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The renewables market in MENA – opportunities and challenges

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Introduction

Policy makers and power investors are increasingly focusing on the possibilities of renewable energy in the Middle East and North Africa (MENA) region, drawn by an abundance of solar energy, growing demand for electricity, declining fossil fuel reserves in many states and the desire of other states to diversify their energy mix on a sustainable basis. A number of high-profile projects have been launched. However, beneath the publicity, the reality is more nuanced. For renewable energy really to take off in the region, a number of technological and commercial challenges must be overcome and significant policy changes made. This guide briefly reviews the demand for renewable energy and the resources available, before examining some of the challenges that have to be faced to meet that demand. It then suggests what governments in the region could do to encourage greater private sector investment in renewable energy projects. The enclosed country briefings provide an analysis of relevant legal developments and recent projects in key parts of the region.

Overview of renewables in the region

Creating a demand

A combination of growing demand for power and desalinated water, a general trend towards higher fuel prices, depleting fossil fuel reserves in a number of countries and advances in renewable energy technology are causing policy makers in the Middle East and North Africa to start focusing on the advantages of power generation and water desalination using renewable energy.

In countries with limited or no fossil fuels of their own, such as Jordan, the primary driver is the same as in other parts of the world that have increased power generation using renewable energy sources – a desire to reduce dependency on hydrocarbon imports and increase energy self-sufficiency. In Saudi Arabia, by contrast, there will be no immediate shortage of hydrocarbons but, given the need to develop the country economically, some policy makers believe that it would be more beneficial to divert hydrocarbons towards export sales or for higher-value use than to use them to generate electricity at subsidised levels. In the UAE, notwithstanding concerns about gas shortages, the primary driver is different again – a desire to diversify the economy away from over-reliance on the hydrocarbon sector and attract high-technology industries to the country so as to achieve technology transfer to local industry and sustainable job creation opportunities.

Population and economic growth are also increasing demand for power and water. Given the shortage of natural freshwater reserves in the region, the only way to meet increased demand is through desalination, which is an energy-intensive process. In Oman, for example, electricity consumption is increasing by 15 per cent annually. With dwindling

oil reserves of its own, Oman is increasingly dependent on natural gas imports. It plans to increase the proportion of generation using cheaper coal (notably through the recently announced Duqm independent water and power project (IWPP)), but this will still be an imported resource – as well as an extremely environmentally unfriendly one. The potential of using renewable energy sources to produce electricity and water while minimising the environmental impact is obvious.

Renewable energy also appeals to certain Islamic investors with a focus on ethically sound investments, because it is a sustainable, environmentally friendly technology.

Finally, a growing awareness of the need for certain countries to reduce emissions of greenhouse gases, in keeping with the objectives under the United Nations Framework Convention on Climate Change, is acting as a spur to incentivise increased activity in the renewables sector across the region.

Resources and development

Attention to date has focused on wind energy and solar energy. Geothermal and ocean energy resources have not yet been analysed to any significant degree in the region (though the natural resources exist), and the area's climate and geography do not favour the development of hydroelectric power or biomass energy (other than with respect to urban waste).

Efficient development of wind power requires careful siting of wind farms in areas with appropriate wind resources (grid-connected wind power generation requires annual average wind speeds of at least six metres per second). Egypt, Jordan, Morocco, Syria and Tunisia have carried out wind mapping and have started to develop commercial wind power projects at suitable locations. However, although some tests have been carried out in other countries, such as Saudi Arabia and the UAE, and Oman and Bahrain have announced pilot schemes, limited wind speed data exist in much of the Middle East. This issue is being rapidly addressed.

A large part of the Middle East falls within the so-called 'sun belt', which benefits from the most energy-intensive sunlight on the globe (in terms of both heat and light). The Gulf states with vast tracts of desert that is rich in sunlight and that is not productive for much else are focusing their attention on solar power. To date, installed capacity of solar power remains tiny, with less than 3MW of photovoltaic (PV) in Saudi Arabia, around 10MW in the UAE and no operational concentrating solar power (CSP) in either Arabian state. However, the latter two countries are starting to develop showcase projects. Masdar has announced the (now-delayed) development of the 100MW Shams 1 solar thermal project and the King Abdullah University of Science and Technology has developed a 2MW PV generation unit that can feed power back into the grid. In Oman, the government has launched

a study for the development of a 150MW solar plant and in Egypt a 150MW integrated solar combined cycle power plant (ISCC) with 20MW of solar capacity is under construction at Kuraymat near Cairo. Other such hybrid plants are under way in Morocco and Algeria and feasibility studies have been performed for an ISCC plant in Kuwait. Qatar has announced ambitious but, as yet, unspecified plans for a $1bn solar project.

The question is whether these projects are isolated examples or the harbingers of a flood of development that will lead to wide-scale introduction of solar power. The answer is decidedly mixed. The next section of this guide looks at the factors behind the success of renewable electricity generation in the European leaders – Spain and Germany – and the US, and looks at what lessons may be drawn for the Middle East.

Requirements for success: foreign jurisdictions

What support is required?

