



League of Arab States



Regional Center for Renewable Energy and Energy Efficiency  
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة



International Renewable Energy Agency



# Renewable Energy in the Arab Region

## Overview of developments

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ISBN 978-92-95111-08-0 (print)

ISBN 978-92-95111-09-7 (PDF)

**Citation:** IRENA (2016), *Renewable Energy in the Arab Region. Overview of Developments*, International Renewable Energy Agency, Abu Dhabi.

### **About IRENA**

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as an important platform for international co-operation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

[www.irena.org](http://www.irena.org)

### **About the League of Arab States (LAS)**

The League of Arab States is a regional intergovernmental organisation of 22 Arab member states. It was established in Cairo on 22 March 1945. The League's main goal is to "draw closer the relations between Member States and co-ordinate collaboration between them, to safeguard their independence and sovereignty, and to consider in a general way the affairs and interests of the Arab countries". The League of Arab States facilitates political, economic, cultural, scientific and social programmes designed to promote the interests of the Arab world. It has served as a forum to coordinate policy positions and to deliberate on matters of common concern.

The Arab Ministerial Council of Electricity (AMCE) was established by the League of Arab States in 1993 as a council in charge of overlooking issues related to the production, transmission and distribution of electricity as well as renewable energy and energy efficiency. The objective of the council is promoting cooperation and coordination and aligning policies among the Arab states to enhance the use of renewable energy and energy efficiency.

[www.las.int](http://www.las.int)

### **About RCREEE**

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an intergovernmental organisation with diplomatic status that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE teams with regional governments and global organisations to initiate and lead clean energy policy dialogues, strategies, technologies and capacity development in order to increase Arab states' share of tomorrow's energy.

[www.rcreee.org](http://www.rcreee.org)

### **Acknowledgement**

This report was prepared by IRENA in collaboration with the League of Arab States and RCREEE. Maged Mahmoud, Mohamad Mahgoub and Louise Sarant (RCREEE) made valuable contributions in the preparation of this overview, which also benefited from the support of Gurbuz Gonul (IRENA), Mustapha Taoumi (former IRENA), Jamila Matar and Ashraf Kraidy (League of Arab States) and Ahmed Badr, Tarek AbdelRazik, Eman Adel, Akram El Mohamadi, Assem Korayem and Hiba Saadaoui (RCREEE). RCREEE focal points in the Arab region provided additional input.

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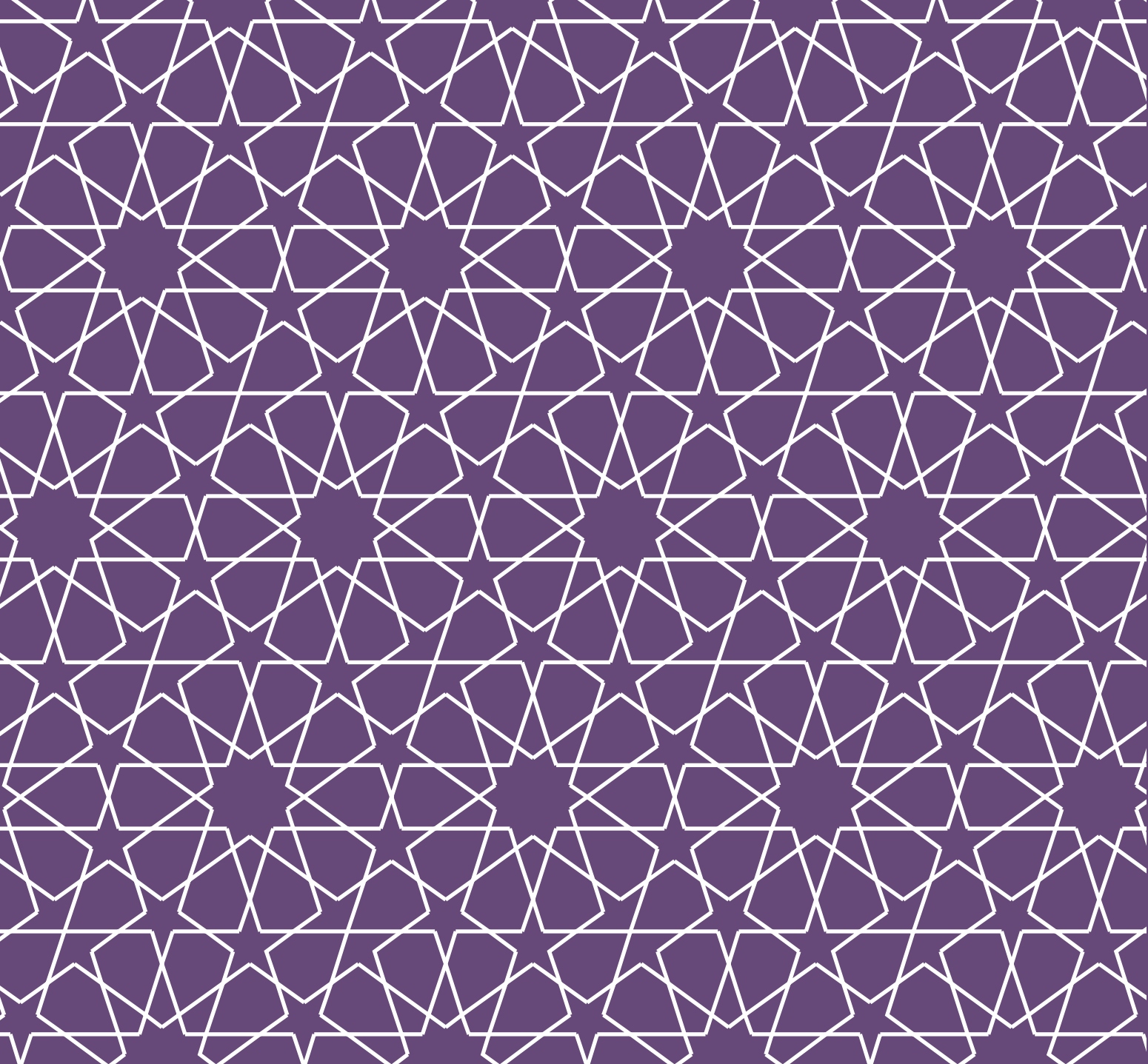
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## Abbreviations

