Framework document

Regional Cooperation Policy for the development of Renewable Energy in North Africa
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December 2013
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# List of acronyms and abbreviations

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<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADEREE</td>
<td>National Agency for the Development of Renewable Energy and Energy Efficiency</td>
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<tr>
<td>NA</td>
<td>North Africa</td>
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<tr>
<td>AFD</td>
<td>French Development Agency</td>
</tr>
<tr>
<td>ANME</td>
<td>National Agency for Energy Control</td>
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<tr>
<td>APRUE</td>
<td>Agency for Promotion and Rationalization of Energy Use</td>
</tr>
<tr>
<td>IEA</td>
<td>International Energy Agency</td>
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<tr>
<td>ADB</td>
<td>African Development Bank</td>
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<tr>
<td>EIB</td>
<td>European Investment Bank</td>
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<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
<tr>
<td>BOOT</td>
<td>Build, Own, Operate and Transfer</td>
</tr>
<tr>
<td>MAD</td>
<td>Moroccan Dirham (1€=1.1 MAD)</td>
</tr>
<tr>
<td>SWH</td>
<td>Solar water heater</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework on Climate Change Convention</td>
</tr>
<tr>
<td>CSP</td>
<td>Concentrated Solar Power Plant</td>
</tr>
<tr>
<td>EGY SOL</td>
<td>Italian cooperation programme for the development of the use of solar water heating in the hotel sector.</td>
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<tr>
<td>EE</td>
<td>Energy Efficiency</td>
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<tr>
<td>RE</td>
<td>Renewable Energy</td>
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<tr>
<td>FIT</td>
<td>Feed in tariff</td>
</tr>
<tr>
<td>FNME</td>
<td>National Energy Control Fund</td>
</tr>
<tr>
<td>FOGEER</td>
<td>Guarantee Fund for Energy Efficiency and Renewable Energy</td>
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<tr>
<td>GWh</td>
<td>Gigawatt-hour</td>
</tr>
<tr>
<td>KfW</td>
<td>German Development Bank</td>
</tr>
<tr>
<td>Kgoe</td>
<td>Kilogram of oil equivalent</td>
</tr>
<tr>
<td>ktoe</td>
<td>Thousand tonnes of oil equivalent</td>
</tr>
<tr>
<td>kWh</td>
<td>Kilowatt hour</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>MEDREC</td>
<td>Mediterranean Renewable Energy Centre</td>
</tr>
<tr>
<td>MEDREP</td>
<td>Mediterranean Renewable Energy Partnership</td>
</tr>
<tr>
<td>MRV</td>
<td>Measurement, Reporting and Verification</td>
</tr>
<tr>
<td>MASEN</td>
<td>Moroccan Agency for Solar Energy</td>
</tr>
<tr>
<td>mtoe</td>
<td>Million tonnes of oil equivalent</td>
</tr>
<tr>
<td>MW</td>
<td>Megawatt</td>
</tr>
<tr>
<td>MWp</td>
<td>Megawatt peak</td>
</tr>
<tr>
<td>MWh</td>
<td>Megawatt hour</td>
</tr>
<tr>
<td>NAMA</td>
<td>Nationally Appropriate Mitigation Action</td>
</tr>
<tr>
<td>NEAL</td>
<td>New Energy Algeria</td>
</tr>
<tr>
<td>ONEE</td>
<td>National Electricity and Drinking Water Office</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>PV</td>
<td>Photo-voltaic</td>
</tr>
<tr>
<td>SIE</td>
<td>Energy Investment Company</td>
</tr>
<tr>
<td>SONELG AZ</td>
<td>Algerian National Electricity and Gas Company</td>
</tr>
<tr>
<td>STEG</td>
<td>National Electricity and Gas Company</td>
</tr>
<tr>
<td>STEG ER</td>
<td>STEG Renewable Energy</td>
</tr>
<tr>
<td>TND</td>
<td>Tunisian Dinar (~€0.5)</td>
</tr>
<tr>
<td>TeCO2</td>
<td>Tonnes of CO2 equivalent</td>
</tr>
<tr>
<td>toe</td>
<td>Tonnes of oil equivalent</td>
</tr>
<tr>
<td>AUE</td>
<td>Arab Union of Electricity</td>
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PREFACE

The North African countries have not yet taken full advantage of the cooperation opportunities in the region, nor in terms of market development (intra-regional trade represents less than 4% of their total trade) nor in terms of promoting new economic opportunities contributing to sustainable growth and job creation. The economic cost of this lack of integration has been estimated at about 2-3 percent of GDP.

The energy sector could play a key role in the region’s socio-economic development and be a driver of regional integration, given on the one hand, the importance of solar energy resources (oil, solar and wind depending on the country) and on the other hand the countries’ strong dependence on energy trade: some to balance their energy budgets, others because their energy exports often constitute the bulk of the wealth created.

Energy policies implemented in the countries of North Africa reflect individual strategies that take little account of the choices made by neighboring countries, despite the proximity of their markets, complementarities that may exist as well as the opportunities for economies of scale.

The challenges (increasing demand for energy, sustainable development, low competitiveness, reducing environmental impacts) and the opportunities (value added, job creation, transfer of knowledge and technology acquisition) that North African countries are experiencing today in this field, call for collective action across the whole region, oriented towards tangible results.

The implementation of the energy transition offers an opportunity to establish new regional industrial sectors (wind, PV, CSP, energy efficiency) creating jobs. The need for the significant investments required to develop these sectors coupled with the need to organize the associated technology transfers, offer many opportunities to build truly innovative public-private partnerships.

The region could further strengthen its position as an actor, forming the Euro-Mediterranean energy transition, and also its collaboration with other regions on the continent, especially the Western region.

In this context, regional cooperation is expected to be built gradually, based on a long-term vision and common strategic areas through (i) a strengthening of the dialogue, information and knowledge exchange, (ii) harmonization of policies and regulatory frameworks and (ii) the implementation of joint projects.

This publication examines issues related to energy transition in North Africa, the way it is understood by the countries, their progress and major challenges faced, in promoting the
development of renewable energies. It focuses on key opportunities for cooperation in four key areas: funding, the development of a regional market, industrial integration and skills development.

The report provides the conceptual basis for a common policy and guidelines for defining a roadmap and a steering mechanism, facilitating implementation.

This publication is the result of a highly participatory process that relied on technical consultations in the context of an enlarged experts’ meeting and a peer review process, to which several partners took part, including UMA, LAS, ESCWA, RCREEE and IRENA. Thanks to all of them.

Finally, it is essential to emphasize the importance and centrality of an effective commitment of the countries and actors in the renewable energy sector, in the implementation of a shared vision and a program of action that combine public and private initiatives, forging regional partnerships that will benefit the welfare of all citizens of the region.

Karima Bounemra Ben Soltane

Director, ECA/SRO-NA
1. Introduction and Background

In 2011, the United Nations Economic Commission for Africa’s Office for North Africa launched a project on innovative financing mechanisms for renewable energy in North Africa. It had for objective to support the efforts of the region’s countries (Algeria, Egypt, Libya, Mauritania, Morocco, Sudan and Tunisia) to enhance energy security and fight climate change.

Through its various expert meetings, the project highlighted the fundamental role of renewable energy for the region’s energy transition. The large-scale development of renewables is expected to accompany the structural transformation of the region’s economies and their progress towards a diversified industrialization, creating great added value and skilled jobs.

In 2012, two studies were published by the project. The first, entitled "The renewable energy sector in North Africa: current situation and prospects", established a baseline for the development of renewable energy and energy efficiency in North Africa. It also analyzed the potential opportunities in the medium and long term, the lessons learned from past and ongoing initiatives, as well as existing barriers and perspectives. The second entitled "Study on innovative financing mechanisms for renewable energy projects in North Africa", focused on the constraints regarding projects’ financing and innovative financing mechanisms suited to the characteristics and objectives of the region and the countries. A compendium of best practices is an integral part of the second study.

The strengthening of regional cooperation has also emerged as an imperative for removing the multiple constraints that are still limiting the development of renewable energy sources. These constraints concern: (a) limited investment capacity, (b) regulations and unattractive market conditions, (c) insufficient interconnection capacities and (d) significant needs in innovation, technology transfer and skills development.

In fact, each country implements its national plan in isolation, while studies of the Maghreb Electricity Committee (COMELEC) highlight that savings could be attained by 2020, through a regional approach promoting synergies between countries and the creation of a regional market.

North Africa has many assets that speak for the establishment of a common cooperation framework for renewable energy: great potential to develop renewable energy resources in
order to increase the electricity generation capacity\textsuperscript{1}, the emergence of new technologies and skills, opportunities to achieve economies of scale and increase trade, more efficient use of resources, improving the competitiveness and the development of economic activities.

In a context of economic globalization and trade, adoption and implementation of a common regional development policy for renewable energy will be a key driver to position the region on the global arena.

