

EXECUTIVE SUMMARY

SUSTAINABLE ENERGY

PROSPECTS, CHALLENGES, OPPORTUNITIES

2013 Report of the Arab Forum for Environment and Development (AFED)

Like in many parts of the world, energy systems in the Arab region, which are dominated by fossil fuels, are not sustainable in economic, environmental or social terms. Although energy intensity and per capita carbon emissions are among the highest in the world, 35 million Arab people are without access to modern energy services, mainly electricity. Unlike many parts of the world, however, the Arab region is well endowed with clean, renewable sources of energy, primarily sun and wind. Together with enhanced energy efficiency and cleaner technologies, those renewable sources can help diversify and power a more sustainable energy future. The 2013 annual report of the Arab Forum for Environment and Development (AFED) on Sustainable Energy in the Arab countries concludes that, with a long-term commitment and the right policies and investments, Arab countries could join the global clean energy club, creating high paying jobs and exporting renewable energy in addition to oil and gas.

The energy sector in the Arab countries plays a critical role in the region's socioeconomic development. Oil and gas revenues have been the major source of income in most of the Arab countries, especially in the Gulf region. According to the Arab Monetary Fund, the oil and gas sector makes up about 36 percent of the total Arab GDP. The share of hydrocarbon revenues in most Arab producers' export earnings ranges from 33 percent in the relatively diversified economy of the UAE to 88 per cent in highly export-oriented economies such as Saudi Arabia and Qatar, and more than 97 percent in Algeria and Iraq. Over the past three decades the GCC countries, which are the major Arab oil exporters, have witnessed an unprecedented economic and social transformation. Oil proceeds have been used to modernize infrastructure, create employment, and improve human development indicators.

On the other hand, oil revenues have not been able to spur the kind of economic diversification many Arab producers aspired and continue to aspire to, leaving most of them exceptionally reliant on what have proven to be highly volatile oil revenues. The political turmoil that has toppled several Arab regimes has, furthermore, revealed the vulnerability of regional oil supply to political disruption at times of intra-regional crisis. Yet, oil continues to be the Arab world's most important natural resource, a status that is unlikely to change any time in the near future. Despite the recent discovery of significant oil reserves outside the Arab world (for instance shale oil in the USA, oil sands in Canada, coal-bed gas in Australia, and deep offshore in Brazil), the Arab world is expected to continue to play a key role in global oil markets, dominating international trade in crude oil and holding the bulk of the world's reserve capacity.

Additionally, climate change concerns and expected reductions in emissions of global greenhouse gases would potentially lead to major policy shifts in global energy markets towards more efficient low carbon clean energy sources. While the ongoing UN climate negotiations have not yet reached agreement on a long-term climate regime post-2020, a shift in the national climate policies of some major energy consumers such as the US, the EU, and China toward low carbon development is already taking place, leading to remarkable developments in the global oil market. The OPEC World Oil Outlook (2011) projected that demand for liquid fuels will increase more rapidly in the transportation sector than in any other end-use sector, with most of the growth projected among developing countries, led by China and India. Market penetration of advanced transport technologies and alternative fuels, however, would reduce world oil demand by about 7 million barrels per day by 2035 compared to business as usual.

Arab economies rely heavily on oil and gas to meet more than 97 percent of domestic energy demand, with renewable energy contributing the remaining 3percent. However, the renewable energy market in Arab countries is rapidly expanding, with a diverse range of countries announcing projects and policies to harness the region's abundance of renewable energy resources for economic growth and energy security enhancement. The Arab world's continued reliance on hydrocarbons to meet its own domestic energy needs also raises challenges of a different kind: surging domestic demand for energy implies an increasing drain on the region's oil production, diverting growing shares to domestic markets away from export. Some analysts estimate that Arab oil producers may lose as much as US\$90 per barrel of oil used domestically instead of exported.