<b>AREF</b>	Arab Renewable Energy Framework
<b>AUE</b>	Arab Union of Electricity
<b>BAU</b>	Business as Usual
<b>COP21</b>	Twenty-first session of the Conference of the Parties
<b>CSP</b>	Concentrating Solar Power
<b>EIB</b>	European Investment Bank
<b>FiT</b>	Feed-in tariff
<b>GCC</b>	Gulf Cooperation Council
<b>GHG</b>	Greenhouse Gas
<b>GIZ</b>	German Agency for International Cooperation ( <i>Gesellschaft für Internationale Zusammenarbeit</i> )
<b>GW</b>	Gigawatt
<b>IEA</b>	International Energy Agency
<b>INDC</b>	Intended Nationally Determined Contribution
<b>IPP</b>	Independent Power Producer
<b>IRENA</b>	International Renewable Energy Agency
<b>kW</b>	Kilowatt
<b>kWh</b>	Kilowatt-hour
<b>LAS</b>	League of Arab States
<b>LCEC</b>	Lebanese Center for Energy Conservation
<b>MENA</b>	Middle East and North Africa

<b>MtCO<sub>2</sub>e</b>	Million Metric tons of Carbon Dioxide equivalent
<b>MW</b>	Megawatt
<b>NREAP</b>	National Renewable Energy Action Plans
<b>NEEAP</b>	National Energy Efficiency Action Plans
<b>PPA</b>	Power Purchase Agreement
<b>PPP</b>	Public-Private Partnership
<b>PV</b>	Photovoltaic
<b>RCREEE</b>	Regional Center for Renewable Energy and Energy Efficiency
<b>REN21</b>	Renewable Energy Policy Network for the 21st Century
<b>RRA</b>	Renewables Readiness Assessment
<b>SWH</b>	Solar Water Heaters
<b>UAE</b>	United Arab Emirates
<b>UNESCWA</b>	United Nations Economic and Social Commission for Western Asia
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change





## Introduction

The potential for wide-scale deployment of renewable energy technologies in the Arab region is considerable. Rapid demographic growth and the rising need for economic development call for additional, stable energy sources that can satisfy demand while protecting the environment. This brochure provides an overview of key initial steps for the region's transition to renewables.

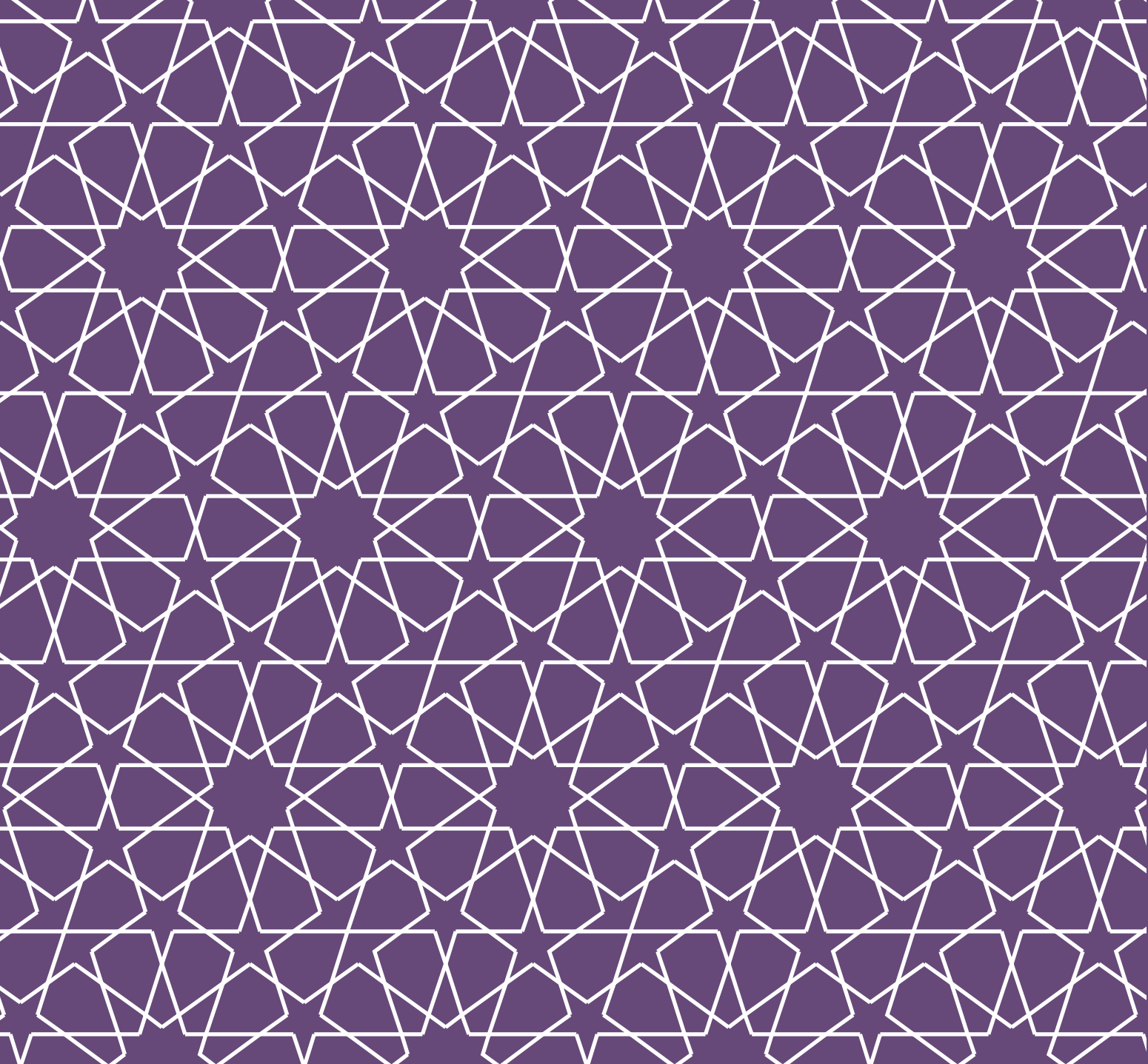
Since 2014, most Arab countries have scaled-up their interest in renewable sources of energy, especially in wind and solar power generation, which offer the highest technological and market maturity. Most Arab countries have, or are in the process of creating, a viable market for renewable energy investments. This is accomplished through enabling conditions (feed-in-tariffs, net metering, auctions, etc) and attractive tariffs in different segments to encourage private investors to enter the market. These enabling conditions are increasingly being supported by official, long-term renewable energy targets set by governments to ensure tangible impact of scaled-up renewable energy investments in the Arab world.

