

# JORDAN CLEAN TECHNOLOGY SECTOR

REPORT  
2016



EDAMA  
Energy, Water & Environment



**USAID**  
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# 1. ACRONYMS & ABBREVIATION

CLEAN-TECH	Clean Technology
DSM	Demand Side Management
EBRD	European Bank for Reconstruction and Development
EDAMA	EDAMA Association for Energy, Water and Environment
EDCO	Electricity Distribution Company
EE	Energy Efficiency
EMRC	Energy and Minerals Regulatory Commission
ESCB	Energy Sector Capacity Building Project
GDP	Gross Domestic Product
GEF	Global Environment Facility
GGGI	The Global Green Growth Institute
GHG	Greenhouse Gas
GoJ	Government of Jordan
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contribution
ISIC	International Standard Industrial Classification
JAB	Jordan Ahli Bank
JCP	Jordan Competitiveness Program
JGBC	Jordan Green Building Council
JLGC	Jordan Loan Guarantee Corporation
JREEEF	Jordan Renewable Energy and Energy Efficiency Fund
JSMO	Jordan Standards and Metrology Organization
MEMR	Ministry of Energy and Mineral Resources
MoEnv	Ministry of Environment
MoPWH	Ministry of Public Works and Housing
MSCoE	Model Skill Center of Excellence
MSW	Municipal Solid Waste
MW	Mega Watt
NEPCO	National Electric Power Company
NES	National Energy Strategy
PPA	Power Purchase Agreements
PV	Photovoltaic
RE	Renewable Energy
REEEL	Renewable Energy and Energy Efficiency Law
TNC	Third National Communication
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
VTC	Vocational Training Corporation

## 2. SECTOR OVERVIEW

### 2.1. CLEAN TECHNOLOGY DEFINITION

The Clean Technology (abbreviated as: clean-tech) is an industry that encompasses economically competitive and productive technologies which use less material and energy, generate less waste and cause less environmental damage than alternatives. Particularly, Clean Technology covers several sub-sectors such as energy efficiency (EE), renewable energy (RE), water management, and waste management.

### 2.2. INTERNATIONAL PERSPECTIVE ON CLEAN TECHNOLOGY SECTOR

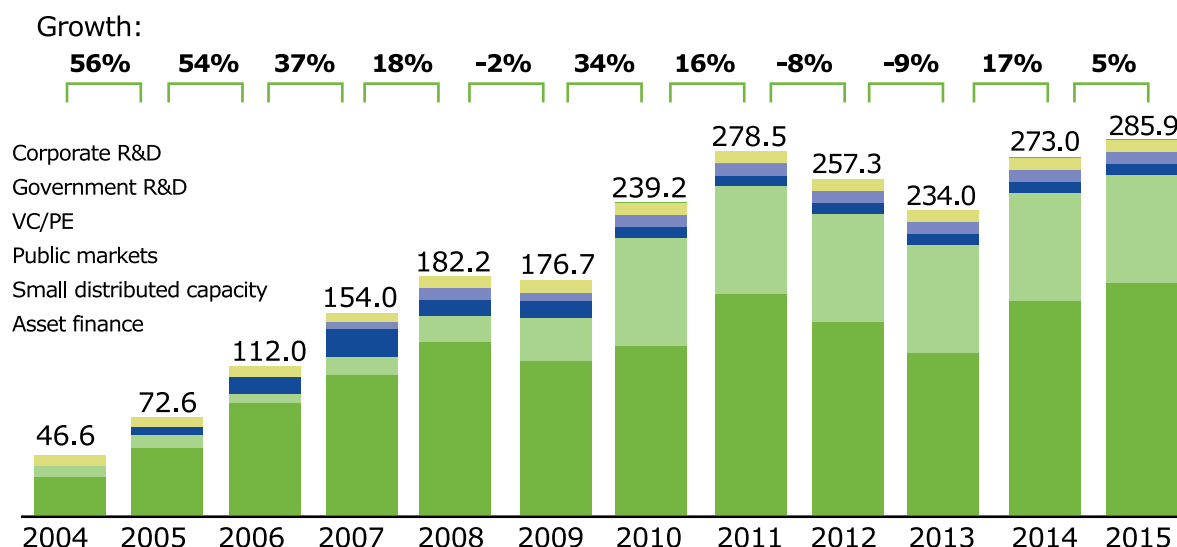
#### 2.2.1. Energy

Scientists across the board recognize fossil fuel burning as the single largest contributor to climate change. Additionally, economists and scientists alike recognize that the old economic model of oil dependency no longer makes businesses sense, and therefore a paradigm shift in the way we generate and consume energy needs to take effect. As ecological thresholds advance to dangerous levels, humans have become aware of the irreversible side effects of industrial activity. Clean energy has thus emerged as a response to mitigate the effects of climate change. Clean energy alternatives are becoming a reliable pathway to reduce CO<sub>2</sub> production, decrease global dependence on fossils fuels, and create a more sustainable international economy. For example, it is estimated that renewable energy currently supplies around 10% of the world's energy needs, preventing nearly 1.5 gigatons of CO<sub>2</sub> emissions each year.

Clean energy technologies include: solar, wind, biofuel, biomass, geothermal, hydropower, and marine (wave and tidal) energy as well as energy efficiency technologies. In the past 12 years more than \$2.3 trillion USD have been invested in renewable energy. Global investments in clean energy technologies have increased 5% in the last year, and more than 55% since 2004 (Figure 1). Renewable energy investments of developing countries have consistently increased, surpassing the annual new-investment of developed countries for the first time in 2015 (Figure 2).

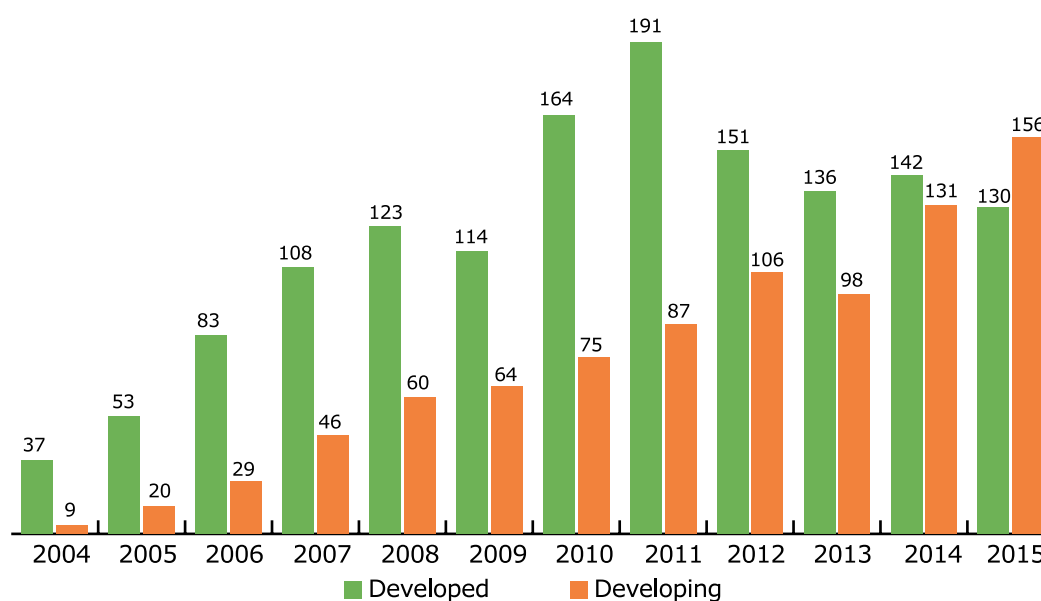
International policy agreements have further encouraged innovation and investment in clean energy projects and technology. Nearly 200 nations worldwide have adopted the United Nations 17 Sustainability Goals and the Paris Climate Change Agreement, both of which strongly advocate for alternative energy solutions.

According to the International Renewable Energy Agency (IRENA), renewable energy employs an estimated 8.1 million people worldwide. This figure does not include those employed in large-scale hydropower plants, which are estimated to add an additional 1.3 million individuals. Solar and biofuel are the largest contributors to employment generating 2.77 million and 1.67 million respectively. Full employment distribution according to sector is presented in Figure 3.



**Figure 1: Global New Investment in Renewable Energy by Asset Class, 2004 - 2015, \$BN**

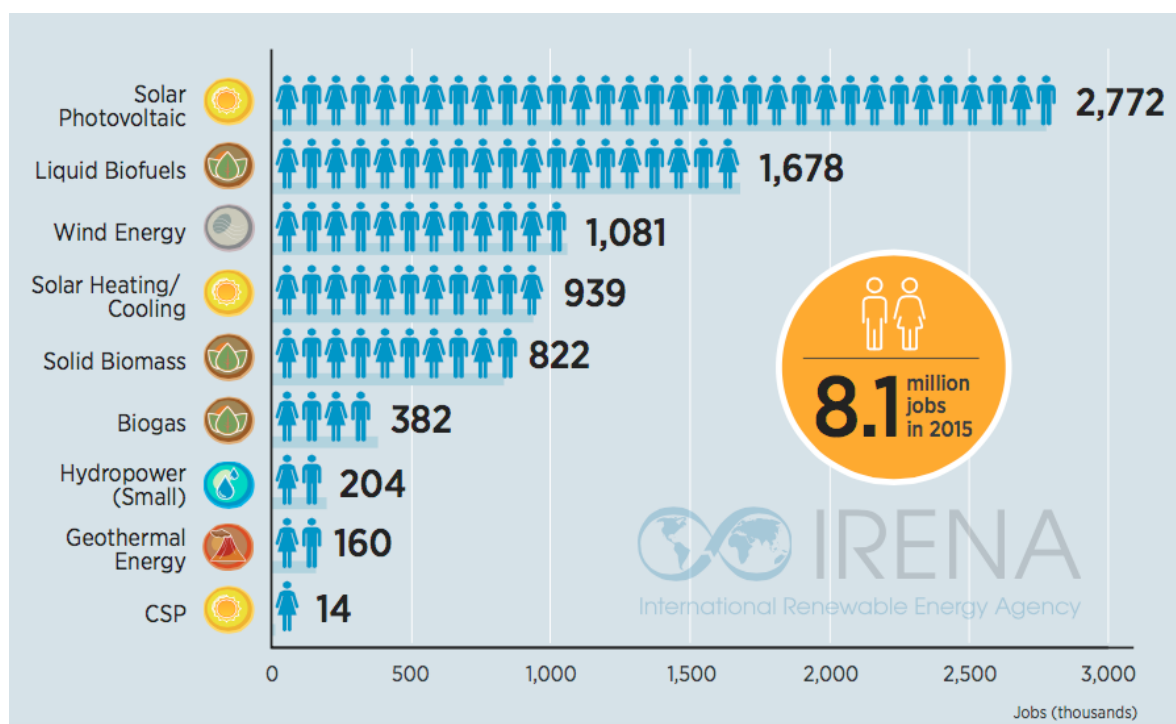
\*Source: United Nations Environment Programme (UNEP), GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT, 2016



New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals. Developed volumes are based on OECD countries excluding Mexico, Chile and Turkey.

**Figure 2: Global New Investment in Renewable Energy: Developed V Developing Countries, 2004 - 2015, \$BN**

\*Source: United Nations Environment Programme (UNEP), GLOBAL TRENDS IN RENEWABLE ENERGY INVESTMENT, 2016



**Figure 3: Full Employment Distribution per Technology**

\*Source: International Renewable Energy Agency (Irena), Renewable Energy and Jobs Annual Review, 2016

### 2.2.2. Water

Recognizing water as both a natural resource and an economic driver, a global strategy that handles effective water management and global fresh water scarcity is needed. According to the United Nations, 783 million people do not have clean or fresh water, while another 2.5 million do not have proper water sanitation. At the same time, groundwater depletion has increased by a steady 1% for the last 30+ years. This increase of global water consumption can largely be attributed to industrial growth, water-intensive energy production, and agricultural practices.

Water security is intimately related to industrial practices and energy sources. While agriculture and irrigation account for roughly 70% of the world's annual water use, energy production alone uses nearly 15% of the global consumption each year. Water depletion for energy production is an inefficient process that needs to be replaced by sustainable alternatives. A solution to our water shortage requires new investment, innovation, and cooperation on a global scale.

In 2015, developing countries alone required approximately \$103 billion USD for wastewater and sanitation. The United Nations estimates that the water sector currently employs around 1% of the world's total workforce – around 71 million people worldwide. If executed properly, the water sector has the power to transform economies and conserve resources.

### 2.2.3. Solid Waste

Solid waste is any discarded garbage, sludge, or liquid by-product of industrial, commercial, or domestic sources. Solid waste is further divided into hazardous and non-hazardous waste. The global solid waste industry has an estimated annual worth of over \$433 billion USD and employs over 40 million people worldwide. More than 4 billion tonnes of waste are produced annually, contributing to over 8% of anthropogenic greenhouse gas emissions. Despite increasing rates of solid waste production, more than 3.5 billion people or 52% of the world's population do not have access to basic waste management services.

#### 2.2.4. The Global Goals for Sustainable Development (SDGs)

In September 2015, the United Nations launched 17 goals for sustainable development in the presence of 193 world leaders. The goals form a strong call for action by all nations to end poverty and protect the planet. Out of the 17 goals, several are dedicated for energy, water and environmental sustainability. Public, private and community-based organizations are shaping their strategies to support this call for action according to the local, national and regional priorities and needs.



**Figure 4: Global Goals for Sustainable Development**

\*Source: United Nations, Sustainable Development Goals, 2015

#### 2.2.5. Climate Change and Paris Agreement

The Paris Agreement aligns all nations around the common goal of strengthening the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees Celsius above pre-industrial levels, and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Countries are required by the Agreement to set ambitious goals and put forward serious efforts through Nationally Determined Contributions (NDCs) and report regularly on their emissions and implementations efforts. On October 2016, the threshold for entry into force of the Paris Agreement was achieved and it entered into force on 4 Nov 2016. The first session of the Conference of the Parties serving as the Meeting of the Parties to the Paris Agreement took place in Marrakech in conjunction with COP 22 and CMP 12.