It is undeniable that the overall cost of producing electricity from renewable sources (taking into account capital costs, operating costs and return on investment) in areas with developed electricity grids is greater than the cost of producing electricity from fossil fuels. It is not realistic to expect private sector investors to develop a renewable energy project and to compete on the same basis as producers of electricity from fossil fuel sources. Accordingly, countries that have achieved a significant increase in the proportion of electricity generated from renewable sources have only done so because of regulatory frameworks that have closed the gap between the costs of different energy sources. One method is to increase the cost of electricity generated from fossil fuels and put a price on the carbon emissions generated. This can be done by way of a straightforward 'carbon tax', which is gaining increasing support in parts of the EU, or by way of market-based incentives such as tradeable carbon certificates. The EU has also been a pioneer in this regard, though the existing carbon trading regime is not widely regarded as a success because the carbon price has been too low due to imbalances caused by an over-allocation of carbon certificates.

Other schemes have also been put in place internationally to reduce the market cost of electricity generated from renewable sources, sometimes in addition to schemes putting a price on carbon emissions. They can broadly be divided into three categories: (a) regimes based on a feed-in tariff, which guarantee a minimum price for such electricity, generally including guaranteed access to the electricity grid for renewable energy facilities; (b) regimes based on a minimum requirement for the production of electricity from renewable sources, typically coupled with the creation of a market in tradeable renewables certificates; and (c) tax incentives, direct grants and indirect support for renewable energy developments, such as finance guarantees and soft loans.

In the EU, Germany and Spain have led the way with extremely successful feed-in tariff regimes.

In Germany, the generation of electricity from renewable sources is promoted by the Renewable Energies Act (Erneuerbare-Energien-Gesetz – EEG). Its general principle is that operators of renewable electricity plants receive a fixed rate for a certain period to enable the operator to run the facilities economically. The local grid operator is obliged to provide priority grid access to plants that produce electricity exclusively from renewable energy and to transmit electricity from those plants on a priority basis. Furthermore, the local grid operator is obliged to remunerate the operator of renewable energy plants on the basis of statutory fixed minimum conditions for up to 20 years. The initial remuneration rate for new plants decreases yearly by a certain percentage to provide an incentive for operators to decrease costs and increase the technical development and efficiency of renewable energy plants. The additional costs resulting from the difference between the fixed remuneration and the market price for electricity in general are divided equally among the energy supply companies and are ultimately borne by consumers.

The EEG has proved to be one of the most efficient pieces of legislation internationally with respect to the development of electricity supply using renewable energies. Its initial target was for 12.5 per cent of the overall electricity supply in Germany to come from renewable energies by 2010. It exceeded this target in 2007 and CO2 emissions were reduced by approximately 45m tonnes in 2006. Over the past 10 years Germany has become a global market leader in the areas of wind energy, PV and biomass power plants. The recent proposal by the German government for a 15 per cent cut in the feed-in tariff for solar PV projects underlines the success of the EEG and the flexibility of the subsidy regime.

In Spain, the 'special regime' (*Régimen Especial*), allows electricity produced from renewable energy facilities with a maximum installed capacity of 50MW to be sold to distributors at a premium over the market price. It also includes advantageous administrative procedures for the construction and operation of renewable energy facilities and conditions for connecting them to the electricity grid.

As a result of this regime, over the past 10 years, the capacity of renewable energy facilities in Spain has undergone an extremely rapid increase and approximately 29 per cent of energy consumed in Spain now derives from renewable sources. In addition, Spain has become a world market leader in the solar PV market – 93 per cent of the renewable energy generation facilities in Spain are solar PV facilities, which is 45 per cent of the worldwide solar PV capacity of 5,559MW.

Indeed, the special regime has been so successful with respect to solar power that the government introduced new legislation in 2008

to slow growth and the unanticipated costs that were being borne by the public sector in funding feed-in tariffs. The resulting reduction in feed-in tariffs has had a dramatic effect on the PV power sector, resulting in the closure of a number of production plants and job losses. These highlight the fragility of sustainable growth in the sector, which remains dependent on an effective regulatory regime.

The renewables portfolio standard (RPS) as adopted in jurisdictions such as Texas, California, Japan and the UK (where it is known as the renewables obligation) is a market-based mechanism that is reliant on a competitive electricity market consisting of several producers and suppliers and under which electricity producers are obliged to produce a minimum proportion of their electricity from renewable sources. If the producer fails to meet the target, it becomes liable for a fine. However, producers that generate electricity from renewable sources are awarded certificates for each MW of electricity generated and a producer that generates a greater amount than the requirement is able to sell certificates to producers that have not met the requirement. An integral part of an RPS-type regime, therefore, is a market in renewable energy certificates that enables developers to generate additional revenue.

RPS regimes can be very successful. In Texas, for example, the original goal was to develop 2,000MW of renewable energy generation capacity between 1999 and 2009. Instead, over 4,000MW of capacity of wind power alone was developed by 2008. However, the UK and Japanese regimes have been criticised for failing to cause sufficient adoption of renewable technologies and it appears that Japan will be devising a feed-in tariff regime in 2010.

In addition, though the legal requirement for production of a proportion of electricity from renewable sources does not in itself require a competitive electricity market, the economic rationale behind the system does. In particular, a company that could suffer a fine for failure to produce sufficient electricity by comparison with its competitors will have a greater incentive to avoid a fine than a utility monopoly with a protected market position. Given the monopoly position of most electricity producers in MENA, an RPS-type system is unlikely to be readily transferable to countries in the region.

Renewable energy projects may also be supported by a favourable fiscal environment and by promoting favourable conditions for financing. This was one of the objectives of the federal-level Recovery and Reinvestment Act 2009 in the US. The legislation strengthened the existing tax credit regime, enabling most renewable energy technologies to obtain a production tax credit for each kWh of electricity produced. It also expanded the existing loan guarantee programme, which is intended to stimulate private financing of renewable energy projects by way of federal guarantees of the majority of the debt. The practical effect remains to be seen, especially given continued constrained credit markets.

