

# Maximizing the value chain: Solar jobs

*In partnership with the Clean Energy Solutions Center (CESC)*

Hugo Lucas Porta

01.05.2019

# Supporters of this Expert Training Series



ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

# 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.

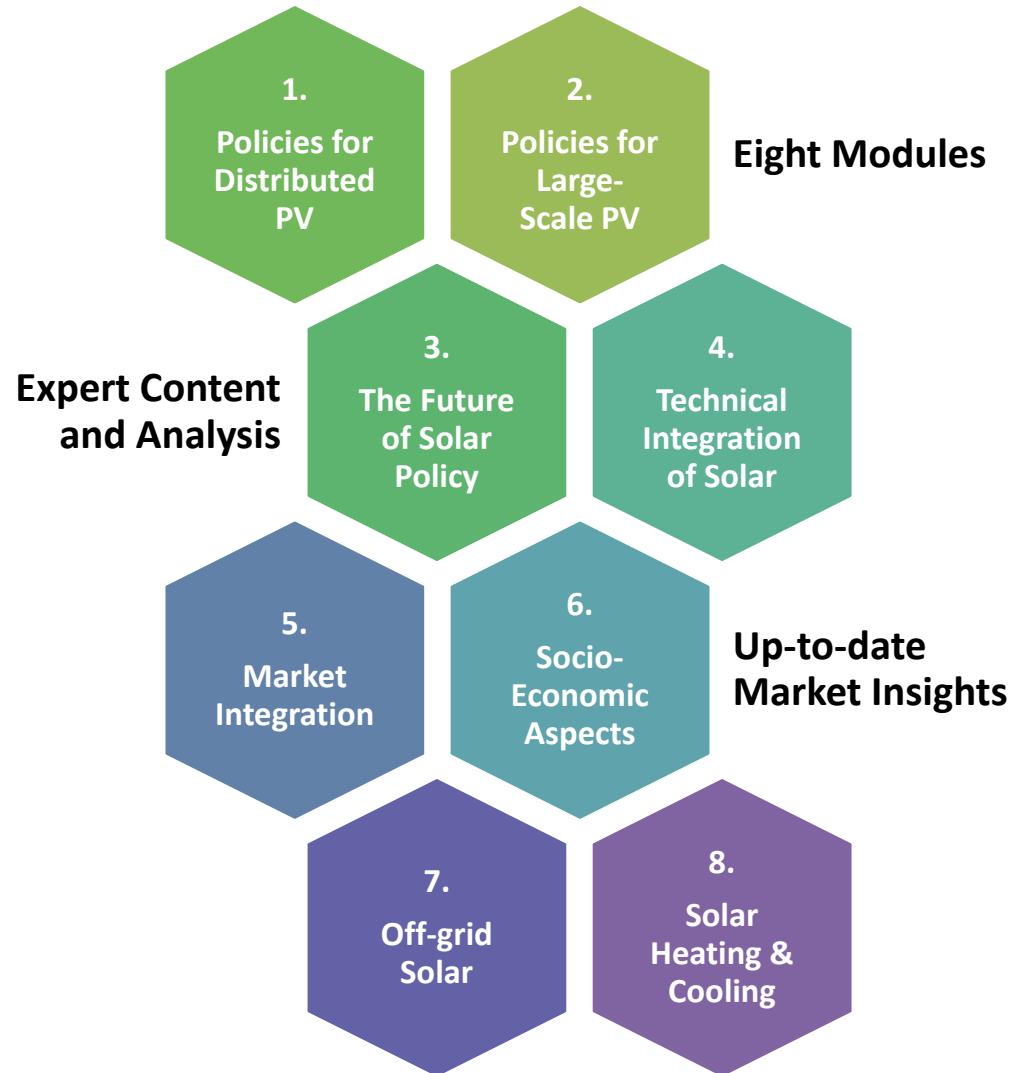
Our own history and experiences are based on constant innovation. This helps us target our services, by combining academic knowledge, technology and practical experience.



**Hugo Lucas Porta**  
Head of Energy  
Dept, [Factor](#)  
20 years in RE  
Sector  
- Worked for  
governments and  
private sector on  
energy transition  
strategies