This publication presents the context, challenges, goals and major strategic directions aiming at the establishment of a regional cooperation framework, which has for objective to promote the dialogue and the reinforcement of the coherence between the national policies in the region, as well as to remove the major obstacles to the development of a true common market for renewable energy.

It has been developed through a participatory and collaborative approach that allowed a large number of experts from the region to contribute, during a workshop held on 24 and 25 September 2013 in Rabat. It has also benefitted from peer review by regional and international institutions (AMU, LAS, IRENA, ESCWA, and RCREEE) and some national institutions (ADEREE, STEG-ER, NREA ...). Synergy with the Arab Renewable Energy Strategy (2010-2030) adopted in January 2013 has been assured.

This document is a first step in a process to create an effective framework for cooperation between the countries. It is a guiding document that aims to formalize the strategic regional vision, but it is also an approach that involves creating synergies, enhancing complementarities and integrating the perspectives of the different actors, including regional and sub-regional institutions. It will also facilitate the dialogue with donors to mobilize and channel funding towards common strategic areas.

The national ownership of the cooperation framework and the commitment of all stakeholders remain indispensable. A regional institution could be identified to continue the regional dialogue and steer the implementation of the cooperation framework.

\textsuperscript{1} The countries need to double their electricity generation capacity by 2020, which implies the creation of an additional installed capacity of 45,000 MW.
2. The North African Energy landscape: The Vital Energy Transition

Although some North African countries are large energy exporters, energy security in the medium and long term remains a common issue of strategic interest for all the countries of the region. They must commit themselves to an energy transition process to make better use both of conventional and non-conventional\textsuperscript{2} energy resources as well as of the great renewable energy potential.

2.1. Energy access challenges

The energy consumption of the countries in the North Africa region is undergoing a steady growth, explained by the increased domestic demand, combined with a fast rate of urbanization and important needs coming from industry development.

The level of primary energy consumption per capita is fairly variable, depending on the country. It is highest in Libya with 2080 Kgoe/capita and lowest in Mauritania with only 280 Kgoe/capita. In the other countries, the specific consumption is between 1116 Kgoe/capita in Algeria and 370 Kgoe/capita in Sudan. These values reflect the difference in energy access in the countries. The average value of the specific consumption, which is 817 Kgoe/capita for the whole region, is less than half of the world average (1,880 Kgoe / capita in 2011, source IEA). The following chart shows the spread of the values for per capita consumption in the countries of the region.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{(Source: IEA, 2013)}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{(Source: IEA, 2013)}
\end{figure}

\textsuperscript{2} Shale gas and shale oil, abundant in many North African countries according to the latest study published "Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries, June 2013 ".

\textsuperscript{2} Shale gas and shale oil, abundant in many North African countries according to the latest study published "Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries, June 2013 ".
Moreover, a similar spread can also be observed for the electricity consumption per capita proving to be fairly variable from one country to another, taking into account the level of electricity connection, the level of economic development and the level of household equipments, with a regional average of 1,228 kWh/capita\(^3\) in 2012 and a 23% growth in comparison with 2011 (average of 986 kWh/ per capita). The specific electricity consumption represents only 40% of the world average. The following chart shows the difference in electricity consumption per capita.

(Source: AUE, 2013)

Mauritania and Sudan and to some extent Morocco, have the lowest values in terms of specific electricity consumption. This is explained by low electrification rates (Mauretania and Sudan), the low level of consumption and household equipment as well as the difficulty in accessing this form of energy in these countries.

Electrification levels do indeed differ between the countries. They vary between 95% and 99% for countries like Algeria, Egypt, Tunisia and Morocco while others like Mauritania and Sudan have much lower electrification rates (in the range of 30-35%). In these latter countries, renewable energy offers an opportunity to provide decentralized electricity in remote areas (generally rural), in a more economical way in comparison with conventional electrification solutions. The decentralized options also have a positive impact on the development in these areas, in particular on health, environment, productivity and education.

### 2.2. A high dependence on conventional energy

The energy mix and in particular the electricity mix in the region is still dominated by conventional energy. In 2012, the share of renewable energy in electricity production did not exceed 8%, with 7% from hydraulic energy and the rest (around 1%) from modern

\(^3\) The average electricity consumption in the region is the ratio of the total consumption of the 7 countries in kWh and the total population of these seven countries.
renewables. At the same time, the latter contributes to reducing the countries’ dependency on the volatile fossil fuel prices.

In 2012, total installed renewable capacity in the region was estimated at around 7,773 MW with 6,550 MW from hydroelectricity and 1,180 MW from other modern renewables, mainly wind power and CSPs. Only four countries have renewable energy facilities other than hydroelectricity: Egypt (550 MW\(^4\) wind power and 140 MW CSP and PV), Morocco (255 MW\(^5\) wind power and 20 MW CSP and PV) and Tunisia (155 MW\(^6\)) and Algeria (50 MW)\(^7\).

### 2.3. Energy security challenges

North Africa has an overall fossil energy surplus, producing around 360 mtoe of gas and oil and consuming nearly 160 mtoe per year (IEA, 2012). The overall coverage rate for these needs was 225% in 2012. However, the energy balance varies between the countries in relation to the available resources and the level of consumption. The following chart shows the level of energy dependence of the countries.

(Source: IEA, 2011)

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\(^4\) Source: NREA  
\(^5\) Source: ONEE  
\(^6\) Source: ANME  
\(^7\) Installed power capacity in the countries of North Africa in 2012 MW (Source, AUE & countries, 2012)
Algeria is one of the main hydrocarbon producing countries, in particular exporting natural gas to Europe via the LNG factories’ pipelines supplying Italy/Slovenia and Spain/Portugal, as well as Tunisia and Morocco in small quantities. It should be stressed that the coverage rate for domestic demand by national production fell from 420% in 2000 to 380% in 2012 (source IEA 2012).

In Libya, the production is essentially focused on oil; hydrocarbons make up the largest part of GDP and export income. The coverage rate for domestic demand by national production fell from 352% in 2000 to 330% 2012.

Sudan (North and South)\(^8\) is the fifth largest oil producer in Africa and three-quarters of its production is exported to Asia. However with the official proclamation of South Sudan’s independence in July 2011, Sudan lost 75% of its oil production, which caused an important imbalance in its economy and created social tensions. Today the question of production, exploitation and distribution of oil revenues between the two countries, remains open.

Egypt is a country in gradual transition, from being a net energy exporting country to becoming a net energy importing country with an ever-growing energy imbalance. Whereas Egypt used to be a large-scale energy exporter, currently it only has a surplus of 23%, which risks being quickly absorbed in the coming years due to the high growth in domestic demand. The country is also experiencing a worsening of its budgetary deficit, at present estimated at 10.9% of GDP, mainly due to the fact that the country is maintaining its high public fuel subsidies.

Since the year 2000, Tunisia has been a net fossil fuel importer with a structural energy balance deficit of approximately 20% in 2012, or approximately 1.9 million tonnes of oil equivalent. This fact is explained by the gap between the available resources and the needs in terms of natural gas that constitutes the key source for electricity production. The gap could start to increase as of the year 2020 and could reach 30 to 40 percent in 2030.\(^9\)

Mauritania suffers from a serious shortage of electricity resources, which cannot be solved by sustainable solutions for several years. The increase in aggregate demand by 2017 has been estimated at more than 500 MW, divided between domestic demand (about 150 MW) and the demand from mining companies based on estimations concerning their development of new development projects (approx. 400 MW). The exploitation of the main Chinguetti offshore oilfield started in 2006 but soon ran into serious technical difficulties which led to a drastic fall in production. The fall from 70,000 barrels a day at the start of 2006 to fewer than 8,000 barrels a day in 2012, leaves the country with a 20% external

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\(^8\) Oil resources are mainly located in South Sudan which produces about 400,000 barrels / day or more than 80% of the total production while Sudan has refineries and a pipeline to the oil port.

\(^9\) Source: ANME (Study of electricity mix 2030)
dependency for its energy supply. Further prospecting is underway, mainly at the edge of the continental shelf that holds the greatest potential for oil and gas reserves. However, there is a large degree of uncertainty regarding the actual hydrocarbon reserves on-shore and off-shore (WB, 2011). Considering the country’s economic growth, this gap risks to widen further in the future due to the foreseeable rise in domestic energy demand. This is the reason as to why the country has launched a gas plant project (350 MW by 2020) from the off-shore Banda gas field.

Lastly, Morocco has no conventional energy resources and is highly dependent on imports for its energy supply - over 97%. Also, its demand for energy is on the rise and the country has to find solutions for its energy supply (the electricity demand is increasing with an annual rate of 8%).

In conclusion, several countries of the region have already encountered serious challenges concerning the security of their energy supply. Even countries which are currently self-sufficient are showing a fast tendency toward lower energy independence given the fast-growing domestic demand and the stagnation of their resources, which in time could transform them into oil-net importers.