Lessons to be learned

Systems based on tax incentives are of limited use in the MENA region due to the low tax base, although the concept of grants and loan guarantee programmes can certainly be replicated and used to encourage local lenders to participate in funding renewables projects without being fully exposed to project risks.

More than 40 countries have put in place feed-in tariff regimes. As tax-based and RPS regimes are not immediately applicable in much of the Middle East, feed-in tariffs, supported by grants and loan guarantees, are likely to be the most appropriate support mechanisms for the MENA region. Feed-in tariffs are not without cost, however. In Germany, the cost is largely borne by the consumer, whereas, in Spain, the cost is borne by the public purse. The result is that producers of electricity from renewable sources receive a price above the market price, designed to compensate them for the extra costs incurred in renewable energy production. The burden of this is borne by consumers, who receive higher electricity prices. For example, a 2009 study found that feed-in tariffs in Germany have led to an increase of approximately 3 per cent in electricity prices. As discussed below, allocation of cost is a sensitive issue in the Middle East. Moreover, the use of feed-in tariffs may not be consistent with exerting maximum competitive pressure on equipment suppliers and could act as a disincentive to the development of indigenous renewable IPP developers because there is some evidence that they favour manufacturer-linked developers, which are currently all foreign to the region.

Although there is much talk of renewables and the existence of numerous natural advantages in the Middle East, what steps are being taken to foster widespread development of renewable energy technologies and what projects are being developed? The enclosed country briefings on Saudi Arabia, the UAE, the remainder of the Gulf region, Egypt, Jordan, Syria and North Africa provide more details.

Technological obstacles

In addition to the requisite legal framework and financial incentives, a number of technological hurdles need to be overcome before any large-scale renewable energy programme can be implemented across the region. These include the following.

Reduced efficiency of CSP

Though the average solar radiation in the Gulf is approximately 2,200kWh per square metre (twice that of the European average), the desert environment is proving to be a significant obstacle to the development of solar power in the region. Despite the apparent intensity of the sunlight, the light can be very diffuse due to a high concentration of sand particles in the atmosphere. Compared with parts of Spain that have similarly bright sunlight, therefore, solar generation can be

considerably less efficient in the Gulf. Previous studies of solar radiation levels were based on satellite data and showed the levels to be very high. However, now that action is being taken on the ground, measurements are giving different results from those expected. For example, satellite observation may suggest a variation of 3 per cent in direct normal radiation, but in reality, intensity can be 15 per cent lower. This is an issue for both PV generation and CSP, though the effects are only just beginning to be researched and understood.

Users of PV in the Gulf have discovered a problem specific to that region – the sand in the air combined with the humidity caused by proximity to the sea results in PV panels becoming covered by an encrusted cake of dust that, if left unchecked, would completely block the light (as anyone who has seen cars left outside in the Gulf can attest). The solution is frequent cleaning of solar panels. Automatic and manual procedures are available, but this increases costs and has an indirect adverse environmental impact, through the use of water. Masdar is already planning a PV cleaning and shading pilot scheme.

Electricity grids

As in Europe, electricity networks in the Middle East have been set up on the basis of large-scale generation using fossil fuels, with dependable capacity and distribution of electricity across large distances to centres of population. Electricity grids need adapting to support the variable output of renewable energy – wind power varies with the wind and, even where it is sunny nearly all year, there will be differences in solar power depending on the time of day. Electricity grids and grid management systems will require strengthening if there is a significant take-up of renewable energy in the region. This is, of course, an opportunity for further infrastructure development with a positive economic impact.

Next steps for governments

As you will see in the individual country and regional overviews, governments in the MENA region need to address the following issues to enable or to ease the implementation of large-scale renewable energy programmes:

The cost of renewables-generated electricity remains greater than that of electricity generated using fossil fuels

This means that renewables-generated electricity cannot yet be sold at the cost of production; it requires support to be competitive. This is more a problem in states with limited financial resources than in the countries of the Gulf, which are able to subsidise renewable energy due to the profits from oil. However, increased efficiency of renewable technology and reduction in capital costs due to economies of scale through increasing uptake should mean that, in the medium term, grid parity will be achieved and subsidies can be reduced.

Green building codes and other measures to increase energy efficiency and reduce demand should go hand in hand with the development of alternative sources of electricity generation

The Gulf countries have the world's biggest carbon footprints and there is considerable scope for reducing electricity consumption before increasing electricity production.

Capacity building

The institutional, regulatory and operational capacities of key stakeholders that are involved in the development of the renewable energy sector need to be strengthened to ensure the long-term sustainable development of the regional renewable energy markets. Ministries and government-owned bodies that will be responsible for formulating and implementing renewable energy policies or adapting operational procedures and network architecture to accept enhanced renewable energy connectivity and outputs need to ensure that their personnel are adequately equipped to face these challenges. Training programmes, funded where appropriate by development agencies, will be key to ensuring that they can meet these objectives. For example, it is important that the impact of enhanced wind capacity on transmission grids is fully understood so that local grid operators have the confidence to take power from such facilities once they are connected.

Wind speed data needs to be collected quickly and compiled in up-to-date wind atlases to give private sector developers access to long-term information that has been properly measured

Without this information, it is unlikely that private sector developers will be comfortable making the required level of investment or banks be prepared to fund such transactions.

