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Renewable Sources of Energy:
The Pan-Arab Prospect

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Renewable Sources of Energy:

The Pan-Arab Prospect

“The Stone Age did not end for the lack of stone, and the Oil Age will end long before the world runs out of oil”

Sheikh Zaki Yamani
Former Oil Minister of Saudi Arabia

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I. Introduction

According to International Renewable Energy Agency (IRENA, 2013), the Arab Gulf is wealthy in fossil fuels and in oil. Due to their wealth, they managed to reach high levels of economic development during the past decades and have evolved into major players in the global energy market. They are the top oil exporters worldwide and provide the European and Asian markets with large supplies of oil and natural gas. Oil-rich countries cope with a strong demand in these markets, thus, their sales are on the rise. However, these countries recently understood that oil and fossil fuels are not indefinite. They have realised that this energy source and, consequently, economic development will eclipse sooner or later.

Bearing this fact in mind, policy makers in the Arab States concluded that a shift to renewable energy sources is necessary, in order to maintain their economic status and to meet the increasing demand for energy supply in their own countries. In the Arab region, there is an enormous renewable energy potential. Nevertheless, up until now, little have been done by these states to take advantage of this potential.

The trend to invest into renewable energy has reached the MENA (Middle East and North Africa) region. As a result, since 2014, all the Arab Countries have an increased interest in renewable sources of energy. They set targets to complete the shift from an oil-based power supply into renewable methods by 2030, mainly in wind and solar power.

In order to achieve this goal, the Arab States have reached a wide political consensus, which resulted in the adoption of the 'Pan-Arab Renewable Energy Strategy 2030'. It was the first time that all the Arab Nations came into agreement. This report includes action plans that have to be taken, the so called National Renewable Energy Action Plans (NREAP), which ,if implemented , will help the Arab states achieve these goals.

The main purpose of this energy policy paper is to present the road-map of the Pan-Arab Strategy towards reaching the renewable energy targets. The analysis of the NREAP is necessary for further understanding of the manner these goals shall be achieved. Following, the institutional cooperation among Arab States is explained.[1] An overview of the current renewable energy situation, as well as currently renewable energy capacity are also provided. Finally, the way of financing energy investments in this region is also presented.

To sum up, the objective of this energy policy paper is to provide all the necessary information for the renewable energy potential in the Arab Region.

[1] Arab Institutions, such as the League of Arab States or the Arab Ministries of Energy and Environment, are trying to find ways to coordinate in the region in the energy sector. Regional Organizations, like the International Renewable Energy Agency based in Abu Dhabi, play a very important role.

II. **Current Renewable Energy Status**

The Arab region's renewable energy prospect is so high that it seems to be the most economically feasible in the world. Particularly, the region enjoys a high potential in solar and wind energy. As far as the solar energy is concerned, the Arab countries are perfectly located, and are generally characterized by high solar irradiation.[2] As a result, they have a strong advantage in solar insolation levels, which are the highest in the world and they can develop large solar power plans. Other sources, such as biomass or geothermal power, hide a huge potential, but they still remain underexplored.

In this chapter, current renewable energy status in MENA region is provided. Statistics were taken from IRENA (International Renewable Energy Agency) and its report 'Renewable Energy in Arab Region: Overview of Developments'. It was conducted in cooperation with League of Arab States and the Regional Center for Renewable Energy and Energy Efficiency. They have researched and analysed today's status in MENA region, comparing it to future targets (IRENA, 2016).

Gulf countries, regionally, are major energy consumers, as the electricity consumption is growing 8% each year. They have to face this increasing demand domestically, as the additional required energy will reach 100 GW in 10 years time.

As it was mentioned in the introduction, since 2014, the region has seen a great shift to renewable sources of energy. A tremendous scale-up of installed renewable capacity has been introduced, which resulted in an increase of 150% compared to 2012. Specifically, the total installed capacity, excluding hydro, in 2012 was 1.2 GW and 3 GW in 2015.

Totally, the whole region's energy needs are up to 232GW. In 2016, the renewable energy in the region accounted for 6% of total energy generation, approximately 14GW. Mostly, it is in the form of hydropower (4.7%), solar power (0.4%) and wind energy (0.9%).[3]

Installed solar power plants currently provide the region with 880MW. The most successful country in this sector is Algeria of 270MW photovoltaic (PV) installed solar capacity and 25MW of concentrated solar power (CSP). Secondly, Egypt improved its PV installed capacity reaching 90 MW.

