Maximizing the value chain: Solar jobs

In partnership with the Clean Energy Solutions Center (CESC)

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Overview of the expert

Factor is an international group, specialized in providing global, innovative and sustainable solutions in areas such as climate change, energy, sustainability, trading and innovation.

Our key value is our people. We have offices in six countries, where our interdisciplinary team works for public and private stakeholders, international organizations and non-profit entities.

Our own history and experiences are based on constant innovation. This helps us target our services, by combining academic knowledge, technology and practical experience.
This Training is part of Module 6, and focuses on solar jobs and the value chain.
Overview of the Training

1. Introduction: Learning Objective
2. Understanding the value chain
3. Main body of presentation
4. Concluding Remarks
5. Further Reading
6. Knowledge Check: Multiple-Choice Questions
1. Introduction: Learning Objective
Learning Objective

This lecture provides:

1. An overview of the employment in the solar market

2. Description of the structure and relevance of the solar PV Value Chain

3. Opportunities for policy makers to maximize the Value Chain
2. The model of the Value Chain
Overview of the value chain

A value chain is a tool for **strategic analysis** for a manufacturing (or service) organization as a system, made up of subsystems each with **inputs**, **transformation processes and outputs**.

Source: Solar DAO
3. Main Body of Presentation
Main Body of Presentation

1 Overview of the employment in the solar market

2 Introduction to the Solar PV Value Chain

3 Maximizing the Value Chain

4 Opportunities of value maximizing along the Value Chain
Overview of the solar market

Source: IRENA jobs database.
Note: Others includes jobs which are not technology specific.
Overview of the solar market – Solar PV

Leaders in Solar PV employment

![Bar chart showing employment in million jobs.]

- China: 2.3 million jobs
- Japan: 0.6 million jobs
- United States: 0.5 million jobs
- India: 0.4 million jobs
- Bangladesh, Malaysia, Germany, Philippines: 0.3 million jobs each
- Turkey, China, United Kingdom, Mexico, Italy: 0.2-0.3 million jobs each
- South Africa: 0.1 million jobs
- Remaining countries: 0.1 million jobs or less

- 65% of PV jobs
- 3.4 million workers

Source: IRENA jobs database.

Note: The threshold for inclusion in the figure is 10,000 jobs.
Overview of the solar market – Heating and Cooling

Source: Greentech Media
Overview of the solar market – China

- Largest number of people employed in renewable energies
  Solar PV:
  - 2.2 million jobs total (+13%);
  - 1.4 million in manufacturing.

Source: Solar Tribune
Overview of the solar market – USA

• Number of solar jobs fell by 9,800 to about 250,000
• Most of the loss in the installation segment
• Installation gains more than half of all US solar jobs

Source: PV Magazine
Overview of the solar market – India

- Solar installations reached new record.
- Employment increased by 36%.
- Construction and Installations account for 46% of the jobs.

Source: Greentech Media
Main Body of Presentation

1 Overview of the employment in the Solar Market

2 Introduction to the Solar PV Value Chain

3 Maximizing the Value Chain

4 Opportunities of value maximizing along the Value Chain
Introduction to the Solar PV Value Chain

The PV Value Chain (multi-crystalline)

Source: Solar DAO
Introduction to the Solar PV Value Chain

Source: Solar DAO
Introduction to the Solar PV Value Chain

Source: QSTec
Introduction to the Solar PV Value Chain

Cluster

Vertical Integration

Diversification
Main Body of Presentation

1 Overview of the employment in the Solar Market

2 Introduction to the Solar PV Value Chain

3 Maximizing the Value Chain

4 Opportunities of value maximizing along the Value Chain
Maximizing the Value Chain – Production perspective

- Technology Differentiation
- Technology Strategy
- Product Quality and Certification
- Production Capability
- Cost Structure
- Vertical Integration
- Financial Strength
- Branding
Maximizing the Solar Value Chain – Strategic Perspective

Source: IRENA

Note: Jobs include solar water heating jobs.
Maximizing the Solar Value Chain – Strategic Perspective