Despite Jordan's relatively low total emissions (0.01% of total global Greenhouse Gas (GHG) emissions), the country is committed to working with the international community to mitigate and adapt to climate change impacts. Jordan was one of the first countries in the region to issue a national Climate Change Policy declaring clear objectives for climate change adaptation and mitigation within various development sectors.

Jordan commits to 14% reduction in GHG emissions by 2030 compared to "business as usual" (BAU) projected emissions, 12.5% of which is conditional upon availability of finance and enhanced support. To achieve those targets, Jordan plans on implementing at least 70+ sectoral priority projects: 43 projects have come out of the mitigation scenario assessment articulated in the Third National Communication (TNC) Report to UNFCCC in 2014, and 27+



projects are proposed concurrently or newly planned and are not listed in the TNC Report (proposed after the development of the TNC). Those projects require USD 5,700,000,000. To meet the unconditional target, the government has already secured USD 542,750,000. Jordan must still finance USD 5,157,250,000 to fulfill its conditional target.

The Intended Nationally Determined Contributions, INDCs, submitted by Jordan encompass a wide range of sectors: energy (including transport), waste, industrial processes, agriculture and land-use, land-use change and forestry (LULUCF) and solvents. Thus, the majority of the measures will be included in relevant Ministries' strategies (energy, water, agriculture, health, and others), and implemented through them. The National Committee on Climate Change (NCCC) is mandated to monitor the progress in the implementation of the Climate Change Policy on the national level and thus the INDC.

The energy, water and waste sectors are the vital ingredients for Jordan to achieve its climate change commitments and ensure climate impacts on those key sectors are well managed.

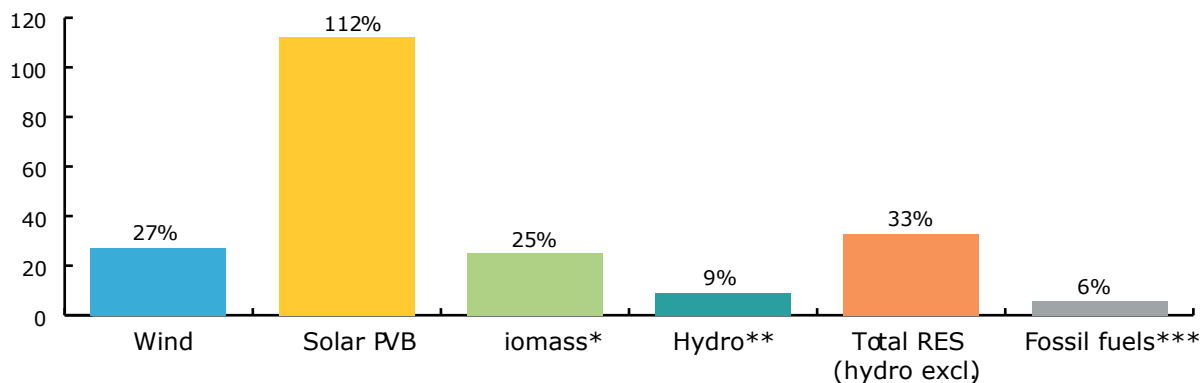
## 2.3. REGIONAL CLEAN TECHNOLOGY PERSPECTIVE

### 2.3.1. Energy

The MENA region is making great strides in its implementation of renewable energy sources in the Clean Technology sector. Investment in renewable energy was upwards of \$2.6 billion USD in 2012; that is more than six times what it was in 2004. Solar development alone has increased 112% regionally between the years of 2008-2011 (Figure 5). However, the region is still far from meeting its energy demands solely from renewable energy. The need for renewable energy projects is particularly important given high rates of regional population growth and MENA's growing industrial economy.

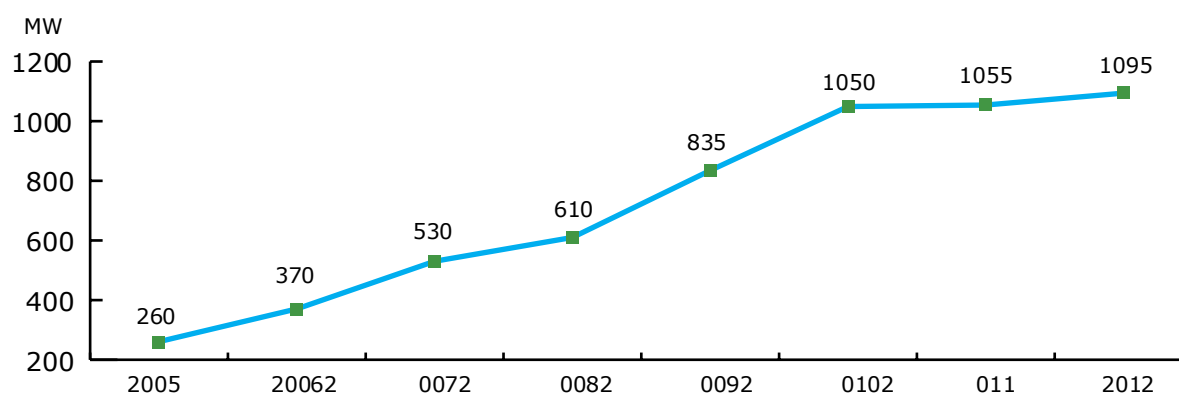
The World Bank estimates that by 2040 the MENA region will require an investment in renewable energy of more than \$30 billion a year in order to meet energy demands. There are currently more than 100 renewable energy ventures underway in the region. Three prominent projects include: the Mohammed Bin Rashid Al Maktoum solar park in Dubai, the Qweira Solar Plant in Jordan and the Tarfay wind farm in Morocco. Building on this success, more renewable energy projects in the region will help to build a sustainable pathway towards economic and social prosperity.





**Figure 5: Annual Average Growth Rate of Electricity Production by Source in the MENA Region, 2008 – 2011**

\*Source: International Energy Agency (IEA), Renewables Information 2009 (Paris: IEA/OECD, 2009); IEA, Renewables Information 2012 (Paris: IEA/OECD, 2012)



**Figure 6: Installed Wind Power Capacity in the MENA Region, 2005 – 2012**

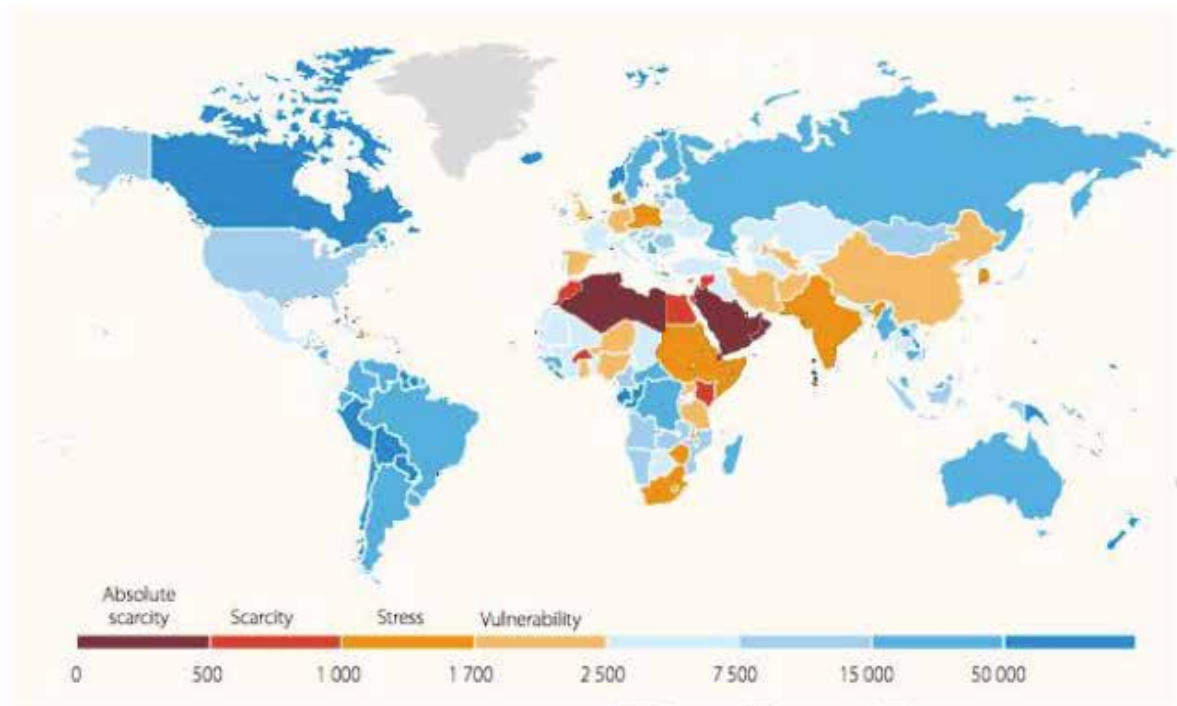
\*Source: International Renewable Energy Agency (Irena), MENA Renewables Status Report, 2013

### 2.3.2. Water

The MENA region is 87% desert, and thus particularly vulnerable to water insecurity, drought, and desertification (Figure 7). Out of the 22 Arab countries, fifteen are considered water insecure and 18% of the regional population does not have access to clean water, according to a study from 2010. Regional water security will continue to be a problem for the region due to population growth, urbanization, agricultural needs, and climate change.

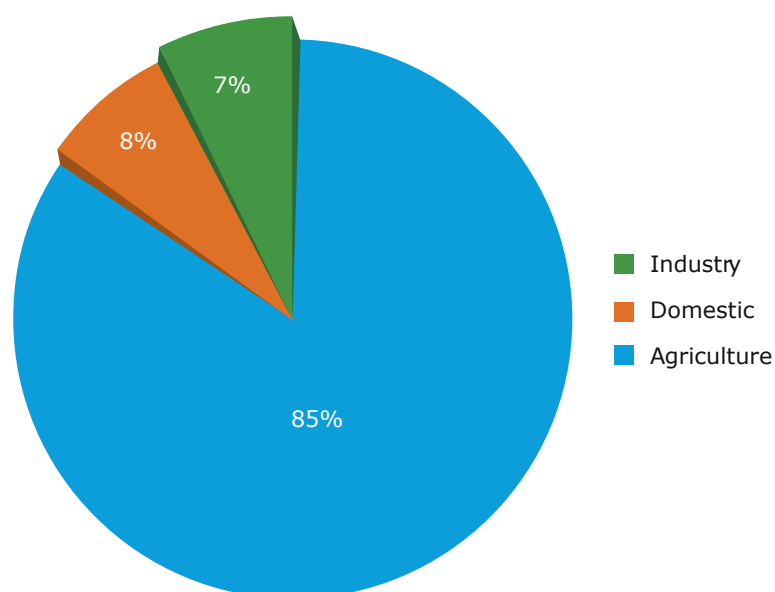
The MENA region has an estimated population of 360 million with an expected population growth of 57% by year 2035, amounting to a regional population of 634 million. Increased population not only threatens water security, but has large implications for food and agricultural production. Approximately 85% of regional water is distributed to agriculture and irrigation needs (Figure 8). Given that an estimated 30% of the Arab region's working population is employed in agriculture, water scarcity is a regional priority for economic and resource survival.

In order to address increasing demands for water, some Arab countries (Saudi Arabia in particular) have invested in desalinization plants. In 2016, water desalination was a \$10 billion USD regional industry yet supplied only 1.8% of the region's water consumption. Based on regional trends, desalinated water is expected to supply nearly 8.5% of MENA's water consumption by year 2025. The Islamic Development Bank estimates that the Arab region will need \$200 billion USD in investments over the next 10 years in order to satisfy regional water demands.



**Figure 7: Total Renewable Water Resources, 2011 (m2 per Capita per Year)**

\*Source: WWAP, prepared with data from FAO AQUASTAT and using UN-Water Capacity Thresholds



**Figure 8: Water Uses in the Arab Region**

\*Source: UNDP, Water Governance in the Arab Region, 2013

### 2.3.3. Solid Waste

Waste disposal services often struggle to supply sufficient waste management in large urban cities or densely populated areas. Municipal waste management and disposal services are exceptionally challenged by urbanization and population growth. As a result, many gated communities in the region, especially in the UAE, have turned to private providers for waste disposal services. Not only do private providers create an alternate platform for Private-Public Partnerships (PPP), they also enable sustainable job creation for effective waste management solutions. It should be recognized that in countries such as Jordan and Egypt where large informal economies exist for waste management, newly implemented PPP solutions would need to be comprehensive enough to account for the livelihoods of informal workers. Privately employed solid waste solutions would thus require a social dimension to any new system. Private partnerships in waste management could expand further in the future to include hazardous or industrial disposal as well. This untapped market has the potential to create a new age of small businesses not only in disposal, but also in the areas of treatment, transportation, and safety measures.

## 2.4. CLEAN TECHNOLOGY SECTOR DEVELOPMENT IN JORDAN

### 2.4.1. Renewable Energy and Energy Efficiency

*Being the two sectors highest in maturity, the Renewable Energy and Energy Efficiency are the focus sectors in this report. Future reports will have an increased focus on water and waste as those two sectors grow and become more mature.*

Prior to 2003, Jordan imported crude oil from Iraq at highly subsidized rates; crude oil imports stopped after the second Gulf War. Later on around 2008, Jordan began importing natural gas from Egypt which was also jeopardized with the Arab Spring and the second Gulf War. Therefore, Jordan had to switch to using imported oil products (heavy fuel oil and diesel) to produce electricity. As a consequence, the cost to produce electricity increased several fold. Additionally, energy prices hiked up worldwide during that period; from 1999 till mid-2008, the price of oil rose significantly and reached a record peak on July 11, 2008.

In recent years, Jordan has been importing an estimated 97% of its energy needs. In 2015, Jordan's energy economy constituted roughly 9.5% of its overall Gross Domestic Product (GDP). This cost constituted roughly 40% of Jordan's annual budget. Furthermore, and according to the 2015 Annual Report of the Ministry of Energy and Mineral Resources, energy costs consume 52.8% of Jordan's revenue made from exports. Additionally, the cost of energy makes up 17.5% of the country's imports. Needless to say, energy security and the deployment of energy efficiency and renewable energy projects has become a top priority for the Kingdom.

