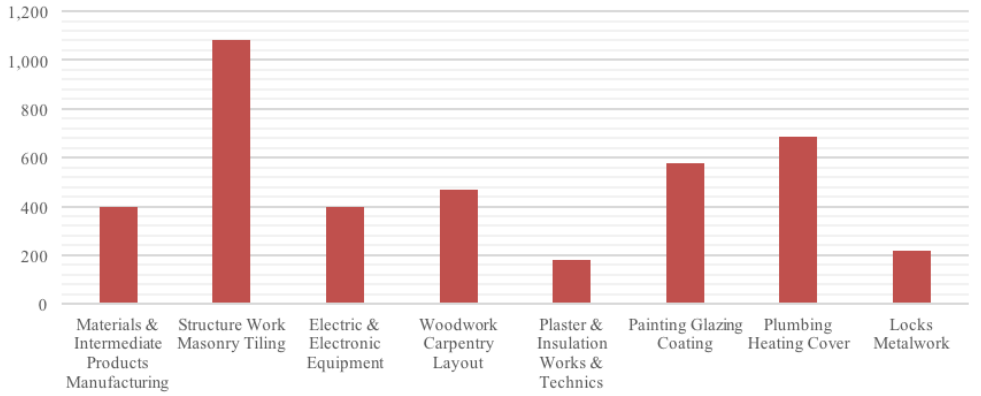
as distribution and trading. Figure 50 summarizes the job potential related to these last three activities, acknowledging that design and installation is the most labor-intensive activity.

Figure 50: Job potential related to the mainstreaming of new building envelopes by 2030, (Plan-Bleu, 2011)



According to Figure 51, thermal renovation of existing buildings is ranking second in terms of potential for job creation with around 5000 new jobs. The EE activities included in this activity are mainly manufacturing of construction materials and intermediate products, of electric and electronic equipment, of plumbing heating cover, woodwork as well as structure work and masonry tilling, which is considered as the most labor-intensive activity in new building renovation, as shown in Figure 51.

Figure 51: Job potential related to the thermal renovation of buildings by building trade by 2030, (Plan-Bleu, 2011)



4.1.8. Recommendations on the Priority Sectors to Focus on in Lebanon

Domestic RE market is still not mature in the country due to the absence of local industry. In order to increase the productivity of the existing local producers, catalyze the private sector participation and turn RE deployment into socio-economic successes, several policy measures should set up to generate effects on the different RE value chains and on job creation.

The results previously presented in this report show that, during the next decade and according to the fixed targets, SWH technology is expected to be the most labor-intensive source of energy with around 21,000 cumulative direct and indirect jobs by 2020. Furthermore, wind energy projects would create on average 800 direct jobs per year where most of them are created during the construction phase. However, most of them are indirect jobs, particularly in the service and infrastructure sector. In fact, infrastructure is needed for the transport of wind farm components in the harbors or along national roads. Such activities need planning and supervision, which entails most of the service sector.

As Solar PV is expected to be more labor intensive when it comes to permanent jobs, the orientation of investment should be towards installation and operation and maintenance of new solar plants. However, the learning curve of solar energy is not as steep because there are many experts and several active companies for PV systems in the country. Furthermore, since the local companies for PV cells and modules manufacturing will not be able to compete with international ones, especially Chinese ones, the segments of the supply chain that could be tackled the most are the installation stage, including system design and testing as well as certification and quality assurance. The unpredictable and fluctuating prices of diesel present a good opportunity for promoting distributed Solar PV systems that start competing with price of conventional sources, thus becoming economically attractive and capable of generating much more jobs in the near future.

On the other hand, adopting energy efficiency measures and regulations will support the creation of jobs across the supply chain of different industries. As previously stated, the application of EE measures and actions planned in the

NEEAP will have a considerable socio-economic impact via the generation of more than 23,000 new jobs by 2030. Most of these jobs will be created through the generalization of efficient envelopes for new buildings, including the manufacturing of materials and intermediate products, their design and installation as well as distribution and trading. Hence, this can be ensured by establishing clear regulations and buildings codes. Additionally, the development of a MEPS and Labeling program for home appliances and industrial motors would contribute to the creation of additional permanent jobs across different segments of the program's implementation, such as testing, label issuing and market surveillance.

