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مؤتمر الطاقات المتجددة السادس لدول الشرق الأوسط وشمال أفريقيا
The Sixth Middle East & North Africa Renewable Energy Conference

UNDER THE PATRONAGE OF HIS HIGHNESS THE EMIR OF THE STATE OF KUWAIT
SHEIKH SABAH AL-AHMAD AL-JABER AL-SABAH

Economic And Social Commission For Western Asia

ESCWA – IRENA Joint Study
"Potential of Manufacturing RE Equipment in the Arab Region"

UNITED NATIONS
الاسكوا
ESCWA

IRENA
International Renewable Energy Agency

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

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
Permit
EIA
Market Analysis
Technical Analysis
Financial Analysis
R&D

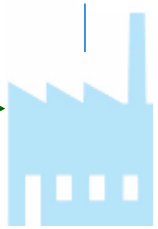
Real Estate Industry
Investors (Local and International)
Funds
Banking
EPC

Raw Materials Supply

OR

Raw Materials **Import**

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



Distribution to the Local Market

OR

Export to the Regional or International Market

Installation, O&M

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

C
- 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

SOLAR MODULE MANUFACTURING

CONSTRUCITON

- 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

Onshore Wind- Value Chain

DESIGN AND DEVELOPMENT

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

RAW MATERIAL

- Steel for Towers
- Reinforcement Steel
- Cement
- Concrete
- Balsa Wood
- Fiber Glass or Carbon Fiber
- Epoxy Resin
- Primer
- Final Coating
- Mineral/Synthetic Oils
- Copper/Aluminum
- Greases

MACHINERY SUPPLIERS

- Machinery for cutting, rolling, welding, bending, etc.
- Cranes
- Transport Equipment

COMPONENTS SUPPLIERS

- Gearboxes
- Bearing
- Tower
- Generators
- Blades
- Transformers
- Cables
- UPS
- Junction Boxes
- Switch Yards
- Frequency Converters
- Hydraulic and Pneumatic Components
- Electronics

WIND MILL MANUFACTURING

WINDTURBINE COMPANY

- Design of Components
- Interfaces
- Project Management

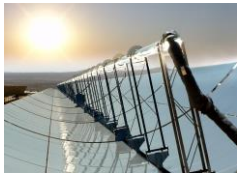
CONSTRUCITON

- Engineering and Procurement (EPC)
- Infrastructure
- Construction Companies
- Electrical Cabinets
- Metering Devices
- Motors
- Pumps
- Valves
- Computer Systems
- Logistics
- Fencing and Observation
- 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

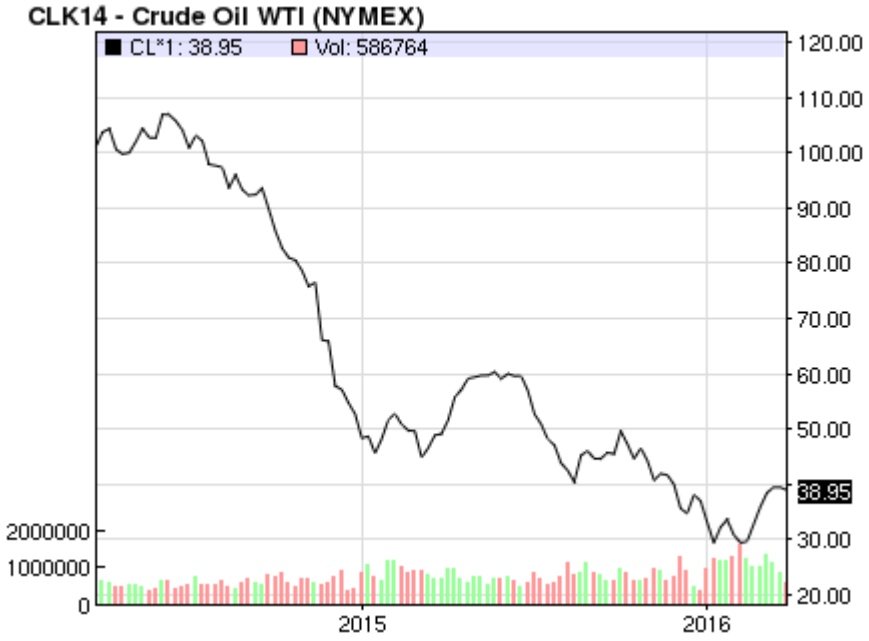
Economic and social indicators in the Arab region