The growth in energy demand is a corollary to the region's economic growth, industrialization, and change in life style. This surge in demand, however, does not need to lead to a surge in air pollution, including carbon emissions. Demand management and a radical shift to more efficient use of energy, producing more units of output for less units of energy input, are overdue. It is well past time for the region to embrace in a big way the shift to renewable energy-a shift that would bring low-carbon economic opportunities, energy security, and a cleaner environment.

The opportunity cost of a continuation of business-as-usual, in a largely undiversified economy, is increasingly unsustainable, raising the question: what role should oil play in the Arab economies over the long-term? This means that many Arab oil producing countries need to invest considerably more capital and effort into developing incentives for private sector activities which are not limited to oil and energy-intensive industries. Current oil revenues should also play a more active role in enhancing regional capacity in research and development of renewable energy technologies, a trend that has just started in some major oil exporting countries such as the United Arab Emirates and Saudi Arabia.

It is also worth noting that the energy sector plays a major role in meeting water and food needs in Arab countries. Fossil fuel-based combined heat and power plants are commonly used for seawater desalination in the region, which hosts nearly 50 percent of the world's desalination capacity. Heavily subsidized electricity from fossil- fuel power plants is also used as the primary

energy source to pump and distribute groundwater. In spite of that, per capita consumption of fresh water in some arid Arab countries is among the highest in the world, and irrigation efficiency is one of the lowest, at an average of 40 percent. Thus, food production in the region continues to rely on expensive, non-renewable energy resources, used in an inefficient manner. Shifting to efficient practices and renewable sources of energy provides viable options for securing a sustainable supply of water resources and food production for decades to come.

Considering Arab countries' relatively large endowment of natural gas resources, the potential of this fuel to help the region both meet its energy needs and manage its global carbon footprint remains under-realized. This is due to a number of factors. Gas pricing policies in the overwhelming majority of Arab countries have kept end-users prices at artificially-low levels, not only contributing to rapid gas demand growth in the region but have also precluded the development of new sources of gas supply. In addition, owing in large part to Arab gas (and energy) pricing policies, attracting the necessary investment to deliver the energy mix that the region requires has been a challenge. With the increasing attractiveness for international oil companies of mature and emerging gas fields in other parts of the world, the need to reform the investment conditions in Arab countries has never been greater.

The Arab region is among the least economically integrated in the world, which impedes the development of viable regional natural gas market. The lack of regional gas trade, with only 11 percent of Arab pipeline gas shipments being exported within the region, means that gas surplus from the Arab region has invariably been traded in far-away markets, depriving gas-short Arab countries from accessing competitively-priced supply from neighbouring countries.

Current trends in energy usage place the Arab economies among the least efficient in the world. There has been no decoupling between economic growth and energy demand in the Arab region in the past decade. Growth in energy consumption has been faster than economic growth; while average annual GDP growth was around 4percent, the annual increase in primary energy and electricity demand has been about 8percent. Fossil fuel subsidies are a major contributing factor to this inefficient use of energy. Arab residential markets, for example, are the most heavily subsidized, with some countries offering an implied subsidy of up to 95 percent for residential energy consumption. Another factor is the prevalence of inefficient electricity infrastructure in most countries of the region. Average Arab electric energy losses in generation, transmission, and distribution, at 19.4 percent are more than twice the world average, at 8.3 percent.

Recognizing the substantial potential gains from energy efficiency, the League of Arab States in 2010 adopted the Arab Energy Efficiency Guidelines, in order to promote cost effective improvements of end use electricity in its member states, through guiding targets, mechanisms, incentives, and institutional frameworks. However, despite many declarations and promises by Arab leaders for more sustainable energy development, today only few countries in the region have published energy efficiency strategies with quantified targets and supporting policy measures. There are many social, economic, and political barriers to energy efficiency in the region that need to be overcome. Energy efficiency can be promoted by influencing consumer behaviour via incentives

in order to overcome market barriers. Successful energy efficiency labeling offers a combination of information, awareness, and incentives to encourage consumers to adopt energy-efficiency technologies and producers to invest in technology innovation and meet energy performance standards.