2.4. Economic challenges for the energy sector

The economic challenges in the region’s energy sector are different for countries which are energy exporters and countries which are energy importers.

For the importing countries, the challenge presents itself both in terms of negative impact on the balance of payments, considering the rise in energy price on the international market, and in terms of pressure on public finances.

In Morocco, national energy imports continue to increase year on year, the national energy bill grows continuously; it reached approximately 11 billion dollars in 2011 compared to 11.7 billion dollars in 2012 (98 billion Dirham) which represented about 11.3% of GDP in 2011. In 2011, direct subsidies of conventional energy were estimated at 5.5 billion dollars which is around 5.1% of GDP. Taking into account this heavy burden, a reform of oil product pricing was initiated as part of the overall reform of the compensation fund, and should be concluded in 2014.

In Tunisia, the retention of the energy price subsidy and the continuous growth in energy demand have led to negative impacts on energy consumption expenditure. Since the mid-2000s, there has been no respite in the growth of energy expenditure and this has become an unbearable burden for the country. The share of energy expenditure in GDP rose from 8.7% in 2008 to 13.7% in 2012. The value of imports amounted to 4 billion dollars (6.4 billion
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

dinars) in 2012, which is 16.8% of the country's total imports. Direct energy subsidies reached 1.7 billion dollars (2.7 billion dinars) in 2012, which is 10% of the State budget. The total (direct and indirect) subsidy to the energy sector totaled 3.2 billion dollars in 2012, which is 20% of the State budget.

For the exporting countries like Algeria, Libya and Sudan (North and South), energy continues to be the essential part of the economy, leaving them vulnerable in the long term because of the expected exhaustion of their resources. In Algeria, the hydrocarbon sector is the backbone of the economy making up 43% of GDP and 98% of the currency revenue. In Libya, hydrocarbons contribute up to 55% of GDP and this proportion might grow in the future, because of the country’s economic situation; it is more and more relying foremost on the oil products.

Taking into account the abundance of energy, these countries are heavily subsidizing energy tariffs. Algeria is one of the Arab countries subsidizing energy products the most, with 10.59 billion dollars in 2010, (whereof 2.13 billion dollars for the electricity sector) or 6.6% of GDP. In 2012, the energy subsidy amount reached 5.8% of the GDP.

In Egypt, the massive subsidies from the government into fuel, gas and electricity are weighing heavily on public finances, and are hampering energy efficiency improvement and the attractiveness of renewable energy for the private sector. In 2012, the subsidy is estimated at approximately 16.3 billion dollars, with 5 billion dollars going to the electricity sector. The subsidy accounts for over 20% of the State budget and around 12% of GDP.

Libya depends mainly on oil revenues, which are considered the main source of income. The subsidies for oil, electricity, natural gas and coal represented 9% of GDP in 2011, according to estimates from the IMF and the World Bank.

2.5. A weak regional energy integration

The electricity exchanges in the area of “North Africa” are foremost emergency swaps. There are neither any real commercial exchanges nor an electricity market. The countries’ electric networks are interconnected in the context of the ELTAM scheme (Egypt, Tunisia, Algeria and Morocco). The first steps toward regional energy integration were taken with the development of the interconnections of the Moroccan electricity network with the one of Algeria10 (transit capacity: 1,200 MW) and of Spain (1,400 MW). A new interconnection is under way between Morocco and Spain, to increase capacity to 2,100 MW. Tunisia has four interconnections with Algeria and a fifth connection of 400 kW should be opened in 2014.

10 Morocco and Algeria were striving to strengthen emergency electricity exchanges between the two countries.
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

Tunisia also possesses three interconnections with Libya, but these lines built in 2003 have not yet become operational for technical reasons.

The 220 kV connection between Tunisia, Algeria and Morocco is synchronized with the European ENTSOE system (European Network of Transmission System Operators for Electricity).

Even if existing interconnections appear to be sufficient to launch a regional electricity market, the gradual strengthening of electricity networks (construction of 400 kW connections) and interconnection networks between the countries (increase of the main international interconnections to an extension of 400 kW) should be speeded up so as to promote integration of renewable energy projects with national networks and enable better demand management.

**The Euro-Mediterranean integration in terms of renewable energy**

North Africa is destined to play a key role in the plan to create a Euro-Mediterranean electricity market. The networks of the three North African countries (Algeria, Morocco, and Tunisia) are already connected to the European network (managed by the European Network of Transmission System Operators for Electricity (ENTSOE)). These countries are taking an active part in the dialogue and initiatives organized by the European Union within the framework of the Euro-Mediterranean energy partnership\(^\text{11}\) which over time aims at integration of energy markets, with the long-term possibility for countries to export electricity to the European Union. Two major initiatives underpin this objective: the Mediterranean Solar Plan and the Desertec Industrial Initiative. Desertec however is currently refocusing its strategy towards creating integrated local markets.

These initiatives focus on several areas related to the convergence of policies, legislative and regulatory frameworks with the provisions in force at European level, the completion of the Mediterranean electricity ring and the strengthening of technological cooperation for the creation of a Euro-Mediterranean industrial landscape for Renewable Energy and electricity networks. They focus on developing the skills of the domestic private sector and the promotion of European industries who wish to take advantage of investment opportunities in renewable power generation projects in North Africa.

The South must strengthen its high voltage network in the context of integration into the Euro-Mediterranean market. The following projects new submarine connections between

\(^{11}\) The EU is counting on renewable energy to help secure its supplies, limit its heavy dependence on imported hydrocarbons and lower carbon emissions. It has set the target of achieving 20% of its energy consumption from renewables by 2020.
the south and north of the Mediterranean are expected to play a key role in achieving the Mediterranean electricity ring:

- Between Spain and Morroco, two cables of 700 MW (alternating current) are in service. A third cable of the same power is planned.
- Between Spain and Algeria, a project of two 1,000 MW cables has been studied. Longer and more expensive, SONELGAZ negotiated a transit fee with ONEE to be able to access the cables in the Strait of Gibraltar.
- Between Italy and Algeria, a project of two cables of 500 MW is planned. They would arrive in Sardinia and would join the existing connection Italy-Corsica, and the connection Italy-Sardinia link.
- Between Italy and Tunisia, a project of 1,000 MW, with 600 MW to be used during the first stage is well advanced; it is associated with the construction of a conventional thermal power plant of 1,200 MW in Tunisia.
- Between Italy and Libya, a project of two cables of 500 MW that could pass through Malta (Malta to be integrated to the large north and south networks).

The following picture illustrates the Mediterranean electricity ring.


3.1. Small achievements thus far, but positive dynamics

Installed renewable electricity capacity in the North Africa reached approximately 7730 MW in 2012, or 12% of total installed capacity. Electricity from hydroelectricity is still the most commonly used renewable energy in the region, with a capacity of 6550 MW. Other renewables (wind and solar) only account for around 2% of installed capacity.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total RE</th>
<th>Hydro</th>
<th>Wind</th>
<th>Solar (CSP and PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>12 949</td>
<td>278</td>
<td>228</td>
<td>-</td>
</tr>
<tr>
<td>Egypt</td>
<td>29 312</td>
<td>3 487</td>
<td>2 800</td>
<td>547</td>
</tr>
<tr>
<td>Libya</td>
<td>8 788</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Morocco*</td>
<td>6 677</td>
<td>2 045</td>
<td>1 770</td>
<td>255</td>
</tr>
<tr>
<td>Mauritania</td>
<td>253</td>
<td>98</td>
<td>97</td>
<td>-</td>
</tr>
<tr>
<td>Sudan</td>
<td>2 850</td>
<td>1 593</td>
<td>1 593</td>
<td>-</td>
</tr>
<tr>
<td>Tunisia*</td>
<td>4 095</td>
<td>225</td>
<td>66</td>
<td>155</td>
</tr>
<tr>
<td>Total</td>
<td>64 924</td>
<td>7 726</td>
<td>6 554</td>
<td>957</td>
</tr>
</tbody>
</table>

Installed electric capacities in the countries of North Africa in 2012 in MW (Source: AUE & countries, 2012)

In terms of electricity production, renewable energy besides hydroelectricity account for less than 1% of the electricity mix and for 8% with hydroelectricity included.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total RE</th>
<th>Hydro</th>
<th>Wind</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>54 086</td>
<td>449</td>
<td>389</td>
<td>-</td>
</tr>
<tr>
<td>Egypt</td>
<td>157 407</td>
<td>14 938</td>
<td>12 934</td>
<td>1 525</td>
</tr>
<tr>
<td>Libya</td>
<td>33 980</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Morocco</td>
<td>26 356</td>
<td>2 570</td>
<td>1 818</td>
<td>728</td>
</tr>
<tr>
<td>Mauritania</td>
<td>470</td>
<td>148</td>
<td>146</td>
<td>-</td>
</tr>
<tr>
<td>Sudan</td>
<td>8 182</td>
<td>5 365</td>
<td>5 365</td>
<td>-</td>
</tr>
<tr>
<td>Tunisia</td>
<td>16 780</td>
<td>313</td>
<td>110</td>
<td>196</td>
</tr>
<tr>
<td>Total</td>
<td>297 261</td>
<td>23 783</td>
<td>20 762</td>
<td>2 449</td>
</tr>
</tbody>
</table>

Electricity production in the countries of North Africa in 2012 in GWh (Source, AUE & countries, 2012)
Electricity generation projects from renewable energy are multiplying in Morocco, Egypt, Algeria, Tunisia and recently also in Mauretania. Egypt and Morocco are far ahead and take the lead in terms of renewable capacity, whereas a country like Libya is still 100% dependent on conventional energy for its electricity production. Mauretania has inaugurated its first solar plant (15MW) in 2013 and has launched the construction of its first wind power plant (31.5MW). The country is preparing its national strategy for renewable energy development.

