



strategy&

Formerly Booz & Company

Energy efficiency in the UAE

Aiming for sustainability

Contacts

Abu Dhabi

George Sarraf

Partner

+971-2-699-2400

george.sarraf

@strategyand.pwc.com

Beirut

Georges Chehade

Partner

+961-1-985-655

georges.chehade

@strategyand.pwc.com

Abdo Tayar

Executive Advisor

+961-1-985-655

tayar.abdo

@strategyand.pwc.com

Dubai

Per-Ola Karlsson

Senior Partner

+971-4-390-0260

per-ola.karlsson

@strategyand.pwc.com

Christopher Decker

Principal

+971-4-390-0260

christopher.decker

@strategyand.pwc.com

Jad Moussalli

Senior Associate

+971-4-390-0260

jad.moussalli

@strategyand.pwc.com

About the authors

Per-Ola Karlsson is a senior partner with Strategy& in Dubai. During the course of his career he has been the firm's European managing partner and has led the organization, change, and leadership practice in Europe. He has worked across industries with numerous large clients in the Middle East on projects focused on organization design, culture and behaviors, and capabilities-driven strategy.

Christopher Decker is a principal with Strategy& based in Dubai. He specializes in strategy and planning development, regulatory frameworks, and operational improvements in the power and water sectors.

Jad Moussalli is a senior associate with Strategy& based in Dubai. He specializes in the oil and gas and utilities industries across their respective value chains. His functional experience includes strategy, regulatory frameworks, transactions, due diligence, and feasibility studies.

This report is based on a workshop that was initiated and sponsored by the Energy Working Group of the UAE-UK Business Council. The UAE-UK Business Council, which operates under the umbrella of the Joint Economic Committee of the two countries, aims to increase cooperation between private-sector companies in the UAE and the U.K., by supporting investment development projects that are beneficial to both sides.

Executive summary



Energy efficiency is a growing challenge in the United Arab Emirates (UAE), due to population growth, economic activity, and high consumption rates that are unsustainable in the long term. To address this challenge, the Energy Working Group of the UAE-UK Business Council recently held a forum — part of Abu Dhabi’s annual Sustainability Week — to discuss potential solutions. The discussion focused on three specific aspects of energy efficiency: smart cities, such as the use of technology in urban planning to reduce energy consumption; building efficiency, including the use of innovative new materials, technologies, and designs to optimize energy usage in buildings; and water desalination, using a combination of hard and soft measures to reduce water demand and the attendant energy required to desalinate, and increase production through more sustainable sources.

Although several of the UAE’s constituent emirates have already launched initiatives in these areas, the scope of the challenge requires a more integrated approach that links all elements into a coherent energy-efficiency strategy. This strategy should include a tailored regulatory framework; a communications and information initiative to persuade residents, builders, and other stakeholders to reduce their energy consumption; and a research and development (R&D) component to make sure the UAE is capitalizing on emerging technology to boost efficiency.

The challenge of sustainability

Energy usage in the UAE has grown at an annual average of 4 percent over the past six years, with projections that it will increase to 5 percent through 2020 (see Exhibit 1). Overall electricity consumption has more than doubled in the past 10 years, at a pace that will be difficult to provide for over the long term.

One relatively straightforward measure to slow the growth of energy consumption is a sustained energy efficiency strategy. Such a strategy could lead to substantial reductions in consumption and could be implemented swiftly and at relatively little expense. Reducing overall energy consumption offers a number of advantages. It would safeguard the UAE's energy reserves, reduce the energy bills of end-users, help utilities manage their infrastructure constraints, and reduce potential subsidy burdens on UAE governments.

Many governments in other regions have already begun crafting policies that promote — and, in some cases, mandate — energy efficiency measures. These initiatives spur more sustainable building design, hybrid vehicles, low-consumption appliances, and more renewable energy sources. Such policies are still in the inception phase, yet governments will need to take action soon if they are to meet the energy sustainability challenge.