Arab countries have a great potential for renewable energy, including solar and wind, as well as hydro and geothermal in certain locations, which are grossly underutilized. However, the renewable energy market in the Arab region has evolved rapidly in recent years with countries announcing projects and policies. The recent expansion of the region's renewable energy market, as well as the diversity of participating countries, is driven by the need to enhance energy security, address major energy demand growth, and deal with water scarcity. As of early 2013, 64 projects totaling almost 6 gigawatts of new renewable capacity were in the pipeline, a four-fold increase over existing capacity. New investment in renewables totaled US\$1.9 billion in 2012, a six-fold increase compared to 2004. In comparison, US\$244 billion was invested in renewable energy globally, the second-highest year ever for renewable energy investments, which cumulatively have totalled US\$1.3 trillion since 2006.

Beyond hydropower, which is the leading source of renewable energy for electricity generation in the region, wind energy is the most common source. As of the end of 2012, at least seven Arab countries, with Egypt in the lead, had wind power capacity. Concentrating Solar Power (CSP) will also contribute to the growing share of solar energy in the region. More than 30 percent of the countries operating CSP plants in the world are in Arab countries, namely: Algeria, Egypt, UAE, and Morocco. In March 2013, the United Arab Emirates became a major player in the CSP market when Shams 1, the world's biggest CSP plant with an installed capacity of 100 megawatts (MW), started operation. Likewise, Saudi Arabia has set an ambitious target aiming at meeting 33 percent of its domestic energy needs through renewable sources by 2032.

The right policies help drive the successful integration of larger shares of renewables in the energy mix, which simultaneously benefit the economy and the environment. Twenty Arab countries have policy targets and 16 have enacted some level of renewable energy enabling policies such as feed-in tariffs, fiscal incentives, and public financing. However, as the MENA Renewables Status Report stated: "It remains to be seen the extent to which government ambitions, currently supported largely through public financing, will lead to transparent, long-term, market-driven policies and incentive mechanisms that encourage private sector involvement in deploying renewable generation capacity."

Policy, investment, and business experts alike have noted that the clean energy economy is emerging as one of the great global economic and environmental opportunities of the 21st century. Leaders at the local, state, and national levels around the world are realizing that by harnessing safe, reliable, and clean energy they can create jobs and businesses, enhance energy security, improve air quality and public health, and mitigate climate change. With a long-term commitment and the right policies and investments, Arab countries could join the global clean energy club, creating high paying jobs and exporting renewable energy in addition to oil and gas.

To meet the growing demand for electricity, a number of Arab countries have announced plans to add nuclear power to their energy mix. Oil producing countries consider that adding nuclear power to the energy mix enhances energy security while hydrocarbon reserves are being depleted, in addition to releasing more oil for export, benefiting from the prevailing favourable market prices. Other countries consider nuclear power a solution to overcome their poverty in hydrocarbon resources.

The ability of Arab countries to manage the entire lifecycle of nuclear power is questionable. Critical safety issues remain to be resolved. Apart from the risk of accidents in nuclear power plants, nuclear waste storage and disposal are still unresolved, and would pose serious public health risk. As stated in the 2011 AFED Report, “international concerns about nuclear weapon proliferation associated with nuclear fuel cycle and uranium enrichment have resulted in global restrictions on these technologies, which would force Arab countries to rely on the international supply market for nuclear fuel even if local uranium reserves were available. Furthermore, local technical capabilities to build, operate and maintain nuclear power plants in Arab countries are extremely weak, which raises major energy security, safety, and dependency concerns over the heavy reliance on foreign expatriate labor. Thus, nuclear energy might not be the most viable policy option for long-term energy supply or security in the Arab region.” Experience from other parts of the world is instructive. According to the World Nuclear Industry Status Report 2013, “three of the world’s largest four economies (China, Germany and Japan), together representing a quarter of global GDP, are now running their economies with a higher share of renewables than nuclear”. The same report also noted, “for the first time in 2012, China and India generated more electricity from wind than from nuclear plants.”