### 3.2. Ambitious national strategies

Today, almost all the countries of the region have strategies for developing renewable energy and most of them have put in place national plans and programmes with ambitious targets to be achieved mid- and long term, 2020/2030\(^\text{12}\). These policies generally focus on the deployment of technologies involving photo-voltaic solar energy, wind power and solar thermal, depending on each country’s existing potential. Within an overall framework, they integrate the aims of environment protection, economic diversification, development of a local industrial base, job creation, knowledge strengthening and human development. In particular they highlight:

- Mobilizing and attracting national and foreign private investment through the improvement of the business environment and the legislation governing investment and trade in the field of renewable energy.
- Building R&D and human capital training in this field.
- The strategic role played by the use of renewable energy in developing a competitive industrial landscape and creating sustainable jobs.

The following table summarizes the long-term objectives announced by the various countries of the region:

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\(^\text{12}\) ECA-NA Publication: The renewable energy sector in North Africa: current situation and prospects. September 2012
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

<table>
<thead>
<tr>
<th>Country</th>
<th>Target year</th>
<th>Objective: % of renewables in the electricity production</th>
<th>Objective: installed renewable energy capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>2030</td>
<td>40% (37% solar and 3% wind)</td>
<td>- CSP: 7200 MW, PV: 2800 MW, Wind: 2000 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- 10 GW dedicated to export, allowing to reach critical market size.</td>
</tr>
<tr>
<td>Egypt</td>
<td>2020</td>
<td>20% (whereof 12% wind and 8% hydro and others)</td>
<td>- Wind: 7200 MW, Biomass: 1500 MW</td>
</tr>
<tr>
<td>Libya</td>
<td>2020</td>
<td>10%</td>
<td>- Wind 1500 MW, CSP: 800 MW, PV: 450 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Solar water heaters: 1 Mm²</td>
</tr>
<tr>
<td>Morocco</td>
<td>2020</td>
<td>42% of the installed power whereof 14% wind, 14% solar and 14% hydro.</td>
<td>- Wind: 2000 MW, CSP/PV: 2000 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hydro 2000 MW, Solar water heaters: 1,7 million m²</td>
</tr>
<tr>
<td>Mauritania</td>
<td>2020</td>
<td>20%</td>
<td>- na</td>
</tr>
<tr>
<td>Tunisia</td>
<td>2030</td>
<td>30% (15% wind, 10% solar PV and 5% CSP)</td>
<td>- Wind 1760 MW, CSP: 460 MW, PV: 1500 MW, Biomass: 300 MW</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Solar water heaters: 1,5 million m²</td>
</tr>
<tr>
<td>Sudan</td>
<td>2030</td>
<td>-</td>
<td>Wind 500 MW, CSP/PV: 2000 MW</td>
</tr>
</tbody>
</table>

National strategy targets for renewable energy in the countries of North Africa (Source: Various national sources)

### 3.3. Emerging tools for implementation

#### 3.3.1. A consolidated institutional base

Today, all of the countries in the region, besides Sudan and Mauritania, have specific institutions and agencies dedicated to energy management and more particularly renewable energy. A non-exhaustive list includes:

- The ANME, STEG-ER and the energy-techno park “Ecopark” in Tunisia
- The ADEREE, MASEN and IRESEN in Morocco
- The NREA in Egypt
- The APRUE and CDER and the AER in Algeria
- The GECOL, the REAOL and the CSER in Libya, etc.

However, in general these institutions need to be strengthened and even reformed in order to be able to play the intended role in supporting energy transition in the countries of the region. So was the case in Morocco before the creation of ADEREE and MASEN, it is the case in Libya and Algeria who are in need of reforms, and to a lesser degree of Egypt and Tunisia where there is a reinforcement need.

#### 3.3.2. Regulatory reforms focusing on greater openness toward the private sector

From a regulatory viewpoint, reforms are ongoing so as to encourage and support the change of scale announced by the strategies, in particular by the opening up of the electricity production to private production from renewables. A number of countries have
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

put in place (or have plans to do so) a specific legal framework for electricity production from renewable energy. Morocco, and in the near future also Tunisia and Egypt, are seen as pioneers in this field.

**In Morocco**, the law 13-09 on renewable energy authorizes private electricity production from renewable sources and electricity self-generation (currently capped at 50MW) with the surplus being fed into the HV grid. Discussions are underway to extend the provisions of the 13-09 law on access by renewable energy to the medium-voltage (MV) and low-voltage (LV) network. This opening marks an important phase in the private production of green electricity. An independent national energy regulation authority is to be created in 2014.

**In Algeria**, the electricity law allows for the purchase of electricity produced from renewable sources and ensures priority access to the network. An Electricity and Gas Regulation Commission is in place since 2005. However, the contribution of the private sector remains limited and is largely dependent on an effective improvement of the business climate.

**In Tunisia**, the legal framework in vigor authorizes private electricity production only in the framework of concessions with the government. The legal framework also allows the private sector to generate electricity for self-consumption with the possibility of feeding the surplus into the network, with a limit of 30% of the electricity produced each year, at a price equivalent to the STEG sales price of medium voltage (MV) electricity. The Government determines sales prices on an annual basis. However, a new bill on electricity production is under discussion to allow independent green electricity producers to sell their production to the network via advertised tariffs guaranteed by the State, for wind and PV solar power and biomass. This bill should be passed and published in 2014.

**In Egypt**, legislation does not give priority access for renewable energy but the electric company (EETC) currently buys all the electricity produced by these renewable sources. A purchase tariff is being prepared. In 2010 Egypt passed a decision to set up long-term purchases (20-25 years). A new bill on public-private partnerships (PPP) was passed in 2010 and provides a framework for private investment in the electricity sector, in particular for wind power generation.

**In Libya**, the electricity sector is undergoing intensive reorganization after the revolution. The sector is not yet open to private investors and no incentive policy has been set up for renewable energy. However, a bill is seemingly being prepared to authorize private enterprises to produce electricity. In the short term, it is foreseen that the first projects will be financed by the State budget. Work still needs to be done as regards regulation to open up the sector to private participation in electricity production and to introduce appropriate support mechanisms to encourage it.

Towards FDI-growth in Moroccan Renewable Energy. Since 2009, Morocco attracts more and more foreign consortia and SMEs in its renewable energy sector. (Concessions and PPP, management contracts, partnership conventions ...)
In Sudan, the electricity law (2001) authorizes private sector electricity production but the current legal framework does neither allow private self-generation of electricity from renewables, nor the possibility of feeding surplus production into the network.

In Mauritania, the electricity code liberalizes segments related to production, transport and distribution but does not differentiate between the sources of energy. A study on electricity pricing is under way.

Despite the advances acknowledged in some countries, there is still work to be done to increase the speed to achieve an effective opening of the electricity market to renewable energy, so as to create real opportunities for independent energy producers and increase the participation of private capital. For the time being, the State remains the largest investor in the sector. Private sector participation continues to depend on the removal of a number of obstacles in particular concerning: i) the opening of the electricity market to independent green energy producers, ii) access to finance (high cost of borrowing), iii) implementation of incentive mechanisms, iv) an increased visibility for network development policies and v) above all, the implementation of actual electricity regulators who can protect private investors against any abuse by national electricity companies whom are still the single buyer of the produced electricity.

The mobilization of private investment is dependent on the clarification of rules, the fixing of electricity price, the reform of fossil fuel subsidies, the implementation of fiscal incentive measures and adapted financing. In almost all the countries in the sub-region, there is a complete absence of renewable energy independent power producers (IPPs) and self-generators, except in Morocco where total renewable electricity generation has reached 124 MW for independent producers and 32 MW for self-generation in 2013. In Morocco in February 2013, GDF SUEZ and its partner Nareva Holding announced the construction of the Tarfaya wind farm, with a capacity of 300 MW. This is the biggest wind project in Africa. The Tarfaya farm has a 20-year electricity purchase contract with the National Office for Electricity and Potable Water (ONEE). In Egypt, the first private wind project (250 MW) is currently undergoing a public tender process and the first auto-production wind project is under construction (120 MW). Note also that Egypt and Tunisia have developed a net-metering policy for small photovoltaic projects connected to the network with Low Voltage.