In 2015, renewable power production (including hydro) did not exceed 6% of total generation capacity. Yet commitment from the region is set to spur unprecedented growth, increasing new renewables. Between 2012 and 2015, total renewable installed capacity witnessed a 150% increase, exceeding 3.0 gigawatt (GW) (excluding hydropower) compared to 1.2 GW in 2012.

The growth of the renewable energy market in 2014–2015 and falling costs for renewable energy technologies are positive signs. Policy makers are looking more seriously than ever into the potential of clean and sustainable energy sources. Some Arab countries have been more committed than others to facilitating the transition towards renewable energy. Despite difficulties faced by regional economies and energy sectors, the Arab world is taking bold steps to advance renewables and play a significant role in the global energy transition.



▲ Since 2014, Arab countries have increased their commitment to renewable energy





## Taking Action on Renewables

The renewable energy landscape in the Arab region is evolving rapidly and significant developments have taken place in recent years. In 2014, the International Renewable Energy Agency (IRENA) partnered with the League of Arab States (LAS) and the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) to identify a set of actions to trigger and increase investments in renewable energy projects. These actions are highlighted in a study, *Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation* (IRENA, 2014).

This brochure reviews key developments since 2014 and provides information on:

- Renewable energy potential and increasing installed capacity;
- National renewable energy targets in Arab countries;
- National renewable energy action plans (NREAPs) ;
- Policies to foster a renewable energy transition; and
- New pledges towards sustainable energy as set in Arab countries' Intended Nationally Determined Contributions (INDCs) on climate.



▲ The Arab world is taking bold steps to advance renewables

## Renewable Resources and Power Capacity

The Arab region's renewable energy potential is high, particularly for wind and solar projects. Most Arab countries are part of the SunBelt<sup>1</sup>, and benefit from solar insolation levels that are among the highest in the world (as high as 6.5 kWh/m<sup>2</sup> per day). This shows that despite favourable natural conditions for renewable energy development, there is much room for progress in utilising these resources.

### Wind and Solar Atlases in the Arab Region

Wind and solar atlases are useful in identifying areas with high renewable energy resources for development. For example, Egypt launched its first wind atlas in 1987, and Jordan designed a comprehensive solar atlas, which is available to developers. The table below summarises the steps taken by Arab countries to develop their wind and solar atlases.

**Table 1: Wind and solar atlas coverage in Arab countries**

	Solar Atlas	Wind Atlas
<b>Algeria</b>	Yes	Yes
<b>Bahrain</b>	Resource assessment completed in 2012	Resource assessment completed in 2012
<b>Egypt</b>	Yes	Yes
<b>Iraq</b>	No	Measurement ongoing
<b>Jordan</b>	Yes	Yes
<b>Kuwait</b>	Yes	Yes
<b>Lebanon</b>	No	Yes
<b>Libya</b>	Preliminary data, 2004-2010	Preliminary data, 2006-2007
<b>Mauritiana</b>	No	No
<b>Morocco</b>	Yes	Yes
<b>Oman</b>	No	Yes
<b>Qatar</b>	Resource mapping ongoing	Resource mapping ongoing
<b>Saudi Arabia</b>	Yes	Yes
<b>State Of Palestine</b>	Yes	Yes
<b>Sudan</b>	Yes	Yes
<b>Syrian Arab Republic</b>	<i>Unverified</i>	<i>Unverified</i>
<b>Tunisia</b>	No	Yes
<b>United Arab Emirates</b>	Yes	Yes
<b>Yemen</b>	<i>Unverified</i>	No

Latest information available; Atlas status in each country as reported by relevant authorities or institutes

<sup>1</sup> A geographical region consisting of countries that are situated between 35°N and 35°S and generally characterised by high solar irradiation (Hauff, J. et al (2010), Unlocking the Sunbelt Potential of Photovoltaics, Second Edition, A.T. Kearney, European Photovoltaic Industry Association, Alliance for Rural Electrification).

## Installed Capacity of Renewable Energy Technologies in the Arab Region

Since 2014, an impressive scale-up of renewable installed capacity has been observed in many Arab countries. The total installed capacity of all renewables (including hydro) reached around 14 GW in 2015. Excluding hydro, the total installed capacity in 2015 amounted to about 3.0 GW a 150% increase when compared to 2012 where the installed capacity was 1.2 GW excluding hydropower.

In 2015, renewable energy accounted for 6% of the region's total power generation capacity, mostly in the form of hydropower (4.7%), wind (0.9%) and solar energy (0.4%).

Morocco continues to lead the region in terms of total installed renewable generation capacity (excluding hydropower).