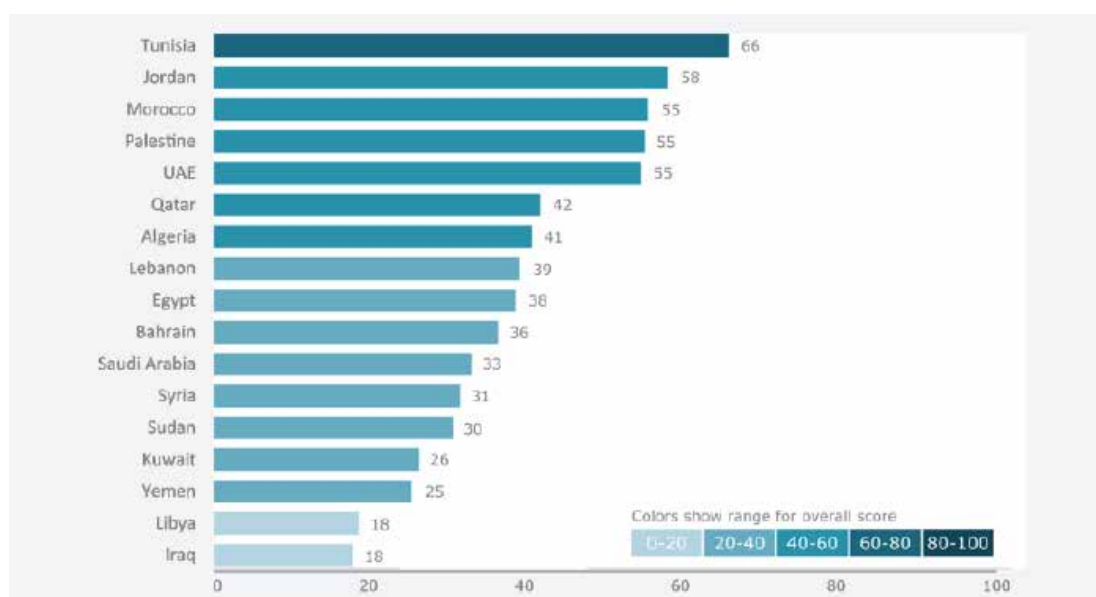
Prior to 2012, Jordan was able to ratify fiscal and energy policies to partially mitigate the impact of the shocks that have hit Jordan's economy in the last decade due to regional geopolitical and socioeconomic instability. Till that time, Jordanian consumers were protected from increases in energy prices through high governmental subsidies and other national measures. Changes to the Tariff were undertaken in 2013. Such measures, however, substantially increased fiscal costs on a national level. This financial burden has contributed to high central government deficits and increased operating losses of the National Electric Power Company (NEPCO). When fuel prices rose, NEPCO accumulated substantial debt in order to cover high governmental subsidies on energy. By 2012, subsidies on petroleum products alone were roughly 2.8 % of GDP and 8.8 % of government expenditures.

Responding to Jordan's energy challenge, the Master Energy Strategy was developed by a Royal Commission headed by His Royal Highness Prince Hamzah bin Al Hussein in 2007. Jordan adopted a strategy that takes advantage of its dry, sunny climate and windswept northern and eastern regions; these climatic conditions are optimal for wind turbine and photovoltaic (PV) solar projects. One of the main objectives of the strategy is to reduce the dependency on imported oil and diversify the energy mix, including increasing the share of renewable energy to 10% by 2020 and energy efficiency by 20% in 2020. This is to be achieved by expanding the development of renewable energy and energy efficiency projects in Jordan.

The country is placing a heavy emphasis on projects in the fields of solar and wind power; it is the first Arab country to endorse legislation governing this sector. The Renewable Energy and Energy Efficiency Law (REEEL), passed as a permanent law in April 2012, and is making the 2020 target more feasible. This law allows investors to identify grid-connected electricity production projects. Additionally, it allows any electricity consumer to cover their electricity needs by installing PV system using either the net-metering or wheeling (the generation of electricity at a different site than where the actual consumer is located) schemes. The law also enables developers to submit direct proposals to the Ministry of Energy and Mineral Resources (MEMR) for the generation of energy using renewable energy technologies. Finally, the law makes investment in renewable energy and energy efficiency more attractive by making all systems and equipment of renewable energy efficiency and energy sources its production inputs whether manufactured locally and/or imported exempt from all custom duties and sales tax.

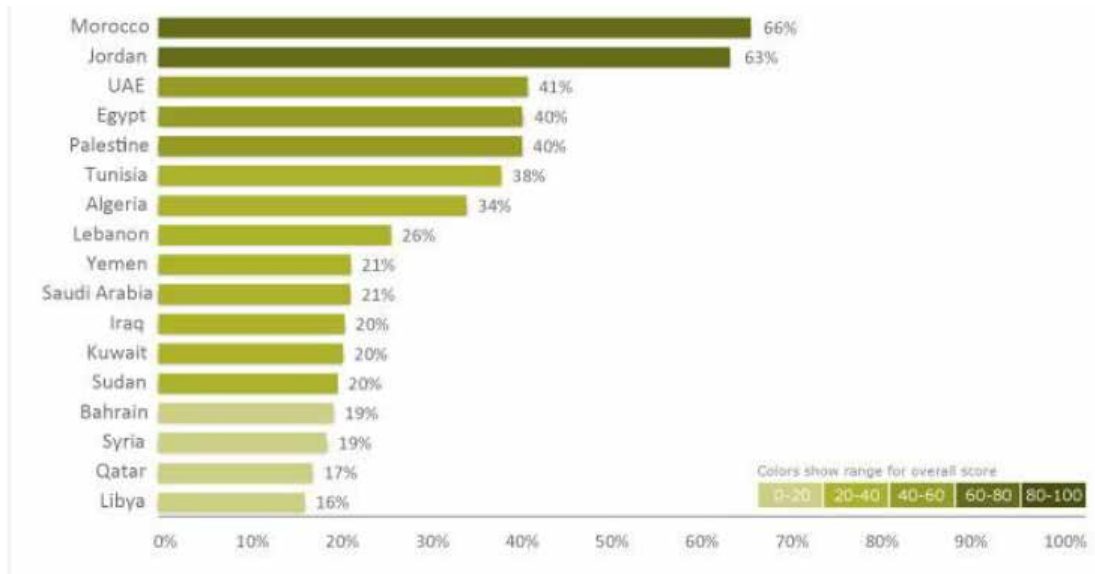
Currently, Jordan's clean energy sector is witnessing "great momentum" and has attracted world-renowned companies with decades of experience to invest in such projects in the Kingdom. According to RCREE's Arab Future Energy Index (AFEX) 2015 findings, Jordan ranks second in the region for creating a favourable environment for renewable energy and energy efficiency investments, surpassed only by a thriving Tunisia. The main accomplishments of Jordan during 2014 include the implementation of a subsidy removal plan, eliminating all subsidies for oil products; the adoption of the country's first National Energy Efficiency Action Plan (NEEAP); the tendering and implementation of large scale Renewable Energy projects, the implementation of net-metering schemes, and the formulation of minimum energy performance standards for household appliances.

#### AFEX 2015 Energy Efficiency Key Findings:



**Figure 9: RCREE's Arab Future Energy Index (AFEX) 2015 - Energy Efficiency**

\*Source: Regional Center for Renewable Energy and Energy Efficiency – RCREE, Arab Future Energy Index (AFEX), 2015



**Figure 10: RCREE's Arab Future Energy Index (AFEX) 2015 - Renewable Energy**

\*Source: Regional Center for Renewable Energy and Energy Efficiency – RCREE, Arab Future Energy Index (AFEX), 2015

There are four tracks for renewable projects in Jordan: 1) the Direct Proposals Schemes carried out under rounds of competitive bidding through MEMR, 2) the Competitive Bidding Process, 3) EPC Turn-Key projects, and 4) Small-Scale Renewable Energy Schemes (net metering and wheeling).

Jordan is placing a heavy emphasis on solar and wind power projects. About 1,335 Megawatts of wind and solar projects are currently under development in Jordan; 400 Megawatts are currently operational. In addition to the project development opportunities announced by the Government of Jordan (GoJ) for centralized power generation, a huge window of opportunity to generate distributed electricity for individual, commercial or industrial use exists under the net-metering and/or the wheeling schemes. Jordan leads the MENA region in net-metering and wheeling; out of the 370 megawatts applied for under the net-metering and wheeling schemes, 84 Megawatts are installed.

## 2.4.2. Renewable Energy Projects - Solar and Wind

**Table 1: List of Ongoing Renewable Power Projects in Jordan (As of August 2016)**

Project	Sponsor(s) & Additional Information	Project Cost	Status	Estimated Project Mega Watt
Tafila Wind	Jordan Wind Project Company (EPGE, InfraMed Infrastructure, Masdar Power)	302 million	Completed	117 MW
Ma'an Solar Park 1 in Ma'an Development Area (MDA)	Includes several solar projects, led by Ma'an Development Company:			70 – 160 MW in Total:
	• Al Zanbaq for Energy Generation	n/a	n/a	10 MW
	• Zahrat Al Salam for Energy Generation;	USD 30 million	n/a	10 MW
	• Al Ward AL Joury for Energy Generation;	n/a	n/a	10 MW
	SunEdison Italia Construction S.r.l – Jordan PSC – Sponsors:	n/a	n/a	20 MW
	• Shams Ma'an Power Generation PSC - Kawar Energy Sponsors: Nebras Power (joint venture between Qatar Electricity and Water Company, Qatar Holding, Qatar Petroleum International), Diamond Generating Europe, Kawar Group;	n/a	Construction; reached financial closure reached; Commercial operations date by end-2016	50 MW
	• Arabia One for Clean Energy Investments, Ennera Energy and Mobility, Hanwha E&C, Arabia Trading & Consulting	USD 30 million	Completed	10 MW

\*Source: OECD (2016), OECD Clean Energy Investment Policy Review of Jordan, Green Finance and Investment, OECD Publishing, Paris. P. 64-65 <http://dx.doi.org/10.1787/9789264266551-en>

Project	Sponsor(s) & Additional Information	Project Cost	Status	Estimated Project Mega Watt
Ma'an Solar Park 1 in Ma'an Development Area (MDA)	• Anwar Al Ardh for Solar Energy Generation PSC; Sponsor: Scatec Solar AS	USD 68 million	Completed	20 MW
	• Ardh Al Amal for Solar Energy; Sponsor: Scatec Solar AS and	USD 34 million	n/a	10 MW
	• Saqer Ma'an Lal-Taka Al Shamsia LLC	n/a	n/a	20 MW
Fujeij Wind Farm	Korea Electric Power Corp	USD 187 million	Pre-construction	90 MW
TSK Al Qweira PV Plant	Funded by Abu Dhabi Fund. Constructed by TSK Grupo and Enviromena Power Systems using an EPC contract	USD 128 million	Pre-construction	100 MW
Ma'an Wind Farm	Kuwait Fund for Arab Economic Development	USD 149 million	Completed since April 2016	80 MW
Mafraq Solar Project	Philadelphia Solar Power Company	USD 23 million	Completed	10 MW
Adenium - Martifer Solar Farm	Adenium Energy Capital, Bright Power Group	USD 26 million	Completed	10 MW
Pilot CSP plant and research lab	Solar Euromed	USD 5.8 million	Pre-construction/construction	0.5 MW
Oryx Solar Project	Scatec Solar AS	USD 31 million	Completed	10 MW
Shamsuna PV Plant in Aqaba Special Economic Zone	Shamsuna Power Co; Foursan Capital Partners I (owner)	USD 20 million	Completed Feb 2016	10 MW



Project	Sponsor(s) & Additional Information	Project Cost	Status	Estimated Project Mega Watt
Royal Hashemite Court PV Plant	n/a	n/a	Commissioned	5.6 MW
Sterling & Wilson Jordan PV Plant	n/a	n/a	Pre-construction	62.5 MW
Martifer Solar Jordan PV Portfolio	Martifer Solar SA (developer)	n/a	Construction	37 MW
GreenWatts Al Rajef Wind Farm	Green Watts LLC (developer). Alcazar Energy Partners is the new sponsor/owner of the project	USD 186 million	Pre-construction	83 MW
Hecate Bab il Hawa Wind Farm	Hecate Energy LLC (owner and developer), then acquired by Alcazar Energy Partners in 2016	n/a	Permitted, PPA signed in Fall 2016	50 MW
Xenel Tafilah Wind Farm	Xenel Industries Ltd (owner and developer)	n/a	Permitted	49.5 MW
Korea Southern Power Tafilah Wind Farm	Korea Southern Power Co Ltd (owner and developer)	n/a	Permitted	49.5 MW
Mafraq I-IV PV Plant	FRV (Fotowatio Renewable Ventures) is the sponsor for two projects. ACWA Power is the sponsor of one project. Fourth project may be acquired, and for now is sponsored by Saudi Oger	n/a	Pre-construction ; PPAs signed; Construction to start in 2018	4 X 50 MW
Water Authority of Jordan (WAJ)	Private developer to be selected to sign a 20- year PPA with WAJ to offset its electricity consumption	USD 70 100 million	Under development	50 MW

Project	Sponsor(s) & Additional Information	Project Cost	Status	Estimated Project Mega Watt
Introduction of Renewable Energy in 3-5 water supply stations using PV water pumping systems.	EU grant managed by EBRD for the benefit of WAJ	EUR 30 million	Under development (due diligence stage)	25 MW
Mafraq Solar Project	Philadelphia Solar Power Company	USD 23 million	Completed	10 MW
Adenium - Martifer Solar Farm	Adenium Energy Capital, Bright Power Group	USD 26 million	Completed	10 MW

#### 2.4.3. Biogas

Jordan has potential to utilize biogas from solid waste for electricity generation. A successful 1 MW pilot project using municipal solid waste (MSW) through landfill and biogas technology systems was constructed and commissioned in 2001. Jordan plans to introduce about 40-50 MW waste to energy power projects by 2020.

