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# Renewable Energy Transitions in Jordan and the MENA Region

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## Foreword

**Richard Probst**
**Regional Coordinator Climate and Energy Project, Deputy Resident Director FES Amman**

The current energy systems are globally, albeit the oil-price is currently at a historical low level, in a crisis. The centuries-long dependence on fossil fuels has led to serious environmental damages. At the same time these energy-systems are in the long run economically and socially not sustainable. Economically, they are not sustainable since they rely on finite resources. Socially, they are not sustainable since while large parts of the global population have no access to electricity only a few benefit from these energy-systems with its inherent centralized production and distribution mechanisms (Kofler/ Netzer (eds.) 2014: Towards a global Energy Transition). Hence, a global energy transition is environmentally, economically, and socially needed. A move away from fossil fuel and nuclear energy resources is globally needed. Currently, we are already witnessing first signs of a take-off towards a global energy transition. This worldwide trend of renewable energy expansion has started to reach the MENA region. Thanks to the accelerated expansion in the past years, a network of private and institutional actors was able to emerge - giving a further push to the professionalization of the MENA renewable sector. A good example is the Hashemite Kingdom of Jordan, where a transparent regulatory and incentive framework successfully attracted developers and investors for the construction of large renewable power projects. In the MENA region in general, but also in Jordan in particular, discussions regarding these projects are mainly of technical nature and neglect socio-economic aspects or the political dimension of a renewable energy transition.

However, experiences in Europe show that, with increasing renewable energy penetration, not only technical issues arise, but also the challenges regarding the socio-economic consequences of such a transformation of the energy system. Hence, it is of particular interest to have a closer look at the socio-economic and governance aspects of energy system transformations in the MENA region. These issues were discussed in the conference „Renewable Energy Transitions in Jordan and the MENA Region“, which was held on 5.05 - 6.05.2015 in Amman and was jointly organized by the Wuppertal Institute for Climate, Environment and Energy and the Friedrich-Ebert-Stiftung under the patronage of H.E. Ibrahim Seif, Minister of Energy and Natural Resources of the Hashemite Kingdom of Jordan. More than 60 experts from Jordan and 8 different countries of the MENA region participated in this conference. The overarching objective of the conference was to motivate a discussion between various stakeholders- politicians, public sector, industry, civil society- on governance and socio-economic aspects of energy system transformations in the MENA region. Two dimensions were explored. First: the regional context, involving the view of several invited experts from selected MENA countries; and second, the Jordanian experience. Inputs on these topics have been explored in form of short input papers. First, this conference paper presents a selection of these papers. Second, it gives an overview over the different discussions during the conference in form of a summery of the different panels.

In 2015 FES created a regional “Sustainability Project” in the MENA region. This project is based in Amman and is working on Renewable Energy and Climate Change. The establishment of this project is in line with the energy-political shifts within the region. The project supports and encourages a transition towards an energy supply based on renewable energy sources and the search for suitable policies to promote energy savings and energy efficiency measures. The team of FES Amman was very happy to host and organize this conference. The “Sustainability Project” of FES is especially grateful to H.E. Ibrahim Seif, Minister of Energy and Mineral Resources, for taking over the patronage of this conference. FES Amman would also like to thank the Wuppertal Institute and in particular its vice-President, Prof. Dr. Manfred Fischedick, for this trustful partnership.

# Section A

# Presented Papers

# Towards Sustainable Energy Supply
# MENA Energy Systems in the Context of Transition Research Theory

*Bernhard Brand, Manfred Fischedick, Thomas Fink*

## Abstract

Sustainable energy visions for the Middle East and North Africa (MENA) region often follow the narratives of top-down planning approaches, such as large transcontinental power exchange schemes with Europe or prestigious renewable energy roadmaps laid out by national governments in the region. The recent setback of some of these concepts raises the question of whether alternative ways exist to portray the transitions of MENA energy systems. We argue that the concept of Transition Research Theory - in particular the Multi-Level Perspective (MLP) - can be a helpful tool to better understand and delineate the complex processes of change and find new narratives for energy system transitions in the MENA region towards more sustainability.

## 1. Introduction and Background

Energy system transitions are complex processes of change, which involve technical, social and political dimensions. The Middle East and North Africa (MENA) region is a particularly complex arena for these transitions, mainly because energy resources, infrastructures, as well as economic and political frameworks in this region are highly heterogeneous and volatile. It is all the more surprising that sustainable energy pathways (e.g. from fossil to renewable energy supply) for MENA countries are still very often imagined in a relatively simplistic fashion. Good examples are the formerly prominent concepts 'Desertec'(Dii, 2013) and the 'Mediterranean Solar Plan' (UfM, 2013). Both emphasize the idea of Euro-Mediterranean renewable energy exchange as the central driver for energy system transition in the region; but the primacy of this narrative seems to be fading as both initiatives have experienced serious setbacks or were even stalled (Hamouchene, 2015; Ansamed, 2013). Other top-down frameworks, like national renewable energy master plans of MENA governments, lag far behind their self-imposed targets and existing roadmaps, mainly because they underestimated the intricacy of managing transformative change towards sustainable energy systems (Brand, 2015).
Learning from the experience of other regions – where energy system transitions are already taking place – is certainly instructive, but also shows limitations. The often-quoted example of the German 'Energiewende' might provide interesting insight into the transition processes of an industrialized country, but it can hardly be taken as a blueprint for the MENA region, where completely different energy market structures, stakeholder networks, and societal aspirations towards energy, climate and environmental policies prevail. It is therefore paramount that the MENA region develops its own genuine paradigm for a sustainable energy transition. In this article, we present the scientific approach of 'Transition Research' as a tool for researchers to better understand and structure the key elements and dynamics of energy transformation processes and align them to the particular socio-economic realities of MENA countries. We particularly focus on Geels' Multi-Level Perspective(Geels, 2002) and highlight some pertinent research questions that might be relevant for managing MENA energysystem transformation processes in the future.

## 2. The Multi-Level Perspective in Transition Research Theory

Transition Research explores how the dynamics of technological innovations and interactions between institutions and socio-economic agents may spur changes in the production/consumption patterns in our society. The concept of transition research has first become popular in the Netherlands (Kemp et al., 2007; Loorbach, 2007; Grin et al., 2010), but is also increasingly being taken up by scholars of other regions in the world. One very popular approach to conceptualize transitions is the so-called Multi-Level Perspective (MLP), developed by Geels (2002). It identifies and explores interactions between three different levels: 'niche innovations', 'socio-technical regime', and 'socio-technical landscape.' These levels are explored as key drivers of transition processes.

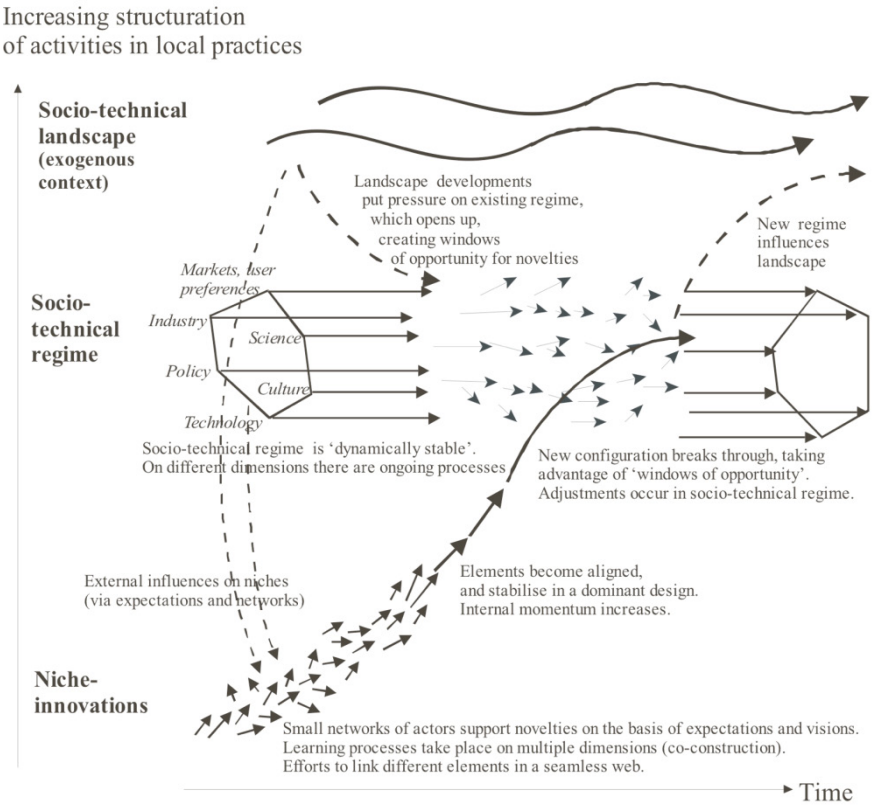


**Fig 1. Illustration of the Multi-Level Perspective on Transitions. (Source: Geels, 2002)**

At the center of this process stands the 'socio-technical regime'. The commonly shared definition of this term is that it represents the "existing practices and structures in policy making, markets, industry, technology and culture" (Geels and Schot, 2007). Thus, in the case of MENA energy systems, we would interpret the 'socio-technical regime' as the current conventional, fossil fuel-based energy system, together with its incumbent institutional actors (e.g. monopolized state utilities), its business routines, and the prevailing legal and regulatory frameworks. If we look at transition towards sustainability, a 'new', transformed regime could be imagined as a mainly renewable-based energy system with completely different supply/demand infrastructures, different players, and also new, different operation rules. How would one describe such a transition, from an 'old' to a 'new' regime? Here, the MLP approach brings the two other transition levels into play - 'socio-technical landscape' and 'niche innovations'. Both exert pressures on the existing regime. As for the 'landscape' level, these pressures are of exogenous nature, stemming, for instance, from geopolitical or macro-economic trends. For the MENA energy systems, for example, the rapidly rising energy demand, driven by demographic/economic growth and urbanization could be seen as a 'landscape' pressure. In the MLP

theory, landscape pressures open up windows of opportunities for novelties, which are subsequently seized by initiatives and actors from the niche level. Generally, the niche level encompasses the multitude of niche actors (entrepreneurs, civil society networks, political advocacy groups), which, in an increasingly coordinated manner, undertake attempts to introduce technological innovations and new business rules. By doing so, the niche level pressurizes and induces changes of the existing regime. A good way to illustrate this is the worldwide trend of dropping costs for solar and wind technologies triggered by various innovative approaches and activities. Lower technology costs have significantly strengthened the economic viability of renewable energy projects vis-à-vis conventional energy projects. This is obviously also the case in MENA, where stakeholders from the 'regime level' (public utilities, energy ministries) increasingly recognize renewable technologies as an option to satisfy the region's increasing energy demand.

**Table 1: Driving elements for a transformation towards sustainable energy systems in MENA energy systems (adapted from Brand and Fink, 2014)**

| Pressures from the "niche "innovation level | Adaptive / transformative behavior at the "regime "level | Pressures from the "land- "scape level |
|---|---|---|
| Innovations and falling cost of renewable energy technologies<br><br>Improved knowledge of economic impact of renewable energy supply<br><br>Support at small-scale/local level<br><br>Emergence of renewable energy advocacy organizations in MENA<br><br>Pilot projects / learning-by-doing | Stakeholders picking up on trends<br><br>Willingness of policy makers to support energy system transformation<br><br>Implementation of legal and regulatory frameworks<br><br>Transnational efforts to expand transmission systems<br><br>Market liberalization / energy price reforms<br><br>Capacity building /education measures<br><br>Improved investment conditions<br><br>Energy efficiency/ energy saving standards being implemented | Demographic development ( (growing energy demand<br><br>Increasing fossil fuel prices<br><br>Difficult fossil fuel supply<br><br>Climate change<br><br>The population's welfare and sustainability aspirations<br><br>Political upheavals<br><br>Social costs of fossil fuel subsidies<br><br>Changing geopolitical framework (e.g. strengthened Euro-Mediterranean collaboration, (… ,lifting Iran trade embargo |

The above-mentioned example **('rising energy demand meets increasing economic viability of renewable technologies')** is only one possible constellation where the complementary of pressures from the landscape level and the niche level can trigger transformative steps at the regime level. Table 1 enumerates, certainly not exhaustively, a number of other driving elements that may also be relevant for sustainable energy transitions in the MENA region.

## 3. Outlook: Opportunities for Research

What can be learned from transition research - or more precisely from the MLP approach - about MENA energy transitions? The first lesson is that "there is no single 'cause' or driver" (Geels, 2011) for transitions. Due to the multitude of processes, pressures and players acting at different levels (see Fig. 1 and Table 1), it is clear that a simple explanatory model for MENA energy system transitions cannot be easily established. This is the reason why the previously mentioned top-down planning approaches (EU-MENA roadmaps, master plans, etc.) with their too-narrow view on single aspects of the transition picture, haven't been able to provide a convincing narrative for sustainable energy expansion in MENA. The MLP approach can be considered a more appropriate method as it captures more details of these transitions and unfolds their full degree of complexity. This, however, also carries a difficulty for the researcher: due to the high level of abstraction of the MLP approach, a risk remains that certain transition aspects become overemphasized while others remain underestimated. One example is climate change. For energy transitions in Western countries, climate policies are generally seen as an important pressure originating from the landscape level; however, the MENA region has so far only shown minor interest in this issue. Therefore, the 'Decarbonization' of energy systems is, for many MENA countries (currently), not a major motivation for implementing renewable energies. Meanwhile, other aspects, such as energy security and social welfare (e.g., job creation, industrial value generation), and also water issues and their relation to the energy sector (the energy-water nexus) play at the moment a visibly more pronounced role in accelerating the transformation of the conventional energy system (Brand and Missaoui, 2013).

This simple example should show that for a deeper insight into the transition processes in MENA countries, a certain level of knowledge[1] of the regional context is necessary. Therefore, for future studies about MENA energy transitions, a strong participation of experts and scholars from the region should be a key requirement. Educational institutions in MENA countries should also consider anchoring transition-related research topics to their academic training and university curricula. A second challenge for research - besides building up expert knowledge - is how to deal with the complexity of MENA energy transitions. Drafting an all-encompassing transition picture for the entire region is by far too large of a scope for any research endeavor; hence, limiting the focus is required. This could be a geographically limited scope (only examining single countries or sub-regions), or focusing on a selected set of modes and phenomena of the transition process. Holtz (2012) proposes the so-called PSM[2] approach to tackle the challenge of complexity by specifying and operationalizing particular 'phenomena of interest' of the Multi-Level Perspective. These 'phenomena of interest' usually refer to "specific interactions between landscape, regime and/or niche or to a characteristic of a niche or regime" (Holtz, 2012), and must be selected on the basis of a thorough assessment of their importance for the regional transition context. A 'phenomenon of interest', which is worthwhile to assess, could be the status of the 'niche level', e.g. the domestic renewable energy industry in a MENA country and its relation to the actors at the 'regime level', e.g. the conventional power sector. Other examples for phenomena of interest include the different pressures from the landscape level on the regime level. Here, the effects of demand growth, energy price developments (oil prices), or even the role of external shocks (political conflicts, security threats) could become the subject of an empirical analysis. All in all, the PSM approach can constitute a bridge between the highly abstract picture of transition within the MLP framework, and more explicit and accessible phenomena that can be scrutinized with empirical methods.

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[1] The required knowledge can be classified into three categories: system, target and transformation knowledge. 'System knowledge' is needed to understand the prevailing socio-technical systems; 'target knowledge, helps define the objectives for sustainability, while 'transformation knowledge' helps to unveil the underlying processes of transitions (see Brand and Fink, 2014).