# Training Course Material

**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

---

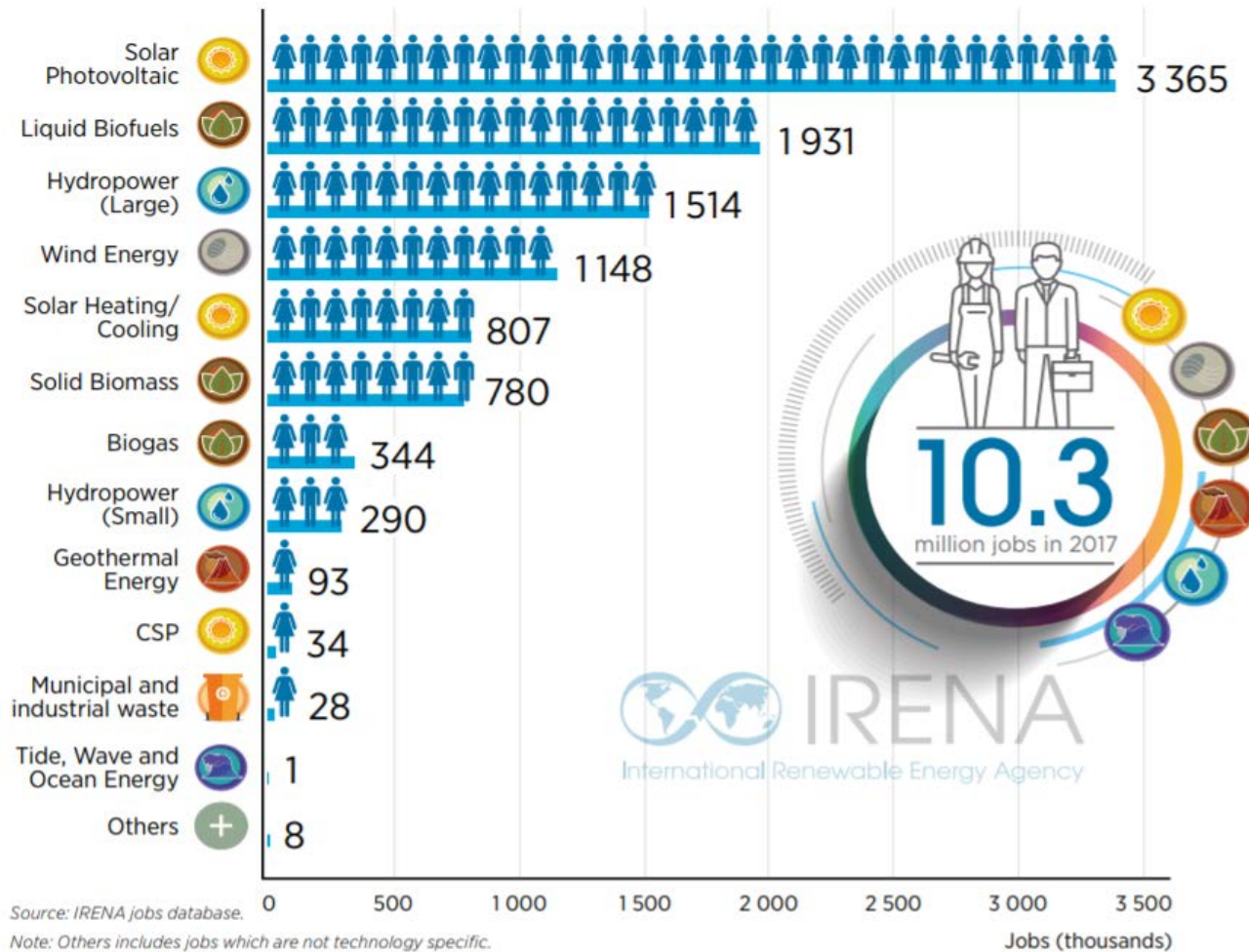
**1 Overview of the employment in the solar market**

**2 Introduction to the Solar PV Value Chain**

**3 Maximizing the Value Chain**

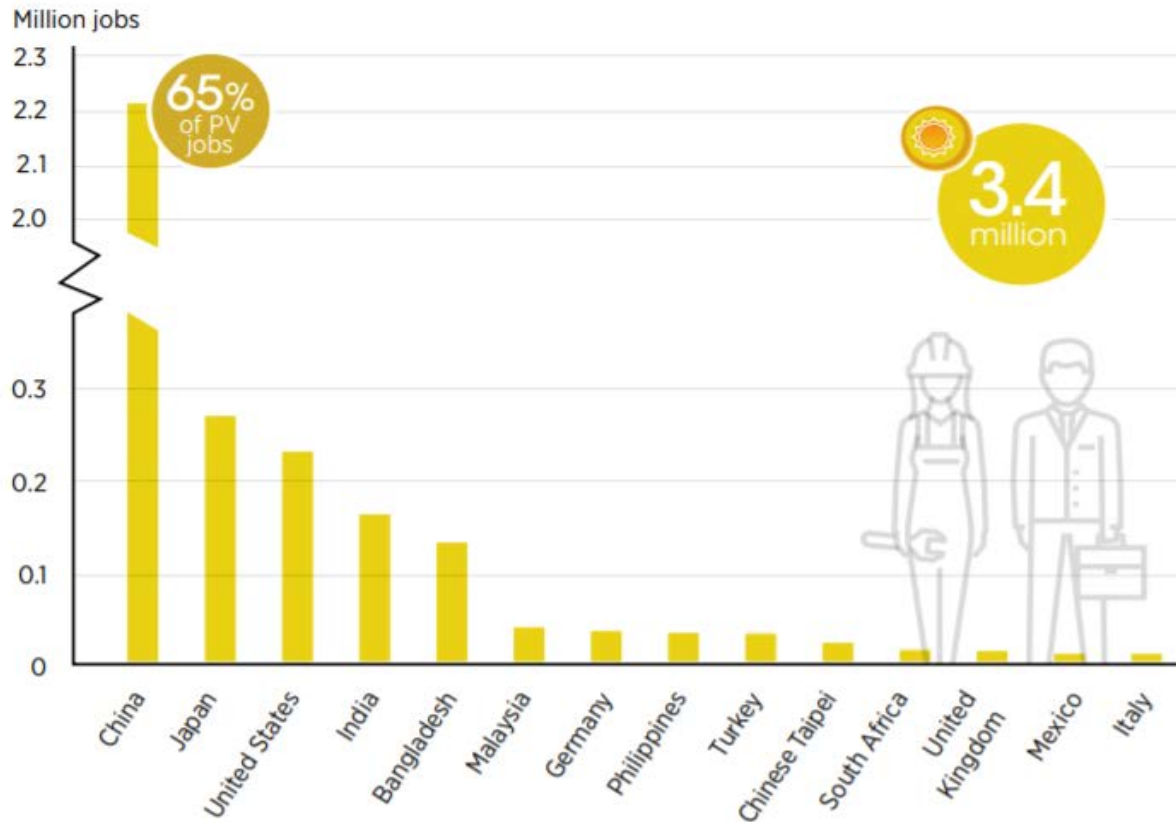
**4 Opportunities of value maximizing along the Value Chain**