Carbon dioxide (CO₂) emissions related to fuel combustion in the Arab region increased by 247 percent from 1990 to 2010, significantly outpacing population growth over the same period. Over 95 percent of these emissions were related to the use of oil and gas. Although the total contribution of the Arab region to global climate change is only about 5 percent, it cannot afford inaction on the global, regional, or national scales, because of its very high vulnerability to projected impacts (as documented in AFED’s 2009 report). There is no longer any credible scientific disagreement about the basic facts. Our world continues to warm. According to World Meteorological Organization (WMO), the last decade, 2001-2010, has been the hottest in modern records with 94 countries experiencing the warmest temperatures in the decade. Sea level is rising and Arctic Sea ice is melting years faster than predicted.

A recent report by the World Bank concluded that the effects of climate change are already being observed in many parts of the Middle East and North Africa. Further, the region is projected to be much drier and hotter, and vulnerable to rising sea levels. The report cited the 2006 flooding of the Nile River Basin, as well as the record five-year drought in the Jordan River Basin that ended in 2008. Of the 19 record temperatures in 2010, almost a quarter were in the Arab world, including Kuwait where peak temperatures reached 52.6 degrees Celsius in 2010 and 53.5 in 2011. In 2010, the Arabian Sea experienced its second-strongest cyclone on record, with winds as strong as 230 kilometers per hour that killed 44 people and caused US\$700 million in damages in Oman.

The region is already the world's most water-scarce, and with climate change, droughts are expected to turn more extreme, and water scarcity is expected to exacerbate. Also, most forms of energy generation, including nuclear, are vulnerable in some way or another to the effects of climate change. If nuclear power is to be used to mitigate the effects of climate change, it must also be capable of adapting to it, including increasing temperatures, sea level rise, extreme weather events, and water scarcity.

It is in the best interest of Arab countries that strong action is taken at the global level on both mitigation and adaptation. In turn, Arab governments should do their part by developing effective strategies for mitigating and adapting to climate change. In the energy sector, measures to mitigate greenhouse gases (GHGs) emissions cover the supply and demand sides. Measures in the supply side include energy efficiency in power generation and oil refining, use of combined heat and power to produce electricity and water, fuel switching away from carbon fuels, electricity imports through regional electricity networks, reduction of losses in transmission and distribution, and power generation using renewable energy resources such as wind and solar. The synergy between power generation and water desalination is a major theme for efficient use of energy in the Arab region.

Another challenge facing governments in most of the Arab countries is the mobilization of sufficient funds to finance projected growth rates in energy demand. At 202 GW, the installed generation capacity of the 22 members of the League of Arab States constitutes only 4% of international installed generation capacity, according World Bank and Global Energy Observatory 2013 figures. Annual electricity consumption per capita in Arab countries averaged 2,396 kilowatt-hour (kWh) in 2010, reaching as high as 18,319 kWh in Kuwait and as low as 248 kWh in Yemen. Demand growth rates in the past decade ranged between 5 and 10 percent per annum and are anticipated to continue to hold at levels between 4 and 8 percent in the coming decade. Meeting the demand for electrical power of a growing consumer base — both in terms of size and consumption per capita — requires the steady installation of approximately 24 GW of capacity per annum for the next 10 years. This translates into the mobilization of new investments in excess of US\$31 billion per year representing 1.5 percent of the GDP of Arab countries. This funding requirement comes in addition to capital investments in transmission and distribution (T&D) network infrastructure as well as operations and maintenance (O&M) expenditure and fuel subsidies. Under a scenario of continuing economic growth and socio-economic development, the funds required to grow and sustain the power supply infrastructure will exceed the public sector's ability to effectively outlay funds and manage capital projects. It is necessary to attract funding from other sources through innovative approaches that can leverage limited public funds to attract significant private investments.

