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FUTURE NOTES

HOW CAN RENEWABLE ENERGY HELP CONTRIBUTE TO THE DEVELOPMENT OF THE MENA COUNTRIES?

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HOW CAN RENEWABLE ENERGY HELP CONTRIBUTE TO THE DEVELOPMENT OF THE MENA COUNTRIES?

Emanuela Menichetti and **Abdelghani El Gharras**[1]

Increasing energy demand, for electricity in particular, a sharp cost reduction in renewable energy technologies and socio-economic benefits are all considerations that have played an important role in advancing the deployment of renewable energy technologies throughout the world. The MENA region is no exception, and it could benefit significantly from a wide-scale deployment of renewable energy.

The MENA countries accounted for around 7.4 percent of the world's total population (545 million inhabitants) in 2015. This is expected to change slightly by 2040, with an additional 213 million inhabitants by that date,[2] which would put an upward pressure on energy demand and thus more greenhouse gas emissions (GHG) if this demand is to be met through fossil fuel resources, which currently dominate the energy mix in the MENA countries.

ENERGY OVERVIEW IN THE MENA REGION[3]

Countries in the MENA region can be classified into two main categories: net energy importers and net energy exporters. All South and East Mediterranean countries, with the exceptions of Algeria and Libya, are net energy importers. In Jordan, Lebanon and Morocco the dependence rate on foreign resources is more than 90 percent. Conversely, all Gulf Cooperation Council (GCC) countries, Iran and Iraq are energy-exporting countries, in addition to Algeria and Libya, as mentioned above.

In terms of fossil fuel reserves, the MENA countries were host to 51.2 percent (869 billion barrels of oil) of global oil proved reserves in 2015, and 47 percent (around 88 trillion cubic metres) of world gas proved reserves.[4] The region also accounted for around 8 percent of global total primary energy supply (1,074 million tons of oil equivalent, Mtoe) in 2014.

Accounting for around 29 percent (more than 622 Mtoe) of total energy production in the region, Saudi Arabia heads the region as the leading energy exporting country, with more than 405 Mtoe (65 percent of domestic energy production) in 2014.[5] Relatively speaking, Qatar and Kuwait export

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2 Based on UNDESA (2015) (medium variant).

3 This part is based on Menichetti (2016).

4 OME analysis based on BP (2016).

5 OME analysis based on IEA Energy Balances.

around 80 percent of their domestic energy production and Iraq almost 70 percent. However, such trends are expected to drastically change in the near future, if energy consumption continues at its present rate, leading to reduced export capacities in order to meet the increasing domestic demand.

The energy mix in the MENA countries is heavily dependent on fossil fuels. This is especially true for the energy exporting countries, with very low penetration of renewable energy sources. On the contrary, renewables are mostly developed in energy-importing countries. Historically, hydro power has been the most dominant source. Other renewable energy sources, mainly wind and solar, have experienced significant progress, reaching more than 21 Mtoe in 2014 in South and East Mediterranean countries. In terms of the share in electricity production, Turkey leads the region with 21 percent, followed by Syria (17 percent), Morocco (14 percent), Egypt, (8 percent), Palestine (8 percent) and Tunisia (7 percent).[6]

In the whole region, around 11 GW of installed capacity are in place, distributed as follows: wind (7.5 GW), solar photovoltaic (PV) (1.7 GW), geothermal (775 MW), biomass and waste (650 MW) and concentrated solar power (CSP) (347 MW) (see Figure 1 in the Annex).

The region is well suited for the development of renewable energy technologies for different applications. As far as solar energy technologies are concerned, most of the countries lie in the so-called Sunbelt, with global horizontal irradiance (GHI) values ranging from 1,600 kWh/m²/y in coastal areas of the Mediterranean to 2,600 kWh/m²/y in the desert, and direct normal irradiance (DNI) varying from 1,800 kWh/m²/y to more than 2,800 kWh/m²/y. This is one of the best areas of the world in terms of solar energy, both for PV and CSP applications (Al-Shalabi et al. 2014: 190). The potential for wind is also very high in several countries of the Mediterranean, such as Morocco, Egypt and Turkey, as well as Iran, with more moderate – but still interesting – potential in GCC countries and Iraq.

