



## **The Economic Impacts of Desert Power**

Socio-economic aspects of an EUMENA  
renewable energy transition



**Dii**





# 1. INTRODUCTION

The countries of the Middle East and North Africa (MENA) are one of the world's largest potential growth markets for renewable energy generation. Countries throughout the region have recognized the great potential of their excellent wind and solar conditions, and ample empty space, and have ambitious plans to develop solar and wind energy. They are already making progress in realizing these renewables targets. They also increasingly recognize the great potential of renewable energy in tackling a range of challenges. At a time of high unemployment, particularly among youth, the growth of renewable energy provides an engine for creating new jobs and fostering new skill profiles among workers. Renewables can increase GDP and form the basis for a significant new source of trade revenues. As a source of energy, renewables reduce dependency on fossil fuels – whether as imports, to supply energy, or as exports.

This report, Economic Impacts of Desert Power (EIDP), investigates how, and under what conditions, renewables in MENA can lead to socio-economic benefits. EIDP shows, under various scenarios, how many jobs can be expected in three exemplary MENA countries, and how the expansion of renewables can lead to higher GDP growth rates across the region. EIDP pinpoints their economic impact across sectors and countries. At the same time, EIDP describes how these effects can be maximized through immediate and sustained policy support. The report also details how such support can be tailored to foster a self-sustaining market. In short, EIDP aims to contribute to a range of debates focused on how to maximize the benefits of green growth.

EIDP illustrates the following points:

- ⚙️ MENA can benefit economically from decarbonizing – even if the rest of the world does not pursue climate action.
- ⚙️ Exporting excess electricity is an economic opportunity for MENA countries – several North African countries could create a major export industry with renewable electricity, which would both create large numbers of jobs and increase economic growth.
- ⚙️ RE-relevant sectors are labor-intensive and can create a significant number of jobs in MENA and internationally.
- ⚙️ MENA industry has already acquired local manufacturing capacity in a number of RE components. It can greatly expand this industry capability by focusing on the components that have the potential to be manufactured locally in the short term.
- ⚙️ A market-friendly approach to industrial policy can help maximize the local benefits of desert power for RE-generating countries in a sustainable way.



EIDP is the first report that fully integrates the three key renewable generation technologies – Wind, solar photovoltaic (PV) and concentrated solar power (CSP) technologies – into a region-wide computable general equilibrium (CGE) model. The report provides transparency on the job impacts of a transition to renewable energy by fully detailing all assumptions and background, including a detailed overview of MENA’s current and (projected) future industry capabilities. It also differentiates between direct and indirect employment effects. Finally, the combination of a quantitative economic model and a market-oriented, qualitative approach to policy support aims to promote discussion and debate with a wide range of stakeholders: from policy-makers to economists and from industry to civil society.

Dii’s report, “Desert Power 2050”, shows the desirability and feasibility of a secure and stable power system for EUMENA based almost entirely on renewables. “Desert Power 2050”, like Dii’s country studies and reference projects, aims to promote the creation of markets for Wind, PV, and CSP in MENA. The second part of this report, “Desert Power: Getting Started”, demonstrates specific pathways for enabling such markets in the coming years.

It is generally assumed that a large number of jobs and a significant increase in economic growth will follow the creation of stable and sizeable RE markets. Indeed, this is a highly attractive feature of renewable energy. Due to the strong focus on job creation and industrial development of governments in MENA, a crucial part of enabling a market for renewables involves providing a clear view of the economic benefits of renewables and how such benefits can be maximized.

EIDP is based on the assumption that such a market will exist and focuses instead on assessing and maximizing the benefits for the local economy and local citizens. In this report, accordingly, Dii has quantified the potential economic and employment effects of RE in MENA, under various scenarios; and has provided recommendations on what needs to be done today to turn these potential benefits into reality. Dii has focused especially on how the state interventions necessary to maximize local benefits can promote, rather than conflict with, the creation of self-sustaining markets. As such, this report attempts to bridge the focus of MENA governments, which emphasize the creation of local economic value, with the priorities of industry, which aims to create a market.

## 2. STATUS QUO

### Challenges

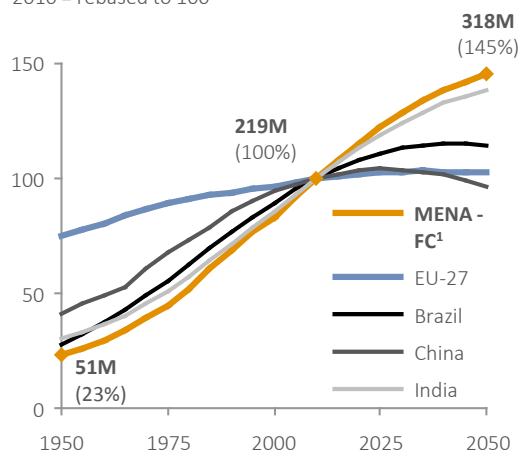
The MENA region faces several challenging economic circumstances. One of its main challenges is that populations are growing quickly, faster than in other developing regions, while too few people are working, as depicted in Figure 1. The number of a country's citizens that are working can be seen through two measures, shown on the right side of Figure 1: first, the labor participation rate, or the share of population currently in the workforce or searching for work; second, the unemployment rate, or the proportion actively seeking work yet currently unable to find a job. There is room for MENA to improve on both measures: it has among the lowest labor participation rates in the world, and among the highest unemployment rates (the same as the EU-27's high unemployment rate). Peer emerging economies and more developed regions both have higher labor participation and, in some cases, lower unem-

ployment rates, as shown on the right side of Figure 1. Of course, MENA's growing population represents a great opportunity for the region, particularly compared to the more stagnant demographic trends in Europe and other emerging economies. However, to fully benefit from this demographic dividend, more jobs are needed, especially for the region's youth.

The education and training systems play an important role in this situation. Across the region, despite promising efforts, the education and training on offer does not always equip young people with the skills necessary to find work in a modern, knowledge- and technology-based economy. Millions of educated young people remain unemployed, their economic and social potential untapped, while employers complain that jobs go unfilled due to a shortage of suitable candidates.

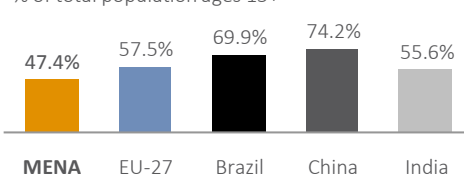
#### Population of MENA focus countries

2010 = rebased to 100



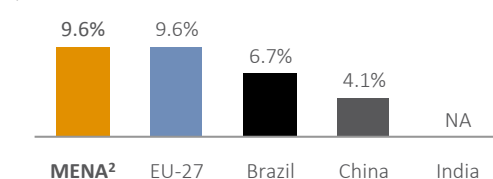
#### Labor participation rate in 2010

% of total population ages 15+



#### Unemployment rate in 2010

% of total labor force



Note: 1) FC = Focus countries; 2) Libya is not included as unemployment rates are not available

Source: United Nations - Department of Economic and Social Affairs, International Labor Organization, International Monetary Fund