Long-term certainty of tariff availability needs to be ensured to guarantee offtake of output from renewable energy projects

The European experience shows that power purchase agreements, although helpful in covering demand risk, are not sufficient to ensure the sustainable development of a renewable energy market. Developers and investors need the certainty of legislation to deliver the required long-term commitment of a subsidised tariff or similar regime rather than relying on successive rounds of contractual negotiation with a utility that may not be incentivised to offer pricing that reflects the increased cost of renewable energy production.

Win the battle of hearts and minds

Governments need to educate local populations on the benefits of renewable energy, particularly where the changing energy mix will lead to increases in electricity prices or pressure to alter behaviour to reduce demand. Similarly, where practicable, the tender process for renewable

energy programmes could impose conditions on foreign suppliers intended to stimulate local job creation opportunities by encouraging foreign equipment suppliers to enter into joint ventures with local contractors or to relocate manufacturing capacity to the region.

Improve the administrative and regulatory process for authorising renewable energy developments

Streamline the number of agencies involved and use one-stop-shops for investors to expedite project implementation.

Learn the lessons from previous failures

Make sure that required regulatory changes are in place before launching wider development programmes that involve private sector investors.

Consider ISCC as an interim stage

Use this as an interim technology before proceeding to stand-alone large-scale CSP plants.

Consider the introduction of government-backed loan guarantee programmes

Schemes such as the US model would help to mobilise local financial markets, which would otherwise be unwilling to fund renewable energy projects.

Cushion the cost of raising electricity tariffs or fund feed-in tariffs

Deploying renewable energy funds and/or imposing a renewables levy on fossil fuel export sales or thermal power-generated electricity consumed by industrial or other large-scale commercial users would do this. Such a levy could also be used to support low-cost loans to finance renewables projects.

Use credits available under the UN Clean Development Mechanism to generate additional revenues for renewable energy projects

Governments should help local developers to understand the applications procedure, to ensure that applications in respect of local renewables projects are not rejected due to inadequate project preparation.

Where relevant, provide tax relief to investors in renewables projects

Encourage foreign direct investment in a regional renewables industry by providing tax and customs duties exemptions and relaxation of majority local corporate ownership requirements. Richer governments could also provide subsidies and credit guarantees to manufacturers that commit to local employment and technology transfer initiatives.

Ensure that local communities benefit from the introduction of renewables technology

This could be through the provision of off-grid installations in remoter regions, the roll-out of subsidised solar water heating programmes and the development of small-scale domestic or local power production from renewable sources, obliging utilities to purchase surplus electricity generated by such producers at subsidised prices.

Introduce a voluntary carbon cap and trading scheme applicable to public and private thermal power producers and large-scale consumers of electricity across all Gulf Co-operation Council (GCC) states

This would encourage regional participants to become more energy efficient and incentivise them to introduce carbon emissions reduction technology in advance of mandatory measures that are likely to be adopted by regional governments to comply with initiatives arising from the Copenhagen climate change conference. A voluntary carbon trading scheme, even if only a shadow scheme at first, would help participants understand the true cost of carbon in their business models.

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Saudi Arabia

Legislative developments

Due to the export potential of its oil reserves and its decision to allocate gas as a feedstock to its petrochemical industries rather than as a fuel for electricity generation, Saudi Arabia has economic incentives to develop renewable energy to meet domestic electricity demand. The country appears to have great natural potential for solar power generation. In addition, given its size and diverse geography, there are likely to be a number of sites suitable for wind power. This is also suggested by satellite data, though little detailed wind mapping has been carried out. At present, renewable-generated electricity is negligible and there is no policy framework to promote it. The 2005 Electricity Law does not mention renewable energy at all. However, this is likely to change as the Saudi Electricity and Co-generation Regulatory Authority (ECRA) is formulating a national renewable energy strategy for Saudi Arabia, which is intended to provide a regulatory environment that will encourage renewable energy development on a competitive and affordable basis. The ECRA has announced general objectives for the development of renewable energy in the Kingdom, including improving the diversification of energy supplies, facilitating the supply of energy to remote areas, developing in-Kingdom knowhow and jobs and putting in place a supportive regulatory framework for investment.

It is understood that the ECRA is considering the introduction of feed-in tariffs and a centralised procurement system that would grant power purchase agreements of at least 20 years, similar to those used to support thermal independent power projects, to developers of facilities of a minimum size (not less than 10MW). They would be output-based, with no capacity payment, given that solar and wind cannot easily provide guaranteed availability.

We await the final publication of the ECRA's strategy but do not expect any policy suggestions to be adopted in enabling legislation until the issue of funding feed-in tariffs has been determined. This is because it is unlikely that the increased costs will be passed directly to the consumer, given the political sensitivity surrounding any reduction in retail electricity price subsidies. One option would be to follow the example of the Egyptian government and create a hydrocarbon fund to impose a levy on additional export revenues and revenues derived from petrochemical feedstock sales on the fuel saved as a consequence of the development of renewable energy.