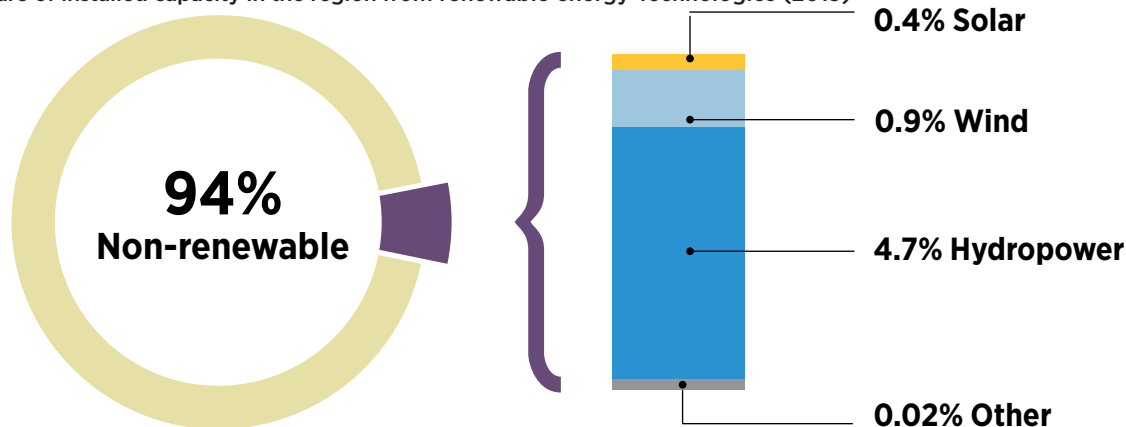
As a result of its long-term efforts and successes in implementing its renewable energy action plan, Morocco has increased its share of solar from 35 megawatts (MW) in 2014 to 198 MW in 2015, and wind from 290 MW in 2012 to around 790 MW early 2016.

Egypt also secured its leading position for the region in wind energy, by commissioning the new 200 MW Gulf of El-Zayt project on the Red Sea coast. The total solar photovoltaic (PV) installed capacity in Egypt reached around 90 MW, predominantly due to the PV rural electrification programme, supported by the UAE, and the feed-in tariff small-scale programme.

The UAE maintains a prominent regional position in solar installations with a combined 133 MW of operational concentrating solar power (CSP) and PV capacities. Almost all other Arab countries have distributed and utility-scale PV installations.

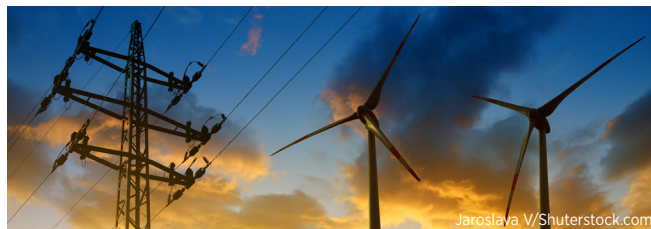
Jordan has made a substantial leap, with wind and PV projects growing tenfold since 2014, to reach a total capacity of 216 MW. In terms of renewable energy share in the overall installed capacity, Sudan leads the region with 51%, mostly attributed to its large hydro capacity. If hydropower is excluded, Mauritania leads with a share of 12%, slightly ahead of Morocco with nearly 11%.

Figure 2: Share of installed capacity in the region from renewable energy Technologies (2015)



Tables 2 and 3 illustrate that countries which have developed solar and wind atlases are the ones with the most significant installed capacity of renewable energy units. This correlation highlights the importance of country's mapping the areas of high wind and solar potential, since the output and efficiency of future projects greatly depend on geographical location.

Over 3,000 MW of new renewable power capacity is now under construction in the region. Table 4 provides examples of projects under construction or in the pipeline in Arab countries.



▲ More of renewable power will soon come online

**Table 2: Renewable and non-renewable power generation: Installed capacity in Arab countries (2015)**

	Non-Renewable	Renewable				Total Installed Capacity	
		Solar	Wind	Hydro	Other		Total Renewables
[MW]	218,726	880	2,020	11,000	44.7	13,950	232,675
[%]	94%	0.38%	0.87%	4.73%	0.02%	6%	100%

Source: Arab Union of Electricity (2015); IRENA (2016b); LAS/RCEEE (2016b)



▲ Renewables bring numerous benefits, including income, jobs and energy security

**Table 3: Renewable power: Installed capacity in Arab countries (2015)**

	Wind	PV	CSP	Hydro	Other	Renewables excluding hydro (2015)		Total Renewables including hydro (2015)	
	[MW]	[MW]	[MW]	[MW]	[MW]	[MW]	[%]	[MW]	[%]
Algeria	10	270	25	228	-	305	2.2	533	4.1
Bahrain	0.5	10	-	-	-	10.5	0.27	10.5	0.27
Egypt	745	90	20	2,874	-	855	2.63	3,729	11.48
Iraq	-	3.5	-	2,513	-	3.5	0.01	2516.5	9.83
Jordan	197	15	-	12	3.5 <sup>2</sup>	215.5	4.39	227.5	4.66
Kuwait	-	1.8	-	-	-	1.8	0.01	1.8	0.01
Lebanon	-	20	-	280	-	20	0.74	300	11.07
Libya	-	5	-	-	-	5	0.05	5	0.05
Mauritania	34.4	18	-	30	-	52.4	12.38	82.4	19.46
Morocco	790.5	15	183	1,770	-	988.5	12.05	2,758.5	33.63
Oman	-	-	7	-	-	7	0.08	7	0.08
State of Palestine	0.7	4	-	-	0.2 <sup>1</sup>	4.7	3.38	4.9	3.38
Qatar	-	1.2	-	-	40 <sup>2</sup>	1.2	0.4	35.6	0.4
Saudi Arabia	-	23.2	-	-	-	23.2	0.05	23.2	0.05
Sudan	-	12	-	1,593	-	12	0.38	1,605	50.89
Tunisia	245	20	-	66	-	265	5.82	331	7.37
UAE	0	33	100	-	1 <sup>2</sup>	133	0.46	135	0.46
Yemen	-	3	-	-	-	3	0.2	3	0.2
<b>Arab region</b>	<b>2,023.1</b>	<b>544.7</b>	<b>335</b>	<b>11,000</b>	<b>44.7</b>	<b>2,947.5</b>	<b>1.27%</b>	<b>13,948</b>	<b>6%</b>

<sup>1</sup> Geothermal <sup>2</sup> Waste to energy

This table is limited to known data in the Arab region and is not exhaustive.