[2] Phenomena of interest (P), Develop specifications and indicators (S) and identify mechanisms (M).

## 4. Summary

This paper presents the 'Multi-Level Perspective' (MLP) of Geels (2002) as a tool to describe and conceptualize transformation processes of MENA energy systems towards more sustainability. The central element of the MLP approach, the three transition levels ('niche', 'regime' and 'landscape') allow for a relatively straightforward mapping of actors, interdependencies and drivers/barriers that influence the pathway from fossil-fuel-centered to more renewable-based energy systems. However, for a meaningful MLP analysis of transitions in the MENA region, sufficient context-specific knowledge is required, which has to be provided by local researchers/experts from MENA countries. Moreover, the generally high level of complexity of transition and also the high level of abstraction of the MLP approach requires some limitation of the research scope and a more focused view on specific, relevant aspects of the transition process. The PSM concept, also presented in this article, represents a useful complement to the MLP framework as it enables structuring the complex transition elements into specific 'phenomena of interest' that are more accessible for empirical observation, and potentially, also for future action-oriented policy making.

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# Renewable Energy Transitions in Jordan and the MENA Region

*Alessandro Rubino*

Societies and markets around the world are progressively more integrated as a result of lower transport costs, faster communication tools and reduced barriers to trade. The process of increased social and economic integration, also known as globalisation, has been a powerful source of growth and reduction in poverty. From an historical perspective, the Mediterranean area has been a natural location for intense trade and has represented a strategic arena for social, economical, political and institutional reasons. The existence of a common past and geographic proximity alone is not enough to qualify the Mediterranean basin as a region. A region is not a mere geographic area; it should have a well-developed and sustainable institutional structure in order to fulfill its primary function - to address political and economic problems before they escalate to global concerns. Energy markets are not exempted from these dynamics, and actually play a crucial role in the context of regional integration.

## Background Information: The Energy Scenario in the Mediterranean Region

The Mediterranean basin is a densely populated area that spans between three continents and includes 24 countries[3]. This region has traditionally been the centre of intense trade activities that have brought together different cultures and traditions offering the opportunity for mutual growth but also occasions for strong disagreement and conflict. Energy has added to this complex picture an essential geo-political dimension that contributed to defining the relationship between the shores of the Mediterranean basin for several decades.

The presence of energy exporting countries (mainly Algeria, Libya and Egypt) has determined that large quantities of oil and gas have been traded from the Southern Mediterranean countries to the industrialised demand hubs in the North creating a South-North flow of energy. Southern Mediterranean countries to the industrialised demand hubs in the North creating a South-North flow of energy. Not with standing these intense trading activities and the vast economic interdependences, countries in the area fail to show convergence in terms of macroeconomic and demographic fundamentals and a significant disparity is notable between the two shores of the Mediterranean basin.

Following OME (2013) analysis, if we only look at the Gross Domestic Production (GDP) and the population distribution in the countries belonging to the region, we find that some interesting diverging patterns can be highlighted. South East Mediterranean Countries[4] (SEMCs), although currently weighting only 25% of the total GDP of the region, are expected to grow at twice the rate of the North Mediterranean Countries (NMCs) till 2030, when they will account altogether to around one third of the total GDP of the region.In terms of population, we observe a similar trend: the population will grow in the SEMCs at a faster rate than in the north and this will imply that by 2030, 60% of the population will be based in the countries belonging to the south shore of the basin.

These patterns are mirrored in the energy sector also by the most accredited forecast[5] and describe an interesting evolution of the demand/supply landscape in the coming years, up to 2030.

[3]Albania, Algeria, Bosnia Herzegovina, Croatia, Cyprus, Northern Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Libya, Lebanon, Malta, Montenegro, Morocco, Palestine, Portugal, Syria , Slovenia, Spain, Tunisia, and Turkey.

[4] Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Palestine, Syria, Lebanon, Israel, and Turkey.

[5] Obervatoire Mediterranéèn de l'Energie and Medgrid 2013.

Depending on the scenarios considered[6], the SEMCs will consume between 43 and 46% of the total electricity demand, growing at an annual rate in the range of 2 and 2.7%, against 1.4% in the Conservative Scenario (the most encouraging) for the Northern countries.The bulk of the demand growth will take place in the SEMCs and mostly concentrated in Egypt and Turkey (accounting for over 60% of the expected demand in 2030) in stark contrast with the situation in 2009 where NMCs[7] accounted for over 70% of the total demand, implying a rapid and radical transformation of the energy pattern in the region. In this landscape it is notable how RES generation will play an increasing role as part of the energy mix in the region to year 2030, independently from the scenario considered.

Non-programmable renewable generation will represent the majority of the newly installed capacity up to 2030 (accounting respectively to 50% in the conservative and 80% in the proactive scenario) meaning that, according to the conservative scenario, over 230 GW or 300 GW of RES generation will be operating in the coming 15 years in the EuroMed area.

The projections presented above describe a radical change in the electricity patterns that started to occur in 2008, when the financial and economic crises and the ongoing demographic decline radically reduced electricity demand outlook in most countries in Europe. The situation since then has not changed and most of the NMCs have to cope now with considerable installed capacity that is underutilised or mothballed.

This panorama has also required a sharp revision of most of the large-size industrial initiatives in the Mediterranean basin (Desertec, Medgrid to name few) that envisaged the possibility of installing new RES generation in SEMCs, mostly to provide considerable additional capacity to be exported in the NMCs, envisaging a significant increase in electricity consumption and in particular in the demand for clean electricity supply from NMCs.

RES flow, according to these industrial projects, would have mirrored primary energy fuel flows, and should have continued to move northward. This paradigm, which has shaped large industrial initiatives in the electricity sector, is partly under question. The majority of new electricity demand will take place in the SEMCs in the coming years, and also considering the abundant underutilised capacity installed, the region shall experience significant North-South flows (at least up to 2030) that have an inverse direction compared to those initially projected.

A new electricity paradigm is therefore taking shape, characterised by two main factors. First, significant additional generation capacity, following the increase of demand in South Mediterranean countries, will need to be installed calling also for a re-organisation of electricity flows in the region. This, in turn, will have major implications for the structure and direction of financial flows within the region. And second, RES technologies are quickly developing, and this, together with its increasing rates of penetration, is likely to alter the Electricity Supply Industry (ESI).

[6] The Conservative Scenario takes into account past trends, current policies and ongoing projects but with a slow rate of adoption of the implementation of new policy measures and planned projects. The Proactive Scenario assumes the implementation of strong energy efficiency programmes and great diversification of the existing energy supply mix (Obervatoire Mediterranéèn de l'Energie and Medgrid 2013, 25).

[7] Portugal, Spain, France, Italy, Greece, Slovenia, Croatia, Bosnia Herzegovina, Montenegro, and Albania.

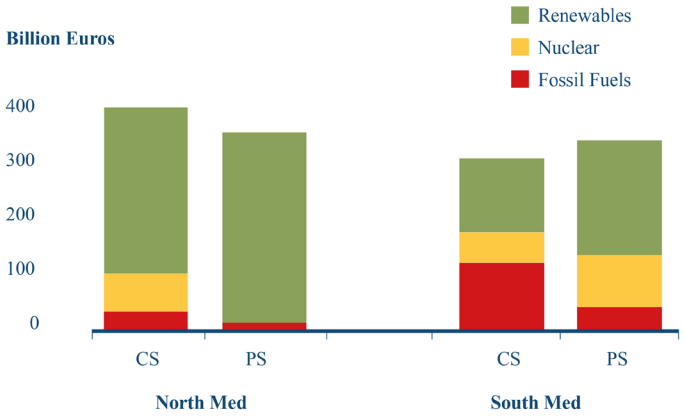



**Figure 1 Power Generation Investments**

These two factors entail a new definition and recalibration of the industrial initiatives in the region, also requiring a significant financial support: over 700 billion Euros will be needed in the coming 16 years to match the investment needs of the region. Moreover, this will call for a new and different understanding of energy policies and their implication in term of the revised regional energy initiatives in the area, also considering their wider social impact. These dynamics will also be strongly influenced by the emerging technology that will become pivotal in the future energy mix in the region: RES generation will significantly affect the forthcoming market structure, the regulatory approach and the definition of the energy paradigm in the Mediterranean region. In this paper, we investigate EU action as rules promoter in the energy sector, also identifying the capacity of the emerging regulatory framework to attract the level of investment needed, taking into consideration three rules diffusion patterns: bottom-up, top-down and network approaches. We do so by investigating the EU pressure in shaping future energy markets in the Mediterranean. The research method adopted consists of a perception survey directed at 20 energy experts coming from 11 non-EU Mediterranean countries[8].

## Role of Regulation for Energy Integration: Medreg

The Mediterranean area is often referred to as a region and this is legitimate when the Mediterranean is considered as a geographical space. On the other hand, the political, economical, and cultural homogeneity of the Mediterranean are less clear. In this context, Medreg represents a change of perspective compared to other previous experiences in the energy field. As a result of its origin, deeply rooted in the political and cultural centres, it represents a joint effort of 21 countries in the Mediterranean area. Medreg aims at the development and harmonization of the regulatory framework in the area, coupled with a progressive move towards integration of the energy markets. Medreg also promotes the regulatory exchange of know-how and expertise in the field of energy regulation for the benefit of its member and promotes the overall welfare of the Euro-med area. Acknowledging the complex historical background of the Mediterranean region, Energy Regulators have a central role to play in promoting a "bottom-up" process.

[8] Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Israel, Jordan, Libya, Montenegro, Palestine and Turkey.

In front of strategic energy challenges, Medreg's duty is to constitute a strong institutional basis to address economic, social and cultural development, as well as the need to conciliate a rising energy demand with sustainable development conditions.
Medreg was founded in 2006 with the primary aim of elaborating proposals for the development, harmonization and integration of Mediterranean energy markets and of promoting the exchange of know-how and expertise in the field of energy regulation. In November 2007, on the occasion of its fourth General Assembly held in Rome, Medreg was turned into a permanent Association. The Constitutive Act was signed by the following countries: Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Jordan, Malta, Montenegro, Morocco, the Palestinian Authority, Portugal, Slovenia, Spain, Tunisia and Turkey. The emphasis of regional cooperation between the Mediterranean countries is therefore on the promotion of a number of common basic rules and activities that should be able to escalate in a greater integration of the market "by diffusion." The regulatory framework within Medreg countries is not imposed, but discussed and evaluated in light of potential mutual gains and possible (prospective) complementarities between diverse countries (exporting vs. importing countries) and regulatory frameworks (liberalised market vs. a vertically integrated monopolistically organised one). Medreg's strategy is to analyse the existing regulatory institutions and rules within members' countries in an attempt to highlight possible harmonisation strategies and road maps for convergence.

## Investment Outlook

This paper presents an overview, working out numbers from PpI database from the World Bank. Between 1984 and 2012, 158 PPP investments went into operation in the region accounting for 3% of the global project implemented, and for a total value of $46 billion representing less than 5% in value. If we only restrict our analysis to the energy sector, we see that, in more than 20 years, only 33 projects reached operational stage representing 1.5% in numbers and almost the same in value. East Asia accounted for almost 50% of the total value invested. In 2012, 85 energy projects arrived to the operational phase, with an annual growth of 21% since 2007. Latin America hosted the largest investment with a total of $28.6 billion value. In the energy segment, 95% of new investment took place in the electricity sector. Transmission projects in both electricity and gas are less popular and more complex to finance.

## Some Highlights

Investment in the MENA region is recovering from a 20-year investment low. Three projects reached financial or contractual closure; no new projects are operational since 2009. The number of transactions is still below the 2009 level, and is struggling to recover after the financial crisis. Two opposite drivers of investment trends dominate the scene:

- Continued political instability
- Strong demographic growth

These drivers, combined, make clear that there is need for urgent action also considering the high level of youth unemployment. The projection of GDP growth at 5% between 2013 and 2018 means that there will be an increasing demand for public services and thus infrastructure needs. The social unrest in the region led to a reduction of fiscal space and of FDI increasing, at the same time, country risk. Large upfront commitments are therefore quite difficult. Although the region includes oil and gas exporting countries, these are nevertheless investing heavily abroad, also because of the low level of economic integration. Only a small fraction of these funds are invested intra-regionally. This situation is very different from what happens in Latin America, which has strong intra-regional investors in infrastructure.

# Renewable Energy Transition in Morocco

*El Mostafa Jamae*

## 1. Moroccan Energy System

### 1.1. Energy Consumption and Supply Sources

Morocco strongly depends on the external markets to source its energy needs. According to the Ministry of Energy, more than 93% of energy supply is currently imported. Morocco imports coal to feed its power plants, and oil products from the international energy markets. In addition, Morocco imports natural gas from Algeria1, in compensation for the Algerian gas pipeline crossing Moroccan territory to arrive in south Spain. Finally, Morocco also imports between 14 to 20 % of its annual power consumption from Spain via the interconnection between the two countries across the Strait of Gibraltar.
Dependency on international markets constitutes a burden for the balance of payments and causes energy insecurity for the country. Due to the increase in energy demand, this burden is worsening and alternatives are mandatory in order to reduce the unsustainability of such energy supply model.

### 1.2. Power Structure and Renewables

More than 99% of households in Morocco have access to electricity. The majority (more than 98%1) has access to the grid and few households in some remote areas have access to electricity by the use of solar home systems.

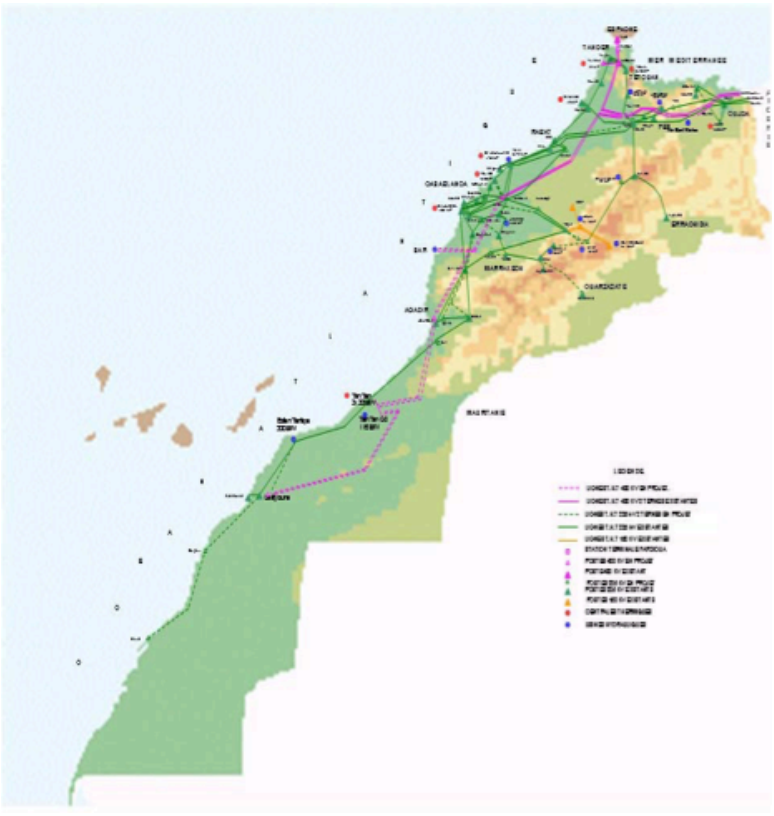


**Figure 1: Electric Network Map**
**1 and 2: source ONEE**

The Moroccan power network covers 164000 kilometers[9]. The power sector is characterized by the existence of a vertically integrated utility. In fact, ONEE (Office National d'Eau et d'Électricité) is the sole TSO, contributes in power generation, and assures distribution in rural areas and some of the small urban centers. On the other hand, there are several independent power producers (IPP) that generate power and sell it to ONEE. Furthermore, some IPP in wind energy have direct power purchase agreements (PPA) with large customers, and there are some large consumers that also generate their own power and use the network to transmit it from generation sites to the consumption sites against the payment of a tax to ONEE. Power distribution in cities and urban areas is assured by private companies or local agencies. On the basis of ONEE's figures dated to the end of 2013, further to our calculation, we estimate that the total installed power capacity in Morocco by the beginning of 2015 is 8358,7 MW.