It should be noted that the increased contribution of the private sector depends mainly on the degree of market opening, the existence of incentive instruments for investment and clear and transparent procurement rules. Feed-in tariffs and the establishment of an appropriate and foreseeable long-term purchasing framework for the produced electricity are vital guarantees for investors.

3.3.3. Innovative financial tools emerging in the region

The development of renewable energy is still heavily based on public funding and Official Development Assistance. Private investment is almost non-existent, mainly because of the

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13 The net metering policy allows small renewable energy projects to feed electricity into the grid. (Purchase of excess production).
specific risks associated with renewable energy, a too long return on investment, unattractive market conditions, the narrow domestic markets and the low degree of integration of the countries’ electrical networks.

In recent years some countries have created specific funds, set up dedicated credit lines and incentive systems to make renewable energy more attractive for end users and investors. Examples include:

- The National Energy Management Fund in Tunisia, set up in 2005 to give investment subsidies to energy efficiency and renewable energy activities. This fund is undergoing substantial reform to diversify its intervention mode (subsidies, credit and investment funds), widen its scope of action and its resources. Its new name will be the Energy Transition Fund.

- The National Energy Management Fund in Algeria, which provides investment subsidies and thereby functions like a guarantee fund. A development fund for renewable energy and cogeneration financed by 1% of the annual oil royalty has also been established. The latter supports the differential related to the implementation of the feed-in tariff for renewable energy (wind, PV and CSP).

- Egypt has started discussions to set up a fund for renewable energy.

- In 2010 Morocco created the Energy Investment Company (SIE) which is a limited public investment company with capital of (1) billion MAD (M€ 100) to support State efforts in implementing policy for renewable energy development. The SIE acts as an investment fund by taking active minority holdings in companies running concrete, profitable projects whose industrial feasibility has been demonstrated. It formalizes its holdings by drawing up shareholders’ memoranda laying down transparent methods of governance along with a clear exit strategy.

The countries have also implemented innovative financing mechanisms to attract more resources from the private sector, development banks and financial institutions. These mechanisms include the use of developing Public Private Partnerships (PPP), subsidies, tax

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14 The shareholders are essentially the State and the Fonds Hassen II.
incentives, feed-in tariffs, loan guarantees and credit facilities. They are presented and analyzed in the ECA study on innovative financing mechanisms in the region, published in 2012.

The scale of funding needed requires an integrated approach that involves all stakeholders and that facilitates the introduction of innovative forms of public-private partnership for shared risk taking and an optimal combination of different sources of funding. Public subsidies should be better targeted and directly benefit end users.

### 3.3.4. Countries in the region willing to master the technology

Technological development is an important component of the national strategies of most of the North African countries. Industrial approaches and concrete measures begin to be implemented in some countries, often in the context of cooperation programs with countries of the North.

For example, Algeria aims in its strategy to develop pilot projects to better build national expertise and gradually develop local industrial capacities through strengthened scientific research and technological development, implementing trainings focusing on new professions and the creation of national and international partnerships. There are currently several specialized research centers and units, including the CDER\(^\text{15}\) and the Renewable Energy Institute (IAER). An African renewable energy school should be established in the near future. The photovoltaic sector, is foreseen to reach more than 60% of integration at the national level by 2020, through the (ongoing) construction of a photovoltaic modules factory, capacity of 140 MWp, by the company Rouiba lighting (branch of SONELGAZ). A project for a silicon factory for solar panels, is also ongoing, led by the Unit for Silicon Technology Development (UDTS) of the Ministry of Higher Education and Scientific Research. Furthermore, Algerian solar projects attract the interest of foreign groups who could provide their know-how within the framework of partnerships with the national companies.

In Egypt, equipment manufacturing has already started in the wind power industry, where the national companies working in partnership with foreign businesses, have acquired the know-how and production capacity to manufacture some wind power components (e.g. towers, blades, cables and electrical components and converters). The government has given support, but only on an ad-hoc basis, to the efforts to strengthen the capacity for local manufacturing of the equipment required in the renewable energy industry. However the creation of a local market remains the best form of support for these businesses.

\(^\text{15}\) The CDER, a research establishment in charge of formulating and implementing scientific and technological development research programs for systems using renewable energy.
Moroccan industry is fairly advanced in wind technology. Discussions have started to define the country’s position on the value chains of the renewable energy industry and an industrial strategy for solar energy technologies in the short and medium term should be drawn up. Morocco is currently building the framework for developing a competitive industrial landscape, targeting R&D promotion, supporting innovation and human resource training. The country has a national research institute (IRESEN)\(^\text{16}\) dedicated to applied research in the field of renewable energy and solar in particular. Several techo-parks are being set up. Professional masters and bachelor’s degrees as well as training modules are developed in schools and specialized institutes and a renewable energy training plan is in the making.

ADEREE has also developed a training centre on renewable energy and energy efficiency “Green Platform” and a regional ADEREE- UNESCO centre of excellence has recently been established. Its purpose is: i) provide support to African countries in implementing strategies and policies ii) create trainings concerning renewable energy programmes to strengthen the actors’ capacities iii) promote the exchange of information and experiences as well as promote South-South and North-South cooperation.

Tunisia remains the pioneer among the countries of the region in the solar water-heating industry. The PROSOL programme, launched in 2005, allowed for the creation of a true market with more than 50 active producers of solar-water heaters. The country has a well-developed, diversified industrial landscape, allowing to support the large scale development of renewable energy, for on-grid electricity production. The companies are capable of producing a large share of the necessary mechanical and electrical equipment for wind park construction and PV and CSP installations. Three PV module manufacturing units are under construction with two of them having reached startup phase. Lastly, wind turbine towers and masts are now manufactured in Tunisia and exported to Europe and other regions of the world. The Energy Technical and Research Centre (CRTEn) brings expertise in terms of scientific research and technology within renewable energy. In 2013, a renewable energy cluster was set up at the Borj Cedria technology park with the support of UNIDO, to develop skills, strengthen capacities and promote collaborative activities and R&D.

In Mauritania, a master’s degree in renewable energy has been set up at the Faculty of Sciences and Technology but there is still a lack of well-equipped research centers.

Despite the ongoing progress, the financing for research and development activities are still too limited and the technical cooperation is inadequate.

\(^{16}\) IRESEN's mandate is to create an environment favoring the development of applied research and transfer of know-how in the RE field. It finances innovative projects, led by consortia composed of universities, national and foreign companies.
The countries of the region would benefit from developing a common approach for industrial integration and technical cooperation, to promote the emergence of national companies, joint ventures and to increase the region’s attractiveness to the international industrial partners.

3.4. The main regional initiatives for developing renewable energy: synergies to be reinforced

3.4.1. The Arab Maghreb Union’s (AMU) initiatives

The AMU has set the target of reaching a level of energy exchange in the order of 20% during the next two decades. The current level of intra-Maghrebian exchange accounts for barely 1% of AMU’s primary energy demand.

To achieve its objectives, the AMU plans to:

- Strengthen cross-border transport networks for electricity, natural gas and oil products.
- Pool skills within specialized technology parks in the various segments of the energy sector, and with time reduce technological dependency.
- Carry out common unifying projects in the electronuclear, solar and equipment production fields.
- Create a permanent framework for consultation, coordination and discussion so as to stimulate integration of the sector, harmonize energy policies and propose cooperation strategies for the Maghreb or with other regions.

With specific regard to renewable energy, the actions planned by the AMU concern:

- Continuing the efforts of developing infrastructure for electricity exchanges between the AMU countries.
- Adopting a unified Maghreb strategy for renewable energy and the preparation of a study on the development of local renewable energy industries.
- Drawing up the commercial and technical rules required to facilitate exchanges of electricity between AMU countries.
- Harmonizing renewable energy norms and standards.
- Developing a solar and wind power ATLAS for the Maghreb.
- Advocacy for the creation of national regulators and the establishment of a Maghreb forum for electricity regulating institutions.
- Creating a Maghreb forum bringing together institutions tasked with energy management.

3.4.2. The Euro-Mediterranean initiatives

The energy policies of some countries, Morocco, Algeria, Tunisia and Egypt in particular, follow a regional and international cooperation development dynamic for the integration of
electricity markets and the development of renewable energy. The energy challenge for the region, beyond the issue of hydrocarbon resources, revolves around the setting up of an "integrated regional electricity market", which will depend on the capacity of the countries to coordinate their energy policies and to integrate the various stakeholders into a coherent whole.