At present, several barriers hold back the potential of renewables in the MENA countries, including weak grid infrastructure, regulatory barriers, access to finance and, most important, subsidies for conventional energy. Almost all countries provide some kind of energy subsidies, which are reflected in the final consumer prices for energy products and services. The highest amounts of energy subsidies are in the energy-exporting countries. In the GCC, for example, the low penetration of renewable energy technologies could be attributed to "institutional inertia faced with new markets, clarity in institutional roles and responsibilities, and lack of dedicated policies and regulations" (Ferroukhi et al. 2016: 17).

Nevertheless, plans are ongoing in almost all MENA countries, although with different implementation speeds. Almost all countries have set up ambitious objectives and plans for the development and deployment of renewable energy either in the energy mix or in electricity production. Government-backed tenders in particular have resulted in some of the most cost-effective projects at world level for solar and wind, with record low prices in Morocco and the UAE.

6 OME database.

Based on the targets announced, the total installed capacity from non-hydro renewable energy sources would stand at more than 192 GW by 2030, thus representing seventeen times growth compared to current levels. By technology, solar PV is expected to have an important role in the electricity mix, with more than 42 percent of installed electric capacity, followed by wind (around 35 percent), solar CSP (around 19 percent), and then biomass and waste (3 percent) and geothermal (less than 1 percent).

POTENTIAL BENEFITS OF RENEWABLES IN THE REGION

Implementing the national renewable energy plans and objectives (amounting to a total installed electric capacity of 192 GW by 2030) and further exploiting renewable energy sources that the region is endowed with could have a significant impact on the whole region, in terms of energy savings, energy security, avoided CO_2 emissions, job creation, industrialization and energy access. The potential benefits of implementing the national renewable energy targets are estimated based on the difference between the net benefits of renewables in 2030 compared with 2016 as the reference year. The benefits take into account renewables installed as of 2016. Hydro power is excluded from the calculations.

- *Energy savings*: Potential average annual energy savings are estimated at 90 Mtoe, reaching an accumulated saving of 1,120 Mtoe – equivalent to slightly higher than the total primary energy supply in 2014 of the whole region – during the 2017–30 period (see Figure 2 in the Annex). Realizing the opportunity cost of saving fossil fuels and directing part of their renewables to export (especially for GCC countries) is one of the potential benefits that some countries could reap from deploying renewable energy.

- *Avoided CO_2 emissions*: Provided that the countries meet their renewable energy targets, around 84 and 428 Mt of CO_2 emissions could be avoided in 2020 and 2030 respectively.[7] The total accumulated savings are estimated at around 2.8 Gigatons of CO_2 ($GtCO_2$) – equivalent to more than 1.1 times the total CO_2 emissions of the whole MENA region in 2014 (see Figure 3 in the Annex). The use of energy is the largest source of greenhouse gas emissions (GHG) in the world (68 percent of the total). The electricity and heat production sector is, by far, the largest CO_2 emitting sector,[8] accounting for 42 percent of total CO_2 emissions from fossil fuel combustion in the world in 2014 (32 $GtCO_2$). Two countries in the region, Saudi Arabia (tenth) and Iran (eighth), were among the top ten CO_2 emitting countries in the world in 2014 (IEA 2016a: 7). Therefore, an increasing energy demand that is fuelled with a business as usual scenario, to be met through fossil fuels, is unsustainable and will contribute to an upward trend in CO_2 emissions.

- *Job creation*: Achieving these objectives could generate on average more than 280,000 direct jobs per year.[9] The total number could reach more than 430,000 by 2030. Most of these jobs will

7 The CO_2 emissions could differ based on the fuel mix for electricity generation. In this analysis, natural gas accounts for an important share of fossil fuel-based electricity generation, especially if that is substituted by renewables. A scenario that gives more weight to coal and oil would cause more CO_2 emissions owing to their higher carbon content.

8 CO_2 accounts for the largest share of GHG emissions, compared to methane (CH_4) and nitrous oxide (N_2O).

9 Renewable energy employment is estimated based on the employment factor approach used by Rutovitz et al. (2015).

be concentrated in countries with the highest renewable energy objectives in absolute terms and where a potential manufacturing industry could emerge, mainly in Saudi Arabia, UAE, Turkey, Egypt, Algeria and Morocco. Solar PV, wind and CSP would account for the largest share of the jobs by 2030, 41 percent, 28 percent and 22 percent, respectively (see Figure 4 in the Annex). The national renewable energy projects could therefore potentially generate an important number of jobs, which are much needed in the region to absorb a portion of the increasingly unemployed populations.