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)

Political Instability in some countries



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

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

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**

Manufacturing industries contribution in GDP from 9.1% in 2013 to 9.8% in 2014 => **Growth rate of 9%**

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^{0}13, 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

3- Sale of Electrical Energy generated from Small RE Systems (Net Metering – Roof Tops)

4- Cost of Connecting RE Facility to Distribution Grid

5 -Electric Power Wheeling Directives

Target Date	2020
Wind	1,200 MW
PV	500 MW
CSP	100 MW
Biomass	50 MW
Geothermal	0
Total	1,850 MW
	10% from electricity generation

- 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

Component	Number of Industries
Connection boxes	5
Cables	5
Frames	8
PV Modules	1
Transformers	1

- 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.

Component	Number of Industries
Connection boxes	8
Cables	-
Frames	2
PV Modules	-
Transformers	1

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

Creation of Local Market

- **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**

Lack in Wind and CSP

- **Easy procedure for international investments**
- **Mandatory local contribution by 20% in the bidding including EPC and O&M**

Potential for manufactur-ing

Jordan RE Local Manufacturing: Gaps

- 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"

Local Market

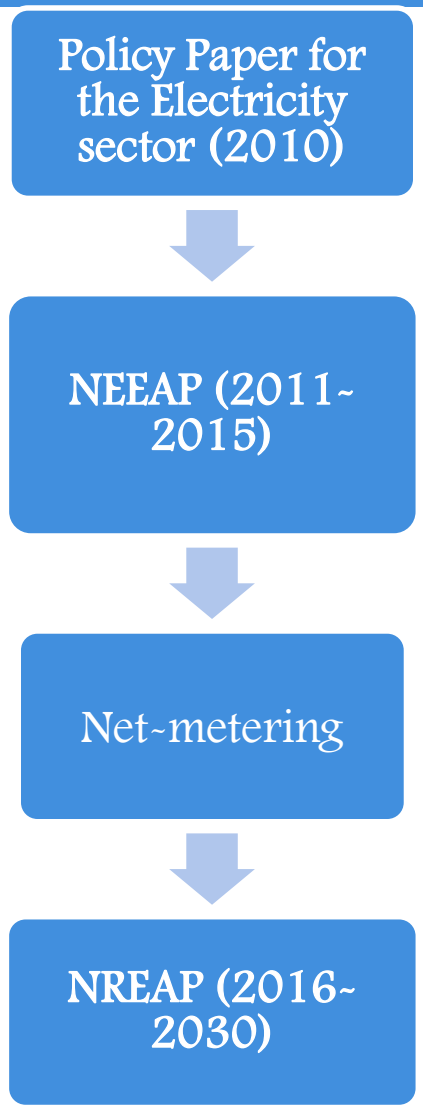
- **Limited R&D**
- **No local testing facilities**