In the framework of the Euro-Mediterranean partnership initiatives such as the Mediterranean Solar Plan (MSP)\(^{17}\), the agreements that exist between the EU and some countries of North Africa, the initiatives within AMU’s framework (COMELEC\(^{18}\), North African platform for scientific and university research in the field of renewables) are all forums for consultation and joint action that may improve technical and financial cooperation for effective development of renewable energy, the promotion of a regional electricity market and the construction of a Euro-Mediterranean electricity network. They encourage the exchange of information and experience, consultation and synergies on policies and legal and regulatory frameworks and the building of partnerships.

The Mediterranean Solar Plan has several components: A Master Plan, shared working platforms, new financial support instruments, pilot projects and capacity development as well as the development of industrial partnerships for the emergence of regional industrial sectors in a co-production logic.

To this end, the MSP action plan (or Master Plan) aims at promoting renewable energy and energy efficiency, strengthening electrical interconnections between the two shores of the Mediterranean and developing regional integrated markets. The master plan involves the following key aspects: setting up favorable strategic and regulatory frameworks, strengthening financial support instruments; modernization of transmission systems and infrastructures; support for industrial development and job creation; improved capacity development and know-how transfer.

At the first AMU-EU Council of Energy Ministers, devoted to the planned integration of the electricity markets of Algeria, Tunisia and Morocco with that of the EU, the ministers committed themselves to continue to harmonize legislative and regulatory frameworks and strengthen infrastructures to create a viable electricity market in the Maghreb (Algiers Declaration, June 2010). To this end, work is under way within COMELEC, and the MEDREG-

\(^{17}\)The MSP plans 20 GW production from solar energy in North Africa by 2020, and the development of the Mediterranean interconnection network, which should, in the longer term, be the basis for establishing a Euro-Mediterranean network.

\(^{18}\)The COMELEC is the Maghreb Electricity Committee which aims to: (a) promote electricity trade among its member countries in developing inter-Maghreb interconnections (making an electrical Highway 400 kV) and (b) facilitate the integration of the Maghreb market into the European market in a context of gradual liberalization process.
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

IMME Task Force\(^\text{19}\) (Integration of Electricity Markets of Maghreb Countries) for the implementation of the IMME action plan (2010-2015). The first MEDREG-IMME seminar (September 2011, Algiers) laid the foundation for cooperation between regulation authorities and Energy Ministers and stressed the importance for all countries to have independent regulators. The second seminar (February 2013, Rabat) dealt with drawing up common rules for access to electricity networks and the third seminar (September 2013, Tunisia) focused on the integration of the electricity markets of the Maghreb countries.

The MEDREG and other initiatives like MED-TSO\(^\text{20}\) and MEDGRID\(^\text{21}\) have started work on establishing a Mediterranean Energy Community by 2020.

In this context, MEDREG has launched a study, currently under way to identify the institutional and technical conditions required to mobilize long-term investments in the Mediterranean region. A first draft of this study was presented at the Union for the Mediterranean Conference of Ministers on Energy, held in Brussels in December 2013.

MEDTSO and MEDGRID have as specific objectives to promote the integration of the electric networks in the Mediterranean. MEDGRID plans to present a master plan in 2014 for electric interconnections by 2020-2030.

The Desertec Industrial Initiative (Dii) is working to create a green electricity market for North Africa, the Middle East and Europe. Its new action plan "Power: Getting Started" published in June 2013 presents the future of Dii activities. Dii will work on overall political conditions, adequate sites, development of the electricity market, transmission lines and socio-economic impacts. According to the report, renewable energy could represent 55% of the electricity mix of Europe, North and Middle East Africa by 2030. By 2050, fossil fuels will only play a reserve role, whilst renewable energy would constitute the backbone of the power supply, covering up to 90%.

\(^{19}\) Integration of Electricity Markets of Maghreb Countries (IMME) The IMME Task Force set up by the Mediterranean Energy Regulators (MEDREG) has since October 2010 been involved in preparing capacity-building seminars to discuss the progress required to integrate the electricity markets of the Maghreb.

\(^{20}\) Med-TSO is a cooperation platform for Mediterranean electric transmission system operators set up in 2012 by the European Commission. Its aim is to improve the integration of a regional electricity market over the long term, by coordinating the development plans and operation of networks in the MED-TSO countries, and encouraging integration of their electricity networks. It also aims to implement common criteria and to establish rules for access and use of the networks that will be fair, harmonized and transparent.

\(^{21}\) MEDGRID is an industrial consortium created in 2010 now bringing together 22 industrial partners at European level as well as from the countries of the South and East of the Mediterranean. Its main objective is to define a blueprint for the electricity interconnection network between Europe and the South and East of the Mediterranean by 2020-2025.
3.4.3. The Arab League’s strategy for developing renewable energy

Within the framework of the League of Arab States (LAS), the Arab countries have adopted the Arab strategy for developing renewable energy (2010-2030).\(^{22}\) According to the targets set by the Arab States, the percentage of renewable energy in electricity production is estimated at 2.3% in 2030. The Strategy foresees to reach a penetration of 6% (without hydroelectricity). To this end the Strategy have five specific objectives: (a) improving energy security by diversification of energy resources, (b) using the abundance of renewable energy resources in the region and address the lack of water resources, (c) meet national and regional development needs (d) keep oil and natural gas as strategic reserves and (e) contribute to solving environmental problems.

To achieve these objectives, the strategy focuses on some key measures including: (a) the adoption of national and regional policies aimed at creating an attractive environment for the development of renewable energy technologies (b) the exchange of expertise and of mechanisms to strengthen regional and international cooperation and (c) the encouragement of private sector involvement in developing technologies and research.

Within the framework of national action plans, but also through a strengthened cooperation between the countries, the Strategy recommends Member States to undertake national reforms to create favorable conditions for developing renewable energy. A road-map\(^{23}\) for implementation is being prepared, in collaboration with IRENA and RCREEE. An economic and technical study on the electrical interconnections between the Arab countries is also underway, financed by the Arab Fund for Economic and Social development (AFESD) and the World Bank.

The implementation of this Strategy will require concerted action between the Member States, the League of Arab States and regional and international organizations.

3.4.4. The Africa-EU cooperation programme within renewable energy

Africa’s commitment to the development of renewable energy has clearly been stated in the Declaration of the Conference of African Ministers in charge of Energy (CEMA) held in Maputo in November 2010, in the Abu Dhabi Communiqué on renewable energy in 2011 and in the adoption of the program of infrastructure development in Africa (PIDA) in January 2012). PIDA has a major energy component, under which it is planned to develop large

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\(^{22}\) The Arab Renewable Energy Strategy (2010-2030) was approved by the Arab Social and Economic Summit in January 2013. Renewable energy, from all sources, make up 6.5% of the total electricity generation capacity in these countries.

\(^{23}\) The roadmap for the implementation of the Arab strategy on renewable energy in 2030 is entitled “Ways toward the Implementation of the Pan-Arab Renewable Energy Strategy 2030: Developing a Renewable Energy Road Map of Actions for Arab Countries.”
regional and continental projects for the production and transmission of clean electricity as well as the exploitation of the continent’s renewable energy resources.

In addition, in order to accelerate the exploitation of Africa’s vast renewable energy potential, African and European leaders launched the Africa-EU Programme of cooperation in the field of renewable energy (RECP, 2011-2020). It was launched during the first high-level meeting of the Africa- EU Energy Partnership (AEEP), held in Vienna in September 2010. The Partnership aims to mobilize more financial resources, technical and human support for development of infrastructure and energy interconnections within Africa and between Africa and Europe, renewable energy and energy efficiency, using instruments such as the Energy Fund, the dialogue and partnership Facility of the European Union Energy initiative, the EU-Africa Infrastructure Trust Fund, as well as numerous bilateral instruments. Activities to develop technical and professional skills, in cooperation with training institutions for professionals in African countries are underway.

With the support of RECP, the Centre for Renewable Energy and Energy Efficiency of the Economic Community of West African States (ECOWAS) has formulated a regional policy on renewable energy that was adopted in 2013 by the Ministers of ECOWAS. To support the implementation of this policy, detailed national and regional plans of action were developed.

### 3.5. The regional institutions

Other regional and international stakeholders can play an important role in raising (institutional and human) capacity at regional level and in supporting the implementation of national renewable energy strategies. By way of example, the following are to be mentioned:

- The Regional Centre for Renewable Energy and energy efficiency (RCREEE)\(^24\) set up in June 2008 in Egypt, provides a knowledge base based on regional cooperation in the field of renewable energy and energy efficiency in the Arab region; the RCREEE is active in 13 countries of the Arab region: Algeria, Bahrain, Egypt, Iraq, Jordan, Lebanon, Sudan, Syria, Libya, Morocco, Palestine, Tunisia and Yemen.