- *Creation of a local industry value chain*: in the MENA region, several countries have adopted such a policy by including local content requirements in auctioning. In the South Mediterranean, for example, and notably in Morocco, local requirements have been important in determining winners. Even though this is at a very early stage, realizing the national plans could create a local industry that can be actively involved in the development of renewable energy projects. Albeit with different stages of local industry integration in renewable energy projects from country to country and from one technology to another, some of the local stakeholders have already been involved in the implementation of renewable energy projects.[10]

- *International cooperation*: international partnerships seem to be key in developing renewable energy projects in the region. Large-scale projects are implemented by consortia of local and foreign developers and engineering, procurement and construction (EPC) companies. Of note is the design of the tendering schemes that are being used by some countries and which others might adopt in the future, especially by integrating local content clauses for a given share of local added value in projects, could eventually contribute to the creation of a local industry across the whole region.

- *Energy access*: in the MENA region, more than 45 million inhabitants are still without electricity access. Electricity rates are low in the following countries: Mauritania (29 percent), Sudan (40 percent) and Yemen (46 percent) (IEA 2016b). Whether they could gradually substitute diesel-generating units in remote areas in countries with already 100 percent electrification rates, decentralized renewable energy generation, especially through PV, could be key in filling this gap, especially in the countries where electrification rates are still low.

CONCLUSIONS AND POLICY RECOMMENDATIONS

The MENA region currently hosts a minor share of total global renewable energy capacity, and its development is especially low in energy-exporting countries. In recent years, several targets have been set by MENA countries for the development of renewable energy technologies but the

Only direct jobs are considered in this analysis. Waste and biomass collection and processing are not included.

10 Whether locally based or foreign companies that have established some local production units, the share of equipment supplied locally is increasing throughout the region. Qatar and Saudi Arabia have declared plans for constructing polysilicon production facilities. Foreign investors are also interested in the region (i.e. Siemens is building a blades manufacturing unit in the north of Morocco and SunEdison is studying the possibility of developing a vertically integrated solar PV manufacturing unit in Saudi Arabia). At the developers and engineering, procurement and construction (EPC) level, a number of examples are worth noting. NAREVA (Morocco), ACWA Power (Saudi Arabia-based) and Masdar (UAE), for example, have been and are currently involved in several large-scale development projects.

implementation speed has been disappointing so far. However, positive signals suggest a possible step change in the near future; government-backed tenders in particular have resulted in some of the most cost-effective projects at world level for solar and wind, with record low prices in Morocco and the UAE.

If the existing renewable energy targets are met, the total installed capacity from non-hydro renewable energy sources would stand at more than 192 GW by 2030, a seventeen times growth compared to current levels. Solar PV and wind would be the two leading technologies, taking into account the specific conditions of the region. Such development would trigger a series of additional environmental and socio-economic benefits, analysed here.

Around 1,120 Mtoe of energy could be saved, around 2.8 $GtCO_2$ emissions could be avoided, a renewable energy local industry could be created and about half a million direct jobs could be created annually. Furthermore, the implementation of large-scale energy projects can favour international partnerships, which can project the MENA countries into the global energy scene. Moreover, decentralized energy through the use of renewable energy technologies can help to increase energy access, especially in remote areas which are not yet served by the grid.

Developing renewable energy technologies would give MENA countries the opportunity to diversify their economies, increase energy security and open new business and market opportunities. Such potential is currently held back by a series of factors, the two major ones being an institutional framework not yet fully favourable to renewable energy development and subsidized low energy tariffs for conventional technologies.