Almost 10% of Moroccan GDP is spent on importing energy sources, which, in turn, constitute one quarter of the country's imports. Rising oil prices seriously aggravate the country's trade deficit. Consequently, Morocco is exploring and undertaking a new energy strategy that focuses on promoting the use of local resources and enhancing energy efficiency usage.

## 2. Energy Strategy in Morocco

In 1995, Morocco launched simultaneously a program to connect households in rural areas to the electricity grid, and a strategy to liberalize power generation. Other major decisions in the Moroccan energy policy consisted of increasing auto-production capacities for industrial groups from 10 MW to 50 MW. However, it is only by the end of the 2000 last decade when the government of Morocco (GoM) considered a more far-reaching energy strategy to respond to the challenges that this vital sector represents for the country. Precisely, in 2009, GoM developed a national energy strategy that focuses on achieving tangible results and attaining precise targets.

The strategy covers five areas:

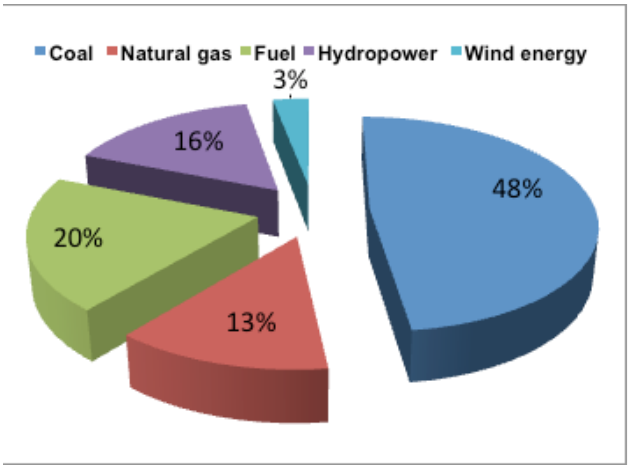
- Establish an optimized fuel mix in the power sector.
- Increase deployment of renewable technologies in power generation.
- Promote private investments in the power sector.
- Promote energy saving and use efficiency in industrial, commercial and residential sectors.
- Promote regional integration.

Accordingly, additional power capacities were scheduled to be added by the year 2020. This regards the extension of the installed capacities in existing power plants (mainly in Jorf Lasfar and Jerrada), and by implementing a new coal power plant in south of Safi, which according to the GoM, will satisfy up to one quarter of the national demand. In addition, Morocco launched its renewable energy program, which consists of achieving an overall installed capacities of 2000 MW wind energy, 2000 MW solar energy, and increasing the hydropower capacity to 2000 MW by 2020. On this basis, renewables installed capacity will account for 42% of the total installed power capacity in 2020.

To achieve the renewable energy targets a new institutional framework was set up, which consisted in creating the Moroccan Solar Energy Agency (Masen) to pilot the solar program, an energy investment firm to promote private investments in energy sector, an institute (Iresen; L'Institut de Recherche en Energie Solaire et Energies Nouvelles) to promote research, innovation and development in the

[9] IEA (2014), Energy Policies Beyond IEA Countries: Morocco 2014, IEA, Paris.

energy sector. Meanwhile, the government started to update, renew or set new rules in the legal and administrative framework related to power generation, transmission and distribution with special focus on renewables. On the other hand, the Agency for the Development of Renewable Energy and Energy Efficiency (ADEREE) launched several programs for enhancing energy saving and efficiency in the industrial sector, at the same time setting new regulations related to energy efficiency measures and practices in new constructions and building.



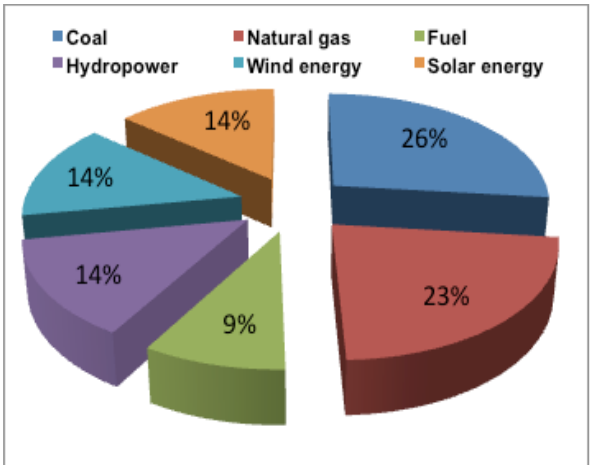




**Figure 2: Mix of installed power capacity in 2010** **Figure 3: Power capacity in 2020**

The Minister of Energy recently announced an ambitious strategy regarding liquefied natural gas (LNG). This strategy, which aims at investing $US 4.6 billion, consists of implementing a new port infrastructure adequate to receive and stock imported LNG south of Casablanca, and pipelines to distribute it. In addition, almost $US 2 billion will be invested in implementing four new combined cycle gas power plants. These power plants will be mainly used to balance the intermittency of wind and solar PV energies. With regards to subsidy allocated to the energy sector, the government removed subsidies allocated to the fuel used in power generation or in the industrial sector, set up oil prices indexed with the international markets, hence removing, de facto, the subsidies. Further, the government is discussing and reflecting on the best approach to remove the subsidies on natural gas (bottled gas2).

## 3. Governance of Renewable Energy in Morocco

### 3.1. Stakeholders Complexity

Main institutional stakeholders involved in renewable energy strategy definition and implementation are:

• The Ministry of Energy, Mines, Water and Environment (MEMEE):
MEMEE is responsible for setting and implementing government policy in the areas of energy, mines, water and environment. It also supervises companies and public institutions that come under its jurisdiction. In the last five years, three ministers from three different political parties succeeded on its portfolio: one from the liberal current, one conservative and one reformist. This gives an idea that the political agenda might influence the implementation of national energy strategy, given that in the case of Morocco; energy remains a sovereign sector and where political agenda influence on strategy setting is minimized.

• MASEN was established in 2009 by the law 57-09. The agency having a legal status of a public shareholding company is mandated to manage the implementation of 2000MW solar capacity by the year 2020, as well as solar industry integration and R&D promotion.

• ADEREE was created in 2009 according to law 16/09, and de facto, was a transformation of the former center of renewable energy that was based in Marrakesh. The agency has the mission to support the GoM in setting and implementing policies related to renewable energies and energy efficiency.

• The National Utility (ONEE): ONEE dominated power generation and distribution in Morocco from the country's early years of independence until the mid of 1990's. Nowadays, ONEE is still operating in the fields of generation, transmission and distribution. With regards to Morocco's energy strategy, ONEE is mandated by the GoM to manage the 2000 MW wind energy program by 2020, and to increase the hydropower installed capacity to 2000MW by 2020.

• SIE (Société d'Investissements Energétiques): is a reference investor in the energy strategy of Morocco. It was set up by the GoM in 2010 to promote private investments in renewable energy and energy efficiency. Currently, SIE is contributing to financing wind energy projects. SIE investment strategy is to take minor shareholding in feasible renewable energy projects.

• IRESEN is an institute aimed to promote research, innovation and development in the energy sector. Within the Moroccan context, a variety of stakeholders are concerned with renewable technologies such as: MEMEE, ONEE, MASEN, SIE, IRESEN, and ADEREE. The existence of this institutional stakeholders' arena demonstrates the high interest that Morocco is giving to renewable energy, in particular, and sustainable development in general. However, such a diverse and multi-levels governance structure requires strong coordination and might create conflicts over competencies. Additionally, domestic energy policies have shaped or been shaped by global energy institutions and issues, and most of energy policies are developed by the central government without strong consideration for regional needs and aspirations.
In front of the multiplicity of stakeholders, eventually, an energy law should be adopted to emphasize strong coordination, transparency and accountability. The current laws, related to each agency or stakeholder, sometimes create confusion with regards to competencies and the need for strong coordination. At the same time, there is urgent need to create a mechanism for transparency and participatory processes in energy decision-making to enable local communities to participate and to encourage more local solutions rather than centralized systems.

### 3.2. Large Scale Projects vs. Decentralized Systems

One of the limitations of the Moroccan renewable energy strategy is the current focus on large-scale projects, which obviously might drive renewable technologies deployment. However, the widespread of renewable technologies and their optimal exploitation would not be achieved without the promotion of small and medium-scale renewable energy projects for the production of electrical and thermal energies and other applications. The current legal and administrative frameworks do not enable an effective development of small and medium-scale renewable energy projects.

### 3.3. Energy Regulation and Climate Change Considerations

Morocco is establishing an independent power and gas regulator that will contribute in reforming the energy sector in Morocco. Additionally, a great effort should be deployed to consider regional needs and local solutions. Given that power generation is the most important source of GHGs emissions, climate change imperatives need to also be taken into consideration when designing post-2020 renewable energy strategy. The post-2020 energy strategy should consider biogas and

biomass potential in the country, and emphasizes energy efficiency and conservation as one of the pillars of the country's long-term energy policy.

### 3.4. From Resources Dependency to Technology Dependency

Alike developing countries, Morocco is confronted with the challenge to substitute its dependency on fossil energy resources to dependency on renewable energy technologies. Notwithstanding the great efforts the GoM is making to build the basis for national industry on renewable energy, which will supply at least part of the components needed for renewable energy projects, the country still needs substantial investments and strong institutional support.

| Key area | Challenges | Competent Agencies |
|---|---|---|
| Regulatory framework | • Energy law emphasizing a strong coordination among stakeholders, accountability and transparency.<br>• Policy integrating biogas and biomass energies.<br>• Laws and administrative framework for the promotion of small and medium-scale renewable energy projects<br>• Energy conservation and efficiency measures. Partici<br>• patory approach in adopting energy decisions. | MEME,<br>ADEREE & GoM |
| Grid Infrastructure | • Extension and reinforcement of the grid infrastructure.<br>• Access to low and middle voltage grids.<br>• Smart management of the grid and creation of local/ regional smart grids. | ONEE &MEME |
| Knowledge and skills | • Technical, economic and financial skills in project development.<br>• Technical skills in project management and O&M. | MEME, Private sector, GoM & ADEREE |
| Finance | • Private investment funds and commercial banks.<br>• Tax exemptions.<br>• Crowd funding for small and medium-scale projects. | Banks, GoM,<br>& SIE |
| Local contents | • Components and technologies.<br>• Processes, engineering and technical expertise.<br>• Innovation, research and development. | Private sector IRESEN, Masen & ADEREE |

## 4. Opportunities for Renewable Energy Deployment in Morocco

### 4.1. Maturity of Renewable Technology

Innovation and development on renewable technologies are contributing in improving the

efficiency of these technologies and reducing costs. Renewable technologies currently offer technically feasible and economically attractive solutions to create additional power capacities or substitute the existing conventional energy capacities in developed and developing countries. Innovations are also helping emerging countries to develop local contents, and hence mastering O&M and the implementation of the projects.

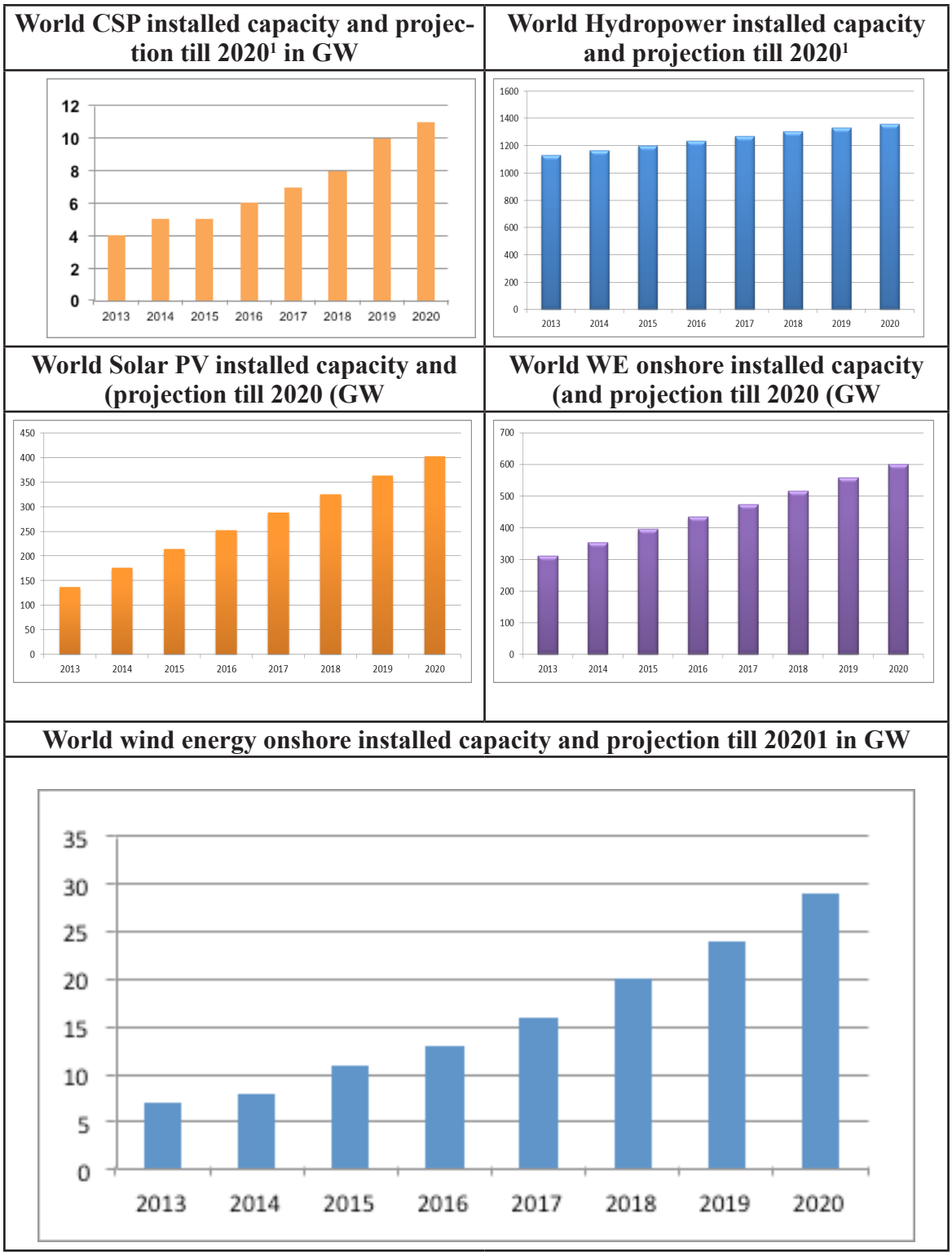
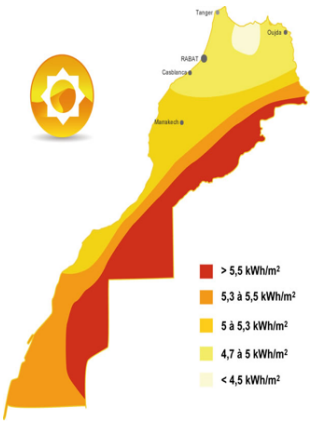


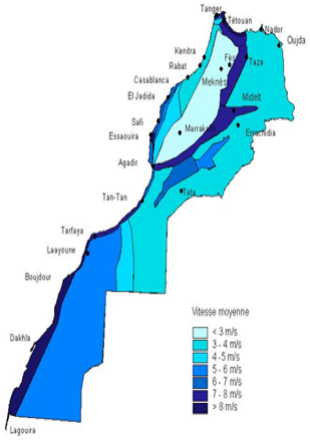

**Figure 4: Installed renewables power capacity worldwide**

### 4.2. Renewable Resources

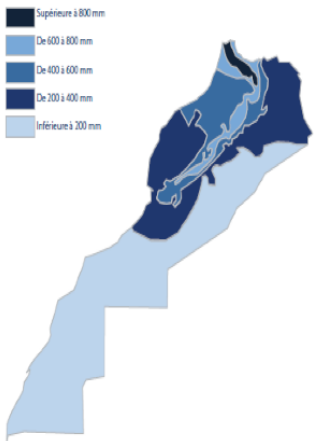
The abundance of renewable resources, mainly solar and wind, as shown in Figure 5 below, constitutes the main opportunity that drives both public and private interests in deploying renewable technologies. As demonstrated in the below maps, solar and wind resources are abundant across Morocco. Their exploitation is technically feasible, deploying mature renewable technologies, and is economically attractive.