- The Mediterranean Renewable Energy Centre (MEDREC)\(^25\) supports five North African countries through mobilization of resources, exchange of information, training and development of pilot projects. It was set up in June 2004 in Tunisia by the Italian cooperation scheme under the Mediterranean Renewable Energy Partnership (MEDREP), and is operating in Algeria, Egypt, Libya, Morocco and Tunisia.

- The aim of the Mediterranean Institute of Renewable Energy (IMEDER), set up in June 2009, at the instigation of the Chamber of Commerce and Industry of Perpignan

\(^{24}\) [www.rcreee.org](http://www.rcreee.org)

\(^{25}\) [www.medrec.org](http://www.medrec.org)
and the Pyrénées-Orientales, is to develop the use of Renewable Energy in the countries around the Mediterranean, via projects "on a human scale". The IMEDER is an association, with the aim of bringing together the professional RE world around collaborative projects integrating public and stakeholders as well as training centers, research laboratories across the 44 countries of the Union for the Mediterranean. The IMEDER addresses all stakeholders and project leaders within Renewable Energy in the countries of the Union for the Mediterranean.

- The International Renewable Energy Agency (IRENA), an intergovernmental organization created in 2009 in Bonn, encourages knowledge management, technological innovation and capacity building. It provides cutting-edge analyses on costs and benefits of renewable energy as well as political recommendations. IRENA works on key questions such as the integration of renewables in electricity networks, assessment of the level of competitiveness and prospects for solar technologies and the development of national and worldwide regulatory frameworks to stimulate innovation and the adoption of the best performing solar energy technologies. IRENA is currently developing a Road map for Renewable Energy (REMAP 2030) and the objective is to double the share of renewables in the global energy mix by 2030.

The regional cooperation policy framework could make it possible, on the basis of common objectives and programs, to improve coordination between all these initiatives and hence optimize their impact, by rationalizing resources and taking advantage of synergies and complementarities.

The development of national capacity for renewable energy production faces a number of multifaceted obstacles that could be overcome through the implementation of a true regional cooperation policy. Although each country is responsible for its own policy, the sharing of experiences, the establishment of partnerships regarding trainings, the transfer of technology and financing, as well as the improvement of synergies between the countries could reinforce the national level activities, making them more effective.

The major obstacles that are hindering the expansion of renewable energy technologies:

- The absence of a policy and framework for investments in renewable energy.
- The gaps in the regulatory and institutional frameworks, in particular in some countries.
- The price distortions that are disadvantageous for renewable energy.
- The high cost for start-up investments.
- The absence of reliable information concerning the potential of renewable energy sources.
- The weak technical command as well as weak industrial development in the region.
- The low level of economic integration of the region’s Member States.
- The lack of information concerning the sustainability of a regional renewable energy market.
- The lack of regional technical norms concerning renewable energy technology.
- The limited competencies in terms of developing bankable projects.

The regional cooperation policy proposed in this document is in coherence with the Arab Strategy on Renewable Energy. It has been developed taking into account the specifics of the North African countries (energy challenges, geographic proximity, continuity of electrical networks, existence of sub-regional institutions like the AMU and the COMELEC, the possibilities for partnership with the EU, etc.).
4.1. The objectives of the cooperation policy

To achieve their ambitious goals, the countries of North Africa are in need of a regional strategic vision that enables them to effectively take advantage of the region’s wealth and of the opportunities related to the development of a strong industrial sector that generates added value and creates jobs. Only a strong regional policy will encourage investors.

The ultimate objective of the regional policy is to create the best conditions for cooperation between the North African countries to promote the development of large-scale and cost effective renewable energy, by taking advantage of opportunities for regional integration and regional complementarities.

These cooperation conditions must lead to the most being made out of the following attributes:

- Synergy effects and combined efforts and resources between the countries in all fields involved in the development of REs (R&D, industrialization, technology transfer, trainings, knowledge sharing, financing, etc.)
- Economies of scale achieved by integration of the regional market and by shared project development (integration of networks, shared storage, etc.)
- Improved negotiating power by the adoption, to the extent possible, of common positions vis-à-vis foreign partners.

Specifically, the framework for the regional cooperation policy should contribute to:

- Supporting national objectives and programs for renewable energy while facilitating dialogue and the exchange of information, mobilization of financial resources and the transfer of knowledge and technologies.
- Creating a regional electricity market based on renewable energy and increasing electricity swaps in the sub-region.
- Supporting the development of industrial integration and strengthening competitiveness in the renewable energy sectors.
- Coordinating regional activities, particularly those aimed at developing RE in the MENA region such as the Union for the Mediterranean with the Mediterranean Solar Plan, the DESERTEC initiative, ...
- Adopting a common external policy concerning cooperation with the European Union, and the big international donors.
4.2. The Strategic axes of the cooperation policy

The regional cooperation policy will be based on four strategic axes:

- Speeding up the development of an attractive regional renewable energy market, particularly for electricity production so as to go beyond the economic constraints linked to the narrow nature of national markets and the technical constraints linked to the low absorption capacity of national electricity networks.

- Increasing investments via the mobilization of financial resources with the private sector and international, regional and national financial institutions as a part of a multi-actor partnership approach.

- Promoting the development of a competitive regional industrial landscape and strengthening the positioning of the region as a platform for industrialization of RE technologies.

- Developing the joint technical and scientific competence through the exchange of experiences, best practice and results from R&D.

For each axis an analysis of the constraints and the action areas are presented below:

4.2.1. Development of the regional renewable energy market

The establishment of a regional market will be made possible by high degree of cooperation among the States, enabling the construction of interconnections, the acceleration of unification of national markets, and the creation of independent regulatory structures with sufficient authority in terms of arbitration and management of disputes and conflicts.

- The major obstacles

The development of the regional market for renewable energy faces a number of constraints which are: a) economic b) technical c) regulatory and d) institutional.

From an economic viewpoint, two major obstacles should be noted in particular:

- Distortions of prices in the energy sector introduced by the tariff subsidies for electricity produced by conventional energy, making renewable energy projects less attractive.

- Specific risks related to investments in renewable energy, in particular for the production of electricity caused by the lack of long-term visibility for the investors.

At a technical level, the common obstacle lie essentially in poor interconnection capacities, which are a fundamental condition for the development of a regional electricity market and
that would allow for a greater flexibility in managing intermittence of renewable energy. However, even when interconnections exist between the countries of the region, market agreements for electricity exchanges are often lacking and the interconnections are generally used solely for occasional emergencies.

**From a regulatory viewpoint,** the major obstacles are the following:

- The lack of harmonized regulations governing renewable energy in the region, thereby hindering market development.
- The lack of transparency for third-party access to the electricity networks and the absence of "Grid Codes" in some countries, a situation that do not promote the injection of electricity from renewable energy into the national networks.
- The low capacity of electricity networks in absorbing renewables due to their irregular nature.
- Lack of common standards and norms for some renewable energy equipment.

**On an institutional level,** five main obstacles have been identified:

- Poor technology command by the public institutions in charge of renewable energy. The development of renewable energy use on a large scale and on a regional level requires a command of the chosen technologies (choice, installation, operation and maintenance) so as to optimize the value chains.
- Insufficient human capacity.
- The absence of a long-term vision to give a strong and reassuring signal to the investors and thus bypass the high costs of developing renewable energy.
- The absence, in some countries, of independent agencies for regulation of the electricity sector.
- The proliferation of dedicated agencies (case of Morocco) when rather, a one-stop-shop scheme and improved administrative procedures should be strived for.

**Actions for a better development of the regional renewable energy market**

The main actions to be implemented in order to develop the regional renewable energy market are the following:

- Complete the operationalization of the electrical interconnections (e.g. Libya-Tunisia) and strengthening existing interconnections and extend them to countries not yet connected (e.g. Mauritania).
- Harmonize the electricity network codes for the integration of renewable energy between the various countries of the region.
- Set up a regional coherent regulatory framework for green electricity exchanges.
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

- Strengthen the regional renewable energy integration capacity in electricity networks (regional network connection plan for renewable energy).
- Adopt a common negotiating position with the European Union with regard to the export of electricity in the framework of the European Directive on renewable energy, Article 9.
- Promote communication and awareness by launching regional campaigns for the public, the decision-makers, etc.