Substantial changes are needed in order for MENA countries to be able to exploit their renewable energy potential and position themselves as sustainable energy champions. The main transformations should occur at the following levels:

i) Setting mandatory renewable energy targets within a stated deadline. Compulsory targets, supported by a roadmap or national energy plan, would give clear signals to market, investors and the population regarding the actual engagement of the government in pursuing sustainability goals, thus creating positive dynamics.

ii) Establishing an institutional framework with clear allocation of roles and responsibilities to allow a transparent market. It is important that clear roles and responsibilities are allocated to the entities in charge, thus avoiding overlaps and increasing the transparency of the system; the establishment of a (renewable) energy agency would be an important step forward for pushing renewable energy development.

iii) Defining fair rules to guarantee market access to independent power producers. A dynamic market can only be created by establishing clear rules for accessing the market and providing long-term certainty to private operators through long-term price guarantee.

iv) Adoption of policy support measures for renewable energy projects based on the project scale, the maturity degree of the technology and the type of application (electricity versus other use).

Regardless of the specific policy support scheme adopted, it is important to ensure that incentives progressively decrease over time in order to move rapidly towards market competitiveness.

v) Gradual phasing out of subsidies to conventional energy technologies. A progressive adjustment of energy prices, including incorporating the externalities from energy production and the removal of subsidies, are needed to ensure a more level playing field for renewables. Of course, such a process should be implemented smoothly, taking into account local socio-economic constraints.

vi) Accurate market design and overall assessment of the impact of increasing renewable energy share on the grid. Massive penetration of renewable electricity requires a deep reorientation of the infrastructure policy. This transition will require considerable investments for grid reinforcement, intelligent grids, electricity transmission, energy storage, distributed energy systems and novel transport methods, together with improvements in energy efficiency, both for the supply and demand side.

vii) Access to finance. Renewable energy finance, especially access to lower cost of finance, would be required for a wider scale deployment of renewable energy technologies. In addition to international financial institutions providing, in particular, concessional loans, the involvement of commercial banks is what is more likely to push sustainable and long-term developments.

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ANNEX

Figure 1 | Installed RE electricity capacity vs. RE targets in MENA countries by 2030 (MW)

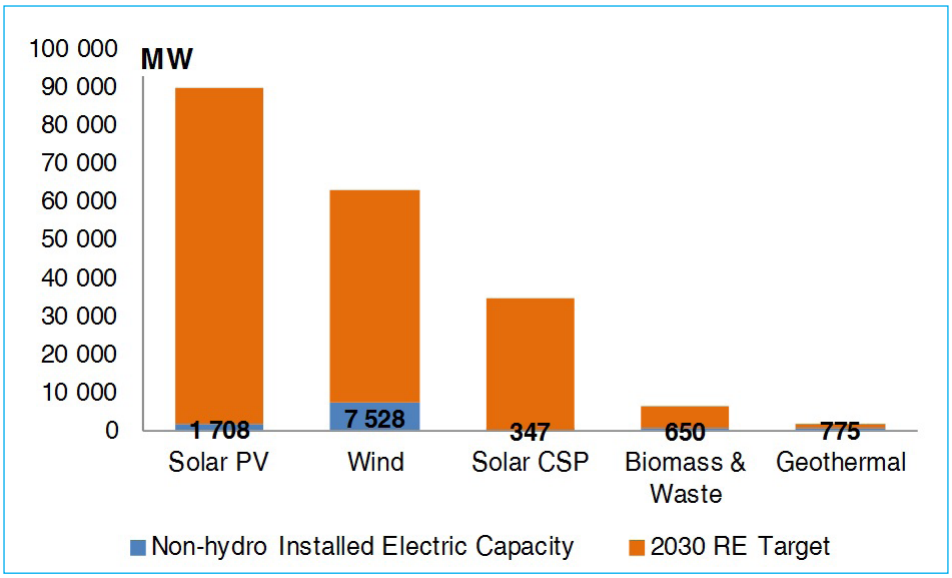


Figure 2 | Energy savings in the MENA countries (Mtoe)