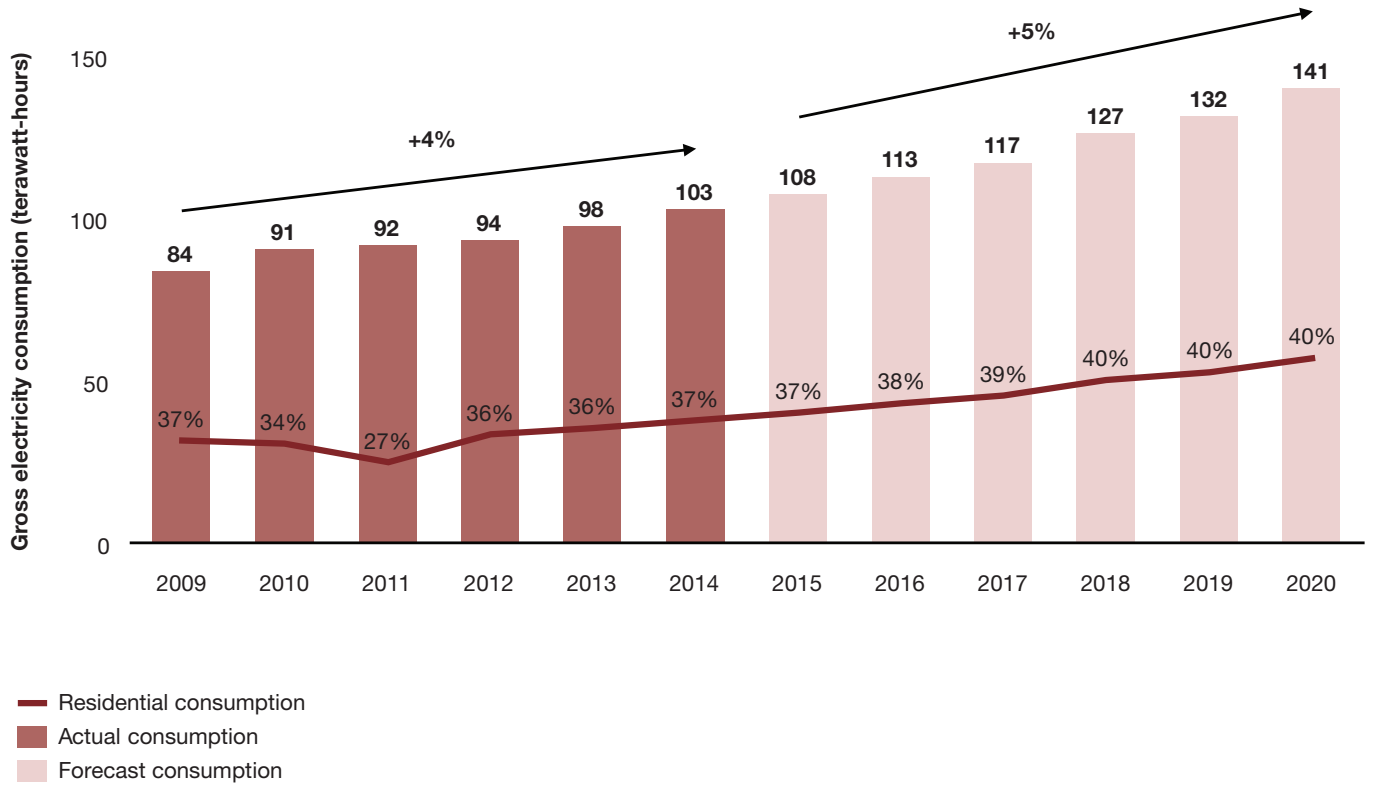
At a recent forum organized by the Energy Working Group of the UAE-UK Business Council, leaders from government, industry, and academia discussed best practices in energy efficiency and explored avenues for further collaboration between the public and private sectors. The meeting was held under the patronage of His Excellency Suhail Al Mazrouei, the UAE's Minister of Energy, and the Right Honourable Matthew Hancock MP, then minister of state at the department of energy and climate change in the U.K. The event was held during Abu Dhabi Sustainability Week in early 2015, and it focused on three specific aspects of energy efficiency — smart cities, building efficiency, and water desalination. This report summarizes the discussion of all three areas, and it builds on them with additional analysis and insight.

Governments in the region will need to take action soon if they are to meet the energy sustainability challenges ahead.

Exhibit 1

The UAE's gross domestic electricity consumption will grow rapidly over the next five years

Total Electricity Consumption and Residential Percentage of Total



Source: The Economist Intelligence Unit, 2015; International Energy Agency (IEA)

The challenges posed by these three aspects of energy efficiency cannot be overcome in isolation. Several common elements unite all three, and represent more foundational priorities for the UAE government. These common elements require that policymakers:

- Develop and implement an integrated energy efficiency strategy for the nation
- Build a regulatory framework that addresses demand and market challenges
- Launch targeted communication and marketing campaigns that change citizens' energy consumption habits
- Promote R&D initiatives to better use emerging technologies

If the UAE addresses these issues, and applies the lessons learned from best-practice energy efficiency programs in other regions — along with the insights provided by the UAE-UK Business Council Energy Working Group workshop — the country could vastly improve its energy sustainability position.

