

Renewable Energy in the Mediterranean Context: State of the Play and Future Perspectives

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Energy is formally defined as the ability or capacity to do work, and command of energy is setting the outer limits of what can be accomplished by communities, nations, or any social entity. To ensure a large and reliable energy supply is thus among the highest priorities of all countries, and at the moment this is still principally achieved through high shares of fossil fuels in the energy mix. In the long run, however, we will have no choice but to base our activities on renewable energy or sustainable non-renewable systems.

The three principal drivers behind a transition towards higher renewable energy shares are climate concerns (as burning fossil fuels releases greenhouse gas), the prospect of stimulating development by creating “green jobs,” and security of energy supply, as renewable energy is typically based on domestic resources. The latter, security of energy supply, seems to be the strongest driver, with nations that are highly dependent on the import of fossil fuels tending to introduce incentives for renewable energy use earlier on and to a greater extent. In the Mediterranean context, security of energy supply has two main aspects. One is the provision of adequate energy services in countries of the southern and eastern Mediterranean rim, where higher per capita energy consumption levels would be expected to enhance development (and political stability). The other is the importance of the Mediterranean Sea for energy transit towards the European Union.

Energy Security in Southern and Eastern Mediterranean Countries

With regard to the first aspect, the positive correlation between per capita energy consumption and human development is especially strong during early stages of development, while excessive energy inputs in highly developed societies will not result in any further human well-being. Energy inputs of about 1 tonne of oil equivalent per capita per year seem to be sufficient to achieve high (though not very high) human development, and this is indeed the level of energy consumption observed in the southern Mediterranean. In 2011 Algerians consumed 1.17 tonnes of oil equivalent per capita, Egyptians 0.99 tonnes of oil equivalent, and Turks 1.41 tonnes of oil equivalent. Meanwhile, France consumes energy at a level of 3.86 tonnes of oil equivalent per capita per year, Spain 3.20 tonnes of oil equivalent per capita per year, and Italy 2.82 tonnes of oil equivalent per capita per year. Such energy consumption patterns are in turn associated with various socio-economic indicators that demonstrate that substantial disparities do indeed remain between the northern compared to the southern and eastern Mediterranean rim. The French are more than five times as wealthy as the Egyptians in terms of per capita GDP, and about a fifth of the population in southern Mediterranean countries lives below the poverty line. A person born in Italy can currently be expected to live about nine years longer than one born in Turkey or Egypt. Practically the entire population of the northern Mediterranean rim is literate, while around 30% in the south cannot read or write. In Egypt and Algeria, for instance, 40% of females over 15 years of age are illiterate. Fertility and population growth rates are also in line with expectations based on energy consumption and other trends. In the wealthy, fully industrialised

nations of Mediterranean Europe, total fertility rates, quantifying the average number of children born per woman, are below, or even well below, replacement level. Two children (surviving until reproductive age) are necessary to replace father and mother, and to keep the population size constant. But in Italy and Spain total fertility rates in 2011 were 1.39 and 1.47 children per woman, respectively. Egypt, on the other hand has a total fertility rate of 2.97, i.e. three children are on average born per woman, Turkey of 2.15, and Algeria of 1.75. The resulting annual population growth rates of 1.96% for Egypt, 1.24 for Turkey, and 1.17 for Algeria may sound low at first glance, however, a population growing at 1.96% per year doubles within 35 years.

Imagine an Egypt with twice as many people as now within a few decades and it will become clear that a lot more energy will be needed in southern and eastern Mediterranean nations, not just to stimulate development for the current population size, but to maintain or increase the current level of per capita energy consumption despite the relatively large population growth. Renewable energy and energy efficiency measures will undoubtedly have their role in such a situation, but fossil fuels are expected to remain dominant for decades to come.

