



Specifically, the government invited developers to submit expressions of interest for the development of renewable projects, indicating the maximum tariffs that the government would pay for different types of renewable power. In the developers' expression of interest, the land required for the project and the proposed size and type of facility had to be identified. Memoranda of understanding are issued for expressions of interest which are acceptable to the government; these provide developers with an exclusivity period of 24 months, during which time they are required to develop the project, sign project agreements with the government, and reach financial closure.

As a result of the introduction of this bottom-up approach, 13 PPP projects were developed between 2012 and 2014, amounting to an investment commitment of US\$1.8 billion. The number of requests for the connection of renewable energy systems, according to the Net-Metering system, has reached 430 requests with 12,352 kW of capacity; of these, 291 (with 2554 kW of capacity) were connected and in operation during the year 2013.

Looking forward

Public-private partnerships are expected to play a growing role in infrastructure

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'PUBLIC-PRIVATE PARTNERSHIPS ARE EXPECTED TO PLAY A GROWING ROLE IN INFRASTRUCTURE INVESTMENT ...'

investment because they represent a shortcut to the modernization of the energy sector and the provision of much-needed infrastructure. Different strategies are possible to achieve the attraction of private stakeholders. The two most successful cases in the MENA region illustrate that both decentralized and centralized models can be viable.

In the first case, positive results have emerged from Jordan following an attempt to promote widespread diffusion and social acceptance of RES, while promoting, at the same time, domestic and residential installations. Decentralized energy projects are also promoted as part of government's localism and rural development agenda, as citizens, rural communities, local authorities, and private organizations are now involved in energy projects and investments, thus developing solutions that meet local needs and involve local stakeholders.

In contrast, Morocco has promoted a centralized investment strategy, to attract a few flagship projects, in

combination with a policy to develop, at the same time, green growth and a RES industrial sector. This main strength of the policy framework also represents the main limitation of the Moroccan renewable energy strategy – that it is focused solely on large-scale projects.

The evidence collected illustrates the fact that stabilization of the remuneration provided with the most common regulatory tool for RES technologies (in particular a RES quota and target) is essential to provide the necessary guarantees, and certainly represents a positive step toward RES penetration. However, while widely diffused, such measures need to be accompanied by a long-term strategy – one capable of generating an environment conducive to investment – in order to become effective. In such a framework, the strategies adopted in Morocco and Jordan, although different in their approach, have been able to provide these preconditions. These two approaches can well represent possible alternative models for the active participation of the private sector in energy investment. To this end, recent policy development, particularly in Egypt and Algeria, testifies for a move toward a more sustainable and investment-friendly environment in the region.



Kuwait needs to rethink its energy mix

Osamah Alsayegh

The Stone Age did not end because we ran out of stones; we transitioned to better solutions (Steven Chu and Arun Majumdar, Nature, August 2012).

We all know that the oil dominance era will not end because we will run out of oil; it will fade away because the world will have alternative options.

Countries with economies that are highly dependent on oil exports and excessive energy intensity (energy consumed per unit of GDP), such as Kuwait, will be significantly impacted if sustainable energy measures and economic diversification actions are not adopted.

The expected decline of oil demand in the long term is suggested by evidence already in existence. Each year, new policies are enacted toward the mitigation of greenhouse gas (GHG) emissions; these require the continuous development of energy efficiency measures and increased use

of clean energy sources (renewables, biofuel, and nuclear). The recent United Nations Framework Convention on Climate Change (UNFCCC) event that was held in Lima, Peru, in December 2014, issued a decision entitled 'Lima Call for Climate Action'. This suggests replacing the Kyoto Protocol with a commitment which would be binding on all countries (rich and poor alike, but with different responsibilities with respect to mitigation, adaptation, finance, technology development, and capacity building) to mitigate GHG. The Lima conference is to be followed by COP21, which will be held in Paris, France, in December 2015; this event is seeking a legally binding agreement on climate from all the nations of the world. The expected impact of the various policies involved has been taken into consideration and its effect on oil demand has been simulated. The 2013 IEA World Energy Outlook and the OPEC World Oil Outlook have projected that global oil demand will decline by 5 per cent and 6 per cent, respectively, from 2010 to 2035.

In addition to the impact of environmental concerns, technological advances have been pushing toward the discovery of new and unconventional energy sources (shale oil/gas) that have been competing with conventional sources and taking part of their market share. Moreover, new (East Africa) and resuming (Libya, Iran, Iraq) oil producers are expected to compete for market share with current oil producers. For a country such as Kuwait, that has about 95 per cent of its revenues coming from oil and oil product exports, this would mean gradually losing part of its market share which would, consequently, affect its economic development.