Source: Arab Union of Electricity (2015); IRENA (2016b); LAS/RCREEE (2016b)



Table 4: Renewable energy projects under construction or planned in the Arab region

● Wind ● PV ● CSP ● Geothermal

Algeria	MW
● Khenchela	20
● Distributed projects at different sites	73
● Guelma	5
● North and Upper Platheus	343
● North and Upper Platheus	5010

Egypt	MW
● Gabal El-Zayt	220
● Gulf of El-Zayt	120
● FiT wind projects	2000
● FiT PV projects	2300

Jordan	MW
● Maan	75
● Shamsuna Aqaba	10
● Al Quaira / Al Aqaba	150
● Al Mafrag	10
● NEPCO/Masdar	200
● Additional projects	400
● Additional projects	230
● Al Fagig / Al Shobk	90

Kuwait	MW
● Shagaya RE Complex I	10
● Shagaya RE Complex I	10
● Shagaya RE Complex I	10

Lebanon	MW
● Systems under the National Energy Efficiency and Renewable Energy Action (NEEREA)	30
● To be confirmed, under bidding process	60-100

Libya	MW
● Darnah	60
● Al-Magron I	80
● Al-Magron I	120
● Al-Jofra	14
● Houn	14
● Sebha	40

Morocco	MW
● Taza	150
● Tanger II	100
● Jbel Khalladi	120
● Boujdour	100
● Tiskrad	300
● Midelt	150
● Jbel Lahdid	200
● Noor II	200
● Noor III	150

Djibouti	MW
● Grand Bara	300

Mauritania	MW
● Nouakchott	30
● Nouakchott	30

Oman	MW
● Amal Oil Field	1021
● Dhofar Wind Farm	50

State of Palestine	kW
● Tubas	470
● Jericho	700

Qatar	MW
● Duhail	10
● Kahramaa project	100

Saudi Arabia	MW
● Al Khafji	15
● Mecca	100
● Green Duba ISCC	50

UAE	MW
● Dubai MBR Solar Park Phase 2	470
● Abu Dhabi Solar Park (including Noor 1 project)	700

This list is not exhaustive and may omit some projects.  
Source: LAS/RCREEE (2016b)

## National Renewable Energy Targets in Arab Countries

Most countries in the Arab region have set targets as part of their national renewable energy plans or sustainable energy strategies, be these medium-term (2020s) or long-term (2030s) targets. Such targets demonstrate a political commitment to the transition towards renewables. Many targets can be seen as relatively ambitious, considering the high and ongoing reliance on fossil fuels in most of the region. In many Arab countries, especially those with a degree of experience in installing and operating utility-scale projects, the targets have been scaled up to correspond to domestic needs and circumstances.

In 2015, Djibouti announced that it intended to achieve a target of 100% renewable power by 2020, despite only having limited generation capacity of around 130 MW. Morocco initially set a target to produce 42% of its installed power capacity through renewables by 2020, subsequently raising this to 52% by 2030. The increase came amid negotiations in Paris, at the twenty-first session of the Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC), as Morocco prepared to host COP22 in Marrakech.

Egypt, meanwhile, extended the timeline for its 20% renewables target by two years, until 2022. It remains a key market, with plans to develop 10 GW of wind and solar projects by that year. Algeria revised in 2015 stepped up a 6% target to 27% of electricity generation by 2030. Tunisia plans to source a third of its electricity generation from renewables. Jordan, the State of Palestine, Iraq and Yemen also adopted targets.

Several Gulf Cooperation Council (GCC) countries have also announced plans that include targets. While Saudi Arabia pushed back its target by eight years, the UAE announced its national clean energy target of 24% by 2021, while the two largest emirates (Abu Dhabi and Dubai) have their own targets for renewables (IRENA, 2016a). Dubai recently increased its capacity target for the Mohamed Bin Rashid Al Maktoum Solar Park from 1 GW to 5 GW in total by 2030.

The targets confirm an overall shift towards solar and wind in the region, as Arab countries focus on the renewable energy technologies that are perceived as mature. In the coming years, however, countries in the region are likely to look increasingly into other types of renewables.

One area gaining interest is waste-to-energy plants. These generate electricity and help minimise the negative impact of waste, which can be expected to increase as populations grow. Bahrain and the UAE plan to develop this technology.

Geothermal projects are in the pipeline in Djibouti, a country with an ideal geographical location on the Rift Valley with high geothermal potential.

With the exception of Djibouti, Eastern Arab countries generally have less ambitious targets (in the range of 5-10%) than Western Arab countries, the targets of which range between 27% and 52%. Yet all Arab countries are moving in a similar direction, paving the way towards a sustainable energy transition.