#### 2.4.4. Hydropower

In 2004, two small hydropower schemes were operational in Jordan. One is located at the Aqaba thermal power station, with a capacity of 5 MW. The other is at King Talal dam spanning the river Zarqa, with a rated electricity-generating capacity of about 5 MW. Though the two small hydropower schemes produce only 0.5 per cent of the total national electricity generation, there is a great possibility to generate electricity by developing the elevation difference between the Red Sea and the Dead Sea. A preliminary pre-feasibility study showed that the potential capacity of hydropower station built in this region could be 800 MW.

Furthermore, small hydropower is a potential energy source in Jordan especially now that the legislation allows for IPPs to operate in the country.

**Table 2: Small Hydropower Potential at Existing Dams in Jordan (Average flows of existing main dams in Jordan and their estimated hydropower generation)**

Name/Location	Average annual flow (10 <sup>6</sup> m <sup>3</sup> /yr)		Hydropower utilization		Estimation hydropower potential (kW)	Projected energy generation potential (MWh/yr)
	In	Out	Yes	No		
Al Wahdah / Irbid	13.0	5.0		X	2 500	15 000
Al Arab / Northern Shounah	10.0	11.5		X	5 750	34 500
Sharhabiel / Northern Jordan Valley	5.1	5.8		X	2 900	17 400
King Talal / Jerash	92.2	92.3	X			
Wadi Shuaib / Southern Shounah	6.1	6.3		X	3 150	18 900
Kafrain / Southern Shounah	11.3	11.3		X	5 650	33 900
Karamah / Southern Shounah	2.1	0.5		X	250	1 500
Tanoor / Jordan Valley	4.1	1.3		X	650	3 900
Waley / Madaba	6.6	8.7		X	4 350	26 100
Mojeb / Karak	3.0	13.0		X	8 000	48 000

\*Source: United Nations Industrial Development Organization (UNIDO) and International Center on Small Hydro Power (ICSHP), World Small Hydropower Development Report, 2013

**Table 3: Small Hydropower Potential at Proposed Dams in Jordan (The storage capacity for proposed small dams in Jordan and their projected small hydropower potential)**

Name / location	Proposed storage capacity (10 <sup>6</sup> m <sup>3</sup> )	Status as of early 2010	Hydropower potential (kW)	Generation potential (MWh/yr)
Maa'in / Madaba	1.0	Under study	500	3 000
Lajjun / Karak	1.0	Under study	500	3 000
Dalaghah / Tafila	1.0	Under study	500	3 000
Shuthim / Tafila	1.0	Under study	500	3 000
Kufranjah / Ajlun	9.0	Under study	4 500	27 000
Bin Hammad	5.0	Under study	2 500	15 000
Wahidi / Maa'n	1.8	Under study	900	5 400
Wadi Karak / Karak	2.1	Updating studies	1 050	6 300
Bayer / Eastern desert	4.0	Completed	2 000	12 000
Jafer / Southern desert	0.5	Under construction	250	1 500
Rukban / North eastern desert	2.0	Completed	1 000	6 000
Khanasree / Mafraq	1.0	Under construction	500	3 000
Ghadaf / Central desert	0.5	Completed	250	1 500

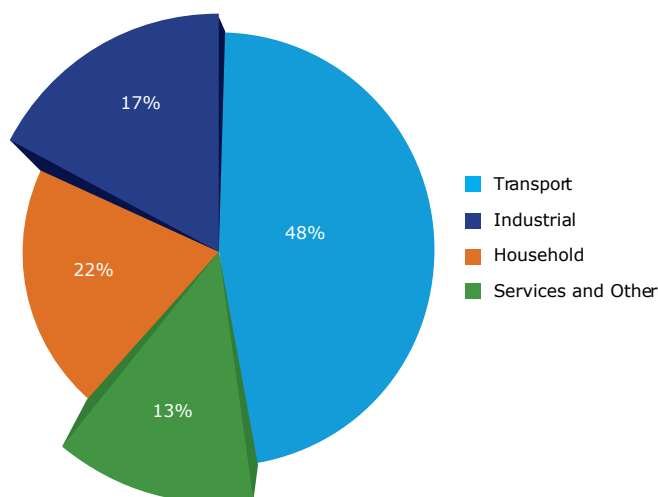
\*Source: United Nations Industrial Development Organization (UNIDO) and International Center on Small Hydro Power (ICSHP), World Small Hydropower Development Report, 2013

#### 2.4.5. Geothermal

Studies by Jordan's Natural Resources Authority have found medium and low geothermal waters along the Dead Sea rift valley. Small geothermal resources are also utilized in aquaculture. A consulting firm recently evaluated the techno-economic potential of utilizing geothermal energy to generate power. The study concluded that additional deep drilling (up to 3,000 meters) is required in order to determine the techno-economic feasibility of geothermal power in Jordan. A road map showing the required actions and costs was developed for this approach.

## 2.5. SNAPSHOT ON ENERGY PER SECTOR

Energy is the backbone for every sector in the Jordanian economy. Therefore, smart energy solutions when implemented provide economic gains in every sector of the Jordanian sector. To gain a better understanding, figure 11 below demonstrates Jordan's key energy-consuming sectors. The main consumer of electricity in Jordan is the transport sector, which accounts for 48% of the total consumption, followed by the household sector at 22%, then industrial at 17%, and finally the services and other sectors that total up to 13%. Overall consumption has steadily increased in recent years.



**Figure 11: Jordan's Energy Consumption per Sector 2015**

\*Source: MEMR, Energy 2016 – Facts and Figures, 2016

### 2.5.1. Energy and the Transport Sector

Jordan's energy response has included increasing renewable energy projects as well as enhancing energy management and efficiency. Jordan has also paid specific attention to niche sectors. For example, according to MEMR Facts & Figures 2016, the transport sector consumes 48% of primary energy in Jordan. Gasoline, the only fuel allowed to be used for passenger cars, makes up 17% of national oil consumption. In 2013, the government decided to revert back to the previous law banning the importation of cars that are more than 5 years old due to their high fuel consumption. Environmental and safety issues like this have decreased the growth of the car market; the main means of transportation in the country.

Fuel prices led to a widespread purchase and use of hybrid cars. According to the U.S. Agency for International Development Jordan Competitiveness Program (USAID JCP) National Clean Energy Marketing and Awareness Strategy issued in 2015, taxis are the primary form of public transportation in Jordan. More than 24,000 cars are used in public transportation in Jordan, but their impact on the energy consumed almost equals the consumption of private cars which makes tackling this sector extremely attractive. During the MENA ICT Forum of 2014, a Letter of Commitment was signed between the Ministry of Environment, the Greater Amman Municipality, and All Sell (Abu Al Haj Taxi in Amman municipality) to implement a project to create 10 charging stations and to have 100 new electric taxis on the road. This project can be used as an energy smart, environmentally friendly and a viable business model that can be used to drive a trend in this market. Introducing electric cars into this sector will result in significant savings on energy. In addition, this new cluster will create new supply markets and jobs as charging stations need to be developed and operated at various locations.

Finally, Jordan has plans to enhance its public transportation services. The Greater Amman Municipality (GAM) will soon begin implementing the Amman Bus Rapid Transit (BRT) System for the Capital - Amman. The Amman BRT is a comprehensive, fast and reliable mass transit system that utilizes large busses that move on lanes designated only for them and stop at specific bus stop locations. The tender for construction of package three (Queen Rania St. and Yajouz Rd. of the Construction of Facilities for Amman BRT) was issued in early 2016. These measures will have positive effects on Jordan's energy security and environmental wellbeing.

### 2.5.2. Energy in the Residential and Real Estate Sector

According to the Department of Statistics 2013 figures, the total population of Jordan is 6.53 million with an average household size of 5.4. 82.6% of residents live in urban areas making the total urban population 5.39m. While no data is available on the number of housing units in Jordan, it can be estimated that there are almost 1 million occupied housing units in the country. Since the residential sector consumes 43% of electricity and 22% of energy in Jordan, the intelligent and strategic introduction of smart energy action in this sector is vitally important. According to the USAID JCP National Clean Energy Marketing and Awareness Strategy issued in 2015, the majority of new apartments are developed by housing companies that focus on luxury, space and price as the main value propositions they provide for their customers. Insulation and green or efficient building features are not being used to attract buyers. According to Euromonitor's Consumer Life-Style Jordan of 2010, Jordanians mainly live in apartment buildings: 96% of dwellings are apartments, while the remaining 4% vary between villas and small houses.

To reduce energy in this sector, mandatory codes and regulations have been passed but are not properly enforced. Voluntary codes are also available to help raise the standard in the sector. More importantly however, there are many measures through which this sector can benefit from in promising high Return on Investment. These measures include solar water

heaters, energy saving lights, proper insulation, double-glazed windows, energy efficiency home appliances and ACs. Additionally, behavioural change can lead to reduced energy consumption, e.g. switching lights off in unused rooms, setting AC temperature, etc.

Moreover, major banks including the Arab Bank, Ahli Bank, Cairo Amman Bank and the Housing Bank have special, interest free finance products with easy instalments. However, they do not have special representatives that promote these products. Instead, these financial products are promoted among other products, leaving high potential for better advertisement and penetration.

### 2.5.3. Energy in the Industrial Sector

Another important sector is the industrial sector. According to the Ministry of Energy and Mineral Resources (MEMR), this sector consumes 17% of Jordan's primary energy consumption and 24% of Jordan's electricity consumption. According to the Chamber of Industry's Annual report of 2015, industrial facilities in Jordan are categorized into three categories: micro facilities, small-medium facilities, and large industrial facilities. Several technical assistance and access to finance projects have been launched targeting the industrial sector in Jordan. Their aim was to encourage industries, especially small and medium ones, to rethink and redesign their operations to be more energy smart. For example, JEDCO is currently supporting 32 industrial facilities conduct audits to determine which measures they can take to optimize their energy consumption.

### 2.5.4. Energy in the Water Sector

About 14% of Jordan's electricity goes to pump water from one location to another. Jordan has begun utilizing solar energy to pump water. The biggest renewable energy water pumping project is a 50 megawatt solar project with the Disi Water Conveyance Project, a water supply project in Jordan. The project is designed to pump 100,000,000 cubic meters of water per year from the Disi aquifer which lies beneath the desert in southern Jordan and northwestern Saudi Arabia to Amman and other cities to meet increased water demand.

#### SECTOR STORY: FIRST PUBLIC PRIVATE SECTOR PROJECT ON WATE

Three million USD have been provided by EBRD as a loan to local energy service companies (ESCOs) owned by Engicon O&M who will in turn finance projects in water and wastewater management. This project is the first project of its kind where a private sector provider works with the public sector, providing comprehensive solutions in the water sector. Part of this investment will target the modernization of the Wala and Lib water pumping stations that serve Madaba. The modernization of the pumping stations will lead to greater energy efficiency, through improved pumping technology, and lower costs for the Water Authority of Jordan, one of the country's largest energy users. The financing, provided under the EBRD's Local Enterprise Facility (LEF), will also be used to improve management and operation of the pumps. Those ESCOs benefiting from the EBRD loan are 100% owned by the Jordanian Operations & Maintenance Company – Engicon.

Several international agencies are supporting the water-energy nexus. For example, the USAID and European Union have supported the construction of many other smaller water pumping projects that use renewable energy across Jordan. Moreover, EDAMA supported a solar pumping project in Ghor Fefa to target a critical community problem - i.e. whenever the community needed to pump water, electricity would be cut.

There are projects and programs that lead innovatively in providing holistic water, energy and agricultural solutions. One such program is Hydroponic Green Farming Initiative (HGFI) program. The program is a three year program which has been launched in 2013 and is supported by USAID and currently being implemented by ECO Consult. It aims to introduce an integrated model of hydroponic farming that is linked with renewable energy generation in large-commercial farms and small rural households. This integrated system will promote water conservation and clean energy use in the hydroponic system, all while increasing agricultural livelihoods. It will do so through introducing new technologies to farmers and households and building partnerships between the private sector and the community.

#### 2.5.5. Energy in the Commercial Sector

The commercial sector consumes 15% of Jordan's electricity. This sector's largest energy consumers are hotels, banks and hospitals who also have the highest electricity tariffs. Implementing energy efficiency and renewable energy projects therefore is incredibly attractive to these sub sectors. Banks, telecom companies, and hospitals alike have begun exploring measures to save on their energy consumption and generate energy to cover their electricity consumption.

Some market segments such as hotels and hospitals cannot cover their electricity consumption through rooftop installations and started to think together in investing in wheeling plants to switch their energy consumption from traditional sources of energy to renewable energy. As REEEL allows different entities to pool together to generate electricity to cover their consumption, the Private Hospitals Association is currently working with a number of private hospitals in Jordan who are interested in generating energy to cover their consumption.

Additionally, telecom companies are also exploring wheeling as an avenue to generate their electricity from renewable sources. Leading in this arena is Orange Jordan who has signed an agreement with a consortium comprising of Paris-based Neoen and Jordan's Millennium Energy Industries (MEI) and Catalyst Private Equity to build five solar PV plants totaling 33.7 MW. This venture is set to be one of the biggest private PV investments in the Middle East region.

Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) is implementing energy efficiency and renewable energy measures in hotels; utilizing financing from the French Development Agency through the Ministry of Planning and International Cooperation. Audits have been conducted in one, two and three star hotels, and in a few Jordanian-owned four star hotels as well in Petra. The results of the audit demonstrated that those hotels can benefit from taking energy conserving measures in the areas of lighting, heating and cooling, boilers, insulation, and glazing. The audit also made recommendations for hotels to implement renewable energy technologies which include PV systems and solar water heaters. Energy Service Companies are working with some of those hotels to implement small and medium sized renewable energy and energy efficiency projects.



### 2.5.6. Water

Jordan maintains high rates of water accessibility throughout the country, reporting that 94% of the population has safe drinking water and 93% have improved sanitation. Given that Jordan's renewable freshwater resources account for roughly 38% of its annual water consumption, the majority of its water supply is generated from deep-water aquifers. Of the 12 major groundwater aquifers in Jordan, half are over-exploited. Jordan receives nearly 61% of its water supply from groundwater, 26% from surface water, and 13% from treated wastewater. Treated wastewater, however, is effectively reused as 91% is reallocated for agricultural uses. Jordan's agriculture sector accounts for 54% of its water consumption, followed by municipal needs at 44% and industrial uses at 4%.