The State of Kuwait is aware of the impending challenges created by the dynamic changes affecting the world energy system, and of the considerable impact on its socio-economic

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'ABOUT 60 TO 70 PER CENT OF GENERATED ELECTRIC ENERGY IS CONSUMED BY A/C SYSTEMS DURING PEAK HOURS IN THE SUMMER.'

development. A number of government, private, and civil society organizations have made sincere efforts to advance economic diversification and energy sustainability practices through energy efficiency and renewable energy programmes over more than three decades. Yet Kuwait is still considered as being among the highest energy consumers and carbon emitters per capita. Energy sustainability indicators, such as energy intensity (consumed energy unit per GDP unit), confirm the unsustainable nature of Kuwait's energy system. According to IEA statistics, Kuwait's energy intensity index shows that the cost of converting energy into GDP has an average annual growth rate of 2.0 per cent. These indicators call for serious investigation to identify the barriers to energy sustainability in Kuwait.

Drivers towards unsustainable energy

The energy system of Kuwait, unlike that of most countries, is simple. Crude oil and natural gas are currently the only primary energy sources. Power plants (which are co-generation plants that produce electricity and potable water) and refineries are its main energy conversion systems, and energy end-use services are mainly driven by electricity, oil products, and petrochemical products. The main end-user sectors include transportation, industry, residential, and commercial.

The key natural forces that push toward unsustainable energy status are harsh weather and the lack of resources, such as fresh water, supporting life. The land area of the State of Kuwait is 17,818 km². Most of its mainland

is a flat sandy desert. The weather is characterized by long, hot, and dry summers (from April to October) and short, warm, and sometimes rainy winters (December to February). Dust storms occur frequently, with a rise in humidity, during late summer. The typical extremes of ambient temperature, over winter and summer, range between 0 °C and above 50 °C. Air conditioning (A/C) use through the summer seasons is necessary for human health and the ability to work. A number of studies carried out by the Kuwait Institute for Scientific Research (KISR) show that about 60 to 70 per cent of generated electric energy is consumed by A/C systems during peak hours in the summer seasons. Moreover, and because of the lack of fresh water, more than 95 per cent of potable water in Kuwait comes from energy-intensive seawater desalination. It is estimated that about 30 per cent of the energy consumed in power plants goes to desalination units (which are mostly multi-stage flash technologies).

In addition to the environmental conditions (which are beyond human control), unsustainable consumption in Kuwait is also driven by a lack of energy demand-side management and by unexploited renewable energy sources. Currently, the average ratio of domestic energy consumption to total energy production is about 20 per cent, according to OPEC data from 2013. The dominant domestic consumer is the electricity and water sector that consumes about 11 per cent of total energy production. The industrial and transportation sectors receive about 5 per cent and 4 per cent of total produced energy, respectively. The annual average consumption growth rate has been about 5.0 per cent for the past 10 years, according to data from Kuwait's Ministry of Electricity and Water.

About 70 per cent of the power plants' input supplies are liquid fuels (oil



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'... THE ENERGY DEMAND OF THE ELECTRICITY AND WATER SECTOR WILL INCREASE BY 65 PER CENT IN THE COMING 20 YEARS.'

and oil products). The remaining 30 per cent is natural gas. It should be mentioned that Kuwait imports about 15 per cent of its gas demand, while its domestic gas source is associated gas. The end-users of the electricity and water sector include residential, commercial, and government buildings, and others (light industries and agriculture). Annual per capita consumption has reached 16.6 MWh and, consequently, the annual per capita carbon dioxide (CO₂) emission is currently around 31.0 tons. Given the status quo (lack of demand-side management measures), it is expected that the energy demand of the electricity and water sector will increase by 65 per cent in the coming 20 years. It is challenging to keep up with such growth – it leads to an unsustainable growth in demand for energy which has, up to now, been met entirely by fossil fuels in Kuwait.

One can see that the challenges are not related to the issues of depletion or lack of energy sources. The challenge is that rapid growth of domestic energy demand is leading to the reduction of oil and oil products export revenues. Since Kuwait is an oil-based economy, the reduction of oil revenue would have a direct negative impact on the development of the country's socio-economic sectors (education, health, civil infrastructure, etc.). Furthermore, the oil market is not stable, and oil prices can fluctuate drastically. Evidence of such a fluctuation was witnessed in the recent oil price drop from about US\$110/barrel in June 2014 to US\$48/barrel in January 2015. Moreover, GHG emissions are another challenging consequence

of oil consumption. The international community's concern about the increasing global temperature has led to the enactment of various policies to mitigate GHG emissions. Such policies might, in the future, constrain Kuwait's fossil energy use and exports, through penalty taxation and other economic sanctions.

Efforts toward energy sustainability

For the past three decades, the government and private sectors and civil society organizations in Kuwait have proposed, developed, and worked on measures toward energy sustainability. The key actions include:

Energy Efficiency Building Code. The building code was first issued and put in action in 1983 by the Ministry of Electricity & Water and has been frequently modified since then. However, enforcing the code effectively has been a major challenge so far.

Solar Energy Program. In the early 1980s, KISR established a Solar Energy Program that carried out research and development (R&D) activities focusing on exploitation of solar energy for electricity generation, steam production, cooling, agriculture, and water desalination applications. The program was disbanded in the late 1980s for economic reasons, when oil prices reached a record low.

Renewable Energy Program. Since the mid 2000s, KISR has revived R&D work in solar energy and tackled other renewable energy and related technologies including wind and energy storage. Renewable R&D activities have also been carried out by Kuwait University.