In wind energy, the region has generally achieved more, due to the huge current projects in Morocco and Egypt. These projects amount for 790MW and 750MW respectively. Tunisia also developed its wind capacity reaching 245MW by wind installed capacity.

As far as total hydropower is concerned, the whole region's installed capacity amounts about to 11 GW. Egypt and Iraq lead the list with a total combined capacity of 5.5 GW, 2.8 and 2.5 GW respectively. Following, Morocco's total capacity of 1.7 GW is in the third place.

In detail, Egypt remains the leading nation in the MENA region as far as the total renewable energy capacity is concerned. In wind energy, the Gulf of El-Zayt project on the Red Sea coast provides 200 MW. As for the solar energy Egypt installed PV capacity, reaching 90 MW. This project helped rural electrification and was implemented with the aid of UAE.

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[2] Arab countries are located between 33oN and 35oN, this region enjoys the highest solar irradiation in the whole world.

[3] Statistics from IRENA, Irena Arab Region Overview 2016

Morocco maintains its solid position. During the last years, it has implemented its renewable energy action plan and has visioned tremendous results. In 2014, the solar energy capacity amounted for 35 MW, but in 2016 it was increased up to 160 MW. Wind power increased from 290 MW, in 2012, to 790 MW in 2016.

The United Arab Emirates (UAE) hold a strong regional position in solar installations with their concentrated solar power (CSP) and photovoltaic (PV) capacities. This combination provides the country with 133 MW of solar energy.[4]

However, the most remarkable case is that of Sudan. The reason why is that the total installed capacity amounts for 50% of renewable energy share, due to the large hydro capacity, reaching 1.5GW.

Nevertheless, there is a sad fact about the renewable capacity in the region. There are many countries, like Qatar, Kuwait, Bahrain or Saudi Arabia, which have not installed renewable capacity yet. Although they may find a huge advantage in these sources, they prefer not to do so, having them unused. As of total power capacity, the renewable capacity ranges between 0.05% and 0.6% in these countries.[5]

These Arab states do have a strong renewable potential, but they prefer to rely on the fossil fuels or the oil much more than installing the necessary capacity. However, the whole region decided to make this shift and, in the next years, it will experience a huge difference in the energy sector.

Table 1. Current Renewable Status

	Wind	PV	CSP	Hydro	Other	Renewables (excluding hydro)		Renewables (including hydro)	
	[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	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	4.7	3.38	4.9	3.38
Qatar	-	1.2	-	-	40	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	133	0.46	135	0.46
Yemen	-	3	-	-	-	3	0.2	3	0.2
Arab region	**2,023.1**	**544.7**	**335**	**11,000**	**44.7**	**2,947.5**	**1.27%**	**13,948**	**6%**

Source : IRENA (2016b)

[4] See also Irena Arab Region Overview of Developments 2016

[5] However, there is a stong shift to renewable energy deployment for Saudi Arabia for 2040 targeting to bouild a whole island which will run on renewables.

III. Targets/ Projects

Interest in renewable resources in the MENA region is on the rise during the recent years. Policy makers expect a rapid growth in energy consumption at a rapid pace because of the continuously growing population.[6] This fact in combination with the cost competitiveness of renewable energy technologies changed the governmental strategies for the energy mix.

Countries of the MENA region have announced plans and strategies to take advantage in the renewable potential of the whole region and to implement the necessary renewable technologies.

As in the previous chapter, statistics are taken from the report of IRENA, LAS and RCREEE for this chapter as well. For complete understanding of the renewable energy fututre in the region, targets must be provided (IRENA, 2016).

In general, targets are set at a national level. There is a variety among the region as far as the investment in renewable energy is concerned. There are different plans depending of the deployment year. Other countries in the Arab region have set targets for 2020 (mid-term goals), while others have set targets for 2030 (long-term goals). In many Arab countries, goals have been set in order to meet the domestic demand (Amin, 2014).

The shift towards renewables is based on the most efficient types of this, which is wind and solar energy. Arab countries focus on these, because they are the most mature and can give tremendous results. However, countries in the region will increasingly start to look at other types of renewables, such as waste-to-waste energy plants or geothermal power. With the necessary technology, waste-to-waste plants help minimize the negative side of waste, and generate this into electricity.[7]

In total, Western Arab countries have set more ambitious targets for renewables, than that of Eastern or Gulf Arab Countries. This is because of the large fossil fuels of the region. However, it is shown that Arab countries are moving into the same direction, the direction of energy transition.