### 2.5.7. Waste

According to the SWEEP-Net Country Report on the Solid Waste Management in Jordan published in April 2014, Jordan generates about 2 million, 45,000, and 4,000 tons of Municipal Solid Waste (MSW), hazardous industrial waste, and medical waste, respectively, per year. Of the MSW produced in Jordan, about 50% is food waste and 35% is packaging material. Based on the breakdown of waste generation, compost and plastic/paper recycling are two high potential areas that could be expanded, both on a household and municipal level.

## 2.6 INVESTMENT CLIMATE

Jordan's limited natural resources and growing demand for more and better water and energy access and access to better waste management infrastructure are main drivers for the country's strategic focus on growing its Clean Technology sector.

Jordan has taken many strides towards creating an investment-friendly environment in the renewable energy and energy efficiency sectors. That in large part is because the GoJ recognizes that increasing investment in those sectors can significantly contribute to addressing many of the country's critical challenges. These include: sustaining economic growth, responding to the large influx of more than one million refugees and asylum seekers, improving energy security, reducing the dependence on fossil fuel, and reducing fiscal pressure that is linked to Jordan's costly fossil fuel imports.

According to the OECD Clean Energy Investment Policy Review of Jordan- 2016, that recognizes the currently standing potential in developing a strong clean energy sector, the GoJ has developed a comprehensive set of laws, incentives, targets and regulations to promote investment in clean energy, especially in solar photovoltaic (PV) and wind energy.

Jordan has demonstrated leadership in the MENA region in terms of committing to the deployment of renewable energy since the establishment of its 2007 National Energy Master Strategy. It has allocated a share of 10% for renewable energy of the total energy mix by 2020. REEEL is the principal foundation of Jordan's renewable energy investment policy framework. Under this law and associated by-laws, Jordan has applied incentive schemes and procurement methods for awarding long-term Power Purchase Agreements to grid-connected renewable energy projects, including a feed-in tariff (the first to be implemented in the Middle East); unsolicited expressions of interest from investors through a "direct submission proposal" procurement scheme; a competitive tender; and public procurement under Engineering, Procurement and Construction "turn-key" contracts. To encourage small and distributed renewable energy in industrial, commercial, or residential sites, Jordan has furthermore established net-metering



and wheeling arrangements. Moreover, the Government has set tax exemptions for renewable energy systems and equipment from customs duties and sales tax. Now, and as a result, Jordan can boast attaining one of the most advanced regulatory and policy frameworks for renewable-power investment in the MENA region.

On a broader level, there are opportunities present in growing the Clean Technology sector. For example, Clean Technology investments within many of Jordan's sectors including but not limited to transport, health and information, and communication technologies can actually make the private sector more competitive for entering foreign markets. Without the private sector demonstrating their sustainability commitments and adhering to the environmental standards placed on products and services, they cannot enter many markets worldwide, noteworthy of which is the European market. Additionally, clean technologies can be applied in almost every sector of the Jordanian economy and they can provide businesses with added value. Therefore, there are many opportunities for youth and innovators to launch a wide array of businesses that provide inventive and market driven products and services.

## 3. SECTOR ENABLERS

### 3.1. ENABLER (1): POLICY, LEGISLATIVE AND REGULATORY ENVIRONMENT

#### 3.1.1. Policy Framework

##### 3.1.1.1. Jordan Vision 2025

In May 2015, the "Jordan Vision 2025" was launched by the GoJ as a 10-year blueprint for economic and social development. The vision has targets for raising the domestic share in the energy mix, and more generally raising the share of renewable energy contribution to the total energy mix.

##### 3.1.1.2. Green Growth Multi-sectoral Strategy

Countries around the world are taking sustainability seriously and many such countries have begun putting in place green growth strategies in order to foster economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies.

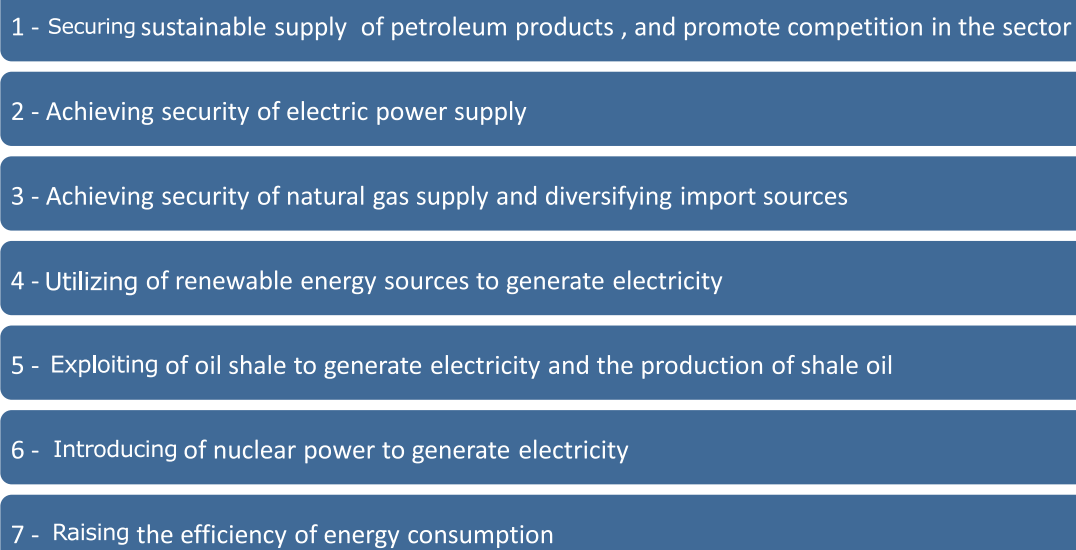
By the end of 2016, Jordan launched its National Green Growth Plan to outline the country's strategy for sustainable growth and development. The plan addresses opportunities, targets, and policies that Jordan intends to pursue in order to promote its green economy. It focuses on the development of six sectors that demonstrate the highest potential for sustainable growth: energy, transportation, water, agriculture, waste, and tourism. Furthermore, the plan discusses five benchmarks by which to track and measure national progress and success: economic growth, social development, GHG emissions, resilience, and biodiversity/ecosystem services. In addition to green growth targets, the plan identifies national barriers to success that include policy limitations, social dispositions, and financial constraints. Taking into account such barriers, the plan focuses on public-private partnerships and human capital as potential solutions to enhance national-sufficiency and limit Jordan's reliance on external actors. The comprehensive green growth strategy demonstrates Jordan's commitment to promote renewables, efficiently manage national resources, and encourage national capacity and skills building.

### 3.1.1.3. National Energy Strategy (NES)

The latest updated NES 2015 – 2025 reflects the government's keenness to diversify energy sources, preserve the environment and optimally utilize local energy resources to meet the rising demand on electricity. It is based on three main strategic goals:

1. Achieve security of energy supply needed for comprehensive and sustainable development;
2. Increase the contribution of domestic energy sources to the total energy mix and reduce dependencies on imports;
3. Reduce the cost of energy on the national economy.

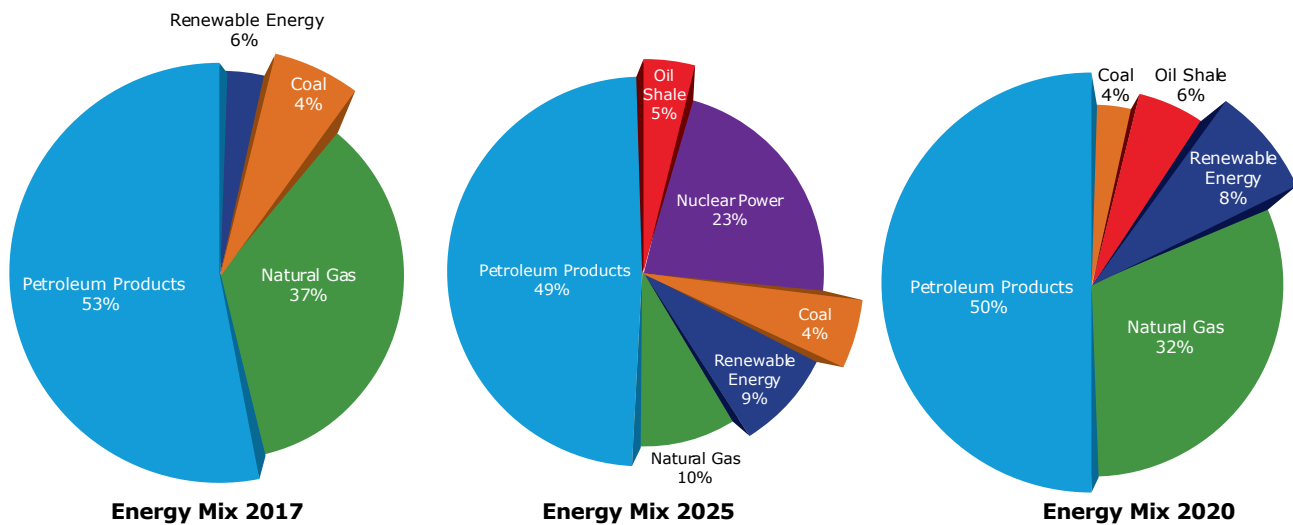
The updated NES is furthermore built on seven pillars as the following figure shows:

- 
- 1 - Securing sustainable supply of petroleum products , and promote competition in the sector
  - 2 - Achieving security of electric power supply
  - 3 - Achieving security of natural gas supply and diversifying import sources
  - 4 - Utilizing of renewable energy sources to generate electricity
  - 5 - Exploiting of oil shale to generate electricity and the production of shale oil
  - 6 - Introducing of nuclear power to generate electricity
  - 7 - Raising the efficiency of energy consumption

**Figure 12: Pillars of Updated National Energy Strategy**

\*Source: MEMR, Energy Sector Strategy 2015 – 2025

The strategy also recommends a revised energy mix for the years 2017, 2020, and 2025.



**Figure 13: Energy Mix: Updated National Energy Strategy**

\*Source: MEMR, Energy Sector Strategy 2015 – 2025

#### 3.1.1.4. National Energy Efficiency Action Plan (NEEAP)

The National Energy Efficiency Action Plan (NEEAP) was approved by the Jordanian Council of Ministers of Jordan in June 2013 for the period 2013-2015. The Jordanian NEEAP comes as a response to the Arab Electrical Energy Efficiency Guideline approved by the Arab Ministerial Council of Electricity in November 2010.

The NEEAP is planned to save more than 502 Gigawatt / Hour (GWh) in the first two years (2013-2015). To achieve the 20% targeted decrease in electricity consumption, around 8 sectors are tackled through 25 different measures. The plan will cost \$ 114 million in total, with a projected pay-back period of about 2.3 years.

#### 3.1.1.5. Jordan Water Strategy

The GoJ adopts the most efficient and effective means for optimizing national objectives in the water sector. Among the main requirements for facilitating and accelerating this achievement is an institutional framework compatible with the complexities of water sector issues and a management system that best serves them.

A significant reorganization of the water agencies was necessary to increase efficiency and responsiveness. In this context, a thorough assessment of the institutional setting and constraint has been developed, and a program of implementation was adopted. The role of the Ministry of Water and Irrigation (MOWI) will be centered on planning, development of the sector, formulation of policy framework and on regulation of various activities related to the water sector. The restructuring program will produce an overall framework articulated by the following three entities:

- The Ministry of Water and Irrigation (MOWI)
- The Water Authority of Jordan (WAJ)
- The Jordan Valley Authority (JVA)

The Jordan Water Strategy is led by the Ministry of Water and Irrigation. It is based on a vision-driven change effort, and identifies the ministry's plans and needed actions to ensure that water is available for people, business and nature. The strategy sets the vision for 2022, and outlines a strategic and integrated approach to the sustainable management of water resources, for the public water supply as well as for the provision of healthy ecosystems and the services they provide. It envisions that by 2022, Jordan will have:

- Adequate, safe and secure drinking water supply;
- Greater understanding and more effective management of groundwater and surface water;
- Healthy aquatic ecosystems;
- A sustainable use of water resources, and implemented fair, affordable and cost-reflective water charges;
- Adaptation to increased population growth and economic development across the water sector, and any sector planning affecting the water resources and water users;
- Preparedness and adaptation towards upcoming, mostly unknown, challenges triggered by Climate Change.

#### SECTOR STORY: DEMAND SIDE MANAGEMENT (DSM) PROGRAM

USAID ESCB has conducted an extensive consultative process with government stakeholders to facilitate the adoption of a DSM Incentive Mechanism. The recommendations were developed cooperatively by MEMR, EMRC, and the four Jordanian electricity companies – NEPCO, Electricity Distribution Company (EDCO), Irbid District Electricity Company (IDECO), and Jordan Electric Power Company (JEPCO).

DSM involves providing incentives and education for customers to support them reduce energy usage through adoption of renewable energy and increased energy efficiency. It also includes a robust monitoring, evaluation and validation system.

The DSM recommendations provide a framework for sustainable DSM programs to be carried out by the electricity companies under the shared oversight of MEMR and EMRC.

The DSM programs will be implemented by newly-established DSM Units in the three private energy utility companies. USAID ESCB is providing training and technical assistance to these units. DSM programs designs are supported by a financial model developed by USAID ESCB, which helps identify the most cost-efficient technologies to adopt for energy savings

#### 3.1.1.6. National Strategy for Municipal Solid Waste (MSW) Management

The waste sector is currently not very attractive for investors because it is regulated by several government bodies, and without a one-stop-shop, private sector entry in the sector is difficult. Many parties play a role in regulating and implementing projects in this sector, including but not limited to the Ministry of Environment, the Ministry of Municipal Affairs, the Ministry of Energy and Mineral Resources, the Ministry of Health, municipalities and others. However, although still not in effect, it is important to mention that the MoEnv drafted the waste framework law. This framework will provide investors with a one-stop-shop, enabling them to start businesses and take advantage of the opportunities available in this sector.