▲ Waste-to-energy plants are attracting interest

**Table 5: Renewable energy targets in the Arab region**

		Renewable Energy Targets						Target Date	
		Wind	PV	CSP	Biomass	Geothermal	Total		
		MW	MW	MW	MW	MW	MW		%
Algeria		1,010	3,000	-	360	5	4,375	15	2020
		5,010	13,575	2,000	1,000	15	21,600	37 <sup>3</sup> /27 <sup>2</sup>	2030
Bahrain		-	-	-	-	-	250	5 <sup>3</sup>	2030
Djibouti		300	200	-	-	500	1,000	100 <sup>2</sup>	2025
Egypt		7,200	2,300 +	-	-	-	9,500	20 <sup>2</sup>	2022
Iraq		-	300	-	-	-	300	1 <sup>2</sup>	2020
Jordan		800	800	100	50	-	1,750	10 <sup>4</sup>	2020
Kuwait		700	4,600	5,700	-	-	11,000	15 <sup>2</sup>	2030
Lebanon		400	150-100	-	-	-	950-900 <sup>5</sup>	12 <sup>2</sup>	2020
Libya		600	344	125	-	-	1,069	7 <sup>2</sup>	2020
		1,000	844	375	-	-	2,219	10 <sup>2</sup>	2025
Mauritania		30	30	-	-	-	60	20 <sup>2</sup>	2020
Morocco		2,000	2,000	-	-	-	6,000 <sup>6</sup>	42 <sup>3</sup>	2020
		4,200	4,560	-	-	-	10,090	52 <sup>3</sup>	2030
State of Palestine		44	45	20	21	-	130	10 <sup>2</sup>	2020
Qatar		-	-	-	-	-	1,800	20 <sup>3</sup>	2030
Saudi Arabia		9,000	16,000	25,000	3,000 <sup>7</sup>	1,000	54,000	30 <sup>3</sup>	2040
Sudan		680	667	50	68	54	1,582 <sup>8</sup>	11 <sup>3</sup>	2020
		1,000	1,000	100	-	-	-2,100	20 <sup>2</sup>	2030
Syrian Arab Republic		1,000	2,000	1,300	250	-	4,550	30	2030
Tunisia		1,755	1,510	460	-	-	3,725	30 <sup>3</sup>	2030
UAE	Abu Dhabi	-	-	-	-	-	-	7 <sup>3</sup>	2020
	Dubai	-	5,000	-	-	-	5,000	25 <sup>2</sup>	2030
Yemen		400	8.25	100	6	200	714.25	15 <sup>3</sup>	2025

<sup>1</sup> Including hydro <sup>2</sup> Electricity generation <sup>3</sup> Installed capacity <sup>4</sup> Primary energy <sup>5</sup> Including 400 MW hydro <sup>6</sup> Including 2,000 MW hydro <sup>7</sup> Waste to energy <sup>8</sup> Including additional 63 MW hydro

Sources: IRENA (2016b); LAS/RCREEE (2016b)



## Creating Regional Momentum: National Renewable Energy Action Plans

The primary objective in harnessing the renewable energy potential in the region is to meet the increasing demand for energy and water from growing populations. Renewables can supply secure, clean energy, providing an efficient solution to climate change by abating harmful greenhouse gas (GHG) emissions.

Policy makers and power producers are increasingly eager to invest in renewable energy in Arab countries, and a number of high-profile projects and targets have been launched in the region.

An important milestone for the deployment of renewable energy in the Arab region was the adoption of the “Pan-Arab Strategy for the Development of Renewable Energy 2010–2030”. Adopted under the LAS umbrella at the third Arab Economic and Social Development Summit in 2013, the strategy sets long-term targets for electricity production from renewables. To reach those targets, the region must scale-up renewable energy development substantially. In addition to electricity, the strategy also sets out regional aims to scale up renewables for heating and cooling, transportation, desalination and rural electrification.

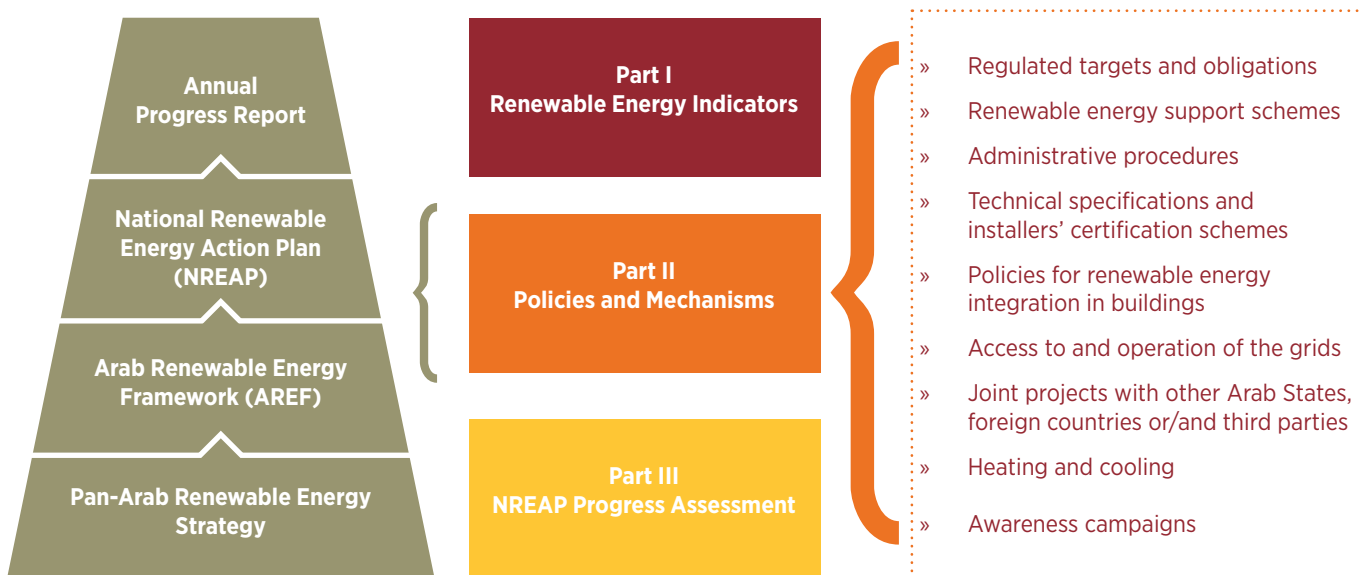
An updated version of the strategy will tackle the issue of sustainable energy more comprehensively.

Implementation of the strategy requires concerted efforts from multiple stakeholders at the regulatory, technical and financial levels. To facilitate this process, the Energy Department of the LAS, in collaboration with RCREEE and the German International Cooperation Agency (GIZ), introduced the Arab Renewable Energy Framework (AREF).