Projects

Public officials have made statements about how Saudi Arabia would like to become a large-scale exporter of solar electricity within the next 30-50 years by covering the desert with solar power plants in the same way that the Desertec project would generate electricity for export to Europe. This is a long-term aspiration, currently rendered unfeasible by technological limitations. To date, there have been few projects in the solar sector in Saudi Arabia, other than small off-grid uses of photovoltaic (PV)

technology. However, Saudi Arabia is now attempting to develop its own renewable energy technology hub. There is a research centre for renewable energy in Dharan, at the King Fahd University of Petroleum and Minerals, which focuses on the feasibility of the location for wind or solar facilities and technical issues. It has carried out limited studies on wind resources in the Kingdom, concluding that the best sites are on the Arabian Gulf near Dharan and along the Red Sea coast; the best is near Yanbu. Comments by the chairman of the Saudi Electricity Company indicate that foreign partners will be sought to help develop projects in these areas. Meanwhile, the new King Abdullah University of Science and Technology has established a renewable energy research centre, which has developed a 2MW PV plant near Jeddah. This plant was built with German technology – by Conergy, the German renewable energy company – but implemented by Saudi developers, with the intention of enabling the development of domestic experience in the sector. It is able to feed power back into the grid under a special arrangement with the Saudi Electricity Company.

The Saudi government has recently announced the development of a number of solar powered desalination plants using nanotechnology developed by the King Abdulaziz City of Science and Technology which aims to cut the cost of desalinated water production by 40 per cent. The first plant, with a capacity to serve 100,000 people, will be built at Al-Khafji.

Another recent project that received media attention is a joint venture between Showa Shell Sekiyu of Japan and Saudi Aramco to develop a small-scale PV generation plant to test technology for use in communities that are not served by the national electricity grid. The longer-term objective is to roll out 1-2MW distributed generation plants in such communities. The recent announcement of a joint venture between First Energy Bank and Saudi industrial investors to construct a $1bn polysilicon plant (a key raw material in PV panel production) in the Kingdom is another example of the growing realisation among local investors of the potential of the renewables sector in the region.

UAE

Legislative developments

The UAE emirate, Abu Dhabi, is often portrayed as a pioneer of renewable energy in the MENA region. Through Mubadala Development Company, the emirate has established Masdar, a state-owned entity with a remit to 'position Abu Dhabi as a world class research and development hub for new energy technologies… and drive the commercialisation and adoption of these and other technologies in sustainable energy, carbon management and water conservation'. In addition, the government of the UAE waged a successful campaign to win the right to host the headquarters of the International Renewable Energy Agency (IRENA), in Masdar City. The UAE has also announced that it aims to produce 7 per cent of electricity from renewable sources by 2020.

Despite these high-profile efforts, there are several structural and practical obstacles to renewables becoming a significant source of energy in the UAE as a whole. The UAE has very few water resources and is in one of the hottest populated regions of the globe. Until the recent economic crisis, the UAE had a fast-growing population, attracting workers and professionals from elsewhere. The principal urban centres of Dubai and Abu Dhabi have expanded without great consideration to the natural environment, with high water use and near-universal use of air-conditioning, requiring a large amount of electricity (the majority of water is produced from desalination), and attempts at economic diversification have included energy-intensive industries such as aluminium smelting. The UAE, thus, has one of the world's biggest carbon footprints.

One of the problems with implementing a comprehensive and effective renewable energy policy in the UAE is that Abu Dhabi is a major oil producer and its citizens expect to benefit from cheap fossil fuel energy as a result of this. Electricity is supplied at as little as 5 per cent of the cost of generation. In addition, with a small and generally wealthy indigenous population, the UAE does not have Saudi Arabia's need to generate additional export revenue to drive domestic development and so there is little incentive to replace hydrocarbon-fuelled power generation with more costly renewable energy, although shortage of gas available for power generation is driving the need to adjust the fuel mix.

There are, however, opportunities on a localised basis, particularly around the capital. The Abu Dhabi 2030 master plan will lead to several more major developments and the construction of a new administrative district. Masdar City, which is intended to be carbon neutral, will also serve as a showcase for what can be done to improve energy efficiency and make use of renewable energy technologies. However, if Abu Dhabi is serious about establishing 'green' credentials on a large scale, then it will need to implement legislation requiring all new buildings to make use of energy conservation techniques and, if possible, renewable energy systems. Recent steps such as the

Abu Dhabi Urban Planning Council's announcement of the *Estidama* (Arabic for 'sustainability') voluntary green-building ratings system and the expected introduction by the Abu Dhabi Municipality in January 2010 of a new building code, which will contain mandatory energy conservation requirements, are to be encouraged.

Progress has been made in Dubai, as well, where green standards have been (theoretically) mandatory since 2007. The Dubai Municipality, as the supreme planning authority (other than for free zones), will soon announce amendments to Dubai's building code that will introduce a minimum sustainable standard for new buildings. Other Dubai government-linked companies that own and operate individual free zones have also obliged developers of new buildings to observe internationally recognised green-building standards, although somewhat confusingly there does not appear to have been any uniform approach.

In July 2009, Sultan Al Jaber, the chief executive of Masdar, stated that plans are being made in Abu Dhabi for a new energy policy entitled 'Energy Vision 2030' that will include energy conservation measures, financial incentives for the development of renewable energy and a new formula for calculating energy costs. It appears that the measures will be limited to the Emirate of Abu Dhabi rather than being a federal policy for the UAE as a whole, though the outcome will undoubtedly be influenced by the federal government's nuclear energy programme, which will be centred on Abu Dhabi. There is no indication whether electricity prices will be raised to fund renewable energy development, but this is unlikely given the political sensitivity of the issue. Other recent reports suggest that the Abu Dhabi Department of Economic Development has been working on plans for a subsidy system (which is strongly supported by Masdar), but that it has been difficult to obtain consensus within the government over the form of such a system and how to fund it.

Projects

The most significant project under consideration to date is the Shams 1 CSP demonstration project, using parabolic trough technology, which is intended to be developed by Masdar on a project financed basis. Shams 1 was originally tendered in October 2008 and attracted bids from consortia with significant Spanish involvement. The Franco-Spanish consortium of Total and Abengoa Solar was selected as preferred bidder, but in July 2009 Masdar withdrew the project and announced that it would be relocated and retendered. No date has yet been set for the new tender process.

The reasons for the withdrawal are not entirely clear but appear to include difficulties in the funding markets and unanticipated technical problems, as well as Masdar having identified other sites that may have more solar radiation potential, although it is now clear that the plant will be constructed at Madinat Zayed where it was originally planned. The suspension of the project is a temporary setback to Abu Dhabi's aspirations of leading the development of renewable energy in the Gulf region. As originally envisaged, the electricity produced by Shams 1 would have been purchased by the Abu Dhabi Water and

Electricity Company (ADWEA) under a 25-year power purchase agreement. However, it is understood that the ADWEA was not going to pay more for electricity produced by Shams 1 than it would pay for conventionally generated electricity. It is understood that it is unlikely that contracts for the development of Shams 1 will be awarded until the general subsidy framework has been formally announced.

Though the most significant project, Shams 1 is not the only high-profile solar power project in the UAE. Masdar's headquarters are already partially powered by photovoltaic (PV)-generated electricity produced by a 10MW plant using Chinese-manufactured PV panels. Enviromena, the privately held company that built the Masdar system, has developed a solar power system at the Yas Island Formula 1 racetrack to supply part of the electricity to the track's viewing tower. Masdar has also recently purchased a thin-film PV production facility in Germany and has plans to establish a larger facility at Taweelah in Abu Dhabi.

In September 2009, it was also announced that Masdar will be testing the possibility of using geothermal energy to generate up to half of its energy needs. It awarded a $1.6m contract to Reykjavik Geothermal to drill test wells up to 4km deep. Abu Dhabi National Oil Company (ADNOC) estimates, based on its oil well drilling in the region, that temperatures could be as high as 150 degrees centigrade. Water would be pumped into wells to convert to steam to drive electricity turbines. If successful, this would be the first use of geothermal energy in the Gulf region.

Masdar has entered into a joint venture with BP Alternative Energy and Rio Tinto Alcan (although Rio Tinto has recently announced it is selling its stake to BP) for the construction of a 500MW integrated hydrogen power generation and water desalination plant that will separate the natural gas feedstock into hydrogen and CO2. The hydrogen will be burned and the CO2 sold back to ADNOC to be used as a substitute for natural gas, which is currently injected into oil fields to enhance oil recovery. Masdar is also looking at using solid waste from wastewater treatment plants to generate power and is in discussion with Abu Dhabi Sewerage Services Company about establishing a bio-solids treatment plant for waste generated by the occupants of Masdar City.

Elsewhere in the UAE, in June 2009, it was announced that Dubai would construct 'the region's largest solar energy manufacturing plant' and it was also confirmed that a feasibility study had been completed to build 66MW of wind generation capacity in the Arabian Sea-facing emirate Fujairah. No firm plans have been made public in respect of either project, however. In Ras Al Khaimah, the Centre Suisse d'Electronique et de Microtechnique had been banking on an experimental offshore solar thermal project, but this has now been abandoned.

The Dubai Water and Electricity Authority is also studying the possibility of a $1bn test wind farm development, which could supply a significant percentage of Dubai's power, if tests are successful and the project is implemented.

Conclusion

The developments announced to date in the UAE are showcase projects, which show what renewable energy technologies are capable of. Though such projects may be steps on the way towards achieving the country's 7 per cent renewable energy goal, their proportion of total power generated will be small and it remains to be seen what practical effect they will have on the take-up of renewable energy in Abu Dhabi and the UAE as a whole, as well as the UAE's ability to hit its target.

Indeed, despite the existence of Masdar, it is not clear whether there is enough political appetite to put in place the mechanisms required to promote the development of solar power on a wider scale and on a sustainable basis, as well as the increase of energy efficiency and the reduction of greenhouse gas emissions. The apparent delay in the introduction of the framework for a subsidy scheme is evidence of the extreme political sensitivity that this issue presents.

In relation to buildings, the signs are not as encouraging as they could be. A number of large-scale residential and commercial developments are being undertaken to meet the requirements of the expanding city, such as Reem Island and Sowah Island. However, the opportunity to adopt the latest energy-conservation techniques and integrate renewable energy systems has not been taken, although it is understood that the developer of Sowah Island is considering making use of district cooling systems. However, things should improve with the Abu Dhabi Municipality's introduction of the new building code.

In the short- to medium-term, the UAE is unlikely to be a jurisdiction particularly favourable to the domestic development of renewable energy generation on a widespread scale. Indeed, the beneficiary of the focus on reducing the use of imported gas for power generation while avoiding burning oil is likely to be the nuclear industry. Abu Dhabi is the furthest-advanced MENA country in developing a nuclear programme.

However, the UAE has established itself as an innovator and the major centre for business in the region. With these foundations, the Masdar City development combined with IRENA is likely to be an attractive base for companies focusing on the renewable energy industry in the region, as well as a local research and technology hub, thereby satisfying the Abu Dhabi government's objectives of enhancing job opportunities for the local population and diversifying the economy away from hydrocarbon production. Moreover, Masdar also acts as a pathfinder with an important mission to raise awareness of renewable energy and sustainable energy conservation among the UAE public and is helping to support the strengthening of institutional, regulatory and operational capacities of key stakeholders, which is required before the full-scale implementation of renewable energy development in the UAE can be achieved.

Oman, Qatar and Kuwait

Elsewhere in the Gulf Cooperation Council, Oman, Kuwait and Qatar have all taken steps to begin developing renewable energy projects. Oman is most advanced.

In 2008, a study by COWI and Partners commissioned by the Public Authority for Electric Regulation and Water (PAEW) to identify sources of renewable energy in Oman emphasised the high solar density in Oman and found that there is significant wind energy potential in coastal areas in the southern part of the country and in the mountains north of Salalah. The study estimated that the cost of wind power in these areas could be close to the cost of fossil fuel-generated electricity. It also considered some options for incentivising the market, with particular consideration given to renewable energy quotas, feed-in tariffs and tax incentives. Following on from this, in mid-2009 the PAEW selected a consortium of international advisers to conduct a feasibility study for a large solar plant in Oman, which may be either photovoltaic (PV) or thermal.

If the feasibility of a large solar plant is confirmed, the Oman Power and Water Procurement Company (a wholly-owned subsidiary of the government-owned Electricity Holding Company) will initiate a competition in 2010 to build, own and operate Oman's first large-scale solar plant. However, participants in the market are pessimistic about the outcome. In particular, the technological obstacles to large-scale thermal solar generation in the desert regions of the Gulf may rule out the use of concentrated solar power. The costs of a large-scale PV plant would be prohibitive, particularly for a state such as Oman, which lacks the revenues of its neighbour Abu Dhabi. However, the project also includes an evaluation of regulatory and financial support structures. It may thus be that, whether or not a solar power plant is constructed, the project will result in a detailed consideration of the mechanisms for the support of renewable energy in Oman, with resulting enabling legislation.

In Kuwait, it was announced in October 2009 that the country aimed to produce 5 per cent of its electricity from renewable sources by 2020 and that a tender for a solar power plant would be issued in 2010. However, with ongoing conflict between the government and the Kuwaiti parliament, it cannot be predicted whether the project will, in fact, proceed and what legislation, if any, will be put in place to support the 5 per cent goal.

In Qatar, there is no evidence of legislation to facilitate renewables, but research into energy efficiency and renewable energy technologies suited to the local environment will start in 2010 at the Centre for Sustainable Energy Efficiency, which is part of the Qatar Science and Technology Park. In an example of a private sector initiative, Chevron will be funding $20m of research at the Centre over the next five years.

Ambitious plans have been announced for a $1bn solar power project and a $500m polysilicon manufacturing plant in Qatar, which are expected to be firmed up during 2010.

Jordan and Syria

Legislative developments

Jordan recently released a national energy strategy that includes an objective to increase the percentage of renewable energy in national primary energy production from about 1 per cent at present to 9 per cent in 2020. This would require some $2.4bn of investment.

To support the strategy, a new energy law with a chapter on the promotion of renewable energy was being discussed by the Jordanian government, though, with the dissolution of parliament in November 2009, its implementation is likely to be delayed. The law exists in a draft form, which includes regulations and incentives for renewable energy production. If it came into force in its current form, the law would provide investors in the renewable energy sector with a number of incentives, including partial exemption from income taxes for a prescribed period and exemption from customs duties on imported materials to be used in renewable energy facilities, as well as guaranteed grid access. In addition, favourable treatment will be afforded to land that is reserved for renewable energy project development and a fund will be established to encourage such development.

Renewable energy developers are likely to consider that the law's principal flaw, if it is enacted as currently drafted, will be the lack of a tariff regime. It appears to be envisaged that power purchase agreements will be concluded with renewable energy developers on a case-by-case basis. Though the law contains a provision enabling developers to make offers to the Ministry of Energy to develop renewable energy projects, it specifies that any tariff offered must be 'within a reasonable range compared to the standard reference'. This may enable a suitable tariff to be negotiated on a case-by-case basis, but it does not provide for a stable long-term regime that would encourage investment. The European experience shows that developers are nervous about committing to developing projects on an independent basis without any medium- to long-term certainty about the incentives regime. It also shows that a renewables market only really takes off when developers and investors can develop a portfolio of projects within the context of a stable legislative regime.

In addition to the proposed law, the Jordanian government (in co-operation with the World Bank) requested at the end of 2009 for consultancy proposals for strengthening the legal, regulatory and institutional framework for the development of renewable energy resources. The outcome of the consultation process is unlikely to emerge for some time, but it is expected that it will take the European experience into account.

Projects

Jordan is developing two wind farms (the 30-40MW Kamshah project and the Fujeij project) and, if they are successful, intends to develop an additional 400MW of capacity by building three plants at Al-Harir, Wadi Araba and Maan. These wind farms are being developed on an ad hoc basis without any particular enabling legislation. However, Jordan may become one of the countries in the region with the most detailed framework for renewable energy, if the new energy law (discussed above) is implemented as currently drafted.

To date, solar power has not been developed to a significant degree in Jordan. However, in May 2009, a private consortium led by BADR Investments announced its intention to develop a 100MW concentrated solar power plant in co-operation with the Ma'an Development Company in the Ma'an Development Area in the south of the country.

Syria has recently announced the development of a 50-100MW wind farm to be located at either Al-Sukhna or Al-Hijana or at both sites. The project will be developed on a design, build, finance, operate (DBFO) basis with a 20-25 year power purchase agreement.

Syria intends to install 2,500MW of wind power and more than 3,000MW of solar power plants by 2030.