Solar resources are abundant across the Moroccan territory. The southeastern part of Morocco has adequate resources for solar CSP power plants, whereas in the northwestern part; optimal conditions exist for PV projects.




Morocco has abundant wind resources, which represent real opportunities for private and public investors. In fact, LCOE of power generated by wind turbines is almost closed to coal power plants in the country. Estimations made by development organisations in Morocco quantify that the economic and technical potential of wind energy in Morocco amount to 26 GW.




Water resources in Morocco are considerable; mainly in the northwest of Morocco, but remain limited in the rest of the country. The first priority in water resources management is to supply drinking water, the second is to supply water for irrigation, and the third is using water from dam reservoirs to drive turbines for power generation. Notably, up to 80% of the mobilized water resources are used for irrigation in the agriculture sector, considering also that the 1.5 million irrigated Ha generate more than 50% of the added value; although, in terms of surface, the irrigated agriculture occupies less than 20% of the SAU.

**Figure 5: Renewable Energy Resources**
**Source: www.menawatt.com and www.invest.gov.ma**

### 4.3. Future Development of Renewable Energy in Morocco

**Table 3: Development scenarios for renewable energy in Morocco**

| **Utility scale renewable systems (wind, solar and hydro)** | | |
|---|---|---|
| A conservative scenario of adding up to 3000 MW wind and 2000 MW solar | A realistic scenario of adding up to 6000 MW wind and 3000 MW solar CSP | An optimistic scenario of adding up to 8000 MW wind and between 4000 and 5000 MW solar |
| This scenario estimates that Morocco will opt to deploy wind energy to meet the increasing demand on power and to install CSP technology with considerable thermal storage capacities. This scenario also takes into consideration that Morocco will add substantive capacities from gas power plants to resolve the intermittencies of renewable energies. | This scenario estimates that Morocco will mainly rely on renewables to meet its increasing demand on electricity and to use both CSP with thermal storage and gas fired power plants to balance the intermittencies from wind and solar PV.<br><br>This scenario also considers that the private sector and households will deploy renewable technologies for a variety of industrial, commercial and residential applications. | This scenario estimates that Morocco will export a part of its green electricity to Europe, and that the private sector will be the main driving force of a strong deployment of renewable technologies.<br><br>This scenario also forecasts that the renewables sector will contribute significantly to Morocco's economic development. |
| **Small and medium-scale systems for power generation (wind, solar, mini-hydro, Biogas)** | | |

Figure 4: Installed renewables power capacity worldwire

| |
|---|
| With regulations to be set, financing mechanisms to be offered by commercial banks, technology, expertise and knowledge transfer, it is expected that small and medium-scale renewable energy systems will be developed. It is expected that creation of these systems will start after 2016 and will grow steadily. It is expected that mini-hydro and solar PV will mostly be deployed rather than wind, biogas and CSP for power generation. |
| **Renewable systems for seawater desalinization (wind and solar)** |
| Wind energy and CSP will have great potential to be deployed for seawater desalinization. Seawater desalted may serve as storage means to the intermittent renewable energies in Morocco, and contribute to meet a part of the increasing demand on water resources for irrigation. |
| **Renewable systems for industrial applications**<br>**(solar process heat, biogas, solar cooling and PV water pumping)** |
| A great potential exists in deploying solar and biogas technologies to generate process heat, space heating and cooling for different industries and solar PV for irrigation. It is expected that the private sector will contribute in developing these systems and that the Moroccan commercial banks will also contribute in this development. |

**Source: www.menawatt.com and www.invest.gov.ma**

## Conclusion

Morocco has adopted an ambitious energy strategy to achieve considerable shifts in its energy system relying on renewable technologies to develop local energy resources and reduce its dependency on the international markets. While important milestones of this strategy have already been achieved, certain improvements are required to optimize the exploitation of renewable resources for a variety of applications in residential, commercial and industrial sectors. On the other hand, the governance structure of the Moroccan renewable energy encompasses both challenges and opportunities. While the multiplicity levels of governance create opportunities for knowledge development and expertise mastering, there is high necessity for strong coordination, as well as for civic society and wide public engagement in debates related to energy matters and decision-making in the Kingdom. Post-2020 development scenarios of renewables in Morocco depend strongly on political will, effective governance and the absorptive capacity of the country in terms of technology mastering and set-up of competitive local industry. All in all, renewable energy remains an opportunity for the Kingdom of Morocco and a resource for sustainable development and social stability.

# Renewable Energy Transition: The Egyptian Perspective

*Hatem Elrefaei*

## 1. Introduction

Geographically, demographically, and politically, Egypt is considered one of the most important countries in Middle East and North Africa, and accordingly, its economic and political stability becomes crucial for the stability of the whole region surrounding it. Being a developing country, Egypt didn't exploit all of its economic potential yet. And as learned from the experiences of developed countries, economic development comes with more energy consumption per capita (primary and finally). Without trivializing energy efficiency potential in Egypt to save some of the energy needed for economic development, Egypt faces a real energy crisis both in the short and medium term, which may impede its ability for economic development if not properly addressed. As Egypt became a net fossil fuel importer in recent years, it had to move fast to boost its activities in the Renewable Energy (RE) sector in order to cover the deficit in its electricity balance. In doing so, legislative and economic adjustments had to be done for such changes to materialize. In this paper, we present the legislative framework that was developed and the incentive mechanisms that were recently designed in the RE sector in Egypt.

## 2. National Renewable Energy Objectives

In February 2008, the Ministry of Electricity and Energy of Egypt put a target of 20% of electricity to come from renewable energy resources by the year 2020. It set a specific target of 12% of the electricity generated to come from wind energy by the target year. This target is translated into total installed capacity of 7200 MW of grid-connected wind projects by 2020 [1]. This amount of installed capacity will be accomplished through three mechanisms and ownership:

• Wind farms owned by NREA (2200 MW), financed through governmental soft loans and international development agencies.
• Wind farms owned by the transmission operator (2500 MW), financed through a competitive bidding process.
• Wind farms owned by the private sector (2500 MW), financed by the private sector and assisted through FiT for a maximum of 50 MW farm each.

While this first target focuses on wind energy, another national target was set and announced in July 2012 by the Ministerial Cabinet, which approved the Egyptian Solar Plan targeting 3500 MW of solar energy by the year 2027. The target amount is divided into 2800 MW of CSP and 700 MW of PV. The plan also addresses the enhancement of the relevant local industries that can feed into the targeted technologies. It is worth mentioning that the plan relies on 67% share of the private investment to implement the required solar projects. This reveals a large opportunity for national and international investors to play an essential role in the future of Egypt's solar projects [1]. The progressive implementation of the solar plan in terms of yearly installed solar capacity is shown in Figure (1).

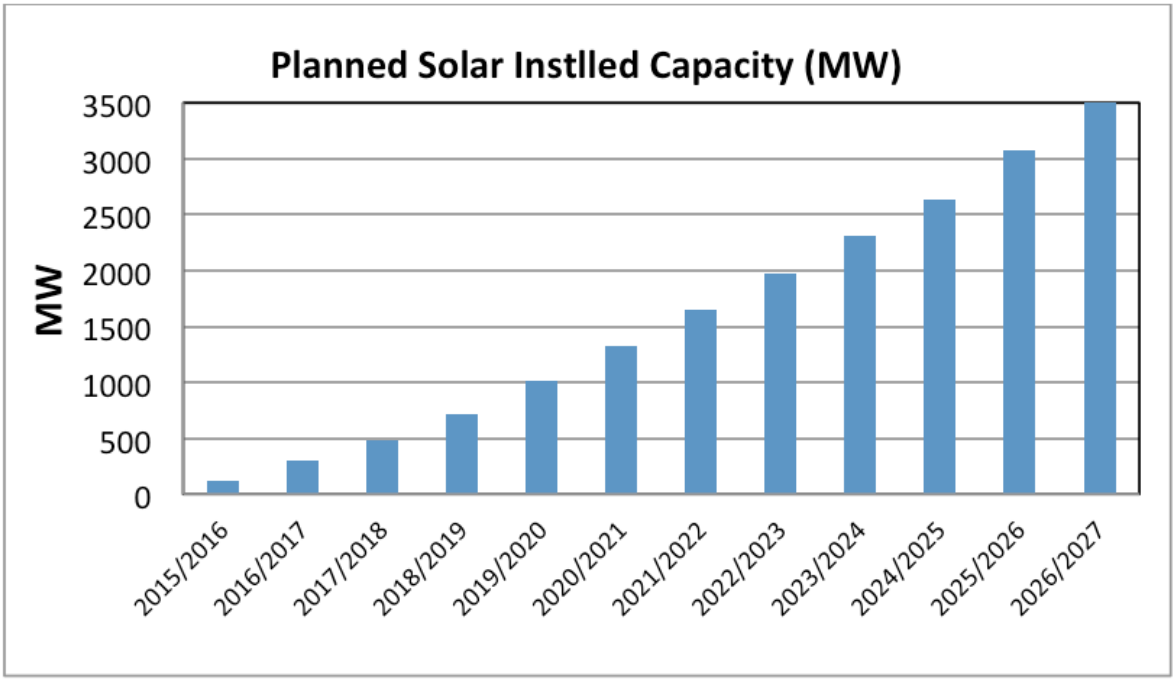



**Figure (1) The progressive development of the planned Egyptian Solar Plan**

### 3. National Regulatory and Legal Conditions

One important pillar in opening the door for the contribution of the private sector to participate in large infrastructure projects in Egypt (greater than 100 M EGP) was Law no. 67-2010 that was issued in May 2010. This law allows the private sector to build, operate, and sell services and products to people in coordination and under the supervision of the government. Service/product quality must be accepted by the government, while the price is approved by both parties. Though this law was generic, it was neither sufficient to build the proper momentum in the RE sector, nor did it address its specifics. However, Law 203-2014 (for stimulating electricity production from RE resources) explicitly sets the framework for the private sector to build, operate, and sell electricity from renewable energy resources. In this law:

• The Egyptian Electricity Transmission Company is the entity authorized to issue bidding for renewable energy projects for the private sector.
• The investor has the right to build, own, and operate renewable energy projects and sell electricity to the Egyptian Electricity Transmission Company or to one of the distribution companies according to a FiT for a maximum of 25 years.
• The project land is assigned to the investor with only a “right of use” during the project period.
• EgyptERA is the only entity allowed and has the right to issue the necessary permissions for private investors to build, own, operate, and sell electricity from renewable energy resources.
• The Egyptian Electricity Transmission Company or the designated distribution company is obliged to purchase the generated electricity even in case it cannot transmit this electricity on its network.
• The Ministry Council is entrusted to issue the defining rules and regulations of the FiT and Certificate of Origin.

**4. Incentives Structure**

EgyptERA plans to stimulate the renewable energy market in Egypt through both push and pull mechanisms. The push mechanisms (FiT, Net Metering, Competitive Bidding, Green Certificates, and Fiscal Incentives) target stimulating the supply side with incentives to increase the availability of electricity originating from renewable energy resources. The pull mechanisms (Quota Obligation, Certificate of Origin) target stimulating the demand side by creating a market that seeks electricity originated from renewable energy resources.

## 4.1 Push Mechanisms

### 4.1.1 Feed-in Tariff (FiT)

In October 2014, and according to Law 203-2014, Egypt announced its FiT regulation for both PV and wind projects, described below in details:

• FiT for PV Projects

The outline of the PV FiT regulations can be summarized as follows:

**1)** The PV projects enjoy a flat rate over a contractual period of 25 years.

**2)** Table (1) illustrates the FiT price for different sizes of PV projects.

| | |
|---|---|
| Residential | P.T/ 84.4 kWh |
| Installed Capacity ≤ 200 kW | P.T./ 90.1 kWh |
| kW ≤ Installed Capacity 200 < 500 kW | P.T./ 97.3 kWh |
| kW ≤ Installed Capacity 500 < 20 MW | .$ 13.6 Cent/kWh |
| MW ≤ Installed Capacity 20 ≤ 50 MW | 14.34 Cent/.$ kWh |

**3)** FiT for installed capacity greater than 500 kW is paid according to the following equation:

PV Project FiT
=15% of FiT ($.Cent)×7.15 (L.E.)
+ 85% of FiT ($.Cent)
×Exchange Rate on the Bill Issuance Day,as Stated in the Contract

**4)** The upper limit for the total contractual PV capacity is:

A. 300 MW for projects with installed capacities up to 500 kW, and

B. 2000 MW for projects with installed capacities from 500 kW and up to 50 MW.

• FiT for Wind Projects

Similarly, the outline of the wind FiT regulations can be summarized as follows:

**1)** The total contractual period for wind projects is 20 years.

**2)** The FiT is divided into two segments as shown in **Table (2)**.

| (Full Operating Hours (FOH | FiT for the 1st tariff segment (5-year period) (($. Cent/kWh | FiT for the 2nd tariff segment (15-year period) ($.Cent/ (kWh |
|---|---|---|
| 2500 | 11.48 | 11.48 |
| 2600 | | 10.56 |
| 2700 | | 9.71 |
| 2800 | | 8.93 |
| 2900 | | 8.19 |
| 3000 | | 7.51 |
| 3100 | 9.57 | 8.93 |
| 3200 | | 8.33 |
| 3300 | | 7.76 |
| 3400 | | 7.23 |
| 3500 | | 6.73 |
| 3600 | | 6.26 |
| 3700 | | 5.81 |
| 3800 | | 5.39 |
| 3900 | | 4.98 |
| 4000 | | 4.6 |

**3)** FiT is paid in E.P according to the following equation:

Wind Project FiT
=30% of FiT ($.Cent)
×7.15 (L.E.)+ 70% of FiT ($.Cent)
×Exchange Rate on the Bill Issuance Day,as Stated in the Contract

**4)** Actual Full Operating Hours (FOH) is approximated to the nearest larger value shown in Table (2).

**5)** The upper limit for a contractual wind installed capacity is 2000 MW.

### 4.1.2 Net Metering

In a way to push forward for the implementation of PV systems in Egypt, EgyptERA approved in December 2012 a Net Metering mechanism for PV rooftops. The main characteristics for this mechanism are:

• The distribution company will be responsible to install a net meter at the customer's premises. The customer will bear its cost, and will be charged the net consumption by the end of every month.
• In case the electricity generation is greater than the consumption in a certain month, the net value of the generated electricity will be calculated according to the largest bracket of consumption in that monthThis amount will be carried over to the next month.
• If the customer has a net credit by the end of the calendar year, this credit will be settled down and will not be carried over to the next year.
• EgyptERA will issue Certificates of Origin to the customer, one certificate for each 1 MWh, provided that the electricity generated from solar energy is not less than 1 MWh/month.

### 4.1.3 Competitive Bidding

Competitive bidding mechanism is used to raise requests for 2500 MW of wind projects in blocks of 250 MW each (i.e. 10 blocks). This will be achieved through 5 different bids, where the first one will be restricted to one block, and the remaining 4 bids will be for 2 or 3 blocks each. Contrary to FiT, the competitive bidding mechanism encourages local manufacturability, which will be considered during bid evaluation. Competitive bidding mechanism aims to:

• Carefully control the expansion of RE projects according to the technicalcapacity of the transmission system.
• Develop the local industries related to RE.
• Increase private investment.
• Better understand the local market from the investors' point of view and thus settle to the lowest possible price that can be used as a bench mark for FiT.
• Send positive and reassuring messages to investors through a long-term purchase power agreement (PPA).

The competitive bidding process flow is shown in Table (3), which reveals that each bid takes about 5 years from issuing, until the project is operating. Putting in mind the target of implementing 2500 MW using this mechanism by 2020, it means multiple bids will be running in parallel during the remaining 5 years.

| Phases | Item | Period |
|---|---|---|
| Phase 1 | Pre-qualification based on the experience and the financial status | 6 months |
| | Wind measurements; | 15 months |
| | Bird migrations and Environmental Impact Assessment (EIA) | |
| | Soil testing | |
| | Choosing the consultant | |
| Phase 2 | Shortlisted Bidders submit their proposals | 3 months |
| | Choosing investor and signing contract | 3 months |
| | Establishing the projects' company, signing PPA and financial closure | 6 months |
| | Constructing the wind farm | 24 months |
| | Commissioning and start up | 3 months |
| Total | | 60 months |

#### 4.1.4 Fiscal Incentives

Concerning customs duties, before 2007, RE equipment were dealt with similar to conventional power plants, and accordingly were subject to 5% customs. With the issuing of law no. 39 in 2007, customs duties were lowered to 2% for complete RE systems. This direction was given a further push in May 2010 with the Ministerial Cabinet order no. 90 where complete RE systems were totally exempted from customs duties, though it is not exempted from sales tax.

### 4.2 Demand-Side Incentives

#### 4.2.1 Quota Obligation and RE Labeling

In the quota obligation system, large electricity consumers will be obliged to supply a certain percentage of their consumption from RE resources. The obligation percentage will be set by the cabinet, and until now there is no actual move to implement this mechanism, though it is part of the overall view of incentives as envisioned by EgyptERA.

In addition, RE labeling will be permitted to certain economic activities; e.g. touristic resorts, hotels, and industrial manufacturers, provided they buy certificates of Guarantee of Origin GoO (see below) stating the amount of RE electricity they used. Labeling mechanism makes use of the voluntarily market created by many consumers who are concerned with global warming and environmental impact of conventional power plants. This mechanism will open the door for green tourism to be marketed internationally, and will allow goods producers to label their product as green products.

#### 4.2.2 Guarantee of Origin (GoO)

As electricity is a commodity, no one can differentiate the origin of the electricity produced or consumed. The GoO system tries to put a mark on the electricity produced from RE sources in order to be dealt with differently in the market. Both the Quota Obligation and GoO play hand-in-hand to create a market that seeks electricity from RE. There are three main players involved in this mechanism:

•Production Device (PD): It is any renewable energy unit that produces electricity; e.g. a wind farm or a PV farm. All PDs that want to benefit from this mechanism should provide general, technical, and economic asset information to the Issuing Body (IB).

•Issuing Body (IB): EgyptERA will be responsible of issuing the certificates, registering and approving the production devices and accounts.

•Account Holder (AH): Any PD owner or a trader or a mixture of both is considered as AH. Any AH will have an account on the system to manage certificates. An AH can have multiple PDs.

## 5. Electricity Tariffs and the Challenge among People

With the increasing rotating blackout that started to occur in a regular fashion during summer times in the last three years, the Egyptian population responded by increasing pressure on the government to utilize RE. Egyptians need no proof to recognize the vast solar resource Egypt is blessed with, and thus have been asking for years why this abundant resource is not adequately utilized. One has to recognize the conflicting pictures from the population and government points of view. From the population's point of view, while there is widely public acceptance of RE utilization, especially solar energy, it was (and still is) difficult for Egyptians to accept the necessity to adjust the electricity prices to reflect its actual cost; which, after decades of electricity subsidies, seems to be a "given right," putting in mind that now 26% of Egyptians are below the poverty line. From the government's

point of view, it wishes to slash the subsidy, which heavily burden the national budget resulting in an ever-declining services' quality (not only electricity but all public services). This electricity subsidy has mounted up to 163 billion EGP to the Ministries of Finance and Petroleum until June 2013. This burdened budget doesn't give the government the leverage to invest in RE technologies. Furthermore, successive governments were not open, transparent, and courageous enough to take all the necessary steps in educating the public and convincing them of all the necessary steps to adjust the subsidy policy, mainly out of fear of widespread discontent and public anger. This was true for decades until recently, when the current president seized the opportunity of his high public ratings and took steps forward in restructuring electricity prices through a 5-year plan in July 2014 [3]. The plan aims to trim the electricity subsidy by 67% over 5 years to reach only 9 billion EGP instead of the 27.4 billion EGP that was allocated in 2014/25 Budget. Before implementing this plan, the average cost of kWh was 47 P.T., while the average selling price was only 22 P.T. Figures (2) and (3) show the electricity tariff and annual percentage increase for residential customers respectively, according to the 5-year plan issued in 2014

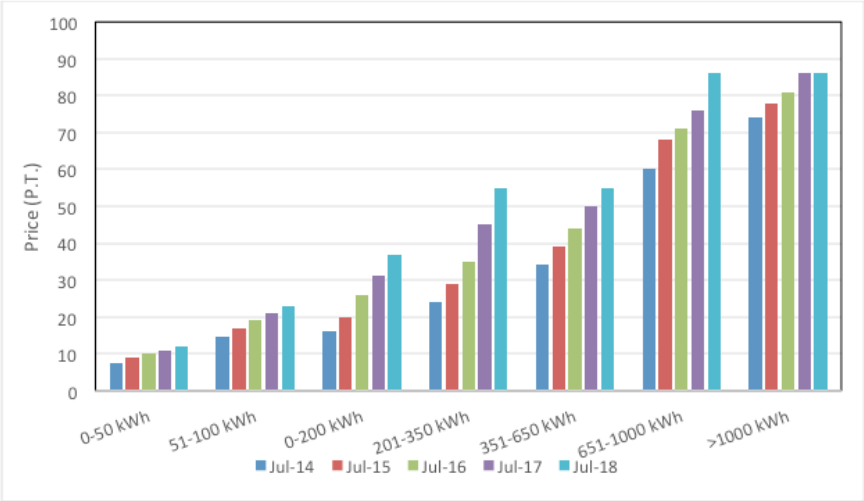



**Figure (2):Electricity tariff for residential customers according to the 5-year plan issued in 2014.**

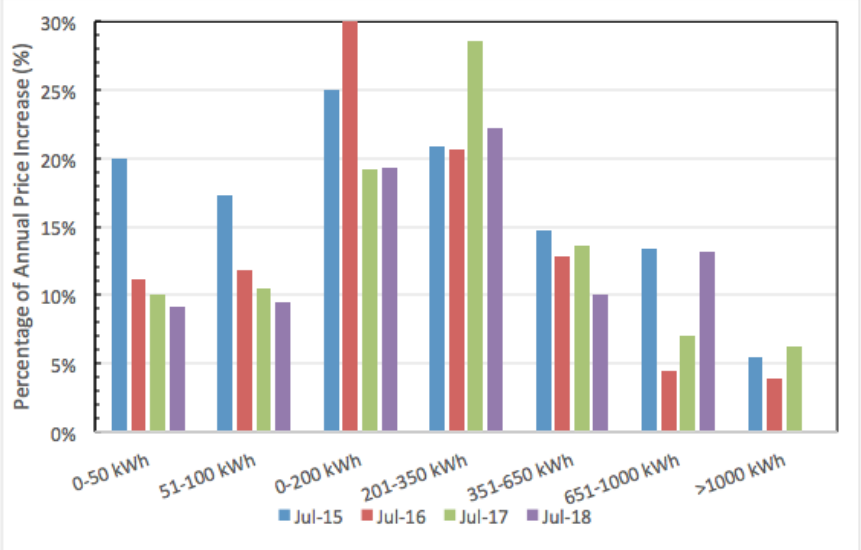



**Figure (3) : The annual percentage increases in each bracket of the residential sector tariff according to the 5-year plan issued in 2014.**

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[1] New and Renewable Energy Authority (NREA) http://www.nrea.gov.eg

[2] Egyptian Electric Utility And Consumer Protection Regulatory Agency (EgyptERA) http://www.egyptera.org/en/

[3] Electricity tariffs http://egyptera.org/ar/t3reefa.aspx

# Renewable Energy Transitions in Jordan: Social Acceptance of Renewable Energies: the Jordanian Case

*Eng. Walid Shahin*

## 1. Introduction

Energy is the vital force powering business, manufacturing, and the transportation of goods and services to serve world economies; it is a key element of sustainable development. The role of energy, specifically electricity, in improving people's quality of life cannot be ignored. Many researchers have shown that there is a strong correlation between electricity consumption and economic growth. Thus, access to modern energy is crucial for the provision of clean water, sanitation and healthcare and for the provision of lighting, heating, cooking, transport and telecommunications services. Energy supply and demand play an increasingly vital role in our national security and the economic output of our nation. Energy plays a fundamental role in the socioeconomic and technological development of any economy. Despite the importance of energy in human life, billions of people still lack access to the most basic energy services in the present day. In order to reduce the level of energy poverty in these countries, many of their governments have engaged in various strategies to provide energy for their citizens.

## 2. The Jordanian Situation

Jordan, like many other countries, lacks indigenous energy recourses. Approximately 97% of Jordan's energy needs are imported, which include mainly: crude oil, petroleum products, and natural gas. Local sources do not contribute more than 3% of these needs; as renewable energy is currently contributing only a small proportion of the energy mix. Jordan is a net energy importer with very limited resources of its own. Jordan's energy demand has increased rapidly in recent years, which caused the energy invoice to become a heavy burden on the Jordanian economy. Energy costs are expected to grow further with increasing demand. Jordan's primary energy and electricity demand forecast implies an annual increase of 5.1 percent and 6.4 percent respectively by the year 2020. Taking into consideration that the annual growth rate of the economy is around 3%, this would indicate a trend towards a less energy-productive economy and most likely a less energy efficient one.

Over the past few years, the energy sector has experienced several setbacks. The increase in the prices of crude oil and its derivatives, as well as the events that occurred in Egypt during the Arab Spring, has significantly affected the energy sector as a whole. As a result of the interruption of the Egyptian gas supply and the shift to expensive heavy fuel for electricity generation, energy imports in 2013 amounted to 4.076 billion JD (5.7 billion USD), which accounts for 26.3% of total imports, and 17.1% of Gross Domestic Product (GDP)[1]. The total subsidies for petroleum products and electricity for the same year were 1.85 billion JD, as a result of the reduction of NG quantities imported from Egypt and having to substitute heavy fuel in the generation of electricity and selling electricity below cost. The policy of the Government of Jordan in the field of energy was shaped through the adoption of the Updated Master Strategy of Energy Sector in Jordan for the period 2007-2020. The main goals of the Energy Strategy are the provision of reliable energy supply by increasing the share of local energy resources in the energy mix, reducing the dependency on imported oil, diversifying the energy resources and enhancing environmental protection.

These goals will be achieved through maximizing the utilization of domestic resources such as oil shale, natural gas, etc., expanding the development of renewable energy projects, generating electricity from nuclear energy, and promoting energy conservation and awareness. The Government of Jordan is seeking to address challenges in the energy sector through a combination of medium and long-term solutions. Furthermore, the Jordanian government is working on the security and reliability of its supply chain to avoid future situations of energy shortages. It is also working on the implementation of measures in line with the objectives to improve fiscal and macro-economic situations and sound and sustainable growth for Jordan.

To alleviate this problem, the Jordanian government has set in motion a number of measures that aim to face these challenges and specifically reduce the dependence on imported energy. The National Energy Strategy 2007-2020 calls for increasing the contribution of local resources from a mere 4% to 39% by the year 2020. Renewable energy is set to contribute around 10% in the primary energy mix.

## 3. Renewable Energy in Jordan

The 2007 Energy Strategy has set ambitious goals for the development of renewable energies in Jordan. By 2020, the share of renewable energies in primary energy supply is to be increased from the current 2% to 10%. A number of single targets have been set, such as for wind power (installation of about 1200 MW), solar power (600 MW), and solar water heaters (share of 30% by 2020), in addition to waste/energy (30-50 MW).

The government has underlined its commitment to reach the ambitious targets set in the Energy Strategy and has issued the Renewable Energy and Energy Efficiency Law on April 17th, 2012. With this law, for the first time in Jordan, unsolicited or direct proposal submission is allowed, where investors have the opportunity to identify and develop renewable grid-connected electricity production projects such as wind parks, solar systems, and others, on their own and propose these to the Ministry of Energy and Mineral Resources. The committed renewable energy projects until 2015 are:

- Wind power project in the Tafila area by the Jordan Wind Project Company (JWPC) with a capacity of (117 MW). The project is expected to run by mid-2015.
- Wind power project in the Fujeij area with a capacity of (90MW).
- Wind power project in the Maan area with a capacity of (70 MW) (Fund for Arab Economic Development Grant).
- PV solar project in the Quweirah area with a capacity of (70 MW) (Abu Dhabi Fund For Development Grant).
- PV solar project with a capacity of (10 MW) in the area of Mafraq.
- Direct proposal solar projects to generate solar electricity (200 MW).
- PV solar project with a capacity of (5 MW) (Spain Grant).
- Wind energy projects from direct proposals to generate electricity (100 MW).

The Ministry of Energy and Mineral Resources with the Mineral & Electricity Regulatory Commission both contributed in the preparation of the guidelines stipulated in the Renewable Energy & Energy Efficiency Law No. (13) Of 2012 in accordance with the policies and relevant legislations. The number of requests for connecting renewable energy systems according to the Net-Metering system has reached 430 requests with 12352 kW of capacity, 291 of which, with 2554 kW, were connected and operated during the year 2013.

## 4. Energy Efficiency

Improving energy efficiency is an integral part of the 2007-2020 Energy Strategy, which calls for a 20% improvement in energy efficiency in all sectors by 2020. High-energy saving potentials have been identified in all sectors and the target is to decrease the energy intensity to reach 180 Kgoe/1000 JD by 2020 compared with 210 kgoe/1000 JD in 2010 in constant prices. The Energy Efficiency By-Law was issued on 14th Nov. 2012, where Solar Water Heaters (SWHs) became mandatory as of April 2013 for new buildings. The Energy Services Company (ESCOs) market has to be licensed and regulated, labeling as well became mandatory to all electric appliances. The Tax Exemptions By-Law was issued on 14th February 2013, exempting all Renewable Energy and Energy Efficiency Systems and Equipments from sales tax and custom duties. Moreover, all Renewable Energy projects shall enjoy the tax exemptions applicable to conventional IPP projects. There are many factors that will determine the successful implementation of the renewable energy strategy, one of which is widely assumed to be 'public acceptance'.

## 5. Social Acceptance of Renewable Energy Projects

There are many factors that explain the successful implementation of renewable energy technologies in a country, one of which is "social acceptance" (Ekins, 2004). "Social acceptance can be divided into three dimensions," according to Wüstenhaagen (2007) [2]. This so called triangle model distinguishes the following dimensions:

- **Socio-political** acceptance refers to the acceptance of both technologies and policies at the most general level, which includes acceptance by key stakeholders and policymakers. Stakeholders and policymakers involved in discussing 'renewable policies' become crucial when addressing planning issues or promoting local involvement initiatives. Thus the assessment of their levels of acceptance is an area of increasing interest for social researchers.
- **Community acceptance** refers to the acceptance of specific projects at the local level, including potentially affected populations, key local stakeholders and the local authorities. This is the area where social debate around renewables arises and develops, and the one that has attracted most of the social research traditionally carried out has been the wind energy field.
- **Market acceptance** refers to the process by which market parties adopt and support (or otherwise) the energy innovations. Here we find processes such as green power marketing and willingness to pay for green power. Market acceptance is proposed in a wider sense, including not only consumers, but also investors and, very significant, intra-firm acceptance.

Jordan is blessed with an abundance of solar energy, which is evident from the annual daily average solar irradiance on a horizontal surface ranges between 5-7 kWh/m2, which is one of the highest in the world. The average sunshine duration is more than 300 days per year. Jordan was one of the first countries in the region to introduce renewable energy specifically for water pumping in remote areas using PV and windmills. The installations have received both official support and community acceptance, and in some cases demand for more installations in other areas of the country.

The National Energy Research Center (NERC) launched a national program for installing Biogas Demonstration Units for Small Animal Farms. The aim of this program is to disseminate biogas technology among the farmers to increase the penetration rate of renewables into the local market. Again, the local community was very receptive of the idea and more demand was received from farmers who wanted to electrify their farms. Jordan enjoys a substantial potential of renewable energy sources. Considerable efforts have been made and great progress has been achieved in the application

of solar, wind, biogas and hydro energy utilization. The renewable energy law emphasized the commitment on the government's side to set the proper framework conditions for the commercial utilization of available RE resources.

Another sign of local acceptance of renewable energy applications in Jordan includes solar water heaters, where more than 300,000 units have been installed, reaching a penetration rate of around 25% back in the 1990's.

## 6. Social Acceptance-Review

Many studies were conducted on public understanding and attitudes towards renewable energy usage in different countries. Liu et al. (2013) examined rural social acceptance of renewable energy deployment taking Shandong in China as a case study via a field questionnaire survey. The results of their study show that rural residents are generally in support of renewable energy development given its positive impacts on the environment, and that the public willingness to pay more for renewable electricity is positively related to household income, individual knowledge level and belief about costs of renewable energy use, but is however negatively related to individual age. [3]

Kaldellis et al. (2012) conducted a study on the public attitudes towards renewable energy applications in Greece. A questionnaire was deployed for conducting the survey based on a representative sample of local inhabitants. The results show that there is a high level of knowledge and acceptability of renewable energy applications in the southern region, although the need for additional public information regarding RES exploitation has also been designated. According to Ek (2005), the public is generally positive towards wind power based on a postal survey that was sent out to 1000 Swedish house owners. The results show that the probability of finding an average individual in support of wind power decreases with age and income. Also, people who have an interest in environmental issues are more likely to be positive towards wind power than the average respondent.

Also, Fastand McLeman (2012) conducted a study on the attitude towards new renewable energy technologies in the Eastern Ontario Highlands using a mail-out survey and focus group discussions for permanent residents, local and regional government decision-makers. The results show strong support among residents to pursue alternative energy sources (89%), mostly out of concerns with rising energy costs, but also from a desire to use local energy sources. The respondents' support was highest for solar technologies (87%) and lowest for wind turbines (58%) and new hydroelectric dams (58%).

Batleyet al. (2001) and Roe et al. (2001) have revealed in their surveys that a large number of people in the UK and the US respectively are willing to pay more for electricity from generation sources that have a minimal adverse impact on the environment. There is lack of scientific studies on public understanding and knowledge of renewable energy sources and technologies in the developing countries in general, and Jordan in specific.

The Tafila Pioneering Development Solar project was the first phase of implementing the "Let Jordan Shine" plan. The project involved sourcing and installing 1,000 smart solar SunWave systems on rooftops in Tafila.[4]
Safety and quality are the two main concerns of the construction of the PV system to ensure no performance issues and/or accidents. The other major objective of any project is positive impact on the standards of living and the quality of life for the beneficiaries, which can be determined by the mean of a social impact study. Such a project has to be beneficial for residents through (a) lowering

electricity bills, (b) encouraging a mindset change towards sustainable development, and (c) leading to adopt such a project in other Governorates in the Kingdom.

In conclusion Social acceptance of renewable energy does not have to be artificially created. It is there and it can be converted into community acceptance through early involvement and participation. The Tafila Pioneering Development project, which was implemented in 2011, is a good example of working with the local community where education of Tafila's residents was an important first step towards gaining acceptance and implementing a community-wide PV project. Any PV installation would not occur without the approval of the residents. Therefore, it was important that the community members understand the purpose and benefits of photovoltaic energy generation to both their community and the country. This will not only increase acceptance, but also understanding in that certain houses are not as suitable as others for PV due to orientation, shading, or structure. Informational packages and community meetings took place with the joint efforts of RSS, IRADA and Petra Solar. These were good starting measures for spreading awareness and knowledge about this type of project, as is seen by the success of a similar renewable energy project in Kyoquot, BC (Pembina Institute, 2007). Education of the youth could be done through school teachings as a component of science, technology and finance lessons. There are numerous teaching guides for solar energy suitable for elementary and high school students from organizations such as NEED (2007) and the Union of Concerned Scientists (2003). This is important to prevent vandalism, as the young residents are less likely to damage the panels if they are aware of their value and benefits to themselves and the community.

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[1] MEMR annual Report.

[2] Koskinen and Olli Laitinen, "Social Acceptance of Wind Energy Projects, STATE-OF-THE-ART REPORT," Country Report of Finland.

[3] Akinwale et el, 2014, "A Descriptive Analysis of Public Understanding and Attitudes of Renewable Energy Resources towards Energy Access and Development in Nigeria."

[4] RSS- "Studying the Technical & Socioeconomic Impact of the Tafila Pioneering Development project," 2012.

# Strengthening the Scientific EU-MENA Exchange: A Collaborative Approach for Research towards a Sustainable Energy System in MENA

*Thomas Fink, Manfred Fischedick*

## Abstract

While a number of transitional organizations that aim to promote sustainable energy cooperation between Europe and the Middle East and North Africa (MENA) have emerged in the past years, such an organization still does not exist in the area of academia and science. This provided the motivation behind an initiative of the Desertec University Network (DUN) and the Wuppertal Institute for Climate, Environment and Energy to establish together with the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) such an organization for the research community in Europe and MENA. This paper describes the background behind the idea and the initial approach of collaboration between research institutions.

### 1. Background

Global challenges like energy supply, water scarcity and climate change are strongly interconnected and must be solved in a cross-border approach that needs a common understanding of sustainability principles. For that purpose, transnational organizations are needed to address these challenges. Within this project we have a special focus on Europe and MENA. With the launching of the EU's Barcelona Process in November 1995, an initial step took place. Later this initiative continued as the Union for Mediterranean (UfM), a relatively solid institution to address the political level. Private sector alliances like the Desertec Industrial Initiative (Dii) and the Medgrid consortium represent the industrial level. Institutions like the Association of Mediterranean Regulators for Electricity and Gas (MED-REG) and the Association of Mediterranean Transmission System Operators (MED-TSO) address the area of regulation and infrastructure planning. However, so far, an overarching transnational institution for academia and science focused on a transformative research approach and addressing the policy-science interface is still absent, although several research institutions have already published scientific works acting in this field. This includes, for instance, research on building renewable energy capabilities in Egypt, Morocco and Tunisia (Vidican 2012, Vidican et al. 2013, Borbonus et al. 2013), developing a participative Tunisian electricity strategy (Lechtenböhmer et al. 2012), and about power market scenarios towards a more sustainable energy system in EU-MENA (Dii 2013, Hafner et al. 2012). However, the coordination of such research activities is still weak, particularly within the MENA region. Against this background, the creation of the EU-MENA Research Institute for Sustainable Energy (EU-MENA RISE) was motivated – a leading forum of ideas and expertise about sustainable energy transitions in Europe and MENA. Since 2011, the project is progressing with support of the Desertec University Network (DUN), Wuppertal Institute for Climate, Environment and Energy, and the Regional Center for Renewable Energy and Energy Efficiency (RCREEE). Several workshops took already place in the past years with many research partners[1] out of different disciplines from both regions to elaborate the idea in a participatory and transparent manner. The following information is based on the project's concept note that has been elaborated by the Wuppertal Institute, RCREEE and DUN supporting institutions (Wuppertal Institute et al. 2015).

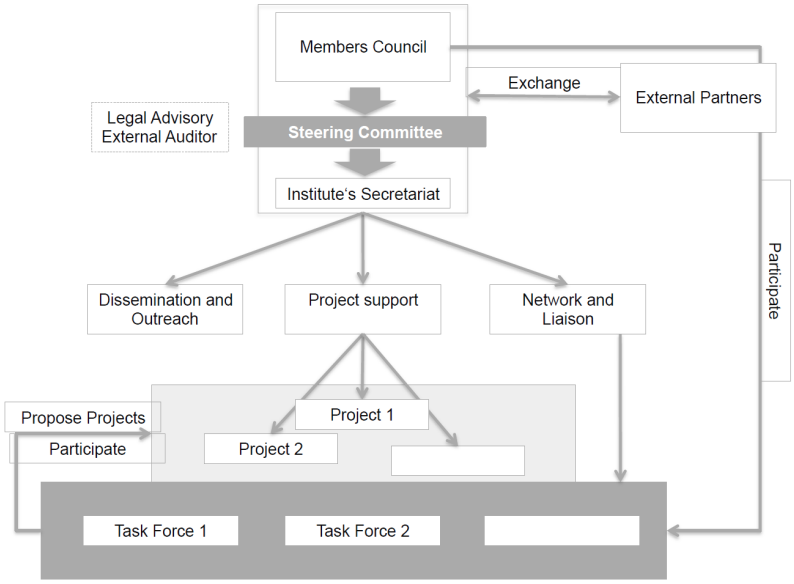
[1]EU-MENA RISE follows an open approach. Members are interested researchers on a private-person basis as well as research institutions. Members take part in the initiative on a non-binding basis. The number of members has increased constantly in the past years with members from Germany, Austria, Italy, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Kuwait, UAE and Saudi Arabia.

## 2. Research Focus and Approach

Several consultation meetings in the past years provided the opportunity to extensively introduce and discuss research activities of participating research institutes. As a result of these meetings, it has been agreed that the project aims to connect and to empower the scientific community in addressing challenges that includes techno- and socio-economic as well as institutional and cultural aspects for a transformation to achieve sustainable energy in the MENA region. Against this background, the project acts as a catalyst for interdisciplinary and transdisciplinary work and serves as a knowledge, information and communication hub for different stakeholders. This includes decision makers from policy, economy and civil society. The research focus of the project is related to the following research areas: (1) energy system transformation based on transitions to sustainability, (2) climate change, and (3) energy-water nexus. The research areas were selected according to their high importance in Europe and especially the MENA region. Within these areas, research on energy system transitions from fossil fuel to renewable energies have been defined as key research activities. In particular, technologies for exploiting the high potential of wind and solar in MENA are in the research focus that is needed to overcome the multitude of challenges of fossil fuel structures in the region. The modernization of the incumbent energy system in MENA is urgently required to compensate for the lack of investment into energy structures in the past years, and to handle the rapidly increasing electricity demand and energy costs. Against this background, the adaptation of new technologies must additionally satisfy the aspirations of the population in MENA as a consequence of the 'Arab Spring'. Higher participation, economic wealth creation and employment are key aspects in this context that must be assessed. The additional research areas, such as climate change and energy-water nexus, are strongly interwoven with the energy system and are becoming of higher interest to the scientific community. Both topics are of significant importance for MENA as the region is particularly vulnerable to these aspects. In this context, the intended research activities are motivated by the discipline of transformative science, in which two concepts have a leading role: transition research and transformation research. While transition research explores transition processes and strategies of change towards sustainable lifestyle, production or consumption patterns, transformative research complements this perspective by focusing on real-term implementation processes resulting in needed system innovations.

## 3. Research Structure

In the initial phase, the project operates as a virtual research institute based on a research network out of members from different scientific disciplines. Within this scope, a competence matrix is developed to provide information about member institutions, their experiences in research activities and scientific competences. This information helps members interested in setting up relevant inter- and trans-disciplinary research projects to identify potential research partners and initiate exchange. The operational structure of the virtual institute facilitates networking between members participating in task forces and project work. Against this background, task forces propose, elaborate and initiate project ideas. Further potential research partners out of the network are identified in this elaboration process if needed. All projects get support from the secretariat, steering committee and member's council during the lifetime of the project. The practical application of developed research projects is guaranteed by initiating a strong exchange with stakeholders from the private sector. Figure 1 illustrates the organizational structure of the virtual institute.




## 4. Summary

This paper briefly introduces a collaborative approach for scientific research towards a sustainable energy system in MENA taking up research competences from Europe and MENA. The approach is established as a newly founded virtual institute called EU-MENA Research Institute for Sustainable Energy (EU-MENA RISE). The project fills the identified gap of an overarching transnational institution for academia and science addressing the policy-science interface and for providing independent science-based knowledge to civil society. The scientific discipline 'transformative science' has been selected as the scientific foundation of the project, which is needed to support and steer a complex energy system transition from fossil fuels to renewable energies – a core aspect of the project's motivation. Three key research areas were identified according to their high relevance for the pressing challenges facing MENA and due to their intertwining with each other. An operational model has been presented to illustrate the way of working and setting up of common research projects between research partners. This includes also the elaboration of a detailed competence matrix of member institutions that provides information about their research experiences and scientific competences. This database will help research institutions in identifying research partners according to their research competences and research interests for setting up inter- and trans-disciplinary research projects. The project has already enjoyed high attention and strong support from several research institutions in the past years.

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# Section B

# Conference Program and Proceedings

Wuppertal Institute
for Climate, Environment
and Energy

الأسبوع الألماني
DEUTSCHE WOCHE
2015

**Renewable Energy Transitions in Jordan and the MENA Region**

**Conference in Amman 5.5 - 6.5. 2015**
**Hotel Crowne Plaza**

**Friedrich-Ebert-Stiftung/ Wuppertal Institute**
**Agenda**


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## Background of the Conference

The worldwide trend of renewable energy expansion has also started to reach the Middle East and North Africa (MENA) region. Today, many MENA countries are implementing - or have already realized - a number of large solar and wind power projects. Thanks to the accelerated expansion in the past years, a network of private and institutional actors was also able to emerge - giving a further push to the professionalization of the MENA renewable sector. A good example is the Kingdom of Jordan, where a transparent regulatory and incentive framework successfully attracted developers and investors for the construction of large renewable power projects. But will these achievements - and those of other MENA countries - really be the start of a profound shift to a renewable energy future in the entire region? So far, it is not clear whether renewable energies can actually become a pillar of the future energy supply - or will rather see the fate of remaining a marginal "add-on" to a predominantly conventional energy system. Experiences in Europe (e.g., Germany) show that, with increasing renewable energy penetration, not only technical issues arise, but likewise the challenges regarding the socio-economic consequences of such a transformation of the energy system. This conference - organized by the Friedrich-Ebert-Stiftung and the Wuppertal Institute for Climate, Environment and Energy - is aimed at addressing these questions by particularly looking at the socio-economic and governance aspects of energy system transformations in the MENA region.

## Objectives of the Conference

The overarching objective of the conference is to motivate a discussion between various stakeholders - politicians, public sector, industry, civil society - on governance and socio-economic aspects of energy system transformations in the MENA region. Two dimensions shall be explored. First: the regional context, involving the view of several invited experts from selected MENA countries; and second, the Jordanian experience, which will be explored in a workshop with Jordanian stakeholders and energy experts. Every participant is encouraged to provide his or her point of view in the form of a short input paper, which will become part of a subsequent publication of the Friedrich-Ebert-Stiftung on the outcome of the conference.

## Renewable Energy Transitions in Jordan and the MENA Region

## Conference in Amman 5.5.-6.5. 2015
## Hotel Crowne Plaza

## Friedrich-Ebert-Stiftung/ Wuppertal Institute
## Agenda

**Tuesday, May 5, 2015**

**Panel I: Introduction**

| | | |
|---|---|---|
| **Registration** | | 9:00-09:30 |
| **Welcome Note** | **Richard Probst**, FES Jordan, MENA Regional Coordinator Climate and Energy Project | 9:30-09:35 |
| **Welcome Note** | **H.E. Ralph Tarraf**, Ambassador of the Federal Republic of Germany to the Hashemite Kingdom of Jordan | 9:35-09:40 |
| **Keynote Welcome and Opening Note** | **H.E. Dr. Ibrahim Saif**, Minister of Energy and Mineral Resources of the Hashemite Kingdom of Jordan | 9:40-9:50 |
| **Keynote Opening Speech** | **Prof. Dr. Manfred Fischedick**, Vice-President Wuppertal Institute<br><br>*"*The Transition of Energy Systems. Global Dimension, Experiences in Germany ("Energiewende"), Socio-Economic Aspects*"* | 09:50-10:10 |
| **Questions and discussion** | **Moderator: Amal Abu-Jiries**, Program Manager FES Jordan | 10:10-10:30 |
| **Coffee Break** | | 10:30-11:00 |

**Panel II: The Transition of Energy Systems in the MENA Region**

This panel takes a macro-perspective on the current status of renewable energy in the MENA region. Recent developments, market trends and policies are explored by looking at the regional dimension of energy system transformation.

| | | |
|---|---|---|
| **Presentation** | **Bernhard Brand,** Wuppertal Institute<br><br>Patterns of Energy System Transition. Can we Observe an Energy System Transition in the MENA Region | 11:00-<br>11:25 |
| **Presentation** | **Nurzat Myrsalieva (RCREEE)**<br><br>Measuring Energy Transformation, Arab Energy Index | 11:25-<br>11:50 |
| **Questions and discussion** | **Moderator: Dr. Beyhan Sentürk** | 11:50-<br>12:30 |
| **Lunch** | | 12:30-<br>14:00 |

**Panel III: Drivers and Barriers for Renewable Energy in Selected MENA Countries**

The pace of renewable energy expansion shows a very high heterogeneity across the MENA region. In this session, energy experts from the Maghreb and the Mashrek will provide an account of the current situation and analyze key drivers and barriers for renewable energy projects in their countries. Particular emphasis is given to governance, regulatory and socio-economic aspects, as well as the current public discussion about national energy strategies in the different countries.

| | | |
|---|---|---|
| **Presentation Jordanian Perspective** | **Prof. Dr. Suhail Kiwan**, German Jordan University (Jordan) | 14:00-<br>14:20 |
| **Presentation Egyptian Perspective** | **Dr. Hatem El Refaei,** Ain Shams University (Egypt) | 14:20-<br>14:40 |
| **Presentation Lebanese Perspective** | **Dr. Joseph Al Assad**, Lebanese Center of Energy Conservation (Lebanon) | 14:40-<br>15:00 |
| **Questions and discussion** | **Moderator: Thomas Fink** (Wuppertal Institute) | 15:00<br>-15:30 |
| **Coffee break** | | 15:30-<br>16:00 |
| **Presentation Moroccan Perspective** | **El Mostafa Jamae**, MENA-RES (Morocco) | 16:00-<br>16:20 |
| **Presentation Algerian Perspective** | **Diaf Said,** CDER (Algeria) | 16:20-<br>16:40 |
| **Presentation Tunisian Perspective** | **Rafik Missaoui**, Alcor (Tunisia) | 16:40-<br>17:00 |
| **Questions and discussion** | **Moderator: Bernhard Brand** (Wuppertal Institute) | 17:00-<br>17:30 |

## Wednesday, May 6, 2015

**Panel IV: Actors, Drivers and Barriers: The Jordanian Situation as a Case Study in the Regional Context**

This session will shed a light on the particularities of renewable energy (RE) deployment in Jordan. Jordanian stakeholders - both from the decision-making domain (politics, ministry, electricity utility), as well as from civil society and industry, will be given the opportunity to exhibit their point of view on future renewable energy strategies. In a subsequent moderated discussion, key findings are summarized and mirrored with the overall regional context and the experiences in other MENA countries.

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| **Registration** | | 08:30-09:00 |
| **Presentation** | **Eng. Mohammad Abu Zarour**, NEPCO<br><br>**Content:** Regulatory Framework, Market Integration of Renewables. | 09:00-09:15 |
| **Presentation** | **Eng. Meqdad Qadoush,** Energy and Minerals Regulatory Commission<br><br>**Content:** RE Regulatory Tools, Regulatory Environment for Consumers and Investors in the Terms of RE on Basis of Justice and Stability | 09:15-09:30 |
| **Presentation** | **Dr. Mahmoud Al Eiss**, Ministry of Energy and Natural Resources Hashemite Kingdom of Jordan<br><br>**Content:** Jordanian Energy Strategy, Conventional, Renewable, Nuclear. Costs of energy supply | 09:30-09:45 |
| **Presentation** | **Jamal Ghammo,** President of the Energy Committee, Jordanian Parliament<br><br>**Content:** Current Issues of Energy Policy in Jordan, Subsidies | 09:45-10:00 |
| **Summary/ Regional wrap-up and Discussion** | **Moderator:** Hussein Muhsen, Program Manager FES Jordan | 10:00-10:30 |
| **Coffee break** | | 10:30-11:00 |
| **Presentation**<br><br>(EDAMA Member Energy, Water & Environment Productivity) | **Mr. Basim Saleh,** Philidelphia Solar<br><br>**Content:** Industrial integration of and local manufacturing potential for renewable technology components. | 11:00-11:15 |

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| **Presentation** | **Safa Al-Jayoussi**, Greenpeace Jordan, MENA Regional Coordinator<br><br>**Content:** Environmentalist view on energy expansion strategies. | 11:15-11:30 |
| **Presentation** | **Eng. Walid Shahin**, Director of the National Energy Research Center<br><br>**Content:** Social acceptance of renewable energies | 11:30-11:45 |
| **Presentation** | **Hala Zawati**, Freelance Consultant<br><br>**Content:** Employment and socio-economic effects | 11:45-12:00 |
| **Summary/ Regional wrap-up and Discussion** | **Moderator: Alessandro Rubino,** RES4MED | 12:00-12:30 |
| **Lunch** | | 12:30-14:00 |

**Panel V: How can sustainability issues of energy system transformation be addressed by politics and research?**

The concluding session examines the question of how sustainability issues of energy transformation can be addressed by politics and research. The first part of the session will discuss which policy recommendations could be given on a regional, as well as national, Jordanian level; the second part will explore the challenges for the research community.

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| **Presentation Policy Recommendations I** | **Dr. Tareq Emtairah**, Executive Director RCREEE<br><br>(Regional perspective) | 14:00-14:20 |
| **Presentation Policy Recommendations II** | **Prof. Dr. Ahmed Salayme**, University of Jordan<br><br>(Jordanian perspective) | 14:20-14:40 |
| **Presentation Policy Recommendations III** | **Thomas Fink**, Wuppertal Institute<br><br>(Current Status and Future Trends of Energy Research) | 14:40-15:00 |
| **Questions and discussion** | **Moderator:** Amal Abu-Jiries, Program Manager FES Jordan | 15:00-15:30 |

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| **Wrap-up from the organizers and Closure** | **Prof. Dr. Manfred Fischedick**, Vice-President Wuppertal Institute<br><br>**Richard Probst**, FES Jordan, MENA Regional Coordinator Climate and Energy Project | 15:30-15:45 |
| **Breakout session and Farewell Coffee break** | | |

## Report on the Conference Proceedings

*Tuesday, May 5th 2015*

**Panel I: Welcome Notes and Introduction**

**H.E. Ralph Tarraf, Ambassador of the Federal Republic of Germany to the Hashemite Kingdom of Jordan**

The Ambassador underlined that the development of renewable energy (RE) will strengthen social justice and economy. He deplored that the energy sector of Jordan today depends mainly on one source (oil/gas) and warned against getting misguided by dropping oil prices. He stressed that the diversification of energy sources is crucial. According to the Ambassador, nuclear energy is NOT to be considered a renewable source, even though some institutions or people may claim it.

**H.E. Dr. Ibrahim Saif, Secretary General at the Ministry of Energy and Mineral Resources of the Hashemite Kingdom of Jordan**

The Secretary General affirmed that all the countries in the MENA region have a huge potential of renewable energy and that they can play a pivotal role and be competitive. He blamed the inefficient transportation sector for being a large consumer of energy. Moreover, due to the increasing number of refugees, consumption in the MENA region is now more intensive than ever. He criticized that the energy costs presented 18% of the GDP in 2010, which is equivalent to 4.6 billion JOD.

**Prof. Dr. Manfred Fischedick, Vice-President of the Wuppertal Institute**

Prof. Dr. Manfred Fischedick emphasized that not only technological infrastructures are needed for the "Energiewende", but also socio-economic infrastructures with long term constructions. The 2050 targets in Germany include that more than 80% of the electricity generation and more than 60% of primary energy consumption will be provided by RE. He stated that since 2011; RE produce more electricity than nuclear power plants. In 2014, RE have been for the first time the most important power source in Germany. Prof. Fischedick explained that the increasing share of volatile electricity generation leads to growing challenges for system stability, but could be handled so far properly (still highest reliability level in Europe). Moreover, he stressed the importance of the regional level. Both top-down and bottom-up strategies are to be used for a successful energy transition. The challenges are in the field of system integration, compatibility, market scheme, infrastructure, investment, stakeholders, policies, innovations, and social acceptance. He concluded that if the "Energiewende" were affordable in Germany, it would be even more so in the MENA Region, as it will produce positive economic results and create jobs. However, he clarified that there is no blue print available for any country.

**Panel II: The Transition of Energy Systems in the MENA Region**

**Dr. Bernhard Brand, Wuppertal Institute**

Dr. Brand advocated a multi-level-approach to achieve a successful energy transition with three levels: 1) Socio-technical landscape (political situation/population growth/energy prices etc.), 2) Socio-technical Regime (existing energy systems), and 3) Niche innovations (Wind/solar technologies/ industry networks/grids). Even though the third level revealed itself uncoordinated in the beginning, it started to put pressure on the established system. Referring to the MENA region and its state of development in the RE system, he affirmed that it passed the pre-development phase and is currently

at the takeoff phase (Germany is at the acceleration phase). He called for a continuation of monitoring on a regular basis and emphasized that further work must be done to quantitatively monitor transition. A concept of transition research into the analysis must be included, according to Dr. Brand.

**Nurzat Myrsalieva (RCREE)**
Nurzat Myrsalieva pointed out that the transport sector must be tackled, as it is one of the biggest energy consumers. Energy consumption grows twice as fast as the GDP. She explained that the prices of oil products in the MENA region are shifting, and are thus not reliable. She regretted that the MENA region has no energy efficiency policies (except Tunisia). Almost all countries set energy targets and revised them, but in Jordan infrastructure problems hinder the implementation. Referring to the Energy Efficiency in the MENA region, she showed that seven countries have mandatory EE Building Regulations, eight countries have voluntary EE Building Regulations, and only one country has a mandatory Green Building Rating System.

**Panel III: Drivers and Barriers for Renewable Energy in Selected MENA Countries**

**Eng. Samer Zawaydeh, German Jordan University**
Eng. Samer Zawaydeh showed that the energy consumption in Jordan consists of 51% transportation, 21% households, 17% industrial, and 11% services and others. The main goals for the energy strategy 2007-2020 are: Diversifying the energy resources, increasing the share of local resources in the energy mix, and reducing the dependency on imported oil. This will be achieved through maximizing the utilization of domestic resources (oil shale, natural gas, etc.), expanding the development of renewable energy projects, generating electricity from nuclear energy, and applying Energy Conservation measures. Barriers for this plan are to be found at the Initial Cost – Wheeling Delays, the electricity grid capacity, a lack of communication among stakeholders, RE qualified manpower, experience in RE Design, construction, testing, commissioning and operation. Mr. Zawaydeh pointed out that the survey process of PV On-Grid Installation needs development. Furthermore, a reduction of the duration for Net Metering Installation and an increase of the manpower resources at the renewable energy departments should be aimed for. In addition to that, guidelines for Grid Impact Study are to be issued and the coordination by using Emails and phones to communicate with Customers should be improved.

**Dr. Hatem El Refaei, Ain Shams University (Egypt)**
Dr. El Refaei showed that even though Egypt's energy production peaked in 1993, consumption keeps on increasing. The 20 – 20 Plan (issued 2008) includes, that 20% of the electricity in the year 2020 will come from RE resources, Hydro will represent 8%, Wind 12% (equivalent to 7200 MW). The Solar Plan (issued 2012) aims for a percentage of 67% share of private investment, and 3500 MW of solar energy by the year 2027, 2800 MW of CSP and 700 MW of PV. Relevant local industries are to be enhanced for this goal. Dr. El Refaei regretted that until now in the electricity sector, there is no Guarantees of Origin. Moreover he criticized that the plans develop really slowly, even though the crisis was foreseen already in the 1990's. He declared that the plans are not ambitious enough. He noted that in Jordan, a top-down policy and a lack of persistence and speed are negative factors for the development of a RE system.

**Dr. Joseph Al-Assad, Lebanese Center for Energy Conservation (Lebanon)**
Dr. Al-Assad deplored that there is no clear political commitment for RE in Lebanon. The Copenhagen plan (2015-2020) envisages only 12% of demanded electricity to be generated by RE, but there is no commitment for the year 2030 yet. As a real innovation, he described Lebanon's first wind farms. Generally, he stressed the high potential of solar and wind energy of the country.

**Discussion**
As for the question about the cutting of subsidies, it turns out that Lebanon subsidizes 18% of its national debt, which goes mostly to the largest energy consumers, not to the poor people. In Egypt, not all the consumers are affected similarly by subsidies, where 25% of the population is poor. Thus, energy prices cannot be increased.
A person in the audience criticized that there is no collective target regarding RE on the international level. This was answered by the statement that "even for ONE country, it is hard to set a target".

**El Mostafa Jamae, MENA-RES (Morocco)**
Mr. Jamae pointed out that Morocco imports 93% of its energy (mostly coal, oil and gas). Only in 2009, Morocco developed its energy strategy. It includes the establishment of an optimized fuel mix in the power sector, and an increased deployment of renewable technologies in power generation. Moreover, private investments in the power sector, energy saving and use efficiency in industrial, commercial and residential sectors are to be promoted, as well as regional integration. Mr. Jamae explained that according to the plan, by the year 2020, wind energy would be increased to 14% (from 3% in 2010), and solar energy to 14% (from close to zero in 2010). However, the institutional framework turns out to be problematic as coordination mechanisms among the stakeholders are missing, as well as a lack of clear mandates and standards. This, and lack of an accountable regime, makes an efficient program impossible.
**Dr. Said Diaf, Deputy Director of the Center of Development of Renewable Energy (CDER), (Algeria)**
Dr. Diaf described the potential of RE in Algeria as one of the largest in the world. Mostly, the solar sector carries a high potential, followed by wind energy, geothermal energy and biomass energy. A legal framework (several laws and decrees) is implemented. The main objectives of the country are the diversification of the energy supply, an improved energy supply security, a valorization of renewable energy potential, the promotion of energy efficiency and the provision of access to electricity in remote areas. According to the plan, by the year 2030, about 40% of electricity produced for domestic consumption will be from RE sources.

**Rafik Missaoui, Alcor (Tunisia)**
Rafik Missaoui declared that the establishment of a RE system is not a choice, but a must for any country, especially in the MENA region. Deploring that only 5% of GDP is given to the energy sector in Tunisia, he supported the target that by the year 2030, a reduction of energy demand by 30% is aimed for and that a new law issued in April 2015 allows the private sector to produce energy. He endorsed that the updated Tunisian Solar Plan (issued in 2009, updated in 2015) is based on transparent rules. To achieve the goals, the required investment will be 6 billion Dollars, which is to be shared between the private and public sector. However, he emphasized the problem of how to share the positive impact between producer and investor.
Discussion
The audience pointed out that Algeria faces problems concerning the grid infrastructure.
Corruption in the RE scenario was deplored; the establishment of reference cost is needed.

## Panel IV: Actors, Drivers and Barriers: The Jordanian Situation as a Case Study in the Regional Context

**Eng. Mohammad Abu Zarour, National Electric Power Company (NEPCO)**
Eng. Mohammad Abu Zarour showed that 42% of total consumed energy is consumed by Jordan's electricity sector. He explained that the Jordanian government is facing a fiscal crisis as it subsidizes more than half the cost of electricity to consumers. Jordan's strong escalation of both peak load and generated electricity demand will continue in the coming years, due to economic and population growth. For the next ten years, he prognosticated that the average annual growth rate of the peak load would be 7%. By the year 2022, the peak load will be in the range of 5000 MW. A target of 10% renewable energy input into the energy mix by 2020 is set in the National Energy Strategy, mainly aiming for about 1000MW of Wind Energy and 600MW of Solar Energy. In 2010, Jordan enacted a Renewable Energy Law that provides for the legal framework for the sector: it permits and encourages the exploitation of renewable energy sources at any geographical location in the Kingdom. Furthermore, it permits the adoption of clean energy technologies at both residential and commercial levels (Net Metering). According to the law, all Renewable Energy and Energy Efficiency Systems and Equipment will be exempted from sales tax and Customs duties. The investors can benefit from the Jordan Investment Promotion Law and the Development Zones' corporate tax incentives and customs tax exemptions, thereby maximize profitability. He affirmed that grid expansion and reinforcement plans are ongoing at NEPCO cost, and that until this point, most of RE projects are in the south of the country. Eng. Abu Zarour pointed out that by having a clear road map as well as schemes and well-defined infrastructure, Jordan is on the right path.

**Eng. Meqdad Qadous, Energy and Minerals Regulatory Commission (EMRC)**
Eng. Meqdad Qadous announced that the RE contribution to the Primary Energy Mix will rise from 7% in 2015 to 10% by the year 2020. For the mechanisms used in Jordan to implement RE, he specified competitive biddings, direct proposal submissions, energy net–metering applications, electric power wheeling applications and self-generation applications. He embraced the fact that that the new amended directive of the law 2013 allows for several customers to install RE systems under a co-operative (sharing RE) facility within the same control area of their electric utility to supply their premises, which will lead to the intensification of small customers.

**Dr. Mahmoud Al Eiss, Ministry of Energy and Natural Resources, Hashemite Kingdom of Jordan**
Dr. Mahmoud Al Eiss blamed the lack of local commercial sources to be the key weakness of Jordan. He deplored that Jordan's oil and gas sources have not been fully explored yet. He announced that from 2020 on, oil shale would contribute to the energy mix. By 2023, the first nuclear reactor will enter the network, and in 2025 the second. Nuclear energy will amount to 22-46% of the total production. From 2017 to 2020, natural gas will dominate the power production. According to Dr. Mahmoud Al Eiss, Jordan's emissions rose because of the interruption of Egyptian gas supply. By 2020, emissions are projected to fall because of nuclear power, which he considers as a clean energy source.

**Jamal Ghammo, President of the Energy Committee, Jordanian Parliament**
Mr. Ghammo explained that the problems with energy supply started only after the American occupation of Iraq and the consequential loss of preferential oil prices. He called the nuclear energy

topic "controversial", as advanced countries are opting out of nuclear energy due to the consequences. He stated that there is a lack of understanding from the side of the parliamentarians and society when it comes to the modern technology of RE. He deplored that the process of transition to RE is too slow and there is a lack of direct supply and offers. Furthermore, according to Ghammo, long democratic debates hinder the transition process. He predicted that RE would lower the energy costs after 5-6 years. To reach this goal, foreign investors have to be embraced and helped, and obstacles should be removed. Moreover, he advocated the local employment and the development of a possibility to store energy.

**Discussion**

NEPCO was accused by the audience of having the intention to slow down the development of REs. This was denied by Mohammed Abu Zarour from NEPCO, who stated: "All the issues are technological. Network would collapse if we would connect wind and solar energy to it without stabilizing it before. Directives about the wheeling process need to be developed."

To the question about the sources of natural gas, Moh. Abu Zarour answered: "It comes from the Mediterranean, Palestine and Gaza. But there's no agreement signed yet with Israel, it's just an option amongst others." A person from the audience commented: "Nobody in Jordan wants Israeli gas. This Zionist gas is pumped through the blood of Palestinians." In this context, Deputy Jamal Ghammo stated: "Israel could switch off the gas at any time, we are against this Zionist agreement, it's neither politically nor socially acceptable."

A comment from the audience addressed to the Ministry of Energy stated: "The nuclear plan is in violation of national strategy." Jamal Ghammo added: "Nuclear will not contribute much to the energy mix. It shouldn't be considered at all. There's no money and water for this technology." Moh. Abu Zarour answers: "The nuclear option is a strategy, but there will be no final decision without nationwide consent. Diversification is important." Another commentator from the audience said: "There was no nationwide dialogue about nuclear power. If nuclear power is reconsidered, also RE should be recalculated." Manfred Fischedick answers: "Germany has 27% of RE now. RE is not a self-dynamic process. There's no blue print for the process. The diagnosis system needs to be improved."

**Basim Saleh, Philadephia Solar (EDAMA Member) Energy, Water & Environment Productivity**

Basim Saleh sees the green manufacturing in Jordan as a largely untapped potential, though there are huge opportunities, huge demands of energy, and a huge access of human resources to affordable prices. He pointed out that there are many examples of successful industries in Jordan and that they should be seen as a good example. He encouraged the audience to think big, international, and positive, to put efforts and work in lobbying instead of focusing on the negative aspects. He criticized that ministers in the government can put breaks on everything. Other challenges are the competition with China and Taiwan, and the dumping of prices of solar products. He underlined that Jordan can be effective despite its lack of resources. He referenced North Korea as an example. He deplored the lack of governmental support and called for local content incentives and/or anti-dumping policies (e.g., US, EU, South Africa, Canada, India, KSA, Brazil, Turkey and others). According to Mr. Saleh, the government should facilitate financing for RE projects and give tax incentives for RE exports.

**Safa Al-Jayoussi, Greenpeace Jordan, MENA Regional Coordinator**

Safa Al-Jayoussi explained that the goal set by Greenpeace Jordan is to produce 100% of the energy with RE by the year 2050. Facing climate change, she described the transition to RE as crucial. She outlined that in the Middle East; RE can provide 34% of total heat demand by 2030 and 89% by 2050. 2020, there are 2 million jobs in the Energy [R]evolution scenario and 1.4 million in the Reference scenario. The fuel cost savings in the Energy [R]evolution scenario reach a total of $207 billion per year. According to Al-Jayoussi, policy changes should support phasing out all subsidies for fossil fuels and nuclear energy, mandate strict efficiency standards for all energy consuming appliances,

buildings and vehicles, establish legally-binding targets for renewable energy and combined heat and power generation, reform the electricity markets by guaranteeing priority access to the grid for renewable power generators, provide defined and stable returns for investors (for example by feed-in tariff programs), implement better labeling and disclosure mechanisms to provide more environmental product information, and increase research and development budgets for renewable energy and energy efficiency.

**Emil Alasis, National Energy Research Center**

As for the energy supply in Jordan in 2015, Emil Alasis stated that 75% is imported and only 25% is domestic. The energy is generated by oil products (51%), natural gas (29%), imported electricity (2%), renewable energy (7%), and oil shale (11%). The plan for the year 2020 stipulates that only 61% of the energy will be imported, whereas 39% will be domestic. It would be produced by oil products (40%), natural gas (29%), imported electricity (1%), Renewable Energy (10%), oil shale (14%), and nuclear energy (6%). According to Alasis, the installation of wind (1200 MW) and solar power (600 MW) is planned. An integral part of the 2007-2020 Energy Strategy calls for a 20% improvement in energy efficiency in all sectors by 2020. He declared that high energy saving potentials have been identified in all sectors and that the target is to decrease energy intensity. He pointed out that Solar Water Heaters (SWHs) are mandatory as of April 2013 for all new buildings. He highlighted three crucial aspects for the RE energy transition process: 1) Socio-political acceptance: key stakeholders and policymakers, 2) Community acceptance: acceptance of specific projects at the local level, potentially affected populations, key local stakeholders and local authorities, and 3) Market acceptance: process by which market parties adopt and support energy innovation. Key actors include, for example, consumers and investors. Alasis concluded that the government of Jordan is moving forward in the energy transition path (slowly but surely) and that it is committed to achieving the security of supply of energy through diversification of the energy mix. He embraced the fact that framework conditions are set for RE and that the private sector is lobbying the government to give more support to RE.

**Eng. Hala Zawati, Freelance Consultant**

Eng. Hala Zawati illustrated that while the electricity demand is growing, costs are increasing. She stated that RE would bring economic growth, improve the GDP as well as living standards, and that RE would lead to an increased level of overall satisfaction. Moreover, it would eliminate or reduce the electricity bill over 20 years, reduce and fix expenses on financial sheets, remove the risk of GOV increasing electricity prices, introduce new businesses to Jordan, lead to partial energy independence and security, revive some businesses that will benefit from the utility scale projects, reduce subsidy for low consumers installing RE systems, reduce imports (oil and gas), increase competitiveness of Jordanian industrial products and services (especially for industries and services paying high electricity tariffs), create a vibrant new economic activity industry in Jordan as well as new job opportunities (direct and indirect jobs). She outlined that local resources should be used as much as possible and that every consumer should be able to install rooftop projects, etc. The challenges for rooftop projects, according to Zawati, include the fact that rooftops in Jordan are almost full with water tanks and satellite dishes, prohibiting consumers from installing rooftop systems. Another challenge is that small consumers have no incentive, especially since they are the most subsidized by the government. Moreover, the electricity tariff for small industries is low and farms connected to the electricity grid have no incentive, only off-grid farmers might be interested as solar systems proved to be feasible. As for distribution companies, she noted a problem in the limited electricity grid capacity, and that they would lose their highly paying subscribers (conflict of interest). As for the challenges for Medium-Sized Projects (Net metering, Wheeling), she pointed out that it is difficult to find land with suitable prices where distribution companies can off take electricity, adding that there is a limited electricity grid capacity over which different interested parties are competing. She said that businesses prefer not to introduce the burden of owning such projects so as to focus on their core business, and that there are no incentives for distribution companies and thus a higher risk. Zawati highlighted challenges

for Government Tenders (EPC) (Maan Wind 65 – 75, Qatraneh Solar 65 – 75) in the funding of new projects, the limited electricity grid capacity, and the competition with private sector direct proposals, as the government has already privatized most of the electricity generation projects. Challenges for Utility Scale Projects (Build, Own and Operate basis) consist of the slow process and the fact that the government changes the rules constantly. Other aspects viewed as challenges include a limited grid capacity, a highly competitive market and limited land for wind projects.

**Discussion**
It was commented by the audience that the actual capacity of RE is smaller than in theory. Investors for RE systems are hard to find, and private sector investors are hesitant. Hala Zawaty presented two examples to show that it pays out to invest in RE. Safa Al-Jayoussi recommended an "awareness project", explained difficulties to change ideas in a few years, and deplored that people don't even try to read about RE. She embraced the fact that all NGOs are swift towards a RE campaign. When it comes to nuclear energy, she claimed that mostly the young generation under 50, which will probably be more affected by its consequences, is opposing it.

**Panel V: How can sustainability issues of energy system transformation be addressed by politics and research?**

**Dr. Tareq Emtairah, Executive Director RCREE (Regional perspective)**
Dr. Tareq Emtairah emphasized the importance of a regional approach as the conditions for sustainable energy transformation could be strongly enhanced through regional coordination/cooperation. He demanded more and better research, and the encouragement of regional think tanks. He deplored that institutions (political/inter-governmental/technical/civil/academic/business) are under-funded, have no political power and are thus ineffective. He called for the provision of energy knowledge (through RCREE/OAPIC), the establishment of a technical infrastructure, the convergence of rules, "Economies of Scale", performance standards, integration policy, exploitation of synergies, power market integration, market rules, and a monitoring body.

**Prof. Dr. Ahmed Salayme, University of Jordan (Jordanian Perspective)**
Prof. Dr. Ahmed Salayme affirmed that RE would lead to economic growth and employment and emphasized the growing benefits for the whole society. According to Prof. Salayme, more scientific research is needed. He deplored that there is no institutionalized research yet. He explained that there are five main inter-related factors that intervene; contributing to or hindering renewable energy diffusion: 1) Access to technologies (knowledge and costs), 2) Regulations and laws, 3) Market development, 4) Social factors supporting market demand, and 5) Connecting R&D with decision mechanisms (MENA). Actions towards RE should include the integration of renewable energy policies into national energy policies with defined and targeted contributions, the strengthening of relevant national institutions, the encouragement of the RE technology transfer and the support of local industries seeking to develop or use renewable energy technologies. Furthermore, steps should be made towards the enhancement of resource assessment activities for RE, intensification of the capacity building and public awareness programs, and the initiation of new financial mechanisms for supporting renewable energy adoption, particularly in rural areas.

**Thomas Fink, Wuppertal Institute**
Thomas Fink outlined the trends in sustainable energy research in the MENA Region as follows:
Trends in the past included "Understanding renewable technologies and their potential role in the MENA region," such as technology (feasibility, field application), resource assessment (wind, solar), economic potential, and large-scale RES supply schemes. Trends in sustainable energy research today include "Understanding the framework, the processes and the impacts of large-scale renewable

deployment in the MENA energy systems," such as (Infrastructures, market integration, financial issues, legal framework and regulations, energy security, geopolitics, stakeholder framework, environmental impacts, technology transfer, business opportunities, industrial development, and employment effects. Thomas Fink criticized that further research about global competitions is still missing.

**Discussion**

The amount of money spent on research is USD 800,000 in Jordan, USD 6 million in Egypt, and USD 2 million in Tunisia. It was shown that in the last years, funding for RE research decreased, even though it saw a rise during the 'Arab Spring'. A point of criticism was that academia is not sufficiently involved in formulating goals and directives and that there is no connection between scientific research and decision makers.

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