# Overview of the solar market



# Overview of the solar market – Solar PV

## Leaders in Solar PV employment



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**

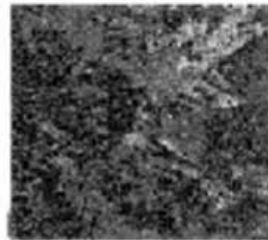
**2 Introduction to the Solar PV Value Chain**

**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)



Polysilicon

Wafer

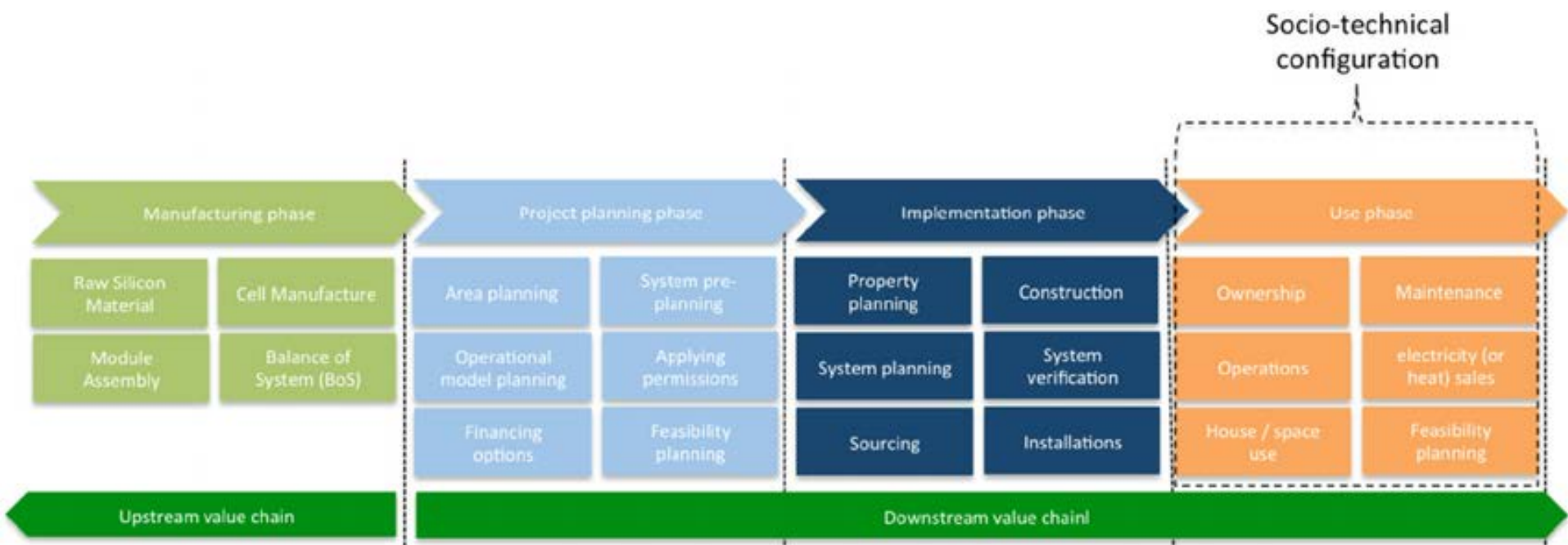
Solar Cell

Solar Module

Systems

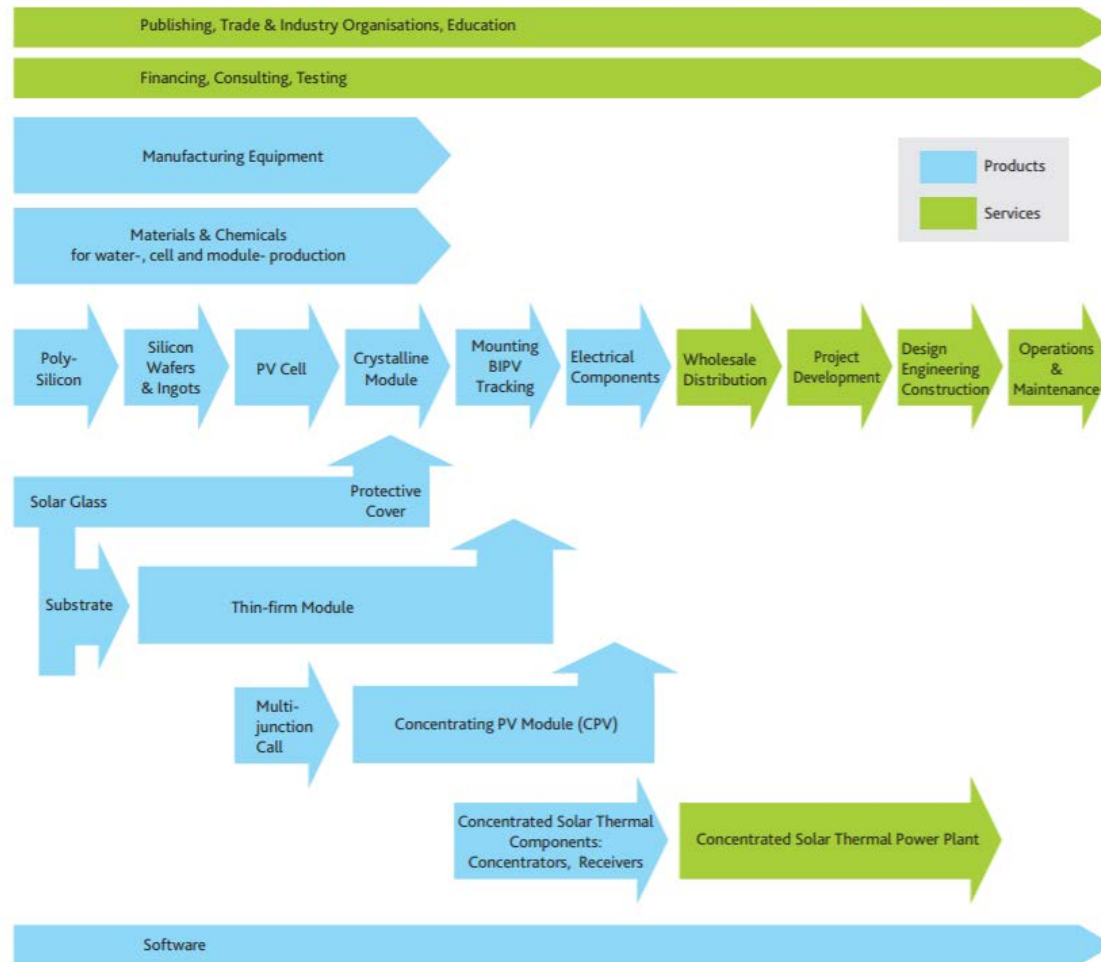
*Source: Solar DAO*

# Introduction to the Solar PV Value Chain



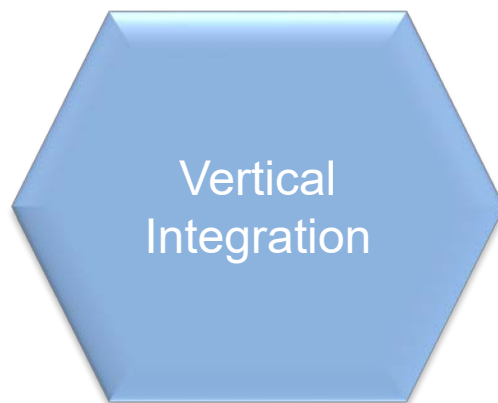
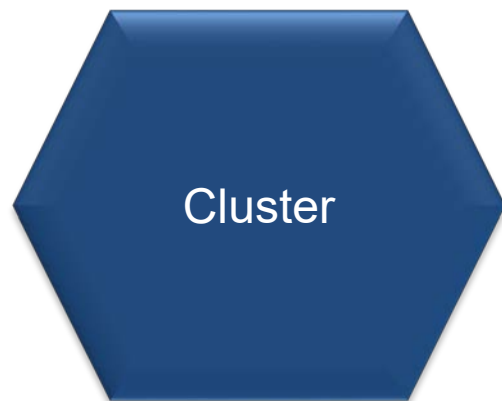
Source: Solar DAO

# Introduction to the Solar PV Value Chain



Source: QSTec

# Introduction to the Solar PV Value Chain



# 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

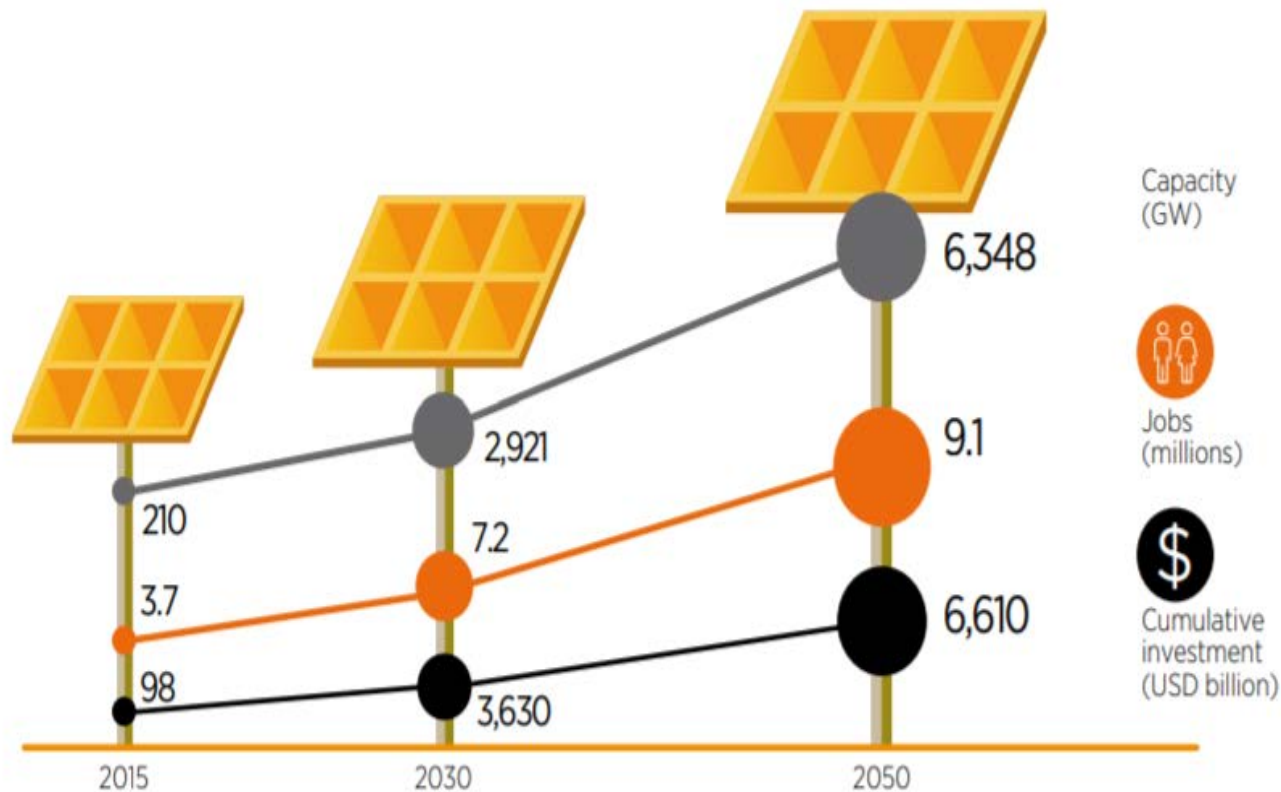
Vertical  
Integration

Financial  
Strength

Branding



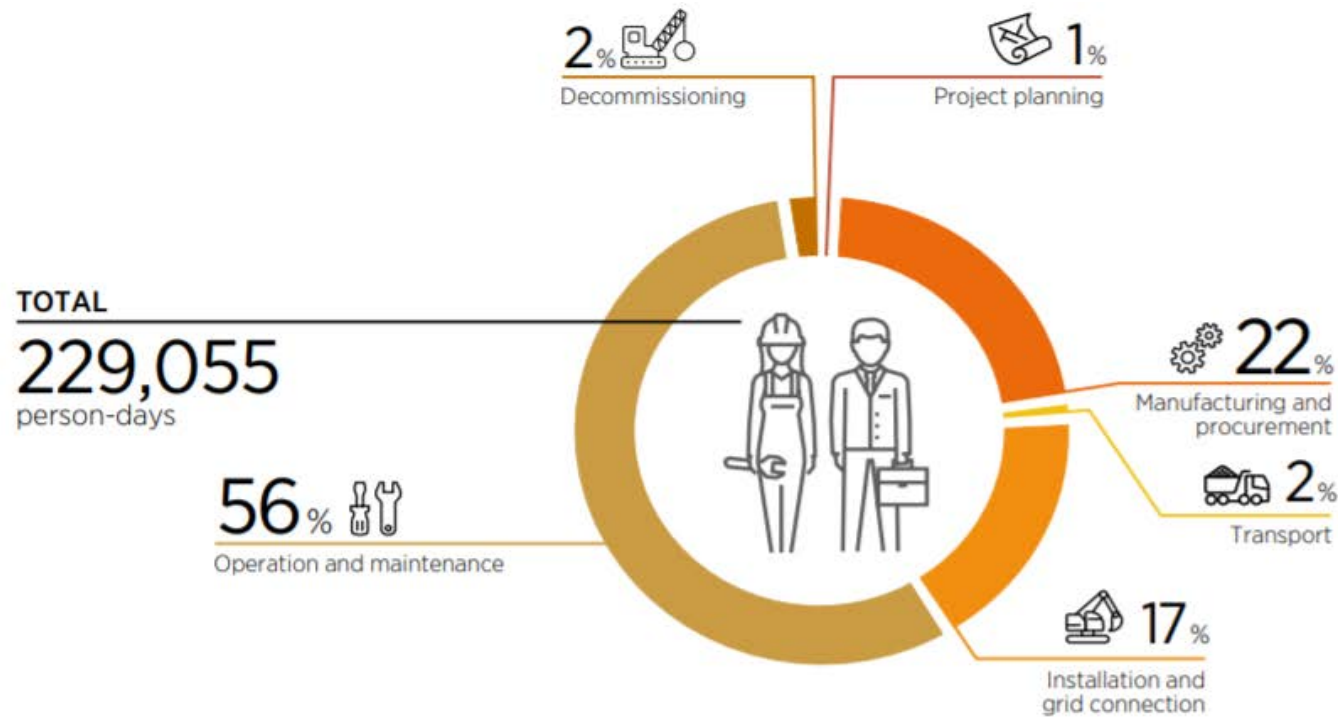
# Maximizing the Solar Value Chain – Strategic Perspective



Note: Jobs include solar water heating jobs.

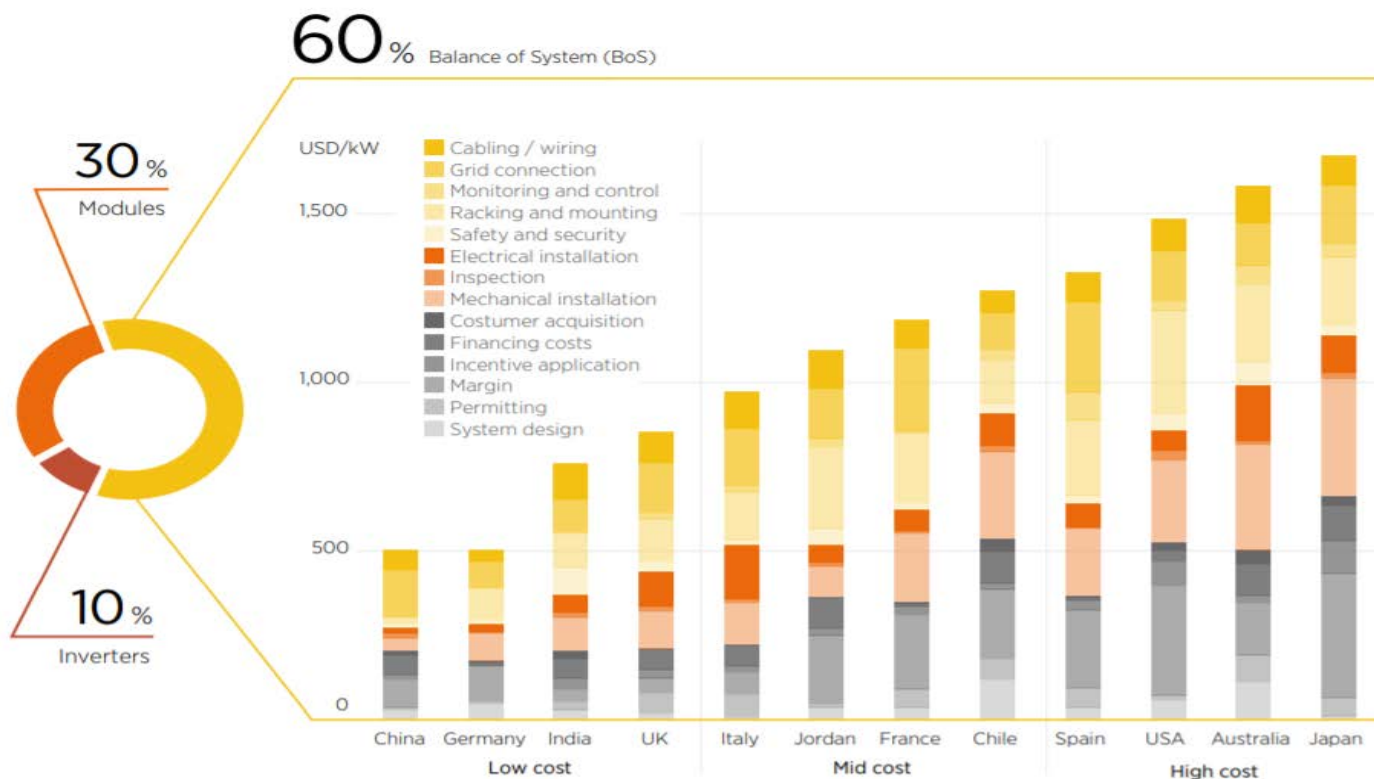
Source: IRENA

# Maximizing the Solar Value Chain – Strategic Perspective



Source: IRENA

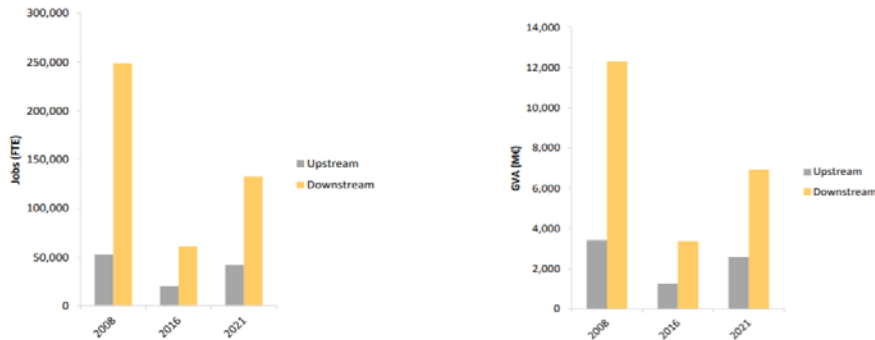
# Maximizing the Solar Value Chain – Strategic Perspective



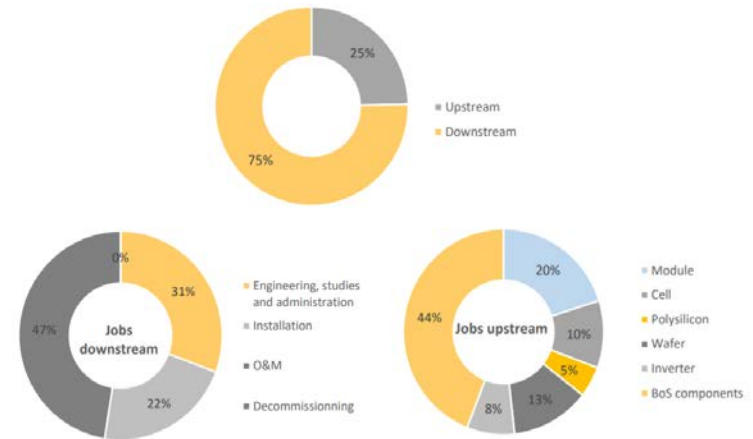
Source: IRENA

# Maximizing the Solar Value Chain – Strategic Perspective

Job support and GVA creation upstream and downstream activities



Breakdown of value chain activities for EU28 2008, 2016 and 2021



Source: EY

# Main Body of Presentation

---

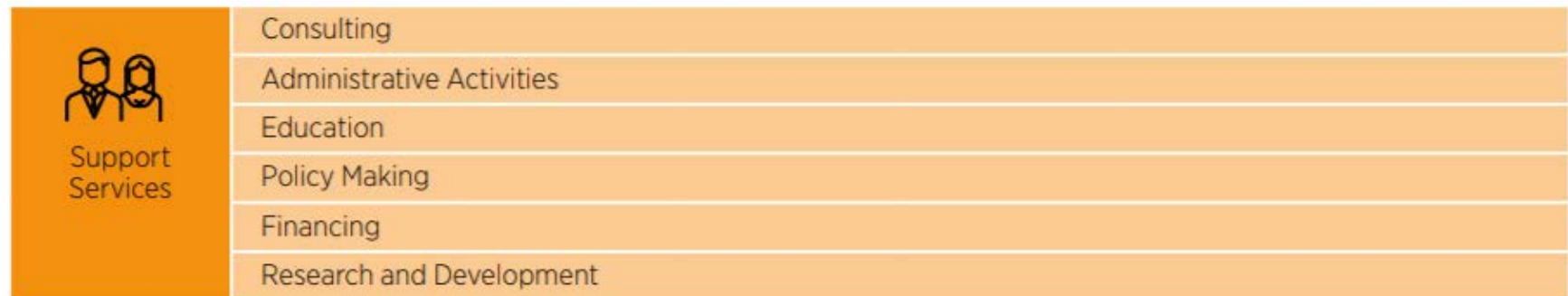
**1 Overview of the employment in the Solar Market**

**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


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

Source: IRENA

# Opportunities of value maximizing along the value chain



## Manufacturing and procurement

 TYPE OF HUMAN RESOURCES	Solar cells	Solar modules	Inverters	Solar trackers and structures	Total by occupation
Factory workers and technicians	16,800	6,300	4,970	3,850	31,920
Industrial engineers	2,310	1,050	980	840	5,180
Administrative personnel	770	770	490	420	2,450
Marketing and sales personnel	770	1,540	-	-	2,310
Logistic experts	770	350	490	420	2,030
Quality control experts	770	175	490	420	1,855
Health and safety experts	770	175	490	420	1,855
Regulation and standardisation experts	770	175	490	420	1,855
Chemical engineers	770	-	-	-	770
<b>Total (as %)</b>	<b>24,500 (49%)</b>	<b>10,535 (21%)</b>	<b>8,400 (17%)</b>	<b>6,970 (14%)</b>	<b>50,225</b>


Source: IRENA



# Opportunities of value maximizing along the value chain



## Installation and grid connection


 TYPE OF HUMAN RESOURCES	Site preparation and civil works	Assembling equipment	Cabling and grid connection	Commissioning	Total by occupation
Construction workers and technical personnel	20,000	8,500	6,000	1,000	<b>35,500</b>
Civil engineers and foremen	1,400	900	-	-	<b>2,300</b>
Health and safety experts	450	150	100	100	<b>800</b>
Electrical and mechanical engineers	-	-	180	200	<b>380</b>
Environmental experts	300	-	-	-	<b>300</b>
Quality-control experts	-	-	100	-	<b>100</b>
<b>Total (as %)</b>	<b>22,150 (56%)</b>	<b>9,550 (24%)</b>	<b>6,380 (16%)</b>	<b>1,300 (4%)</b>	<b>39,380</b>

Source: IRENA

# Opportunities of value maximizing along the value chain

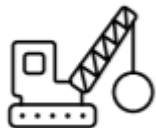


## Operation and maintenance


 TYPE OF HUMAN RESOURCES	Operation	Maintenance	Total by occupation
Construction workers	-	5,313-7,650	5,313-7,650
Safety experts	-	2,253-2,975	2,253-2,975
Industrial, electrical and telecommunication engineers	486	1,488	1,974
Operators	1,100	-	1,100
Technical personnel	-	893-1,190	893-1,190
Administrative and accountant personnel	179	-	179
Lawyers, experts in energy regulation	114	-	114
Management	57	-	57
<b>Total (as %)</b>	<b>1,770 (-14%)</b>	<b>9,946-13,302 (-86%)</b>	<b>11,882 - 15,239 (13,560 average)</b>

Source: IRENA

# Opportunities of value maximizing along the value chain



## Decommissioning

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

Source: IRENA

# Opportunities of value maximizing along the value chain

## Access and Jobs

FIGURE 7A. ILLUSTRATIVE SUPPLY CHAIN FOR SPV SYSTEMS



FIGURE 7B. ILLUSTRATIVE SUPPLY CHAIN FOR SMALL / MICRO HYDRO



FIGURE 7C. ILLUSTRATIVE SUPPLY CHAIN FOR IMPROVED COOKSTOVES



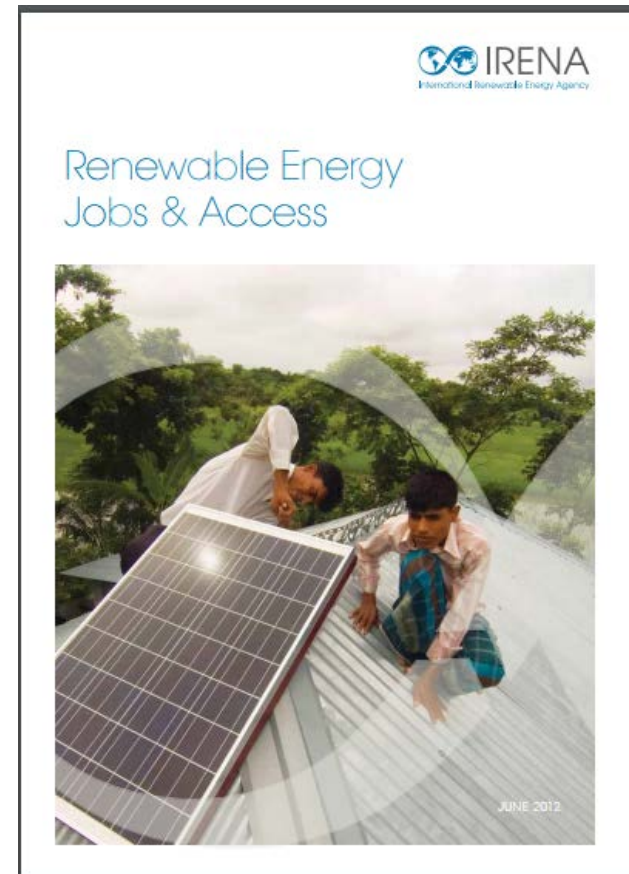
FIGURE 7D. ILLUSTRATIVE SUPPLY CHAIN FOR BIOGAS PLANTS



NOTE: COLOUR LEGEND



Source: IRENA





# Education and training shortage

## Access and Jobs



[Search](#) | [Newsletter](#) | [Contact](#) | [Member Login](#)  [Donate](#)

[About us](#) | [ARE Services](#) | [Member Solutions](#) | [ARE Partners](#) | [Media & Events](#) | [Resources](#) | [Membership](#)



### Off-Grid Job Platform

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

[Contact](#)

## 4. Concluding Remarks

# 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!



ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY



## 5. Further Reading

IRENA (2018): Renewable Energy and Jobs, Annual Review 2018. Available at: [https://irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA\\_RE\\_Jobs\\_Annual\\_Review\\_2018.pdf](https://irena.org/-/media/Files/IRENA/Agency/Publication/2018/May/IRENA_RE_Jobs_Annual_Review_2018.pdf)

IRENA (2017): Renewable Energy Benefits, Leveraging Local Capacity for Solar PV. Available at: [https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA\\_Leveraging\\_for\\_Solar\\_PV\\_2017.pdf?la=en&hash=8F7696966CF492DE832EA83024021B98E37A0260](https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Jun/IRENA_Leveraging_for_Solar_PV_2017.pdf?la=en&hash=8F7696966CF492DE832EA83024021B98E37A0260)

EY (2017): Solar PV Jobs & Value Added in Europe. Available at: [https://www.ey.com/Publication/vwLUAssets/EY-solar-pv-jobs-and-value-added-in-europe/\\$FILE/EY-solar-pv-jobs-and-value-added-in-europe.pdf](https://www.ey.com/Publication/vwLUAssets/EY-solar-pv-jobs-and-value-added-in-europe/$FILE/EY-solar-pv-jobs-and-value-added-in-europe.pdf)

ICTSD (2017): Building Supply Chain Efficiency in Solar and Wind Energy. Available at: [https://www.ictsd.org/sites/default/files/research/building\\_supply\\_chain\\_efficiency\\_in\\_solar\\_and\\_wind\\_energy\\_digital.pdf](https://www.ictsd.org/sites/default/files/research/building_supply_chain_efficiency_in_solar_and_wind_energy_digital.pdf)

## 6. Knowledge Checkpoint: Multiple Choice Questions