AREF is a guideline for Arab states to develop their national renewable energy action plans (NREAPs) to 2030. It is based on customised templates and progress reports. The factors at play behind the development of renewable energy in the region are illustrated in Figure 3. The strategy works as the foundation for both national and regional activities of renewable energy. AREF works as a regional framework for countries to develop their NREAPs, which in turn provides the baseline for annual progress reports. The Arab Ministerial Council of Electricity in its 11th session in June 2015 asked the LAS energy department and RCREEE to provide technical support to Arab countries in the preparation and implementation of their renewable energy plans based on the AREF and NREAP template.

Since the adoption of the AREF and NREAP template by LAS member states in mid-2015, two countries (Lebanon and Sudan), have taken the lead and prepared a national plan based on these documents. Public consultations on the Lebanese NREAP draft began in September 2015, with official endorsement expected to follow in 2016. The draft highlighted renewable energy targets of 12-15% by 2030.

**Figure 3: Pan-Arab Renewable Energy Strategy, AREF and NREAP: connections and mechanisms**



Sudan's NREAP draft unveiled renewable energy targets of 11% (excluding hydropower) and 55% (including hydropower) by 2020. NREAP preparations revealed the need for enabling policies, regulations and measures to encourage private investment in renewables. Accordingly, discussion started in 2016 on a set of policy measures and regulations that would ensure market access for private renewable energy developers.

Regional approaches would facilitate the penetration of a higher share of renewables in the power grid, foster technology transfer and promote power trade. These issues have been extensively discussed in the region in recent years. IRENA, in close cooperation with regional actors – LAS, the United Nations Economic and Social Commission for Western Asia (UNESCWA) and RCREEE – initiated the development of a comprehensive cooperation framework with the aim of creating an integrated market for sustainable energy in the region.

*Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation*, a report jointly developed by IRENA, LAS and RCREEE in consultation with other national and regional organisations and endorsed by the Arab Ministerial Council in September 2014, identified a set of actions and initiatives to facilitate mobilisation of investments to accelerate deployment of clean and indigenous renewable energy resources in the Arab region.

Planning for tangible growth in renewable electricity generation in the Arab region is often accompanied by concerns regarding integration with existing transmission and distribution grids, as well as additional investments to maintain grid security, reliability and operability. The priorities identified in the study include the development of a clean energy initiative for the Arab region. Accordingly, IRENA in collaboration with its regional partners started the Pan-Arab Clean Energy initiative, which aims at supporting Arab countries and creating synergies among them in the integration of larger shares of

renewable energy on their grids. The ultimate objective is to achieve an integrated power grid covering the entire Arab region, allowing for renewables-based power exchanges.

A regional dialogue could help alleviate concerns and create an effective coordination mechanism among key regional actors. Complementary resources, economies of scale and added value to national economies would benefit the entire region.

The Renewable Energy and Energy Efficiency committee, affiliated to the Arab Ministerial Council for Electricity, recommended the identification of the minimum technical requirements to integrate different renewable energy technologies into the region's grids with a focus on PV and wind technologies. As a result, a "Guideline on Technical Requirements to Integrating Renewable Energy Projects into Grids" was developed through close cooperation between LAS, RCREEE and Egypt's Electric Utility & Consumer Protection Regulatory Agency. The Arab Ministerial Council has adopted the guideline.

The Renewables Readiness Assessment (RRA) is a country-led process facilitated by IRENA. The organisation assists with engaging stakeholders in a national or regional dialogue, in order to pinpoint renewable energy drivers, comparative advantages, enabling policies and measures. The aim is to set out a tangible action plan to enable the development and scale-up of renewable energy. The first pilot RRA in the Arab region was conducted in Oman. IRENA continues to support country-led RRAs, with greater use of a pool of regional experts to broaden and enhance this process. In 2014, Mauritania conducted an RRA while another is being finalised for Tunisia and the process has recently been initiated in Egypt. In addition, IRENA's REmap analysis, focusing on capacity building and resource mapping, was initiated for four Arab countries (Egypt, Morocco, Saudi Arabia and the UAE).

The socio-economic benefits of renewable energy and local content are of great interest to the MENA region, as the development of the sector presents crucial opportunities, such as job creation, energy security and income generation. IRENA

has conducted extensive work on the socio-economic benefits of renewable energy, some in collaboration with regional partners, such as the German-funded RE-Activate project.

A study on the renewable energy manufacturing potential has been conducted by IRENA in collaboration with the European Investment Bank (EIB) to assess the current renewable energy manufacturing base of the South Mediterranean Partner Countries, namely Egypt, Morocco and Tunisia. This study is now being expanded to cover Jordan, Lebanon and the UAE by way of cooperation between IRENA and UNESCWA.

The study proposes an action agenda to support the expansion of renewable energy equipment manufacturing. This follows several technology-focused studies carried out by the World Bank in the region. However, these efforts still need comprehensive mechanisms for follow up and for channelling recommendations to policy makers at a national level, facilitated through regionally coordinated efforts. To complement this assessment, UNESCWA and the Lebanese Center for Energy Conservation (LCEC) have initiated collaboration on a similar study covering the Middle East. The ultimate aim of such studies is to build a renewable energy local manufacturing strategy for the whole Arab region.



- ▲ Targets have been scaled up in line with each country's needs and circumstances

## Policies to Support the Energy Transition

In the region, a range of barriers hinder the smooth transition of Arab countries towards renewable energy and impede the creation of vigorous markets. Those barriers differ depending on the technology used and the deployment priorities that have been agreed upon, be it utility-scale centralised PV, CSP, wind power or small, decentralised renewable energy applications. While renewable energy systems have become increasingly cost effective and have gained competitive advantages in the past few years, many of these technologies are still in an early stage of commercialisation in the region. In addition, there is an urgent need to adopt policies and incentives in the region that mitigate market and commercial risks for investors and lenders associated with deployment of renewable energy projects.