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To be sure, the southern and eastern Mediterranean countries combined have a large fossil resource base, and there are several net fossil fuel exporters: Algeria, Egypt, Libya, and Syria. Algeria ranks 16th in global oil reserves, it has the eighth-largest reserves of natural gas in the world, and is the fourth-largest gas exporter. Libya has some 46 billion barrels of oil in terms of proven reserves, equalling 3.4% of total proven global reserves (by comparison, Saudi Arabia has some 264 billion barrels). Tunisia recently became a net importer of fossil fuels, while Egypt keeps exporting natural gas though it has turned into an oil importer. Whether the region's fossil fuel importers – Morocco, Tunisia, Israel, Jordan and Turkey – can in fact benefit

from these resources will ultimately depend on future levels of regional cooperation.

Energy Security in the European Union

Notably, there will be increased competition for these resources from the regions north of the Mediterranean Sea. France, Italy and Spain are among the world's top ten oil importers, and imports into the EU as a whole rose by 29% in the ten years between 1996 and 2006. By 2010, proven reserves of 6.3 billion barrels of oil and a domestic production of just below two million barrels per day did not exactly look favourable compared to the EU consumption of nearly 14 million barrels per day. Some 86% of the oil consumed had to be imported, and by 2030 this figure will be 93% under a "business as usual" scenario. The situation looks somewhat better with regard to natural gas, where a production of 174.9 billion cubic metres in 2010 compared to a consumption of 492.5 billion cubic metres, translating to 64% imports (projected to be 75% by 2015 and 84% by 2030), while proven reserves stood at 2.4 trillion cubic metres at the end of 2010.

One of the European Union's strategies to hedge against supply risks is to diversify its oil and gas imports. Another is to shift more energy consumption from oil to gas. Excluding oil from Norway, the EU now sources about half of its oil imports from the former Soviet Union, a fifth from the Middle East, and some 14% from West Africa. In terms of natural gas imports, the Russian Federation is even more important to the EU, not least because Russia's natural gas reserves are substantially larger than Russian oil reserves.

To decrease its energy dependence on Russia, the EU has increasingly turned to the Mediterranean. Some 65% of the oil and natural gas consumed in Western Europe passes through the Mediterranean, and the share is bound to increase, as pipeline projects have proliferated rapidly during the past years in just about every corner of the Mediterranean. Turkey already transits oil from Iraq, Russia, the Caucasus, and the Caspian region, and the 3,893 km Nabucco pipeline will, beginning in about 2017 and without touching Russian soil, transport gas from Iraq and Azerbaijan (and potentially from Turkmenistan, Kazakhstan, and even Iran) via Turkey to Bulgaria, Romania, Hungary and Austria, from where it can be further distributed. What is more, a gas pipe-

line connection is planned between Turkey and Syria to be integrated with the Arab Gas Pipeline, thus allowing for the export of Egyptian gas to Western Europe, while currently most Egyptian gas exports are in the form of liquefied natural gas (LNG), which requires far more expensive infrastructure.

To be sure, the role of Algeria is currently much more important to the European Union in energy terms than that of Egypt. Algerian natural gas has long been delivered to Europe through a western pipeline running through Morocco to Spain and an eastern one running through Tunisia to Sicily. In addition, a new direct submarine pipeline from Algeria to Spain through the Mediterranean has recently been opened. Similarly, a gas pipeline from Libya to Sicily has been inaugurated, though it was temporarily closed due to the turmoil in Libya.

Towards More Renewable Energy in the Mediterranean

All the above indicates that a lot of focus remains on fossil energy. However, to utilise more renewable energy is another strategy through which the EU can enhance its energy security, and it comes with the additional benefit of reducing the emission of climate-altering greenhouse gases associated with the use of fossil fuels. The EU has thus committed itself to the “20-20-20” targets, that is: a reduction in EU greenhouse gas emissions to at least 20% below 1990 levels; for 20% of EU energy consumption to come from renewable resources; and a 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency. Mediterranean EU countries have been doing relatively well in this respect. Spain was meeting 15% of its electricity demand with wind power by the beginning of 2011, ranked fourth (behind China, the United States, and Germany) in terms of globally installed wind power capacity, and ranked second (behind Germany) in installed photovoltaic capacity. Meanwhile, Italy ranked fourth in terms of installed photovoltaic capacity, and Greece fifth for installed solar water heaters.

To be sure, Directive 2009/28/EC, laying out the rules with respect to reaching the renewable energy share goals by 2020, allows for EU Member States to achieve their national targets by investing in renewable electricity installations in “third countries,” provided that the produced electricity is being con-

sumed in an EU member country. Member States do not usually view this as an attractive option, simply because their governments prefer to invest in renewable energy to create local employment and increase national energy security. Nevertheless, producing electricity from renewable sources in southern Mediterranean nations for consumption in northern Mediterranean countries is indeed a viable option, and the EU has expanded its renewable energy plans towards the south.

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The Mediterranean Solar Plan (MSP) is one of six key initiatives of the Union for the Mediterranean (UfM), launched in Paris in 2008, and includes two complementary goals: developing 20 GW of new renewable energy production capacities, and achieving significant energy savings around the Mediterranean by 2020. The European Commission supports the objectives of the MSP through capacity-building projects as well as through its financial support to the European Investment Bank's Facility for Euro-Mediterranean Investment and Partnership (EIB/FEMIP) and the Neighbourhood Investment Facility (NIF). Cooperation with international financial institutions, including the World Bank Clean Technology Fund, is an essential part of the MSP, and so is support for industrial renewable energy initiatives such as the French MEDGRID, which focuses more on power transmission, or the German DESERTEC initiative, which focuses more on electricity production.

Desert Energy for Europe

The attraction of such initiatives has to be viewed within the overall potential and limitations of renewable energy. Though everyone would agree that we would all like to live our lives supported by inexpensive, clean and abundant renewable energy, there are a few drawbacks. Renewable energy tends to be more expensive than fossil energy (with externalities

being somewhat irrelevant in the real world as long as they remain excluded from market prices). Renewable energy tends to be intermittent (with solar energy, for instance, delivering during daytime only, and inexpensive, large-scale energy storage solutions besides pumped hydroelectricity still lacking). And renewable energy sources tend to have low energy intensity per unit area, while people are increasingly living in concentrated urban settings. But here recent technological developments have started to make the concept of harvesting renewable energy in North African countries, and delivering it to Europe, more attractive.

First of all, North African countries, stretching deep into desert regions, are less densely populated than European countries. Also, these countries exhibit excellent conditions to harvest wind and especially solar energy. The DESERTEC initiative, for instance, is thus based to a large extent on two technologies. The first, for electricity generation, is concentrated solar power (CSP), which is much more efficient than photovoltaic installations and involves mirrors concentrating solar radiation on a tube or tower to heat a liquid in order to create steam to drive a conventional turbine. Such plants are ideal where a lot of space is available and have been demonstrated in the south-western United States, for instance. The second, for electricity transmission, is an energy grid of high-voltage, direct current (HVDC) power lines, which can transmit electricity with energy losses as low as 3% per 1000 km. In short, such concepts are sound from the technological standpoint, though questions remain with regard to grid stability and energy storage.

Most importantly, it has to be ensured that such projects will indeed entail technology transfer and capacity-building in the south, and that host countries do not just end up being exporters of renewable electricity. To stimulate development, electricity generated this way needs to serve, first of all, local needs, and only surplus power should be exported. But renewable energy often requires substantial investment. The “fuel” tends to be free for renewable energy regimes, and yet renewable energy is more expensive than fossil energy. This implies that most of the lifetime cost of renewable energy installations is incurred up front, while only a quarter is in the case of a natural gas power plant, for instance. The DESERTEC initiative, aiming to utilise Saharan concentrated solar power to meet 15% of Europe’s electricity demand by 2050, comes with a price tag

of 400 billion euros. Attracting investments of this magnitude will require stability more than anything, as no government in Europe will base much of its energy security on power lines coming from unstable regions. Unfortunately, the events of the “Arab Spring,” though carrying the hope for a freer, more democratic and more prosperous Mediterranean, have in the short run introduced much instability: at the time of writing, an outright war is being waged in Syria, rival militias are still engaging in deadly clashes in southern Libya, and plenty of Egyptians feel they have been robbed of their revolution by the military.

Tumbling Photovoltaics Prices

To be sure, instability, though of a different kind, has also characterised the northern Mediterranean during the past years. The Greek economy has been rescued, for the moment, by other EU member countries (and Portugal received bail-out loans as well). Spain keeps on struggling, and might be stumbling, and the collapse of Italy, owing about a quarter of all government debt in the euro zone, looms as a nightmare scenario with unpleasantly real potential and tremendous dimensions. Under such circumstances the goals of climate protection and promotion of relatively costly renewable energy systems are no longer priorities, and the generous incentive schemes behind the rise of renewable energy in Spain and Italy, for instance, have indeed been cut to trim budget deficits.

But here, finally, comes what policymakers might view as the best news in recent developments in renewable energy: an astonishing price decrease of photovoltaic solar panels. In part the cutback of generous feed-in tariffs for photovoltaic installations in Germany and Italy is behind this. Germany installed half of global photovoltaic capacity in 2009 and more in 2010 than the entire world combined did the previous year. German taxpayers thus financed the build-up of the photovoltaics industry, but the country no longer offers the same growth incentives, which has left the panel market oversupplied. A few years ago, the growth of the solar industry was hampered by a shortage of polysilicon, from which most photovoltaic panels are made, with prices roughly doubling between 2004 and 2007. In turn, European incentive schemes prompted substantial investments in polysilicon production capacity that ulti-

mately led to the current situation. Critics have argued that the generous feed-in tariffs provided in Europe have failed to trigger innovation in the photovoltaics industry, as practical silicon panels are still no more than 15% efficient. But everyone would agree that they did indeed achieve the mass production of panels that led to price decreases, which were further accelerated when the feed-in tariffs were reduced, causing demand to fall. The current volatility in the industry, characterised by panel makers dumping their product on the market at minimal prices and shutting down excess capacity, will likely be followed by a painful wave of consolidation to adjust to the new level of demand. However, prices are expected to remain relatively low and photovoltaic installations should become competitive without, or with minimal, government support in sunny Mediterranean regions.

In Malta, situated centrally in the Mediterranean Sea, some 1,550 kWh per year will be delivered per kW peak installed, with a space requirement of about 13 square meters per kW peak given a panel inclination of 30 degrees and optimal spacing to avoid shading. In early 2009, photovoltaic module prices were still above 4,500 euros per kW peak, but now the average retail price is between 2,000 euros and 2,500 euros per kW peak, and the lowest stated prices are well below 1,000 euros per kW peak. These prices are exclusive of sales taxes for single modules, and module cost is about 40% of the total installed cost of a solar energy system. However, prices below 2,000 euros per kW peak for total installed systems in residential dimensions have been quoted recently. It is thus easy to see that photovoltaic installations with a lifetime of more than twenty years can now be a reasonable proposal in Mediterranean settings without government incentives, providing that such countries as Egypt (1.9 eurocents per kWh) and Algeria (3.5 eurocents per kWh) end their subsidies to energy consumption and move the average rates of their electricity system closer to those of Mediterranean Europe, where, for instance, in Spain and Italy rates are typically about 13 eurocents per kWh for industry and above 20 eurocents per kWh, including all taxes, for residential consumers. Best of all, photovoltaic installations can play an important role in meeting part of the peak electricity demand during summer daytime in Mediterranean regions as they get wealthier and employ more air conditioning.

More Renewable Capacity in the South

To be sure, the most efficient way to utilise solar energy remains through solar water heaters, though it comes with the drawback that hot water is a much less versatile form of energy than electricity. Solar water heaters have long been cost effective in Mediterranean settings, and Turkey actually ranks second only to China among all nations in the world in terms of installed capacity. Morocco, lacking the oil and gas resources of other North African nations, is also striving to achieve a leading position in renewable energy: the government rolled out an ambitious plan to spend billions of euros on (concentrating) solar energy in order to build several solar power plants capable of producing around 40% of the kingdom's electricity by 2020. Meanwhile, both Morocco and Egypt have created independent agencies for the development of renewable energy projects and have teamed up with the World Bank to install hybrid gas/concentrated solar power plants. All these are hints that future years will see larger renewable energy capacities to be installed in southern rather than northern parts of the Mediterranean.

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