Solar technologies in North Africa: Potentials and targets of local manufacturing

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Local Manufacturing Potential of CSP projects in MENA Analysis for World Bank 2010

1. Results of the study

2. General findings: Local manufacturing of solar technologies in MENA

(available for download)
Solar technology targets in North Africa

Source data: own research; underlying radiation map: (Dii and Fraunhofer ISI, 2012)
Assessment of local manufacturing of CSP in North Africa

Countries in focus of the study for the World Bank in 2010:
Algeria, Egypt, Jordan, Morocco, Tunisia

Main objectives of the study:

1. Provide an overview of manufacturing processes, costs and cost reduction potential for key CSP components

2. Assess the potential for a CSP manufacturing industry in the MENA region

3. Establish roadmaps and an action plan for the development of local CSP manufacturing in MENA

4. Analyze potential economic benefits of a CSP component manufacturing industry in MENA
1. Step: Local and international participation in completed CSP projects

![Graph showing local share of investment in completed CSP projects]

- Local share of investment:
  - Plant I (local)
  - Plant II (local)
  - Reference (total)

- Breakdown of investment:
  - Labor
  - Cost Site and Solar Field
  - Equipment Solar Field and HTF System
  - Thermal Storage System
  - Conventional Plant Components and Plant System
  - Others
  - Total

- Key percentages:
  - Steel structure: 18%
  - EP C: 43%

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2. Step:
Global CSP value chain: What are the opportunities for local companies?

<table>
<thead>
<tr>
<th>Core value chain</th>
<th>Project Development</th>
<th>Materials</th>
<th>Components</th>
<th>Plant Engineering &amp; Construction</th>
<th>Operation</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements of the core value chain</td>
<td>Concept Engineering</td>
<td>Concrete</td>
<td>Mirrors</td>
<td>EPC-Contractor: Detailed Engineering</td>
<td>Operation &amp; maintenance of the plant</td>
<td>Utility</td>
</tr>
<tr>
<td></td>
<td>Geographical Determination</td>
<td>Steel</td>
<td>Mounting Structure</td>
<td>Procurement</td>
<td>Transport &amp; distribution of electricity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Determination of general requirements</td>
<td>Sand</td>
<td>Receiver</td>
<td>Construction</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Glass</td>
<td>HTF</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Silver</td>
<td>Connection piping</td>
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<tr>
<td></td>
<td></td>
<td>Copper</td>
<td>Steam generator / heat exchanger</td>
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<td></td>
<td>Salt</td>
<td>Pumps</td>
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<tr>
<td></td>
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<td>Other chemicals</td>
<td>Storage System</td>
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<td>Power Block</td>
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<td>Grid connect.</td>
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</tr>
</tbody>
</table>

Analysis of the CSP value-chain:
- Identification of current market players
- Review of production processes
- Cost analysis / cost reduction potential
- Complexity assessment for components
Evaluation of component manufacturing

Figure: Results of the industry survey on potential of local manufacturing
(Normal = status, italic = medium target)
Local market demand is often below typical production sizes of components

► Examples of market thresholds for investments in manufacturing facilities

<table>
<thead>
<tr>
<th>Components of the value chain</th>
<th>Annual output of a typical factory (MW/year)</th>
<th>Investment per factory (in Mio €)</th>
<th>Jobs per factory (Jobs p.a.)</th>
<th>Specific Jobs (Jobs/MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>200 – 400 MW p.a.</td>
<td>40 Mio €</td>
<td>140 Jobs</td>
<td>0.3 – 0.7</td>
</tr>
<tr>
<td>Mirrors</td>
<td>200 – 600 MW p.a.</td>
<td>30 Mio €</td>
<td>300 Jobs</td>
<td>0.7 – 1.5</td>
</tr>
<tr>
<td>Steel structure</td>
<td>50 – 200 MW p.a.</td>
<td>10 Mio €</td>
<td>70 Jobs</td>
<td>0.3 – 0.5</td>
</tr>
<tr>
<td>HTF</td>
<td>Very high</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
3. Step:
Competitive advantages and weaknesses of CSP value chain in MENA

- Small market size
- Fiscal, institutional and legislative framework
- Insufficient training of workforce and availability of skilled workers
- Lack of awareness
- Market competition

+ Low labor cost
+ Short distance to Europe
+ First experience
+ Political will to develop a local RE technologies industries
+ High growth in the electricity demand => new capacity required
4. Step: Calculation of local potentials and job creation

RE Technologies Market Development Model (RETMD)

Inputs
- Data research
- Expert interviews
- Competitiveness factors
- Market scenarios

Decision Parameters
- Status quo in projects
- Know-how (component)
- Know-how (countries)
- Factory specifications
- Market demand & Forecast
  Installed capacity per technology/component
- Technologies
  - Reference plant
  - Layout and capacity
  - Construction and operation
  - Technology parameter
    - Cost structure
    - Cost projection (learning curve)
    - Employment rates

Decisions
- Continuous increase
- Max./Min. potential

Results
- Qualitative decision per component
- Quantitative decision per component

Potential of local value creation (PLVC)
- RETMD output
  - Annual revenues
  - Annual FTE jobs
Potential local participation during construction of CSP plants

Local share of value generation during construction in %

- Scenario: BAU
- Scenario: Moderate
- Scenario: Ambitious
- Scenario: Moderate - North Africa cooperation

Source: C. Kost et al. (2012), Value generation of future CSP projects in North Africa

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Potential local participation during construction of CSP plants

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Source: C. Kost et al. (2012), Value generation of future CSP projects in North Africa
Potential local participation during construction of CSP plants

Larger market and regional integration facilitate local manufacturing

Source: C. Kost et al. (2012), Value generation of future CSP projects in North Africa

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Part 2:
General discussion
Why are renewable energy technologies specific?

- Energy investments represent a high share of national infrastructure investments (limited budgets)
- Monopolistic market structure in energy markets
- Subsidies still required
- Market still in early market stage: Market depends on projects, no stable market demand
- Large power plants instead of dezentralized, small projects

Problems:
- Job creation during construction/manufacturing, not during operation
- Local demand of jobs vs limited industry capabilities/know-how
- But: Prices for high-tech goods or skilled worker relatively high
- Small R&D spendings
International influence on local markets and local industries

- Increasing competition in global RE market
- Some market distortions (over-supply, limited projects)
- Tender system supported by international donors (specific requirements)
- High technical requirements in tender systems
- Need of reference projects
- High technology standards
How to create local markets and industries in smaller countries?

- Stable markets (high important)
- Avoid stop-and-go in local markets
- Define clear project roadmaps
- Define regulatory framework
- Reduce RE project sizes
- Find niche markets, focus on certain technologies
- Regional integration: Specialization and synergies
- Avoid high requirements of local content, better: continuous industry development
Thank you very much for your attention!

Fraunhofer-Institute for Solar Energy Systems ISE

Largest European solar energy research institute
>1200 members of staff (incl. students)

Areas of business:
- Silicon Photovoltaics
- Photovoltaic Modules and Systems
- Alternative Photovoltaic Technologies
- Solar Thermal Technologies
- Renewable Power Generation
- Applied Optics and Functional Surfaces
- Hydrogen Technology

10% basic financing
90% contract research
45% industry, 45% public
€ 73 M total budget (2011)
> 10% p.a. growth rate

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Thank You Very Much for Your Attention!

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Download of study under press releases of ise.fraunhofer.de

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High amount of jobs during construction and installation

- Labor Cost Site and Solar Field: 63%
- Equipment Solar Field and HTF System
- Thermal Storage System
- Conventional Plant Components and Plant System
- Other Project Costs
- Total: 100%