The most impressive targets for achieving renewable energy status is that of Djibouti. This small country aims at 100% of renewable energy capacity until 2025. Due to its low energy demand, it can be achieved with the necessary technology for solar energy.

Morocco leads the whole MENA region for its targets. At first phase, Moroccan policy makers set goals to produce 42% of its installed power capacity through renewables. Because this was too optimistic, they set new target for 2030, reaching 52% of total renewable status, reaching 10 GW in total.

Due to its strong wind energy potential, Egypt has set ambitious targets too. Egypt aims to develop 10 GW of wind and solar projects until 2022.

Another ambitious program was set by Algeria , which aims to generate 21GW until 2030, that is 27% of its

[6] National Authorities across the region have concluded in this and it is the main reason for the shift to renewables.

[7] As mentioned before, different types of renewables remain underexplored, however there will be plans to take advantage in these.

capacity, while Tunisia plans to source a third of its electricity generation until 2030, 4GW from both solar and wind energy.[8]

Among the Gulf Cooperation Council countries, Saudi Arabia has set the most ambitious target for 2040. In total, this country aims at 30% of renewables, amounting for 54 GW. This huge amount is because of the strong solar energy potential of the region. Policy makers set a goal for 41 GW from solar power, 16 GW from PV (photovoltaic) and 25 GW from CSP (concentrated solar power).[9]

At this point some of the most famous projects will be presented. The biggest and the most ambitious project was launched on September 2017 in Dubai. It is the world's largest CSP (concentrated solar power) project and it will take place in Mohammed bin Rashid Al Maktoum Solar Park. This project will hold a 260-meter tower, which will receive focused sunlight. It is the biggest investment in the Arab region for renewable energy.

A consortium comprised by SAUDI ARABIA ACWA Power and Chinese Shanghai Electric has been awarded the contract for this project. At the end it will contain the world's tallest solar tower, which will generate 700MW of energy to support Dubai's electricity grid. The total cost will be up to $3.9bn.

The whole project will be completed partially and will start in Q4 2020. It will generate 700 MW totally and the whole solar park, Mohamed bin Rashid Al Maktoum Solar Park, will generate 5 GW in total, by the time it is completed. Up until today two phases of PV have become operational, first in 2013, 13 MW and secondly, in 2017, 200 MW. The third phase will include 800 MW and will be operational in 2020.[10]

Morocco is the leading nation in Africa for renewable technology. In February 2016, the first phase of Noor Solar Complex was opened by the King. It generates 160 MW using Concentrated Solar Power technology and is located near Quazazarte, a town in Morocco's southern desert. Noor 2 and Noor 3 use the same technology but in a larger scale, in order to store energy for seven hours. Above all, there is Noor 4, which will be completed in 2018, generating 350 MW. As long as the wind energy is concerned, Siemens and Nareva, an investment company owned by King Mohamed VI, have won a bid to build five large wind farms, which will contribute 850 MW to national power grid.[11]

Due to Suez Canal, Egypt enjoys excellent wind, which can be used for electricity. National target is to generate 12% of electricity (7GW until 2022) through wind farms. That is why, Germany, European Investment Bank, Japan, European Union and MASDAR are currently cooperating and preparing wind projects, which will take place at the Gulf of Suez. The aim is to build wind farms that will produce approximately 1.5 GW.[12]

European Investment Bank, European Commission and the Union for the Mediterranean launched an initiative for the implementation of renewable energy and energy efficiency projects in some Mediterranean countries. It is called Mediterranean Solar Plan and it will be deployed in Egypt, Algeria, Jordan, Tunisia, Lebanon and Morocco. 'Mediterranean Solar Plan is managed by a Strategic Council Board of high-level representatives, chaired by Christian Stoffaës, General Delegate, asked to define the vision and the objectives and a Scientific Council in charge of projects and publications for their promotion with various organisations'.[13] Funds will be provided by the EU-funded Neighbourhood Investment Facility,

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8 Information about targets provided by IRENA (2016b), League of Arab States and Regional Center for Renewable Energy and Energy Efficiency (2016b)

9 IRENA, Renewable Energy Market Analysis (2016)

10 https://cleantechnica.com/2017/09/19/dubai-will-soon-home-worlds-largest-concentrated-solar-facility/