In recent years, independent power production (IPP) has emerged as the most prominent public-private partnership (PPP) scheme in the region; In 2010 Arab countries had about 40 GW of operating IPP capacity, representing more than US\$50 billion of private investments and financing. The experience of the past decade in Saudi Arabia, Abu Dhabi, Qatar, Oman, and Morocco present a solid track record for private sector participation in developing generation capacity. Recently, local IPP developers and commercial banks

in these countries have built sufficient capabilities to take a leading role in financing and delivering large scale generation projects across the entire Arab region and beyond.

RECOMMENDATIONS

Arab countries can foster the sustainability of their energy sectors by making crucial strategic choices, which entail high economic potential while at the same time securing balanced resource management. These choices include improving energy efficiency, exploiting the huge potential of untapped renewable energy resources, and harnessing oil and gas reserves in cleaner and more competent ways. Revenues from oil exports need to be utilized to build regional capacity in developing and acquiring clean energy technologies, including aggressively exploring carbon capture and storage (CCS).

The AFED 2013 report puts forward a set of recommendations to help the transition to a sustainable Arab energy sector, mainly urging policy makers to take concerted action across several dimensions:

- Policymakers should mobilize sufficient investment in production capacity to maintain the region's role as a global production leader over the coming decades and provide for the effective use of oil and gas revenues to diversify the region's economics away from continued reliance on fossil fuels and the management of domestic energy demand and supply.
- Policymakers need to reform gas and related energy product pricing mechanisms in such a way as to drive a shift to a sustainable energy system where natural gas can play a greater role in the Arab energy transition and future economic development.
- Policymakers in the Arab region should establish the appropriate enablers for private sector participation in energy supply infrastructure investments, including well-defined policies and a sound regulatory framework. They should build on the already established IPP model with modifications to address a few key limitations. By establishing prudent long-term government liabilities management, building capable regulatory institutions, and deploying methodical project tendering processes, Arab governments can leverage limited public funds to attract significant private sector investments.
- Policymakers need to facilitate the mobilization of local equity and debt financing through supporting the establishment of third-party investment funds, developing more flexible legal instruments (e.g. partnership flips and sale leasebacks), and granting infrastructure developers better access to corporate bond/Islamic Sukuk markets.
- Policymakers/regulators should enable comparability across projects and countries through increased transparency regarding factors influencing investment decisions, including projected investment plans, fuel supply allocations, and remuneration mechanisms.
- Policymakers should phase out energy subsidies and reform energy

pricing policies in order to incentivize the rapid deployment of energy efficiency and renewable energy technologies. Leveling the playing field for renewables and reducing reliance on public and “soft” financing would also foster greater private investment.

- Policymakers should effectively implement the Arab Energy Efficiency Guidelines, adopted in 2010, by establishing national energy efficiency strategies with qualified targets, timetables, and supporting policy measures. Governments should also provide public awareness and incentives for adoption of energy efficient technologies and practices.
- Policymakers, in addressing climate change mitigation and adaptation in the energy sector, should:
 - Systematically assess and monitor energy systems to ensure that they are robust enough to adapt to anticipated climate-related impacts.
 - Mainstream climate impact assessment into environmental impact assessment (EIA) and strategic environmental assessment (SEA) for new energy systems' expansion plans.
 - Address energy poverty as an integral part of adaptation strategies.
 - Promote shifting toward decentralized, renewable energy supply system in remote and rural areas.
 - Implement energy efficiency and demand management as an adaptation measure.
 - Develop a new holistic approach to deal with the energy-water-climate nexus in the Arab region.
- Policymakers should embrace cutting-edge sustainable energy technologies as a means of economic and developmental leapfrogging, for business innovation, and for manufacturing of hardware and software, geared towards widespread deployment.