4.2.2. Mobilization of financing

- The major obstacles

The difficulties in mobilizing financing for renewable energy development in the North Africa region stem mainly from the following constraints:

- Lack of visibility and political will in the sense that the strategies announced by the countries are often limited to quantitative targets, but are not accompanied by concrete action plans and genuine political and budgetary commitments by the governments.
- Poor knowledge of the finance needs and the gaps between needs and financial supply, due to the lack of credible evaluation studies on the needs.
- Lack of knowledge among public officials hindering private sector involvement in RE development, this also being the case in Public-Private Partnerships.
- Lack of independent regulators in some countries who could reassure private investors concerning possible abuse by national electricity companies or other State bodies.
- Unattractive business environment in the region, and lack of mechanisms and institutions to mitigate country risks.
- Low profitability of renewable energy projects for the private sector in most countries of the region, considering the absence of suitable purchase tariffs for renewable electricity.
- Compartmentalization of renewable energy markets in the region including the small scale of national markets which do not attract big investors and the implantation of production lines and logistics chains.
- Weak state, business and household financing capacity; investment in renewable energy requires financing capacity, often absent or limited with the countries’ stakeholders.
- Poor involvement of the regional banking sector which is often reluctant to invest in renewable energy.
Regional Cooperation Policy for the development of Renewable Energy in North Africa:

- **Actions for financing mobilization**

  - Improve assessment and analysis of investment and finance needs in the region for the various renewable energy sectors.
  - Set up a specific regional investment fund for renewable energy which could then also play the role of coordinating international financing in the field.
  - Promote the collective dialogue with the big donors (climate fund, ...)
  - Organize regional investment forums.
  - Promote the good practice of some countries of the region in terms of renewable energy finance.
  - Increase the ability of private actors to develop bankable projects.
  - Raise awareness and commitment among central banks in the countries in order to support commercial banks.
  - Develop a common program to build the capacity of regional and national bank institutions (risk assessments, terms for financing projects, etc.)
  - Set up common mechanisms to mitigate risks for investors in renewable energy in the region.
  - Gradually reduce conventional energy subsidies used for energy production, in particular electricity, while assuring a protection of disadvantaged social classes.
  - Developing in parallel, energy efficiency programs that will favor renewable energy development (improving the efficiency of electricity networks to reduce losses, improve the efficiency of electrical appliances to facilitate the removal of subsidies ...).

**4.2.3. Industrial integration**

The countries have the possibility to generate value throughout the whole value chain for renewable energy projects in terms of production of material and components, construction, running and maintenance. These represent the majority of employment opportunities within many renewable energy technologies.

- **The major obstacles**

  The main constraints encountered in terms of industrial integration at regional level are the following:

  - Lack of political will and commitment. A regional industrial integration can never take place in the absence of countries’ genuine will.
  - Lack of information on the state of the industry in the region. It is a matter of achieving industrial integration, using an approach based on complementarity; to do
so, it is useful to develop an information system on the state of the industry at regional level.
- Small size of renewable energy markets, lacking a critical mass.
- Customs and taxation barriers. The import taxes often applied to the trade between the North African countries constitute a hinder for the development of a regional renewable energy market; renewable energy equipment and property must benefit from appropriate taxation conditions.
- Lack of real prospects in the renewable energy market, there is a lack of visibility regarding the orientations of the countries and national programs.
- Equipment quality and standardization. The multiplication of standards adopted and the absence of a common orientation/harmonization concerning the quality of the products causes the presence of bad quality products on the market.
- Lack of finance for R&D activities. Technological adaptation and innovation are essential R&D activities for which financing often is insufficient or inexistent;
- Lack of regional platforms and mechanisms to enhance the value of the R&D results (partnership relationships between industries and R&D)

**Actions for a better regional industrial integration**

The following main actions aim at enhancing the regional integration for renewable energy equipment:

- Take stock of the regional industry situation and examine the comparative advantages of the countries and draw up a database of the expertise and renewable energy equipment industries in the region.
- Speed up the introduction of the free trade zone between the countries of the region to promote trade in renewable energy equipment.
- Take stock of R&D and formulate an action plan to make use of the results and promote a networked integration of the research centers of the region’s countries.
- Support the creation of a regional association for the renewable energy industry.
- Support the creation of a Centre of Excellence for the renewable energy industries in the region so as to promote synergy between the countries and the transfer of knowledge between the various actors.
4.2.4. **Skills development**

- **The major obstacles**

The main constraints encountered in terms of skills development at regional level are the following:

- Lack of capacities in engineering. Taking into account the variety of country experiences in the field of renewable energy and the diversity of the development programs of the related technologies, the region is marked by a lack of skills in engineering, required for the study, preparation and prescription of tools to implement renewable energy policies and programs.

- Lack of qualification in the renewable energy sector. Operationalization and implementation of renewable energy programs and their activities require qualified operators to cover the full renewable energy value chain as shown in the scheme below.

![Graphic: Renewable energy value chain, ECO-Ser/RE Cluster 2013](image)

- **Actions to develop skills**

  - Assess training needs in the countries in and the region, and analyze the programs required, these should be country-specific.
  
  - Strengthen the cooperation regarding training programs and undertake joint such.
  
  - Connect, through a network, all research centres in order to create a synergy based on regional experiences.
  
  - Develop a common basis of technological know-how.
  
  - Build partnerships between industry, universities and research centers in the new sectors and in the research of innovative technologies (clusters, competitive hubs).
5. Conditions for operationalization of the regional cooperation policy

The conditions for operationalizing the regional cooperation policy for the development of renewable energy in the North Africa region will require the participation of all stakeholders and the following key prerequisites should be considered:

- Anchoring the cooperation policy with an existing specialized regional structure, involving all the countries of North Africa, which will lead its implementation, in coherence with ongoing national and regional initiatives.
- Assuring the fundamental national ownership of the regional cooperation policy. Indeed, its realization is based on the acceptance and willingness of the Member States and the concerned stakeholders.
- Formulating a regional action plan to operationalize the cooperation policy, in coherence with the framework and planning tools developed by the LAS and the RCREEE for the implementation of the Arab renewable energy strategy.
- Strengthening the coherence between the multiple national and regional initiatives to capitalize on the results and avoid duplication of efforts.
- Promoting dialogue, exchange of information, experiences and good practices and the development of cooperation projects around common interests, through a major effort of creating networking between actors (renewable energy professionals, academics, researchers, civil society, regulatory agencies, specialized national agencies/ Ministries, etc.).
- Strengthening cooperation with countries of the ECOWAS, the EU and the Gulf.
6. Conclusion

The adoption of a regional approach is essential to support and coordinate the countries’ efforts to achieve their proclaimed objectives in terms of renewable energy development. If each country continues to cling to its energy policy, limits such as the ones linked to supply security, to regional complementarity or still, to commercial trade, will appear quickly. Although the energy policy decisions concern, above all, the various States’ sovereignty, such an approach will facilitate dialogue, cooperation, pooling of available resources, capitalization and exchange of experiences and technology transfers. Thereby it will meet the challenges and remove the barriers to the development of renewable energy and interregional trade.

The approach should allow for an increased production capacity, an extension and integration of networks and markets, achievement of economies of scale and lower production costs. In addition, as the internal market is set up, a regional strategy becomes necessary to avoid imbalances between countries and distortions of energy markets.

Regional energy integration requires a clearly articulated, common policy, promoting harmonization of policies, regulation frameworks, norms/standards and procedures and the putting in place of fair trade conditions, to send a strong political message to investors, enhancing their interest. A harmonized regulation of the market is a first step towards the establishment of a regional market.

A common vision of the regional development of renewable energy would boost the confidence of investors and financial partners and would contribute to mobilization of more funding.

The region has the opportunity to develop a competitive economic and industrial branch in the solar and wind technology sector, by promoting participation of local businesses in construction and engineering work related to the commissioning of new plants, as well as the implantation of local branches of international groups which can form joint ventures with national companies and thereby achieve technology transfer. However, attracting private investment in the local supply chain first requires that its components be identified and the benefits offered by the local option over the choice for imports, are clearly defined. Market shares must be sufficient and guaranteed by long-term contracts to justify these investments.

The setting up of a regional framework can also help structure a large part of the region's scientific and university development and create new skills profiles, by strengthening research and training activities, innovation, networking and the creation of partnerships. Development of local skills helps bring down the import cost for equipment and for
economic development, and also promotes job creation in the R&D, production, construction, installation, maintenance and engineering sectors.

A joint approach, proclaimed with one voice, will also enable the region to strengthen its negotiating power and to play a major role on the international market. In this context, the North African countries currently prioritizing bilateral cooperation with the countries of the European Union, regardless of the energy policies adopted by their neighbors, would benefit from reconsidering these parallel approaches that are not benefitting the region, in favor of a better regional consultation and cooperation, which alone can promote the establishment of win-win partnership scenarios with the main partners of the region.

In conclusion, regional cooperation is an essential element of the transition process that the North African countries are undertaking. It requires the adoption of a unifying framework capable of promoting a coherent, complementary and harmonized implementation of national policies, also maximizing potential synergies and promoting a better division of labor between the actors. The policy should be supported by all state and non-state stakeholders, including regional and international organizations, in order to open up for new perspectives for renewable energy.

The ECA will continue its consultations with its Member States and the regional institutions to identify the appropriate institutional framework and to support the implementation of the cooperation framework for the development of renewable energy in North Africa.
7. Bibliography

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