11 More details about Morocco's projects can be found at the article. www.theguardian.com/global-development/2016/nov/17/cop22-host-morocco-lights-way-africa-renewable-energy-2020

12 https://www.evwind.es/2017/03/30/european-investment-bank-eib-to-back-200-mw-egypt-wind-farm/59233

13 https://www.plansolairemediterraneen.org/preface-the-consortium/

created and managed by European Commission.[14]

Table 2. Renewable Energy Targets

	Wind [MW]	PV [MW]	CSP [MW]	Biomass [MW]	Geothermal [MW]	Total [MW]	Total [%]	Target Date
Algeria	1,010	3,000	-	360	5	4,375	15	2020
	5,010	13,575	2,000	1,000	15	21,600	27	2030
Bahrain	-	-	-	-	-	250	5	2030
Egypt	7,200	2,300	-	-	-	9,500	20	2022
Iraq	-	300	-	-	-	300	1	2020
Jordan	800	800	100	50	-	1,750	10	2020
Kuwait	700	4,600	5,700	-	-	11,000	15	2030
Libya	600	344	125	-	-	1,069	7	2020
	1000	844	375	-	-	2,219	10	2025
Mauritania	30	30	-	-	-	60	20	2020
Morocco	2,000	2,000		-	-	6,000	42	2020
	4,200	4,560		-	-	10,900	52	2030
Syrian Arab Republic	1,000	2,000	1,300	250	-	4,550	30	2030
Qatar	-	-	-	-	-	1,800	20	2030
Saudi Arabia	9,000	16,000	25,000	3,000	1,000	54,000	30	2040
Sudan	680	667	50	68	54	1,582	11	2020
	1,000	1,000	100	-	-	2,100	20	2030
Tunisia	1,755	1,510	460	-	-	3,725	30	2030
UAE Abu Dhabi	-	-	-	-	-	-	7	2020
UAE Dubai	-	5,000	-	-	-	5,000	25	2030
Yemen	400	8.25	100	6	200	714.25	15	2025

Source: IRENA (2016b)

[14] http://www.eib.org/infocentre/publications/all/mediterranean-solar-plan-project-preparation-initiative.htm

IV. Framework

In this chapter, the necessary framework is presented. Arab Countries in order to achieve their goals demonstrated some necessary common actions that shall be taken for the shift to renewables. As Adnan Amin stated (IRENA, 2013), Pan-Arab Renewable Energy Strategy 2030 is the most important because it gives details for the whole strategy. Moreover, Arab Renewable Energy Framework (AREF) is also important for the countries, because it consists of the necessary guidance. Last but not least, National Renewable Energy Action Plan (NREAP) consists of the actions countries take either on mid-term or long-term. It highlights the necessary policies and mechanisms that help Arab states to achieve their targets.

A. The Pan-Arab Strategy 2030

A common base for all Arab countries, in order to achieve their targets, is the 'Pan-Arab Renewable Energy Strategy 2030 : Roadmap of Actions for Implementation'. It was adopted at the Third Economic and Social Development Summit during January 2013 in Riyadh and was developed by IRENA (International Renewable Energy Agency), LAS (League of Arab States) and RCREEE (Regional Center for Renewable Energy and Energy Efficiency). The main goal of this document is to promote the idea of renewable energy sources among the Arab States, to provide guidelines to achieve their goals and to develop their national renewable energy action plans. However, The primary attempt is to tap into the region's significant renewable energy resources in order to meet the ongoing increasing demand of electricity supply.[15]

Specifically, in this strategy there are some directions that countries should follow, in order to achieve their targets either for 2020 or 2030. First of all, they have to use the abundance of the renewable resources. As mentioned above, the region is full of renewable potential, but until today, little have been done to take advantage in this.

Secondly, another idea is to enhance energy security. By using both fossil fuels and renewable resources, Arab countries will promote energy security in the near future because of the diversification of energy sources. Due to lack of dependence in a certain source of energy, energy mix will be much better and economically efficient.

Third, by following the Pan-Arab Strategy, countries in the region will be able to meet domestic electricity demand, which is always growing due to population growth. This is also the main purpose of this Strategy. It also collerates with social benefits.

Moreover, the shift to renewables will help countries of the region maintain indigenous oil and natural gas reserves for as long as possible in a strategic way. This leads in a better energy security. Last but not least, another goal refers to environmental issues; states will solve environmental problems that are created by oil and natural gas exploration, transportation and use. There is a high sensitivity among arab societies for environmental problems and climate change, which have made governments decide a strong shift to cleaner energy.