The preferred policy option for utility-scale projects in the region appears to be public competitive bidding by independent power producers (IPP). In such cases, the developer is chosen through a tendering process, and a power purchase agreement (PPA) is signed with the successful bidder based on the most competitive bid offer.

Additionally, the adoption of feed-in tariff schemes and direct proposal submission are also gaining momentum for the development of large-scale renewable energy projects in some countries. In Egypt, for example, the three schemes co-exist.

Direct proposal submission targets gigawatt-scale investments, including local content preferences, while bidding schemes are used for projects of a scale of several hundred megawatts and feed-in tariffs for projects with a capacity of less than 50 MW. In Jordan, some of the previously planned projects under bid and the feed-in tariffs have been switched to a direct proposal submission scheme. Morocco, on the other hand, is experienced

at carrying out IPP public competitive bidding processes for renewable energy projects that rely on highly concessional conditions.

The energy prices in the Arab region decided under the IPP bidding highlight the competitiveness of wind and solar PV power, with developers running a cost race for both. The auction of the second phase of UAE's Mohammed bin Rashid Al Maktoum Solar Park resulted in a price of USD 0.0585/kWh while its third phase was awarded the lowest bid of USD 0.0299/kWh.

For wind power, Egypt's 200 MW Gulf of El-Zayt wind project (currently under negotiation) received a price of about USD 0.04/kWh, while Morocco secured average bids of just USD 0.03/kWh from its tender for 850 MW large-scale wind energy projects, with the lowest tariff at around USD 0.025/kWh. Those prices are possible because of the region's remarkable solar and wind energy resources, backed by some concessional finance coupled with policy measures to reduce the various risks and encourage investment.

Pre-defined feed-in tariff rates were adopted in Egypt, Algeria and the State of Palestine. The applied schemes vary greatly in duration, scope, tariff structure and tariff levels depending on the technology considered, availability and the site specific natural resources (i.e. operating hours). The feed-in tariff has proved successful in attracting massive investments in a relatively short time period in Egypt, since over 100 projects were preselected for the first round of the feed-in tariff.

Jordan, Lebanon, Tunisia, the UAE and to some extent Morocco and Egypt, have adopted net-metering policies. Jordan and Tunisia have relatively simple schemes that have attracted smaller system investors. Other Arab countries are still in the early stages of implementation of net-metering policies.

**Table 6: Policies promoting renewable energy in the Arab region**

	Competitive Bidding	Direct Proposal Submission	FiT	Net Metering
Algeria			●	
Egypt	●	●	●	●
Jordan	●	●	●	●
Kuwait	●			
Lebanon	●			●
Morocco	●			●
Oman	●			
State of Palestine	●		●	●
Syrian Arabic Republic	●		●	●
Tunisia				●
United Arab Emirates	●			●
Yemen	●			



▲ The “Pan-Arab Renewable Energy Strategy 2030” will help mobilise investments in clean, indigenous power resources

## New Pledges on Sustainable Energy: Arab countries' Nationally Determined Contributions under the Paris Agreement

Global sustainable development action had a landmark year in 2015, as it witnessed the adoption of the *2030 Agenda for Sustainable Development* in September, followed by the adoption of the Paris Agreement in December. COP21 has clearly tipped the balance in favour of renewable energy deployment and acceleration. In the run up to the Paris Climate Conference, many Arab countries revealed new environmental pledges towards sustainable energy through the submission of the INDCs with vastly different levels of ambition regarding GHG emission reduction and deployment of renewable energy technologies. Although not all Arab countries indicated specific renewable energy targets in their pledges, the INDCs submitted have clearly put these countries on a path towards a low-carbon, climate-resilient future.

Regionally, Morocco is taking the lead in terms of deployment of renewable energy and carbon dioxide abatement, with a pledge to produce 52% of its electricity through renewable energy by 2030 and to reduce emissions by 13% below the business-as-usual scenario (BAU). Similarly, Tunisia's INDC advocates 14% of electricity production by renewable energy in 2020 and 30% in 2030. Following the same path in its INDC, Algeria indicated a target of 27% of electricity generated from renewable energy by 2030 contributing to emission reduction targets of 7-22% from BAU, with the lower end being unconditional and the upper end of this objective being provisional on climate finance and access to technology. Jordan, the first Arab country to submit its INDC, has committed to cutting its GHG emissions by 1.5% from BAU levels by 2030, a percentage that could rise to 14% provided international finance materialises.

Jordan plans to boost its local renewable energy deployment with a target of 11% of its energy demand sourced from solar, wind and hydropower by 2025, and to improve its energy efficiency by 20% by 2020. Lebanon plans to cover 15% of the power and heat demand by renewables in 2030.

Saudi Arabia put forward a target goal to reduce 130 million metric tons of carbon dioxide equivalent (MtCO<sub>2</sub>e) annually by 2030, subject to adjustment based on oil export trends. The UAE seeks to increase its share of clean energy to 24% of the total energy mix by 2021, up from 0.2% in 2014. Oman's INDC pledged an unconditional 2% emissions cut in 2030, relative to BAU, achieved through an increase in renewables and reduction in gas flaring.

Bahrain's Economic Vision 2030 aims to diversify the country's economy and reduce its dependence on oil and gas products. Qatar took the same approach as Bahrain: it plans to bring down emissions by diversifying its economy, but has not communicated any reduction target.

Sudan's INDC indicated plans to reach 20% renewables in its power mix by 2030. Djibouti's INDC contains an unconditional pledge to reduce emissions by 40% by 2030 (compared to BAU), and a conditional pledge to reduce emissions by a further 20%. Mauritania pledged by 2030 to reduce its emissions by 22.3% from BAU levels. The INDC specifies that 88% of this pledge is conditional upon international support (such as climate finance flows, technology transfer), and that 12% will be achieved unconditionally.

Yemen's emission cut by 2030 could be at 1% compared to BAU, or climb up to 14% assuming international support is provided, with a conditional pledge to produce 15% of power from renewable energy by 2025.

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