The National Strategy for MSW Management, financed by the World Bank, mainly aims to define the most cost effective, efficient, affordable, and environmentally and socially sound MSW management framework for Jordan.

Developed under the National Agenda directions for the years 2006 – 2016, the strategy lists four main initiatives:

1. Extend the coverage of solid waste services;
2. Promote environmentally sound practices for disposal and/or treatment of solid waste;
3. Reduce production of solid waste;
4. Increase reuse and recycling of solid waste.

### 3.1.2. Legislative and Regulatory Framework

Jordan has implemented a regulatory framework enabling RE investments through the Renewable Energy and Efficiency Law (REEEL). The law provides investors, developers and electricity consumers with an enabling framework that allows and even encourages them to generate energy from renewable sources and improve energy efficiency in various sectors. The law also aims to contribute to the environmental protection and sustainable development. It finally aims to rationalize the exploitation of energy and improve its efficiency in various sectors.

REEEL (which is Law no. 13):

- Enables MEMR to identify – in cooperation with the specialized technical bodies and centers – suitable geographical locations that can be used for the purposes of generating energy from renewable energy sources.
- Allows MEMR to issue tenders and attract proposals on a competitive basis from the private sector. This mechanism provides the private sector with an avenue to participate in developing and constructing mega-scale projects (known as Direct Proposals).
- Enables the private sector to apply for direct unsolicited proposals to MEMR.
- Exempts from all custom duties and sales tax systems and equipment of renewable energy sources and energy efficiency and its production inputs whether manufactured locally and/or imported.
- Allows all energy consumers to generate energy from renewable energy sources to cover up to 100% of their consumption through net-metering, wheeling and pooling mechanisms with detailed instructions and guidelines issued by Energy and Minerals Regulatory Commission (EMRC).
- Establishes a Fund (currently known as the Jordan Renewable Energy and Energy Efficiency Fund – JREEEF) that provides the necessary funding to increase the penetration of renewable energy and energy efficiency.

Additionally, MEMR and EMRC have also issued several regulations and instructions that outline the framework and provide mechanisms for all relevant parties to implement the renewable energy and energy efficiency actions outlined in REEEL. Those include:

**Table 4: Most Important Regulations**

The Directive Governing the Sale of Electrical Energy Generated from Renewable Energy Systems. نظام وتعليمات بيع الطاقة الكهربائية المولدة من نظم الطاقة المتجددة	MEMR	This Directive provides clear instructions for individual energy consumers to produce up to 100% of their energy consumption from renewable energy sources through the net-metering scheme.
Direct Proposal Bylaw نظام العرض المباشر لمشاريع الطاقة المتجددة لتوليد الطاقة الكهربائية والربط على الشبكة	MEMR	This bylaw outlines the mechanism for the issuance, submission and evaluation of Direct Proposals.
By-law of Provisions and Conditions of Exempting Systems of Renewable Energy Sources and its Devices and Equipment. نظام أحكام وشروط إعفاء نظم مصادر الطاقة المتجددة وأجهزتها ومعداتها	MEMR	This by-law outlines the criteria of exempt systems and the mechanism for exempting all renewable energy and energy efficiency systems equipment and their production input from all custom fees and sales tax.
The Bylaw on Regulating Procedures and Means of Conserving Energy and Improving Its Efficiency. نظام تنظيم إجراءات ووسائل ترشيد الطاقة وتحسين كفاءتها	MEMR	This bylaw outlines the mechanism for encouraging the conservation of energy and improvement of energy efficiency. Most notably, this bylaw: <ul style="list-style-type: none"> <li>• Promotes the import and manufacturing of energy efficient equipment, tools, and supplies and the use of the energy efficiency label.</li> <li>• Mandates the installation of Solar Water Heaters on certain buildings, apartment buildings and offices.</li> </ul>
Jordan Renewable Energy and Energy Efficiency Fund Bylaw. نظام صندوق تشجيع الطاقة المتجددة وترشيد الطاقة	MEMR	This bylaw outlines rules through which the Jordan Renewable Energy and Energy Efficiency Fund is governed.

**Table 5: Most Important Instructions**

Instruction	Issuing Body
Instructions of regulating activities related to industrial fuel from waste تعليمات تنظيم الأنشطة المتعلقة بالوقود الصناعي من النفايات	MEMR
Licensing instructions for people involved in the design, supply, operation, maintenance and inspection of renewable energy sources' systems. تعليمات ترخيص الأشخاص العاملين في مجال تصميم وتوريد وتشغيل وصيانة وفحص نظم مصادر الطاقة المتجددة	EMRC
Instructions for granting licenses for energy audits for the year 2015. تعليمات منح رخصة ممارسة نشاط تقديم خدمات التدقيق الطاقي لعام ٢٠١٥	MEMR
Directives of power wheeling that is generated from renewable energy systems for the purposes of consumption and not for the purposes of sale. التعليمات المنظمة لعبور الطاقة الكهربائية المولدة من نظم مصادر الطاقة المتجددة لغايات استهلاكها وليس لغايات البيع	EMRC
The directive governing the sale of electrical energy generated from renewable energy systems. التعليمات المنظمة لبيع الطاقة الكهربائية المولدة من نظم مصادر الطاقة المتجددة	EMRC
Instructions for submitting and preparing direct proposals تعليمات تقديم وإعداد العروض المباشرة	MEMR
The reference pricelist record for the calculation of electrical energy purchase prices from renewable energy sources. سجل مرجع القياس لاحتساب أسعار شراء الطاقة من مصادر الطاقة المتجددة	EMRC
The directive for the costs of power wheeling. تعليمات بدل تكاليف عبور الطاقة الكهربائية	MEMC
The directive for the costs of connecting renewable energy facility to the distribution system for direct proposals and competitive tenders. تعليمات تكاليف ربط منشأة الطاقة المتجددة على نظام التوزيع في حالات العطاءات التنافسية والعروض المباشرة الصادرة	EMRC
Municipality regulation on connecting to the grid. تعليمات البلدية لربط نظم مصادر الطاقة المتجددة على شبكة التوزيع	EMRC
Guidelines for connecting renewable energy sources systems using net metering. الدليل الإرشادي لربط نظم مصادر الطاقة المتجددة باستخدام عدادات القياس	EMRC
Electric power wheeling directives التعليمات النازمة لمشاريع ربط نظم مصادر الطاقة المتجددة بموجب نظام النقل بالعبور	EMRC



### 3.1.3. Codes and Standards

#### 3.1.3.1. NEPCO Transmission Grid Code

The Transmission Code is produced by NEPCO to enable it to meet its transmission license conditions and thereby maintain the integrity and security of the transmission system. It is designed to facilitate the safe, economic, equitable and efficient planning, development, operation, and maintenance of the interconnected transmission system in Jordan for the benefit of all consumers in the country. It sets out the rules and procedure for all users directly connected to the transmission network in Jordan and those that require wheeling across this network. It also covers the transmission network operated by NEPCO and, in specific contexts, the user networks connected to this transmission network including the distribution networks.

The Transmission Code also covers:

- The requirements with regard to the medium-term development and operational planning of the transmission system including generation capacity planning.
- Technical standards relating to plant and apparatus.
- The connection of user plant and apparatus at a new connection point.
- The modification of user plant and apparatus at an existing connection point.

#### 3.1.3.2. Energy Efficiency Standards and Labeling

The GoJ has taken concerted actions to enhance energy utilization efficiency. One such action is the introduction of energy efficiency Standards and Labelling (S&L) of home appliances. The implementation of S&L is expected to increase the share of energy-efficient appliances in the Jordanian market, resulting in significant benefits. The Jordan Standards and Metrology Organization (JSMO), with the support of the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), is developing the S&L strategy and mechanism for the country. Noteworthy, the draft prepared by JSMO aligns with the European Union's (EU) S&L scheme. Both strategies recognize that a successful S&L program will ensure that local manufacturers and suppliers are ready and capable of supplying/servicing energy efficient appliances (with appropriate labels) in the market.

Building on Article 7 (b) of the bylaw No. 73 (2012) which prohibits the manufacturing and importing of equipment, tools and supplies that do not satisfy the prescribed minimum energy efficiency standards, JSMO has issued eco-labels for 3 household appliances: ACs, refrigerators, and washing machines. Energy labeling laboratories were established at National Energy Research Center (NERC) in order to test those appliances and ensure they meet the label standards.

#### 3.1.3.3. Jordanian National Building Law, Green Building Guide and Mini Checklist

The Ministry of Public Works and Housing (MoPWH) issued the Jordanian National Building Law in 1993 and the Jordan Engineers Association is mandated by law to ensure buildings are in compliance with this law and with relevant building codes issued as per this law. In recent years, the codes within this law have been modified to integrate renewable energy and energy efficiency measures and improve energy performance in buildings.

In addition to the improvement made on the mandatory building codes, obtaining a certification or a label is now possible on voluntary basis. The process is initiated by a client or a developer who wants the quality of their constructions to be recognized. These labels

and certifications are indicators of comfort, reduced costs, and environmental respect, to buyers and prospective tenants. The intervention of a third party prevents manipulations and helps the customers by giving them a reliable certification that provides an independent endorsement of the building.

In November 2010, the Royal Scientific Society issued the Jordan Green Building Guide, established and approved by the Jordan National Building Council (established in accordance with the Jordanian National Building Law). The guide was developed through the participation of several stakeholders, including but not limited to, the National Building Council / MoPWH, Royal Scientific Society / Building Research Centre, and Jordan Engineers Association.

The guide references Jordan's related mandatory building codes and provides additional voluntary standards and codes that were developed utilizing international green rating systems such as LEED, BREEAM, ESTIDAMA, Dubai green building rating system, GSAS, and many more. More specifically, the codes and standards are designed with an eye for the parameters and credits that are suitable for Jordan's climate, resources, legislation, policies and policy instruments, building techniques and strategies. Although the guidelines are voluntary, they provide a blueprint for the development and construction of green buildings in Jordan. Furthermore, Greater Amman Municipality launched an incentive program for the adoption of green building in Jordan based on the Jordan Green Building Guide in September 2015.

Additionally, the Jordan Green Building Council - JGBC (a non-governmental not-for-profit organization founded in 2009 in Jordan) has created a voluntary simplified market-driven rating tool called the "Mini Checklist". It is customized for both existing and new buildings in Jordan. The objective of this checklist is to service residents' and buyers' need for more efficient buildings and encourage real-estate developers to distinguish their green buildings. The checklist has taken the Jordan Green Building Guide as a reference.

## 3.2. ENABLER (2): GREEN FINANCING MECHANISMS

Green financing refers to the use of financial products and services, such as loans, insurance, stocks, private equity and bonds in green (or eco-friendly) projects. It is among the most important enablers to spur innovation in and boost the adoption of green solutions and practices in various economic sectors in Jordan.

Improvement of energy performance, reduction of consumption, and increasing the contribution of renewable energy to the total energy mix are national priorities. Sustainable development, green growth, and climate change mitigation are also a national focus. Therefore, during the past few years green financing has become ever more relevant in Jordan. This transition must be supported by green financing mechanisms. More specifically, access to finance makes investing in renewable energy and energy efficiency solutions more feasible and appealing for small and medium enterprises and individuals who comprise a significant percentage of energy consumers in the country.

Jordan is one of the earliest proponents of green financing in the Middle East. Green financing in Jordan is being offered through public channels, such as JREEEF, commercial banks and micro-finance institutions, as well as International Financial Institutions.

Jordan enjoys a valuable presence of multilateral development banks. Multinational Financing Institutions such as the European Bank for Reconstruction and Development (EBRD), French Development Agency (AFD), European Investment Bank (EIB), and International Finance

Corporation (IFC) provide loans with low interest rates to commercial banks to enable them to provide competitive green financing to individuals and institutions who are then enabled to invest in renewable energy and energy efficiency solutions.

Also, last year, the Central Bank of Jordan advanced a new monetary framework encouraging commercial banks to provide attractive green financing to the private sector. The framework provides commercial banks with medium to long-term funds at low interest rates so they in turn can lend to qualified industrial facilities at comparable rates. The Central Bank has already signed agreements with 12 Jordanian commercial banks who can now support industrial facilities making renewable energy and energy efficiency improvements in their own facilities. In addition to loan provision, an important ingredient to the success of any green financing scheme is the provision of loan guarantees. Currently, several loan guarantee facilities are available in Jordan to facilitate and improve access to finance for clean energy projects.

Another important ingredient to the success of any green financing scheme is the provision of loan guarantees. Currently, several loan guarantee facilities are available in Jordan to facilitate and improve access to finance for clean energy projects. Currently loan guarantee programs are given through two parties. The first party is the Jordan Loan Guarantee corporation (JLGC), while the second party is the Jordan Loan Guarantee Facility (JLGF), which is supported by the Overseas Private Investment Corporation (OPIC), in partnership with USAID. Those loan guarantee facilities provide partial loan guarantees and technical assistance to mobilize bank financing for creditworthy but previously underserved SMEs. For example, JLGF currently works with seven partner banks: Arab Bank, Cairo Amman Bank, Capital Bank, Bank Al Etihad, Housing Bank, Jordan Ahli Bank (JAB), and Jordan Kuwait Bank. It has also facilitated the financing needed for the installation of solar energy systems at schools, universities, and factories.

In order to increase the penetration of renewable energy and energy efficiency solutions and enable the success of green projects, green financing mechanisms must be supported by technical assistance, awareness raising, and targeted marketing activities. Technical assistance makes it easier for banks to assess the feasibility and calculate the payback period for green solutions. Currently, there are several key players in Jordan that provide technical assistance. Some multinational financing institutions such as EBRD and AFD provide technical assistance along with their loans. Additionally, USAID JCP and JREEEF also provide technical assistance service to energy users and renewable energy and energy efficiency project developers.

On the awareness raising and targeted marketing of green financing, JREEEF has set aside funds to execute targeted marketing and awareness raising activities with the purpose of increasing the penetration of renewable energy and energy efficiency solutions across various market segments such as the public, industrial, commercial, residential, and tourism sectors. Their marketing and awareness raising approach utilizes a wide range of players, including: governmental bodies, non-governmental organizations, business associations, community-based organizations, and universities & research centers.