Three scenarios are outlined in the Strategy, which refer to periods 2010-2020 and 2020-2030 and are characterized as low, medium and high (IRENA,2013). It depends on the total percentage that renewables will contribute to the electricity generation by first 2020, then 2030. Low scenario means that in 2030 renewable energy will be only 2.3% of total electricity production. Medium scenario means that Arab

15 Irena, Pan-Arab Renewable Energy Strategy 2030 : Roadmap of Actions for Implementation

Countries will have a higher interest in renewables in order to diversify their electricity mix to reduce their dependence on fossil fuels. Contribution from renewables will reach almost 5%. High scenario expects a huge deployment of renewables that will reach 10% in 2030, twice bigger than that of 2020 expected.[16]

B. Arab Renewable Energy Framework

Arab Renewable Energy Framework was introduced in order to help Arab states in their effort to meet their demands and goals. It was introduced by the League of Arab States (LAS) in coordination with Regional Center for Renewable Energy and Energy Efficiency (RCREEE), and the German International Cooperation Agency (GIZ).

AREF operates as a regional framework, as a guideline so that Arab states will develop their NREAPs for 2030, and it is based on customised templates and progress reports. It also works as a strategy for regional and national activities for renewable energy.[17]

It includes some articles that countries have to follow for better implementation of their targets.

C. National Renewable Energy Action Plan

NREAP is a useful tool for the Arab region for the national renewable energy planning. It needs to cover every essential element of the renewable planning for their successful implementation. However, Arab states need to have a strong communication among them and technical assistance for their NREAP. The necessary needs vary from country to country depending on their level of implementation.

Nevertheless, support is needed for many reasons. First of all, for the development of the necessary human and institutional capacity, which will help countries with the assess to the renewable energy source base and new technologies. Moreover, it aids countries with their planning for the electricity production, for some certain sectors within energy system such as cooling and heating, and for some technologies.

The main aspect of NREAP is that it helps countries with the adoption of some financial and fiscal incentives in order to overcome economic barriers that block the deployment of renewables. Also, it encourages the participation of the private sector. For this reason, it puts in place some specific regulations to ensure market access.

Furthermore, NREAP supports countries for the necessary infrastucture so that they can transmit renewable energy to consumers all across the region.

These three templates play an important role for the deployment of the renewables. They collaborate and provide countries with the necessary framework and actions that shall be taken. However there is an hierarchy among them for developing renewable energy in the region. The most important is the Pan-Arab Strategy 2030 which operates as the basis for both national and regional activities for renewables. AREF is the appropriate regional framework for states to develop their NREAPS, which consist of the actions and targets. These in turn are the baseline for the adoption of the annual progress reports.

16 See also IRENA, Pan-Arab Renewable Energy Strategy 2030 : Roadmap of Actions for Impemenation

17 IRENA, Renewable Enegy in the Arab Region, 2016

V. Cooperation

Arab states acknowledged the importance of renewable energy sources deployment. Planning solid long-terms targets and getting into action is a difficult procedure. That is why, during last years policy makers, institutions and even companies made a shift to cooperation too.

It is also a serious matter, that has attracted the interest of many researchers, political scientists and international relations specialists during the last few years. A. Amin, J. Matar and T. Emtairah have highlighted all the aspects of possible cooperation in Arab Region and have concluded that more need to be done, so that renewables deployment is easily achieved (IRENA, 2014).

Many regional and international organisations have been created to promote the idea of renewable energy sources. The most notable organisation is based on U.A.E. And its purpose is to promote the renewables idea worldwide. It is called International Renewable Energy Agency (IRENA) and has created some useful initiatives and tools that will help countries to deploy renewable energy. It supports the energy transition and serves as the principal platform for international and regional cooperation.

It also made a lot of research on some issues. It contains lots of renewable energy statistics and data that address sharply rising energy needs. This organisation also advices on development matters and gives insights on financial mechanisms. Moreover, it includes scientific researches with a large amount of publications.