**Figure 1** MENA population and employment trends in an international context



## Economic Structure

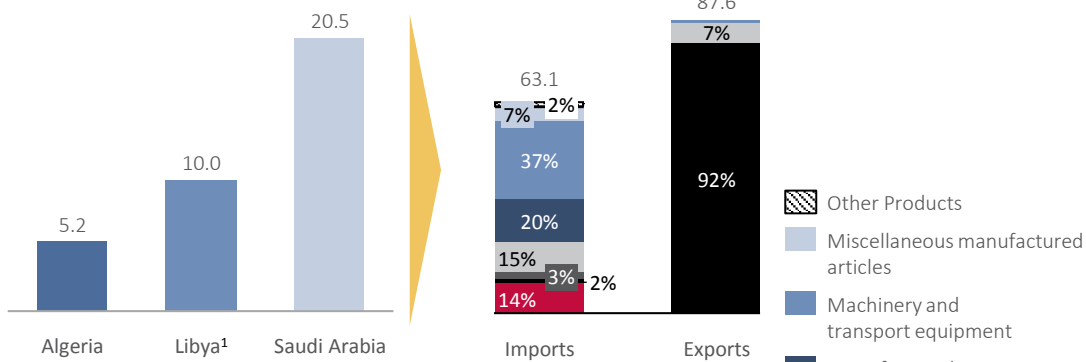
The MENA region comprises two types of countries: exporters of fossil fuels and importers. This report focuses on three countries from each category. Algeria, Libya, and Saudi Arabia are the fossil fuel exporters examined; Morocco, Tunisia and Egypt are the other countries that, generally speaking, are fossil fuel importers. Exporters have significantly higher GDP per capita and run large trade surpluses. The one exception here, with regards to GDP per capita, is Algeria, which, as shown in Figure 2, has significantly lower GDP per capita than Libya and Saudi Arabia. The reason for this is that Algeria has a similarly sized population to Saudi Arabia, yet exports far less gas (in dollar terms) than Saudi Arabia does oil. Libya's GDP per capita, in contrast, is higher due to its much smaller population. Importers, on the other hand, have lower GDP per capita and sizeable trade deficits. This distinction can also be seen clearly in trade with Europe, as shown in Figure 2. Exporters primarily sell oil and gas to Europe and, in return, import technically sophisticated goods and food. Importers, meanwhile, export lower-complexity goods to Europe and import more complex goods.

The EU is the main trading partner of the MENA region, with a share of almost 40% of MENA imports and almost 30% of exports. Within the MENA region, North Africa is more oriented towards Europe – particularly to the large continental European economies (France, Italy, Spain and Germany). The Middle East's trading partners are more diversified, though Europe occupies a significant share. At the same time, the share of emerging economies like China has been increasing in recent years: for example, China's trade with MENA has grown 33-fold since 1995. This growth has, however, led to a situation in which MENA's trade with countries like China is structurally unbalanced. MENA primarily exports gas and oil to China, while Chinese products displace MENA manufactured products on domestic and international markets. Intra-MENA trade is concentrated heavily in oil and gas, as shown in Figure 3. Within the region, there is limited integration of markets, which hampers the development of domestic manufacturing due to the lack of market size, among other consequences.

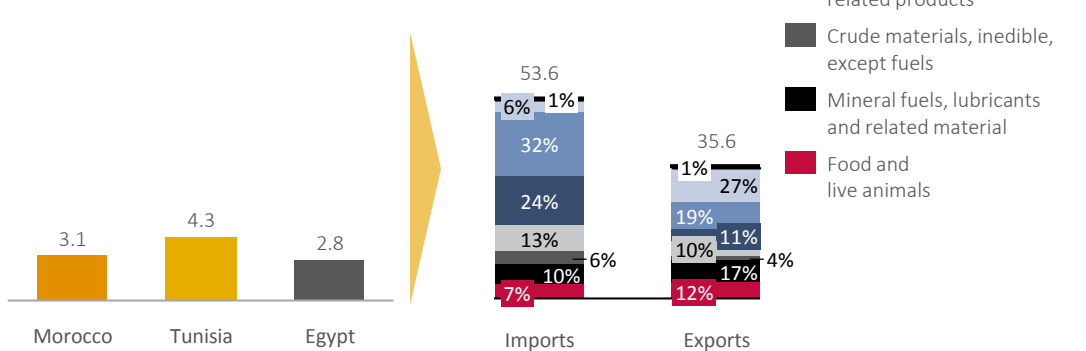
## GDP and Trade

GDP per capita (in thousand USD/capita, 2011) Trade structure of MENA focus countries with EU (in billion USD, 2011)

### MENA – Fossil Fuel Exporters



### MENA – Other Focus Countries



Note: 1) GDP/capita from 2009; 2) Other Products include beverages and tobacco; animal and vegetable oils, fats and waxes; commodities and transactions, n.e.s.

Source: World Bank, UnctadStat (2013), <http://unctadstat.unctad.org>

**Figure 2** Trade structure of trade with EU for MENA fossil fuel exporters vs. MENA fossil fuel importers

## Opportunities

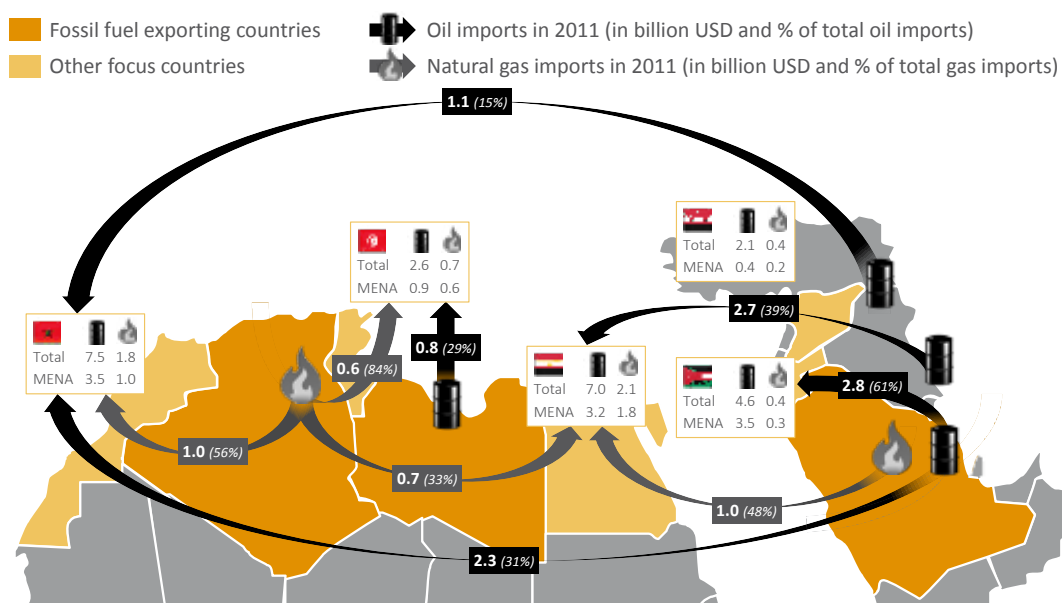
The renewable energy sector can play a central role in addressing the MENA region's challenges. Solar and wind resources are abundant on the vast and sparsely populated land mass of North Africa and the Middle East. Electricity demand in MENA is rising quickly, at annual rates of 6-8%, due to a growing population and increasing use of electric appliances, e.g. air conditioning and desalination. New energy solutions are needed, therefore, and the MENA region has all the right conditions for a transition to renewable energy, which would benefit the region in various ways. Renewable energy offers MENA countries the

opportunity to create a large domestic market for heavy RE infrastructure. This would allow MENA countries to tap their natural advantages in this sector and thereby use investment in RE as a means to develop new industries and create new jobs. This strategy could also provide an impetus for greater integration among the region's markets and thus fits well with the drive for greater regional integration promoted by a range of institutions in MENA, including the African Union and the Arab Maghreb Union, as well as outside actors like the European Commission.





## MENA focus countries – Fossil fuel imports



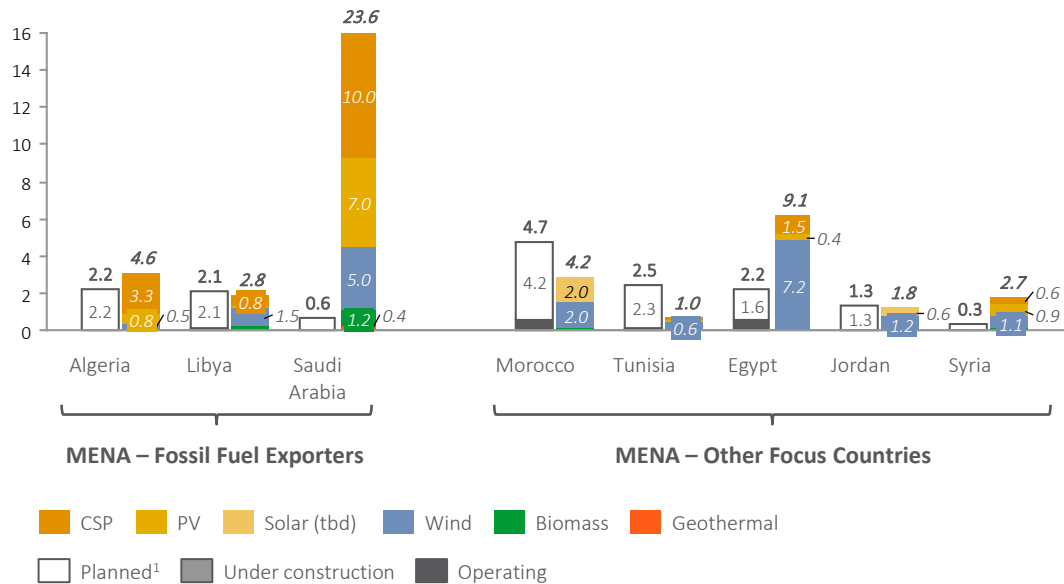
Note: MENA fossil fuel trades on country level are only shown if import/export volume is above 0.5 billion USD p.a.  
Source: UnctadStat