Furthermore, offering education programs for all RE technologies along the value chain is crucial to build calibers capable of ensuring necessary assistance by increasing the efficiency of the system, thus ensuring the sustainable deployment of renewable energies in the country. In addition to several professional vocational trainings for PV and SWH installers provided by different NGOs and training centers, Lebanon has around 5000 new graduates with basic knowledge on RE and EE annually. Furthermore, most of the technical universities have specialized programs on RE in addition to several courses in different master's degrees. Moreover, investing in R&D is essential to increase the maturity of the market and build a national industry. Hence, the organization of awareness campaigns, especially for youth, is important to attract young generations to the RE field.

It is worth highlighting that in order to increase the productivity in different RE and EE sectors/sub-sectors and ensure the transfer of knowledge between generations, the Lebanese government has to adopt necessary measures to ensure the smooth involvement and participation of youth in these fields. Also, a special focus should be given to highly qualified graduates in order to stop brain drain.

5. Conclusion

It is crucial that RE and EE projects are implemented in SEMC, especially those presented in this study. Due to their nature, such projects will help the countries to improve their economies, whether through the decrease of GHG emissions, the improvement of the trade balance and/or the creation of new jobs. In order to ensure a successful energy transition process, investment in RE and EE projects is inevitable, but also accommodating policies, e.g. the elimination of fossil fuel subsidies. Egypt and Tunisia have already started to liberalize their energy markets. Another advantage of RE and EE is the fact that they increase the access to electricity, especially in rural areas. The main aim of this report was to give a full assessment of the number of jobs created, by technology and per supply chain, during the last decade by such projects, and to provide future forecasts, based on the employment factors and given the future targets of installed capacities.

Accordingly, in 2015, 3,000 jobs have been created by both RE and EE projects in Tunisia. It has been concluded that most jobs created by RE projects were during the construction phase. In addition, EE in buildings generates most of the jobs, especially in the installation phase. Most of the jobs created were by the PROSOL project; for instance, in 2015 1,465 jobs were created, including 1,200 installers, 52 suppliers and 7 local manufactures in the SWH industry.

In Egypt, in general, wind energy is the major contributor to job creation, compared to other RE technologies. While LED production has created most of the direct and indirect jobs. However, since 2016 motor technology was taking over the majority of EE indirect jobs. The changes in electricity and fossil fuels subsidies have had an impact on the energy use; and major changes in RE and EE markets will be witnessed in the next period, when more jobs will be created in the industry.

In Lebanon, the residential sector accounts for the majority of jobs created by the SWH technology, and the estimates shows that it will still be responsible for 90% of jobs created in the SWH field, if no new policy and/or financial schemes are adopted to increase their use by other sectors. Moreover, more than 23,000 jobs could be generated from the deployment of renewables in Lebanon. Until this moment, Solar PV projects have contributed to 670 direct

and indirect jobs mainly at the installation stage and it is expected to create more than 6400 jobs in 2021. Additionally, it is estimated that wind energy projects will create more than 2200 new jobs only in 2021.

Although it is was not mentioned in the report, the very recent study conducted in Algeria by (Lehr & Banning, 2019) to assess RE expansion takes into consideration two different scenarios: the base scenario and the scenario based on the declaration of the government in 2018. In the base scenario, the RE is expected to satisfy 27% of the electricity production by 2030 and its share in the total installed capacity will be 37%. While in the second scenario, electricity production from RE sources will reach 2000 MW by 2020. This is equal to 2,014 MW cumulative capacity in 2020 compared to 4,010 MW in the base scenario for the same year. Their results show that 61,708 and 137,928 new jobs will be created, by 2020 and 2030 respectively, according to the base scenario. However, based on the second scenario a smaller number of jobs will be created, estimated at 41,060 and 113,185 new jobs respectively.

It is worth noting that most of the jobs are generated in the wind energy industry. According to the ambitious scenario, the wind energy industry will still generate mainly direct jobs, especially during the operations and maintenance phase (O&M); indirect jobs will be created mainly in the solar energy field instead, especially during the installation phase.