Some essential elements for the organisational's work are strengthening technologies and innovation, enabling policies and enhanced capacity, knowledge sharing and encouraging investment flows too.[18]

The most important and central pillar of the work IRENA does is the Renewables Readiness Assessment process (RRA) (Amin, Matar, Emtirah, 2014). It is a country-driven process, and IRENA's purpose is to engage countries with all relevant stakeholders in a national and regional dialogue. It aims to create an action plan by pinpointing renewable energy sources, policy measures and comparative advantages.[19]

The Renewable Center for Renewable Energy and Energy Efficiency (RCREEE) was established in 2008 by government representatives from 10 Arab Countries. Its base is in Cairo, Egypt and its two main objectives are 'to diffuse the implementation of cost-effective renewable energy and energy efficiency policies, strategies and technologies in the Arab region' and to 'to increase the share of renewable energy and energy efficiency products and services in the Arab region and their share of global market'.[20]

RCREEE is an international organisation, it obtained its legal status in August 2010 and its goal is the promotion of the idea of cleaner energy and the shift to renewable energy sources all across the region. It cooperates with governments and other organisations to implement strategies, technologies and renewables deployment. Moreover, it plays an important role for the necessary communication among Arab countries of the region. It leads policy dialogues and collaborates with policy makers for the better understanding and promoting the idea.

RCREEE is also close to businesses and academic communities in order to conduct researches and statistics. It provides countries with useful information for the necessary policies and regulations that have to be taken for better implementing. Finally, it contributes to projects that have already started in the MENA region.

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18 http://www.irena.org/

19 IRENA, Renewable Readiness Assessment 2013

20 As mentioned at RCREEE website rcreee.org/content/who-we-are

However, cooperation is not limited in the borders of the Arab countries. As Jamila Matar, Director of Energy Department of League of Arab States has mentioned, during the past years, European Union has increased its interest in helping the promotion of renewables in the region. Arab countries have signed bilateral and multilateral agreements to benefit from EU's technical and financial assistance. EU is also involved in some projects in the sector of research and development of large-scale power plants.[21]

Several other organisations are active in Mediterranean sea and collaborate with regional agents and prove the cross-regional interest. Some of them are Observatoire Mediteraneen de l' Energie (OME), IPEMED (Euro-Mediterranean think tank to promote sustainable energy), MEDGRID (a consortium of industry leaders in electricity field) and Mediterranean Association of National Agencies of Energy conservation (MEDENER). The fields of actions are mainly power generation, transmission systems and regulations. They hold a solid collaboration with RCREEE to strengthen their efforts to establish Mediterranean Energy Community.[22]

Nevertheless, cooperation in the Mediterranean Sea may be difficult because of huge stocks of natural gas. Since there are huge amounts of natural gas at some Mediterranean countries, the shift to renewables may be underestimated. Natural gas in some countries, like Algeria, are the central pillar of national economy, and it is really difficult to change in order to move into other sources of energy. Moreover, national elites, whose interests are connected to natural gas exploration and supply, play a negative role in the cooperation, as they do not wish to lose their interests from the shift to renewables.

Regional cooperation has benefited renewable energy deployment regards to the necessary policies and regulations. Some regional institutions, such as Middle East Solar Industry Association and Clean Energy Business Council, contributed in building a network among governments for better practice sharing and for better providing researches and feedback on how better regulations and framework shall be implemented.

The last years, there has been a development in the sector of survey and research too. Institutions started to complete research on energy demand and supply, including fossil fuels and alternative energies. Institutions include Kuwait Institute for Scientific and Research, Qatar Foundation, King Abdullah Petroleum Studies and Research Center in Saudi Arabia.

As regards to technology issues, a cooperation progress has been done. RCREEE, League of Arab States and Egypt's Electric Utility and Consumer Protection Regulatory Agency have collaborated in order to conduct a survey named 'Guideline on Technical Requirements to Integrating Renewable Energy Projects into Grids'. It contains the recommendations on how renewable technology shall be integrated into the region's grid focusing on PV and Wind technologies.

The last few years, there has been a significant progress in institutional and policy framework in the Arab region. Creation of specialised institutions has benefited regional cooperation in the fields of research, information and technology capability sharing for faster scale-up of developments. However, certain countries have not promoted institutional cooperation and still a lot need to be done to achieve 2030 targets.

[21] Jamila Matar, 'An Overview of the Activities the Arab Ministerial Council of Electricity', Energy Department League of Arab States

[22] IRENA, Pan-Arab Renewable Energy Strategy 2030 : Roadmap of Actions for Implementation

VI. Financing the Projects

The way of financing the establishment of the projects is a main issue. However, the region is dedicated to the shift to renewables and, thus, willing to contribute the most in order to implement the announced projects. Governments, financial institutions, Companies, Banks and some specific funds provide the most money for the projects.