Smart cities

The UAE is one of the most urbanized countries in the world, with 85 percent of its population living in urban areas in 2014. The urban population is forecast to continue growing and should reach 91 percent of the UAE population by 2050, according to the UN. The UAE therefore needs to have integrated infrastructure planning as a prerequisite to any urban master plan.

Perhaps the best way of doing this, which takes advantage of digitization and the Big Data that urban populations produce, is through the so-called smart city approach. Although the term *smart city* does not have a formal definition, it typically entails integrated infrastructure planning that applies digital technologies to deliver better services and, critically for the UAE, reduce energy consumption.¹ The shift to smart cities is still in its early stages, and the overall relationship between improved urban design and the total sustainability effect of those initiatives has yet to be measured. The transition to smart cities entails overcoming the inertia that stems from ingrained habits, whether in terms of urban planning or citizens' behaviors. It also requires the development and implementation of coherent government policies that will deal with the complex changes that smart cities engender. Nonetheless, there is a broad consensus that smart cities will improve energy efficiency.

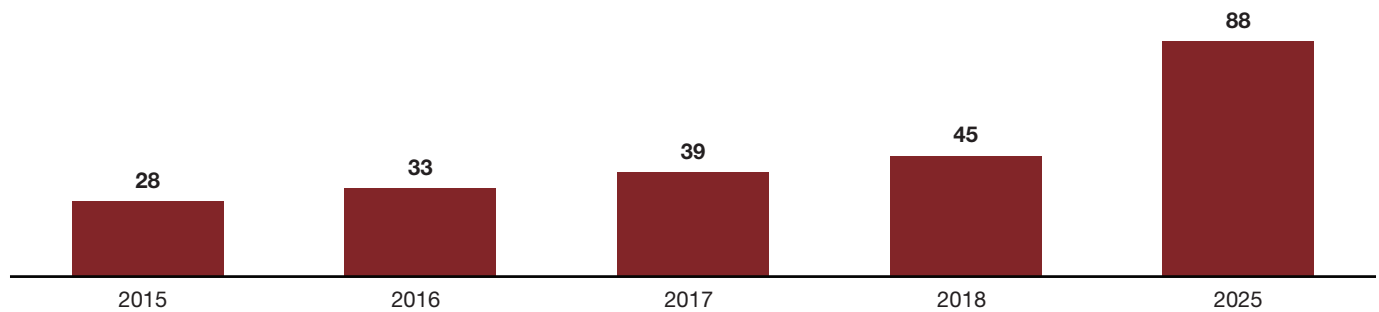
By adopting a more comprehensive approach, smart cities allow city planners and managers to improve efficiency at the intersection of different infrastructure sectors, such as electricity, water, transport, telecommunications, cooling, and waste. The number of smart cities is projected to triple worldwide by 2025 because of these advantages (see Exhibit 2).

One advantage of smarter urban electrical grids is that they monitor usage over time, and so can encourage the more efficient consumption habits that lead to significant decreases in usage. For example, electricity demand in Abu Dhabi has been growing by more than 10 percent a year, which exceeds the emirate's remarkable annual population growth rate of 9 percent. In response, the Abu Dhabi government has deployed an advanced metering system that offers a wide range of functionalities and rates to encourage customers to reduce consumption or shift it to off-peak

Smart cities allow city planners to improve efficiency at the intersection of different infrastructure sectors.

Exhibit 2

The number of smart cities will more than treble over the next decade (forecast totals)



Source: IHS Technology,
July 2014

hours. Similarly, Dubai now has several interrelated programs in place to substantially reduce electricity consumption, including smart metering, demand-side management to encourage energy users to consume more efficiently, and distributed generation (which involves generating energy on-site to reduce transmission losses). From 2009 through 2014, these measures have saved more than 1,100 gigawatt-hours of electricity and 5.4 billion gallons of water, and reduced carbon dioxide emissions by over 536,000 tons.²

Another important aspect of smart cities is transportation, an area in which technology has advanced dramatically. The UAE is encouraging the use of electric cars and building the necessary infrastructure to support them. The country currently has in place 16 power charging stations for electric vehicles, and it expects to have more than 100 by the end of 2015. However, electric vehicles are only a small part of the solution. To meet the transportation needs of an increasingly urban population, the UAE still must address broader challenges, such as improving the fuel-efficiency and emissions of imported cars, persuading residents that they may not need to own a vehicle, and reducing the dependence on cheap gasoline.