Source: IRENA
Maximizing the Solar Value Chain – Strategic Perspective

Source: IRENA
Maximizing the Solar Value Chain – Strategic Perspective

Source: EY
Main Body of Presentation

1 Overview of the employment in the Solar Market

2 Introduction to the Solar PV Value Chain

3 Maximizing the Value Chain

4 Opportunities of value maximizing along the Value Chain
Opportunities of value maximizing along the value chain

Source: IRENA
Opportunities of value maximizing along the value chain

### Project planning

<table>
<thead>
<tr>
<th>TYPE OF HUMAN RESOURCES</th>
<th>Site selection</th>
<th>Feasibility analyses</th>
<th>Engineering design</th>
<th>Project development</th>
<th>Total by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal, energy regulation, real estate and taxation experts</td>
<td>180</td>
<td>60</td>
<td>85</td>
<td>500</td>
<td>825</td>
</tr>
<tr>
<td>Financial analysts</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>500</td>
<td>530</td>
</tr>
<tr>
<td>Electrical, civil, mechanical and energy engineers</td>
<td>120</td>
<td>130</td>
<td>135</td>
<td>-</td>
<td>385</td>
</tr>
<tr>
<td>Logistic experts</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Environmental experts</td>
<td>60</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>90</td>
</tr>
<tr>
<td>Health and safety experts</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total (as %)</strong></td>
<td><strong>360 (17%)</strong></td>
<td><strong>250 (12%)</strong></td>
<td><strong>260 (12%)</strong></td>
<td><strong>1,250 (59%)</strong></td>
<td><strong>2,120</strong></td>
</tr>
</tbody>
</table>

Source: IRENA
Opportunities of value maximizing along the value chain

### Manufacturing and procurement

<table>
<thead>
<tr>
<th>TYPE OF HUMAN RESOURCES</th>
<th>Solar cells</th>
<th>Solar modules</th>
<th>Inverters</th>
<th>Solar trackers and structures</th>
<th>Total by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory workers and technicians</td>
<td>16,800</td>
<td>6,300</td>
<td>4,970</td>
<td>3,850</td>
<td>31,920</td>
</tr>
<tr>
<td>Industrial engineers</td>
<td>2,310</td>
<td>1,050</td>
<td>980</td>
<td>840</td>
<td>5,180</td>
</tr>
<tr>
<td>Administrative personnel</td>
<td>770</td>
<td>770</td>
<td>490</td>
<td>420</td>
<td>2,450</td>
</tr>
<tr>
<td>Marketing and sales personnel</td>
<td>770</td>
<td>1,540</td>
<td>-</td>
<td>-</td>
<td>2,310</td>
</tr>
<tr>
<td>Logistic experts</td>
<td>770</td>
<td>350</td>
<td>490</td>
<td>420</td>
<td>2,030</td>
</tr>
<tr>
<td>Quality control experts</td>
<td>770</td>
<td>175</td>
<td>490</td>
<td>420</td>
<td>1,855</td>
</tr>
<tr>
<td>Health and safety experts</td>
<td>770</td>
<td>175</td>
<td>490</td>
<td>420</td>
<td>1,855</td>
</tr>
<tr>
<td>Regulation and standardisation experts</td>
<td>770</td>
<td>175</td>
<td>490</td>
<td>420</td>
<td>1,855</td>
</tr>
<tr>
<td>Chemical engineers</td>
<td>770</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>770</td>
</tr>
<tr>
<td><strong>Total</strong> <em>(as %)</em></td>
<td><strong>24,500</strong></td>
<td><strong>10,535</strong></td>
<td><strong>8,400</strong></td>
<td><strong>6,970</strong></td>
<td><strong>50,225</strong></td>
</tr>
</tbody>
</table>

Source: IRENA
Opportunities of value maximizing along the value chain

Installation and grid connection

<table>
<thead>
<tr>
<th>TYPE OF HUMAN RESOURCES</th>
<th>Site preparation and civil works</th>
<th>Assembling equipment</th>
<th>Cabling and grid connection</th>
<th>Commissioning</th>
<th>Total by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction workers and technical personnel</td>
<td>20,000</td>
<td>8,500</td>
<td>6,000</td>
<td>1,000</td>
<td>35,500</td>
</tr>
<tr>
<td>Civil engineers and foremen</td>
<td>1,400</td>
<td>900</td>
<td>-</td>
<td>-</td>
<td>2,300</td>
</tr>
<tr>
<td>Health and safety experts</td>
<td>450</td>
<td>150</td>
<td>100</td>
<td>100</td>
<td>800</td>
</tr>
<tr>
<td>Electrical and mechanical engineers</td>
<td>-</td>
<td>-</td>
<td>180</td>
<td>200</td>
<td>380</td>
</tr>
<tr>
<td>Environmental experts</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>300</td>
</tr>
<tr>
<td>Quality-control experts</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total (as %)</strong></td>
<td><strong>22,150</strong></td>
<td><strong>9,550</strong></td>
<td><strong>6,380</strong></td>
<td><strong>1,300</strong></td>
<td><strong>39,380</strong></td>
</tr>
</tbody>
</table>