**Figure 3** Fossil fuel imports within the MENA region

An RE market would enable MENA economies to diversify from their current reliance on fossil fuels – whether as an imported source of power or form of export revenue – and towards a more technology-driven model. This would provide an opportunity to increase inflows of foreign direct investment (FDI) to manufacturing industries, which create far more jobs than FDI inflows to the oil and gas industries, the dominant type of FDI inflow today. The potential to develop a large domestic market in MENA is reason enough for investment in an RE industry, while increasing foreign currency earnings through electricity export to Europe could provide further benefits and utilize the natural advantages of the MENA region.

As of early 2013, renewable energy has been embraced by governments throughout the region. This report's six focus countries have all formulated RE targets, though implementation to date has been slow, except for Morocco, as depicted in Figure 4. The region is, in other words, at the very beginning of a long yet promising process of expanding its RE industry. As RE targets become reality, governments across the region can use the sector as a way to address other challenges. For example, RE manufacturing provides a natural focus for training, and thus for new attempts to increase employment and tackle the skills mismatch in the region. Measures to support RE can, and should, be used as tools to create new jobs and new industries.

### Capacities of non-hydro renewable projects vs. renewable targets in 2020 [GW]



Note: 1) Planned RE projects includes all projects that are either announced, in the tendering process or already awarded  
 Source: Dii analysis and individual country RE targets

**Figure 4** MENA RE targets vs. current capacities of non-hydro RE projects

## 3. INDUSTRY LANDSCAPE

The technological focus of this study is on the three renewable technologies: Wind, PV, and CSP. Wind is a mature technology that can often compete on a purely commercial basis in the power mix. PV has seen a steep learning curve and is now at the same cost level as peak power in most MENA countries for the mid-day air-conditioning peaks. CSP is the least mature technology and requires further support but, due to the option of storing power, is an important future option that would complement the other intermittent renewable technologies.

That said, even CSP is currently cheaper than oil for power production (for further details on cost comparisons, see Dii's study Desert Power: Getting Started, see: [www.dii-eumena.com/dpgs.html](http://www.dii-eumena.com/dpgs.html)).

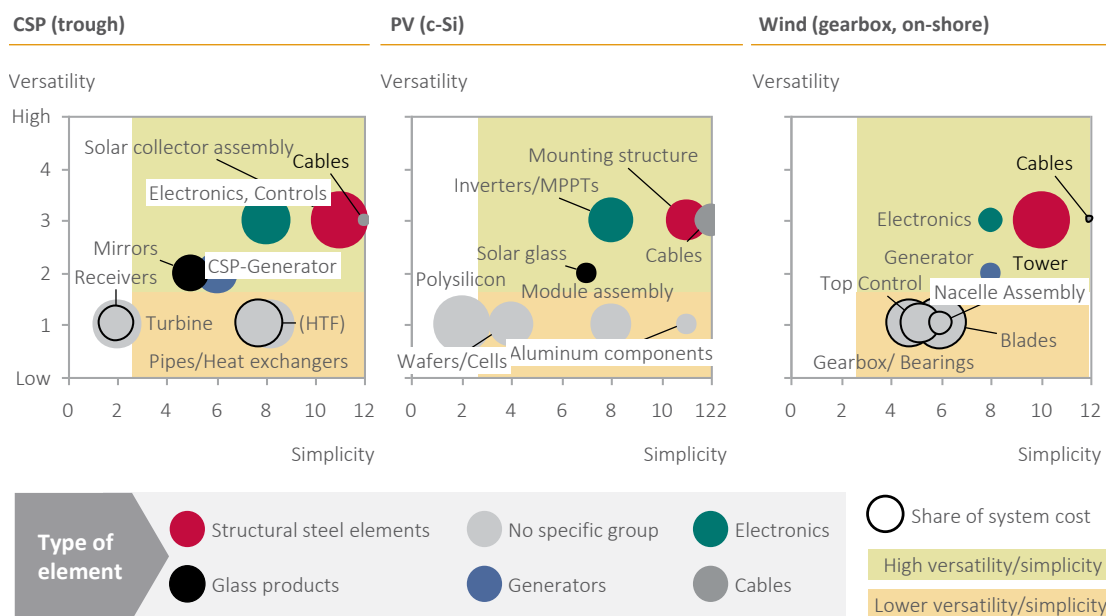
It should be noted that, although technologies change and specifications alter over time, this report focuses on the trough specification for CSP, silicon-based PV and Wind on-shore using gearbox, since these are the most mature technologies currently used.



An economy’s capability to manufacture technology components domestically has a direct impact on the economic benefits created by expanding renewable energy in that country. In order to provide a clearer picture of such capabilities, we analyze the simplicity and versatility of various components: versatility is defined as the adaptability of a component to different types of renewable energy technology, while complexity is measured in technological, financial, market and quality terms. Such an analysis sheds light on two key factors, versatility and simplicity, in determining industry capability to manufacture components. Component complexity (or simplicity) was ranked on a scale of 1 to 12, while versatility is an indication of the

ability to use a single component group across the three RE technologies. Some components are more versatile, since they can be utilized for more than one renewable energy technology. Structural steel elements, electronics, glass products and generators, for example, are part of more than one renewable energy power plant type. Such components also tend to be simpler to produce (lower complexity), as shown in Figure 5, thus providing ample opportunities for their production to be expanded in new countries. On the other hand, components that are less versatile, e.g. that are specific to a single technology, also tend to involve more complex manufacturing processes.

### Versatility and complexity of RE components

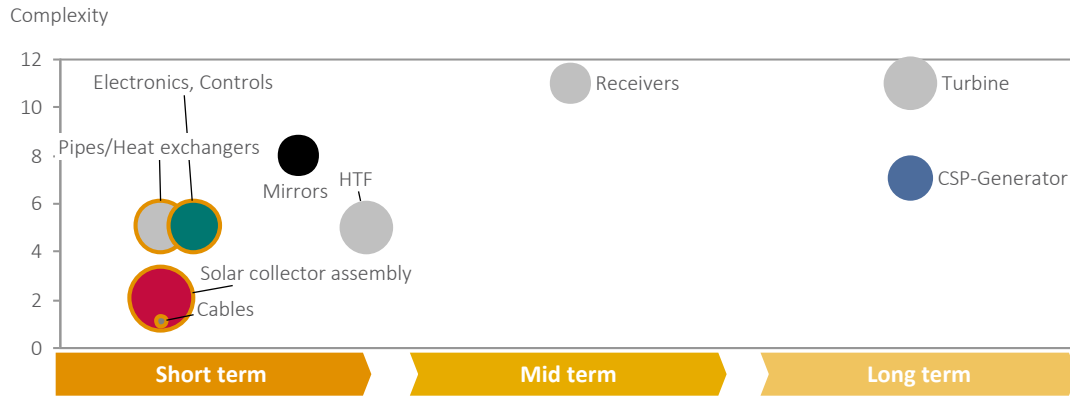


Source: Dii

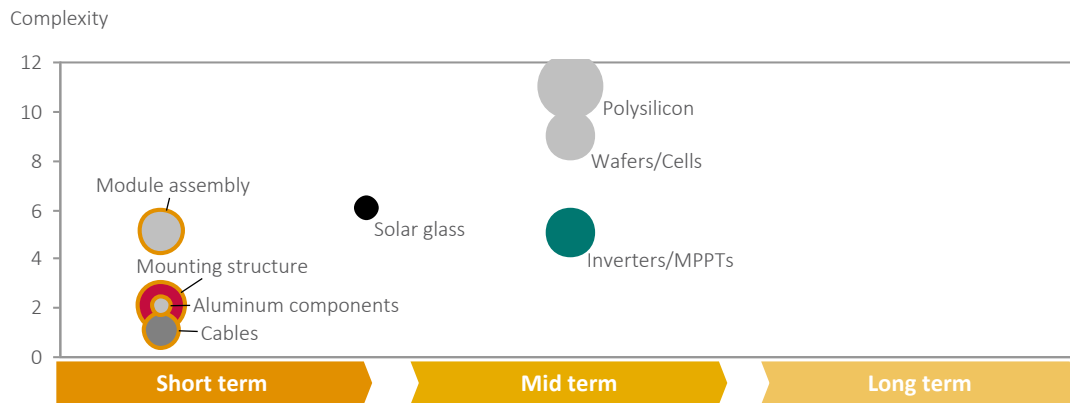
Figure 5 Versatility vs. simplicity for key components

### Localization period of CSP, PV and Wind technology

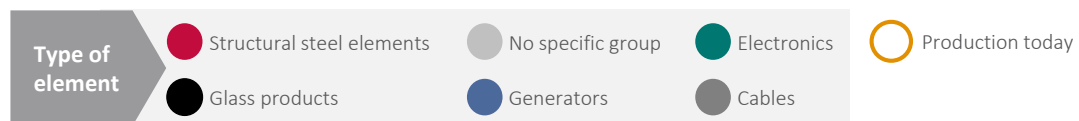
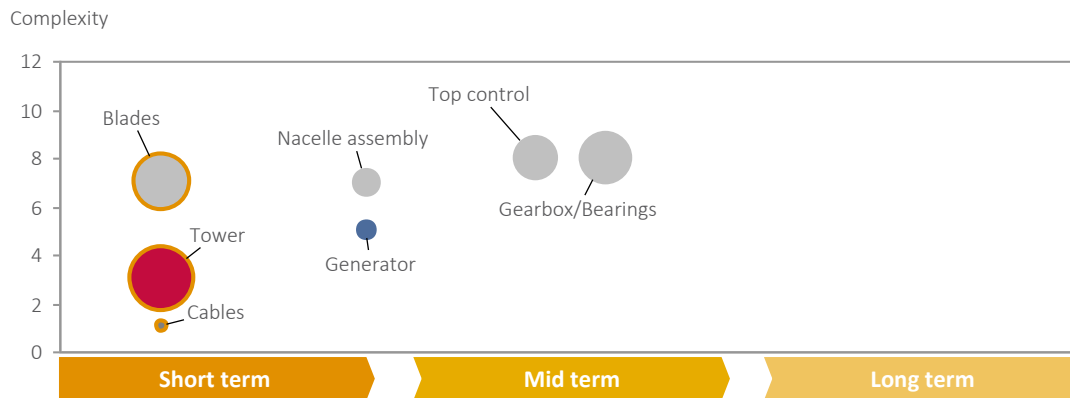
#### CSP technology in MENA (manufacturing of components)



#### PV technology in MENA (manufacturing of components)



#### Wind technology in MENA (manufacturing of components)



Note: Size of bubble shows relative value of CAPEX  
Source: Dii

Figure 6 Projection for local manufacturing capability in MENA



For all technologies, some components can already be manufactured locally in the MENA region today. These tend to be the less complex components. Others can follow as soon as markets are allowed to develop, while some will require more time.

Alongside complexity and versatility, the annual installed capacity of power plants and the industry capabilities of MENA firms further spur local production in MENA. Market entry barriers, such as high investment into manufacturing facilities and strong quality requirements, present potential obstacles for the local manufacturing of most components in MENA.

Wind technology has the greatest potential for local manufacturing in MENA in the next 5-10 years, as shown in Figure 6 (note that the bubble size refers to the CAPEX share devoted to a particular component). It is followed by PV, for which components can be manufactured in the short and medium term, as shown in Figure 6.

A few CSP components are unlikely to be manufactured locally in the short to medium term, see Figure 6. For example, due to the power block's high level of complexity, related components will continue to be sourced internationally to some extent in the next 10-20 years unless the market becomes very attractive.

The expansion of renewables generation capacity would create a larger market. This, in turn would help improve the region's capabilities in manufacturing more complex components. Expanding renewables generation capacity should be pursued alongside a targeted focus on improving production capabilities for individual components.

To maximize the benefits for their economies, MENA countries should focus first on components with high versatility and low complexity. This will allow them to increase local value creation before moving to the more complex parts (as shown in Figure 6). Thus the most promising components for a first wave of RE industry localization are:

- ⚙️ CSP: electronics/ control systems, cables, pipes/ heat exchangers, mirrors, solar collector assembly (incl. mounting structure)
- ⚙️ PV: mounting structure, aluminum components, cables, solar glass, module assembly
- ⚙️ Wind: tower, cables, blades, generator, nacelle assembly (incl. nacelle housing)



## 4. MACROECONOMIC EFFECTS

Decarbonization provides clear economic benefits to the MENA region: it is both economically feasible and presents an enormous opportunity to the region. The analysis conducted by the Kiel Institute for the World Economy's (IfW) computable general equilibrium (CGE) model provides a solid, detailed basis for such statements. It clearly details the country-level macroeconomic impacts of a transition to renewables in MENA, in terms of overall GDP as well as sectoral economic activity. The model is comprehensive and takes into account all economic sectors and global economic interdependencies, as well as the electricity generation figures and potential trade flows of renewable electricity from "Desert Power 2050".

Two main questions are addressed:

- ⚙️ What are the economic impacts of decarbonization in MENA?
- ⚙️ What are the economic impacts of producing additional electricity in MENA for export to Europe, while also fully supplying domestic electricity demand from renewable sources?

To answer these questions, the modeling focuses on two scenario comparisons. The first comparison examines the differences between a scenario in which the world continues with business as usual (Current Policy) and a scenario in which the EUMENA region decarbonizes and trades electricity between MENA and the EU (Desert Power in Current Policy). The second comparison looks at a world that decarbonizes, but without electricity trade between MENA and EU (Climate Action), and contrasts this with a decarbonized world in which the MENA and EU regions trade electricity (Desert Power in Climate Action). For all decarbonization scenarios, decarbonization is defined as policy action necessary to meet a 2 degree target.

This scenario analysis provides clear answers to the questions posed earlier:

Decarbonization is economically beneficial for MENA: Even without considering the negative externalities of fossil fuels, decarbonizing does not have negative effects on GDP in the MENA region as a whole. Indeed, MENA would have slightly higher GDP if it pursued decarbonization over Current Policy, see Figure 7. In other words, as long as enough FDI is attracted to finance the transition, decarbonization makes economic sense for MENA.

- ⚙️ If MENA decarbonizes while the rest of the world does not, fossil fuel importers benefit from decarbonizing their economies, improving their trade balance and also trading electricity with Europe, while fossil fuel exporters benefit if they can export electricity.
- ⚙️ For fossil fuel importers, the benefits of desert power are clear and substantial. Rather than relying on the fluctuating prices of oil and gas importers, countries that currently import fossil fuels can achieve greater energy independence and greater control over their energy costs by investing in renewables. At the same time, the possibility to export excess electricity to neighbors in the region and to Europe means that fossil fuel importers can also monetize renewables and tap a significant new source of foreign currency inflows.
- ⚙️ For fossil fuel exporters, the analysis of economic benefits is more intricate, since two opposing effects are involved. On the one hand, decarbonization means that the production of fossil fuels is reduced and the cost of producing electricity can increase if fossil fuels are valued at production cost. On the other hand, there are clear economic benefits that can be obtained from delaying the depletion of reserves of replacing fossil fuel consumption for electricity, which frees resources for export.



Due to the excellent solar and wind resources in the MENA region, the cost of producing electricity from the sun and wind can, under certain conditions, be comparable to fossil fuel power plants. The competitiveness of renewables depends on whether gas or oil is used for electricity production and assumes that fuel is accounted for at global market prices. Furthermore, value creation from RE is based on labor and technology-driven manufacturing, as opposed to the extraction of non-renewable natural resources. Thus, the RE industry creates more direct jobs per value added than the oil and gas industry.

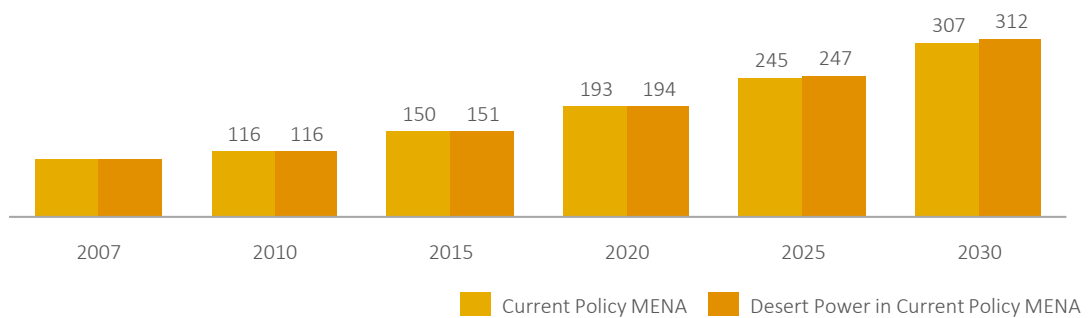
Our analysis indicates that the opposing GDP effects described above can be kept at a balance. Indeed, the model shows a slightly positive balance for Algeria and Libya and a slightly negative one for Saudi Arabia, which exports

less electricity in our scenarios due to its high domestic demand. In addition to such GDP effects, climate mitigation, job creation and resource preservation not only provide clear benefits but can also be pursued without jeopardizing economic growth.

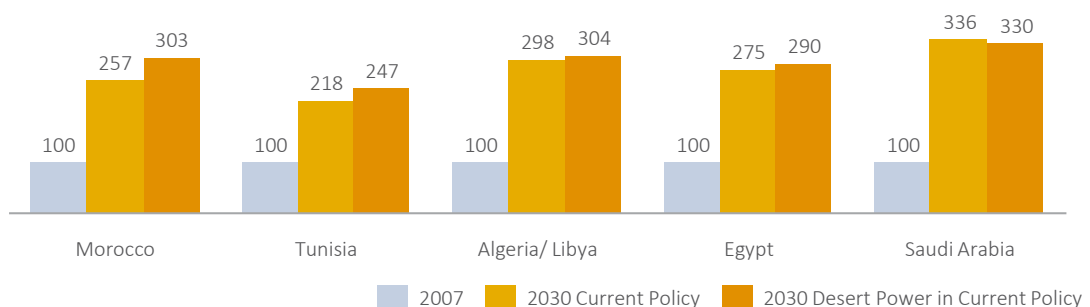
Electricity export has clear economic benefits for MENA: as shown in Figure 7, the export of electricity to Europe can have positive impacts on MENA economies, as long as sufficient FDI is attracted, interconnectors are built and a stable regulatory framework is in place. Solar and wind resources are so abundant in the region that there is no shortage of renewable electricity for domestic supply, leaving ample electricity available for export. Fossil fuel importers and exporters alike benefit from electricity exports, if the rest of the world undertakes Climate Action, as shown in Figure 8.

## MENA GDP development in a world of heterogeneous climate action

GDP level difference between Desert Power in Current Policy and Current Policy in MENA (rebased to 100)



GDP level difference between Desert Power in Current Policy and Current Policy by country (rebased to 100)

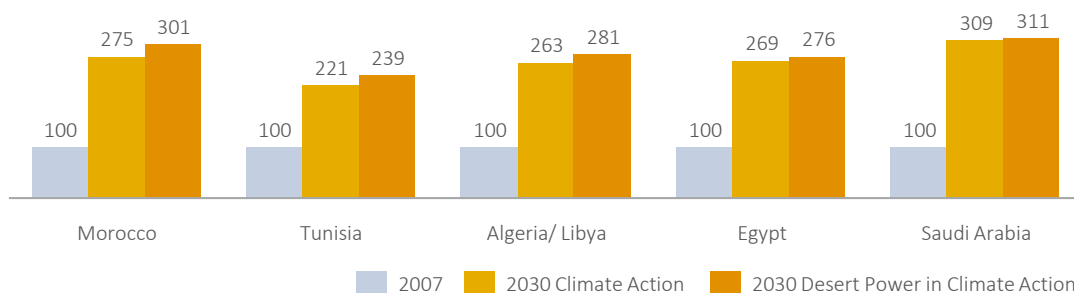


Source: IfW/ Dii

**Figure 7** GDP in MENA countries, Desert Power in Current Policy vs. Current Policy

## MENA GDP development in a world of global climate action

GDP level difference between Desert Power in Climate Action and Climate Action by country (rebased to 100)



Source: IfW/ Dii

**Figure 8** GDP in MENA countries, Desert Power in Climate Action vs. Climate Action

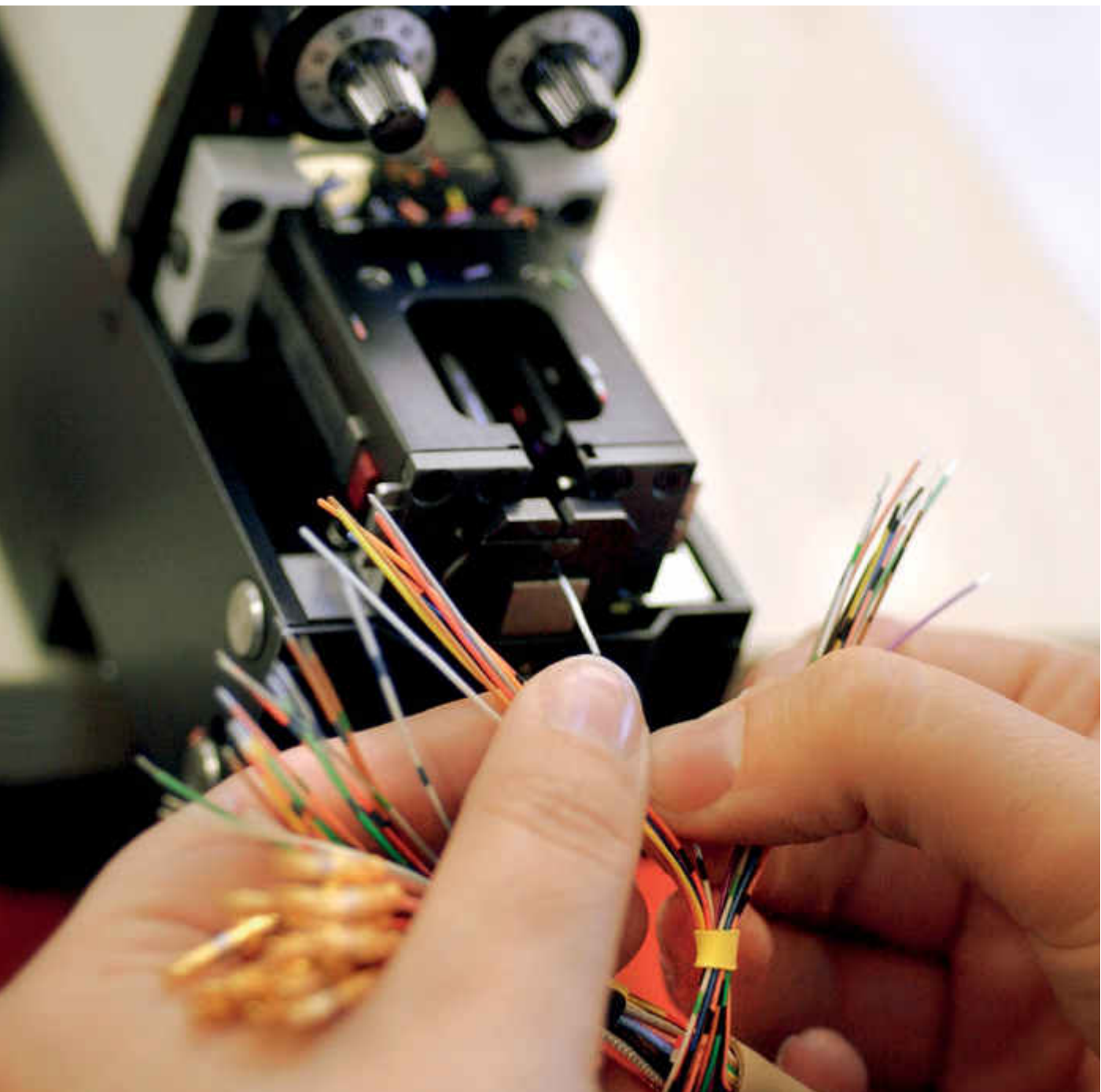
Finally, the RE sectors have the potential to contribute significantly to the GDP of some MENA countries in 2030 and to contribute to total exports with double-digit percentages in the medium- to long-term. Electricity exports from MENA have the potential to make up a high portion of overall exports in Morocco, Algeria, Libya, Tunisia and Egypt. The renewable energy sectors could contribute up to 5% of economic output in Morocco, 4% in Algeria and Libya and 3% in Tunisia. In Egypt, the renewable energy sector could make up 2%, and in Saudi Arabia 1%, of overall economic output. At the same time, fossil fuel imports as a share of GDP could decrease by up to 35% in Egypt, 30% in Tunisia and 15% in Morocco, if these countries decarbonize compared to Current Policy in 2030.

Three key drivers are responsible for fueling economic growth in the transition to renewable energy in MENA:

- ⚙️ decreasing import dependency on fossil fuels increases the potential for economic growth and improves the trade balance,
- ⚙️ electricity trade strongly increases export revenues and the trade balance improves when countries decarbonize, which contributes to rising economic activity,
- ⚙️ FDI increases the domestic capital stock and thus contributes to GDP growth.

Turning the MENA region's natural comparative advantage in wind and solar resources into real economic effects will also require appropriate industrial and education policy measures in order to improve the sometimes low availability of capital and skills, as detailed later in this report.





## 5. EMPLOYMENT EFFECTS

How many jobs can be created in the renewables industry, and under what conditions, are among the most pressing questions facing policymakers. The employment effects analysis details the job creation potential resulting from the deployment of the CSP, PV and Wind technologies in Morocco, Egypt, and Saudi Arabia. The employment effects of renewable energy were analyzed by IfW based on a multiplier analysis, while a detailed integration of the CSP, PV and Wind sectors into the input-output matrices of three MENA economies (Morocco, Egypt, Saudi Arabia) was performed. The focus of the analysis is on job years, the standard measurement used in such analyses to calculate job impacts: one job year refers to employment for one person for one year (e.g. one job that is predicted to last two years is counted as two job years).

Labor productivity data for the MENA region contain certain inconsistencies and thus should be handled with care. The underlying reason is that some sectors, especially the agriculture and services sectors, which could supply intermediate inputs to renewable energy technologies, have low productivity levels due to the fact that economically active persons are accounted for differently across countries. As a result, they tend to overestimate the number of jobs per EUR 1bn invested. To account for this, we show the potential ranges of job effects: the dotted lines in Figure 9 identify the sectors with uncertain labor figures.

The potential job effects in MENA can only be realized if accompanied by self-sustaining market development and reliable, lasting renewable energy technology deployment. Comparing the employment effects of EUR 1bn investment for the build-up of each technology, different effects can be seen across countries if we assume that components are sourced domestically according to the results of our industry landscape assessment.

The reason for these variations in job effects lies in the following differences in structural characteristics in MENA countries:

- ⚙ Differences in labor productivity: higher productivity levels lead to fewer jobs
- ⚙ Differences in local integration of production (linkages between domestic economic sectors), which is generally weaker in Saudi Arabia than in Morocco and Egypt: higher levels of local integration leads to more indirect jobs, i.e. in other, non-RE sectors
- ⚙ Differences in import dependency of domestic sectors: lower import dependency leads to more jobs

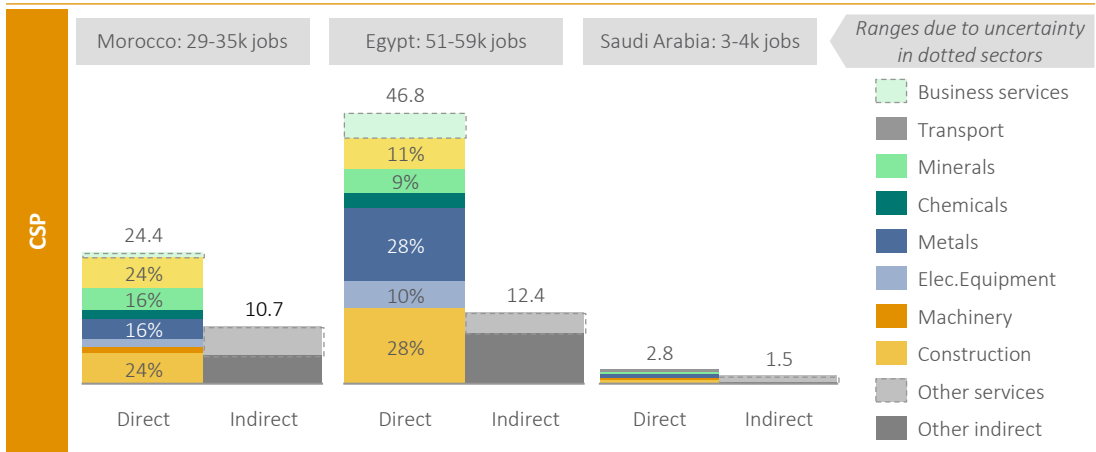
Due to data uncertainty, certain ranges were determined, as follows:

- ⚙ EUR 1bn investment in CSP power plant build-up generates between 29k and 35k jobs in Morocco, 51k to 59k jobs in Egypt, and 3k to 4k jobs in Saudi Arabia, as shown in Figure 9. Job effects in Saudi Arabia are at such a low level due to high labor productivity and high import shares of sectors addressed,
- ⚙ EUR 1bn investment in PV power plant build-up generates between 15k and 23k jobs in Morocco, 22k to 42k jobs in Egypt, and 1k to 4k jobs in Saudi Arabia, as depicted in Figure 9,
- ⚙ EUR 1bn investment in Wind power plant build-up generates between 36k to 46k jobs in Morocco, 60k to 82k jobs in Egypt, and 3k to 6k jobs in Saudi Arabia, as shown in Figure 9.

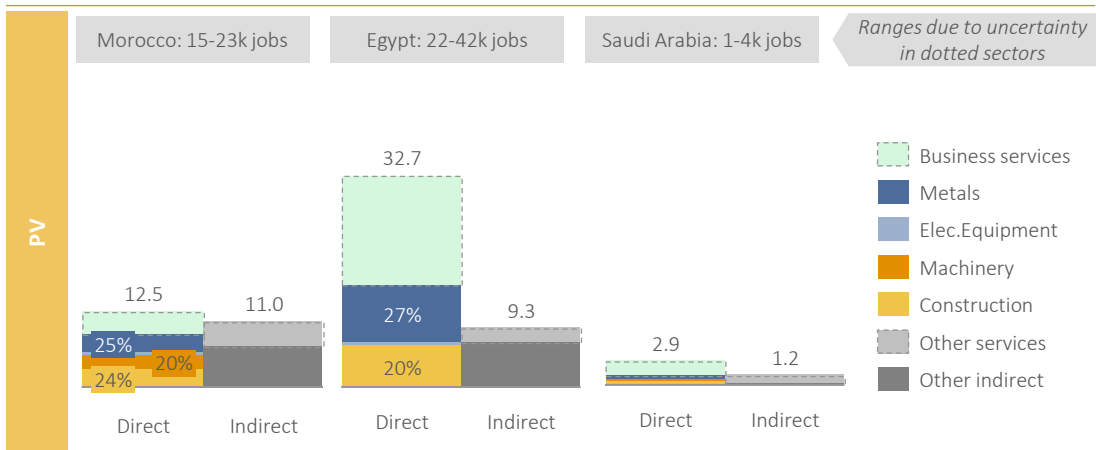


## Job creation from CSP, PV and Wind power plant build-up

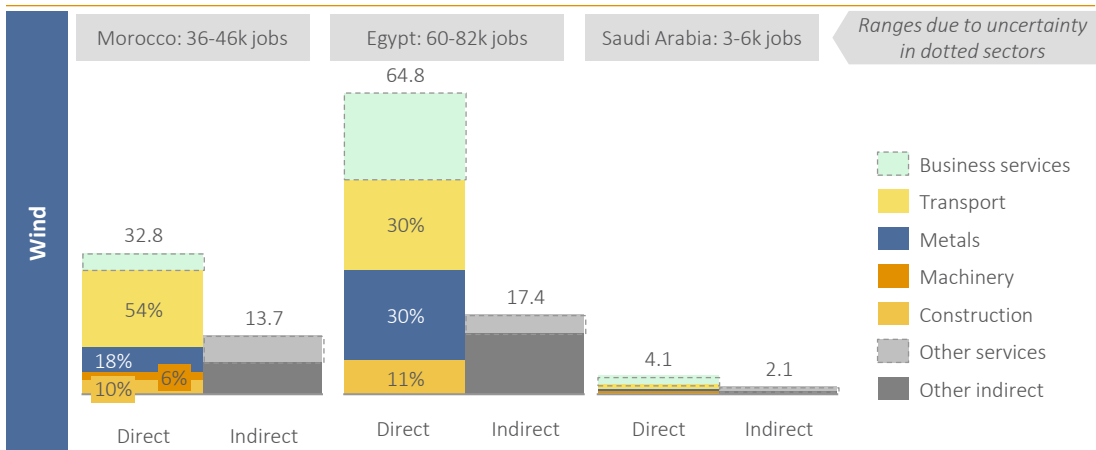
### CSP: Thousand jobs per EUR 1bn investment per technology (construction of power plants)



### PV: Thousand jobs per EUR 1bn investment per technology (construction of power plants)



### Wind: Thousand jobs per EUR 1bn investment per technology (construction of power plants)

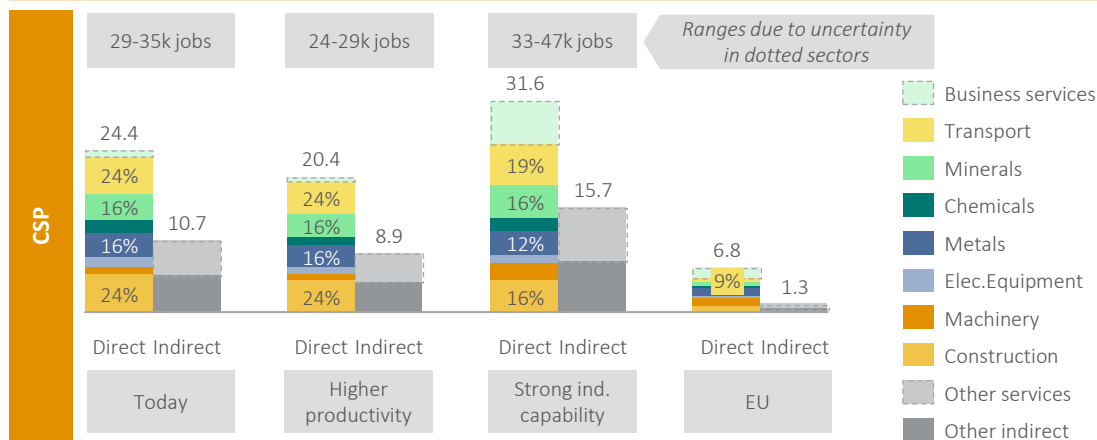


Source: IfW/ Dii

Figure 9 Job effects per EUR 1 bn. investment for CSP, PV, Wind

## Morocco: Job creation from CSP power plant build-up

Morocco: Thousand jobs per EUR 1bn investment per technology (construction of power plants)



Note: Higher productivity means that after 20 years labor productivity improves; strong industry capability assumes that more components are sourced domestically and higher productivity after 20 years; EU refers to Germany (including productivity gains after 20 years)  
Source: IfW/ Dii

**Figure 10** Changes in job effects depending on industry capabilities (CSP in Morocco)

In the future, two main effects can impact these numbers. Higher labor productivity leads to the creation of fewer jobs. Stronger industry capability, on the other hand, allows countries to source more components domestically, and can increase job effects. Their effects on Morocco, for example, can be seen in Figure 10. This trend is similar for Egypt and Saudi Arabia. By way of comparison, fewer jobs are created in the EU if similar investments are assumed. In the power plant build-up phase, CSP technology creates the most jobs in the minerals, metals, transport equipment, and construction sectors. PV creates the most jobs in the metals, machinery, and construction sectors. Wind creates the most jobs in the metals, transport equipment and construction sectors. Jobs are also created in other sectors, such as chemicals, business services and other services.

During operation, PV creates the most jobs, followed by CSP and Wind, if EUR 1bn investment per technology is assumed. PV creates 0.3-4.3k jobs, CSP creates 0.2-2.4k jobs and Wind creates 0.1-1.1k jobs.

RE sectors are generally based on mechanical, technically-intensive production technologies. For this reason, more blue-collar than white-collar workers are required. Power plant build-up (incl. component manufacturing) requires more blue-collar workers (ca. 80-90% of total workforce) than power plant operation (ca. 30-40%). In other words, both RE power plant manufacturing and construction are dominated by technical jobs that require sound vocational

training. This constitutes an advantage for the MENA region, since the training process for local workers is relatively fast for these technical jobs. The social status accorded to jobs, especially blue-collar jobs, requiring vocational training in the MENA region could, however, be an impediment to attracting good workers to the sector. The expansion of RE in MENA can also create jobs internationally. Particularly in the short term, international and EU industry can create jobs by exporting RE components to the MENA region, since the industry capabilities of MENA economies are still catching up. For EU industry, MENA markets are especially attractive as an export destination for complex components. Free trade agreements (e.g. DCFTAs) for goods and services can further facilitate trade in sectors related to renewable energy technology. A range of components would likely be exported from the EU to MENA, and would thereby lead to the creation of jobs in the EU. CSP build-up would require receivers, turbines, and generators, while PV would require modules and inverters. For the build-up of Wind in MENA, gearbox/ bearings and top control would likely be exported from Europe. The EU electronic equipment and machinery sectors, which supply many of these components, could benefit the most from investment in the MENA region. EUR 1bn investment in MENA in CSP could create 2,000 jobs in the EU; if invested in PV, it could create 4,000 jobs in PV in the EU; EUR 1bn invested in Wind generation in MENA could create 3,000 jobs in the EU due to the export of components to MENA.



## 6. INDUSTRIAL POLICY TOOLS

Industrial policy is the intervention of governments in specific sector with the aim to foster economic development and maximize the benefits of economic growth. Governments typically use industrial policy to increase the competitiveness of a sector or industry and catch up with global leaders. Successful “catch-up” countries (e.g. Korea, Taiwan, Singapore) have made extensive use of industrial policy tools. Since MENA countries want to use RE as a way to create jobs and promote economic growth, they are using, and will likely expand, industrial policy measures in order to maximize the local economic benefits of an RE industry. RE industries and sectors are particularly promising areas to which industrial policy can be applied. Due to the region’s excellent natural resources, there is the potential for significant growth in

RE generation. If governments facilitate the emergence of a local RE industry, local firms will have the opportunity to gain competitiveness on a dynamic and growing domestic market. The process of acquiring domestic competitiveness can then provide them with the experience necessary to become competitive in the region.

From a private sector perspective, it is crucial for industrial policy to focus on equipping companies with the capabilities to compete, instead of limiting competition. The ultimate goal of industrial policy should be to produce a self-sustaining market. Rather than choosing companies, tools should be accessible to all companies so that the strongest players can emerge. The key principles outlined in Figure 11, below, can help ensure this.