To that end, awareness campaigns should be part of a smart city initiative and represent a softer means of influencing citizens' behaviors. The UAE has already begun allocating budgets for such campaigns. For example, the Dubai Supreme Council of Energy has launched the Emirates Energy Award, which offers monetary prizes for innovative work in projects of all sizes across both the public and private sectors. The Dubai Electricity and Water Authority (DEWA) has also launched customer awareness campaigns that have, among other things, persuaded residents and businesses to set their air conditioners to warmer settings. In all, DEWA's initiative has saved more than 600 million AED (US\$163 million) since 2009.³

Building efficiency

Building efficiency — commonly referred to as “green” or “sustainable” construction — refers to structures that are designed and built with improved energy efficiency as a key design constraint. The concept aims to reduce the environmental impact of buildings and to improve the well-being of their occupants.

The UAE already has a range of building efficiency measures in place. For example, in Abu Dhabi, a program called *Estidama* (the Arabic word for sustainability) regulates the design, construction, and operation of buildings through phased approvals. *Estidama* also uses an assessment scale called the “Pearl Rating System,” which measures the sustainability performance of villas, buildings, and communities. In Dubai, the government has issued a set of green building regulations and specifications that cover planning, the use of resources, materials, and waste. Notably, the regulations are intended to improve the sustainability performance of buildings throughout their entire life cycles, from design through construction, operation, and ultimate tear-down.

Government authorities throughout the UAE will still need to develop more detailed regulations and frameworks that dictate energy efficiency in buildings, particularly during construction. These regulations can use a range of levers: licensing contractors based on energy performance; mandating procurement procedures that factor in total life-cycle cost, rather than just initial construction; and requiring advance modelling and simulations to predict the energy consumption footprint prior to construction, as part of the procurement process (a tool known as building information modeling).

Government authorities throughout the UAE will still need to develop more detailed regulations and frameworks that dictate energy efficiency in buildings.

In addition, district cooling holds significant potential to increase the energy efficiency of UAE urban areas.⁴ Currently, the cooling of buildings represents about 70 percent of the peak electricity load in the GCC. District cooling is a network-based system that uses centralized infrastructure to provide air conditioning to multiple buildings at once. Such a system is far more efficient than the current approach to air conditioning because it pools the demand for cooler air. Increasing the use of district cooling would reduce the burden of the cooling load on overall energy consumption. In the UAE, various regulatory authorities are exploring ways to mandate and regulate district cooling, and the technology should be considered for any new urban planning concept.

What are also needed are enhanced communication and information campaigns that persuade real estate companies to improve the energy efficiency of their projects without regulation. For example, such campaigns can highlight the efficiency benefits of new technologies, designs, and materials, as well as compare building performance among similar buildings and award energy performance certificates that include incentives for builders.

Finally, the government should encourage the use of innovative building technologies, materials, and systems. Advanced concrete mixes, wall insulation, glass glazing, and coatings that are adapted to the region's requirements would substantially improve the efficiency of buildings. These materials are already used in other markets as they deliver benefits in building efficiency as soon as they are in place. The UAE government should ensure that these materials are considered — or required — during the design and construction of new projects. Once construction is complete, projects can still generate gains due to increased energy efficiency, through tools such as advanced building automation, integrated applications, and monitoring and reporting, which increase energy awareness among occupants and facility managers and drastically reduce consumption.

Water usage

Water consumption in the UAE is about 740 cubic meters per capita per annum (m³ pcpa), or roughly 50 percent higher than the 500 m³ pcpa world average. In addition, the energy required to desalinate seawater represents approximately 30 percent of the country's total power consumption, primarily due to major issues in the way the UAE acquires fresh water.⁵

The great majority of the UAE's water is generated as a by-product of thermal energy plants, through combined water-and-power infrastructure. The problem is that these two resources have different demand cycles. Electricity has large peaks in demand, whereas water demand is relatively flat. As a result of these different cycles, the infrastructure cannot be optimized for either resource.

In addition, the UAE has major constraints when it comes to reclaiming and recycling water. Recycling would reduce the country's reliance on desalinated water. However, there is insufficient infrastructure for recycling, and leakages lead to further losses.

One coming change that will mitigate this problem is the planned introduction of nuclear energy as a prominent source of power in the UAE. Nuclear power will break the connection between water and electrical infrastructure, creating opportunities to use more efficient desalination technologies such as reverse osmosis.