Egypt

Legislative developments

In the early 1980s, a renewable energy strategy was formulated as an integral part of national energy planning in Egypt. This strategy has been revised in view of the projections for possible renewable energy technologies and application options, available financing sources and investment opportunities in the field.

The New and Renewable Energy Authority (NREA) was established in 1986 to act as the national focal point to introduce and promote renewable energy technologies for potential applications – particularly generating electricity on a commercial scale with implementation of related energy conservation measures. It is responsible for the implementation of renewable energy projects, among other things.

Currently, the strategy targets 20 per cent of electricity to be generated by renewable energy sources by 2020, including a 12 per cent contribution from wind energy. However, there are still significant barriers hindering the development of renewable energy – in particular, the financial barriers due to subsidised conventional energy prices, the absence of well-defined legislation and the institutional barrier of having two ministries responsible for energy issues (the Ministry of Electricity and Energy and the Ministry of Petroleum), which makes integrated energy planning more difficult (although the Higher Energy Council, consisting of members of the key ministries of electricity, petroleum, finance, planning and economic development, which is tasked with reviewing overall energy policy and planning, is intended to overcome this concern).

The NREA has recently drafted a new electricity law, which is being reviewed by the Egyptian parliament. It includes a chapter to support the use of renewable energy sources through subsidies that mitigate the price gap between conventional energy technologies and those needed to capture and develop renewable energy sources. A system of feed-in tariffs has been announced but no details have yet been provided. The law also provides administrative support for investments. According to news on certain websites, the new law will establish a new and more efficient procedure, having a single drop-in centre for international investors, the general authority for investments.

Projects

As outlined in the accompanying overview, the NREA is developing an integrated solar combined cycle power (ISCC) plant at Kuraymat, south of Cairo. The plant will have a combined capacity of 150MW, including a 20MW solar field. The project is intended to demonstrate the operational viability of hybrid solar thermal power generation technology and contribute to the replication of ISCC technology elsewhere in Egypt. The plant is being funded by a combination of a Japan Bank for International Co-operation loan, a World Bank Global Environment Facility grant and contributions from the Egyptian government.

In the public sector, the NREA owns a 430MW wind farm at Zafarana in the Gulf of Suez, which has been conventionally procured and funded using mixed credits from the Danish aid organisation DANIDA and kfW. It plans to expand the Zafarana capacity to 1,230MW by 2014 and to 2,200MW by 2020. In addition, the NREA will finance the construction of a 200MW wind farm at Gabal el Zeit on the west bank of the Gulf of Suez, some 400km south of Cairo, in part from a facility provided by the European Investment Bank and other European institutions such as KfW and AfD. This project is to be structured on a build, own and operate basis with a 20- to 25-year power purchase agreement to be signed with the Egyptian Electricity Transmission Company and guaranteed by the Egyptian government. It is anticipated that the project will be commissioned in 2013. The project has generated a great deal of interest in the market and over 60 expressions of interest were submitted, from which 10 bidders were shortlisted. Egypt recently announced the launch of a 200MW wind farm in the Gulf of Suez to be developed jointly by the New and Renewable Energy Authority and Abu Dhabi's Masdar. There are no details yet as to how this project will be financed. The project is part of an overall package of 10 250MW plants.

North Africa

Morocco and Tunisia have taken significant steps to promote renewable energy.

In Tunisia, the 2004 Loi Relative a la Maitrise de l'Energie No. 2004-72 included provisions on rational use of energy and of renewable energy. More importantly, the 2009 Loi de développement de l'auto production de l'électricité included provisions for a feed-in tariff. The Tunisian government has set an objective for 200MW of installed capacity of wind power between 2007 and 2011 and a four-year energy conservation programme for the period 2008-2011 aims at increasing the contribution of renewable energy to 4 per cent of energy demand.

Meanwhile, the Moroccan government is actively promoting a policy to develop renewable energy. The Renewable Energy Law was passed in 2007, including a target of 20 per cent up to 2012 of renewable energy generation for electricity and guaranteed third party access to the grid. A number of small off-grid photovoltaic (PV) projects have been built under development programmes and, in November 2009, Morocco announced that it aims to produce 2GW of electricity from solar sources by 2010. The 470MW integrated solar combined cycle power plant at Ain Beni Mathar-Oujda is the first of five regional plants intended to help achieve this objective. It is funded by the African Development Bank and will be developed by an Alstom-Abengoa joint venture. In addition, over 940MW of wind capacity is under varying stages of development by the Office Nationale d'Électricité.

In Tunisia, the National Electricity Power Company has developed two pilot wind farm projects and over 150MW of new capacity has been announced in projects that will receive a significant degree of funding from the Spanish Development Aid Fund. The Italian Moncada Energy group has also announced plans to build a 500MW wind farm and 200MW of solar power installations but the status of these projects is uncertain.

At a regional level, in December 2009, the World Bank's Clean Technology Fund approved $750m of funding for CSP projects in North Africa, which is intended to mobilise $4.85bn from 'other' sources. This is potentially significant, but will rely on governments and private sector participants to develop the necessary projects and sufficient appetite from commercial lenders and other development banks to provide the additional funds.

One of the objectives for the World Bank funding is to promote electricity exports. The German Desertec consortium has already begun to explore the potential of the Saharan region for developing exportable solar power. Its ambitions are vast, envisaging the construction of a network of CSP plants across North Africa and the Middle East, linked to European electricity networks. The objective is to supply a substantial part of local electricity demand and 15 per cent of European demand by 2050. Studies as to the required regulatory and legal framework, technologies and methods of financing are already underway.