CHAPTER 4

Analysis of Potential Economic Benefits of Developing a CSP Industry in North Africa

The final section analyzes local economic benefits of an industry development in the MENA region. A dynamic economic model, with market scenarios and reference plants, assesses the local share of a CSP deployment and manufacturing of components.

The results are aggregated by a sub-analysis of four different parameters.

- Average share of local manufacturing in MENA region
- Economic impact on GDP
- Labor impact: job creation
- Foreign trade impact

4.1 Introduction to the Modeling Concept

If the MENA CSP IP and a successful long-term strategy, with national and international financial support, are implemented, new local markets will open up in the MENA region. New CSP projects will add valuable economic benefits to the economies of the MENA countries through the creation of new jobs, GDP growth, international trade and energy security.

These prospective economic and social benefits are to be taken into account in setting up the financial support plan for the Scale-up Initiative, since they will establish long-term economic growth for the MENA region. The potential benefits from the renewable energy technology CSP for the development of the regional industry and technology will be summarized in this section. The advantages of a

realized MENA CSP IP in combination with the growth of local manufacturing and new factories for CSP components are highlighted.

Large-scale development of the CSP market—both local and worldwide—will give a return to the MENA countries if they participate in local CSP component manufacturing for domestic as well as for international markets. Any early market entry could create first mover advantages, where competitive production capacities supply regional and world-wide markets.

As a result, MENA countries would obtain significant economic and social benefits. Further, the technical know-how in renewable energy technologies would increase in these countries. In an optimistic scenario, the total potential of the local manufactured added value of CSP plants could reach medial 60 percent. That considers a continuous local market based on the three scenarios A, B and C which have been presented in the previous chapter.

Modeling approach

To assess the economic effects of a growing CSP market in MENA, a dynamic model approach is used. At first the status quo of local manufacturing in the year 2010 is determined based on recent ISCCS plants in the region. Therefore the value chain and investment cost analysis (see chapter 1) play an important role. To guarantee the comparability, the reference plant as introduced before (50 MW and 7.5 hours storage) is used. The model is calculated on the three different market scenarios (A, B, C) explained in the previous chapter. The dynamic development of local share is calculated considering several influencing factors.

Some of the main influencing factors are: The market development, investment costs, the status quo in North Africa, varying experience curves, technology requirements and complexity, production capacities, productivity, local know-how, and local differences. The model refers to component specifications based on technology requirements (see chapter 1) as well as on country and project related assumptions for local manufacturing of components and plant construction (chapter 2). A bottom-up approach is applied as the effects are calculated component by component, service by service identifying, for example, both direct and indirect economic and job effects.

The most important pre-analyses (market scenarios, reference plant, status quo, cost scenarios, component specific input and job development) are presented in this chapter. The results from the local share, economic effects, job effects and foreign trade effects are also discussed. The share of local manufacturing is dynamically modeled with respect to the required market size and the continuous growth of local, technical skill and expertise.

Some general remarks:

- If a service (construction) and a component were indicated to be produced by a company based in North Africa, the total cost volume was added to the “local” share. If a component came from a company based abroad, it was added to the “international” share.

- Purchase of services (construction, project development, Management, EPC) is a "*construction related effect*".
- Purchase of components of a power plant is summarized as "*component and supply chain effects*" for North Africa.
- Job effects during construction and operation are assumed, based on data from recent local and international projects.
- Jobs and Economic Development Impact (JEDI) models from NREL have been used as reference, but they do not provide a dynamic environment for local manufacturing in MENA.

Induced effects are not being considered as determination is relatively difficult and would be inaccurate In the JEDI model, I-O tables of US states were used for comparative purposes The results in values for induced effects are almost the same size as effects of the supply chain (in the US). For more details on the modelling approach, see the Annex.

Market growth scenarios

To calculate and analyze the potential economic benefit, different market deployment and growth scenarios A, B and C (described in chapter 3) as well as assumptions for the world market are used.

- Effects of an internal CSP market growth are considered to be linked with export of CSP components to the world market, e.g. to other MENA countries or Southern European countries like Spain, Greece or Italy.
- Scenarios cover the different cases of market development that will have different implications on the economic benefit and the implementation of local supply and component manufacturing in factories of the MENA countries.

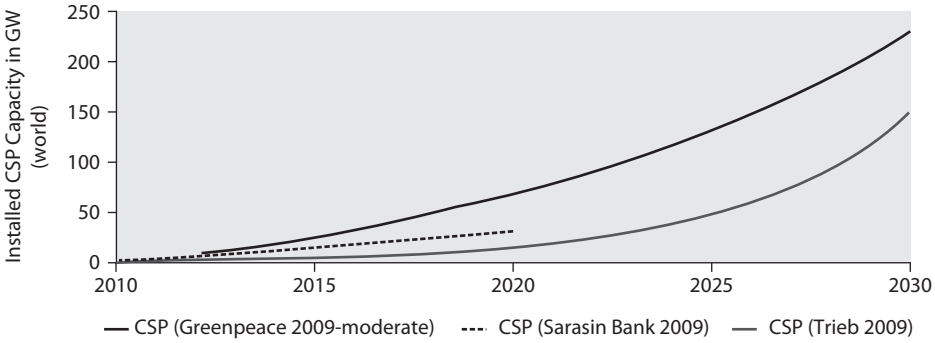
Table 4.1. shows the three different market scenarios and export market demand of components for MENA countries.

A large difference in installed power was modeled for the three scenarios. Scenario B is limited to 1000 MW by 2020 and 2100 MW by 2030. This scenario constitutes the minimum level which the CSP Scale-up initiative should achieve while it is expected to trigger additonal impacts. Compared to scenario B, the "Transformation" scenario shows a dynamic growth up to 5000 MW by 2020 and up to 31,200 MW by 2030. By 2020 an additional export demand is expected in this scenario for components for CSP plants with 2000 MW capacity. This has

Table 4.1 ■ Different Market Growth Scenarios with Export Projections

Scenario	Installed capacity in 5 Countries by 2020	Export market demand of components
Scenario A (Stagnation)	500 MW	0 MW
Scenario B (No-replication)	1000 MW	0 MW
Scenario C (Transformation)	5000 MW	2000 MW

Figure 4.1 ■ CSP World Market Growth through to 2030 as Determined by Three Different Studies



to be distinguished from CSP plants built in MENA countries and which export electricity to Europe. Within each scenario, a defined roadmap for CSP installation exists for each country. The roadmap depends on the current (solar) investment plans for the region and the size of the electricity market.

World-wide CSP deployment scenarios were defined for the period from 2010 to 2030. For the period after 2020, the market developments have been connected to the reference, moderate and advanced scenarios of the Greenpeace Report (Greenpeace, 2009) with a share of 10 to 20 percent of the world market. These market developments serve as the basis for the local demand for CSP components, the driver for local manufacturing and the construction of new plants. Additional export demand was created in scenario C where a total component export of 5180 MW is expected by 2025. Both economic and social effects are considered in these scenarios.

Reference plant

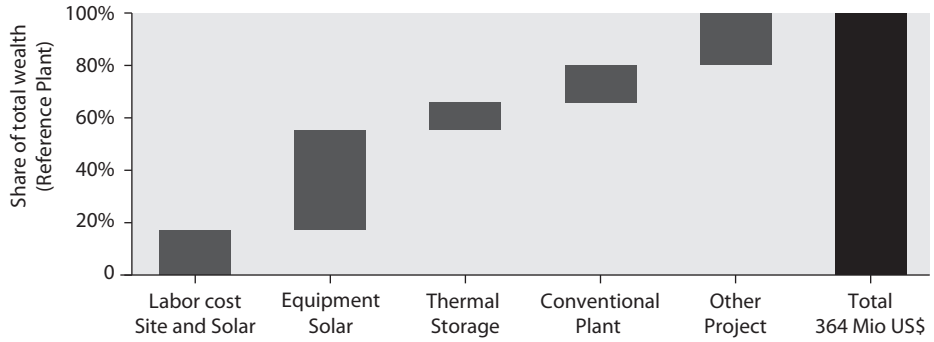
A 50 MW plant with 7 hours storage and the cost structure (as presented in section 1.4) were used as a reference. This reference plant was evaluated to obtain all data about construction costs, component costs and labor effects connected to this plant. Furthermore, the specific requirements and constraints put on market

Table 4.2 ■ Newly Installed CSP Plant Capacity in MENA by 2020

CSP Scenarios in MW		2011–2014	2015–2017	2018–2020	Total by 2020	Total by 2025
Scenario A	domestic	80	160	260	500	1050
	component export	0	0	0	0	0
Scenario B	domestic	160	320	520	1000	1550
	component export	0	0	0	0	0
Scenario C	domestic	800	1600	2600	5000	14500
	component export	250	600	1150	2000	5180

Note: The exports refer to components expressed in terms of equivalent CSP plants

Figure 4.2 ■ Total Cost Distribution for Reference Plant



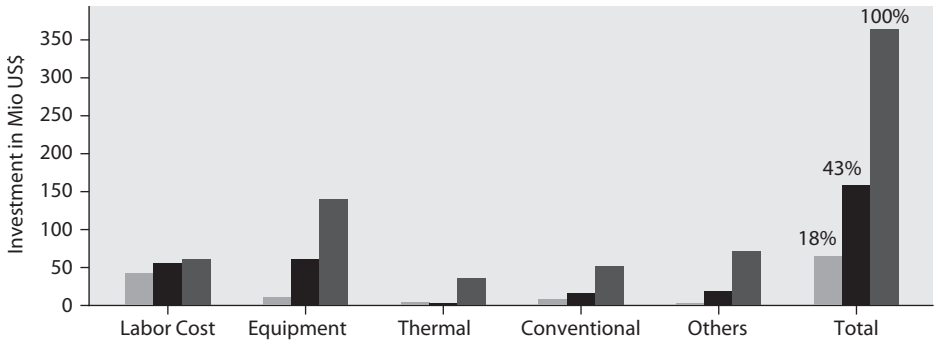
demand, complexity levels, and job effects related to the components used (as described in 1.3 and 1.4) were identified.

The calculation starts with a total investment of US$364 Million in 2010, and considers continuous cost reductions with increasing production. The five larger cost groups have shares between 14 percent (Power Block) and 38 percent (Equipment of Solar Field and HTF) of the total investment. They also include several sub-services and sub-components (Table 1.7). "Equipment Solar Field and HFT System" consists of mirrors, metal structure, receivers, piping, etc. Category "Others" (19 percent) includes the important cost parameters: project development, management, financing (and allowances).

Share of the local manufacturing – recent ISCCS projects

Information has been collected from newly installed ISCCS plants in the MENA region to identify the current status quo of local manufacturing. The findings have been transferred to a virtual 50 MW reference plant because the ISCCS power plants have a quite different plant design due to the low solar share (approx. 5 percent) related to the output of the combined cycle plant.

Figure 4.3 ■ Comparison of the Status Quo of Local Manufacturing for CSP Projects in the MENA Region



The virtual reference plant shown for two different cases, a low and medium share of local manufacturing respectively, indicates the different situations of local manufacturing. The situations are project related and depend on many circumstances and the project characteristics.

Plant 2 (similar to Egyptian ISCCS plant) has a local share of over 43 percent with respect to the total plant investment. The share of components or services imported from international companies which provide project development or management is still high with 57 percent.

Lower shares of local content at 18 percent are, however, also found in the region. In Plant 1 (other ISCCS in MENA region), only civil and construction works are provided by the local workforce and companies. The status quo was obtained and cross-checked by industry surveys and expert interviews.

This current status was used as the baseline for future projects, with the projection that future projects increase the local shares. Future forecasts will give average potential results for local manufacturing in the region as different, project-related local shares occur. Plants with a higher share of local manufacturing are expected to have a strong economic and social impact compared to CSP plants with lower shares.

The economic benefit varies from one country to another, depending on market size, industrial potential of local manufacturing and the available technical know-how for manufacturing and producing components. The value of the involvement in the construction and planning of the plant is also considered.

The proposed actions and programs detailed in the previous chapter would shift the share of local manufacturing over time in MENA countries. This effect is also reflected in the model.

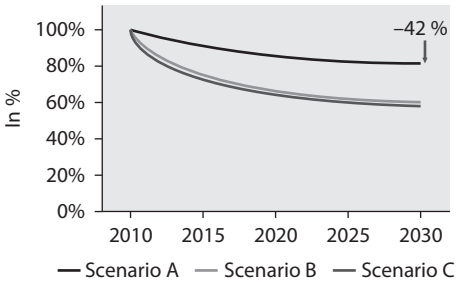
Cost scenarios

To calculate the value added in the region, a simulation model of the future investment costs for CSP plants is necessary to obtain annual data over the next 20 years. Future cost developments and cost reductions on the component and plant level have been modeled by learning curves which are related to the world market growth as determined in the scenarios of the Greenpeace Report (reference, moderate and advanced). Learning curves are based on a historical observation of different technologies whereby the production costs decrease over a longer period, if output is doubled. Experience curves for CSP are broken down by findings from the SEGS plants in California with parameters ranging from 90 percent for solar field and 98 percent for conventional plant components (Trieb 2009). The starting value for the total investment is based on US$364 million in 2010. As shown in section 1.4, this already takes into account a reduction of investment costs of 7 percent compared previous Spanish CSP projects. The results of the cost reductions are cross-checked with the expectations and forecasts recently published by Estela and AT Kearney in June 2010 (see Table 13) that are in line with the authors´ estimations.

These learning curves were generated for the different costs of the plant (construction, solar field components, power block, etc.) and take into consideration

Table 4.3 ■ Learning Curve Parameters for Cost Scenarios (Experience Curve, see also Trieb 2009)

CSP plant 50 MW with storage (7 hours)	Experience curve parameters
Labor Costs: site and solar field	98%
Equipment Solar Field and HFT System	90%
Thermal Storage System	92%
Conventional Plant Components	98%
Others	90%



the different world market scenarios of the Greenpeace Report 2009. The experience curve describes the decline of investment costs when the production volume of CSP doubles. Since scenarios B and C are linked with the moderate and advanced scenario, cost reductions are larger than in scenario A because of the low world market growth.

Components specific input

To create a local CSP industry in MENA, a large market demand is first required so that local and international firms build up new production capacities in MENA. Volume barriers of factory output have been included to obtain the specific demand levels necessary for opening up new factories.

Process and product know-how must be available in order for local companies to enter the market. For companies existing in other countries, their numbers of local skilled workers has been large enough in each country so that new productions and factories are created with or without joint ventures.

Selection of most main parameters influencing the model:

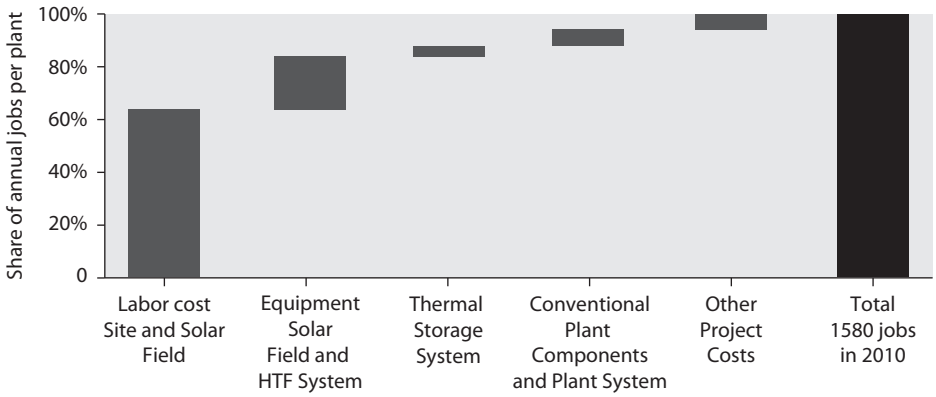
- Status quo of local manufacturing in CSP project
- Component specific potential for local manufacturing
- Minimum annual factory output
- Market potential/market scenarios
- Job impacts

Job development

In sections 1.3 and 1.4 the job effects of CSP have been presented based on a European CSP plant. For the modeling some assumptions have been made to shift the job effects on the MENA market:

The job market in MENA is highly influenced by low labor costs, availability of skilled and low-skilled workers but also by lower productivity of the workforce. As a result, twice as many workers as needed are used for construction.

Figure 4.4 ■ Total Number of Jobs Created by a Reference Plant in 2010



For component manufacturing, the same number of required jobs was assumed as in Europe because many production processes would include similar machine equipment in MENA. Thus, a similar workforce would be needed to run such factories.

With an experience curve value of 0.98 on the labor costs, the number of workers required to construct the plant will decline continuously as cost reductions will also influence the number of jobs on the construction site.

The basis of the job calculation is the number of total jobs that are created by one reference plant. This reference plant in North Africa had a total amount of 1,580 employees in 2010 (one-year equivalent)[1].

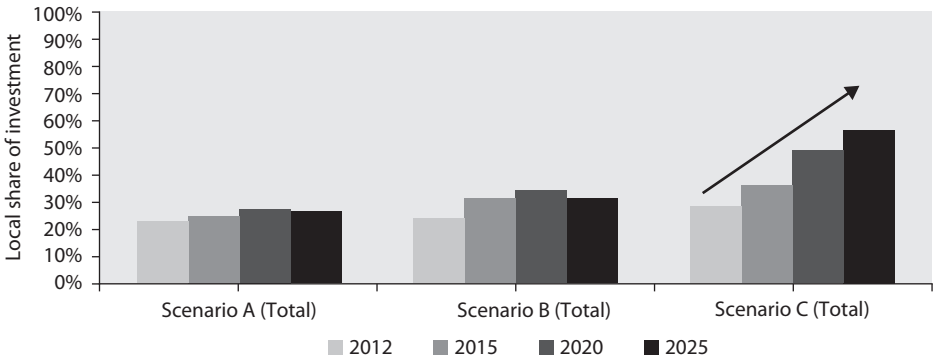
Operation and maintenance of the plants will add many new jobs over a longer time period, after the initial construction of the plant. Wages and the amount of employees were adapted to the MENA case: lower wages and more workers over the lifetime of the plant (41 direct jobs). Because of low labor cost in North Africa, higher values for jobs are expected compared to European or US power plants. For future plants, a fixed number of workers is assumed. Efficiency gains and new methods of O&M planning, however, could decrease this number.

4.2 Average Share of Local Manufacturing in the MENA Region

The share of local manufacturing for the defined scenarios A, B and C covers all CSP plants constructed in the future in the region. The status quo of local shares lies between 17 percent and 43 percent. The average local share of added value ranges from 23 percent in 2012 in scenario A to 57percent in 2025 in scenario C.

[1] Protermosolar, as a feedback to this report, provided a higher figure of 4000 employees (1 year equivalent) for the reference plant including the whole value chain: R&D, project and site development, basic engineering, manufacturing of components, financing, EPC, detailed engineering, construction.

Figure 4.5 ■ Share of Total Local Manufacturing Potential in Scenario A, B, C



In a slow market development scenarios resulting from other competitive technologies or low financial support, the local share is limited to about 34 percent of the total investment for construction and components (scenario A).

Scenario B has a low impact on local manufacturing because the main CSP components are imported from elsewhere. Only experience in construction and project organization increase. After 2020, a continued low market growth could decrease the local share of each plant since larger production in other countries could produce components more economically than companies in a small MENA market.

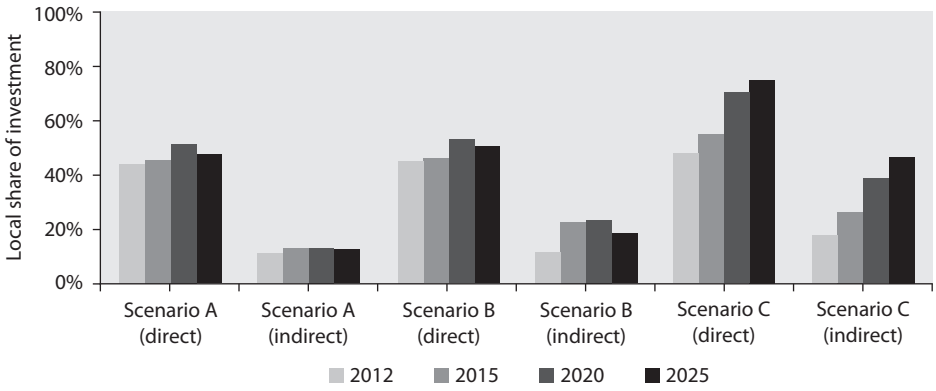
Large market demand (scenario C) stimulates the creation of a CSP industry in the MENA region. This development could increase the local share up to 70 pecent of the total value in some projects. Local mirror and receiver production starts in this scenario between 2015 and 2017. Other special components are also produced due to the large market size. After 2025, the share of local manufacturing is assumed to increase further due to more technology transfer and knowledge sharing through realization of many CSP plants in the region.

Market demand is the main driver of local manufacturing as the size of the market attracts local companies to invest in new production lines or international investors to build up local subsidiaries.

If the investment is split in direct (construction) and indirect (components) effects, then the scenarios can be analyzed in a bit more detail. Direct effects contain all labor on the construction site as well as costs related to project development, project management, financing and allowances.

Scenario C, the "Transformation" scenario, also leads to growth in the manufacturing industry with a local investment share of up to 50 percent. Scenario C also forecasts a mirror production capacity in MENA. At the same time, the construction is done locally with an overall share of up to 75 percent in 2025. Opposite effects are observed in scenarios with small markets. Here only 20 percent (only metal structure and some other components) could be produced locally. Direct effects are lower in all scenarios because it also includes engineering, management, and financing values, which contribute to

Figure 4.6 ■ Total Local Manufacturing Potential for Construction and Components



a decreased share of local content in the labor specific works (construction of solar field).

The scenarios do not contain modeling of local content clauses which would require a specific local share for each project. If such local content obligations would be introduced, the share of local manufacturing could be much higher. However, this could also affect costs, design or plant realization.

A stable market and large market demand (scenario C) will influence many investment decisions on the local production of CSP components. Many added value processes could be done locally as shown in the following table, e.g. mirror production (2016–2020) and project development (2020–2025) in MENA.

4.3 Direct and Indirect Economic Impact

Effects on direct and indirect economic values are calculated in absolute numbers for each scenario. In addition to local manufacturing of components and construction of the plant, operation and maintenance (O&M) will also contribute to the

Table 4.4 ■ Time Schedule of Local Manufacturing of Components and Services

Scenario A and B:			
From 2010	**2011–2015**	**2016–2020**	**2021–2025**
Pylons, Foundation, Support structure (Egypt)	Metal support structure, EPC (Egypt)	EPC (rest)	
Scenario C:			
From 2010	**2011–2015**	**2016–2020**	**2021–2025**
Pylons, Foundation, Support structure (Egypt)	Metal support structure, EPC (rest)	Mirrors, Swivel joints, Receiver	Project development, Management

economic impact of CSP plants in MENA. Local economic impact is calculated for each scenario by a model which integrates the dynamic development of the local share and market size over time. All investments in components and services provided by local companies and by international companies producing locally are added up to local economic impact. ***Direct*** **economic impact is related to construction of new power plants.** ***Indirect*** **effects are economic impacts by demand in the supply value chain.**

The economic impact is strongly related to the market size of CSP in MENA. An installed capacity of 5 GW by 2020 as in the "Transformation" scenario creates a local economic impact of US$14.3 billion, compared to US$2.2 billion in scenario B. The higher share of local manufacturing in the "Transformation" scenario adds more economic benefit to the countries. Local revenue in scenario A is only US$916 million in 2020. The following table summarizes the cumulative impact in 2012, 2015, 2020 and 2025. The local economic impact rises from 32 percent in scenario B to 40 percent in scenario C by 2020 due to the larger market size.

The share of O&M in the economic impact increases from 8 percent in 2012 to 32 percent in 2025 because of the continuous economic impact over the lifetime of the power plant. Annual expenditures for operation and maintenance as well as employee salaries create an important long-term positive impact.

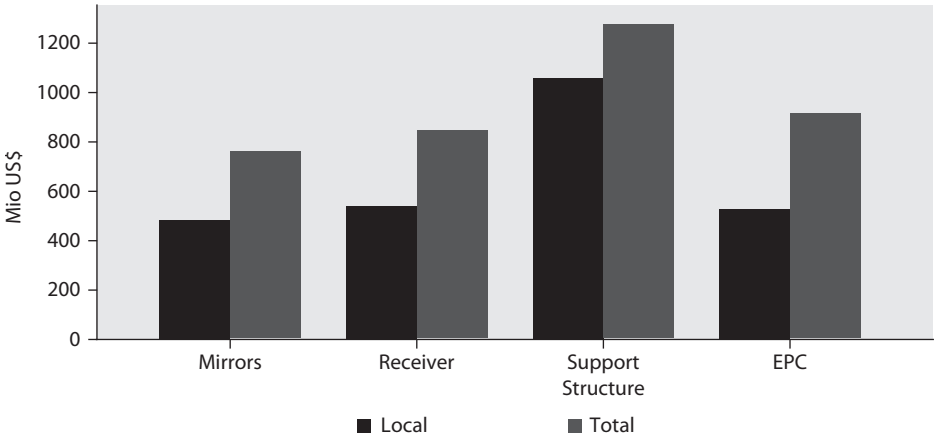
Additional induced economic impacts will appear if investment in CSP takes place in a region. Models (JEDI) for US regional assessment, established by the New Renewable Energy Laboratory (NREL), describe almost the same amount of induced impact for a region as indirect ones. **Induced impacts result from an increase of wealth and income that create new demand for more services and products.** Significant induced impacts need to be added on top of calculated direct and indirect effects but are difficult to assess correctly.

The total effect of US$2.2 billion in scenario B ("No-replication" scenario) is calculated as a total value over all countries and projects. It includes the results of the previous section giving an average local share of 40 percent in 2020. If all projects will be realized with the same local content as the reference, Plant 2,

Table 4.5 ■ Direct and Indirect Local Economic Impact in Scenarios A, B and C

In US$ million (cumulated)	2012	2015	2020	2025	Local share by 2025	Cost reduction by 2025
Scenario A	30	193	916	1,498	25.7 %	~ 16 %
direct	20	125	571	946		
indirect (supply value chain)	10	68	344	551		
Scenario B	61	465	2,163	3,495	30.6 %	~ 36 %
direct	39	251	1,167	1,959		
indirect (supply value chain)	22	213	996	1,535		
Scenario C	368	2,803	14,277	45,226	56.6 %	~ 40 %
direct	206	1,403	6,999	21,675		
indirect (supply value chain)	162	1,401	7,278	23,551		

Figure 4.7 ■ Local and Total Revenue for Selected Components in 2025 in Scenario C



this value will be significantly higher because the local content for Plant 2 is assumed to be above 40 percent (for a reference 50 MW plant with storage). The average value of 35 percent in 2020 is lower because of a lower assumed status quo in other projects.

A breakdown of revenues for selected components (mirrors, receivers, support structure and EPC services) in the year 2025 is shown in Figure 4.7 for scenario C.

4.4 Labor Impact: Job Creation

The results of the labor impact assessment give the numbers of direct job creation during CSP plant construction as well as the indirect job creation in the factories of local manufactures while using the same definitions for local impact as for the economic effects.

The operation and maintenance of the plant will also create long-term employment in the solar sector as about 41 jobs are needed to run a reference power plant. Because of the replacement of components and equipment, the plant maintenance also has an indirect impact on new jobs. Many new jobs in construction and O&M will also have an impact on induced jobs in the region. Number of indirect jobs for construction and O&M will increase other induced jobs. This leads to higher wealth and income of the region when new services and products for their private consumption are demanded.

Permanent local jobs by 2025

Until the year 2025 the number of local jobs in construction and manufacturing rises up to 46,000 and 60,000 jobs plus 19,000 jobs in the operation and maintenance in scenario C. In case of a strong market development as in scenario C (also in B) the jobs in construction still increase, so that even the project-based,

construction effects have a permanent and long-term character. Jobs from O&M are permanent jobs for at least 25 years.

Local jobs in construction and value chain (cumulated numbers)

The labor impact is calculated on the values for construction of the reference plant and the number of jobs created by component manufacturing as local market demand for components grows as well. It is given below as cumulated number of one-year jobs between 2011 and 2025. During the construction of the plants, which represents the largest number of jobs, until the year 2020 about 15,000 local jobs will be created in scenario B compared to 72,000 in scenario C (cumulated values, see Figure 4.8).

The number of local jobs related to total jobs increases in scenario C as the local share increases. However the higher learning curves and cost reductions in the best case scenario lead to a decrease of the absolute (local and international) number of jobs.

Figure 4.8 ■ Cumulated Number of Jobs (1-Year Full-Time Equivalent) During Construction for Scenario B and C

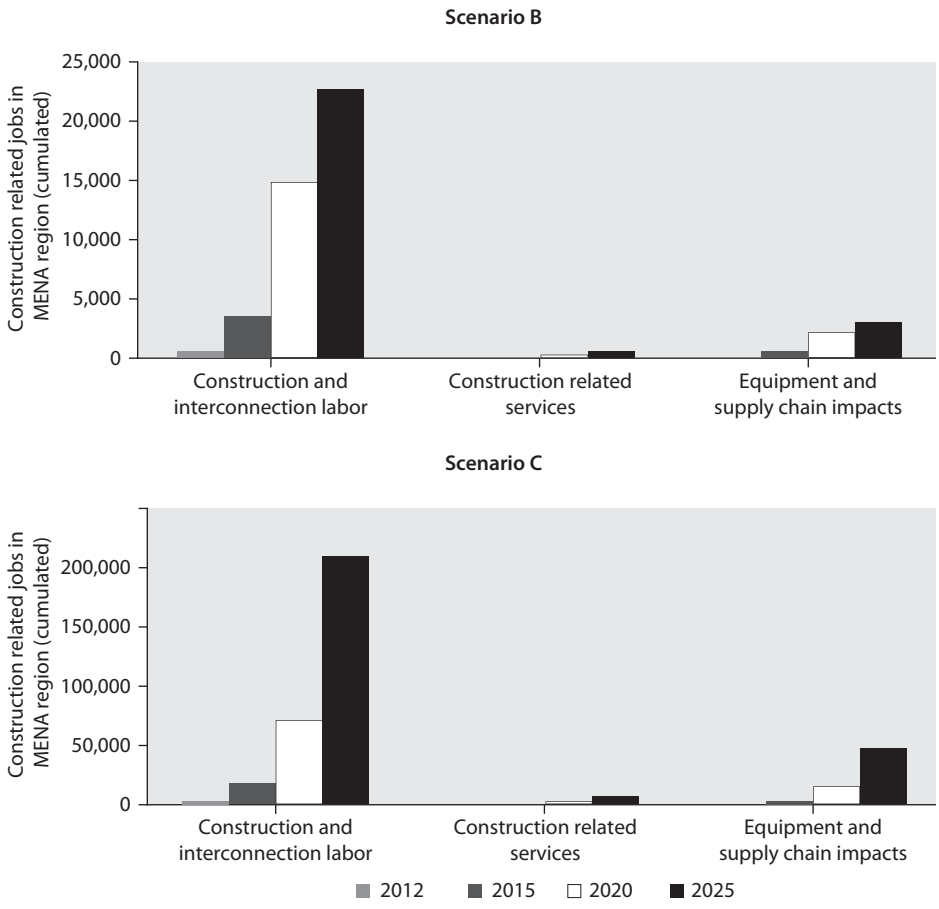


Table 4.6 ■ Number of Employees for O&M of CSP Plants in the Five Countries of the MENA Region

O&M Jobs in year	2012	2015	2020	2025
Scenario A	26	158	657	1,018
Scenario B	53	315	1,313	2,036
Scenario C *	263	1,576	6,567	19,102

* only plants built in the CTF MENA countries are considered here (i.e. 5 GW in 2020)

If the CSP market grows to over 20 GW by 2025 as in the "Transformation" scenario, a cumulated number of jobs of over 200,000 (1-year full-time equivalent) for construction and interconnection labour will be created in the five countries. Additionally, 8,000 high-skilled jobs in construction-related services for project management and development will also improve the socio-economic situation. In the "Transformation" scenario, 48,700 new local jobs for manufacturing of components could also be created by 2025 in a conservative calculation, assuming that local component manufacturers use the same number of employees as comparable factories in Europe.

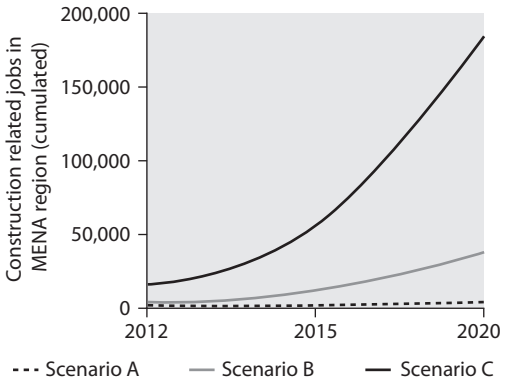
Jobs in operation and maintenance

Operation and maintenance (O&M) of the CSP plants in each scenario requires also a large number of regular jobs during the lifetime of a CSP plant. By 2025, 19,000 employees are to work in O&M as operator, cleaning personnel, technical worker or security staff in one of the CSP plants (scenario C). As O&M is strongly linked with the installed CSP capacity, these values in scenarios A and B are lower with 1,000 and 2,000 employees respectively by 2025. These tasks can be mainly performed by local employees and add more socio-economic benefit to the countries as the number of required employees are higher than those of conventional power plants with similar output.

Total local jobs by 2020 (cumulated)

If all O&M jobs are added to the jobs during the construction phase, the number increases further. By 2020, the total cumulated jobs (one-year jobs in full-time equivalents) will jump to over 180,000 in scenario C. Only 33,000 jobs in scenario B will have a lower impact on the local economics and technological know-how. In 2020, 34,000

Figure 4.9 ■ Total Number of Annual Jobs Created by CSP Deployment in the Five Countries of MENA



employees work in construction and O&M in scenario C permanently. In scenario B (in 2020) a workforce of 4,500 local employees is created.

Opportunities for new highly skilled employees in MENA countries

Besides these direct and indirect impacts, CSP plants offer the opportunity for MENA countries to attract more jobs for highly skilled workers, like engineers and technicians. By creating a skill enhancement for local workers, a sustainable development of the region can be reached within the next two decades.

The cooperation with international operating firms in the energy sector will open further business opportunities for these countries and this can lead to additional economic benefits. The local manufacturing of CSP components can push the local manufacturing of other products and create an attractive income for the local industry if the products are sold on the global CSP market.

4.5 Foreign Trade Impact

Trade growth of CSP components to external CSP projects in African or Arab countries, or in European or US markets, can strongly increase if a national decision to promote CSP technologies is made at an early stage of market development. First movers, potentially based in the MENA region due to the established large local markets and attractive solar potential in North Africa, could supply the international market. These international markets could be either found in the surrounding area. Exports to international CSP projects will have the additional benefits of promoting international integration on the political, social and economic level.

In scenario C a volume of 2,000 MW for components export was included to show economic impacts on the economies in the MENA region. In the model, the export market adds additional demand for manufacturing in MENA. This demand facilitates the growth of a local MENA market. But export will only take place if local demand exists in the region.

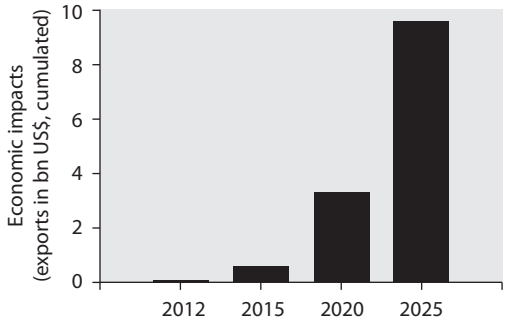
Components like mirrors or receivers are exported in the scenario C (with a demand of 2 GW to supply CSP by the MENA region). This demand could only be continuously satisfied by local factories. If competitiveness is reached, export will start with the same components that are produced locally in 2012: metal support structure or pylons. Later, when other key components like mirrors are produced locally, export markets could be supplied by factories in North Africa.

In such a scenario, job creation and growth of GDP arise out of this export opportunity. By 2025, over US$9.6 billion could be earned by exporting CSP components to external CSP projects. That would create 19,000 annual jobs, especially in the manufacturing of components. As in scenario C, products including parabolic mirrors, receivers and other highly technical equipment are produced for the local market and for export on the international market by 2020.

Key success factors for the foreign trade impact are:

- Stable home market as basis for export expansion
- Large growing world market
- Price competitiveness to international competitors
- International quality standards
- Reduction of trade barriers within MENA and to Europe
- Creation of regional lead market players for different components and equipment

Figure 4.10 Economic Benefit and Job Effect by Export Outside MENA Region



Price competitiveness is a particular strength for North Africa as industry representatives expect lower production costs in MENA compared to Europe. Quality control will be critical, however, and potential local companies will have to focus on this issue.

4.6 Conclusion of Chapter 4

In the "Transformation" scenario (scenario C) with large market growth, the total potential of local manufactured added value of CSP plants will increase constantly and could reach almost 60 percent as average value for all CSP projects.

The average share of local added value ranges from 20 percent in 2012 in scenario A to 60 percent in 2025 in scenario C. Assuming a slow market development, which can be the result of competition with other technologies or a lack of financial support for CSP plants, the local share would be limited to about 27 percent of the total investment for construction and components (scenario A). Also under the conditions of scenario B ("No-replication" scenario) the impact on local manufacturing is comparatively low, as most CSP components would remain imported, only construction, and project management, and basic engineering services might increase.

Market demand is the main driver of local manufacturing because a large market attracts local companies to invest in new production lines or international investors to build up local subsidiaries. Large market demand (scenario C) stimulates the creation of a CSP industry in the MENA region. This development could increase the local share of some projects up to 70 percent. After 2025 the share of local manufacturing is assumed to increase further due to technology transfer and the knowledge acquired through realization of many CSP plants in the region.

The level of local share influences economic impact and job impact of CSP development in the MENA region. Economic impact is strongly related with market

size of CSP in the MENA region. 5 GW by 2020 in scenario C create a local economic impact of US$14.3 billion, compared to US$2.2 billion in Scenario B.

In the year 2025 the number of permanent local jobs can rise up to between 64,000 and 79,000 (scenario C). In the construction and manufacturing sector there are 45,000 to 60,000 annual jobs created plus 19,000 annual jobs in operation and maintenance.

Looking at the time horizon of the CTF projects (only until 2020), between 2011 and 2020 the following results arise: Within these ten years the cumulated total jobs of full-time equivalent (1-year) for construction, manufacturing and O&M will increase to over 180,000 in scenario C. That means 34,000 employees working in CSP industry permanently by 2020. By contrast, in scenario B 33,000 jobs (cumulated over 10 years) will have a lower impact on the local economy and technological expertise. In this scenario a permanent workforce of 4500 to 6000 local employees is created by the year 2020.

Additional impacts for job creation and growth of GDP could come from an export opportunity of CSP components. Besides economic and social benefits, MENA countries could also increase local technical expertise in renewable energy technologies by following the path to invest in solar energy.