The introduction of nuclear power will break the connection between water and electrical infrastructure, creating opportunities to use more efficient desalination technologies.

To address these market challenges, policymakers must develop an integrated strategy for managing electricity and water generation and distribution. Part of this strategy should be a selection of water treatment technologies that are more in line with future production requirements and can decrease system inefficiencies.

Furthermore, the government can craft regulations that address demand through both hard and soft approaches. Hard interventions would, for example, reduce water demand through increased water tariffs — which brings market forces and the economic elasticity of different customers' water requirements to bear. Another hard measure is to mandate efficient practices such as advanced irrigation and use of materials for landscaping that maximize water reclamation and minimize undue burden on the water infrastructure. Softer regulatory measures include awareness campaigns and other measures to persuade residents to willingly change their water usage. In particular, campaigns should target younger residents and the workforce, who have substantial influence and the ability to drive behavioral changes in their respective environments (schools, universities, and companies). The effectiveness of such campaigns was demonstrated in Dubai in 2012 when communications and information succeeded in reducing overall water demand for the following year.

To address market challenges, policymakers must develop an integrated strategy for managing electricity and water generation and distribution.

Four strategic priorities

Although each of these areas has unique aspects, the authorities in the UAE can generate greater progress toward energy efficiency by focusing on four strategic priorities.

Develop and implement an integrated energy efficiency strategy

As noted above, several emirates have already launched individual measures to improve their performance. However, the UAE needs an overarching strategy that joins individual sectors and their respective value chains around a single set of goals and objectives.

Develop a regulatory framework that addresses demand/market challenges

Once the strategy is in place, the UAE needs to ensure that regulations provide the enforcement mechanism to intervene in the different energy sectors — through both penalties and incentives — in order to change behaviors and maximize benefits.

Launch communication and information campaigns to demonstrate the benefits of energy efficiency — and the consequences of a failure to act

One of the most important aspects of sustainability is obtaining support from all stakeholders, in particular consumers. The public needs to understand how it benefits and how it can be engaged in achieving sustainability.

Identify and promote region-specific R&D and technology

Targeted R&D and technology can create an innovative ecosystem that can help meet energy efficiency goals while also boosting the overall economy.

The UAE needs an overarching strategy that joins individual sectors and their respective value chains around a single set of goals and objectives.

Conclusion

For decades, the abundance of easily accessible hydrocarbon resources meant that energy efficiency was not a pressing topic in the UAE. However, steady population and economic growth have changed attitudes. Today, sustainability is a critical issue that is becoming more urgent each year. The time is ripe for the government of the UAE to intervene and create a more sustainable future for the country. By leveraging other countries' experience, and focusing on the priorities discussed in this paper, the UAE can ensure that it meets the needs of its citizens, while also safeguarding the environment for upcoming generations.

Endnotes

¹ “Building next-generation sustainable cities: A road map for economic, social, and environmental sustainability,” Strategy&, 2014.

² “DEWA saves Dh752m through energy efficiency measures,” Emirates 24/7, April 8, 2015 (<http://www.emirates247.com/business/energy/dewa-saves-dh752m-through-energy-efficiency-measures-2015-04-08-1.586734>).

³ “DEWA extends its 24° Celsius campaign to the commercial sector,” DEWA website, August 13, 2014 (<https://e-services.dewa.gov.ae/NewsHist/details.aspx?id=02433114000000000000000002433114>).

⁴ “Unlocking the potential of district cooling: The need for GCC governments to take action,” Strategy&, 2012.

⁵ “Achieving a sustainable water sector in the GCC: Managing supply and demand, building institutions,” Strategy&, 2014.

Strategy& is a global team of practical strategists committed to helping you seize essential advantage.

We do that by working alongside you to solve your toughest problems and helping you capture your greatest opportunities.

These are complex and high-stakes undertakings — often game-changing transformations. We bring 100 years of strategy consulting experience and the unrivaled industry and functional capabilities of the PwC network to the task. Whether you're

charting your corporate strategy, transforming a function or business unit, or building critical capabilities, we'll help you create the value you're looking for with speed, confidence, and impact.

We are part of the PwC network of firms in 157 countries with more than 195,000 people committed to delivering quality in assurance, tax, and advisory services. Tell us what matters to you and find out more by visiting us at strategyand.pwc.com/me.

www.strategyand.pwc.com

© 2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details. Disclaimer: This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors.