ESCWA – IRENA Joint Study
“Potential of Manufacturing RE Equipment in the Arab Region”
Background

▪ **2014:** IRENA and LAS published Pan-Arab RE Strategy 2030: Road of Actions for Implementation, to address the current state of RE, targets, market, incentives, gaps (technical, financial, legal, political), AREF & NREAP

▪ **2015:** Recommendation of ESCWA’s Committee on Energy held in Amman in March 2016

▪ **2015:** Similar study was conducted by IRENA and FEMIP: focusing on Egypt, Morocco, and Tunisia (North Africa)

▪ **2016:** IRENA and UN-ESCWA signed a MoU and are jointly conducting the study about the potential of local manufacturing of RE equipment in the Arab Region

© Copyright 2016 ESCWA. All rights reserved. No part of this presentation in all its property may be used or reproduced in any form without a written permission
Why RE manufacturing in the Arab region?

- Increase Job Creation
- Increase Economic activity
- Lower RE prices
- Increase RE installation
- Reach the RE target and lower the dependency on conventional fuel
Why RE manufacturing in the Arab region?

Key players in RE manufacturing

- **Public Sector**
  - Input
  - EIA
  - Market Analysis
  - Technical Analysis
  - Financial Analysis
  - R&D

- **Real Estate Industry**
  - Investors (Local and International)
  - Funds
  - Banking
  - EPC

- **Raw Materials**
  - Supply

- **R&D**
  - Production Lines
  - Packaging and Labeling
  - QA and Testing
  - Labors (Food, Dorms, Salaries, Insurance)

- **Distribution**
  - to the Local Market

- **Installation, O&M**

- **Export**
  - to the Regional or International Market

- **Raw Materials Import**

© Copyright 2016 ESCWA. All rights reserved. No part of this presentation in all its property may be used or reproduced in any form without a written permission.
Selected Case Studies

- Three countries: Jordan, Lebanon and United Arab Emirates (UAE)
- These countries showed a high interest and investment in RE especially in the last 5 years
- The total installed RE capacity increased significantly, and particularly in Jordan and UAE
- Lebanon’s incentives and financing mechanism dedicated to RE are remarkable and inducing further implementation of RE projects
- For Lebanon and Jordan, they lack sufficient power capacity and RE can play a remarkable role in this regard
- As for UAE, the aim is diversifying energy resources, increasing RE share in the energy mix
Objectives of ESCWA – IRENA Present Study

1. Positioning of potential manufacturing of RE technologies (mainly PV, CSP and onshore wind), in terms of Supply Chains, Export Opportunities, Industrial Structure, Regional Cooperation

2. Identifying Gaps: Technical, industrial, financial, political, with a focus on Lebanon, Jordan and UAE, as considered, as 3 case studies, to be addressed within this context.

3. Providing Recommendations and Action plans: based on gaps, success factors, and regional linkages
Study Methodology

A. Reviewing previous studies and results regarding RE manufacturing in the Arab region

B. Analysis of PV, CSP, and onshore wind value chains

C. Analysis of the Industrial Structure (available industries, strengths, weaknesses) in the Arab Region focusing on Lebanon, Jordan and UAE

D. Matching (if possible) available industries into supply chains components showing related industries and potential extensions in other industries

D. Review of key success factors (incentives, skills...) in Arab region and case studies showing threats and opportunities of local manufacturing

D. SWOT Analysis followed by recommendations including technical, industrial, commercial, financial, and political aspects
Recommendations from Previous Studies

I. Local Level
   a) Review RE Policies and strategies
   b) Coordinate with other local ministries and institutions
   c) Design dedicated education programs
   d) Propose a soft loan regime for new investments in the field of RE.
   e) Facilitate foreign investments

II. Regional Level
   a) Coordinate national renewable energy plans and policies
   b) Optimize development of renewable energy resources and manufacturing capacities
   c) Cross-border trade and R&D collaboration
   d) Establish a regional financial framework and financing facility
Solar PV-Value Chain

**Design and Development**
- Land Claims
- Survey Reports
- Design and Engineering
- Financial and Economic Analysis
- Permission Process
- Grid Integration

**Raw Material**
- Silicon
- Crystalline
- Polycrystalline
- Thin Film
- Copper and Aluminum
- Steel
- Cement
- Concrete

**Wafer Manufacturing**
- Ingot
- Slurry
- Ingot Mounting Adhesives
- Acids
- Doping to create n-type and p-type wafers
- Saws

**Cells Manufacturing**
- Ingot
- Slurry
- Ingot Mounting Adhesives
- Acids
- Doping to create n-type and p-type wafers
- Saws

**Solar Module Assembly**
- Cells
- Ribbon
- Glass Surface
- Encapsulates
- Back Sheet
- Cables
- Junction Boxes
- Connector
- Frame

**Construction**
- Engineering and Procurement (EPC)
- Infrastructure
- Foundations
- Steel Support Structure
- Transformers
- Electrical Cabinets
- Metering Devices
- Computer Systems
- Logistics
- Fencing and Observation
- Trucks, cars, cranes, lifts
- EHS

**Operation and Maintenance**
- Operation of the Plant
- Scheduled and Unscheduled Maintenance
CSP-Value Chain

DESIGN AND DEVELOPMENT
- Land Claims
- Survey Reports
- Design and Engineering
- Financial and Economic Analysis
- Permission Process
- Grid Integration

RAW MATERIAL
- Steel (Raw and Galvanized, reinforcement, pipes, etc.)
- Low Iron Sand
- Flat Glass
- Silver
- Film
- Primers
- Coatings
- Concrete
- Solar Salt
- Mineral/Glass Wool
- Chemicals
- Mineral and Synthetic Oils
- Water
- Natural Gas/Diesel

SOLAR FIELD
- Mirrors (Flat or Curvet)
- Support Structure
- Receiver
- Bail Joints
- Bearings
- HTF and Piping
- Trackers
- Cables
- Junction Boxes

THERMAL STORAGE
- Storage Vessels
- Storage Material (Salt)
- Heat Exchanger
- Pumps
- Valves
- Motors
- Hydraulic and Pneumatic Components
- Steel Structure
- Nitrogen
- Isolation
- Foundation

BALANCE OF PLANT AND POWER BLOCK
- Steam Boiler
- Steam Turbine
- Generator
- Condenser
- Control System
- Transformers
- Switchgears
- Cables
- Junction Boxes
- Inverters
- UPS
- Overhead Lines
- Pumps
- Valves
- Motors
- Vessels/Tanks
- Isolation
- Hydraulic and Pneumatic Components
- Compressors
- Auxiliary Boilers
- Chemicals/Acid

SOLAR SITE ASSEMBLY
- Assembly of Mirror Structure
- Infrastructure
- Foundation, Civil Construction
- Support Structure, Assembly/Process Construction
- Metering Devices
- Electrical Cabinets
- Computer Systems
- Logistics
- Fencing and Observation
- EHS
- Trucks, Cars, Cranes, Lifts
- Machinery for cutting, rolling, welding, bending, etc.

OPERATION AND MAINTENANCE
- Operation of the Plant
- Trucks, Cars, Cranes, Lifts
- Scheduled and Unscheduled Maintenance
- Further Optimization of Power Block

COMPONENT MANUFACTURING
Economic and Social Development in the Arab Region

Total imports in 2014: 1,157 Billion USD

Total exports in 2014: 1,443 Billion USD

Total labor force in 2014: 124 Million in 2013 => around 33.2% of the total Arab population

Unemployment rate in 2014: between 0.3% and 35% depending on the country
Economic and social indicators in the Arab region

Total current GDP of Arab Countries

- 2,757 Billion USD in 2014
- 2,717 Billion USD in 2013

Growth Rate = 1.5% vs 3% (2012-2013)

- Decline in oil export revenues (decline in Oil prices)
- Decline in the stability of oil production

Political Instability in some countries
Inter-Arab Trade Agreements and Zones

- Agreement to Facilitate the development of trade among Arab countries (1981, 1997)
- Greater Arab Free Trade Area/GAFTA (~ all Arab Countries, 2005)
- Agadir Agreement (Egypt, Jordan, Morocco, Tunisia, 2001)
- Council of Arab Economic Unity (Egypt, Iraq, Jordan, Kuwait, Libya, Mauritania, Palestine, Saudi Arabia, Sudan, Tunisia, Syria, UAE, Yemen)
- Arab Maghreb Union (Algeria, Tunisia, Libya, Mauritania and Morocco)
- Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates)
- Treaty of Joint Defense and Economic Co-operation of the League of Arab States
Industrial Structure in the Arab Region

- Total industrial output in 2014 = 1,214 Billion USD equivalent to 44% of the total Arab GDP
- Decrease in 5.1% compared to 2013
- 17.4% of total Arab workforce in the industrial sector

Manufacturing industries contribution in GDP from 9.1% in 2013 to 9.8% in 2014

=> Growth rate of 9%

in the contribution of commodity production sector from 59.7% in 2013 to 57.3% in 2014

in the contribution of the mining and quarrying industry in GDP from 38% in 2013 to 34.2% in 2014
Industrial Structure in the Arab Region

- Food, beverages and tobacco
- Textile and leather products
- Wearing apparel, dressing and dyeing fur
- Paper products, publishing and printing
- Wood products including furniture
- Basic metals
- Chemical products, coal, rubber and plastics
- Coke, refined petroleum and nuclear fuel
- Non-metallic mineral products
- Office accounting and computing machinery
- Electrical machinery and apparatus
- Fabricated metal products
- Machinery and equipment

Directly related to the Value Chains of RE Technologies
Jordan: RE Current State

RE & EE Law N° 18, 2012: The Law was issued in April 2012

The by-laws and regulations related to RE projects and electricity generation:
1. Tax Exemptions By-law

2. The Reference Price List which includes the indicative prices for each type of Renewable Source


4. Cost of Connecting RE Facility to Distribution Grid

5. Electric Power Wheeling Directives

<table>
<thead>
<tr>
<th>Target Date</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>1,200 MW</td>
</tr>
<tr>
<td>PV</td>
<td>500 MW</td>
</tr>
<tr>
<td>CSP</td>
<td>100 MW</td>
</tr>
<tr>
<td>Biomass</td>
<td>50 MW</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1,850 MW</td>
</tr>
</tbody>
</table>

- Country Capacity by 2018: 1132 MW
- 20% of the installed generated capacity
- 9% contribution in electricity generation
Jordan: Main Industries

• The Jordanian authorities are encouraging foreign investments, by setting special conditions for the investors at the thirteen special economic zones
• Jordan's import policy theoretically => promotes domestic manufacturing industries by ensuring their access to cheaper imported capital goods, raw materials, and other intermediate inputs rather than granting them monopoly markets.
• Main Industries:
  ▪ Mineral and Mining Sector (5th World producer of Potash, 5th world producer/4th world exporter of Phosphate, Fertilizers, chemicals, cement, refineries)
  ▪ Plastics, Paper, packaging
  ▪ Publishing, glass and rubber products, electrical equipment, and machinery--each of which (< 1 %) of total manufacturing output value
  ▪ Real estate market
  ▪ Apparel and textiles (30% of Jordanian exports=> 55,000 workers)
  ▪ Pharmaceuticals
  ▪ Agriculture and Food
Jordan: Existing RE Local Manufacturing

- Some industries are currently manufacturing PV system components according to national and International standards to meet either local or non-local demands.

<table>
<thead>
<tr>
<th>Component</th>
<th>Number of Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection boxes</td>
<td>5</td>
</tr>
<tr>
<td>Cables</td>
<td>5</td>
</tr>
<tr>
<td>Frames</td>
<td>8</td>
</tr>
<tr>
<td>PV Modules</td>
<td>1</td>
</tr>
<tr>
<td>Transformers</td>
<td>1</td>
</tr>
</tbody>
</table>

- Other industries are producing PV components but not according to national standards. However with technical and financial support they can upgrade their supply chain to comply with the standards.

<table>
<thead>
<tr>
<th>Component</th>
<th>Number of Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection boxes</td>
<td>8</td>
</tr>
<tr>
<td>Cables</td>
<td>-</td>
</tr>
<tr>
<td>Frames</td>
<td>2</td>
</tr>
<tr>
<td>PV Modules</td>
<td>-</td>
</tr>
<tr>
<td>Transformers</td>
<td>1</td>
</tr>
</tbody>
</table>
Jordan RE Local Manufacturing: Potential

- Well Defined Target
- RE and EE law since 2013
- Institutional Framework (Net-metering for residential, FIT)
- Financial Support (JREEEF, Exemptions…)
- Direct Project Submittal
- PPA and IPPs
- Standards available for PV components
- No Environmental impact assessment needed for PV technologies
- PV: Mature and easy installed technology leading to a large market potential
- PV: Available technical skills
- Easy procedure for international investments
- Mandatory local contribution by 20% in the bidding including EPC and O&M
Local Market

- RE electricity generated tariffs fixed
- PPA for 20 years and not related to fuel prices causing high PBPs in many cases
- Limited space especially in Urban Areas
- Small grid capacity but being upgraded through the “Green Corridor”

Technical

- Limited R&D
- No local testing facilities

Manufacturing

- Regional Instability
- High Land Cost especially in Urban Areas
- Although subsidized, the electricity cost is high compared to GCC => shutting down some existing industries
Lebanon: RE Current State

- NEEAP (2011-2015)
- Net-metering
- NREAP (2016-2030)