Source: IRENA
Opportunities of value maximizing along the value chain

## Operation and maintenance

<table>
<thead>
<tr>
<th>TYPE OF HUMAN RESOURCES</th>
<th>Operation</th>
<th>Maintenance</th>
<th>Total by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction workers</td>
<td>-</td>
<td>5,313-7,650</td>
<td>5,313-7,650</td>
</tr>
<tr>
<td>Safety experts</td>
<td>-</td>
<td>2,253-2,975</td>
<td>2,253-2,975</td>
</tr>
<tr>
<td>Industrial, electrical and telecommunication engineers</td>
<td>486</td>
<td>1,488</td>
<td>1,974</td>
</tr>
<tr>
<td>Operators</td>
<td>1,100</td>
<td>-</td>
<td>1,100</td>
</tr>
<tr>
<td>Technical personnel</td>
<td>-</td>
<td>893-1,190</td>
<td>893-1,190</td>
</tr>
<tr>
<td>Administrative and accountant personnel</td>
<td>179</td>
<td>-</td>
<td>179</td>
</tr>
<tr>
<td>Lawyers, experts in energy regulation</td>
<td>114</td>
<td>-</td>
<td>114</td>
</tr>
<tr>
<td>Management</td>
<td>57</td>
<td>-</td>
<td>57</td>
</tr>
<tr>
<td><strong>Total (as %)</strong></td>
<td><strong>1,770</strong></td>
<td><strong>9,946-13,302</strong></td>
<td><strong>11,882 - 15,239</strong></td>
</tr>
</tbody>
</table>

Source: IRENA
# Opportunities of value maximizing along the value chain

## Decommissioning

<table>
<thead>
<tr>
<th>TYPE OF HUMAN RESOURCES</th>
<th>Planning the activity</th>
<th>Dismantling the project</th>
<th>Disposing of equipment</th>
<th>Clearing the site</th>
<th>Total by occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical personnel and construction workers</td>
<td>-</td>
<td>2,000</td>
<td>750</td>
<td>1,000</td>
<td>3,750</td>
</tr>
<tr>
<td>Truck drivers and crane operators</td>
<td>-</td>
<td>740</td>
<td>-</td>
<td>-</td>
<td>740</td>
</tr>
<tr>
<td>Industrial/mechanical/electrical engineers</td>
<td>30</td>
<td>160</td>
<td>-</td>
<td>40</td>
<td>230</td>
</tr>
<tr>
<td>Environmental experts</td>
<td>25</td>
<td>80</td>
<td>40</td>
<td>40</td>
<td>185</td>
</tr>
<tr>
<td>Safety experts</td>
<td>-</td>
<td>80</td>
<td>40</td>
<td>40</td>
<td>170</td>
</tr>
<tr>
<td>Logistic experts</td>
<td>25</td>
<td>-</td>
<td>60</td>
<td>-</td>
<td>85</td>
</tr>
<tr>
<td><strong>Total (as %)</strong></td>
<td><strong>80 (2%)</strong></td>
<td><strong>3,060 (60%)</strong></td>
<td><strong>890 (17%)</strong></td>
<td><strong>1,120 (21%)</strong></td>
<td><strong>5,150</strong></td>
</tr>
</tbody>
</table>

Source: IRENA
Opportunities of value maximizing along the value chain

Access and Jobs

Source: IRENA
Education and training shortage

Access and Jobs

Off-Grid Job Platform

With this tailor-made international off-grid job platform ARE offers the possibility for:

- Enterprises to connect directly to qualified off-grid job seekers
- Job seekers to directly contact interested enterprises

Contact
4. Concluding Remarks
1. Several forces define the socio-economic impacts of the PV industry. The most significant are: **annual installed capacity**, **efficiency gains in manufacturing and services** and **incentive schemes** for installations.

2. Opportunities for domestic value creation can be created **at each segment of the value chain**, in the **form of jobs and income generation** for enterprises operating in the country.

3. Opportunities **for leveraging local labor markets** and existing industries can be identified to maximize domestic value.
Thank you for your time!

CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY
5. Further Reading


6. Knowledge Checkpoint: Multiple Choice Questions