Interest in green financing has been a rising trend in Jordanian commercial banks as of late. Almost all commercial banks in Jordan provide green financing solutions to consumers on ad hoc basis. Still, innovation in how financing is provided and packaged is a critical component to the continued and sustainable growth of access to finance. With that regard, Ahli Bank is the only bank which currently provides a comprehensive green financing product. The bank receives and packages low-interest loans, loan guarantees and technical assistance, providing consumers with the well-rounded and comprehensive financing they need. Another example of innovation in green financing is the "Seven Sisters" financing scheme. Seven Sisters provided financing to seven smaller scale PV plants for the total amount of \$207, 5 million and 190 MW capacity. The financing of seven plants together brought lower transaction and fixed costs.

### SECTOR STORY: GREEN FINANCING FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY PROJECTS

Jordan Ahli Bank (JAB) recently signed a strategic partnership agreement with the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF), functioning under the Ministry of Energy and Mineral Resources, to help with the financing of renewable energy and energy efficiency projects for the various programs supported by the fund. This partnership builds on the first-of-a-kind clean energy product that JAB has developed with technical assistance by USAID JCP.

Under the partnership, the installation of household solar heating will be funded at JD 500, the installation of home solar energy electric generation systems at JD 3,000, and the investment of small and medium-sized enterprises in power generation systems reaching JD 250,000. In addition, a number of technical and advisory services necessary to implement such projects are provided.

JREEEF was established to facilitate scaling-up renewable energy and energy efficiency to meet the energy needs of Jordan in accordance with the NES and National Energy Efficiency Action Plan. JREEEF provides financial resources (funding and/or partial grants, full or partial interest subsidy, energy audit grants, investment cost-sharing, and bulk procurement), and technical assistance to energy users and renewable energy and energy efficiency project developers to facilitate the deployment of RE and EE technologies, reduce associated risks, expand market potential, and leverage existing resources.

JREEEF has very recently signed agreements with local banks and with the Jordan Loan Guarantee Corporation (JLGC) to finance renewable energy projects. The agreements will help speed up the implementation of projects supported by JREEEF by providing the necessary funds to individuals and small and medium-sized enterprises, mostly in the industrial and tourism sectors. The agreements were supported by the Central Bank of Jordan (CBJ) which allows banks to use money allocated to the energy sector against low interest rates when funding programs implemented by the fund.

The funding program includes financing households to install solar heaters with up to JD500, installing electricity-generation systems using solar energy in houses with up to JD3,000 and installing electricity-generation systems for SMEs with up to JD250,000. The funding is presented without interest or commission, and the only requirement for borrowers is to repay the actual value of the loan within a maximum of six years for companies or 18 months for solar heater loans. JLGC guarantees 70 per cent of the value of loans the banks present under the program.

The agreement was signed by JREEEF, JLGC, Islamic International Arab Bank, Ittihad Bank, Ahli Bank, Jordan Islamic Bank, Cairo Amman Bank and Capital Bank.

## 3.3. ENABLER (3): CAPACITY DEVELOPMENT AND EDUCATION

### 3.3.1. Formal Education

There are six public universities in Jordan offering bachelor's degrees in energy and/or water engineering.

Mutah University	<ul style="list-style-type: none"> <li>•Water and environmental engineering</li> </ul>
The Hashemite University	<ul style="list-style-type: none"> <li>•Earth and environmental science</li> <li>•Land and water management</li> <li>•Water environmental management</li> </ul>
Al al-Bayt University	<ul style="list-style-type: none"> <li>•Programs under the Institute of Earth and Environmental Sciences in geology and environmental science</li> </ul>
Al-Hussein Bin Talal University	<ul style="list-style-type: none"> <li>•Natural resources engineering</li> </ul>
Tafila Technical University	<ul style="list-style-type: none"> <li>•Natural resources engineering</li> </ul>
German Jordan University	<ul style="list-style-type: none"> <li>•Water and environmental engineering.</li> <li>•Energy engineering</li> </ul>

**Figure 14: Public Universities in Jordan that Offer Bachelor's Degrees in Energy and/or Water Engineering**

Additionally, private universities in Jordan have similar programs such as the Middle East University which has a program for renewable energy engineering, Jerash University which has a climate change and sustainable policy minor, and Princess Sumayya University for Technology which has a program for power and energy engineering.

Of the universities that listed graduate programs, there are six public universities that have master's degree programs.

The University of Jordan	<ul style="list-style-type: none"> <li>•Civil engineering -water and environment, energy management, environmental technology and climate change, renewable energy, and environmental sciences and management</li> </ul>
Mutah University	<ul style="list-style-type: none"> <li>•Renewable energy, and water and environmental engineering</li> </ul>
Jordan University of Science and Technology	<ul style="list-style-type: none"> <li>•Civil engineering -water resources and environment and mechanical engineering -renewable energy and sustainable development</li> </ul>
The Hashemite University	<ul style="list-style-type: none"> <li>•Applied geology, climate change and sustainable drylands, and environmental science and management</li> </ul>
Al al-Bayt University	<ul style="list-style-type: none"> <li>•Water and environmental resources</li> </ul>
German Jordanian University	<ul style="list-style-type: none"> <li>•Water and environmental engineering.</li> <li>•Energy engineering</li> </ul>

**Figure 15: Public Universities that have Master's Degree Programs**

The Vocational Training Corporation (VTC) has established Model Skill Centers of Excellence (MSCoE) with the goal of graduating highly skilled technicians labor force who can be easily employed locally and internationally because they have the necessary skills and qualifications demanded by today's labor market. Relevant to clean technology, the VTC established a Water and Environment MSCoE in Marka to ensure that the country can graduate the technicians the market needs instead of depending on bringing this labor force from other countries. The Center has graduated 46 technicians. Currently, 74 technicians are undergoing training.

The VTC has also established a Renewable Energy MSCoE in Ma'an. The Center currently provides a Photovoltaic Installation program (PVI) and will be launching their Solar Thermal Program soon. The Center has trained 63 technicians and has 15 technicians receiving training this year. The Center also provides shorter private-sector-led and customized courses with the aim of providing the market with the labor force it requires during the construction of large-scale renewable energy projects. To date, over 300 technicians have been trained in Quweira, Jafer, Al Husseinia, and Ma'an.

EDAMA, Ma'an Development Company and the VTC signed a Memorandum of Understanding (MoU) to achieve a strategic affiliation to customize training courses and provide initial and continuous professional vocational training for the existing and emerging renewable energy sector. BEST (Canadian Project) supported the project by a sector assessment.

Universities are not only providing specialized degrees in the Clean Technology sectors, they are also investing in technology to optimize their learning and research environment. For example, University of Jordan, German Jordan University, Jordan University of Science and Technology, Al-Hussein Bin Talal University, Jerash University, and Princess Sumayya University for Technology all listed a laboratory for working with renewable energy in their university on their website.



### 3.3.2. Training & Certification

In addition to formal educational tracks in Clean Technology provided by universities and vocational training centers across Jordan, the sector is also witnessing an increased interest from numerous training centers and institutions for providing technical training in the field of renewable energy and energy efficiency.

#### **Jordan Energy Chapter – EDAMA:**

The Jordan Energy Chapter (JEC-EDAMA) was founded in 2010 to develop awareness of energy issues in Jordan, provide technical support for the Jordanian energy sector and equip Jordanian professionals with the necessary tools and capabilities needed to help them become leaders in green and energy saving methods – locally and regionally. It is the only local chapter representing the Association of Energy Engineers (AEE), headquartered in the USA. AEE's certification programs are recognized by such agencies as the U.S. Department of Energy and the U.S. Agency for International Development, as well as by Fortune 1000 corporations, utilities, and energy service companies. Through AEE, JEC-EDAMA currently offers four internationally certified training courses; these are: Certified Energy Manager (CEM), Renewable Energy Professional (REP), Carbon Reduction Manager (CRM) and Certified Energy Auditor (CEA). Since its inception, JEC-EDAMA has trained more than 600 engineers from Jordan, Lebanon, Saudi Arabia, Qatar, and the United Arab Emirates. USAID Energy Sector Capacity Building Project (ESCB) fully sponsors participants in relevant positions within the public sector to take AEE courses through JEC-EDAMA. They do so in order to enhance the skills and knowledge of relevant public sector employees who can in turn contribute more effectively to the continued growth of the energy sector in Jordan. USAID JCP in turn sponsors employed and unemployed female engineers to take those courses at highly subsidized rates in order to increase the number of certified women energy professionals in Jordan, enhance their employment opportunities and improve their participation in the workforce.

#### **ESTIDAMA for Environment:**

ESTIDAMA for Environment is a not for profit organization that specializes in environmental sustainability, climate change, disaster risk management, and community and urban planning and development in Jordan and the region. Its training and capacity development arm offers educational training, and mentoring services that target professionals in the form of classical training courses with different modules and approaches, as well as hands on training through the daily work with staff from partner institutions. The programs allow for capacity building at an individual level through training, and skill adaptation to advance individuals and their skills for embracing sustainability.

#### **Jordan Green Building Council/ Green Academy:**

The Academy offers a wide range of specialized green buildings and international accredited training including the LEED training schemes that are certified by USGBC. Since 2009, the Green Academy has trained around 4000 professionals across different engineering specialties across the MENA region.

#### **Al Asalah Academy:**

Al Asalah Pioneer Technology Academy exclusively offers engineering and other technical courses in Jordan. Trainees receive a credited certificate from the Ministry of Labor, (Accreditation and Quality Assurance Center). The Academy offers several specialized courses in various engineering disciplines such as designing & sizing of photovoltaic system, maintenance and installation of photovoltaic cells, and improving the level of efficiency practices amongst others. It serves engineers, technicians, teachers, students, and individuals from governmental institutions, international organizations, and local communities.

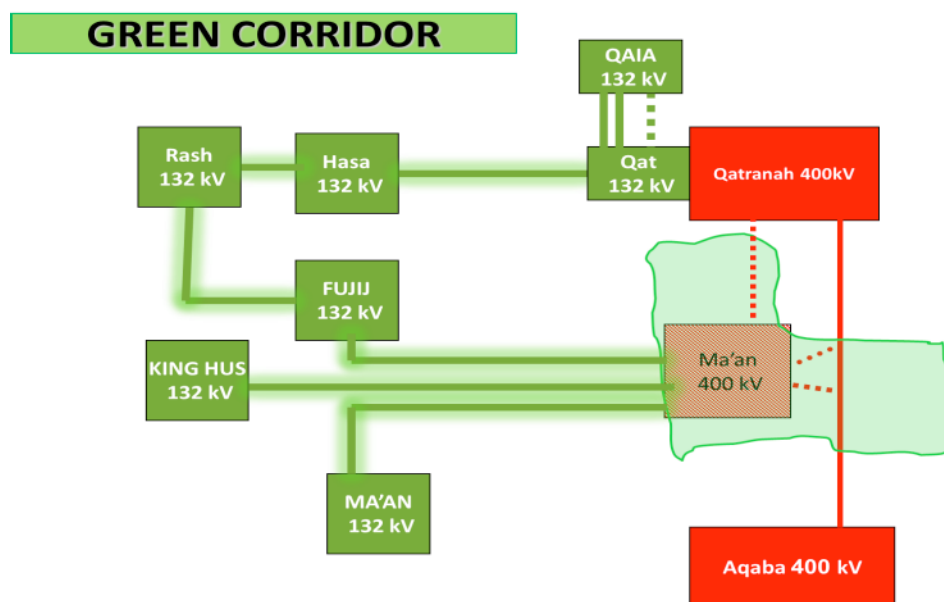


## 3.4. ENABLER (4): INFRASTRUCTURE

A large obstacle for Jordan's renewable energy sector is the limited grid capacity; the current grid's capacity is 3,600 MW. An upgrade of the national grid infrastructure is required before additional renewable energy projects are announced. There is also a need for a higher structured grid access rules ensuring a real RE dispatching priority and enhancing clarity of costs related to grid.

In response to the grid capacity challenge, MEMR announced earlier this year that a plan for grid expansion and reinforcement is currently underway. Jordan is currently working on expanding its grid capacity via "The Green Corridor Project". This Project will increase the grid capacity by an additional 1,000 MW to absorb the loads generated by new renewable energy projects and the expansion is expected to be complete by mid 2019. The first phase of the expansion and upgrades involves the construction of two new transmission lines – a 400-KV, 150-km line and a 132-KV, 51-km line – as well as upgrades to three existing 132-KV lines stretching 100 km each.

159.7 million USD are being invested in the Green Corridor project. The European Investment Bank has extended a \$72 million loan to finance the Green Corridor project, while the French Development Agency has provided a \$54.9 million soft loan and NEPCO has contributed \$12.6 million, in addition to an EU grant of \$20.2 million offered under the Neighbourhood Investment Facility.



**Figure 16: Capacity / Green Corridor**

\*Source: NEPCO, Jordan Electricity Sector

## 3.5. ENABLER (5): AWARENESS-ACROSS-THE-BOARD

Through the efforts of USAID JCP, a national communication strategy was developed to help identify clean energy market segments with opportunities to create trends and increase demand on renewable energy and/or energy efficiency solutions by increasing the awareness of the target markets. Four main sectors were identified (Transportation, Residential, Mosques, and Commercial) and a communication and outreach strategy was developed for each sector.

While the transportation sector was identified given the fact that it is one of the top sectors in energy consumption in Jordan, this sector was beyond the scope of the strategy.

This strategy also identified the target audience for each sector and provided several suggested campaigns as part of the outreach strategy that included tactics such as direct marketing, social media, and/or above-the-line activities. These campaigns can be implemented on a national level involving different parties and resulting in country wide trends.

Business associations and several NGOs are also taking initiative and assuming co-responsibility in promoting energy efficiency practices, technologies and services, and showcasing of renewable energy technologies to the target markets. They also address the public at large by raising awareness on the Clean-tech sector's contribution to the society and the economy.

EDAMA conducts and supports nationwide awareness campaigns to elevate and stress the importance of energy and water conservation and efficiency measures, and their impact on the Jordanian economy, environment, and society. Awareness activities range from changing mindsets and demonstrating impact to communities through its Eco-Village and Eco-Schools initiatives to partnering with key sector players to increase the penetration of effective energy, water, and environment solutions.