There exist some reports referring to this subject, J. Krupa and R. Pudineh have conducted an analytical report, highlighting the factors that make these projects, concluding that financing is the most important part for renewables implementation (Krupa, Pudineh, 2017).

Until today, the main financial source are the governments. The shift was decided by the governments, and as result investments are made mostly by them. Projects all across the MENA region receive public funding. Public financing is regarded as an important tool in creating an efficient environment for renewable energy investment. Governments are helped by public finance institutions for this reason. They tend to provide capitals to serve public good and that is why they are the main source of funding.

Some governments of the region took the decision to create national renewable energy and energy efficiency funds to invest in the projects. Such countries are Egypt, Morocco, Tunisia, Jordan and Algeria. Some examples of the funds that were created are Morocco's Energy Development Fund, which was supported USD 1 billion from other countries, UAE and Saudi Arabia, and Algeria's National Renewable Energy Fund, which is financed by 0.5% tax on oil revenues.[23]

Other governments opted for alternative ways of financing, by creating stat-backed private entities. These are mostly funded by public funds to invest them in regional renewable projects. The most known entity is MASDAR. It is created by the Emirate of Abu Dhabi and is a privately structured company, which aims to channel money of the UAE's sovereign wealth fund to domestic and regional renewable energy projects. It is also UAE's primary investment fund in clean and efficient energy.[24]

In a similar way, Morocco created Société d'investissement Energetiques (SIE), which is a privately structured company as well. SIE uses public funds of the Kingdom of Morocco to design and finance the sustainable energy projects domestically.[25]

Other Arab countries, instead of creating new companies, preferred to use existing financing channels. Kuwait uses its own sovereign wealth fund (Kuwait Investment Authority) to finance plans of renewable energy projects within the country. Libya also has chosen to direct a portion of the public budget to these plans.

Beyond public funding there is also funding from Institutions. These are mainly International Financing Institutions, which use their own funds or governments funds. Some examples include World Bank, European Investment Bank, Islamic Investment Bank, or African Development Bank, mainly for projects in North Africa (Krupa, Pudineh, 2017). There are also local financial institutions with a high presence in the domestic market.

Projects in the region are also supported by EPC Companies (Engineering, Procurement, Construction). They may be either foreign companies or local ones. Examples of foreign EPC Companies are SENER (Spain), First Solar (USA) and Abengoa (Spain). Examples of local companies are MASDAR (UAE), Abdul Latif Jameel (Saudi

[23] IRENA, Pan-Arab Renewable Energy Strategy 2030 : Roadmap of Actions for Implementation .

[24] http://www.masdar.ae/en/

[25] See more about the investments made by SIE at their own website. www.siem.ma/en/investment-principles

Arabia) and ACWA Power (Saudi Arabia).

For most of the larger projects, a consortium between foreign and local companies is created to carry out these projects. In this way, there is a combination of local ability in project development and of the EPC expertise. This is the main factor of success of large renewable projects, like Ouarzazate 1 (Morocco), Shams 1 (UAE), the larger ongoing renewable project in the region, and the second phase of Mohamed bin Rashid Al Maktoum (UAE). Other small scale developers are successfully operating in the region. UAE's Enviromena has recently acquired a portfolio which includes 30 projects in Gulf.

Finally, there are also some climate finance institutions, which are international climate funds and institutions created by government donors to provide developing countries with public funds in order to implement climate-related projects. The most notable are Climate Investment Funds (CIF), Global Environment Facility (GEF) and Green Climate Fund (GCF).

In the region there are the necessary instruments and organizations to finance these investments. With time, and the appropriate experience, investment in renewable projects will be rapidly scaled-up. Public funds, Sovereign Wealth Funds, Banks, Institutions and Companies are willing to collaborate and finance these investments, because of the attractiveness of the market. The final result will depend on the ability of the renewable energy market to attract local and foreign investments.

VII. Towards the Deployment

The policies that need to be taken is a huge issue and many authors, researchers and scientists have written about it. A. Amin admits that it is a complex and multidimensional issue, as improvement of institutional framework is not enough to achieve the goals, but also, the availability of finance must be ensured, necessary workforce must be taught the appropriate skills and grid infrastructure has to be built (Amin, Matar, Emtairah, 2014).

In this chapter some measures and policies are presented, in order to understand that the way towards renewables is not a simple path, but requires commitment and hard work in many ways.