Meeting 15 per cent of the Demand Through Renewable Energy by 2030. His Highness, the Amir of the State of Kuwait, Sheikh Sabah Al-Ahmad Al-Sabah, announced in the opening ceremony of the United Nations 18th

Conference for Climate Change on 4 December 2012 in Doha, Qatar, that Kuwait will meet 15 per cent of its energy demand from renewable sources by 2030. This announcement is considered to be a general policy towards the adoption of renewable energy systems in the country.

Shagaya Renewable Energy Park. Shagaya is a multiple renewable energy technologies (photovoltaic, concentrated solar power, and wind) utility-scale plant with total planned installed capacity of more than 2000 MW. Shagaya Phase-1 is currently being constructed and is expected to be commissioned by 2017. It has a total installed capacity of 70 MW. In Shagaya Phase-2, the installed capacity will reach 1,000 MW and it is expected to be commissioned by 2025. The total installed capacity in the third and last phase of Shagaya will extend to more than 2000 MW by 2030.

Building Integrated Photovoltaic (PV) Systems. In order to realize H. H. the Amir's call to exploit renewable energy to meet 15 per cent of demand, a number of government and private organizations have started to integrate PV systems with their buildings, making use of their roofs and car ports. An initiative is currently being led by the Kuwait Foundation for the Advancement of Sciences (KFAS) to install rooftop PV systems on 150 residential homes with an estimated total capacity of 1.5 MW.

Environmental Protection Law. The Kuwaiti parliament has recently approved the Environmental Protection Law Number 42 for the year 2014. This law aims to protect human health, the environment, and natural resources, and control pollution. A numbers of its articles address energy issues involving the enforcement of energy efficiency measures and the use of clean energy technologies.

Thus far, even with the aforementioned actions toward sustainability, Kuwait's energy intensity performance has not improved. Indeed, the latest IEA statistics show that its energy intensity increased from 0.49 kWh/US\$ in 2005 to 0.56 kWh/US\$ in 2012. There are numerous factors underlying the deficient behaviour of Kuwait's energy system; these are discussed in the following section.

Barriers toward sustainability

The main barriers to energy sustainability in Kuwait involve, but are not limited to:

Undefined goals with respect to energy efficiency and conservation in terms of:

- Quantity and quality, for example, an energy saving target that is based on total consumption, per capita, or GDP. In other words, how much do we want to save? Is the indicator based on per capita savings, energy intensity improvement, or some other measure?
- Time duration needed to achieve the energy saving goals.

Lack of an implementation roadmap strategy that has clear and achievable milestones. In 2012, KISR developed such a roadmap for the deployment of renewable energy systems to meet 10 per cent of the demand. However, it has not been utilized due to the absence of a mandated authority to implement it.

Lack of an authority that is empowered with legal framework to follow up and enforce energy sustainability in the country. So far, a number of fragmented efforts have been carried out by a range of public and private organizations. Such efforts need to be concentrated in order to reach the intended goals more effectively. A national authority is needed to coordinate the efforts of the energy stakeholders and to be responsible for the development and implementation of the energy roadmap strategy.

Political pressure. The continual political pressure to provide substantial energy subsidies has been the key barrier toward sustainability in Kuwait. In 2011, the total energy subsidy in Kuwait was US\$11.1 billion, which represented 7 per cent of GDP (see Jim Krane's article in this issue). The government has advised in favour of, and has attempted to pass, a number of propositions to increase the energy tariff. However, all of these attempts have been vetoed by the parliament.

Necessary actions

These barriers can be addressed through short/medium and long-term actions. Within the short and medium terms (five to ten years), an energy consumption labelling system for appliances could be developed and applied, to encourage the use of energy-efficient systems. Moreover, the present building code may be revised to reduce energy consumption per building area unit further, and put

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'... LEGISLATION FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY MUST BE DEVELOPED AND APPLIED ...'

restrictions on the building areas. In addition to appliance and building code development and improvement, legislation for energy efficiency and renewable energy must be developed and applied, in order to regulate related applications, deployments, pricing policies, and financial incentives, etc., to stimulate sustainability practices. Furthermore, there must be promotion of energy service companies, to advance energy efficiency practices and renewable energy deployment. A national entity – such as a National Energy Council – must be established to manage energy resources, impose energy efficiency measures, and sustain the deployment of renewable energy systems. Such a body would have a mandate to secure the energy supply and to enforce efficient energy use, in order to assure socio-economic development and environmental sustainability.

For a long-term strategy for action, the education system should be developed to embed a culture of responsibility toward sustainability. Additionally, such a strategy ought to embrace a communication plan to disseminate to the public the importance of, and need for, sustainability. Such a strategy would support investment in long-term R&D programmes that are adapted to the nature of Kuwait's energy challenges.

Renewable energy can drive job creation in the GCC

Rabia Ferroukhi and Arslan Khalid*

As global economies continue to struggle with remnants of the persistent economic crisis, unemployment and

its associated social and economic impacts remains a key concern and an instrumental driver of public policy.

Renewable energy offers considerable potential for gross job creation. In fact, according to estimates in the