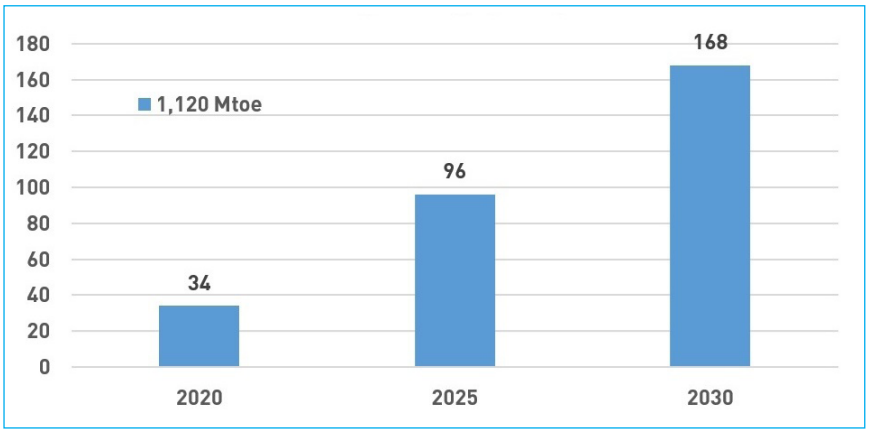


Figure 3 | CO_2 emissions savings in the MENA countries (Mt)

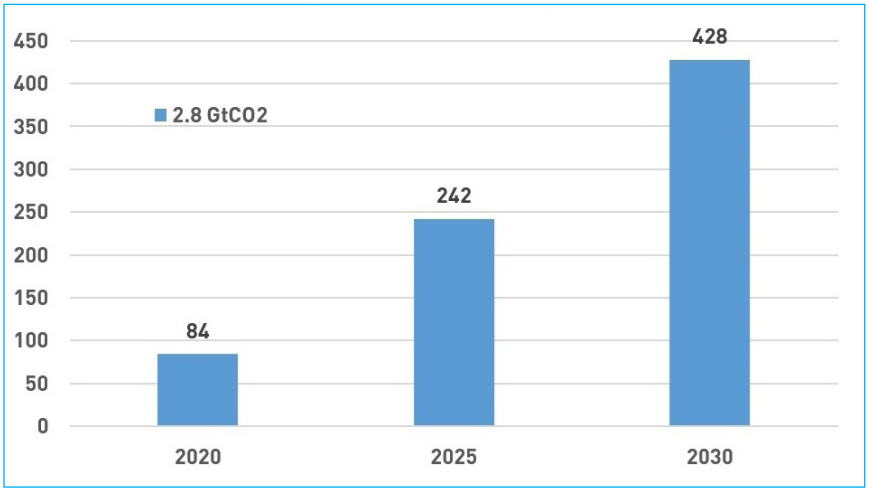
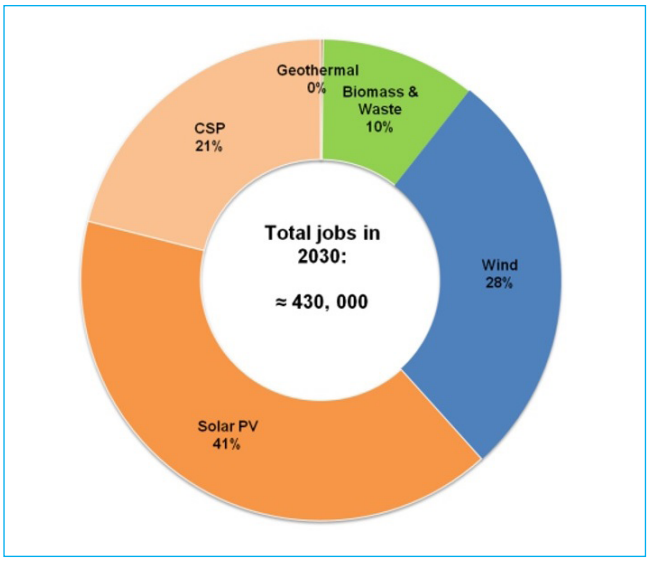


Figure 4 | Job creation by technology in 2030



Middle East and North Africa Regional Architecture: Mapping geopolitical shifts, regional order and domestic transformations (MENARA) is a research project that aims to shed light on domestic dynamics and bottom-up perspectives in the Middle East and North Africa amid increasingly volatile and uncertain times.

MENARA maps the driving variables and forces behind these dynamics and poses a single all-encompassing research question: Will the geopolitical future of the region be marked by either centrifugal or centripetal dynamics or a combination of both? In answering this question, the project is articulated around three levels of analysis (domestic, regional and global) and outlines future scenarios for 2025 and 2050. Its final objective is to provide EU Member States policy makers with valuable insights.

MENARA is carried out by a consortium of leading research institutions in the field of international relations, identity and religion politics, history, political sociology, demography, energy, economy, military and environmental studies.

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