### SECTOR STORY: EDAMA ECO-VILLAGE INITIATIVE

EDAMA launched its Eco-Village Initiative to turn marginalized and impoverished areas, such as the Jordan Valley, into model eco-villages. This initiative aims to improve living conditions in underprivileged areas by providing clean and affordable energy resources, reducing energy bills on both beneficiaries and the government, and inspiring positive environmental action and private sector CSR investment in the general public.

Ghor Fefa-Karak was chosen to be the beneficiary of Phase I of the initiative that was sponsored by the Arab Potash Company. Photovoltaic systems with a total capacity of 65 kWp were installed on 7 public buildings, 2 dwellings, and 3 PV powered light poles in a Bedouin area that is not connected to the grid. The PV systems, which commenced operation in July 2014, cover 30% of the village's electricity consumption. They have resulted in 40-100% savings on electricity bills and reduced CO2 emissions by 73 tons per year.

In phase II of the initiative, photovoltaic systems with a total capacity of 107 kWp were installed on 7 public buildings in Ghor Al Mazra'a and Tafila also under the sponsorship of the Arab Potash Company. The systems commenced operation in June 2016, resulting in 50-100% savings on electricity bills and reduced CO2 emissions by 120 tons per year.

## 3.6. THE ROLE OF NGOs AND BUSINESS ASSOCIATIONS IN SECTOR DEVELOPMENT

Business Associations play a vital role in the development and advancement of emerging sectors. Such associations are unique in that they operate on a multi-lateral platform, engaging both the public and private sectors and making an impact on communities. In terms of sector growth, business associations promote better business practices and establish sector standards of performance. Established associations are often able to provide sector research that can aid in tracking and benchmarking industry progress. Associations are particularly useful in promoting sector communication and competition in a way that benefits the community and its members. Within local communities, associations often engage the public through awareness and legislative campaigns, enabling the creation of an environment that is productive for its members and supporting the overall sector development. Associations unify leaders within the sector, and credible associations become sources of consultation for policymakers and strong advocates for CSR policies.

### SECTOR STORY: COALITION OF ENERGY SERVICE ASSOCIATIONS (CESA)

It would not be possible for the country to achieve its clean energy objectives, and thus more energy security, without developing a cluster of energy services companies that has the credibility and the ability to implement clean energy projects. Achieving this would require a market-based voluntary accreditation system that would boost the sector's capabilities and quality of services.

Over the past 2 years there has been a concerted effort by three established associations: EDAMA, Jordan GBC and REES with support provided from USAID Energy Sector Capacity Building Project (ESCB) to establish the Coalition of Energy Services Associations (CESA) whose purpose is to provide accreditation for companies working in the sector. CESA has been officially registered as a not-for-profit in May 2015. With the collaboration of NAESCO from the USA, CESA has focused on creating a transparent, reputable and rigorous accreditation system which will develop trust between consumers and service providers and facilitate access to finance. By being accredited, ESPs will improve the performance of their businesses, increase their competitiveness through a third party recognized accreditation, help structure the sector avoiding unqualified entities, and boost accredited companies' overall profitability. As consumers gain awareness of the value of accreditation, and whenever the need arises, they will have access to qualified ESPs for their energy efficiency and renewable energy projects that suite their individual needs.

## 3.7. OPPORTUNITIES OUTLOOK

The Clean Technology Component under USAID JCP identified Eco-Cities as one of the high priority R&D areas that promote energy efficiency and provide valuable opportunities in the sector. Smart energy cities integrate distributed renewable energy sources through ICT networked infrastructure. Integration of smart solutions in transportation, sensing, smart signage, street light control, Electric-Vehicle (EV) charging, smart parking, digital power meters, security and surveillance.



ECO-Cities

The burden of fuel prices on the national economy and the 7% rise in the number of cars annually is prompting the Kingdom to head towards supporting and expanding the use of electric vehicles.

### Electric Vehicles

During the World Economic Forum on the MENA region in May 2016, a Memorandum of Understanding was signed with manufacturers of electric cars - Tesla, BMW and Renault - to gradually adopt the use of electric vehicles (EV) in the public sector as an environment-friendly means of transport. The Greater Amman Municipality (GAM) is already using 4 EVs, and plans to eventually use 150. Moreover, Taxi Al Mumayaz is the first taxi fleet in the Middle East to use electric cars. By the end of April 2016, there were 690 electric vehicles in Jordan.

GAM is developing 10 electric vehicle charging stations through a partnership with the French Government and another 10 stations through a partnership with Nissan. These charging stations should provide at least some comfort to would be electric vehicle buyers until a more extensive network of chargers is developed across Jordan.

Last year, the government decided to exempt electric cars from registration fees, which range between JD8,000 and JD9,000, and the licensing renewal only costs JD100 per year.

In May 2016, EMRC issued regulations for electric vehicle charging stations. The instructions stipulate the key technical, financial and Health & Safety (HS) aspects of EV charging activities, including that the electricity tariff for charging electric vehicles shall not exceed 100 Fils per kilowatt hour.

Big prospects are also present in ICT Clean Technology applications and the role they can play in producing renewable energy and supporting the current renewable energy production process.

### SECTOR STORY: ELECTRIC VEHICLE CHARGING STATIONS IN JORDAN

Imagine being able to charge your electric car on your way to work, or better yet, establishing your own charging station. Jordan's EMRC has issued new regulations allowing ordinary citizens as well as fuel retailers to establish, own, or operate electric vehicle (EV) charging stations licensed by the Commission - a key step to unlocking massive investment in this new sub-sector. The USAID JCP, which assisted EMRC with developing the EV charging station regulation, has already begun working to build the technical and legal capacity of EMRC staff, who will be overseeing implementation of the new rules.

### Grid Integration

Promising and lucrative opportunities also present themselves in the grid integration of large-capacity renewable energy sources in addition to the much aspired electrical energy storage services and solutions.

It is also worth adding that the German Solar Association (BSW-Solar) has engaged in a cooperative relationship with solar industry associations from Jordan. This partnership aims at providing firsthand access to information on the Jordanian solar markets and helps to initiate business between the association's member companies.

### Energy Storage

## 4. ACKNOWLEDGEMENT

This report was made possible thanks to the support and advice of many organizations and individuals. The report team would like to thank everyone who contributed to this endeavor.

Particular thanks go to the Renewable Energy Establishment Society (REES). We highly appreciate their insights, goodwill and friendship that have translated into signing an MOU for cooperation in the implementation of this initiative.



We would also like to acknowledge the support and advice of key stakeholders in the industry who participated in two brainstorming sessions and provided their kind buy-in, input and council. Special thanks go to:

- The Ministry of Energy and Mineral Resources- MEMR/ Dr. Wael Ababneh
- The Energy and Mineral Regulatory Commission- EMRC / Ms. Muna Al Mousa
- USAID Energy Sector Capacity Building Project - ESCB / Ms. Mary Worzalla, Mr. Ghassan Naji
- Jordan Renewable Energy and Energy Efficiency Fund - JREEEF/ Ms. Ola Al Sarhan
- Renewable Energy Establishments Society - REES/ Mr. Nasri Amara, Ms. Haneen Amara
- Jordan Green Building Council / Ms. Abeer Jabaji, Ms. Ala'a Abdullah

Sincere gratitude also goes to energy expert Mr. Mohammad Maaytah who generously contributed his valuable time to review and edit the classification classes and sub-classes, participated in meetings and both brainstorming sessions and provided advice and consultation when needed.

## 5. REFERENCES

The following references were used for the "Sector Overview 2015" section.

1. ESP Accreditation in Jordan: Assessment of Options and Recommendations/ USAID Jordan Energy Sector Capacity Building - Prepared by NAESCO. October 2014
2. R&D Issues identified through stakeholders engagement/ Jordan Competitiveness Program Clean Technology Component May 2014
3. The National Climate Change Policy of the Hashemite Kingdom of Jordan 2013-2020 – Ministry of Environment Supported by Global Environment Facility (GEF) and the United Nations Development Programme (UNDP) 2013
4. Energy – The Report: Jordan 2015/ Oxford Business Group
5. Article - Kingdom 'on track' to meet 2020 green energy target / <http://www.jordantimes.com/news/local/kingdom-track%E2%80%99-meet-2020-green-energy-target>
6. Article - Jordan pushes ahead on renewables/ Oxford Business Group. June 2016
7. Renewable Energy Perspectives in Jordan / Suhil Kiwan Professor of Mechanical Engineering at Jordan University of Science and Technology Irbid-Jordan. February 2016
8. Article - Gov't launches 'Jordan 2025' development blueprint/ The Jordan Times. May 2015
9. Jordan 2025 Overview/ <http://www.jorelaunched.jo/jordan-2025/#2025overview>
10. Green Building Guideline of Jordan/ T. Awadallah, S. Habet, A. Mahasneh, H. Adas - Royal Scientific Society, Amman, Jordan and the National Energy Research Center, Amman, Jordan
11. Enabling PV in the MENA Region - The Emerging PV Market in Jordan Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH – 2014
12. Survey on the main barriers affecting investments in RE capacity in the Mediterranean. Focus on Southern and Eastern Mediterranean Countries (SEMCs) / RES4MED Working Group led by PWC. 2016 Edition
13. National Clean Energy Marketing and Awareness Strategy – First Draft/ Prepared by DAI- USAID. March 2015
14. Impact of the Upcoming Energy Efficiency Standards in Jordan / National Energy Research Centre / Royal Scientific Society and United Nations Development Programme (UNDP)
15. International Monetary Fund / Jordan 2015
16. Article - Jordan takes part in ceremony to sign Paris climate agreement/  
<http://www.jordantimes.com/news/local/jordan-takes-part-ceremony-sign-paris-climate-agreement>
17. Media Article by BSW-Solar- BSW-Solar expands its international services/ <https://www.solarwirtschaft.de/en/media/single-view/news/bsw-solar-expands-its-international-services.html>

18. PPT - Jordan Electricity Sector/ Eng. Abdelfattah Aldaradkah - NEPCO's Managing Director
19. EDAMA Newsletter- Q3 2016
20. PRL - Jordan Ahli Bank signs agreement with Jordan Renewable Energy and Energy Efficiency Fund
21. AFEX 2015 - <http://www.rcreee.org/projects/arab-future-energy-index%E2%84%A2-afex>
22. World Small Hydropower Development Report 2013 – [www.smallhydropowerworld.org](http://www.smallhydropowerworld.org)
23. The National Energy Efficiency Action Plan of Jordan / RCREEE - [http://www.rcreee.org/sites/default/files/plans\\_jordanian\\_neeap\\_summery\\_2013.pdf](http://www.rcreee.org/sites/default/files/plans_jordanian_neeap_summery_2013.pdf)
24. Water for Life - Jordan's Water Strategy 2008-2022 - [http://www.mwi.gov.jo/sites/en-us/Documents/Jordan\\_Water\\_Strategy\\_English.pdf](http://www.mwi.gov.jo/sites/en-us/Documents/Jordan_Water_Strategy_English.pdf)
25. The Water Policy – Ministry of Water and Irrigation - <http://www.mwi.gov.jo/sites/en-us/SitePages/Water%20Policies/Water%20Policy.aspx>



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## ABOUT EDAMA

EDAMA is an Arabic word meaning “sustainability”. EDAMA Association is a Jordanian NGO established in 2009. EDAMA was founded in 2009 pursuant to the EDAMA initiative of 2008 which was launched as a nationwide effort to activate the role of the private sector in realizing the targets outlined in the Master Energy Strategy developed by the Royal Commission in 2007. The initiative evolved in 2009 into a Business Association primarily concerned with developing an environment conducive to the establishment of a green economy in Jordan.

EDAMA seeks innovative solutions for energy and water independence and environmental conservation. The Association strives to advance Jordan’s movement towards a green economy via creating a vibrant new economic sector of energy businesses, driving applied research, developing and commercializing Jordanian technologies, building public awareness, and advocating for policies that will make Jordan a model of energy efficiency, water conservation and environmental stewardship.

EDAMA is the first and only association of its kind in Jordan servicing the energy, water and environment sectors. It provides a platform for a large number of public, private and NGO sector representatives to discuss the future development of the Energy, Water and Environment sectors in Jordan.

EDAMA has a membership of 85 companies. EDAMA’s members represent all sectors of Jordan’s economy, and their membership indicates their willingness to support EDAMA in furthering Jordan’s transition to a green economy.

EDAMA’s membership base includes 34 Renewable Energy & Energy Efficiency companies, 10 banks (most of which provide green services), 2 of the top leasing companies, 9 consulting companies (legal, auditing and environmental) as well as 2 Multinational Financial Institutions (EBRD & IFC). Those combined represent the biggest players across the value chain in the Clean Technology sector in Jordan.

EDAMA’s contributions range from sector-level and nation-wide support and its work spans across four main pillars: 1) Public Advocacy, 2) Capacity Building and Certification, 3) Awareness, Education and Innovation, 4) Networking and Business Development. It also develops and implements community-oriented initiatives.



## ABOUT JORDAN COMPETITIVENESS PROGRAM USAID-JCP

The USAID Jordan Competitiveness Program (JCP) works with policymakers, business associations, and the private sector to: 1) draft and advocate for enabling legislation and regulation; 2) leverage these policy interventions to stimulate exports and attract foreign direct investment, especially to Jordan's specially designated development zones; and 3) ensure that these investments result in employment opportunities for Jordanians and, where appropriate, other residents of the Kingdom.

To these ends, USAID JCP works closely with other USAID programs and relevant Government of Jordan entities to identify investment opportunities made possible by the Jordan Compact—which includes, among other stipulations, relaxed rules of origin for Jordanian exports to the European Union. By coordinating closely with the Compact's Program Management Unit (PMU), which is housed at the Ministry of Planning and International Cooperation, USAID JCP seeks to add value to the current efforts of the broader donor community.

Contracted by EDAMA Association, this project was conducted by



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This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of EDAMA and do not necessarily reflect the views of USAID or the United States Government.