The most important aspect is the political stability. There has to be a strong political commitment to implement renewable energy infrastructure and it will be a difficult shift, because in the MENA region, there exist many interests associated with oil and natural gas. As a result, the shift to renewables will be a difficult decision for many governments in the region. However, it is really important that policy makers take measures, which attract investors, and avoid past practices, which drive away potential investors (Krupa, Pudineh, 2017).[26]

As regards to the technical assistance, the proposed initiative by IRENA includes technical and financial support to countries, capacity building and expert workshops at regional levels, so that national energy specialists are engaged to NREAP development (IRENA, 2013). Moreover, a web-based Pan-Arab platform should be introduced, which will contain all the necessary information and advice on support for NREAP preparation. It will also contain a template for progress monitoring, reports to the League of Arab States, and performance indicators.[27]

The way of financing is an important issue as well, it was described in a separate chapter in this paper. There exist many opportunities in financing the scheduled projects, but the most important is to establish regulations that permit and promote private investments. There has to be cooperation among the states and elites in these countries, because it hides a huge potential. The biggest projects need the participation of great energy companies of the region, which will contribute with the necessary studies, researches, technology and skilled workforce as well.

Some parts of the AREF and NREAP template include grid issues, which state that significant investment in new renewable power plants and transmission system infrastructure is required (IRENA, 2013). IRENA in cooperation with the League of Arab States have launched a regional initiative, the Clean Energy Initiative in the Arab region, which aims to promote an action agenda that include key regional elements. Some important are 'capacity building to develop the human and institutional capacity build, plan, operate and maintain power grids with higher shares of renewable electricity integration' and 'enabling framework for investments to open markets to renewable power producers, reduce the cost of renewable power financing and facilitate renewable power trade' (IRENA, 2013).[28]

As years go by renewable energy infrastructure is becoming more and more cost effective and has gained competitive advantages. However, technology to build the necessary systems is still in an early stage. More EPC companies shall be involved in the projects, because they can contribute in building infrastructure across the region. For this issue, cooperation between different players is needed, a fact which proves that this transition needs a wider consensus. EPC companies can play an important role in building infrastructure

[26] J. Krupa, K. Pudineh, 'Financing Renewable Electricity in the resource-rich countries of the Middle East and North Africa', The Oxford Institute for Energy Studies, 2017

[27] IRENA, Pan-Arab Renewable Energy Strategy 2030: Roadmap of Actions for Implementation.

[28] See also IRENA, Pan-Arab Renewable Energy Strategy 2030:Roadmap of Actions for Impementation.

and systems, as they can contribute with skilled work labour as well.

VII. **Conclusion**

Arab countries across the Gulf are great players in the energy sector worldwide. They have managed to achieve and maintain significant development taking advantage in their fossil fuels; whole economies in the region are based on these fossil fuels. However, since oil and gas will not last forever, policy makers in the MENA Region came into agreement for a shift to renewable sources of energy.

Currently, there are some Arab States, which have already deployed some renewable plants, mainly for solar and wind power. Across the MENA region there is high solar irradiation, which gives a great advantage to Arab countries for developing renewables infrastructure. Egypt, Morocco and the United Arab Emirates have implemented some solar and wind powerplants.

The shift to renewables was decided in 2014, because of the huge potential that the region has. Energy consumption is always increasing domestically and the decision to shift was driven by the need to cover this consumption. Targets have been set by Arab states for 2020 and 2030 and some projects are already under construction.

Cooperation among countries is on the rise, as they are trying to exchange necessary information. Technology, infrastructure, capitals and human capitals are the main sectors in which the cooperation is going forward. However, there shall be cooperation in each aspect for better implementation of renewables.

Governments and institutions are coordinating in research and innovation, while financial institutions and companies find solutions for the capitals needed to invest. The basic source of funding the projects will be public funds, governmental funding. Moreover, Institutions will also fund some projects, while financial aid will also come from abroad, like the European Union. Finally, there have been some efforts for private sector participation in the projects, but they still remain in early stages due to barriers in these countries. However, in the next years participation of the private sector is expected to be promoted.

To sum up, the purpose of this Energy Policy Paper is to present the prospect and the potential that Arab countries have regards to renewable energy implementation. These countries are willing to do significant efforts in order to achieve the targets that are set. On any case, international energy community expects lot from Arab states, because they will show the way to other countries to implement renewable energy.

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