Technical

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

Manufacturing

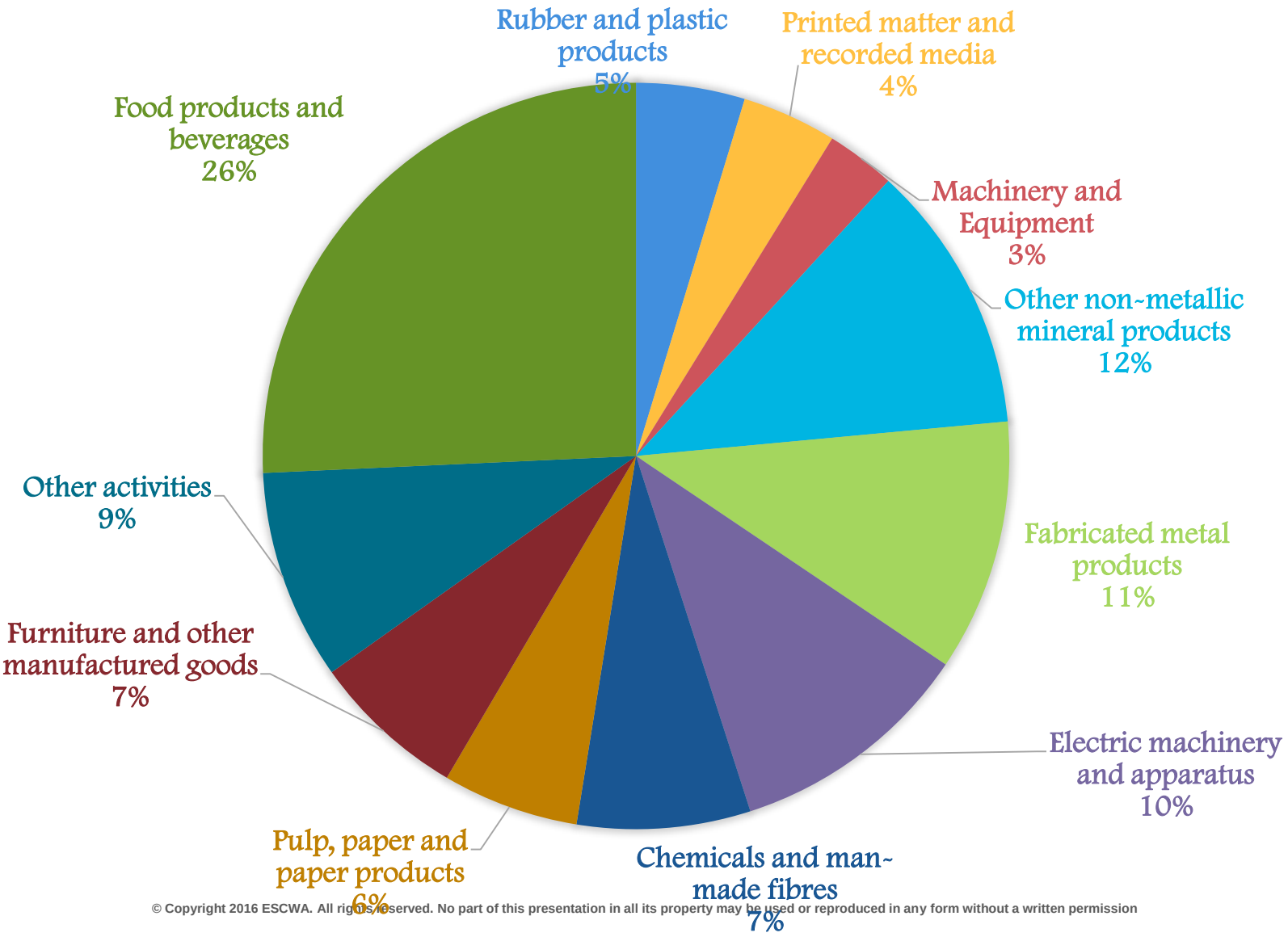
Lebanon: RE Current State



Target Date	2020
Wind	MW
PV	MW
CSP	MW
Biomass	MW
Geothermal	
Total	MW
	12% from electricity generation

- Country Capacity end 2015: 20 MW

Lebanon: Main Industries



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

Creation of Local Market

- Qualified and experienced managers, engineers and technicians

Technical

- Logistics for import and export
- Financial incentives for the industrial sector (through Central Bank of Lebanon)

Potential for manufactur-ing

Lebanon RE Local Manufacturing: Gaps

- Absence of minimum threshold of local content
- Weak Public Private Partnership

Local Market

- Limited R&D
- No local testing facilities

Technical

- Regional instability
- High Land Cost especially in Urban Areas
- High Energy Cost
- Power Shortage

Manufacturing

UAE: RE current State

- Dubai Integrated Energy Strategy (2030)

	RE Targets		Target dates
	Total		
	MW	%	
Abu Dhabi	460	7	2020
Dubai	3000	15	2030

RE Technology	MW	Project	Total
PV	200	Dubai Solar Park Phase 2	550
PV	350	Abu Dhabi Solar Park (including Noor 1 Noor 1 project)	

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

Creation of Local Market

- **Easy procedure for international investments**
- **Logistics for import and export**
- **GCC trade (tax free)**