<table>
<thead>
<tr>
<th>Target Date</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>MW</td>
</tr>
<tr>
<td>PV</td>
<td>MW</td>
</tr>
<tr>
<td>CSP</td>
<td>MW</td>
</tr>
<tr>
<td>Biomass</td>
<td>MW</td>
</tr>
<tr>
<td>Geothermal</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>MW</td>
</tr>
</tbody>
</table>

- 12% from electricity generation

- Country Capacity end 2015: 20 MW
Lebanon: Main Industries

- Food products and beverages: 26%
- Rubber and plastic products: 5%
- Printed matter and recorded media: 4%
- Machinery and Equipment: 3%
- Other non-metallic mineral products: 12%
- Fabricated metal products: 11%
- Electric machinery and apparatus: 10%
- Chemicals and man-made fibres: 7%
- Pulp, paper and paper products: 6%
- Furniture and other manufactured goods: 7%
- Other activities: 9%
Lebanon: Existing RE Local Manufacturing

- Cables
- Transformers
- Structure (steel, aluminum,…)
- EPC
- O&M
- Control and automation
- Inverters
Lebanon RE Local Manufacturing: Potential

- Well Defined Target
- Institutional Framework (Net-metering)
- Currently Optimizing the mix

- Qualified and experienced managers, engineers and technicians

- Logistics for import and export
- Financial incentives for the industrial sector (through Central Bank of Lebanon)
Lebanon RE Local Manufacturing: Gaps

- Absence of minimum threshold of local content
- Weak Public Private Partnership
- Limited R&D
- No local testing facilities
- Regional instability
- High Land Cost especially in Urban Areas
- High Energy Cost
- Power Shortage
UAE: RE current State

- Dubai Integrated Energy Strategy (2030)

<table>
<thead>
<tr>
<th>Region</th>
<th>RE Targets</th>
<th>Target dates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total MW</td>
<td>%</td>
</tr>
<tr>
<td>Abu Dhabi</td>
<td>460</td>
<td>7</td>
</tr>
<tr>
<td>Dubai</td>
<td>3000</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RE Technology</th>
<th>MW</th>
<th>Project</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>200</td>
<td>Dubai Solar Park Phase 2</td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td>350</td>
<td>Abu Dhabi Solar Park (including Noor 1</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Noor 1 project)</td>
<td></td>
</tr>
</tbody>
</table>
UAE: Main Industries

- Oil and Gas
- Free Trade Zone: Jebel Ali, Sharjah and Ajman
- Advertising, Market Research, Public Relations, Media and Entertainment
- Engineering, construction and real estate
- Retail/trade and logistics
- Production/manufacturing, automotive and ancillary:
  - Petroleum products
  - Chemicals
  - Rubber and plastic products (PVC and polyethylene sheets, tubes and other materials)
  - Basic metal industries
  - Metal products
  - Machinery & equipment
  - Electrical equipment & parts
UAE: Existing RE local manufacturing

- PV module assembly (2 factories)
- Cables
- Transformers
- Structure (steel, aluminum,...)
- EPC
- O&M
- Unemployment: 4.1%
UAE RE Local Manufacturing: Potential

- Well Defined Target
- Institutional Framework (Net-metering)
- Currently revising energy policy (target to be 24% clean energy on 2021) => Optimizing the mix

- Easy procedure for international investments
- Logistics for import and export
- GCC trade (tax free)
UAE RE Local Manufacturing: Gaps

- No clear Strategy and Regulatory framework (project by project)
- No minimum threshold for local content contribution
- Weak Public Private Partnership

- Limited R&D
- No local testing facilities

- High Land Cost especially in Urban Areas
- Instable Cost of Energy
- Management is expensive
- Non Sustainable workforce
General Recommendations based on Gaps

• R&D shouldn’t be optional but rather a must to keep the market (0.1% increase in panels efficiency is needed in order to think about establishing a PV module manufacturing facility)
• Need of Mapping and integration between R&D and industrial applications
• Need of cooperation between all institutions
• O&M need more capacity building than it seems
• Technical skills can be easily obtained (1 or 2 trainings)
• EPC, business, finance skills are available from earlier experience
• Short term Visibility => assembly related to the local demand (some elements of the value chain e.g. 70% of the inverter are components and 30% (assembly, testing...) could be locally done)
• Long term Visibility => export (more elements in the value chain)
General Recommendations based on Gaps

- Government clear vision
- Financial sector (currency state, banking sector, incentives...)
- Institutions (R&D, capacity building, NGO)
- Infrastructure (energy, land, roads, logistics...)
- Time frame protection for industries
- Access to markets: free zones, tax holidays
THANK YOU