Energy transmission has become an emergency with the current global climate situation. Fossil fuels are becoming old-fashioned day by day and relying on them, during the next decades, may affect the competitiveness of correspondent economies and their ability to develop local industries. Since energy is an input, final products will witness an increase in their prices.

Hence, local industries will face difficulties when competing in international markets, as well as domestic ones. Therefore, governments may turn to protectionist policies to protect their local producers and, according to international economics theories, this will harm the overall welfare as well as the level of productivity, because a higher price will be paid but less variety will be available on the market. In fact, next studies should tackle the importance of energy transition policies, not only for the environment and labor market, but also for the overall economic competitiveness. Job

creation should not be any longer looked at as a co-benefit of the energy transition but as one of the main triggers for increasing investment in the RE and EE fields.

Women and youth are still underrepresented, although the region is not far from the international benchmarks when it comes to the RE sector. Nevertheless, all labor forces should be involved in these sectors to ensure a smooth growth in terms of efficiency and productivity as well as smooth energy transition in the near future.

Bibliography

- Lehr, U., & Banning, M. (2019). *Développement Économique Local Grâce À Des Projets Axés Sur Les Énergies Renouvelables En Algérie*. Osnabrück : GWS.
- (SEDF), S. E. (2016).
- AFEX-EE. (2017). *Arab Future Energy Index*. Cairo: RCREEE.
- AFEX-RE. (2016). *Arab Future Energy Index - Renewable Energy*. Cairo: RCREEE.
- Al-Wahdawi. (2016, February 7). Retrieved from http://www.alwahdawi.net/news_details.php?sid=15225
- Al-Wahdawi. (2016, February 7). Retrieved from http://www.alwahdawi.net/news_details.php?sid=15225
- Apergis, N., Payne, J.E. . (2012). *The electricity consumption-growth nexus: Renewable versus nonrenewable electricity in Central America. Energy Sources, Part B: Economics, Planning, and Policy,* 7, 423-431.
- Arab Union of Electricity. (2015). *Arab Union of Electricity. Statistical Bulletin*, p. 4. Retrieved 9 5, 2016, from Our Publications: http://www.auptde.org/Article_Files/inside%202016.pdf
- AUE Stastistical Bulletin. (2017).
- Baccouche, A. (2014). *The Tunisian solar thermal market: a change of scale.* Energy Procedia 48 , 1627 – 1634.
- Braun, F., Blazejczak, J., Edler, D., & Schill, W.-P. (2011). *Economic effects of renewable energy expansion : A model-based analysis for Germany.* DIW Discussion Papers, No. 1156, Deutsches Institut für Wirtschaftsforschung (DIW).
- Central Bank of Tunisia. (2017). *Périodique de Conjoncture*, No. 116.
- Cooperative & Agricultural Credit Bank. (2016).
- Cooperative & Agricultural Credit Bank. (2016). Personal communication.
- Döring, M.. (2019). *Energy planning towards sustainability: anchoring Tunisia's energy transition to the local level (BICC Policy Brief, 1/2019).* Bonn : Bonn International Center for Conversion (BICC).
- DTI. (2004). *Renewable Supply Chain Gap Analysis.* DTI.
- Farag, N., & Komendantova, N. (2014). *Multiplier Effects on Socioeconomic Development from Investment in Renewable Energy Projects in Egypt: Desertec Versus Energy For Local Consumption Scenarios.* INTERNATIONAL JOURNAL of RENEWABLE ENERGY RESEARCH.
- French Embassy in Tunisia. (2018, January). *Le secteur des énergies renouvelables en Tunisie.* Tunisia.
- Gager, E. (2018). *Le rôle de l'entrepreneuriat technico-commercial dans le développement du marché solaire. Promotion de l'entrepreneuriat et du profil technicocommercial dans le secteur photovoltaïque.*

- General Authority for Post and Postal Savings, & Eng. Yasir Al-Jaradi. (2016). Personal communication.
- Geoffron, P., & Chevalier, J.-M. (2013). *The New Energy Crisis : Climate, Economics and Geopolitics.* New York: Palgrave Macmillan.
- GFA Consulting Group. (2018). *Emploi vert: Promotion de l'entreprenariat technico-commercial dans le secteur photovoltaique.* Tunis.
- GIZ & ANME. (2019). *Enquête et analyse de la situation de référence, femmes et emploi dans les entreprises privées du secteur de la maîtrise de l'énergie en Tunisie.* (pp. 16-33). Tunis : Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- GIZ. (2012). *Renewable energy and energy efficiency in Tunisia – employment, qualification and economic effects.* Tunis: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- GIZ. (2016). *RENEWABLE ENERGY AND ENERGY EFFICIENCY IN TUNISIA EMPLOYMENT, QUALIFICATION AND ECONOMIC EFFECTS New frameworks – new results.* Eschborn: GIZ.
- GIZ. (2016). Renewable energy and energy efficiency in Tunisia, employment, qualification and economic effects. New framework, new results. Eschborn: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- Greenpeace & EPIA. (2008). Solar Generation V - 2008. *Solar electricity for over one billion people and two million jobs by 2020.* Hamburg: EPIA a.i.s.b.l./Greenpeace International .
- GSI and IISD. (2014). *Fossil-Fuel Subsides: A barrier to renewable energy in five Middle East and North African countries.* The International Institute for Sustainable Development.
- Hatlelid, I. B., & Aass, J. (2016). *The Socio-Economic Impact of Renewable Energy in Sub-Saharan Africa.* Paris: Norwegian School of Economics.
- Hegazi, D. A. (2019, July 7). *Scoping mission for the MEETMED project - Activity A32*. (M. Bououd, Interviewer)
- IEA. (2010-2016). Statistics. Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2010-2016). Statistics. Retrieved December 22, 2018, from https://www.iea.org/statistics/?country=LEBANON&year=2012&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012-2016). Statistics. Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- IEA. (2012-2016). Statistics. Retrieved from https://www.iea.org/statistics/?country=LEBANON&year=2016&category=Key%20indicators&indicator=TPESbySource&mode=chart&categoryBrowse=false&dataTable=BALANCES&showDataTable=true
- ILO.(2015). *Key Indicators of the Labour Market 2015.* Geneva: International Labour Organisation.

- ILO. (2018). *World Employment and Social Outlook 2018: Greening with jobs.* Geneva: International Labour Organisation.
- Integrated Food Security Phase Classification. (2016). IPC analysis – Summary of findings, Acute Food Insecurity Current Situation Overview. Retrieved from http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/1_IPC_Yemen_June2016_AcuteFoodInsecurityAnalysis_CommunicationBrief.pdf
- IPC, T. I. (2016). *Republic of Yemen, IPC analysis – Summary of findings.* EU and Food and Agriculuture Organization of the United Nation and Yemen Food Security Information (FSIS) Development Programme.
- IRENA. (2011). *Renewable Energy Jobs: Status, Prospects & Policies.* Abu Dhabi: IRENA Working Paper.
- IRENA. (2013). *Renewable Energy and Jobs. Abu Dhabi: International Renewable.*
- IRENA. (2016). *Renewable Energy Benefits: Measuring The Economics.* Abu Dhabi: IRENA.
- IRENA. (2016). *Renewable Energy Benefits: Measuring The Economics.* Abu Dhabi: IRENA.
- IRENA. (2017). *Renewable Energy and Jobs - Annual Review 2017.* Abu Dhabi: International Energy Agency .
- IRENA. (2018). *Country Rankings.* Retrieved from IRENA: https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Country-Rankings
- IRENA. (2019). *Renewable Energy and Jobs - Annual review*. AbuDhabi: IRENA.
- IRENA. (2019). *Renewable Energy and Jobs, Annual Review.*
- IRENA. (2019). *Renewable Energy and Jobs: Annual Review 2019.*
- IRENA and CEM. (2014). *The socio-economic benefits of large-scale solar and wind: an econValue report.* Abu Dhabi: IRENA.
- LCEC. (2017).
- Lean, H.H., Smith, R.. (2013). *Disaggregated energy demand by fuel type and economic growth in Malaysia.* Discussion paper, No. 43-13, Department of Economics, Monash University.
- Leonics. (n.d.). Retrieved from Basics of Solar Cell: http://www.leonics.com/support/article2_13j/articles2_13j_en.php
- Mahmoud, M. K. (2019). *Dynamics of the Renewable Energy Markets in the Arab countries. Africa High Level Forum on Renewable Energy Africa Renewable Energy Initiative (AREI) West Africa Regional Consultations*, (p. 21). Conakry, Guinea.
- Marinaş M-C, Dinu M, Socol A-G, Socol C. (2018). *Renewable energy consumption and economic growth Causality relationship in Central and Eastern European countries.* PLoS ONE 13 (10): e0202951.
- Mckinsey & Company. (2019). *Global Energy Perpective 2019 : Reference Case.* McKinsey Solutions Sprl .
- Menegaki, A.N.. (2011). *Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis.* Energy Economics, 33, 257-263.