Potential for manufacturing

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

Local Market

- **Limited R&D**
- **No local testing facilities**

Technical

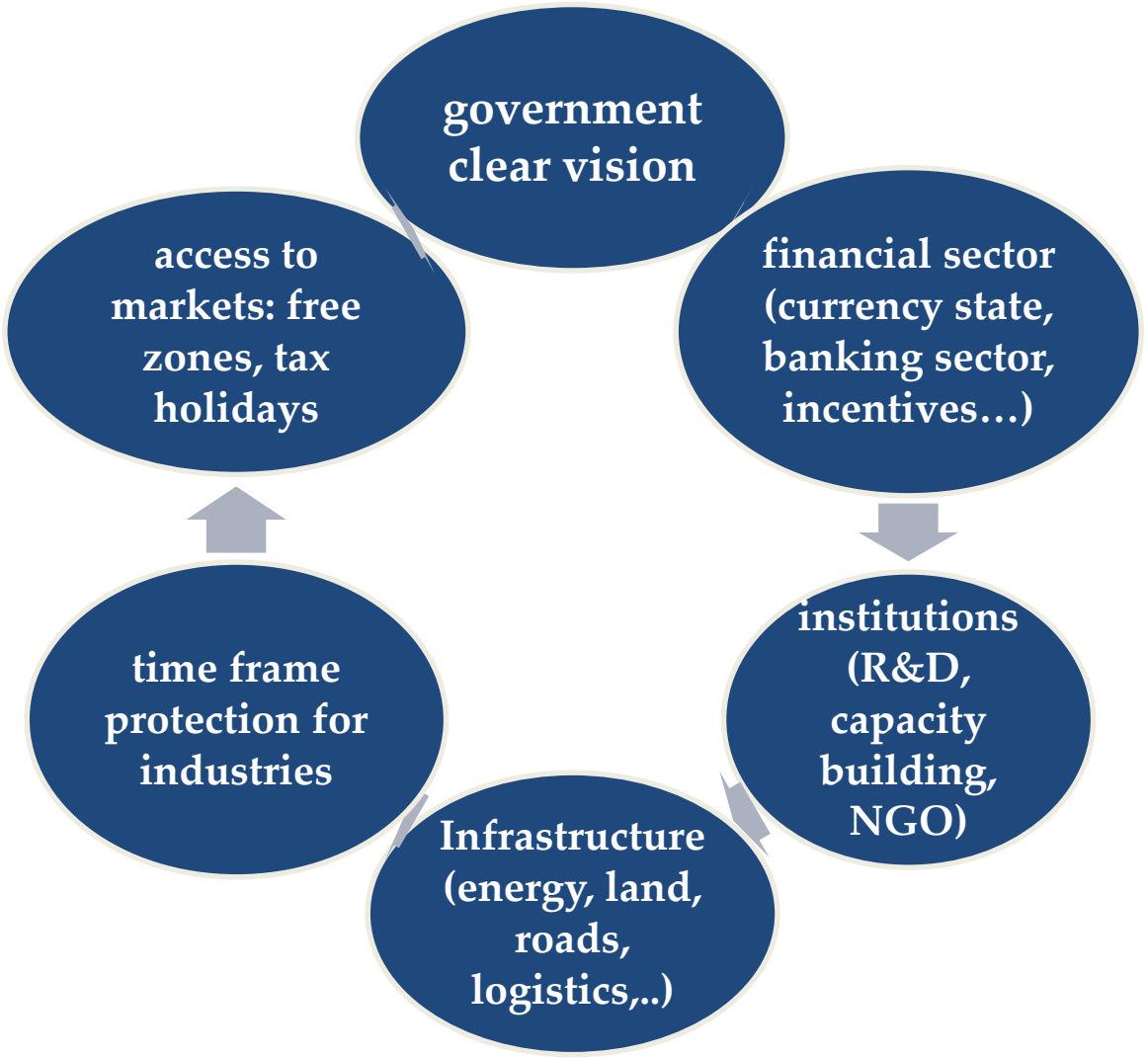
- **High Land Cost especially in Urban Areas**
- **Instable Cost of Energy**
- **Management is expensive**
- **Non Sustainable workforce ????**

Manufacturing

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



THANK YOU

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