### Principles of market-friendly industrial policy

1	Avoid protectionism
2	Provide equal access to all firms
3	Promote competition: let competition, not public authorities, pick winners
4	Minimize public sector dominance in PPPs
5	Design an exit strategy prior to industrial policy intervention

**Figure 11** Principles of market friendly industrial policy

Key levers for industrial policy are:

- ⚙️ Targeted education and training on all skill levels to equip industry with the employees it needs. Due to the likely high demand for blue collars with the appropriate skills, a short-term focus on vocational training can deliver results quickly. High-quality, private training institutes might help scale up programs that provide workers with the skills demanded on the labor market. Greater involvement of the private sector in education and training in general can also help address today's skills mismatch in the MENA region.
- ⚙️ Know-how transfer, both on an individual and institutional or company level. Exchange programs at all levels between EU and MENA educational institutions are a useful vehicle for this. Exchanges and know-how transfer should also be used to promote ties within the MENA region. At the same time, incentives to encourage companies to work together can promote know-how transfer between EU and MENA firms.
- ⚙️ Creating the basis for innovation in the long term by supporting the creation of industry clusters and R&D today. In the long term, R&D is one of the key ways to provide firms with capabilities that enable greater competitiveness. Science and technology parks are an excellent vehicle with which to provide such resources to firms.
- ⚙️ Policy coordination: Effective industrial policy for RE requires an approach that is not limited to energy, industry development or education and training, but rather one that encompasses all these aspects. Thus it makes sense to embed policies fostering a competitive RE industry into other political decisions. This also requires transparency for the public and private sectors on industrial policies, e.g. in the form of stakeholder consultations.



## 7. POLICY RECOMMENDATIONS

Dii's policy recommendations propose concrete steps that can be taken to maximize the socio-economic benefits of a RE market for local citizens. They are based on the precondition that a RE market is created, and thereby the demand for products, services and workers rises. They are crafted with the goal of maximizing the benefits for the economies of countries with RE generation, and thus focus primarily (though not exclusively) on the manufacturing of RE components. They do not show what is necessary to expand renewable energy in the region, a topic that is covered in "Desert Power: Getting Started". Instead, they indicate concrete steps that can be taken today to improve the competitiveness of local workers and local firms involved in the manufacturing of RE-related components and in the construction, operation and maintenance of RE power plants.

### ⚙️ Certification of components:

Local firms in MENA countries should be provided with the resources necessary to acquire internationally recognized certification in key components. A certification institute in a MENA country should work together with local firms to illustrate necessary requirements and identify strategies that a firm could use to gain an internationally recognized certification. Such an institute could be funded by the respective country's government and should work together

with an international certification company. Acquiring an internationally recognized certification can help increase the capabilities of local firms while also making them more competitive, e.g. by facilitating bankability and reducing the cost of capital. A targeted effort to provide MENA firms with the resources to bring key components in line with international quality standards is an efficient way to use industrial policy in a non-discriminatory, market-friendly way.

### ⚙️ Science and technology parks:

Existing and new science and technology (S&T) parks should follow market-friendly principles to encourage R&D, particularly in the private sector, as well as to promote know-how transfer.

They should prioritize private-sector R&D and provide firms with incentives to increase their R&D expenditures and activities. They should promote technology transfer, by providing incentives to encourage partnerships between foreign and local firms. In general, the resources on offer should be provided on a non-discriminatory basis to firms operating in the country. Finally, S&T parks should make an explicit attempt to attract members of a country's diaspora in order to further the transfer of know-how and best practices.

### ⚙️ Exchange programs:

Exchange programs should be founded to encourage the exchange of students at all levels between the EU and MENA.

In particular, a flagship exchange program for the EUMENA region should be established, along the lines of the US Fulbright scholarship or existing Eastern European programs. It should aim to encourage bidirectional exchange – with Europeans going to MENA as well as vice versa. Such an exchange program should have a home residency requirement in order to minimize brain drain. EU institutions like the European Commission’s Directorate-General (DG) Education and Culture and DG Development and Cooperation could play an important role in funding and implementation, since such programs promote the European Commission’s goals for greater regional integration in the Maghreb. So too could civil society foundations in both Europe and MENA. The experience of exchange programs successfully designed and implemented by MENA countries can also help guide new programs.

Exchange programs should not be limited to the highest educational levels. Exchanges related to vocational training should be promoted in order to encourage know-how transfer while also improving the social standing of vocational training programs in MENA. For example, an exchange program could provide students with exposure to cooperative training programs, in which students pursue an integrated course of study alongside in-company experience.

### ⚙️ Private sector training:

A marketplace for private-sector, for-profit vocational training should be enabled in RE-relevant subjects in the MENA region. Private-sector, for-profit training should be promoted as a way to complement efforts for more effective vocational training. A pilot project should be supported. In such a project, an international training company should partner with a MENA company in order

to develop a business model and found a pilot training academy that includes a train the trainer program. Financing for such a project might come from an international finance institution as well as from private investors and companies. Such a pilot project would aim to provide immediate results in addressing the RE industry’s projected need for large numbers of well-trained, blue-collar workers. In particular, creating a lasting, sustainable model for employer-relevant, RE-targeted training can ensure that local workers have the necessary skills, including soft skills, identified by a council made up of industry representatives and training providers.

### ⚙️ Policy coordination - socio-economic development plan:

An RE socio-economic development plan should aim to coordinate, and encourage collaboration between, the responsible political actors. With such a plan, existing strategies on energy, investment, and environment should be merged into one consistent master plan for RE development. This plan should aim to encourage collaboration between the two major players involved: energy or environment/resource ministries, which are responsible for reaching RE targets, and economic/industrial development ministries, which aim to maximize the economic benefits of RE for local citizens. These complementary goals can only be realized when pursued in close collaboration. Such a master plan could also be envisioned on a regional level in order to promote the regional integration that is necessary for the expansion of RE in MENA.





## 8. CONCLUSION

Following the Arab Spring and with an economic crisis in Europe, job creation and industrial development are clear priorities for governments on both sides of the Mediterranean. RE is a promising area to develop the capabilities of local firms and workers, since the conditions and incentives for market development are good – starting with the excellent solar and wind resources, and wide empty spaces, in the MENA region. Developing an RE market in MENA can benefit countries in both Europe and MENA. For MENA countries, it is an opportunity to drive economic growth, create jobs and expand industrial capability, all while reducing dependence on fossil fuels. For Europe – and especially for the southern European countries, which are most closely interlinked with MENA both historically and, today, economically – this market represents an opportunity for exporting components and, in the longer run, a potential source of imports of affordable, clean electricity.

To maximize the economic benefits of an RE market for their economies and citizens, MENA governments should focus on creating favorable

market conditions, capable of attracting significant FDI inflows, while also fostering local industry and local workers with market-friendly approaches. The local jobs and economic growth described in this report will not simply be created automatically by meeting RE targets. Instead, they rely on stable, sizeable RE markets, and a clear, stable and coherent industrial policy to promote them. At the same time, the RE industry, which today is far more concentrated in Europe than in MENA, must appreciate that job creation and know-how transfer (e.g. through worker training programs) need to be an integral part of its value proposition in MENA.

EIDP describes the potential economic effects of RE market development in MENA, as well as steps that can be taken in order to start maximizing local benefits today. On this basis, concrete action should be taken. Dii welcomes the opportunity to be involved in discussing and implementing the findings and recommendations from this report with the wide range of stakeholders involved in RE in EUMENA.

## Acknowledgements

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Dii management, Shareholders and Associated Partners as well as numerous third party experts have made significant contributions at all stages writing this report.

The quantitative modeling of macroeconomic impacts and employment effects was conducted by Gernot Klepper, Manfred Wiebelt and Alvaro Calzadilla of the Kiel Institute for the World Economy (IfW).

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**Published by** Dii GmbH  
Kaiserstr. 14  
80801 Munich, Germany  
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**First Edition** June 2013

**Photo Credits** *page 5, 7, 25* ABB, *page 13* Shams Power Company, *page 17* Leoni,  
*page 22* Dii

**Design & Layout** Paul Grabowski, Medienkeller (Deckblatt)

**Print** MEOX Druck GmbH, München

ISBN 978-3-944746-08-1

# Disclaimer

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English 06/2013

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