- MEW. (2018).
- Missaoui, R. (2019, April 17). *Scoping mission - Tunisia.* (RCREEE, Interviewer)
- Ocal, O., Aslan, A. (2013). *Renewable energy consumption–economic growth nexus in Turkey. Renewable and Sustainable Energy Reviews,* 28, 494-499.
- OECD. (2014, March 28). *Glossary of statistical terms.* Retrieved from OECD: https://stats.oecd.org/glossary/detail.asp?ID=1034
- OECD. (2018). *OECD Economic Surveys : Tunisia.* OECD.
- RCREEE. (2014). *Environmental Externalities from Electric Power Generation: The Case of RCREEE Member States.* RCREEE.
- RCREEE. (2017). *The Socio-Economic Impacts of Renewable Energy and Energy Efficiency in Egypt Local Value and Employment.*
- RCREEE. (2019). *AFEX.* Cairo: RCREEE.
- REN21. (2019). *Renewables 2019 Global Status Report.* Paris : REN21.
- Renewable Energy Solutions For the Mediterranean. (2018). *Analyse du cas tunisien : Présentation de la création d'emploi au sein des projets d'énergies renouvelables et étude du cas tunisien.* Renewable Energy Solutions For the Mediterranean.
- Rutovitz, J. D. (2015). *Calculating global energy sector jobs: 2015 methodology.* Prepared for Greenpeace International by the Institute for Sustainable Futures, University of Technology Sydney.
- SEI, S. E. (2017). *Gender Equality in Renewable Energy in the Lower Mekong: Assessment and Opportunities.* USAID CLEAN POWER ASIA.
- Sharha, W. (2016, March 1). Retrieved August 25, 2016, from http://www.sampress.net/portal/news-15343.htm
- Shweinfurth, A., & Ben Khemis, H. (2016, December 13-14). *Promotion de l'emploi et renforcement des capacités de formation pour le marché solaire et la maîtrise de l'énergie.* Tunis .
- Solar Foundation. (2016). *National Solar Jobs Census 2016.* Washington, DC.
- UNDP. (2014). *Lebanon's First National Survey Study of TheSolar Water Heaters Market.*
- UNDP. (2019). R*enewable Energy Sector In Lebanon Value Chain Assessment And Analysis.*
- UNDP. (2019). *Renewable Energy Sector In Lebanon: Value Chain Assessment And Analysis.*
- UNDP-CEDRO. (2019). *Renewable Energy Sector In Lebanon: Value Chain Assessment And Analysis.*
- UNDP-DREG. (2017). *2017 Solar PV Status Report For Lebanon.*
- UNHCR. (2018). LEBANON. Retrieved from UNHCR: http://reporting.unhcr.org/node/2520
- World Bank. (2012-2016). World Bank Open Data. Retrieved from https://data.worldbank.org/
- World Bank. (2012-2018). World Bank Open Data. Retrieved from https://data.worldbank.org/
- World Bank. (*World Development Indicators and Sustainable Energy for All*). Databank. Retrieved from World Bank: https://databank.worldbank.org/source/world-development-indicators#selectedDimension_WDI_Ctry.
- World Bank, E. a. (2017). *State and trends of carbon pricing.* Washington, DC: World Bank.

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